Texila International Journal of Public Health
ISSN: 2520-3134
DOI: 10.21522/TIJPH.2013.10.01.Art006

Conceptual Framework for Epidemics and Vaccination Dilemma

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Abstract

Outbreaks of diseases have positive and negative effects on humans. An example of the positive epidemic dilemma was seen in the 2020 lockdown across the world where families spent quality time together and couples seeking for the fruit of the womb conceived after many years, working from home was introduced, Lagosians working from home reduced stress from traffic, remote jobs were increased, online zoom, Webex webinars, online surveys, seminars, conference, Viva Voca, graduation and growth for online business and banking. Apps were available for the masses to access health online, known as Telemedicine. While the negative epidemics dilemma includes loss of jobs, slow down in economy across the world, poverty, drug abuse, self–medication, Anti-microbial resistance, child abuse, rape, divorce, shadow pandemic, death, and no access to education for those that do not have internet facilities to learn/study/school online. Vaccine's hesitancy is an established dilemma that contributes to significant health challenges which cause a high rate of infant sickness and death. There are certain factors like cultural, social, demographic, and psychosocial factors that contribute to the vaccine dilemma. This conceptual framework illustrates the factors that drive epidemics and vaccine dilemma, which can be vaccination acceptance and hesitancy. For an intervention to be implemented successfully, we need to understand the triggers of epidemics and vaccination dilemma. The socio-demographic characteristics like age, sex, marital status, level of education, choice of hospital, employment status, level of income, health insurance status and the number of children is significantly associated with vaccine uptake among parents.

Keywords: *Dilemma, Epidemics, Vaccination.*

Introduction

An epidemic simply means the sudden spread of disease to a large number of people in a given community or population within a short period of time. An emerging disease is one that has newly appeared in a population or that has been known for some time but is raiding increasing in incidence or geographic spread or occurrence, such as COVID 19 first observed in Wuhan China in December 2019.

A re-emerging disease is one that once was a major problem in a particular country or globally, and then declined in incidence, but is again becoming a public health problem. Another form of classification groups emerging infectious diseases into four classes:

Diseases not previously known examples include the Hanta virus, Ebola virus, and Acquired Immune Deficiency Syndrome. Diseases that are re-emerging having been previously brought under control: examples are Tuberculosis and Malaria.

New manifestations of known disease agents: examples are the genital, respiratory, and cardiac manifestations of Chlamydia. Chlamydia, the causative agent of Trachoma, was originally known as one of the leading causes of blindness in developing countries. Chlamydia is also now associated with the occurrence and exacerbation of Asthma.

Introduction of known agents into new territories: an example is the sudden spread of

Received: 17.01.2022 ***Accepted: 02.02.2022*** ***Published on: 30.03.2022***
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West Nile Virus in the last decade of the 20th Century in the United States [1].

Developing countries such as Nigeria are now faced historically with a predominance of communicable diseases, but increasingly with changes in lifestyle, these countries are also now recording increasing incidences of non-communicable diseases such as cancer, Type 2 Diabetes, Stroke, and Ischaemic Heart Disease. So, for many developing communities, some of the non – communicable diseases are emerging and are compounding the health problems of the populations even in the face of very weak health systems [1]. Emerging and re-emerging diseases can be communicable and non - communicable disease.

More than 1400 microbes are known to cause disease in man, and these are therefore classified as pathogenic microbes. Most of the microbes on earth are benign to man, and a few may very well be beneficial to the ecosystem. Of the 1400 pathogens, only about 12% are accountable for emerging and re-emerging diseases. The globe is conversant with over 80% of the pathogenic microbes, although we might not always have potent weapons to destroy each and all of them. In most situations, we have successfully maintained a particularly good balance to mitigate the microbes to prevent a threat to human survival except when these microbes mutate [1].

