Epidemics and Vaccination Dilemma in Complex Networks: A Case Study of Kosefe and Shomolu Local Government Area Lagos Nigeria

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Abstract

Vaccination is undoubtedly one of the foremost important preventive measures of modern times; epidemics are feared as one of the most damaging phenomena in human societies. Aim: The thesis unveiled how the interplay between the probability of infection, vaccine effectiveness, and cost gives rise to non–linear responses in vaccine uptake. The study design was a cross-sectional descriptive study that used pretested closed-ended questionnaire that was distributed to the respondents. The sample size of 375 was adopted, which was calculated from the target population using the Cochrane formula for sample size calculation. Parents/guardians that strongly believe politicians should be role models that encourage vaccination were 61.87%, while 50.67% of mothers/caregivers were not sure if there is still a link between MMR vaccination and autism. The majority of parents/guardians (55.47% + 29.87%) strongly agree plus agree that media reports on vaccination programmes encourage them to vaccinate their children. 32.80% strongly agree, and 22.40% agree that the media exaggerates reports about disease outbreaks. Conclusion: The level of education plays an important role in the level of knowledge and attitude towards epidemics and vaccination. Income and Cost of vaccines affect vaccination uptake because of the present economic situation in Nigeria. Media plays a key role in vaccination campaigns, awareness, and intervention and should be promoted more to achieve the goal of ensuring all children are vaccinated properly. Doctors and Public Health Nurses have a major role to play in terms of influencing parents/guardian's vaccination uptake.

Keywords: Epidemics, Vaccination, Networks.

Introduction

Research on the epidemic outbreak in complex networks has a root that goes back to the start of the 21st century [1] when it had been shown that enormous fluctuations within the degrees of people in social networks considerably strengthen the incidence of epidemic outbreaks. Vaccination is undoubtedly among the foremost important preventive measures of recent times; epidemics are feared to be the majority of damaging phenomena in human societies. An example is the recent COVID 19 pandemic which Nigeria is inclusive. Recent research has explored the pivotal implications of individual behaviour and heterogeneous contact patterns in networked populations, including the numerous feedback loops that exist between vaccinating behaviours and disease propagation [2]. Interdisciplinary explorations in data analysis have given rise to theoretical epidemiology, as additionally on the speculation of epidemic processes in complex networks. From classical models assuming well-mixed populations and ignoring human behaviours to recent models that account for behavioural feedback and population structure, we have made progress in understanding disease transmission and disease dynamics, plus using this information to plan and execute preventive strategies.

With the newest advances in science and technology, today, safe and effective vaccines exist for several of the uttermost common

infectious diseases, like smallpox (already eradicated), measles, polio, influenza, hepatitis, chicken pox and diphtheria and also the use of vaccines has been estimated to save lots of scores of children's lives each year [3]. However, because of the high economic cost of vaccination and sometimes also personal beliefs and the perception of vaccination aftereffects, people usually regard vaccination as a voluntary rather than a compulsive measure. This leads to behavioural vaccination, borrowing the framework of behaviour dynamics within the scientific theory and psychology, which becomes a useful research framework to elucidate real-world disease spreading and prevention [2].

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.

Immunization through the vaccination of populations has been estimated to annually prevent 2-3 million deaths from infectious diseases such like measles, diphtheria, pertussis, and tetanus [4]. This number may rise substantially with the improvement of strategies to further increase global vaccine coverage [5]. Aside from negotiating long-term protection against the disease to the vaccinated individual, vaccination has an excellent important community-level benefit. Sufficiently high vaccine coverage makes it difficult for the pathogen to discover susceptible hosts, thereby conferring herd immunity to the entire population [6, 7].

