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Original Research Article

COVID – 19 Pandemics: Impact, Interventions, Progress and Future Direction

Jeremiah Onubi[1], Patricia Eseigbe[2], Adesegun Elisha[3], Jemimah Agyaema[2], George AA Chima[2*]

[1]Senior Lecturer and HOD (FMC Path), Department of Chemical Pathology, College of Medicine and Allied Health Sciences, Bingham University, Jos campus

[2]Department of Family Medicine, College of Medicine and Allied Health Sciences, Bingham University, Jos campus

[3]Prof. of Family Medicine and Sub – Dean Students Affairs, College of Medicine and Allied Health Sciences, Bingham University Jos campus.

[4]Lecturer 1 Department of Medical Microbiology and Parasitology

***Correspondence Author's E-mail: anyuku.chima-george@binghamuni.edu.ng**

Abstract

Though the global health and socioeconomic crisis created by COVID–19 with its rapid spreading nature, high infectivity and fatality rate leading to impairment in human health, psychosocial life and world economy, mass fear of COVID – 19 (corona-phobia) appears forgotten in many countries of the world. Yet consciously or unconsciously the high economic burden, mass emotional distress and abundance of psychiatric manifestations are still being felt including the fear of future similar occurrence. This review investigated the health, psycho-socioeconomic impact and interventions aimed at addressing the menace forced upon the globe by COVID- 19 in order to bring to the fore, the future direction in combating any epidemic or pandemic in the world. We searched for literatures in PubMed, Google, Google scholar etc. using key words: COVID – 19, Pandemic, psycho-socioeconomic, Technology-utilization, Telemedicine for articles addressing the above subject matter. From over a thousand articles on COVID -19, we selected 58 articles that addressed the subject matter with global, regional and local perspectives included and utilizing same in writing this paper. We conclude that future pandemics can be tackled effectively by adopting a three-pronged approach: - public health, early preparedness, and involvement of the entire society as a unitary force.

Keywords: COVID – 19, Impact, Interventions, Pandemic, Progress

INTRODUCTION

Though the COVID – 19pandemics has been on the decline, the huge cost implications for health systems and psycho-socioeconomic impact on the human society remains a concern (Mashige et al., 2021; Singh et al., 2021).

The negative rippling effect on the health care system led the WHO to declare COVID- 19 a global emergency by January; 30th 2020 (Mashige et al., 2021; Singh et al., 2021; Josephson et al., 2021). The declaration made various governments to close down their borders, enforce travel restrictions and introduce quarantine which in turn led to economic and recession crises. This review focuses on the impact on health systems and other aspects of human life, taking the various interventions made so far and future drive towards the control, prevention and eradication of COVID 19 into consideration.

So far none of the four theories about the origin of the virus: an intermediate host, Direct zoonotic, through the cold/food chain, and from laboratory incidents has been conclusive (Josephson et al., 2021; Nicolaa et al., 2021).

The structure of SARS COV 2; the unique FURIN cleavage site in the spike protein, papain–like protease (SCoV2-PLpro), ORF3b and non-structural proteins and the energetic adjustments in the spike protein and other

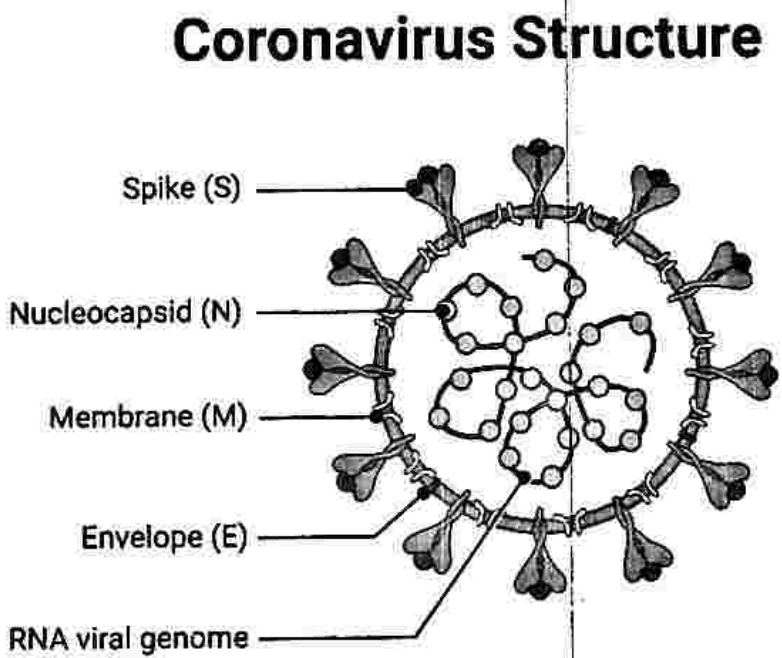

Figure 1. The structure of Coronavirus

parts of the virus gives SARS COV-2 the infectivity and virulence edge over previous coronaviruses (Kumar et al., 2021). Figure 1

