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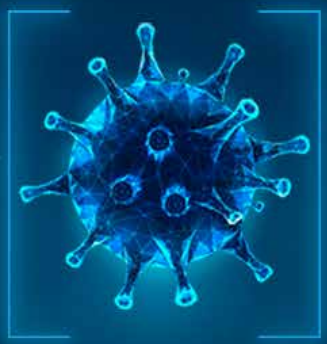

HIGHLIGHTS

1. Use of Technologies in **COVID-19** Containment in Rwanda
2. Global Trend of **COVID-19** Treatment
3. **COVID-19** Rwanda response updates
4. Easing Lockdown Restrictions during **COVID-19** Outbreak in Rwanda

Ministry of Health

Rwanda Biomedical Centre
Healthy People, Wealthy Nation

Rwanda
Public Health Bulletin

General Information

Rwanda Public Health Bulletin (RPHB) is an open access source and peer reviewed journal published by Rwanda Health Communication Centre (RHCC) and indexed by Bioline International.

Its mission is to serve as a knowledge sharing platform for national and international public health scientific information. Content published under RPHB will be used to control and address potential public health outbreak threats and strengthen health systems through real time availability of information.

This will allow more and effective communication between policy makers, researchers and health practitioners.

A new issue is published quarterly with supplements and special reports. Publication materials are submitted online at https://www.rwandapublichealthbulletin.org/manuscripts/submission and should fulfill the RPHB's instructions.

Go to https://www.rwandapublichealthbulletin.org/about/instructions for instructions to authors.

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CONTENT

Dear Readers,

I take this opportunity to thank the readers of the Rwanda Public Health Bulletin (RPHB) for the support of the continuous publication of the bulletin.

I would like to assure RPHB readers that since the declaration of the outbreak in China in December 2019, Rwanda developed mitigation strategies and established policies and protocols to respond to COVID-19. While implementing the prevention measures in effort to contain the COVID-19 pandemic, Rwanda has been evaluating the progress and closely following up with the updates on the COVID-19 management as the new data emerge and prevention measures are implemented locally.

According to both WHO and Johns Hopkins' Coronavirus Resource Center, Rwanda was listed among very few countries with COVID-19 reliable testing, tracing and effective management. Rwanda's progress has gained trust from the European Union which listed Rwanda among the 15 countries whose citizens are allowed to travel to Europe as it opens up its borders.

As the fight against COVID-19 continues, it is very critical that authentic and evidence-based information is accessible to healthcare workers and the entire general population. The RPHB is one of the credible sources with a mission to disseminate the reliable and accurate information to all healthcare professionals and general population. This allows Rwanda's task force to concentrate their efforts on actual response activities and not scatter energy on addressing rumors, therefore reinforcing prevention measures to the overall population.

This issue provides updates on the COVID-19, preventive and response measures, updated knowledge and progress on vaccine and cure development as well as the use of technology in the management of COVID-19 in Rwanda and the effect of COVID-19 lockdown.

As you read the bulletin, I would like to encourage you to share information with your colleagues and keep fully engaged in the fight against COVID-19 as it continues to claim lives worldwide.

Stay healthy and safe.

Dr. Sabin Nsanzimana, MD, PhD
Director General
Rwanda Biomedical Centre

Dear Colleagues,

I'm pleased to present to you the second issue of the Rwanda Public Health Bulletin (RPHB). This issue comes when Rwanda and the world in particular is still fighting the COVID-19 pandemic.

As the spread of COVID-19 is on a continuous rise globally, Rwanda continues the fight against the pandemic, and the COVID-19 taskforce in Rwanda, has made tremendous progresses. In May 2020, Rwanda eased some movement restrictions and opened businesses in efforts to boost the national economy. However, some prevention measures and cautions were maintained.

In the efforts to contain the pandemic, Rwanda, in partnership with the United Nations Development Programme (UNDP), deployed five high tech robots to assist frontline workers in the fight against COVID-19.

This innovative technological approach assists healthcare professionals in COVID-19 case management by recording individual's vital signs including temperature and other clinical symptoms and automatically creates patient's clinical record.

With no cure or vaccine available yet, it is important for public health professionals and healthcare workers to be constantly informed on the current progress and latest updates on scientifically approved treatment options and prevention measures.

This issue highlights Rwanda's efforts and global progress in the fight against COVID-19. The content covers the use of robotics and their applications in the fight against COVID-19 in Rwanda, the global trend of COVID-19 treatment, the COVID-19 Rwanda response updates, the new massive testing using pooled testing, the lessons learned from the fight against the pandemic and easing lockdown restrictions during COVID-19. As you read this issue, I would like to note that each of us is called to play a role in responding to this outbreak.

I wish you a pleasant reading.

Prof. Leon Mutesa, MD, PhD
Editor-in-Chief

Use of Technologies in COVID-19 Containment in Rwanda

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ABSTRACT

The Coronavirus disease 2019 (COVID-19) emerged from Wuhan, China at the end of December 2019 and was thought to be an unknown pneumonia that was causing acute severe respiratory distress and respiratory failure in some patients as well as other complications. Later on, the disease showed high virulence and rapid transmission from person to person. WHO declared the disease as pandemic when the spread was affecting most countries. Different modes of technologies combined with prevention strategies were conceived to minimize the rate of transmission in Rwanda. Technology solutions that are mainly used in Rwanda include: Artificial Intelligence (AI) and robotics for patient managements and data recording in hospitals, drones in broadcasting appropriate information in regards to COVID-19 symptoms and strategies for prevention, geolocalized hotspot mapping used for contact tracing, and self-testing of unstructured supplementary services data (USSD) easily accessed by dialing *114#. This outbreak report paper discusses the use of technology in the control and surveillance of the COVID-19 pandemic in Rwanda context.

Keywords: COVID-19, Data Science, Artificial intelligence (AI), Technology

INTRODUCTION

The Coronavirus disease 2019 (COVID-19) emerged from Wuhan, China at the end of December 2019 and was thought to be an unknown pneumonia that was causing acute severe respiratory distress and respiratory failure in some patients as well as other complications [1]. Later on, the disease showed high virulence and rapid transmission from person to person. WHO declared the disease a pandemic as the spread was affecting most countries.

Different modes of technologies have helped to tackle and contain this disease [1]. COVID-19's rapid mode of transmission triggered the use of technologies on another level for control and surveillance within the health system. For instance, to strengthen community awareness about prevention measures such as maintaining social distancing, public health messages are disseminated using SMS or via the internet.

Most people worldwide are benefiting from technology as one of the efficient tools applied to gain knowledge about this pandemic [2]. Technology is key in streamlining the workflows in healthcare and in public health settings. Artificial Intelligence and data science are seen as influential tools for control and surveillance of COVID-19 worldwide, currently used in fast-tracking diagnosis, containing, analyzing and predicting COVID-19 in a fast, scalable and efficient manner [3]. The COVID-19 pandemic stimulated the need to develop and position various applications such as health maps that present the worldwide pandemic outbreak situation in real-time [4]. Robotics utilization in healthcare management for COVID-19 has been deployed and is so far assisting healthcare practitioners as well as the epidemiologists [5]. The prime use of such robots is to lessen contact from person to person, to engage in hospital sterilization along with cleaning and to assist in patient monitoring with the overall goal to minimize viral spreading to doctors and medical staff actively engaged in COVID-19 management. Robots not only facilitate healthcare professionals but also improve overall healthcare facility efficiency by decreasing their workload in managing the pandemic [6]. The robots used in healthcare facilities are primarily categorized based on their design and applications. There are now 12 category of robots used in healthcare facilities, which are hospital nurse robots, receptionist robots, ambulance robots, hospital serving robots, cleaning robots, radiologist robots, disinfection/ spraying robots, telemedicine robots, surgical robots, food robots, outdoor delivery robots and rehabilitation robots [7]. COVID-19 propagates not only from person to person in close contact through respiratory droplets but also its virus can persist on non-living surfaces such as plastics, metals and glasses for days. Fortunately, robots engage in disinfection with the help of ultraviolet (UV) and provide disinfected surfaces at hospitals. Nowadays, assisted or automated appropriate robots are being used in the collection of oropharyngeal and nasopharyngeal swab samples which speeds up the diagnosis process [8]. The use of robotics in fighting COVID-19 has significantly improved the safety and quality of healthcare providers that are actively engaged with patients. In most African countries and low- and middle-income countries where the majority of the populations do not own TV sets and smart phones, messages are sent on mobile phones and by radio to educate people about the pandemic, symptoms and prevention measures [9].

Rwanda, as one of the advanced countries in promoting IT in the region, kept the momentum in applying technologies in surveillance and control of epidemics especially in COVID-19 containment [10]. For example, when the first COVID-19 case was identified in the country, several containment measures were put in place including technologies that promote community awareness and streamline data management from community to central level. In addition, machine-learning is being applied in Rwanda to examine the community health impacts, and test potential treatments as well as individual diagnoses [11]. Rwanda and Tunisia are the African countries using this technology to reduce the pandemic transmission. Tunisia used police robots that helped to ensure that the lockdown was applied by asking people why they are out, checking if they have permission to be outside of their homes, ensuring social distance, and educating people about measures to minimize COVID-19 transmission [12]. In Rwanda, healthcare workers take the temperature measurements of patients in isolation rooms using robots that were offered by the Ministry of Health with support from the United Nations Development Programmed (UNDP-Rwanda). They are programmed to communicate appropriately, keep medical records of patients, educate healthcare workers and patients on the dangers of the virus and how to stay safe. They also minimize physical contact by carrying foods and medications to the patients [13]. This report discusses different technologies being applied in Rwanda setting.

