Modelling COVID-19 Transmission Dynamics:
Possible Scenarios in Namibia

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Abstract

COVID-19 was first reported in China in December 2019 where adverse impact was felt in Wuhan with more than 80,000 people infected and at least 3000 people died of the disease by mid-March 2020. The time when first case was reported in Italy, it was hopped that it would follow similar trend that was experienced in China, however this was not the case as they experienced steeper graphs of new infections and high peaks of deaths due to COVID-19. Spain, France and United Kingdom have experience similar dynamics as Italy. United States of America is an exceptional given its high population and it might have a different dynamic altogether. African countries are in panic given the devastating statistics in Asia, Europe and North America since the first case reported on 25 February 2020 in Algeria. This is as a result of their limited health systems and high dependency to the developed nations. Namibia Republic is experiencing similar worries as her counterparts in Africa. It reported the first case in 14 March 2020 and by 6 April 2020 there were 16 cases overall and 3 recoveries. Several measures were taken by Namibian Government in-line with World Health Organization guidelines such as; suspending international air travels, restricting public gathering, closing of learning institutions and locking down some towns amongst others. There is no vaccine or therapeutic treatment for the virus at the moment and this causes fear of second cycle of outbreaks. A mathematical model is therefore developed to understand possible scenarios of COVID-19 transmission Dynamics for
Namibia to be used in decision making in developing control strategies in case of such outbreaks. Result indicates that lock-downs and social distancing may reduce cases and deaths significantly however it will compromise economy performance and social rights of individuals. Alternative strategies involves strengthening Healthcare systems which was found to able to reduce the case by almost 50%.

Mathematics Subject Classification: xxxxx

Keywords: Case Detection, COVID-19, Quarantine, Reproduction Number, Transmission Dynamics

1 Introduction

The Coronavirus disease 2019 formerly called 2019-nCoV, or SARS-CoV-2 by ICTV (severe acute respiratory syndrome coronavirus 2, by the International Committee on Taxonomy of Viruses) or (COVID-19) as officially called by WHO (coronavirus disease 2019, by World Health Organization) is a new and contagious disease caused by a new virus, known as novel corona virus. It affects lungs and causes respiratory illness with clinical symptoms like the flu such as cold, throat infection, cough, fever, and in critical cases, difficulty in breathing. The active period of the novel corona virus is of fourteen days [1].

The virus has spread quickly in the world since its first appearance in China in December 2019 where adverse impact was felt in Wuhan. More than 80,000 people got infected and at least 3,000 died of the disease by mid-March 2020 in China, however cases reduced significantly in China after implementing the WHO control strategies. Unfortunately, Italy, Spain, France, United Kingdom and United States of America reported higher cases and increased number of deaths despite the implementation control strategies. This indicates that, there are some other underlying factors which are country dependent that might be important in understanding the dynamics of Covid-19.

Africa reported the first case on 25 February 2020 in Egypt [2, 3]. Since then, the outbreak appears to have reached almost every nation on the continent of 1.2 billion people by May 2020 while only Lesotho is yet to report a case of the virus. Most of the first cases in African countries were reported to be international arrivals coming from world COVID-19 epicenters in particular Europe where the vast majority of Africas cases have originated and has increasingly been a great concerned [4]. Namibia reported its first case on the 14 March 2020 who also was an international arrival. By the end of April 2020, the total number of cases remained to be sixteen. Various control actions that was taken by the Namibian government following the WHO guideline.

Despite the stagnating curve of new cases which may impracticably mean that a country is safe from any new outbreak, many African countries are
still in fear of possible scenarios similar to what is experience in Europe, USA and Asia or even worse since there is still no therapeutic treatment currently available, and a vaccine for the virus. The only approaches that are available to stop the epidemic are those of classical epidemic control, such as case isolation, contact tracing and quarantine, physical distancing and hygiene measures [5].

Fatality rates are likely to be higher in the low-income counties where critical care facilities are limited [6] considering that developed nations with strongest possible mitigation action were overwhelmed, and the indirect effects caused by compromised health care services [7]. There is also a challenge for all African countries of keeping track of index cases and trace back all contacts of the individuals.