Consequently, even those members of the community who are unable to receive vaccination, like newborns and immune-suppressed individuals, are protected against the disease. In essence, any disease caused by a pathogen that only has human hosts are often eradicated by mass immunization, provided there's a sufficiently efficacious vaccine that's readily available. Such an outcome has been realized for smallpox [8, 9] and is predicted to be achieved for polio [10, 11]. Conversely, the presence of a remarkable fraction of non-immunized individuals, which disrupts the population's herd immunity, might evolve in the recurrent outbreaks of vaccine-preventable diseases like measles, mumps, and pertussis [5]. Elucidating the mechanisms that promote wider acceptance of vaccination amongst the population can therefore help explicate the causes behind the failure of immunization programs.

One in all the foremost important challenges in implementing a successful immunization program is to make sure that enough individuals consent to get vaccinated. This decision may well be supported with plenty of factors like an individual's knowledge about the prices, including perceived side-effects, and benefits of vaccination, in addition to the social, economic, and cultural environment to which they belong [12]. The shortage of public confidence in the efficacy and/or safety of vaccines can cause an increase to vaccine hesitancy (that is., delay or refusal to be vaccinated despite the availability of vaccine services) [13], and in extreme cases, generate vaccine scares [14, 15]. Even when there is the absence of any bias against a vaccine as a matter of fact, vaccine uptake inside the population may vary over time with changing prevalence of the disease. Indeed, it's expected that individuals are more likely to urge themselves to be vaccinated when there's a big risk of getting infected [16]. Conversely, low disease incidence may often result in a drastic decrease in vaccine uptake, presumably due to the lower perceived risk of contracting the disease [17]. This means that when the threat of infection is high, the individual incorporates a powerful incentive to be vaccinated, while sometimes of lower risk, the individual might be tempted to avoid vaccination and free ride on the

herd immunity provided by immunized members of a population without bearing any cost herself. However, if everyone argues during this manner and avoids vaccination, it can leave the population completely exposed to invasion by the pathogen.

Nigeria is one of the ten countries in the world where most of the incompletely immunized children live despite the massive investments in immunization programme by governmental and non-governmental organizations. There's a disparity within the rate of immunization incompleteness between the north and south of the country, with the previous having an increase in proportion. This disparity may be explained by the factors that operate at individual, community, and state levels. Low level of educational attainment, high level of poverty, poor antenatal care attendance and hospital delivery, and a higher population of rural inhabitants, including poor socioeconomic status, are more pronounced across the northern region [18].

Research Aim, Objectives, and Assumptions

Aim: The aim of this Thesis is to unveil how the interplay between the probability of infection, vaccine effectiveness, and cost gives rise to non–linear responses in vaccine uptake.

Specific Objectives

The specific objectives are:
1. To establish socio-cultural factors as defined by education, religion and cultures that affect infection in Kosofe and Shomolu Local Government Area of Lagos, Nigeria.
2. To outline socio-cultural factors as defined by education, religion and cultures that affect vaccine effectiveness and uptake in Kosofe and Shomolu Local Government Area of Lagos, Nigeria.
3. To examine economic factors that affect vaccine uptake among the residents of Kosofe and Shomolu Local Government Area of Lagos, Nigeria.

4. To determine the probability of infection, vaccine effectiveness, and cost that give rise to non-linear responses in vaccine uptake.

Literature Review

Nigeria contributes the highest number of global pneumonia child deaths [19]. Pneumonia – a preventable disease – kills more children globally than some other infections [19]. Pneumonia claimed the lives of over 800,000 children under the age of 5 last year globally, or one child every 39 seconds, in line with the 2019 analysis [19].

Nigerian children made up the outrageous number of those who died, with an estimated 162,000 deaths in 2018 – 443 deaths per day, or 18 every hour [19].

In Nigeria, 19% of child deaths were because of pneumonia in 2018, and it was absolutely the highest killer of children under-five in 2017 [19].

"Pneumonia has been confirmed to be a deadly disease and takes so numerous children's lives – although this is mostly preventable [19]. And yet, this killer disease has been largely forgotten in the world and national health agendas [19]. We should and be capable of changing this," said Pernille Ironside, Acting UNICEF Representative in Nigeria [19].