Examples of emerging infectious diseases:

1. Ebola Virus (first outbreak in 1976 and thus the discovery of the virus in 1977).
2. HIV/AIDS (virus first isolated in 1983)
3. Hepatitis C (first discovered in 1989, known as the foremost common result of post-transfusion hepatitis worldwide).
4. Influenza A(H5N1) virus (well-known pathogen in birds but first isolated from humans in 1997).
5. Legionella pneumophila (first outbreak in 1976 known as legionnaire disease and related to similar outbreaks linked to poorly maintained air-cooling systems).
6. E. coli O157:H7 (first discovered in 1982, which can be transmitted through contaminated food and has resulted to outbreaks of hemolytic uremic syndrome).
7. Borrelia burgdogeri (first detected in 1982 and identified as the reason for Lyme disease).
8. Severe Acute Respiratory Syndrome (SARS) (first detected in 2003 in Asia); this is first emerging infectious disease of our present century.
9. Swine flu Influenza A (H1N1) (first observed in 2009 in Mexico).

The Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS), both diseases caused by the coronavirus group, but which fortunately have low levels of infectiousness. This low level of infectiousness has largely limited their potential for causing global epidemics (pandemic) unlike the recent pandemic COVID 19 which also belongs to the coronavirus group. SARS killed a minimum of 775 people after it emerged in China in late 2002, while MERS, which first appeared in Saudi Arabia in September 2012, had infected about 79 people. On July 9th, 2013, the WHO convened an emergency meeting to find out whether the coronavirus which causes MERS constituted a 'public health emergency of international concern'. Nevertheless, SARS causes the worldwide economy some $50 billion [1].

There was a generally slow response to the Ebola outbreak in some countries across West Africa which claimed over 5,000 lives. The Flu pandemic of 1918 – 1919 killed twenty-two million people through the flu virus is an acknowledged trickster that constantly changes its surface antigens thus fooling the body's immunity each time; we must provide rapid response to emerging infectious diseases employing a multiplicity of strategies [1].

Factors Contributing to the Emergence and Re-emergence of Infectious Diseases

The Institute of medicine in the United States published in 2003 a report titled “Microbial Threats to Health: Emergence, Detection and Response.” This report identified several factors contributing to the emergence and re-emergence of infectious diseases, and the following are adapted from that publication.

Microbial Adaptation: Self–medication with antibiotics has led to a global health issue known as antimicrobial resistance.

Human Susceptibility: When an individual’s immune system is low due to certain factors like age, bad health status (suffering from a chronic disease) it becomes easier for an organism to encroach the body.

Climate, Weather, and Change Ecosystem: Climate change is the change in weather conditions. This has led to desertification, an increase in temperature, and loss of species. Recently certain vectors can now survive in some geographical areas and contribute to the spread of diseases. An example is the tiger mosquito that transmits Chikunguya disease can now survive in some parts of Europe, Although Chikunguya disease does not cause fatality, it is evident that climate change can result in emerging disease [1]. Climate change has disrupted the agricultural practices of man and consequently bring him in closer contact with the agents of disease.

Human Demographics and Behaviour: Increasing human population due to urban migration in search for green pastures and overcrowding makes it easier for the spread of diseases. Failure to observe social distancing can be seen in the spread of Covid 19. Commercial sex works and newly defined sexual practices and behaviour, for example multiplicity of sexual partners and male-to-male practices, will result in increased exposure to agents of diseases [1].

Economic Development and Land Use: Cutting down trees can lead to, and destruction of buses can drive animals like rat to live in homes, thereby spreading Lassa fever.

Technology and Industry: Food storage and supply if not properly refrigerated and well packaged, can host infective agents that distribute diseases.

International Travel and Commerce: The importation of Ebola by a Liberian man Mr. Patrick Sawyer in 2014 and the importation of COVID – 19 by an Italian man into Nigeria Is an examples. The only reason COVID – 19 was spread from China to all over the world is as a result of international travel and commerce.

Breakdown of Public Health Infrastructure: One major defining feature of the protracted Ebola Epidemic in Liberia, Sierra Leone, and Guinea is the collapsed Public Health Infrastructure in those countries. This has made it difficult for the epidemic that was reported in March 2014 to have remained out of control in those countries until external help has been poured into those countries [1].

Poverty and Social Inequality: Poverty and social inequity will lead to people living in areas that are overcrowded and with poor sanitary facilities as well as deprive them of access to resources that are preventive of diseases. Poverty will also expose people to activities and behavior that increase exposure to health risks [1].