During the Namibian Government presidential press briefing made on 30th April 2020, the president released new guidelines for stage 2 control measures of COVID-19 with a lot of caution as possible for new infections [8]. These guidelines were well thought considering new outbreaks might occur if not followed. During the dispensation of the guidelines of stage 2 onwards, the government will be monitoring closely possible scenarios that are likely to occur before making decision of implementing next level guidelines. Such decisions require accurate data-based models. There has been and increased use of mathematical modeling in epidemiology (MME). When data are not there, or not yet there, MME provides rationales in Public Health problems to support decisions in Public Health, and this constitutes one of the reasons for the increased use of MME [9]. One of the main aims of mathematical modeling is helping to understand the spread of diseases in host populations, both in time and space. The processes involve; systematically clarifying model assumptions, interpreting its variables, estimating parameters and monitoring unobserved patterns. This Chapter therefore outlines possible scenarios of the COVID-19 transmission dynamics of Namibia using mathematical models.

2 Model Formulation

In this section, we describe the basic SEIR model which is the most widely adopted compartmental model for characterizing the epidemic of COVID-19 [10, 11]. We start by presenting the epidemiological characteristics of COVID-19 then introduce a general and a detailed description of our model. We generalize the basic SEIR model by introducing six different states, that is \( S(t); E(t); I_u(t); I_d(t); R(t); D(t) \). The compartments/variables used in this model are: Susceptible (denoted by \( S \)), Exposed (denoted by \( E \)), Undetected Infectious (denoted by \( I_u \)), Detected Infectious (denoted by \( I_d \)), Dead by COVID-19 (denoted by \( D \)) and Recovered (denoted by \( R \)).
2.1 Basic Model Representation

The transmission dynamics is summarized in the compartmental model in Figure 1. The susceptible population can be increased by new recruitment of individuals through either birth or immigration at a rate \( \nu \) or when the recovered individuals lose (wane) their immunity then rejoin the susceptible at the rate of \( \delta \). We assume that all the individuals who are recruited into the population exclude the infected immigrants.

Figure 1: Compartmental model representing transmission dynamic of COVID-19.

The susceptible can either be infected by individuals who either are exposed, or infected-undetected or infected-detected with a force of infection \( \lambda \). Let \( \kappa_1 \), \( \kappa_2 \) and \( \kappa_3 \), be contact rates of susceptible with exposed individuals, infected who are detected and Infected but undetected respectively. Given the movement behaviors of the three infected classes, it is assumed that the \( \kappa_1 > \kappa_3 > \kappa_2 \) in the sense that the exposed individuals are not aware of their status hence they interact normally. The infected-undetected already have stated to show clinical signs but are not yet confined hence they can still interact but not as normally. The infected-detected are already confined and the interaction is limited. If a contact is made, the probability that an infection occurs is \( p_1 \), \( p_2 \) and \( p_3 \), for exposed individuals, infected who are detected and Infected but undetected such that \( p_1 \kappa_1 \), \( p_2 \kappa_2 \) and \( p_3 \kappa_3 \) are the effective contact rate respectively. The force of infection \( \lambda \) is therefore given by (1);

\[
\lambda = \frac{(p_1 \kappa_1 E(t) + p_2 \kappa_2 I_d(t) + p_3 \kappa_3 I_u(t))}{(N(t))} \tag{1}
\]

An Exposed individual may progress to show symptoms at a rate of \( \rho \) (\( \frac{1}{\rho} \) is called the latent period). On the other hand, they may remain in this state but
then later recover from the virus at the rate of $\pi$ ($\frac{1}{\pi}$ is the duration the virus can survive in a carrier individual). Such group of individuals are carriers. Carriers here plays a very important role in transmission dynamics since no one notice them, but they keep on infecting others.

The proportion of detected infected individuals who are also isolated and hospitalized is $\theta$. The symptoms of such individuals are monitored and maintained/controlled using medical care hence they may recover at a rate of $\gamma$ ($\frac{1}{\gamma}$ is the infectious period). The recovery rate for the infected individuals who are not isolated and hence do not receive any medical care is reduced by $\varepsilon < 1$.