The biggest risk factors for child pneumonia deaths in Nigeria are malnutrition, indoor air pollution from the use of solid fuels, and outdoor air pollution [19]. While Nigeria is battling with the recent report by the World Health Organization, WHO, which shows that Nigeria topped the list of different nations with unvaccinated children from measles, including the newest Multi-Indicator Cluster Survey, MICS/ National Immunization Coverage Survey, that also showed that the country continues to be far behind the Global Vaccine Action Plan, GVAP, of achieving 90 per cent vaccinations of children, the 2017 International Vaccines Access Centre, IVAC, report released in 2019 showed that Nigeria not only ranks among countries with the worst burden of the disease but also among the countries that are yet

to improve interventions aimed towards reducing the deaths and treating effectively [19]. Health watchers are worried that more Nigerians may lose their lives if nothing is carried out urgently to arrest the trend [19].

Most global child pneumonia deaths occurred among children under the age of two, and almost 153,000 within the initial month of life [19]. Reflecting on the alarm about this forgotten epidemic, six leading health and children's organizations launched an appeal for global action in 2019 [20].

In January 2019, the group hosted world leaders at the Global Forum on Childhood Pneumonia in Spain. Pneumonia is caused by bacteria, viruses or fungi and leaves children fighting for breath as their lungs fill with pus and fluid. More children under the age of 5 died from the disease in 2018 than from some other diseases. 4,37,000 children under five died because of diarrhoea and 272,000 to malaria [21].

Just five countries were accountable for over half of child pneumonia deaths: Nigeria (162,000), India (127,000), Pakistan (58,000), the Democratic Republic of Congo (40,000) and Ethiopia (32,000) [21].

Children with immune systems weakened by other infections like HIV or by malnutrition, and people living in areas with high levels of air pollution and unsafe water, are at far greater risk [21. If properly diagnosed, the disease is prevented with vaccines and simply treated with low-cost antibiotics [21]. But tens of millions of children are still unvaccinated – and one in three with symptoms doesn't receive essential medical aid or treatment [21].

Children with severe cases of pneumonia might also need oxygen treatment, which is hardly ever available in the poorest countries to the children who need it [22]. Funding available to tackle pneumonia lags far behind other diseases [22]. Only 3% of current global communicable disease research spending is allocated to pneumonia, despite the disease-causing 15% of deaths in children under the age of 5 [22].

"Increased investment is critical to the fight against this disease," said Pernille Ironside [22]. "Only through cost-effective protective, preventative and treatment interventions delivered to where children are – including especially the foremost vulnerable and hardest-to-reach - will we be able to save hundreds of thousands of lives in Nigeria." Said Pernille Ironside [22].

In a joint call to action, the six organizations urge:

1. Governments within the worst-affected countries to develop and implement Pneumonia Control Strategies to minimize child pneumonia deaths, and to enhance access to primary health care as a part of a wider strategy for universal health coverage.
2. Richer countries, international donors, and private sector companies to increase immunization coverage by reducing the price of key vaccines and ensuring the successful replenishment of Gavi, the Vaccine Alliance; and increasing funding for research and innovation to tackle pneumonia.

Boosting efforts to fight pneumonia could avert over 2 million child deaths from pneumonia and other major diseases in Nigeria, a new analysis has found [22].

The modelling by Johns Hopkins University was released in 2020 as nine leading health and children's agencies host the world's first global conference on childhood pneumonia in Barcelona [22].

In 2018, 71 million children did not get the recommended three doses of pneumococcal conjugate vaccine (PCV), thereby putting them at a higher risk of pneumonia [22]. Globally, 32% of children with suspected pneumonia were not taken to a health facility [22]. That figure rose to 40% for the poorest children in low- and middle-income countries [22].

Forecasts showed that 1.4 million children under the age of five might die from pneumonia

over the next decade in Nigeria, on current trends – the highest number of any country in the world and more than 20% of childhood deaths from pneumonia globally [22].