War and Famine: Wars cause a lot of social disruptions and damages to physical infrastructures such as water and electricity supply, thus paving the way for the spread of diseases. Rape and abuses during wars also aid the spread of diseases as was clearly documented during Rwandan War when so many raped women gave birth to many HIV-infected babies [1]. Northern Nigeria, affected by insurgency has displaced a lot of families living in various IDP camps. We have seen cases of cholera, malnutrition, kidnapping, and young girls giving birth to babies without being married as a result of rape and poverty.

Lack of Political Will: Lack of political will at times delay the prompt allocation of resources to contain emerging diseases until the diseases get out of hand. An example has been the Ebola outbreak in West Africa that has claimed over 5,000 lives and the recent COVID – 19, which has claimed numerous lives. It took a while for WHO to declare an emergency compared to the urgency with which the body convened an emergency meeting when SARS has claimed less than 300 lives. National governments also, at times, are slow to recognize their responsibilities [1].

Intent to Harm: Bioterrorists could cause the release of an infective agent into populations and thereby causing the emergence or re-emergence of an infectious disease. The use of Antrax through the Post in the United States of America in 2011 is one example [1]. It is still being debated if the recent COVID – 19 was an intent to harm.

Some Challenges Faced from Emerging and Re-emerging Infectious Diseases

1. The agent in an emerging infectious disease is new, and there may be no known specific treatment or cure like COVID-19 [1].
2. The disease may not be known, can have symptoms of some different diseases, and professionals in the health sector may lack experience in proper diagnosis, such as COVID – 19 and malaria [1].
3. Because of the lack of experience in identifying and managing, health workers may be inadvertently exposed to infective agents, this is the reason a lot of health workers died in Africa as a result of Ebola [1].
4. There may be a lack of resources for diagnosis, treatment, and isolation [1].
5. The psychosocial fears and social stigmatization of patients, contacts, health care workers which is usually displayed among members of the public. This was experienced in Nigeria during Ebola and COVID – 19 outbreaks [1].
6. The confusion between "duty of care" on health workers and likely exposure to infectious agents [1].
7. Strike actions by health workers due to unpaid wages or under payment of Medical Doctors.
8. Lack of personal protective equipment (PPEs) for health workers.

Vaccines save a lot of lives and protect you and your family from serious infectious diseases that may cause disability and even death [2]. one in all the foremost important challenges in implementing an efficient immunization program is to make sure that enough individuals comply with get vaccinated. This decision can be supported by many factors like an individual's knowledge about the prices, including perceived side-effects, and benefits of vaccination, in addition because of the social, economic, and cultural environment to which they belong [3,4]. The shortage of public confidence within the efficacy and/or safety of vaccines can create to vaccine hesitancy (i.e., delay or refusal to induce vaccinated despite the supply of vaccine services) [5] and in extreme cases, generate vaccine scares [6,7]. Even within the absence of any bias against a vaccine intrinsically, vaccine uptake within the population can change from time to time with changing prevalence of the disease. Indeed, it's expected that individuals are more likely to induce themselves vaccinated when there's a better risk of getting infected [8]. Conversely, low disease incidence may often result in a big call vaccine uptake, presumably due to the lower perceived risk of contracting the disease [9]. This is often essentially an instance of a social dilemma [10] that always arises in a well-thought-out relationship between rational individuals, who are attempting to maximize the advantages accruing to them from their actions and people of others [11]. Sharma et al. states that when the threat of infection is high, the individual contains a strong incentive to urge vaccinated, while every now and then of the lower risk, she is also tempted to avoid vaccination and free ride on the herd immunity provided by immunized members of a population without bearing any cost herself [12]. However, Sharma et al says that, if the masses argue in this manner and avoid vaccination, it would leave the population entirely exposed to invasion by the microbes or diseases [12]. Sharma further explained that, while free riding appears to be optimal from an individual's perspective, it ends up in a clearly undesirable collective outcome [12]. Which is often one in every of the issues central to scientific theory, which therefore provides a natural framework for understanding the conditions under which a population of rational individuals will voluntarily attempt to get vaccinated [12].