Each of the proteins above is essential in the viral functioning and in the development of therapeutic strategies aimed at curbing the pandemic as follows: the S – Protein for attachment and fusion, N – Protein for promotion of viral entry, procession, and post-entry activities, E – Protein for viral assembly, M – Protein promotes spike incorporations and the interaction with E protein thereby facilitates virion production. There is a need to further study the interaction between the S – protein of SARS – CoV – 2 and ACE2 to further elucidate the mechanism of SARS – CoV – 2 infections (Kumar et al., 2021).

Impact on Healthcare systems

The pandemic has, undoubtedly, overwhelmed the health systems of both developed and developing countries (Tessema et al., 2022). The health systems in each country burdened with COVID – 19 prevention, control and treatment strategies realized the weaknesses in their health surveillance system from inadequate infrastructure to fragmented reporting systems (World Health Organization, 2021). Healthcare workers' wellbeing and healthcare systems stability were disrupted leading to global mobilization of public health and clinical protocol measures were adopted for healthcare and facility risk assessment (Tessema et al., 2022; World Health Organization, 2021). Essential and general health services across several countries were impacted upon leading to decreased health service and facility utilization for non-communicable diseases as priority was given to the COVID – 19 pandemic (Tessema et al., 2022). However reproductive and maternal healthcare services were more resilient to the impact of the pandemic than other healthcare services probably due to the design and organization of health systems prior to the pandemic (Tessema et al., 2022; Arsenault et al., 2022).

Social distancing, mask-wearing, decreased mobility, and reduced trauma cases contributed to decrease in the spread of infectious diseases (Arsenault et al., 2022).

Healthcare workers (HCWs) suffered from increased risk of infection and occupational exposure to the disease and the sudden need to adopt responsibilities and duties in the hospital setting (World Health Organization, 2021; World Health Organization, 2021). Surveillance data obtained by WHO showed that between January 2020 and May 2021, 6,643 health workers out of 3.45 million deaths globally were due to COVID-19 with population-based estimate put at 115,493 deaths among HCWs over the same period (World Health Organization, 2021).

Emotional fatigue and burnout from work-related stress during normal situation were made worse by the pandemic leading to higher psychological disorder rates (Lynch and Pusey-Murray, 2021).

Telemedicine – like video consultations etc. used in previous outbreaks like SARS CoV, Ebola and Zika and MERS – CoV were deployed to reduce infection rate (Lynch and Pusey-Murray, 2021; Ohannessian et al.,

2020; Hollander and Carr, 2020; Liu et al., 2020). The COVID-19 pandemic has highlighted the crucial need for restructuring and developing resilient healthcare systems through sustainable investments.

Economic Impact

In addition to the health impact enumerated above, the economic impact has led to global economic crisis emanating from global lock down and other intervention measures for example restrictions in human movement (UNECA, 2023; Faber et al., 2020; World Bank Group, 2020; Gondwe, 2023; Ke and Hsiao, 2022; Ali et al., 2021; Andam et al., 2020).

Unemployment, loss of jobs, closure of industries and increased hunger and malnutrition were visible across the globe (World Bank Group, 2020; Gondwe, 2023; Ke and Hsiao, 2022; Ali et al., 2021; Andam et al., 2020). Wealthy nations grappled with their own internal economic pressures from COVID-19 and the attempt to help poor nations (Faber et al., 2020; World Bank Group, 2020; Gondwe, 2023; Ke and Hsiao, 2022; Ali et al., 2021; Andam et al., 2020).

In Nigeria, the GDP declined by 34.1%, attributed to decline in the services sector of the economy (Andam et al., 2020). Government mitigating measures included palliatives inform of cash, processed and unprocessed foods, and other household needs. Countries like Pakistan fared well in the distribution of palliatives while others did not (UNECA, 2023; Faber et al., 2020; World Bank Group, 2020; Gondwe, 2023; Ke and Hsiao, 2022; Ali et al., 2021; Andam et al., 2020).

Psychosocial Impact

The COVID- 19 pandemic did not only impact on the human health and economy but also the emotional and social life of humans on earth by striking into humans the most primitive response to our emotional well-being – fear (Dubey et al., 2020; Seethaler et al., 2021; Purdie et al., 2020).

Fear stimulates our survival instincts and helps to activate cognition, motor, and physiological responses corresponding to the three levels of response in the human body (Dubey et al., 2020; Seethaler et al., 2021; Purdie et al., 2020; Ogrodniczuka et al., 2021). Pleasant fear is good but when unpleasant causes dysfunction and domination of human lives which in turn leads to anxiety disorders (Seethaler et al.,•2021; Purdie et al., 2020; Ogrodniczuka et al., 2021).