TECHNOLOGIES IN CONTROL AND SURVEILLANCE OF COVID-19 IN RWANDA

Early detection and diagnosis of the infection

At the beginning of the pandemic, an AI system (Health Map) from Boston Children's Hospital was used to identify different information about the pandemic that was available online to detect, visualize and monitor any new outbreaks [14]. This website helps in identifying the new unknown pneumonia that was reported to start from Wuhan, China. The first AI epidemiologist to warn against a new outbreak was a Canadian tech Blue Dot

whose algorithm scours foreign language news reports and gave a warning about a danger zone [15]. The former used AI software "Infer vision" for lung cancer and diagnosis from CT scan images was also changed to detect pneumonia using previous data on SARS and the diagnosis was made faster in different hospitals. Proper screening and diagnosis are difficult especially when there is a large number of infected persons [16]. Therefore, early diagnosis of this disease is very crucial in management. On the other hand, even if CT scan is not the gold standard for diagnosis it was shown to be the most effective, reliable, rapid way of the virus detection in the early stages of the disease compared to the RT-PCR [16]. Different applications and monitoring devices are available and help people who are asymptomatic or have mild symptoms to be screened using different questions and tests such as breathing tests and thermoscan machine that are used for fever screening and detecting arriving passenger with high fever. This data is manipulated and also used to assess the rate of infection in certain populations including those people with mild disease who are not followed at the hospital. Rwanda has put in place a self-screening app (USSD) to facilitate early detection of the infection in the population. Rwanda uses geological hotspot mapping in contact tracing (Figure 1) [17], and also uses drones to broadcast the appropriate information to the public in regards to the pandemic outbreak by informing them on the mode of transmission, preventive measures and sensitizing the public to get tested for COVID-19 at their nearest public health centers. This helps to rapidly spread accurate information on prevention measures as well as bust myths and clear misinformation about the COVID-19 pandemic [18].

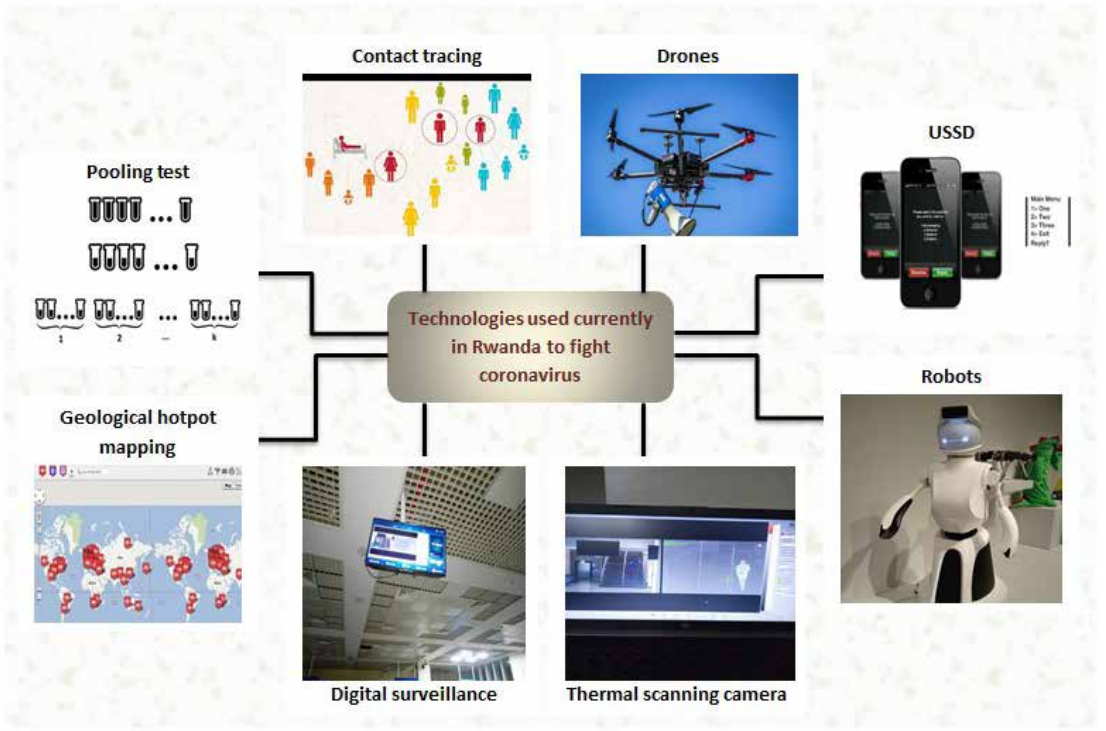

Figure 1: *Technologies used in Rwanda to fight against COVID-19 as per May 2020.*

Patient care and treatment monitoring

Robots and machinery are used to store the data of patients during diagnosis and treatment. In addition, AI through the use of robotics is crucial for the routine follow-up of patients as they improve. Evidence reports positive impact in the use of robotics for example in the reduction of unnecessary contacts between healthcare providers and patients and has shown great efficacy in maximizing safety for healthcare providers [14].

In addition, as the disease rapidly contaminated many people, which required a big number of health providers in a short period, the technology has helped to reduce the workload of healthcare providers by easing the diagnosis procedure,

rapid intervention, and patient monitoring [19]. It has assisted the physicians and students to learn more about the new disease in a short time. It has also reduced tthe risks of infection by minimizing physical contacts with the patients. Patients have been given the capacity to have control over their care, with access to their records especially for those patients who are discharged from the hospital but still need observation.

Those patients are attended by the doctor virtually and still stay with their families which speeds up recovery [20].

Rwanda started to use robots in healthcare facilities as soon as the pandemic outbreak was announced by the World Health Organization (WHO).

Robots are now used to fight the virus pandemic and their role is to work hand in hand with healthcare providers as they do not get infected by the virus [13]. These robots have different roles including vital signs measurements such as blood pressure and body temperature as well as oxygen saturation of severely ill patients who are on ventilator machines. They are also used for food and medicine transportation and patients monitoring [21]. Recently, the United Nations Development programmed donated five high-tech robots in order to minimize contact between infected patients with nurses and doctors thus reducing their risk of exposure to infection. The robots were given Rwandan names which are Akazuba, Ikizere, Ngabo, Mwiza and Urumuri (Figure 2) [22].

Figure 2: *Robots in Rwanda to fight COVID-19*

Pooling testing strategies for mass screening has also been incorporated and approved in Rwanda. This method has shown promising results. Therefore, it has been applied in survey testing that led to lockdown easing on 1st May 2020; the survey was conducted in 30 districts of Rwanda in 3 percent of healthcare facilities [23].

Logistical planning and economic interventions

The pandemic has created a need for various and numerous equipment: personal protective equipment (PPE), masks and gowns, test kits, ventilators, and ICU beds used in healthcare facilities [4].

Therefore, data science techniques have emerged to support the supply chain management for healthcare supplies. By using data of hospitalization rate and lab results, the health system is able to predict the needed supplies in real-time [24].

Rwanda is adopting step by step the use of data science techniques in all services to determine the best economic proceedings at a high level of granularity primarily in analyzing and harmonization of COVID-19 containment strategies [25].

When a vaccine becomes available, collecting data on transportation and storage conditions will be crucial to efficiently distribute them. Suboptimal conditions could lead to these temperature-sensitive vaccines becoming less effective. While RBC is currently monitoring storage locations, Internet of Things (IoT) remote monitoring technology could be incorporated into systems to not only monitor conditions in real-time, but also to use SMS to alert key stakeholders of dangerous changes, which can save lives and potentially reduce healthcare costs.

Furthermore, IoT remote monitoring could offer broader support to healthcare systems, combined with RFID technology, to automate the tracking of PPE items to easily monitor both location and quantities in real-time. This would allow the Government of Rwanda to better understand stock levels, and combined with machine-learning algorithms, forecast project future needs affordably and at scale.

DISCUSSION

Technologies used in Rwanda for suppressing the pandemic dissemination are similar to those used globally and great outcome has been observed by accelerating use of technology in Rwanda [26]. Technology solutions that are currently used to mitigate the virus spread in Rwanda include: Artificial Intelligence (AI) and robotics for patient management and data recording in hospitals, drones in broadcasting appropriate information in regard to COVID-19 symptoms and strategies for prevention, geolocalized hotspot mapping for contact tracing, self-testing of unstructured supplementary services data (USSD) that can easily be accessed by dialing *114# [27]. Digital contact tracing is widely used with the help of mobile applications in order to contact any person who interacted with an infected person within two weeks of contact and send a warning signal to the concerned personnel or authorities to trace the person and offer them the required care and this slows down the pandemic propagation [28].

Robots are playing a tremendous role in the battle to fight COVID-19 where they work hand in hand with the doctors. These robots operate in the most infectious wards thus reducing the doctor's risk of catching the virus by avoiding direct contact with the patients [13].

The robots are also involved in monitoring some patient's clinical parameters such as heart rate, oxygen saturation, respiration rate and blood pressure [7].

Disinfection robots are equipped with ultraviolet light that kills the slightest microbes and germs on the hospital surfaces. Drones are mainly used for delivering blood, medication and food. These drones are also involved in warning and informing the public about various strategies to fight the pandemic such as wearing masks, social distancing and washing hands [29]. High-tech wearable devices are also implemented, and they function by monitoring patients for symptoms of COVID-19 with the help of wireless biosensor systems [16].

Policy implications in Rwanda

Although Rwanda has put considerable efforts in the use of technology in COVID-19 containment, additional steps may be considered to bridge the remaining gaps. For example, integration of wearable devices to ease and monitor physiological changes, software development such as human interaction tracking systems which identifies potential areas of infection of known outbreaks and predict the unknown outbreak, IoT remote monitoring systems to share real-time data on medical supply chains, development of software and tools based on open source computer simulation programs that are developed for tracking, simulation and COVID-19 forecast, use of artificial intelligence algorithm that accurately predicts COVID-19 without testing, facial recognition software that identifies faces even partially covered with masks and single out people who are not wearing masks at building entrance, technologies in development of drugs and vaccines [4]. In addition, Rwanda may enforce the use of technology by developing different software that will be used in hospitals, for simulation and tracking COVID-19 incidents. Wearable devices may also be approved and applied in order to easily detect any physiological change and online health assessment. Lastly, use of technologies in drug and vaccine development may be given a priority in Rwanda and Africa settings.