Public health is the science and art of preventing disease, elongating life, and making the quality of life better via constant interventions and knowledgeable decisions of the population, masses, communities, and individuals. Analyzing the determinants of health of a population in terms of epidemics and vaccination dilemma is the basis for public health.

Methodology

Overview

To address the epidemics and vaccination dilemma, the following factors were used to design the conceptual framework.

1. Dependent variables: Socio-demographic and employment status.
2. Information about disease outbreaks (cholera, COVID – 19, Rotavirus, and Pneumonia) and vaccination.

Protocol

Previous articles were reviewed which were used as a guideline to design a conceptual framework for epidemics and vaccination dilemma.

Study Area

This study was conducted in Kosofe and Shomolu Local Government Area in Lagos State, Nigeria. Kosofe means 'nothing is free. Somolu is known for many things. Most famous is its being known as a central printing hub. You will find print shops for almost any print jobs. In particular, the Bajulaiye Road axis has offset and digital print shops. Epidemics occur everywhere in the world, including Kosefe and Shomolu Local government. We carried out our research at Health Centre at Kosofe LGA called Oworoshoki health centre, General Hospital Gbagada, and the popular R Jolad is a good place to study and capture epidemics and vaccination dilemma.

Study Population

The population is comprised of all the parents/childcare givers in Kosofe and Shomolu LGA. The study subjects were Mothers/Fathers/Childcare givers/guardians that use Kosofe LGA Health Centre, General Hospital, and R Jolad hospital to vaccinate their children. This comprised of those that take vaccines as well as track epidemics, both emerging and re-emerging diseases.