However, an estimated 809,000 of those deaths would be averted by significantly improving services to prevent and treat pneumonia [22].

Researchers also found out that boosting pneumonia services can create an additional 'ripple effect', preventing 1.2 million extra child deaths from other major childhood diseases at the same time [22].

Pneumonia is caused by bacteria, viruses or fungi and leaves children fighting for breath as their lungs fill with pus and fluid [22]. The disease is the leading killer of children in Nigeria, causing 19% of under-five deaths [22].

Most pneumonia deaths can be prevented with vaccines and easily treated with low-cost antibiotics [22]. But more than 40% of one-year-olds in Nigeria are unvaccinated, and three in four children suffering from pneumonia symptoms do not get access to medical treatment [22].

At the sentinel sites, children less than five years of age admitted with diarrhoea, regardless of duration or presence of blood in the stool, can be enrolled in the surveillance sites but children with hospital-acquired diarrhoea will be excluded. Each of the sites is expected to collect a minimum of 150 stool samples per year. According to data collected from the sentinel sites, 2,043(47%) of the 4,377 cases enrolled over an 8-years period are positive for Rotavirus, with a case fatality rate of 1.3%. The incidence of rotavirus diarrhoea is highest in the months of January and February each year [23].

Null Hypothesis

High cost gives rise to non-linear responses in vaccine uptake, and there may be other significant determinants like level of education, religion, media, choice, and decision of the head of the family, which determine epidemics and vaccination dilemmas.

Methodology

Study Design

A descriptive cross-sectional study was carried out to assess the epidemics and vaccination dilemma among parents/childcare givers at Kosofe and Shomolu LGA.

Description of Study Area

This study was conducted in Kosofe and Shomolu Local Government Area in Lagos State, Nigeria. Kosofe means 'nothing is free. This underscores the diverse commercial activities which characterized the indigenes and early settlers of the area in the mid-nineteenth century, the people were noted for massive trade in vegetables, fruits, maize, cassava, and fish. Its location at the gateway to the metropolitan Lagos further entrenches Kosofe as an important name in commerce in modern-day Nigeria [24]. The present-day Kosofe is still a bustling commercial Centre, being the terminal for all food items from all parts of the nation. This is understandable as Lagos State remains the major market for all agricultural products from the hinterland as a result, the present-day Kosofe is mainly occupied by traders, civil servants and elites, no wonder Kosofe's motto reads thus: "cradle of excellence [24]."

Kosofe is located at the Northern part of Lagos State. It is bounded by (3) other Local Governments, namely: Ikeja, Ikorodu and Somolu. It also shares a boundary with Ogun State. Its jurisdiction comprises of seven wards and encompasses an area of about 17.85sq/km. its headquarters is at Ogudu Road, Ojota, Lagos. Presently, Kosofe falls under the East Senatorial District [24].

Despite the diversity of its dwellers, the Local Government is very peaceful, and the relationship between the different groups is very cordial. This gives a favorable background for the development of the area [25].

Shomolu, also spelled Somolu, is a town, in Lagos State, southwestern Nigeria, just north of Lagos city. A residential suburb of Lagos, the

town is plagued by problems of overcrowding, poor housing, and inadequate sanitation [26]. Most of its inhabitants are Yoruba. The town's local activities include work in leather handicrafts and printing. The population of the Shomolu local government area is 402,673. Bariga area used to be a part of Somolu local government until it was carved out as a Local Community Development Area. Somolu local government forms a part of the Lagos East Senatorial zone and also has a lawmaker representing the district at the Federal House of Representatives [27].

Epidemics occur everywhere in the world, including in Kosefe and Shomolu Local governments. 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 dilemmas.

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 of both emerging and re-emerging diseases.

Inclusion Criteria

Mothers/Fathers/Child caregivers/Guardians that use Kosofe LGA Health Centre, General Hospital and R Jolad hospital to vaccinate their children with their consent.