The use of robots may be implemented in different areas such as street patrol and surveillance [30].

CONCLUSION

As COVID-19 pandemic disseminates, the integration of technology deployment is multiplying in an attempt to contain the outbreak and alleviate the overload on healthcare providers in healthcare settings. Technology and internet are solutions that play a major role in COVID-19 containment in Rwanda.

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Review article

Open Access

Global Trend of COVID-19 Treatment

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INTRODUCTION

Since the virus first emerged in Wuhan, China in December 2019, The COVID-19 pandemic has caused worldwide concern and has become a major public health concern and infected more than 6.5 millions and led to more than 400,000 deaths worldwide [1-4]. Treatments and vaccines have been the focus of the pharmaceutical companies for effectively fighting the pandemic [5].

Currently, there is no effective treatment for COVID-19 but studies are being conducted to develop a cure and vaccines [6]. Drugs approved or licensed for other indications have been used for treatment of the infected cases [7].

Nevertheless, global COVID-19 management trends have proven that timely and proper diagnosis as well as early management of symptoms to minimize the number of infected patients migrating from mild/moderate to severe disease translate, in many countries, to effective management of COVID-19 [4,5].

CURRENT KNOWLEDGE OF MANAGEMENT

Based on the available knowledge, COVID-19 clinical presentation was divided into stages to allow better orientation of the management and symptomatic treatments (Figure 1) [4].

Asymptomatic: Are confirmed cases with positive test for SARS-CoV-2 but have no symptoms.

Asymptomatic patients: are encouraged to self-isolate for a 14-day period and report to healthcare providers if they develop any symptoms [6-8].

Mild Illness: Are confirmed cases who have any of these: fever, cough, sore throat, malaise, headache, muscle pain without shortness of breath, dyspnea, or abnormal chest imaging. If they are healthy with only mild symptoms, no need of specific laboratory evaluations and they can be managed in an ambulatory setting or isolation centers and be closely monitored [4,6,8].

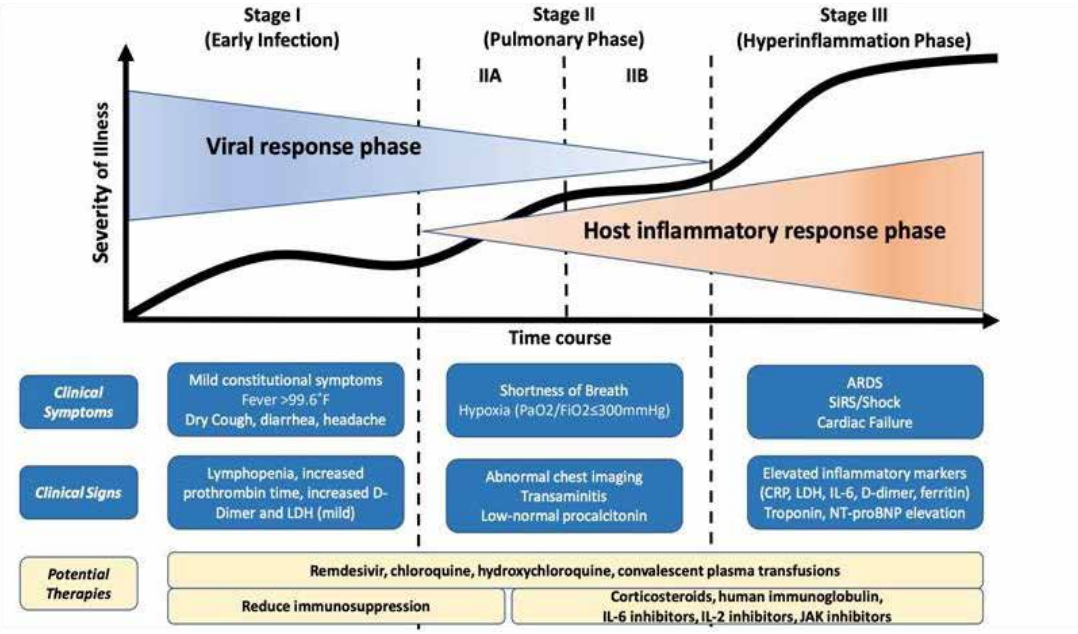

Figure 1: *COVID-19 clinical stages and treatment rationale (Adapted from " COVID-19 illness in native and immunosuppressed states: A clinical−therapeutic staging proposal" by Hasan K. Siddiqi and Mandeep R. Mehra, 2020, Elsevier, January 2020).*

Moderate Illness: Are confirmed cases with lower respiratory disease with oxygen saturation of (SpO2) ≥94% on room air [4,8].

Close monitoring of these patients is recommended and the empiric antibiotic treatment for community acquired pneumonia is used for secondary bacterial pneumonia in these patients [4,7,8]. Clinicians refer to the latest data and updated guidelines for the use of drugs against COVID-19 [4,6].

Severe Illness: Are confirmed cases with respiratory frequency >30 breaths per minute, SpO2 <94% on room air, arterial partial pressure of oxygen to fraction of inspired oxygen (PaO2/FiO2) ratio of <300 mmHg, or lung infiltrates >50% [4,8]. Oxygen therapy should be immediately administered and if pneumonia is suspected, administer empiric antibiotics [3,7]. Laboratory tests like chest x-ray, ultrasound, CT, ECG should be conducted for investigation or evaluation [4]. Clinicians should refer to the latest data and updated guidelines of drugs against COVID-19.

Critical Illness: Are confirmed cases who have respiratory failure, septic shock, and/or multiple organ dysfunction.

These patients are admitted in the intensive care unit (ICU). COVID-19 patients are managed depending on the reason of ICU admission [3,4]. Clinicians use guidelines on the management of critically ill adults with (COVID-19) [4,8] developed by Surviving Sepsis Campaign (SSC).

TREATMENT EVOLUTION FOR COVID-19

There are no approved specific treatments for COVID-19; and all treatments are experimental until proven effective by resuly of clinical trials [9]. Only treatments with high-quality clinical trial data are considered as potential treatment and are based on to inform clinical practice and treatment guidelines.

In an effort to develop the treatment rapidly, scientists have returned to medications already in existence and approved for other diseases.

This is because the development of a new vaccine compound might require a longer period to be developed and approved [1,4].

The existing antivirals are tested to assess their effectiveness against COVID-19 by mainly targeting the virus in its three stages of infection: preventing the virus from entering cells, preventing it from replicating after entering and minimizing the damage to the patient's organs (Figure 1) [1].

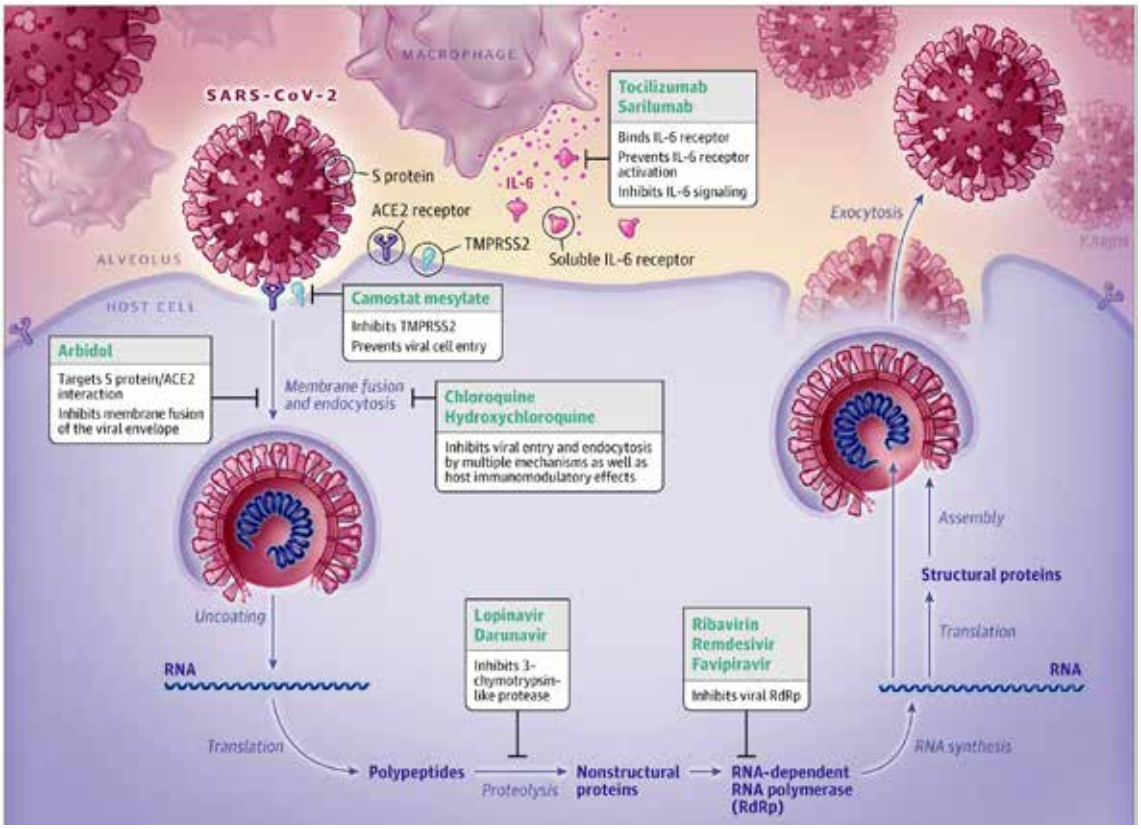

Figure 2: *Pharmacologic Treatments for Coronavirus Disease 2019 (COVID-19) (Adapted from " Pharmacologic Treatments for Coronavirus Disease 2019 (COVID-19): A Review" by James M. Sanders, Marguerite L. Monogue, Tomasz Z. Jodlowski, James B. Cutrell, 2020, JAMA, Vol 323, NO: 18).*

Based on the available data, there are 4 drugs (lopinavir/ritonavir, CCR5 inhibitors, remdesivir, tocilizumab), one plasma (convalescent plasma), and a vaccine(mARN) are both used at different levels for the COVID-19 management. These drugs are still under clinical trials to identify their safety and efficacy, and at different level of experimental progress. The healthcare professionals are encouraged to consult the latest data available before prescribing a particular drug [4].