Conceptual Framework for Epidemics and Vaccination Dilemma

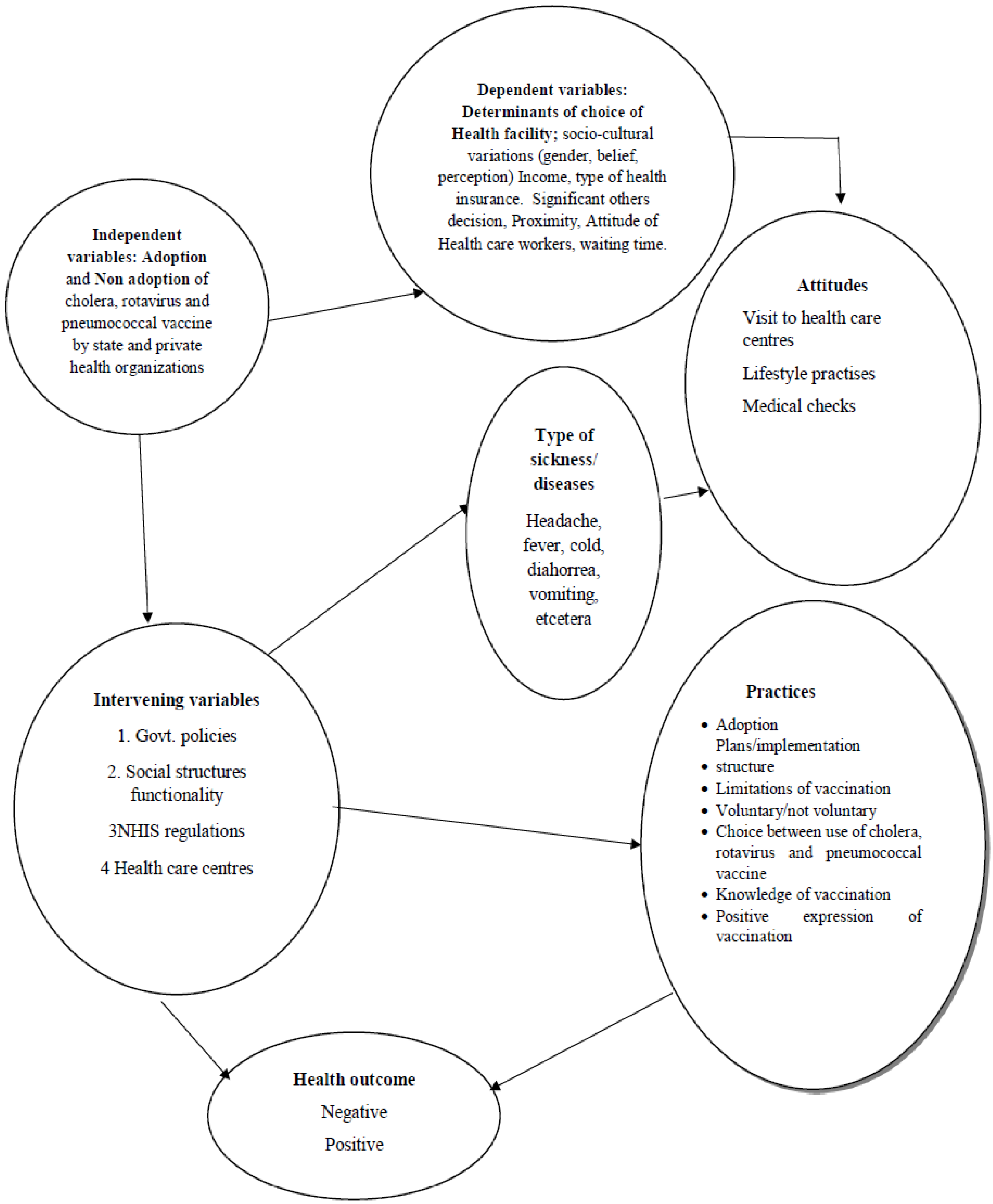

Figure 1. Conceptual Framework

As an epidemic propagates through the community, members may get the local news about the detailed number of infected cases in her complex network or neighbourhood (that is with whom she has direct contact), moreover as global information about the disease prevalence within the entire network. These days, information or news on epidemics can be obtained through any medium, for example via mass-media within the case of worldwide information, social media (Facebook, Instagram, Linkedin, Tik Tok, Whatsapp etc) and through word of mouth for local information. The agents even have information about the extent to which their neighbourhood offers them protection from the disease. This is often provided by their knowledge of what percentage of their neighbours are immune as a result of either having recovered from the disease earlier or through vaccination. Each member of a community makes use of the above information to see their likelihood of getting infected. This threat is supported by the impression; the members or individuals subsequently make a planned resolution on whether to urge vaccinated by taking into consideration the "cost" related to vaccination. This cost is as a result of fear or threat of side-effects, which can be true or false, because the effort involved in getting vaccinated and tempts the agent to free ride on the protection that will be offered by the immunity of their neighbours, particularly when the prevalence is low [12]. By engaging in such behaviour, members/individuals/ agents can enjoy the advantages of immunization without bearing the price of getting vaccinated themselves [12]. However, if every agent argues along identical lines, it will cause exceptionally low vaccine uptake, causing the loss of herd immunity and exposing the population to the chance of a pandemic outbreak of a vaccine-preventable disease. This ends up in a dilemma for a community or population of well-informed rational individuals (agents), who decide their motives are based on the premise of maximizing their individual payoffs [12].

Article Review

Most of the eligible articles use models with vaccination or social distancing as a prevention measure, though other strategies are considered. The selection of prevention measures naturally depends on the disease under study. For example, the invention and implementation of Rotavirus and pneumococcal for diarrhoea and pneumonia has resulted within the publication of models with pre-exposure as individual behaviour. A minority of models don't specify the preventive action taken by individuals. When a bearing on the contact rate was mentioned, we assumed that the preventive action was good hygiene, healthy practices, and social distancing [13]. Social distancing is interpreted as reducing the spread of epidemics. We then used the Conceptual framework model to structure the identified components aligning the terminology employed in the vaccine frameworks to correspond. Particularly, we organized our vaccine framework to present the knowledge by dimensions and criteria. In this framework, the broader headings involve the most domains to be assessed (that is, the burden of illness or problem, benefits and harms, values and preferences, resources use, equity, and feasibility) [14]. The standards for every domain are then presented as subheadings (e.g., forms of sickness, attitudes, practices, dependent and independent variables, Intervening variables etc.) placed at subsequently narrow levels of the proposed hierarchy [14].