Exclusion Criteria

Mothers/Fathers/Childcare givers/Guardians that do not use Kosofe LGA Health Centre, General Hospital and R Jolad hospital to vaccinate their children.

Sample Size Determination

The Cochran formula is [28]:

$$n = \frac{Z^2{}_{pq}}{d^2}$$

n = desired sample size (when population is greater than 10,000).

Z = Standard normal deviate at 95% confidence interval = 1.96.

P = proportion of residents of Mushin LGA with severe adult illnesses or behavioural illnesses, respondents preferred doctors in government facilities (48.1% and 59.9%, respectively) [29].

P = 59.9%.

q = 1 - p, 1 - 0.599 = 0.40.

d = Margin of error desired 5% = 0.05.

Therefore,

n = 1.96^2 x 0.599 x 0.40/0.05^2 = 0.9204/.0025 n = 368.

To make allowance for non-response and attrition, 5% will be added using the formula

If n_r = 5% Divide n by (100% - 5%) = 95% = .95

Final n_f = 368/.95 = 387

The sample size was determined in order to have 95% confidence limits of 5% maximum error of the estimate when the probability is 59.9% [29]. This leads to a requirement of 368 residents. For a no-response expectation, the sample size was increased to 387 residents. 375 completed questionnaires were used.

Sampling Technique

The technique of Multistage sampling was used to obtain cross-sectional data for this study in Lagos state. The Lagos state was divided geographically into 37 Local governments Area.

Therefore, the sample size of 387 residents was distributed according to the number of residents in each LCA as follows:

Stage 1: The balloting method of simple random sampling was used to pick 2 LGA.

Stage 2: The balloting method of simple random sampling was used to select 3 Health facilities (a Health Centre, government, and private hospital) from the Stratified list of hospitals.

Stage 3: Simple random sampling method using patient's registers was used to select the patients that were sampled in each hospital.

Method of Data Collection

Questionnaire was developed for this study based on the previous research questions related to epidemics and vaccination dilemmas. A pilot study was carried out for 20 residents with children, and necessary modifications will be carried out. The questionnaire contains four sections. The first is the demographic section, which contains questions regarding age, gender, marital status, education level, household income, occupation, and health insurance. The second section was designed to assess participants' knowledge and understanding of epidemics and on use of the vaccine. The third section of the questionnaire consists of questions on knowledge of all vaccines for children.

The investigator explained the study to the participants, including the conditions for participating, as well as privacy and confidentiality for data collection. Although the study was free from any serious ethical issues, the researcher designed a participant's information sheet that explained the voluntary nature of the study in detail, and the anonymity and confidentiality in the study. Necessary translation of the contents of the tools for this research will be done to assist the less learned but with care not to influence or distort the judgment of the participants. The researcher, through trained health workers for data collection, gave the participant's information sheet and questionnaire to eligible and willing participants at the various places designated for data collection.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of Lagos University Teaching Hospital. Permission was also obtained from the Chairman of Lagos state health service commission and Lagos University Teaching Hospital Health Research committee before the commencement of the study. Participation was voluntary, all the participants were required to provide written informed consent, and they were assured of the confidentiality regarding information collected from them.

Results

Section A: Socio-Demographic Data

The mean, modal ages and standard deviation of Parents, were 32.82 years, 30 years old and 5.86. The youngest respondent was 17 years old, and the oldest respondent was 59.