The psychosocial impact cuts across the entire societal strata - the US, South America, Asia, Europe, Africa, etc (Purdie et al., 2020; Ogrodniczuka et al., 2021; Shimazu et al., 2020; Rodríguez and Sánchez, 2020; Ali and Nausheen, 2022). The story is the same COVID- 19 disease have left us with mass morbid fear called "corona-phobia", spectrum of mental health conditions – Mass hysteria, acute panic attacks, anxiety states, obsessive behaviors, paranoia, etc. with disruption of children's lifestyle by lockdown and school closures (Akin-Odanye et al., 2021; Gianino et al., 2021; United Nations, 2021).

The segment of the society affected mostly psychosocially as described were those infected with SARSCoV-2 and high risk of infection, the elderly, those with pre–existing medical conditions, or mental health conditions, persons who abuse or use substances and HCWs (Rodríguez and Sánchez, 2020; Ali and Nausheen, 2022; Akin-Odanye et al., 2021; Gianino et al., 2021; United Nations, 2021; Dan-Nwafor et al., 2020).

Many in the general population with lower risk of infection suffered higher levels of depression from the economic impact of the COVID -19 - disease (Ogrodniczuka et al., 2021).

A survey of 148 countries showed that the Psychosocial impact of COVID – 19 cuts across all populations including children and families and that about 10 to 20% of child and adolescent age had mental disorders (Dan-Nwafor et al., 2020; Jacobs and Okeke, 2022; Vargo et al., 2021; Whitelaw et al., 2020; Budd et al., 2020).

The various governments and stakeholders globally should take cognizance of the Psychosocial impact of COVID – 19and related consequences incorporate mental care into future pandemic care, prevention and control (Seethaler et al., 2021).

Interventions and Progress Made

With WHO declaration of the pandemic as a threat to human existence and UN declaration of the pandemic as an economic, humanitarian, securtiy and human crisis the stage was set for global, regional and national interventios (United Nations, 2021). The responses included Prevention, Surveillance, Containment, Treatment, and Coordination strategies aimed at curbing the menace cursed by the pandemic and preservation of lives (United Nations, 2021).

Large-scale coordinated health responses, adoption of policies that will address the devastating socio-economic, humanitarian, and human rights aspects of the crisis, recovery processes that will lead to better building and rebuilding processes were initiated (United Nations, 2021; Dan-Nwafor et al., 2020).

In Nigeria for instance an Italian infected with the virus, that came in through Lagos and visited Ogun State led to contact tracing of 216 persons out of which only one person was confirmed to have been infected by the Italian and thus was the second confirmed case in Nigeria (Jacobs and Okeke, 2022).

Coronavirus preparedness group was set up and

training of Coronavirus Rapid Response Teams commenced and concluded in the 36 states and Abuja between December; 2019 and January 2020 (Jacobs and Okeke, 2022; Vargo et al., 2021). The Nigerian Centre for Disease Control swung into action to ensure that the National Guideline for COVID -19 prevention, care, treatment, and control was effectively activated and implemented across the nation including daily reporting of diagnosed, treated, discharged, and mortalities (Jacobs and Okeke, 2022; Vargo et al., 2021).

Other interventions in Nigeria included the post-ponement of the National Sports Festival, suspension of the NYSC orientation camp program, closure of schools and markets in various states, travel restrictions within states, inter-state, and international travel ban, establishment of COVID – 19 prevention protocols, SOPs, Guidelines on Restrictions and transfer of suspected were approved for implementation by the Nigeria Government between March and June 2020 (Jacobs and Okeke, 2022; Vargo et al., 2021).

Despite the above interventions, palpable fear of the rapidly spreading nature and associated mortalities spread throughout the nation, made worse by health experts prediction that Africa and Nigeria in particular were in for a hard time of controlling the virus because of their weak economic status and inconsistencies policies and policy implementation which soon manifested as people abandoned social distancing in pursuit of daily means of survival, leading to the rapid spread of the disease in states like Lagos with high population density (Jacobs and Okeke, 2022; Vargo et al., 2021).

The Way Forward

The Pandemic obviously exposed the inadequacy and lapses in Nigeria and other African countries' pre-paredness in the handling of pandemic. Thus, moving forward societal involvement and ownership approach in disease management, diagnostic and therapeutic measures and supportive care were designed (United Nations, 2021; Dan-Nwafor et al., 2020; Jacobs and Okeke, 2022; Vargo et al., 2021).

A robust plan was put in place that encompassed human capacity development, planning, coordination, and communication across all societal strata. With the various National agencies responsible for the control of the pandemic put in charge to ensure the prioritization of resources, formation of expert working groups, and massive involvement of relevant individuals, families, and communities (United Nations, 2021; Dan-Nwafor et al., 2020; Jacobs and Okeke, 2022; Vargo et al., 2021).