The conceptual framework provides a natural setting for investigating Epidemics and vaccination dilemma, and we design the vaccine uptake decision process of parents/guardians in terms of Choice of hospital, Knowledge, and attitude towards epidemics and vaccination. so as to create a strategic decision, each parents/guardian plays a symmetric 2-person game against a virtual opponent who shares an identical neighbourhood and hence has identical information. Note that within the heterogeneous setting that we consider where the complex network (neighbourhood) of every parents/guardian is distinct, the knowledge on the idea of which she takes a call also differs from the hospital used for vaccination [12]. Thus, each individual or agent asks whether by changing his/her action she could have increased his/her payoff given his/her unique situation. so as to attain this, we allow the focal agent to contemplate a virtual opponent to which she attributes information the image of that which he/she possesses and follows the identical decision process as his/hers. This implies that, the agent plays against her presumed self so as to work out if she could have done better if he/she had chosen a special action with the identical information and within the same setting [12].

Vaccine dilemma typically rises with decreasing disease incidence as a consequence of reduced risk perception among individuals of contracting the disease [12]. Understanding the mechanisms driving such behaviour is vital because it can reverse the success of any immunization program near achieving the eradication of disease [15]. We utilize the framework of scientific theory to research vaccine uptake behaviour because it provides an intuitive description for the action of rational agents, that is in the absence of any social or religious bias against the decision to induce vaccinated [12]. In contrast to previous approaches, we simulate the spread of a communicable disease on a complex network, where each agent can, at any time step, decide whether to urge vaccinated [12]. The decision process of every agent is modelled by a game, within which the payoffs for various actions vary over time because the epidemic progress and, therefore the immunization status of the neighbouring agents change [12]. Each agent plays against a hypothetical opponent who shares the identical neighbourhood and thus has identical information, imposing symmetry on the payoff matrix [12]. The researchers examined whether information about a virulent disease outbreak at the local or global level can result in the emergence of voluntary vaccine uptake behaviour in an exceedingly population of agents that are attentive to the advantages of free riding on the immunity of their peers. Specifically, the researchers focused on how Spatio-temporal heterogeneity in individuals' vaccine uptake decisions can affect the general vaccine coverage at the population level and consequently determine the fate of an outbreak [12]. The researchers also stressed that this heterogeneity is both in terms of the knowledge a personal receives from the network neighbourhood, as well as the response that supported her individual risk perception [13].

Sharma observed that a defining factor for efficient disease control through voluntary vaccination is the source of data [12]. Faster and more efficient vaccine coverage is observed for the case when individuals assess their risk of catching infection supported the prevalence within the local complex network neighbourhood, as hostile that within the entire population of their social network [12]. Compared to the scale of the entire population, the number of cases that are reported within the initial phase of pestilence are low, and thus a personal which only has access to the worldwide prevalence information might not perceive the disease to be a significant threat [12]. Consequently, the perception of risk in contracting the disease takes a while to become significant enough to incite vaccine uptake among individuals [12]. However, by the time global prevalence becomes high enough in order that the perceived risk of infection outweighs the price of vaccination, the epidemic will have already affected an outsized fraction of the population [12]. Sharma found that this delay within the emergence of vaccination behaviour can sometimes manifest as an outsized final size of the epidemic despite high vaccine coverage [12]. On the opposite hand, the presence of disease in an agent's neighbourhood increases the chance of infection even at the first stage of a pestilence and thus results in a direct increase in vaccine uptake [12]. This not only increases the full vaccine coverage but also reduces the burden of disease [12] which is the current experience with Covid–19 vaccinations. An intriguing observation within the case of agents using local information is that the emergence of voluntary vaccination ends up in bimodal distributions of the ultimate epidemic size and vaccine coverage for diseases [12]. This behaviour, observed near the epidemic threshold, may be attributed to competition between the 2 possible final outcomes for the state of an initially susceptible individual, namely, to urge vaccinated or to induce infected [12].

Previous game theory-based models of vaccination during epidemic outbreaks have considered the effect of strategic decision-making in well-mixed populations where all individuals have identical risk assessment [16, 17]. In contrast Sharma model captured the impact of inhomogeneous risk and benefit perception at the individual level, which provides rise to spatio-temporally diverse games and hence different Nash equilibria across the population [12]. Consequently, the full population would never converge to a state within which every agent has the identical strategy unless the disease is totally eradicated [12]. This also rules out the chance that the strategic decision to vaccinate will disappear from the population with time, unlike in models that utilize imitation game dynamics to explain vaccination behaviour [12]. Indeed, such models suggest that the persistence of high vaccine coverage can only be ensured by incentivizing vaccine distribution [18]. Sharma findings show that the model presented provides a complementary mechanism for the emergence of voluntary vaccination [12]. This arises as a response to the potential threat of a virulent disease outbreak if each agent utilizes the data available to them and makes a rational decision whether getting vaccinated could be beneficial to her or not [12].