The death rate due to COVID-19 is denoted by $\zeta$. This value is reduced with a proportion of $\epsilon < 1$ for individuals who are put under medical care

This analysis uses deterministic model as a first approach, since this is a new problem with a few data concerning its dynamics. Diekmann, Heesterbeek, & Britton [12] suggested deterministic models to be used as the first tool in place of stochastic when modelling a new problem with few data. Deterministic models use the theory of ordinary differential equations for analyzing and interpreting the dynamics. Using the parameters and variable described above and assuming zero recruitment rate into the population and a very small natural mortality death rate, the model can be represented in a system of ordinary differential equations in (2)

$$
\frac{dS(t)}{dt} = \delta R(t) - \frac{S(t)}{N(t)}(p_1\kappa_1 E(t) + p_2\kappa_2 I_d(t) + p_3\kappa_3 I_u(t))
$$

$$
\frac{dE(t)}{dt} = \frac{S(t)}{N(t)}(p_1\kappa_1 E(t) + p_2\kappa_2 I_d(t) + p_3\kappa_3 I_u(t)) - \rho E(t) - \pi E(t)
$$

$$
\frac{dI_u(t)}{dt} = \rho(1 - \theta) E(t) - \zeta I_u(t) - \varepsilon\gamma I_u(t)
$$

$$
\frac{dI_d(t)}{dt} = \theta\rho E(t) - \epsilon\zeta I_d(t) - \gamma I_d(t)
$$

$$
\frac{dR(t)}{dt} = \gamma I_d(t) + \varepsilon\gamma I_u(t) + \pi E(t) - \delta R(t)
$$

$$
\frac{dD(t)}{dt} = \zeta I_u(t) + \epsilon\zeta I_d(t)
$$

$$
N(t) = S(t) + E(t) + I_u(t) + I_d(t) + R(t)
$$

$$
\frac{dN(t)}{dt} = \frac{dS(t)}{dt} + \frac{dE(t)}{dt} + \frac{dI_u(t)}{dt} + \frac{dI_d(t)}{dt} + \frac{dR(t)}{dt}
$$

$$
\frac{dN(t)}{dt} \leq \nu - \mu N(t) - \zeta I_u(t) - \epsilon\zeta I_d(t)
$$

$$
N(t) \leq \nu/\mu + e^{(-\mu t)}(N(0) - \nu/\mu)
$$

The total population size $N(t)$ can be determined using (3). The rate of change of the population size is determined by adding all the equations in (2) resulting to (4) Where $N(t) \geq 0, S(t) \geq 0, E(t) \geq 0, I_u(t) \geq 0, I_d(t) \geq 0$
and $R(t) \geq 0$ at time $t(\forall > 0)$ and will therefore be analyzed in a suitable region. The results in (4) indicate that $0 \leq N(t) \leq \frac{\nu}{\mu}$ hence solutions of (??) is bounded.

### 3 Analysis of the Model

In model (??), we suggest that equation 6 be solved separately since it is not coupled with the other equations. Thus, we can solve the first five equations of that system and the solution of the last equations can be computed by using Equation (5)

$$D(t) = D(t_0) + \int_{t_0}^{t} \zeta I_a(t) + \epsilon \zeta I_d(t) \quad (5)$$

#### 3.1 Basic Reproduction Number

Basic Reproduction Number ($R_o$) is used to justify and explain why lockdowns, social distancing, and other mitigation strategies are needed to keep the contact rates low [13]. In computing the reproduction number, the approach developed by Diekmann & Heesterbeek [12] and Driessche & Watmough [14] resulting to (6);

$$R_o = \frac{p_1 \kappa_1}{\rho \pi} + \frac{p_2 \kappa_2 \rho \theta}{(\rho \pi)(\epsilon \zeta + \gamma)} + \frac{p_3 \kappa_3 \rho (1 - \theta)}{(\rho \pi)(\zeta + \epsilon \gamma)} \quad (6)$$

The reproduction number is directly proportional to the effective rate of contact $p_i \kappa_i$ and is the sum three terms; $\frac{p_1 \kappa_1}{\rho \pi}$, $\frac{p_2 \kappa_2 \rho \theta}{(\rho \pi)(\epsilon \zeta + \gamma)}$ and $\frac{p_3 \kappa_3 \rho (1 - \theta)}{(\rho \pi)(\zeta + \epsilon \gamma)}$ which represent the number of secondary infections caused by one infected individual in a population. A partial derivative of $R_o$ with respect to the parameters are used in the sensitivity analysis and identifies their importance to $R_o$.