The strategies put in place included early identification and point-specific management; digital contact tracing and interoperability, remote monitoring and wearable services, artificial intelligent chatbots, digital front door, robotics, and Telehealth and 5G expansion application (Whitelaw et al., 2020; Budd et al., 2020; Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022).

Face – time and zoom for virtual clinical visits and other measures above allowed health care providers to cover a wide range of conditions ranging from urgent and primary care, checkups and medication follow-ups (Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022).

Digital Contact Tracing and Interoperability, Remote Monitoring and Wearable Devices, Artificial Intelligence Chatbots, Digital Front Door and Robotic smart devices were clearly shown to be the future direction in combating any future epidemic or pandemic (Budd et al., 2020; Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022).

Diagnostics

Diagnostic interventions included RT – PCR testing targeting three genes- Orf1b gene/human RNA polymerase protein, N-gene/N-protein, and E-gene/E-protein. Several types of RT-PCR kits are currently available, ELIZA testing to detect IgG antibodies, though this is less sensitive when compared to the PCR testing, Immunofluorescence assay and Real–time Rapid test (Xpert) (Peeling et al., 2022; Bio-Techne, 2022; Kumar et al., 2020). Other laboratory tests include western blot for individuals that have been exposed to the virus, POCT(Point of Care Testing), Vivalytic COVID 19 detection kit, Abbott ID NOW, lateral flow immunoassay rapid test, chem-bio diagnostic DPP COVID – 19 IgM/IgG POCT (Peeling et al., 2022; Bio-Techne, 2022; Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022). A real-time Rapid test (Xpert Xpress SARS-CoV-2 test) gives confirmatory results within 45 minutes.

Immunoassay using Enzyme-linked Immunosorbent assay (ELIZA). This confirms SARS-CoV-2 by detecting Immunoglobulin-G though less sensitive than PCR (Peeling et al., 2022; Bio-Techne, 2022; Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022). Besides the above ELIZA which is laborious needs PCR for for confirmation (Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022). Western Blot identifies individuals already exposed to the virus by detecting IgM and IgG. IgM appears 10-30 days after the exposure while IgG appears 20 days later.

With POCT immunodiagnostics e.g., Vivalytic COVID 19 test kit (this kit can detect 9 other viruses with results in less than 15 minutes), actively dividing viruses are detected within minutes making it the foremost test for the future (Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022; Bio-Techne, 2022; Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022). This immunodiagnostic test gives results within minutes. Other rapid immuno-assays include the Lateral flow that detects IgM and IgG antibodies within 10mins utilizing 20ul of plasma/serum

from patients and Chembio Diagnostics providing results within 15mins future (Kritikos, 2020; Maharana et al., 2021; Peeling et al., 2022; Bio-Techne, 2022; Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022).

Precision Medicine and Precision Public Health

The deployment of PM and PPH have highlighted the importance of precise diagnostic and treatment modalities using various biomarkers like genetic variants and environmental, lifestyle, and behavioral data in addressing COVID 19 (Omnia Health, 2022; Zhou et al., 2021). This approach have reduced the length of time needed to produce new drugs for specific diseases, thereby minimizing resource wastages e.g., the use of PPEs and Ventilators while serving population diversities. typical example is the link of worsening cases of COVID – 19 to genetic variations in the Chromosomes 3 (3p21.31) and 9 (9q34.2), ApoE e4 genotype, and loss-of-function mutations on X-chromosome TLR7 noted from recent studies (Zhou et al., 2021; Chakraborty et al., 2022).

On the other hand, using more precise modalities to assess vulnerability, behavior, and disease spread in population health has contributed to public health efforts towards the containment of COVID – 19 (Zhou et al., 2021; Chakraborty et al., 2022). Thus, exact genetic information application to host and virus has been brought to the fore using genomic pathogens to track genetic variations of SARS – COV – 2 virus and by this local public health officials were helped in choice making (Zhou et al., 2021; Chakraborty et al., 2022).

Drug Repurposing

This is the use of existing drugs against a new pathogenic agent/strain with no known cure or treatment; to ascertain which of the drugs has a better therapeutic effect/potency against the agent/new strain. With no known specific treatment for COVID – 19 at the onset, drug repurposing became the best approach since most viruses shared similarities in their genomic constitution (Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021). This process reduces time, risks, and costs associated with new drug development. Drugs like Remdesivir and favipiravir were tried and eventually became the approved drug for COVID – 19 (Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021). Protease inhibitors like Lopinavir, ritonavir, and darunavir have been used in some places to treat COVID – 19 (Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021). Others include: inhibitors like Umifenovir have shown promising results (Bio-Techne, 2022; Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022; Zhou et al., 2021; Chakraborty et al., 2022; Srivastava and Singh, 2021; Ng et al., 2021). soluble glycoproteins like IFNs – though still under investigation were used to modulate the immune response to infection by inducing specific responses to extracellular stimuli; Monoclonal, Polyclonal, Sacrilumab and Tocilizumab antibodies have variously been used for their prophylactic and therapeutic effects respectively (Banerjee et al., 2022; Yang et al., 2021; Ahmed and Hassan, 2020).