Remdesivir: A nucleotide analogue binding to RNA-dependent RNA polymerase and inhibits viral replication. It is used for hospitalized patients with severe COVID-19 and for COVID-19 patients on mechanical ventilation. Data from randomized controlled trials showed that hospitalized patients with severe COVID-19 symptoms who received remdesivir for 5 days had a shorter time to clinical recovery than those who received placebo. Participants on remdesivir treatment had a 31% faster recovery time compared with those who received placebo, P <.001; and a mortality rate of 8.0% for the group receiving remdesivir versus 11.6% for the placebo group, P = .059) [9,12,13]. There is no sufficient data for mildly and moderately ill COVID-19 patients, and multiple clinical trials are currently underway.

The safety and effectiveness of remdesivir for COVID-19 treatment have not yet been studied in pregnant and pediatric patients. Remdesivir is used in these patients if indicated and if the benefits outweigh side effects [1].

Antithrombotic therapy: COVID-19 associated with thromboembolic disease is globally treated with anticoagulant therapy at the same dose and management of non-COVID-19 patients [1].

Dexamethasone: Researchers at the University of Oxford in England have determined its effectiveness in patients with severe COVID-19 symptoms by reducing the inflammation [1,14]. Mortality reduction by one third was shown in COVID-19 patients on ventilators according to findings shared with WHO but no benefit seen in mildly ill patients [1].

EXPERIMENTAL TREATMENTS AND VACCINE DEVELOPMENT

With continuously growing number of COVID-19 cases and deaths, scientists around the world are racing to develop the treatments and vaccines.

DRUGS

Toculizimab: A humanized monoclonal antibody that inhibits membrane-bound and soluble IL-6 receptors. Already approved by FDA for rheumatoid arthritis and cytokine release syndrome treatment related to chimeric antigen receptor-T cell therapy. It was reported that elevated IL- 6 in severe COVID-19 ia associated with increased mortality. Data (pre-print) on 21 patients with tocilizumab showed fever resolution, decreased oxygen requirement, resolution of opacities on CT scan, and improved patients C-reactive protein (CRP) [15].

Convalescent Plasma: Five convalescent patients from COVID-19 (age 18-60 years old, recovered from SARS CoV-2 infection,asymptomatic for > 10 days, Serum SARS-COV-2 specific ELISA Ab > 1:1000 + neutralizing Ab > 40, at time of donation-negative for SARS-CoV-2, other respiratory viruses, HBV, HCV, HIV, syphilis) volunteered to give their plasma to treat 5 selected COVID-19 patients (critically ill patients age 36-65 years old) with severe pneumonia with rapid progression and high viral load despite antiviral treatment, PaO2/FiO2 < 300, any of the following: mechanically ventilated, shock, multi-organ failure, given at 10-22 day from admission) [16,17,19]. The treatment with convalescent plasma showed normalization of temperature within 3 days, sequential organ failure assessment score (SOFA) score decreased, resolved ARDS at 12 days post transfusion, weaned from mechanical ventilation within 14 days, and discharged from hospital (length of stay: 53 days) 53 days) [16]. The effectiveness of convalescent plasma and hyperimmune immunoglobulin is still under experimentation.

Baricitinib: This is a Janus kinase (JAK) inhibitor which is in Phase 3 of clinical trial to determine its effectiveness against COVID-19 [1].

Bemcentinib: A selective AXL kinase inhibitor developed by BerGenBio and previously proven to be effective against Ebola and Zika viruses. Its effectiveness against SARS-CoV-2 is being studied and it is in phase 2 of clinical trial [18].

Colchicine: This an anti-inflammatory that is being studied to reduce the excessive inflammatory reaction caused by coronavirus thus, preventing the COVID-19 complications.

Lopinavir/ritonavir (Kaletra): HIV medications (lopinavir/ritonavir (in-vitro), darunavir, atazanavir, delutegravir, and efavirenz (molecular docking testing) have shown activities against SARS-CoV-2, and randomized control trial of LPV/RTV versus standard of care for patients with severe COVID showed at 14 days that 13.8% of LPV/RTV recipients decreased drug dosage for side effects [16,19,20].

EIDD-2801: A broad spectrum oral antiviral called EIDD-2801 developed by Ridgeback Biotherapeutics got FDA permission to start clinical trial to determine its use as prophylactic or treatment for COVID-19 [1].

Favipiravir: An antiviral drug approved in Japan as the treatment of influenza. It is in the phase 2 clinical trial [1].

Remdesivir considered a small number of study participants, and lopinavir/ritonavir had different data/modelling studies from in vitro to clinical data. Best data should be well powered, and randomized controlled trials should evaluate potential treatment candidates and determine drugs safety and efficacy [4,11,19].

VACCINES

These are some investigational vaccines being studied in different locations internationally.

BNT162: An mRNA vaccine developed by Pfizer Inc. and BioNTech SE. It is in Phase 1/2 clinical trial in the United States of America (USA) where first participants have been dosed [21].

This is the second dosing after the first completed in the first cohort in Germany [1,21].

AZD1222: It is investigational vaccine against COVID-19 in development and is in phase I/II

clinical trial in England to study its efficacy, safety and immunogenicity [22].

mRNA Vaccine-1273: This vaccine developed by Moderna Inc. has showed positive results in interim Phase 1 and the mouse challenge model. The phase 3 is scheduled to start in July 2020 [23].

INO-4800: This vaccine candidate against COVID-19 developed by INOVIO Pharmaceuticals, Inc., was accepted by FDA to enter phase I clinical trial [24].

In summary, investigational antiviral drugs still need definitive clinical trial data and more scientific research projects are underway to identify safe and effective treatments and vaccine for COVID-19 to slow down and eradicate the pandemic.

Remdesivir is the first antiviral showing promising results for treatment of COVID-19 in well-designed clinical trials.

Multiple studies of hydrochloroquine have shown no beneficial effect, risk of harms and increased mortality have been observed. Convalescent plasma may have benefit for COVID-19, more data is needed. Many vaccine candidates are at different stages of evaluation. Supportive treatments of COVID-19 patients, personal protection and transmission control measures remain the only means available for the fight against COVID-19 pandemic.

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COVID-19 Rwanda response updates

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INTRODUCTION

Rwanda's response activities continue to be led through a multi sectoral, multi-partners approach: The Prime Minister and the National Epidemic Preparedness & Response Coordination Committee (NEPRCC) continue to lead response activities via the COVID-19 Joint Task Force Committee (JTFC). Since March 2020, the JFTC works with expert advisory teams from the Ministry of Health, Ministry of Defense, Ministry of Finance and Economic Planning, the Ministry of Internal Security and the Ministry of Local Government as well health focused international organizations, for the management of COVID-19.

Rwanda's COVID-19 response activities are implemented through the COVID-19 national Incident Management and Coordination Structure (Figure 1):

Members of the command post, under different cells develop mathematical models to predict Rwanda's outbreak and use epidemiological models to forecast COVID-19 supply needs under different simulated scenarios. The command post also develops and presents to advisory teams different lockdown exit strategies with subsequent epidemiological effects/impacts.

Early identification of cases, prompt isolation, testing and contact tracing continue to play major roles in allowing the country to better manage the global pandemic. Cases are mainly identified through surveillance systems at points of entries (now mostly at land borders), at community and health facility levels as well as through contact tracing and active case search focusing on populations at high-risk.

However, measures to slow down the spread of COVID-19, particularly lockdown series came with strong social economic impacts. Rwanda's recent national Social Protection Response and Recovery Plan reported that people, particularly informal workers, were likely to face reduced income opportunities with prolonged implementation of lockdown measures.