One of the key assumptions that underpin Sharma approach is that agents are well-informed and make rational decisions supported by the data available to them [12]. Sometimes, the conditions under which individuals make vaccination decisions may, of course, differ from this assumption. However, the rational agent framework, where individuals make decisions based on self-interest, provides a benchmark for investigating voluntary vaccination behaviour [19]. This could be then extended to incorporate, for instance, the effect of non-public beliefs and peer influence [19] which may lead to anti-vaccine sentiments [20] or vaccine scares [21].

While Eubank investigated how the ultimate size and vaccine coverage varies for diseases with different contagiousness; it's also possible to reinforce our model with additional parameters that capture other features like case fatality ratio. For example, two diseases with comparable, like COVID - 19 and Influenza, and thus similar transmission rate and vaccination costs, could lead to different coverages, supported the subjective perception of how harmful (or severe) a disease is. The dynamics of disease progression can also be modified by including additional stages, as an example to account for appreciably long infection periods [22]. Additionally, one could also explore the consequence of differential vaccine efficacy among individuals and finite durations for the protection afforded by the vaccine [12]. The complex network on which the disease spreads have, for simplicity, been assumed to be static through the course of a virulent disease [12]. However, over time the network can indeed change by vital dynamics, that's through individuals dying and new ones being born [23]. An extra source of temporal variation within the connection structure arises from the changing behavior of the agents [23], including actions taken by them in response to the epidemic, like social distancing [24, 25].

Sharma 2019 stressed that their results are independent of population size and micro-level structural details, like the existence of modularity, but depend strongly on the degree (average number of contacts an individual has) of the network [12]. this might partly be because we are primarily considering the ultimate outcome of the simulated epidemics, like final epidemic size and total vaccine coverage [12]. Another potential reason is that the strategic decision in our model depends crucially on the neighbourhood, which could be a micro-level detail of the social network. From a policy-making viewpoint, it's easier to estimate what percentage of social contacts someone has on average instead of micro-and macro-level details, which widens the scope of our model and its results [12]. Sharma also stressed on the importance of taking into consideration the heterogeneity within the disease status of neighbours during a social network for risk assessment when deciding whether to vaccinate [12]. The prevalence aggregated over the entire population may sometimes end in a false perception of risk, especially if the disease is in one's vicinity [12]. The key outcome for public health planning is that accurate and localized reporting of disease outbreaks is crucial for changing individuals' risk perception and thereby their attitude towards vaccination, especially during the initial phase of an endemic [12].

Some of the commonly reported health system barriers causing vaccination dilemma amongst stakeholders interviewed by Oku, Oyo-Ita are funding constraints, human resource factors (health worker shortages, training deficiencies, poor attitude of medical experts and vaccination teams), inadequate infrastructure and equipment, and weak political will [26]. Community-level factors included the attitudes of community stakeholders and of fogeys and caregivers. Oku, Oyo-Ita also identified factors that were perceived to facilitate communication activities. This included political support, engagement of traditional and non-secular institutions, and the use of organized communication committees [26].

Recommendation

The above conceptual framework illustrates the factors that drive vaccine dilemma, which can be vaccination acceptance and hesitancy. For an intervention to be implemented successfully, we need to understand the triggers of epidemics and vaccination dilemma. The socio-demographic characteristics like age, sex, marital status, level of education, choice of hospital, employment status, level of income, health insurance status, and the number of children are significantly associated with vaccine uptake among parents and guardians in Kosofe and Shomolu Local Government. Most health insurance in Nigeria only cover expenses for only primary vaccines, which are also free in government health facilities. Most parents and guardians have no other choice than to pay for a secondary vaccine-like Cholera. On the other hand, lower vaccine uptake can be associated with determinants like prolonged delays at the hospital, lack of time by parents/guardians, lockdown, perception, inadequate supply of vaccines, transportation to the hospital, decision by head of family, the child may have chronic illness, level of education, low income, and unemployment.