Antibodies from the plasma of COVID – 19 convalescent patients have also been used in the treatment of patients infected with the SARS – Cov – 2 in the same way it was successfully used against SARS-CoV, MERS-CoV, and Ebola virus in the past. Successful treatments of COVID – 19 critically ill patients were recorded within 3 days with the neutralization of the virus in China (Banerjee et al., 2022; Yang et al., 2021; Ahmed and Hassan, 2020).

Other treatment modalities included the use of quinoline derivatives, chloroquine, and its hydroxy derivatives. Hydroxychloroquine was noted to have shown significant inhibitory activity against the virus with an EC50 value of 1.13um (Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022). In some other settings hydroxychloroquine in combination with azithromycin showed remarkable clinical improvement and reduction in the duration of treatment, even though studies are still ongoing to ascertain the role of these two drugs (Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021). Ivermectin is another that has demonstrated effectiveness in combating the Coronavirus due to its nuclear transport inhibitory activity, thus reducing the viral RNA (Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021). Corticosteroids (Dexamethasone 6mg) showed better outcomes within 10 days when given IV or orally to critically ill patients on mechanical ventilation in comparison to control group (Li et al., 2022). The death rate was also shown to have reduced by 20% in those that received oxygen supplementation as well (Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021; Ahmed and Hassan, 2020).

Although globally, COVID – 19 cases are declining, some regions like the US and similarly developed countries were still reporting new cases and more importantly the emergence of new strains of the SARS – CoV - 2.

Supportive Measures

Supportive measures such as vaccination, treatment, and other medical supplies were coordinated and made available to countries by WHO. Other supportive measures include capacity development – provision of technical support by relevant government agencies

responsible for public human health emergencies (Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022; Zhou et al., 2021; Chakraborty et al., 2022; Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021; Banerjee et al., 2022; Yang et al., 2021; Ahmed and Hassan, 2020; Li et al., 2022). Training of critical field epidemiologist was also embarked upon in several countries where insufficient personnel existed to enable the investigation, collation, analysis and interpretation of surveillance data (Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022; Zhou et al., 2021; Chakraborty et al., 2022; Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021; Banerjee et al., 2022; Yang et al., 2021; Ahmed and Hassan, 2020; Li et al., 2022).

Laboratory personnel were also trained in the use of new technologies in the diagnosis of the coronavirus disease and other complications arising from the condition. Laboratory platforms were provided for gene sequencing and point of care diagnostics aimed at improving the detection and differentiating Coronavirus from other respiratory viral infections (Kumar et al., 2020; Wang et al., 2020; Omnia Health, 2022; Zhou et al., 2021; Chakraborty et al., 2022; Srivastava and Singh, 2021; Ng et al., 2021; Rodrigues et al., 2022; Abdolvahab et al., 2021; Banerjee et al., 2022; Yang et al., 2021; Ahmed and Hassan, 2020; Li et al., 2022).

Reduction in community spread was facilitated by the use of 5G expansion in contact tracing, supply of fresh clean water, improved sanitation, and hygiene practices (Omboni et al., 2022). These measures helped to improve infection prevention and control policies and procedures in both rural and urban communities building on existing infection prevention and control protocols and processes (Omboni et al., 2022). The use of PPEs was promoted and supplies were increasingly made available. Nasal sprays for COVID – 19 vaccines were developed and deployed particularly in developed countries.

The Future Direction

With the conceptual framework for telemedicine in a pandemic published in 2015 and updated in 2019 as a result of the COVID 19 it is expected that all countries yet to develop and promote the use of telemedicine should borrow a leaf from the developed countries where the technology was already in use (Monaghesh and Hajizadeh, 2020; Kichloo et al., 2020; Jean-Gilles et al., 2010).

The response strategy included early diagnosis, patient isolation, symptomatic monitoring of contacts as well as suspected and confirmed cases, and public health quarantine. In this context, telemedicine, particularly video consultations, has been promoted and scaled up to reduce the risk of transmission, especially in the United Kingdom and the United States of America (Monaghesh and Hajizadeh, 2020; Kichloo et al., 2020; Jean-Gilles et al., 2010). Based on a literature review, the first conceptual framework for telemedicine implementation during outbreaks which was published in 2015; an updated framework for telemedicine in the COVID-19 pandemic era was defined (Monaghesh and Hajizadeh, 2020; Kichloo et al., 2020; Jean-Gilles et al., 2010). This framework could be applied at a large scale to improve the national public health response. Most countries, however, lack a regulatory framework to authorize, integrate, and reimburse telemedicine services, including in emergency and outbreak situations.