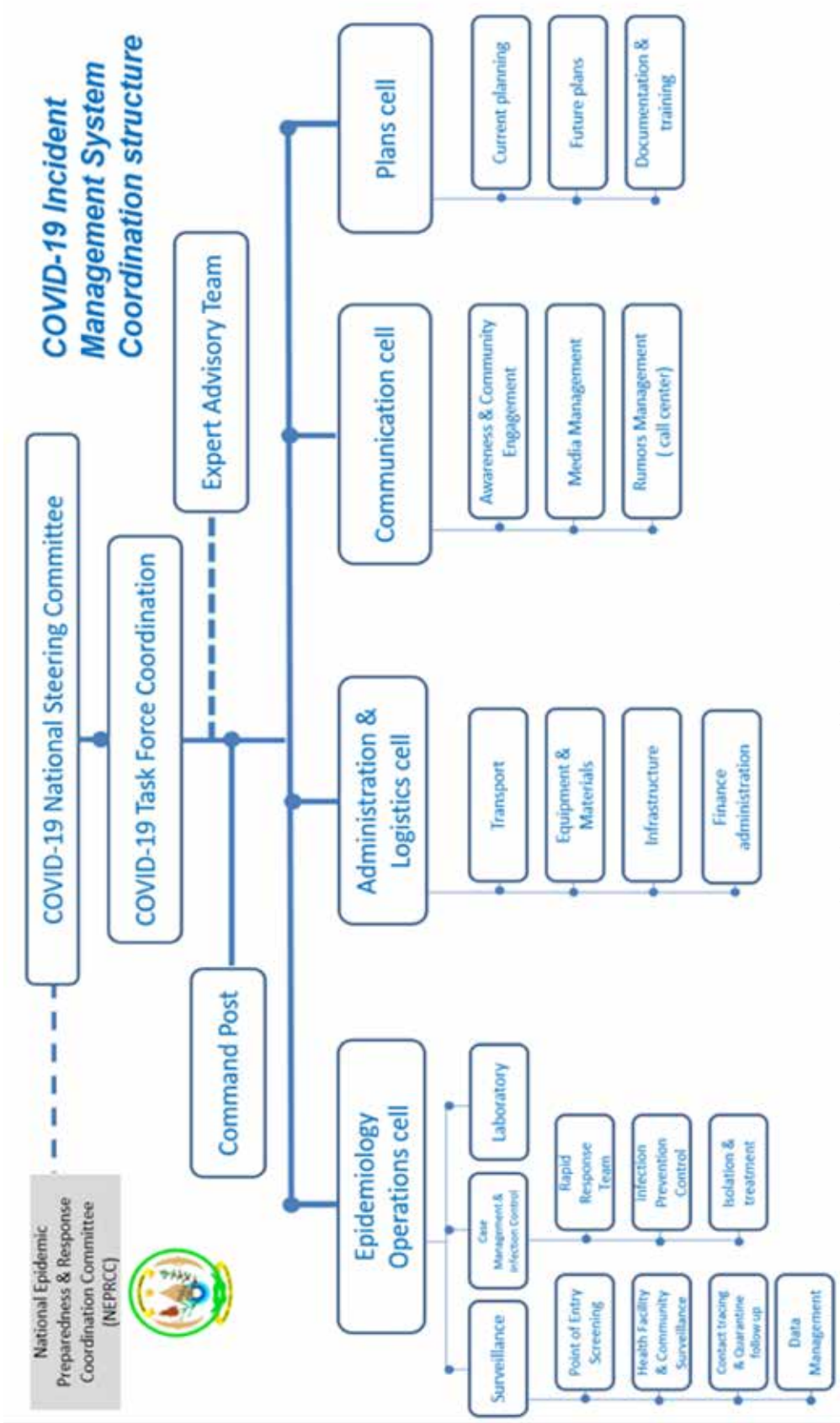

Figure 1: *The Coordination structure of the Covid-19 Incident Management System.*

Consequently, on May 4th 2020, Rwanda eased its total lock down and allowed businesses, public transport to resume but under well-defined health and safety measures. Progressively, to further allow social protection and economic recovery, the county has been releasing more services, such as allowing motorbike riders back in the transport system and promoting local/ internal tourism. The narrative below shows the country's status following the uplift of total lockdown.

RWANDA COVID-19 CURRENT KEY HIGHLIGHTS

- A total cumulative number of 878 cases with an increase in local cases linked to importation in mid-June compared with previous days and months (Figure 2).

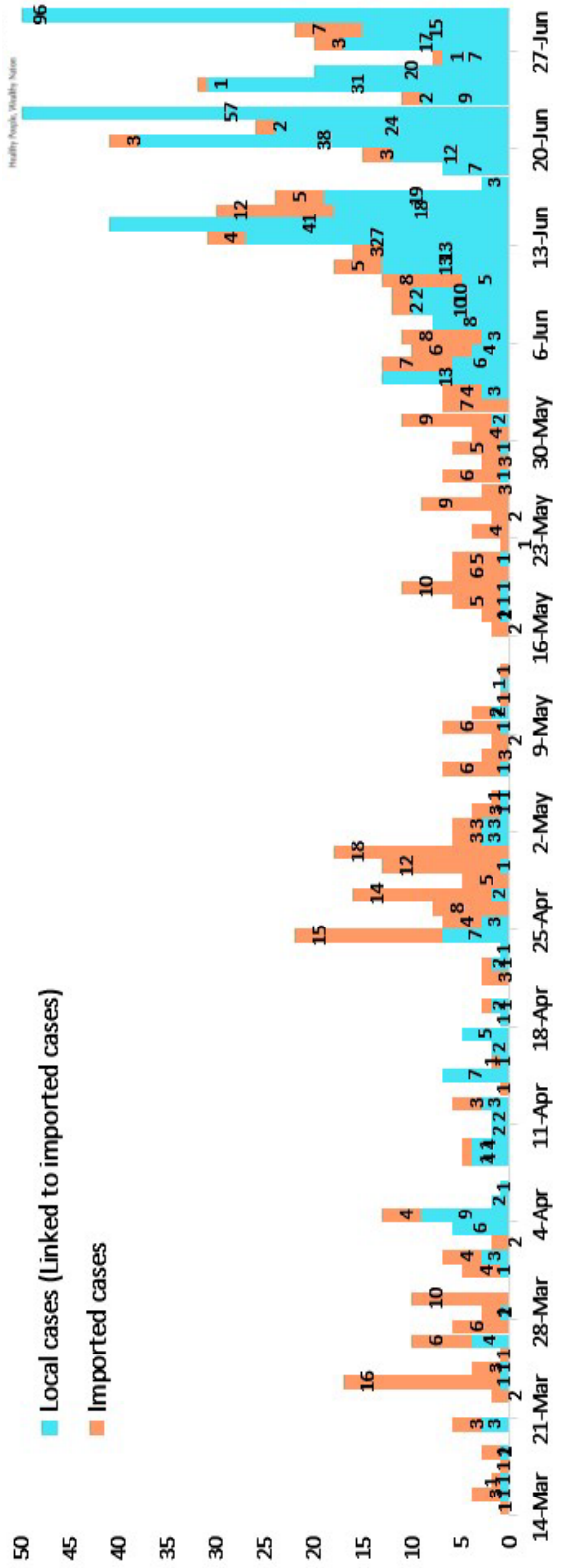

Figure 2: *COVID-19 confirmed cases in Rwanda (RBC)*

- About 85% of all new cases (all mild/ moderate), registered from April to date, are truck drivers crossing from the Rusumo boarder in the Eastern province, and citizens of Rusizi district in the western part of the country.
- Total Recoveries/ Discharges: 413 cases and
- Two deaths (all Rwandan imported cases)

Although current cases are mostly clustered in the Eastern and Western provinces of the country, a few local cases are also being recorded in Kigali- suggesting possible community transmissions. To understand the dynamism of the outbreak, the COVID-19 command post has been implementing community testing strategies in different parts of the city. This has resulted into two-weeks partial lockdowns of a few villages in Kigali.

SURVEILLANCE

Quality data and holistic surveillance is still proven to be crucial for accurate assessment of the disease progression and for timely response strategies.

To reinforce surveillance systems, active case finding and the management of COVID-19, sub- national command posts were created in all districts across the country to ensure district and provincial health systems are better prepared and supported to manage COVID-19. Screenings are currently established at 31 entry points (at the Kigali International Airport and 30 land and water border entries). Staff working at these points use surveillance screening documents distributed early this year. All re-opened public spaces are mandated to have in place hand washing stations and temperature monitoring devices. It is also mandatory for everyone in public to use a mask.

To protect healthcare workers and other front liners, Rwanda is minimizing the level of interaction between healthcare workers and COVID-19 patients. Recently, the country introduced artificial intelligence strategies whereby robots are now used in treatment centers for temperature monitoring and other basic clinical assessments.

The country introduced other digital solutions such as the use of GIS and GPS tracking systems to monitor truck drivers' movements and reduce the need for the Rwanda national police to escort trucks from boarders to quarantine sites. Together with countries in the region, there are discussions to harmonize data sharing mechanisms to allow timely exchange of drivers' data records to reduce reliability on paper documents.

LABORATORY

Presently, Rwanda uses RT-PCR method for SARS-CoV-2 testing on manual platforms with ABI Thermo Fisher, BioRad and Rotor-Gene equipment available at the National Reference Laboratory (NRL) alongside automated platforms from Roche. Thus far, SARS-CoV-2 testing has been conducted at the NRL, with a testing output ranging between 1000 and 2500 samples per day. Identification of hotspots has led to recent activation of testing sites in both Kirehe and Rusizi. These sites are each equipped with one BioRad and Rusizi has an Abbott m2000.

The current workflow of COVID-19 testing in Rwanda is described below.

» Specimen collection

In Rwanda, oro-pharyngeal swabs are collected by wiping the tonsil and posterior pharyngeal wall with one swab and immersion of the swab heads into the viral transport media that contains an antibiotic to suppress bacteria and fungi contamination as well as a phenol red PH indicator to ensure medium integrity.

» Specimen transportation

Specimens are transported in cooler boxes to the testing sites immediately after collection.

» Laboroatory diagnostic testing

SARS-CoV-2 testing is conducted by lab technicians trained to use real time reverse transcription-polymerase chain reaction (RT-PCR) methods. The current algorithm uses a multiplex RT-PCR assay based on the detection of Orf1ab and N gene (2019-nCoV RNA RT-PCR, DAAN Gene Co., Ltd. Of Sun Yat-sen University, 19, Xiangshanv Road, Guangzhou Hi-Tech Industrial Development Zone, China) as initial screening test while the LightMix RT-PCR kit (TIB MOLBIOL Synthese labor GmbH, Eresburgstr. 22-23, D-12103 Berlin,Germany), based on the detection of the E and RdRp genes, is used for confirmation purposes [2,3].

A recently operational Roche cobas 6800 is being used at NRL as a screening and confirmatory platform as well.

Pooling approach for massive testing

In Rwanda, an algorithm and a proof of concept based on a mathematical model was developed and provides evidence for sample pooling [4]. Pooling for SARS-CoV-2 testing is defined as combining multiple patient samples in a single test with subsequent individual testing of positive pools, resulting in cost and human resources savings while retaining clinical accuracy compared to individual patient sample testing. The pool sizes in Rwanda are of 20 samples, although 50 samples have proven to be effective as well and could thus be applied.

When a pool's result is positive, all samples included in the pool are retested individually. Pooling may be useful in resource constrained settings where overall prevalence remains low and details are provided in the network section.