The knowledge and sensitization about "how, when, where, who and which" people would be vaccinated should be readily available. Rumors about safety/potential vaccine harm like MMR vaccine, efficacy, rushed development, cost, and effectiveness of COVID-19 vaccine were among the reason for vaccination dilemma [27-31]. Family decisions and experiences with vaccinations can encourage the roll out of COVID – 19 vaccinations for children. For instance, studies have shown that individuals currently vaccinated against the Flu vaccine have a strong inclination to accept a COVID-19 vaccine when available [32,28,34]. Various advantages of vaccination, such as protection of high-risk children with chronic diseases and the need for school children to return not to be set back home or die due to potential disease outbreak as seen with Queen's College Cholera outbreak.

Detailed and evidence-based health communication is important in encouraging positive health behaviors and gaining the trust of the parents/guardians. Risk perception regarding the disease infection, vaccines, and vaccine uptake is closely related with confidence and influence in health workers and in government. Parents/guardians have stated that if Rotavirus and cholera vaccines are free, then there would be an increase in vaccination uptake. Effective and concise communication on the infection and vaccine must be provided by government officials like NAFDAC explaining the effectiveness and safety of the vaccine [34, 35], or recommended by their doctor or the health worker [34, 32, 30]. A researcher discovered that the frequency of watching, listening, or reading the news can increase vaccine uptake [35]. Sometimes, the media often exaggerated the risks of vaccination, which can lead to decreased vaccine acceptance among the parents/guardians in Kosofe and Shomolu Local government Area.

Before designing effective communication strategies campaign interventions to promote vaccine adoption for children, policymakers, health experts, and health communication workers should first understand the characteristics of the target audiences/non-adopters [36]. This conceptual framework adopts two theories which are, The Health Belief Model (HBM) and the Theory of Planned Behavior (TPB). The HBM, according to Guidry states that the likelihood of a person adopting specific health behavior is determined by the belief in a personal threat of illness or disease, together with a belief in the effectiveness of the recommended health behavior [31]. The health behaviour focuses on six aspects from HBM, including attitudes toward the perceived threat of infection (a) perceived susceptibility [37] and (b) perceived severity [37], attitudes regarding perceived expectations of vaccination [37] (c) perceived risk and benefits [37] and (d) perceived barriers [37], (e) cues to action to vaccinate [37], and (f) self-efficacy for obtaining vaccinations against diseases [37]. The framework shows that a lot of factors can cause epidemics and vaccination dilemma. While Joshi states that the TPB suggests that behavior is determined by a purpose to carry out the behavior, determined by attitudes toward a vaccine (that is its perceived benefit), social norms (that is whether valued others support getting a vaccine), and perceived behavioral control (that is whether the ability to get the vaccine is within an individual’s control) [37] as related to getting all children’s primary and secondary vaccine [31].

Conclusion

The conceptual framework reviewed different health behaviour theories and different studies on epidemics and vaccination dilemma. Intervention programs can work with different stakeholders, parents, guardians to adjust certain loopholes to achieve the goal of ensuring all children receive all primary and secondary vaccines and keep them safe from vaccine-preventable disease outbreaks. Prompt information on new epidemics should be made available to the public. These can result in emergent patterns of collective choice behavior which may provide useful information that will help to increase vaccine acceptance, which could be important for public health planning.

Acknowledgement

All praises to God for the gift of life, mercy and good health that enabled me to complete this review. I would like to express my gratitude to Thesis Guide Dr. Pius Okpoko, Thesis supervisor Dr. Daniel Ganu, Mentor, Ms. Jesna, my lecturers, and its Management of Texila American University. I am highly thankful for the kind support bestowed on me by my Husband Mr. Noris Chimezie Odis, children (Chimuanya, Ogechukwu, Chisimudi), Sweet Mum Mrs Bibiana Anyichie, Siblings, family, friends, and all respondents in this study.

Conflicts of Interest

The author declares no conflict of interest.

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