Several challenges remain for the global use and integration of telemedicine into the public health response to COVID-19 and future outbreaks. All stakeholders are, therefore, encouraged to collaborate in deploring best practices learnt during the COVID-19 pandemic to promote the safe and evidence-based use of telemedicine infuture outbreaks (World Health Organization, 2023; World Bank Group, 2023). For countries without integrated telemedicine into their national healthcare system, the COVID-19 pandemic is a wake-up call to adopt the necessary regulatory frameworks for supporting the adoption of telemedicine (World Health Organization, 2023; World Bank Group, 2023). Finally, the utilization of experiences and lessons learnt from the SARS and Ebola outbreaks; early preparedness, and involvement of the entire society as a unitary force against COVID- 19 Pandemic gave 7 countries an edge over other countries of the world and should be adopted by other countries as well for the future (World Health Organization, 2023; World Bank Group, 2023).

To this end the World Health Organization have recommended 5 actions that should be taken before, during and after a pandemic (World Health Organization, 2023). Pandemic has also been divided into phases as in the table below and the recommended actions are to be taken during each phase of the pandemic (World Health Organization, 2023). Table 1

Adopted from the WHO recommended guidelines for a pandemic following the report of findings from the influenza pandemic.

The five recommended actions are 1. planning and coordination 2. situation monitoring and assessment 3. reducing the spread of disease 4. continuity of health care provision and 5. Communications; while table 2 showcases the summary of recommended actions (World Health Organization, 2023). Table 2

Figure 1 below illustrates how the entire society can deployed as a unitary force in the combat of an epidemic (World Health Organization, 2023).

World bank in their own recommendation for future action against any pandemic have come up with the one health strategic approach to future pandemic prevention

Table 1. Description of phases of Pandemic

Phases	Description
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Phase 4	Human – to – human transmission (H2H) of an animal or human – animal influenza reassortant virus able to sustain community-level outbreaks has been verified
Phase 5	The same identified virus has caused sustained community level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in phase 5, the same virus has caused sustained community level outbreaks in at least one other country in another WHO region.
Post peak period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible new wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post pandemic period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.

Table 2. Summary table of recommended actions and phases

PREPAREDNESS COMPONENTS	PHASES				
	1-3	4	5-6	POST PEAK	POST PANDEMIC
PLANNING AND COORDINATION	**Develop, exercise**, and periodically **revise** national influenza pandemic preparedness and response **plans.**	Direct and coordinate rapid pandemic **containment** activities in collaboration with WHO to limit or delay the spread of infection.	Provide **leadership** and **coordination** to **multisectoral resources** to mitigate the societal and economic impacts.	Plan and coordinate for **additional resources** and **capacities** during possible future waves.	**Review** lessons learned and share experiences with the international community. **Replenish** resources.
SITUATION MONITORING AND ASSESSMENT	**Develop** robust national **surveillance** systems in collaboration with national animal health authorities, and other relevant sectors.	**Increase** surveillance. Monitor containment operations. Share findings with WHO and the international community.	**Actively monitor and assess** the evolving pandemic and its impacts and mitigation measures.	**Continue** surveillance to detect subsequent waves.	**Evaluate** the pandemic characteristics and situation monitoring and assessment tools for the next pandemic and other public health emergencies.
REDUCING THE SPREAD OF DISEASE	**Promote beneficial behaviours** in individuals for self protection. Plan for use of pharmaceuticals and vaccines.	Implement rapid pandemic **containment** operations and other activities; collaborate with WHO and the international community as necessary.	**Implement** individual, societal, and pharmaceutical measures.	**Evaluate** the effectiveness of the measures used to update guidelines, protocols, and algorithms.	Conduct a **thorough evaluation** of all interventions implemented.
CONTINUITY OF HEALTH CARE PROVISION	**Prepare** the health system to **scale up.**	Activate **contingency** plans.	**Implement** contingency plans for health systems at all levels.	**Rest, restock** resources, **revise** plans, **and rebuild** essential services.	**Evaluate** the response of the health system to the pandemic and **share** the lessons learned.
COMMUNICATIONS	**Complete** communications planning and initiate **communications** activities to communicate real and potential risks.	Promote and communicate recommended **interventions** to prevent and reduce population and individual risk.	Continue **providing updates** to general public and all stakeholders on the state of the pandemic and measures to mitigate risk.	**Regularly update** the public and other stakeholders on any changes to the status of the pandemic.	Publicly **acknowledge** contributions of all communities and sectors and communicate the lessons learned; **incorporate** lessons learned into communications activities and planning for the next major public health crisis.