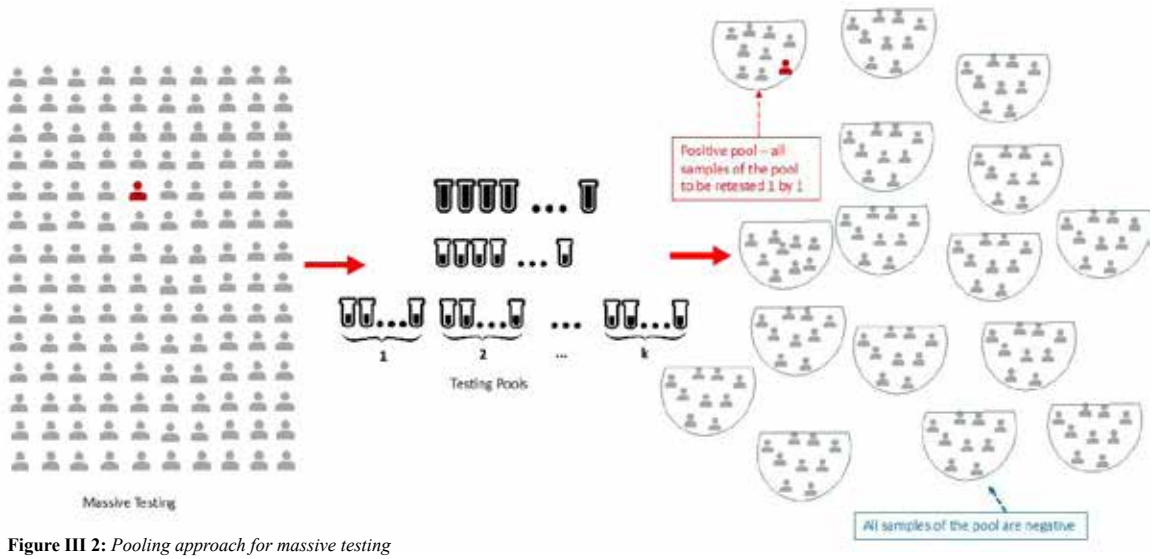

Figure III 2: *Pooling approach for massive testing*

RISK COMMUNICATION AND COMMUNITY ENGAGEMENT

Health education and public awareness have shown impact in addressing and controlling COVID-19. In Rwanda, education campaigns are ongoing through megaphones at community levels through the national radio, the national television and on different social media platforms and other private stations. Education contents emphasize hand washing and observing social distancing as effective prevention strategies for COVID- 19. Further education is provided by The National Police Task Force, community health workers and local village leaders to reinforce understanding on the importance of the "Stay at home campaign".

In conclusion, Rwanda's efforts to address COVID-19 show a controlled pandemic situation with less complicated cases, even though the country is currently registering more cases. This success is mainly due to strong surveillance systems, holistic contact tracing and the progressive scaling up of testing capacities. Continuous population awareness will further strengthen existing efforts.

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Easing Lockdown Restrictions during COVID-19 Outbreak in Rwanda

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ABSTRACT

Lockdown measures have helped to contain COVID-19 while also creating socioeconomic harms as well. As of this summer, many countries are deciding to ease social distancing measures to revive their economies. This review article examines responses to the pandemic in countries outside Africa, across the continent, and within Rwanda. Specifically, it explores the dynamics of maintaining public health measures that seem to be at odds with national goals of employment, business development, and growth of GDP. This desk review combines data from epidemiology, African area studies, international relations, political science, and economics to offer an interdisciplinary assessment of Rwanda's position as a current pandemic success story, but which may experience future economic hardships as a result of lockdown measures.

Keywords: coronavirus, social distancing, economic development, poverty, health governance.

INTRODUCTION

According to the WHO's recommendations, Rwanda implemented a national response preparedness plan against COVID-19 beginning in March 2020 [1,2]. The main goals for the preparedness plan were prevention, early detection, and a quick response. This article explores not only the public health but also the economic impacts of the plan's social distancing measures across the country. It explains that COVID-19 has not spread as rapidly across Rwanda as initially predicted, and consequently has not caused the total financial fallout feared by some officials, but Rwanda's continued success in containing the virus is also a part and parcel of its management of the national economy.

Early efforts included expanding laboratory testing and diagnostic capacities, augmenting appropriate tools, refining procedures, and implementing new technologies. Additionally, the Ministry of Health increased training for National Reference Laboratory (NRL) staff in screenings, surveillance activities, and improved sample collection. Across Rwanda, there were amplified entry-point screenings across provinces, and quarantine points and treatment centers were readied [1].

The preparedness plan effectively raised public awareness before the country's first confirmed case. Besides, report show an estimation of 95% of contacts are traced.

As it has become clear that the source of transmission chain for positive cases is originated from cross-border truck drivers transporting goods from Tanzania and DRC into Rwanda, the government of Rwanda with the support from border officials created a system in which cross-border truck drivers exchange vehicles with non-infected domestic drivers at the border [3].

The Rwandan government continues to strengthen capacity for enabling mass-testing, contact tracing, and public health education [4]. Rwanda's ability to control the spread of COVID-19 continues to impress especially with clinical outcomes surpassing those in other countries affected by COVID19 worldwide.

The Rwandan government officially commenced a lockdown on 22nd March 2020 and partially lifted it in phases beginning on 4th May 2020 [5] At each phase of easing social distancing measures, relevant health authorities monitored transmission rates domestically and internationally [6]. Rwandans have been fully educated on the mode of transmission of this disease and were asked to follow measures to reduce risk of infection such as wearing face masks, handwashing, avoiding handshakes, avoiding public gatherings such as bars, gym, churches, schools and prohibition motorbikes usage as a mode for transport [8]. Public and private sectors have been allowed to resume activities [7]. However, public and private transportation were allowed only in the cities with social distancing measures of 1m between passengers in public transportation, as well as curfew from 8:00 p.m. to 5:00 a.m. Borders remained closed except for goods entry. Rwandans willing to enter the country were subject to a mandatory quarantine of 14 days. On 2nd June 2020, the regulations were reviewed and some restrictions were lifted: shortened curfew from 9:00 p.m. to 5:00 a.m., public transport motorbikes were permitted to operate with strict hygiene standards, and inter-cities and cross-districts travels were allowed (except to Rubavu and Rusizi districts where there were more cases identified due to forbidden Congolese border crossing) [8]. The partial lifting of lockdown in Rwanda was guided by a survey conducted in 30% of the hospitals across the country [9].

GLOBAL SOCIAL DISTANCING MEASURES AND GLOBAL ECONOMIES

China, with the origin of the pandemic in Wuhan, was the first country to implement total lockdown and contributed to early easing containment measures [10]. By the end of March 2020, well over 100 countries across the globe had either a full or partial lockdown in place, demobilizing billions of people. Currently, the WHO strongly cautions of the consequences of a second wave of COVID-19 if countries too quickly ease social distancing measures, as the U.S.A may very well do despite overly lax measures leading to the highest rates of infection in the world there [11,12]. COVID-19 containment measures have enormously helped with the pandemic, but at the same time yielded direct and indirect negative impacts. Other public health problems have come to for as a result of social distancing though. Rates of stress, anxiety, and depression in the face if physical inactivity, change in daily routine, isolation, and economic uncertainty are clear [13]. Additionally, there are concerns that containment measures may be contributing to a rise of domestic violence rates, as close confinement, stress, and unemployment exacerbate potentially violent household dynamics [14]. There is too little research to date on the impact of the pandemic and its containment measurements on healthcare providers on the frontline of the pandemic [15].

In addition to the public health concerns, perhaps no other epidemiological phenomenon is so poised to threaten both macro and micro economic stability. Global GDP is projected to drop by an average of 2.1% [16]. The GDP for high-income countries is estimated to decline by 1.9% and for developing countries by 2.5%, with the understanding that low-income countries are less able to withstand economic shocks. As an extreme case, China GDP is estimated to lessen by 3.7%. The largest GDP losses are predicted in Africa, Southeast Asia, and the Pacific region due to immense dependency on international trade and tourism. Rwanda, along with Malaysia, Singapore and Thailand, is one of the country's with the highest portion of GDP dependent on tourism [17]. Most countries will definitely experience a drop in GDP, employment, and citizen income leading to greater poverty, food insecurity, and malnutrition.

In response to the economic impact of COVID-19, some European countries began cautiously lifting the lockdown beginning in April 2020, but now weigh the financial benefits in the face of a potential second wave [18].

As a case to consider, the UK began easing the lockdown in discreet monthly steps [19]. The first step prioritized workers whose jobs required physical presence but advised them against public transportations. The next step will be to open shops and then public spaces, e.g. parks. The British government declared that there will be a recovery fund for small businesses [20]

.

Experts report that Europe, Asia, and North America are likely to face their worst economic crises triggered by coronavirus, and the concern for the Global South is that the spillover could cause long-term damage. The global GDP is projected to drop by 2.1%. In this sense, African countries could be the most vulnerable to the pandemic [21].

In addition, all 54 have confirmed cases and there were over 10,000 registered cases by April of this year [21,22]. The African countries with highest number of confirmed cases include Egypt, Djibouti, South Africa, Algeria, Tunisia, Cameroon, Ghana, Nigeria, Guinea, and Ivory Coast—and these includes some of the nations with the highest rates of poverty as well. Ethiopia, already struggling with food insecurity among 7 million people, now has an estimated 15 million people who could experience a food consumption gap due to the pandemic's social distancing measures [23]. The Democratic Republic of Congo (DRC) is currently dealing with two outbreaks simultaneously, COVID-19 and Ebola. Approximately 3500 people are infected with Ebola and 2280 have already died while COVID-19 reaches almost 5000 cases [24]. However, African leaders must contend with both the pandemic and acute poverty in a way by adopting the suitable Africa intervention models tailored to their country culture and environment without necessary coping exactly what other countries, especially western countries, implement. Although, some restrictions are still in place such as night curfews, public gathering prohibitions, mandatory face masks, and limited border closures, many countries started to resume economic activities at the beginning of May [25,26].