### 4 Numerical Simulations and Discussions

The parameters that are used in the numerical simulation are based on the data availability. Some values assigned to the parameters have been derived from epidemiological literature while other parameters have been estimated within the values where they make biological sense.

#### 4.1 Parameter Estimation

The parameter values for simulation are given in Table 1.
Table 1: Summary of COVID-19 model parameters values.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\nu$</td>
<td>100-250</td>
<td>[15]</td>
</tr>
<tr>
<td>$\mu$</td>
<td>$1.891 \times 10^5$</td>
<td>[15]</td>
</tr>
<tr>
<td>$\kappa_1$</td>
<td>16</td>
<td>[16]</td>
</tr>
<tr>
<td>$\kappa_2$</td>
<td>$\kappa_2 &lt; \kappa_1$</td>
<td>Estimated</td>
</tr>
<tr>
<td>$\kappa_3$</td>
<td>$\kappa_3 &lt; \kappa_2$</td>
<td>Estimated</td>
</tr>
<tr>
<td>$p_1, p_2, p_3$</td>
<td>[0 - 1]</td>
<td>Estimated</td>
</tr>
<tr>
<td>$\theta$</td>
<td>$[0.5 - 0.9]$</td>
<td>Estimated</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.0714285</td>
<td>[17]</td>
</tr>
<tr>
<td>$\pi$</td>
<td>0.2</td>
<td>Estimated</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.14</td>
<td>[18]</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>$[0.0667 - 0.2]$</td>
<td>[19, 20]</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>0.04</td>
<td>[18]</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>[0 - 1]</td>
<td>Estimated</td>
</tr>
<tr>
<td>$\epsilon$</td>
<td>[0 - 1]</td>
<td>Estimated</td>
</tr>
<tr>
<td>$N(0)$</td>
<td>2,748,437</td>
<td>[15]</td>
</tr>
</tbody>
</table>

4.2 Sensitivity Analysis of the Basic Reproduction Number

The parameters values shown in Table 1 are used to assess their impact on the reproduction number, in aiming at reducing the value of the basic reproduction number, the parameters that are practically adjustable are used that is; contact rate, case detection and self-immunity.

Table 2: Sensitivity Analysis with adjustable parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rate of change in $R_0$ w.r.t Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\kappa_1$</td>
<td>0.03684211496</td>
</tr>
<tr>
<td>$\kappa_2$</td>
<td>0.2006284886</td>
</tr>
<tr>
<td>$\kappa_3$</td>
<td>0.3288923106</td>
</tr>
<tr>
<td>$\theta$</td>
<td>-2.438166042</td>
</tr>
<tr>
<td>$\pi$</td>
<td>-8.359600982</td>
</tr>
</tbody>
</table>

The simulation results shown in Table 2 show that the most sensitive parameter to the basic reproduction number is self-immunity parameters, a slight positive change in the individuals self-immunity reduces the basic reproduction number with a larger magnitude. This is an in individual initiative on choosing the king of lifestyle. Another important aspect of improving self-immunity is well management of underlying medical conditions. People with who are immunocompromised conditions like diabetes, blood pressure HIV, prolonged
use of corticosteroids and other immune weakening medications are at high risk. This confirms the results by Center for Disease Control and Prevention [21]. Case detection is also evidently important in reducing the value of the basic reproduction number. This is a public health prevention strategy that would easily lead to contact tracing of individuals who make contacts with infected persons.

4.3 Simulation of Possible COVID-19 Transmission Dynamic Scenarios in Namibia

Based on the data available for Namibia, this model is used to simulate possible scenarios that are likely to occur given different strategy measure that is taken by the government.

4.3.1 Scenario 1: No Interventions to COVID-19 Spread

In this scenario, the simulation process considers a situation when there is no any interventions taken. It is important to start the simulation at this level (no intervention) so that significant and effective strategies can be identified. In this scenario, it is assumed that

1. population live in their normal lifestyle.

2. The immigration into the country and emigration into the country is approximately equals hence assumed not to affect the population size.

3. The death rates and birth rates are dependent on the current population size and will change when the population changes. However their effects are negligible hence the recruitment and natural mortality are zero.

4. All individuals in the population are susceptible to COVID-19 independent of socio-demographic behavior and therefore each must belong to any of the disease compartments.