Figure 2. The Whole Society Approach to Pandemic Preparedness

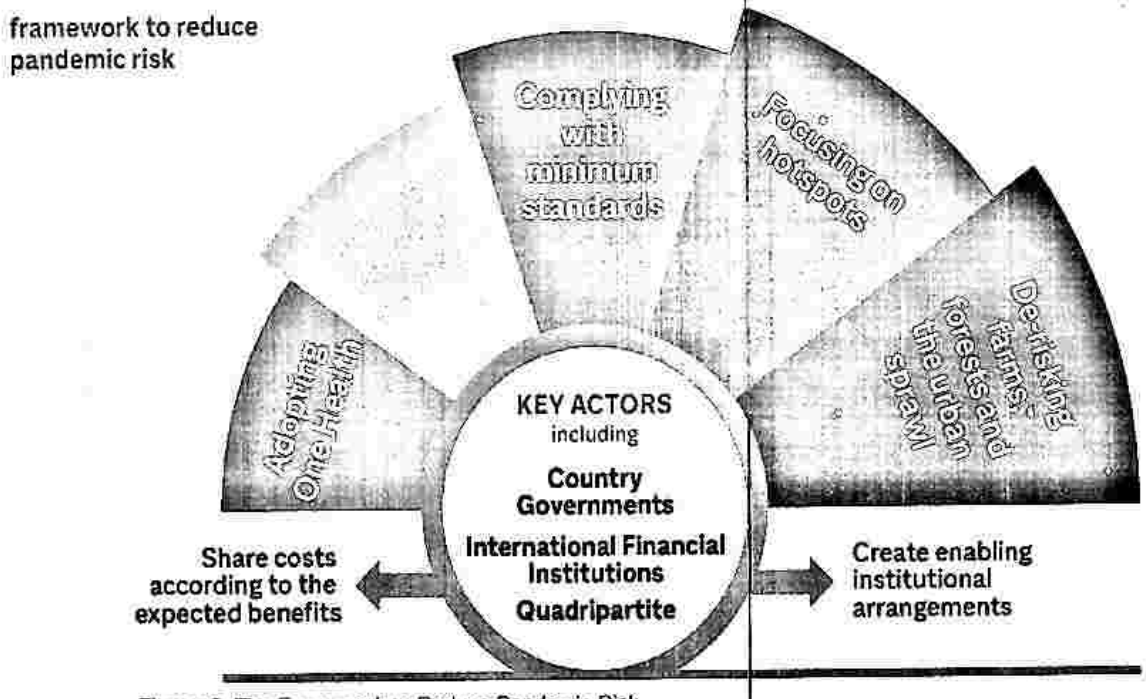

Figure 3. The Framework to Reduce Pandemic Risk

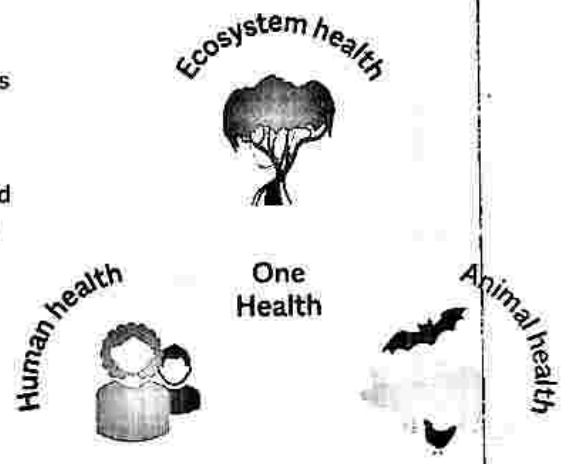

FIGURE 2:
One Health recognizes the connections and interdependency among the health of humans, domestic and wild animals, and the health of the ecosystems they share

The One Health approach improves the ability to effectively **prevent; detect; respond to, and recover** from, outbreaks; prepare for future pandemics; and accomplish development goals such as improved health and economic security, climate resilience, and food safety.