On another notes, the pandemic arrived during African seasons of rain and floods that displace communities, increasing public health concerns.

These disasters such as heavy rains, floods, and natural disasters have destroyed homes and separated families [27]. Accounting for the needs of forced migrants during COVID-19 is a dynamic challenge because itinerant populations have a high number of casual contacts, face logistical barriers to hygiene practices, no testing or treatment facilities, and are difficult to monitor. Crops that were not initially destroyed by weather patterns may be abandoned by farmers who must leave for other reasons, e.g: unemployment, and therefore leave their plots fallow [28]. Clearly, the pandemic has greatly affected African country economies and hindered implementation of fiscal stimuli due to high debt burden [29]. For this reason, Cash and Patel questions the European-centric use of lockdowns in combination with a focus on sophisticated tertiary hospital care and technological solutions [30].

As an example of this discrepancy, per capital annual healthcare expenditures in Africa are an estimated $292, whereas in other developed countries it is reported at above $1000 [31]. The authors "question the appropriateness of these particular strategies based on developed economies for less-resourced countries with distinct population structures, vastly different public health needs, immensely fewer healthcare resources, less participatory governance, massive within-country inequities, and fragile economies." They argue such measures subvert two core principles of public health—local context, social justice, and equity are paramount.

RWANDA'S LOCKDOWN AND ECONOMIC REALITIES DURING COVID-19

According to the WHO, economic conditions should not determine prevention and social distancing measures. Instead, the current number of cases, capacity to track, manage the healthcare system, and the capacity of the population to follow regulations should drive decision-making [31]. The good news for Africa is that the true case fatality rate (CFR) is lower than the reported CFR of 3.5%, which is considered as the global average (0.7%).

Although only ten countries account for 76% of total cases in Africa, the pandemic is so quick to spread that these numbers could shift continent-wide very quickly [32].

As a result of this dynamic, most of Africa actually has not experienced greatly damaged economics as of now, but this is dependent on the spread of cases. Accounting for this, according to a World Bank forecast, GDP contraction in sub-Saharan Africa is estimated at 2-5% in 2020 due to disrupted time engaged in public and financial activities out of the home [32]. Although the economy of Rwanda has benefitted from successful government policy that raised the GDP to 10% in 2019, Rwandan GDP could certainly be affected by COVID-19 pandemic.

To keep a low transmission rate in the community, some principles must be maintained in all countries regardless of economic realities. There are six key criteria to help maintain a low level or no transmission.

First, "COVID 19 transmission control" mandates that before the release of lockdown, the healthcare system should be able to manage the cases based on the status of contacts.

The second criterion is ensuring that there is "sufficient health system and public health capacities in place" such as detection, testing, isolation facilities, and quarantine measures in place.

The third is ensuring that the "outbreak risks in high vulnerability settings are minimized"; there should be protective gear for frontline healthcare practitioners, ways to maintain and repair equipment, and suitable measures against nosocomial infection.

Fourth, workplace preventive measures should be established for physical distancing, hand washing, temperature monitoring, etc.

The fifth criterion is risk management for imported cases, requiring rapid detection, case management of suspected cases, and quarantine facilities.

Lastly, communities must be fully engaged through public awareness of the severity of the disease, mode of transmission, and preventive measures [6]. In light of global WHO recommendations, the question stands in Rwanda: What is the financial and social costs of maintaining these measures here?

The lockdown has intensively damaged the domestic tourism sector, currently the larger earner for GDP. Rwandan tourism, especially that based on mountain gorillas, has suffered not only from the standstill in non-essential international travel, but also from expert concerns about transmission of Corona to wildlife [33]. In addition to tourism worries, however, on the individual level, Rwanda is a nation of small business owners in all industries.

A survey conducted by the Business Networking Company (BPN) on small- and medium-sized entrepreneurs during the national lockdown reported that 42.5% of entrepreneurs are still operating to some degree while 57.5% of entrepreneurs are not operating at all [34]. As for employees, the number of working hours per week is diminished across almost all sectors. Businesses that adhered to lockdown regulations saw lowered profits and, in turn, separated employees. Rwandan entrepreneurs presented high economic anxieties as the percentage of the number of employees decreased to 29.09% from 63.63% [35].

Over 64% of business owners report selling fewer goods and services. So far, 13% of entrepreneurs were able to develop new products and 87% of entrepreneurs could not afford to develop such products, incurring great economic loss [36]. The capacity of entrepreneurs to pay loans, taxes and employees is hindered by this pandemic, and so many harbor concerns about the outcome of 2020. Of this economic downfall, 5% of Rwanda businessowners will be able to sustain their families for only one month, 17% for two months and only 59% for at least four months [36].

For public health measures to be effective, they cannot drive a country into bankruptcy and impoverish its citizens. At the same time, rapid spread of a pandemic causes illness, death, and unstable behaviors that, on their own, can destroy livelihoods and financial infrastructure.

The challenge for Rwanda moving forward is to strike a balance between adhering to WHO

recommendations and staying true to Vision 2020 goals of economic development.

Policy Implications

Rwanda is among the countries most successfully implementing WHO criteria to manage COVID-19, ease the lockdown, and balance public health needs with economic ones. Further research on COVID-19 would be beneficial if it assessed the combined direct and indirect effects of the pandemic on outcomes such as patient death or food insecurity caused by the death of a caregiver. Understanding key patient populations and identifying whether patients experienced worse clinical outcomes during the pandemic could inform future practices.

In terms of pandemic control, health officials must routinely collect HMIS indicators to monitor COVID-19-related symptoms. Doing so through health centers in specific and targeted geographic regions sampled at the district level, will enable health officials to identify potential COVID-19 hotspots. They may then take immediate action by allocating necessary medical equipment, personnel, and additional measures that lessen the burden of both the disease and its economic outcomes [37].

Economic realities are a part of public health too as income levels determine access to medical care, housing, hygiene practices, and health literacy. Two concrete policy recommendations would be to offer small business stimulus packages in tandem with financial education trainings for small business owners. Co-funding small businesses impacted by COVID-19 could come in the form of low interest loans or loan repayment deferments, to avoid the complete fall out of the businesses [36].

Additionally, the government may consider instructing entrepreneurs on maintaining their businesses amidst this pandemic using e-learning tools and socially distant trainings, in order to increase their solvency, lower under-employment, and bolster the economy of the country Broadcasting on both the health and economic realities of COVID-19 may continue regardless of social distancing measures, heightening community awareness about control of the epidemic, predicting movements, and thus, enforcing the containment measures.

CONCLUSION

This analysis brings together research from both public health and economics to offer an interdisciplinary examination of COVID-19. It aims at illustrating international reactions to the pandemics in order to compare and contrast those in Rwanda. Thus far, Rwanda has been spared from the worst but this position as a success story is predicated on continued official management, civic education, and ensuring the population has a baseline level of financial security so as to not drive violations of social distancing measures. These forces, containing the pandemic and fostering economic development, are often discussed as being in opposition to one another. There is a common idea that lockdowns must come at financial costs and boosting economic activities must necessarily threaten public health in 2020. As we move forward in better understanding the epidemiology dynamics and their social implications, the collective goal should be to find a way to manage COVID-19 in a way that not only mitigates income loss, but also may even enhance it.

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Rwanda
Public Health Bulletin

About the Rwanda Public Health Bulletin (RPHB)

The Rwanda Public Health Bulletin (RPHB) is a printed and open access, peer-reviewed journal, published as the flagship scientific and technical periodical publication. RPHB is a public health bulletin launched in March 2019 by the Rwandan Ministry of Health, through the Rwanda Biomedical Centre (RBC) in collaboration with the Centres for Disease Control and Prevention Foundation and with support from Bloomberg Philanthropies Data for Health Initiative.

Mission

To serve as a scientific information dissemination platform of national and international significance, mainly in areas related to the Rwanda Ministry of Health's essential mission to strengthen national and local health systems and improve the health of the people of Rwanda. The Rwanda Public Health Bulletin publishes disease surveillance summaries, public health response guidelines, public health notices, case reports, outbreak reports, original research papers, and policy briefs among others. It generally features issues of importance to its targeted audience which is health professionals, academic researchers, policymakers and anybody interested in health issues. Articles for publication are received from doctors, nurses, allied health professionals, students, policymakers, government bodies, non-governmental bodies and others.

Aim

To bridge the gap in public health information sharing between policy-makers, researchers, health professionals and practitioners.

Publisher

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INSTRUCTIONS TO AUTHORS

All works submitted to this bulletin will have to belong to the types of articles stated below:

1. ORIGINAL RESEARCH

Referred to as "Primary Research" pioneer in a determined domain. It can be from various aspects: Clinical features, pathophysiology, biochemistry, molecular biology, etc.

THE TITLE

The title of the article should be concise and informative. It should contain enough thoughts on the subject.

ABSTRACT

Abstract of 250 words maximum must accompany each manuscript and is divided into 4 paragraphs with the following headings and MeSH keywords:

1. Introduction: stating the purposes/aims of the work; the research undertaken, the hypothesis tested or the procedure evaluated.

2. Materials and methods: briefly stating what was done and what materials were used, including the number of subjects, the methods to assess the data and to control bias.

3. Results: Providing key findings of the study, including indicators of statistical significance, actual numbers, as well as percentages.

4. Conclusion: Summarizing in 1 or 2 sentences the work on the basis of the findings. It emphasizes new and important aspects of the study or observations.

5. Keywords: Following the abstract. They are 3 to 10 words or short phrases that assist indexers in cross-indexing the article. They should be MeSH terms, and are published with the article.