5. Infected individuals who have already shown clinical symptoms are subjected to self-restriction in movements and therefore reduces contacts. This is due to voluntarily seeking medical attention or lack of self-esteem to mingle around with other people.

Using the parameter estimated in Table 1, the basic reproduction number is 2.269, implying that, an infected individual will infect on average three other people in the their lifetime of infectiousness. This value is high considering the infectiousness of COVID-19. A review of the reproduction number of COVID-19 was conducted by Liu, Gayle, Wilder-Smith, & Rocklov [22] and
they confirmed it ranges between 2 and 3. However, as more research on COVID-19 intensifies, and more information become available, the value may be computed accurately. This simulation is based on the information that the first case was recorded on 14th March 2020 hence that is the starting time \((t=0)\). With a population size of 2.7 Million (Approximated population size of Namibia).

One of the most important question that many countries are asking is when the curve will flatten. As the disease reaches its endemic equilibrium, the curve is expected to flattens. Figure 2 (A,B,C and D) shows the population dynamics under scenario 1. the number of active cases increases sharply from the 3rd month and starts flattening towards the end of 4th month onwards. More than half of the population in Namibia will be infected by the end of 3rd month from the time first case is recorded. The population of recoveries are at par with the active cases indicating almost 50% recovery rates. The highest record of deaths due to COVID-19 will also be experienced in the fourth and fifth month as shown in Figure 2 (D). The reduction in the number of deaths is due to the reduction in the population and increase in the number of recoveries. The total deaths over the 12 months (Area under the curve) is 1.7 million. This implies that when no interventions taken, the population can easily go to extinction. The assessment of the model when no natural death neither recruitment into the susceptible compartment (i.e. considering \(\mu = 0\) and \(\nu = 0\) indicates that the number of active cases and deaths remained unchanged as shown in Figure
Figure 3: Model comparison when $\mu \neq 0, \nu \neq 0$ and when $\mu = 0, \nu = 0$

3 since the original set values of $\mu$ and $\nu$ were insignificant to bring a change within a short time of the pandemic and therefore in the next and subsequent scenarios we only consider Model in (2).

4.3.2 Scenario 2: Dynamics of COVID-19 with Respect to Reduction of Contact Rate Through Lockdown and Social Distancing

Mitigation strategies were enforced by the Namibian Governments such as policy on social distancing, including a full society lock-down, and improved personal and environmental hygiene aimed at slowing the disease by reducing contact rates of individuals. Contact rate have significant effect on the basic reproductive number. Results in Table 3 indicate that efforts to reduce the contact rates will reduce the basic reproduction number. If the value is above 1, the infection spreads more, and the outbreak will continue to grow. When it falls below 1, the outbreak will continue but at a lower death rate, since less than 1 infected case follows the resolution of an earlier case by death or recovery. The sensitivity analysis results shown in the Table 3 show that the effect of contact with the infected individuals who are undetected is higher than the contacts with detected and exposed individuals, this is where lock-downs and social distancing is going to reduce the contact with the undetected infected individuals. The movement of the exposed individuals who also do not know their disease status but can transmits the virus, may be reduced by enforcing lockdowns, social distancing and hygiene. Studies indicate that social distancing and lock down policies can reduce contact rates by 25% to 95% de-
Figure 4: Effect of Lockdown and Social distance policy COVID-19 dynamics. In this simulation, S(0)=2.7 million, E(0)=1, I(0)=0, R(0)=0.

Depending on the method of enforcing the policy [20]. Where complete lockdown yielded 95% contact reduction. The impact of lockdown and social distancing is however more on the contacts with the undetected cases as compared to the detected who are already hospitalized. Lockdown and social distancing have proven to be the most effective strategy for flattening the COVID-19 graphs. Theoretically, if substantial social distancing and lockdown are implemented early enough, there would be significant reduction of spread. However, rigorous measures would bring about deep social influences and economic consequences [23]. So, it is challenging to choose the right response at the right scale in the right area at the right time. The results in Figure 4 (A) show a scenario when the economy is locked down at different levels.