Figure 4. One Health approach in Recognition of Human, Ecosystem and Animal Health

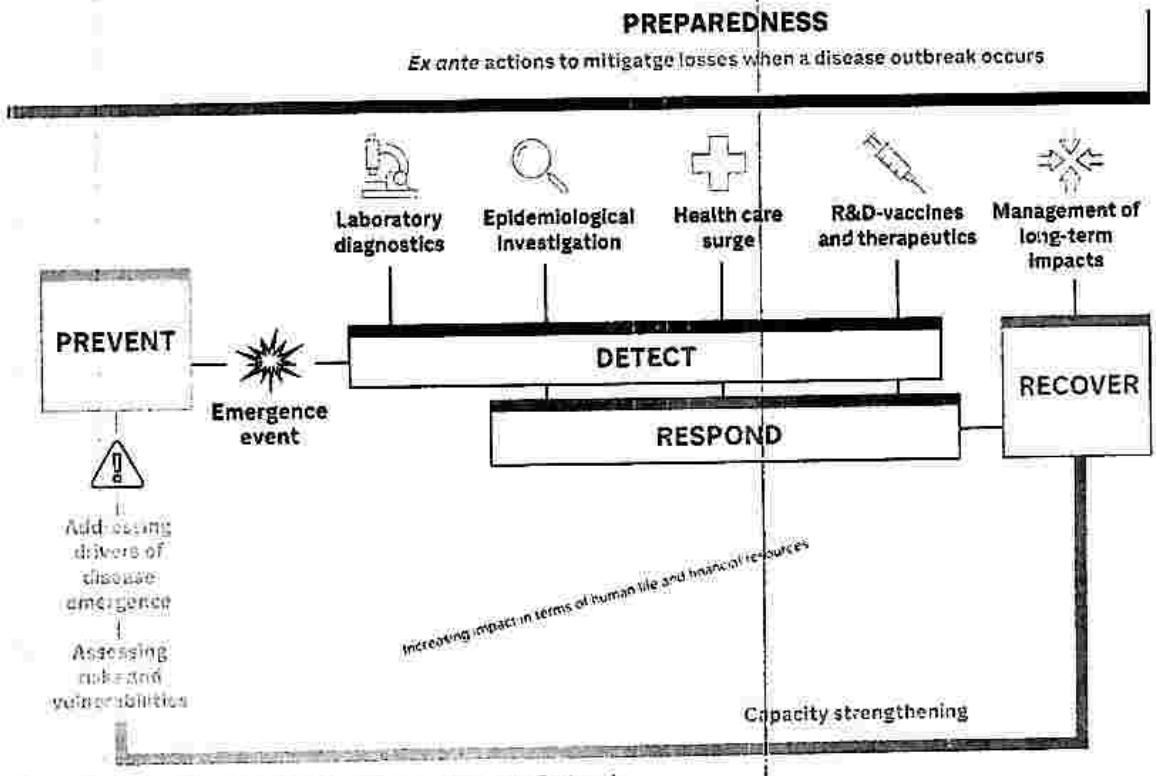

Figure 5. Complete Preparedness Plan for a Disease Outbreak

and control (World Health Organization, 2023). The approach is based on systemic thinking, involvement of the entire society in planning, incorporation of collaboration across disciplines within the human-animal-ecosystem interfaces that will cumulate into global health security (World Bank Group, 2023). This approach to pandemic prevention and control will be guided by five core principles (World Bank Group, 2023).

1. Adoption of one health multisectoral approach that will bring sustainability and balance to the health of people, animals and ecosystem.
2. Prioritization of prevention as part of health security.

3. Complying with already existing minimum standards that are relevant to one health.
4. Focus on geographical locations with higher risks for spillover within the human-animal-ecosystem interfaces.
5. Reduction in risk of spillovers in forests, farms and sprawling urban areas.

The one health approach is as shown by the three figures below (World Bank Group, 2023): Figure 2-3

CONCLUSION

The world seems to have relaxed measures put in place in fighting the pandemic, whereas, the virus which has a way of mutating can actually cause a future pandemic. Public health approach, involvement of the entire society together with early preparedness should be utilized for a future war against a pandemic.

It is also imperative that the new frame of work should be for a global pandemic prevention and control readiness, protection and preservation of health systems in place, and strengthening of our defenses against future epidemics and pandemics. The one health approach is certainly the way to go for a safer global human, animal and ecosystem health.

RECOMMENDATIONS

World Health Organization, World Health Assembly, and other global bodies need to closely work together to ensure that no country is left behind in epidemic and pandemic prevention and control preparedness (Jean-Gilles et al., 2010; World Health Organization, 2023).

According to the WHO Director-General Countries of the world can draw lessons from Italy, Mauritius, Mongolia, Uruguay, Pakistan, Japan, and New Zealand's handling of the COVID- 19 Pandemic to deal with future Pandemics (Jean-Gilles et al., 2010; World Health Organization, 2023).

Authors contribution

Dr. Onubi J – Intellectual content, conceptualization and writing articles on economic impact, interventions, laboratory interventions and future direction
Dr. Chima AAG –Conceptualization, and definition of intellectual content, Literature search, writing on Psychosocial Impact, Interventions and future directions and manuscript preparation and review; also, as guarantor for entire work.
Dr. Eseigbe P. – literature search and writing of article on Health impact on COVID 19.
Drs. Adesegun Elisha and Agyema J. contributed in general editing and proof reading and final approval of the work.

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