THE MAIN TEXT

The text of observational and experimental articles is divided into sections with the following headings: Introduction: should always begin the text, and requires brevity and focuses. It conveys the nature and purpose of the work, and quotes the relevant literature. Only strictly pertinent background information is necessary for understanding why the topic is important. We suggest the final paragraph clearly states the hypothesis or research question of the study.

METHODS

Details of clinical and technical procedures should follow the introduction. A clear description of the selection of the observational or experimental subjects should be given. The identification of all aspects of the study, its reasoning, and the related relevance should be explicitly justified. In case, the study was done in a particular way, the guiding principles should all be clarified. Exclusion and inclusion criteria or partial inclusion, the reliability index, the confidentiality index, the analysis step, and the data collection processes should be also carefully specified. This section should provide sufficient details on the methods, instrumentation, procedures, all drugs and chemicals used (including generic names, doses, routes of administration). It should allow other workers to reproduce the study if necessary.

This section should also state the self-evaluation of the study by: independent/consensus readings blinded or unblended to other information and estimate the fluctuation of recall biases by random ordering of studies.

Be clear about the retrospective or prospective nature of the study. Finally, provide references to established methods, including statistical methods that have been published, forthcoming, or that may not be well known. New description or substantially modified methods may be used however, give reasons for the use of these techniques, and evaluate their limitations. Statistical methods should be described with enough details to enable a knowledgeable reader

with access to the original data to verify the reported results. A general description of methods would be defined in the methods section, whereas a specific statistical method used into analysis would be summarized in the results section. Any general-use of the computer program should be specified, and more details have to be clarified about any randomization issues.

RESULTS

Logical sequence of presentation of results is required in the text; along with tables, and illustrations. Repetition of data from illustrations into the text should be avoided; however, emphasize or summary of only important observations would be helpful. Avoid the ‘’non-technical use’’ of technical terms in statistics which should be defined and reserved for the right purpose. Moreover, define all those statistical terms aside with or including abbreviations and/or most used symbols. Any complication and/or unexpected finding should be reported and the more possibly explained and the author should report lost to follow up and dropouts from a clinical trial.

DISCUSSION

Use ample subheadings. Emphasize the new and important aspects of the study and the conclusions that follow from them. Avoid repetition of details included in other parts. This section requires the mention of the implication of the findings, and their limitations for future research, involving relating the observations to other relevant studies.

Finally, the conclusions should be linked to the goals of the study; though mostly avoiding:

Unqualified statement not completely supported by the data

Statement on economic benefits and costs unless the report includes economic data and analyses

Claim of priority and alluding to work that has not been completed.

Whereas new hypotheses could be suggested when warranted, but they should be clearly labeled as such and recommendations, when appropriate and needed, may be given.

Acknowledgments

List all contributors who do not meet the criteria of authorship, such as those who provided purely technical help, writing assistance, or a department chair who provided only general support; and their respective contribution will be headed as provided. Everybody must have given written permission to be acknowledged. References: References should be numbered consecutively in the order in which they were first mentioned in the text. They will be identified in the text, tables, and legends by arabic numbers. This bulletin uses the IEEE style (Institute of Electrical and Electronics Engineers) for referencing the citations. It is advised to avoid citations or personal communication unless they provide essential and pertinent information. In all case, the name of the person and date of communication should be cited in parentheses in the text.

2. CHECKLIST FOR SURVEILLANCE REPORTS

Disease surveillance summaries are reported following the checklist below:

Title

Compose a title that includes the name of the health condition, population, time and place.

Abstract

Provide a structured abstract including the following sub- headings: Background; Objectives; Methods; Results; and Conclusion. Introduction

Context

Summarize the current situation regarding the health condition under surveillance and identify why it is important. Objectives: State the objective of the surveillance report.

Method

Setting

Describe the setting, locations and dates of the surveillance period.

Population

Describe the population under surveillance. Definitions: Provide definitions for each health event under surveillance, including case definitions and any public health interventions.

Information sources

Describe all data sources, including the objective of any surveillance systems, what data were collected and how data were gathered, transferred and stored. Supplementary data: If appropriate, note where to access supplemental material (e.g., www.opendata.gc.ca).

Data quality, missing data and reporting delays

Describe how the data quality was assessed. Explain how missing data were addressed. If data is reported by date of diagnosis or symptom onset, include a statement about whether the data for the most recent periods may be revised.

DATA ANALYSIS

Describe any analytical methods used providing sufficient detail to enable a knowledgeable reader with access to the original data to judge its appropriateness and to assess the reported results.

Results

Descriptive

Provide a summary of the descriptive data, including demographics.

Data Quality

Report on data quality (e.g., completeness, missing data, under reporting)

Analytic data

Provide a summary of the analysis including (when indicated) estimates of trends. When applicable, point estimates should include appropriate indicators of measurement error such as 95% confidence intervals (e.g., average annual percentage change used to describe trends or odds ratios used to describe subgroup differences).

Figures

Create the minimum number of figures to highlight key results. Create a title that includes person, time and place.

Discussion

Key results

Summarize key results with reference to study objectives

Comparison

Consider these findings in relation to the current literature. Strengths and weaknesses: Discuss the strengths and weaknesses of the study (data quality, completeness, sources of potential bias). Interpretation and generalizability: Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence.

Conclusion: Ensure conclusions address objective and follow from the results.

3. PUBLIC HEALTH NOTICES / OUTBREAK REPORTS

Following the Centre for Disease Control recommendations, for PH notices and outbreak reports to be published they need to cover all four components as stated below:

INTRODUCTION

Generally, the introductory paragraph should begin with 1 to 3 sentences establishing the

existence of the outbreak or underlying public health problem (e.g., "On January 2, 2008, the Nevada State Health Division contacted CDC concerning surveillance reports received regarding two persons recently diagnosed with acute hepatitis C."). The introductory paragraph also usually contains: a) a statement that an investigation was conducted, when and by whom; b) the most important finding(s); c) the actions taken to stem the outbreak; and d) a statement of the public health implications and actions that should be taken in response to the investigation. Investigation and results: First, present the initial investigation and its findings. This might include: 1) a description of the setting and a statement of how the outbreak came to the attention of health authorities; 2) a clinical description of the index case or initial cases; 3) initial key test results; and 4) hypothesis generation activities and results. Next, summarize the full investigation, including: case definition, case-finding activities, method of investigation, and results. Cases should be counted and described by clinical characteristics, treatment, and outcome, as well as time, place, and person descriptive results. Next, present the methods and results of any analytic epidemiologic studies (e.g., cohort or case-control studies). Finally, provide the results of any relevant microbiologic, genetic, or toxicologic results, followed by the results of any testing of environmental samples. Public health response: When appropriate, a brief description summarizing any public health interventions taken and the results of the interventions follows.

DISCUSSION

Same as for a Full Report, except that a Limitations paragraph might not be required for an Outbreak Report.

4. POLICY BRIEFS

This bulletin will use guidelines on reporting/ publishing policy notes as they are suggested by the Centre for Disease Control (CDC). As the CDC defines them; Policy Notes are intended to announce new official policies or recommendations (e.g., from ACIP or CDC). These reports can be thought of as briefs. Maximum word count at submission is 1,400 words. Up to three tables, figures, or boxes may be included. Policy Notes contain no Discussion or Limitations, and a summary box is not required. Although policy notes or brief might vary, following is a rough guide of what basic notes should have: Introduction: The introductory paragraph should be limited to 150–200 words. It might contain all or some of the following components: a brief introductory statement orienting the reader to the topic and placing it in context, a brief description of the public health problem, a brief statement of the rationale for the policy or recommendation, mention of the most important parts of the policy or recommendations, and one or two sentences stating the conclusions and the public health implications of the new policy or recommendations.

BACKGROUND

The Policy Note should include a paragraph after the introduction that summarizes background information relevant to the policy or recommendation that can help the reader understand the context and need for the policy or recommendation.

Methods

Should include a summary of the methods used to establish the policy or recommendation, including answers to some or all of these questions: Who was involved in the production of the guidelines or recommendations, and how? What evidence base was considered? What was the rationale for considering this evidence base? Was other evidence excluded from consideration and, if so, why? Rationale and evidence: The Policy Note should provide a concise review of the rationale for the policy or recommendation and a descriptive review of the scientific evidence used to establish it. It should include an explanation of how the policy or recommendation adds to, or differs from, relevant policies or recommendations established previously. Presentation of the policy or recommendation: The policy or recommendation should state clearly when it takes effect and to

whom and under what circumstances it applies.

DISCUSSION OR COMMENT

The Policy Note should comment on the likely impact of the new policy or recommendation and plans for assessment of the policy or recommendation

5. CASE REPORTS

These are reports of an individual patient on their symptoms, treatment reactions on a disease or condition of interest. These reports normally focus on unusual reactions or occurrences. Similar to other research reports, case reports might include a literature review of previous similar. Case reports might also address positive patient outcome on particular treatment guidelines or individual impact of a particular intervention. These are mainly used for educational and decision-making purposes. Case reports are normally reported following a checklist found at the CARE Guidelines

6. CASE STUDIES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. They have to be well-described case studies on healthcare interventions of public health concern. These could be:

Rigorous assessments of processes and program interventions.

Recommendations on possible health interventions. Never on individual patient (= case report)

7. COMMENTARIES / OPINION / METHODOLOGY ARTICLES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. Though these articles are moderated, they should be:

Short, focused, opinionated to previous articles or any subject related to the journal entirely.

Contemporary and focusing on specific issues.

Franc critics to the journal are bravely motivated and would be as much as possible published.
Are normally up to 800 words.

8. FORMATTING THE MANUSCRIPT

Please note that Articles which are not correctly formatted will be returned to the authors

Format text

Style: No Spacing, Single column, Single Spacing
Font: Single Spacing, Times New Roman - size 12
Titles: Capitals and bold, size 14

Format tables

Times New Roman, Font size 9 No vertical lines.
Horizontal lines in the table can be removed
No table should be larger than a single A4 page.
Footnote should be size 9 and italic

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