The results indicate that when lockdown and social distance policy is implemented so that the contact rates are reduced by 50%, then the peak of the total cases will be delayed for more than three months and at the same time the peak will be lower than when the policy is not implemented. A more stringent implementation of the lockdown and social distance policy so that contact is reduced by 75%, the peak will be reduced further and lower. A similar trend is seen on the death toll due to COVID-19 as shown in Figure 4 (B). There will be more deaths if the lockdown policy is not enforced. If enforced such that contacts are reduced by 75%, then total deaths in one year will not go beyond 500.
4.3.3 Scenario 3: Impact of Case Management Through Detection, Hospitalization, Isolation and Quarantines

The World Health Organization recommends that a successful fight against the spread of COVID-19 requires commitment of every government and individuals by conducting testing to identify cases and conduct contact tracing [24]. The confirmed cases are hospitalized or isolated depending on the sovereignty of the symptoms. The suspected cases are quarantined to avoid more contacts and possibilities of further spread. This requires a substantial investment in the healthcare system to achieve. This scenario is modelled by varying case detection rate, recovery rate and disease induced death rate. Effect of case detection: The main objective of any containment strategy is to prevent transmission to control the spread of SARS-CoV2 and therefore the approach of testing, tracking and tracing (TTT) becomes central tool for achieving this objective as many countries have decisively implemented it [25]. The results on the effect of testing, tracking and tracing shown in Figure 5. Scaling up TTT by 10% will increase the total cases by 18% while increasing it by 20% reduces total cases by 45%. This reduction in the total cases is as a result of making it easy for the governments confine the infected individuals hence reducing contacts with susceptible individuals.

Effect of Hospitalization and Quarantine (Improved Healthcare system): Hospitals are important fortresses in the war against COVID pandemic as any other emerging infectious diseases. The mortality rate might increase dramatically if the healthcare system collapses with the spread of diseases in hospitals as well. The strategies of hospital are modified in many counties to take care of emerging numbers of cases according to the latest information about the epidemic [25]. The impact of Improved Healthcare systems increases
4.4 Model validation using with available data

Up to date, there are a number data sources on COVID-19 which are published both on real time and print press. By the end of July 2020 (approximately 120 days from the time 1st case was recorded.), Namibia had recorded 2,052 cases, and 10 deaths[27]. These figures follows after a number of measures that were undertaken by the Namibian Government for example; lock-downs, health system improvement, contact tracing and case detection amongst others. When all these strategies are combined together, the transmission dynamics is as shown in the Figure 7. The simulation results indicate that by day 120 from the 1st case, the number of cases are still below 3000 and the number of deaths below 30. This are approximately similar to the actual results seen in [27].

5 Conclusion

The simulation done in this paper has given a highlight of the most important scenarios that can be used to base public health decisions. Three months af-
Figure 7: Model validation of scenarios based on the available data as at July 2020.

After the first case recorded is a time to watch since the burden of the disease is experienced during this time. It is a time when the peak of the number of infections is reached and deaths due to COVID-19 is realised. Since the reproduction number is directly proportional to contact rates, a reduction of the value of the reproduction number will be achieved easily by reducing contact rates, hence the strategy of lockdowns, social distancing and quarantine comes handy. Implementation of lockdowns plays an important role in fighting COVID-19 spread. Though, it is not possible to enforce 100% lockdown due to its economic and social implications, 75% enforcement may reduce the disease burden drastically. This is in consistent with what was experienced in Namibia when they implemented lockdown policy in the first month after the first case and to date of this paper, the number of cases has remained below 50. As the government relaxes the lockdown policy, the number of cases stated to rise again. To save the compromised social and economic implication as a result of lockdown many countries decided to relax their lockdown restrictions despite more new cases. Alternatively, social distancing policy when enforced strongly, can reduce the contact rates. It requires a lot of personal commitments adherence for social distancing policy to succeed. The highly contagious group in the population are those infected but has not been detected and that is why lockdown and social distancing policy will be the most important strategy for controlling COVID-19. The impact of increasing percentage of detection of cases will reduce the epidemic drastically reduced which confirms the research output by Ivorra, Vela, & Ferrndez, [10]. Many lives upto 50% of the total cases may be saved from the disease as a result of conducting case identifica-
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Case detection here involved testing, and contact tracing. Management of confirmed cases at hospitals and quarantine facilities play major role of reducing death cases. This requires well organized and improved health systems. This model is suitable for most developing countries and is recommended for preparedness for worst case scenario. More efforts should be put on strengthening health systems and campaign to enlighten people on social distancing and self-hygiene.

References


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