Table 2. Socio-demographic Characteristics of Parents/Guardians

Characteristics	Frequency n = 375	Percentage (%)
Hospital Respondent used for vaccination		
General Hospital Gbagada	122	32.53
R Jolad Hospital Gbagada	123	32.80
Oworoshoki Health center	114	30.40
Both Gbagada General and R Jolad Hospital	5	1.33
Both Gbagada General & Oworoshoki health center	6	1.60
Gbagada General, R Jolad hospital and Oworoshoki health center	5	1.33
Sex of respondent		
Male	25	6.67
Female	350	93.33
Marital Status		

Single	12	3.20
Married	361	96.27
Divorced	1	0.27
Separated	1	0.27
Education		
No formal education	2	0.53
Primary	1+0	2.67
Secondary	110	29.33
Tertiary	253	67.47
Religion		
Christian	314	83.73
Islam	60	16.00
Others	1	0.27
Employment Status		
Employed	140	37.33
Unemployed	38	10.13
Self employed	197	52.53
Income		
<50,000 Naira	148	39.47
50,000 – 99,999	85	22.67
100,000 – 150,000	71	18.93
>150,000	71	18.93
Health Insurance status		
Yes	144	38.40
No	231	61.60
Mode of vaccine payment		
Free (Subsized by Government)	227	60.53
Health Insurance	16	4.27
Out of pocket payment	92	24.53
Free and Health insurance	7	1.87
Health insurance& out of pocket	24	6.40
Free, Health insurance & out of pocket	9	2.40

An interesting observation was made while collecting data at an Oworoshoki Health center and General hospital Gbagada, some mothers came with R – Jolad vaccination cards. When we interviewed them, they said they gave birth at R -Jolad and their health insurance paid for the expenses and some primary vaccines, but they could not afford to pay for vaccines like Pneumococcal, Rotavirus, Measles, Mumps, Rubella etc. and were the reason they came to Oworoshoki Health Centre. Surprisingly some mothers that met me at R Jolad and Oworoshoki health Centre saw me at General hospital Gbagada, and this is to justify that 1.33% of parents use the 3-health facility while 1.60% use Both Oworoshoki and R – Jolad hospital for vaccination and 1.33% use General hospital Gbagada and R – Jolad hospital for vaccination. The population of children that uses R Jolad hospital for vaccination in a day was not as much as children that use Health center and General Hospital Gbagada. It is interesting to note that R

Jolad parents often come together to get their children vaccinated. This was not common in Oworoshoki health center of General Hospital Gbagada.

Majority of the parents/Guardian were self-employed (52.53%), and most mothers are self-employed to create more time for their children. Mothers now learn skills like tailoring, hair styling, event management and are most involve in networking business, buying, and selling. Thirty – seven percent of our parents/guardians were employed and most of them complained of not having the time or getting permission from their various organizations to take their children for vaccination. Thirty – eight percent of our parents/guardians were unemployed. Most health insurance companies do not cover vaccines like Rotavirus, Cholera, Flu, HPV etc.

The modal number of children is 2 followed by 1 and then 3. Parents in these categories were found at R Jolad hospital, probably because of their level of education and cost of the vaccine. We can see that parents now try to have the number of children they can afford to train because of the economy. The parents that have 4, 5, 6, and 7 children use Oworoshoki Health center and General hospital, respectively.

Almost all our respondents (99.47%) vaccinate their children except for 2 Nannies who do not have their own child/children. In Nigeria, we often use the word 'immunization' for vaccination.

Section B: Knowledge of Epidemics and Vaccination

From Table 2 below, 84.80% of the parents/guardians strongly believe that it is important for their children to receive all the necessary vaccines while 0.80% disagree.

Most (61.87%) of parents/guardians strongly believe politicians should be role models that encourage vaccination, while 4.53 strongly disagree. Half (50.67%) of mothers/caregiver were not sure if there is still a link between MMR vaccination and autism; 21.07% and 18.13% strongly agree and agree respectively that there is a link between the MMR vaccination and autism; 6.13% and 4% strongly disagree and disagree respectively that there could be a link between MMR vaccination and autism.

The difference between parents/guardian that worry or do not worry that vaccinations are irreversible is 1.60%, this is a vaccination dilemma and about 21.60% were still not sure if they are worried that vaccinations are irreversible. This simply means that we need to continue creating awareness campaigns on vaccination/immunization. Majority of parents, 70.93% believe vaccination programmes are worthwhile. This is a good vaccination dilemma.
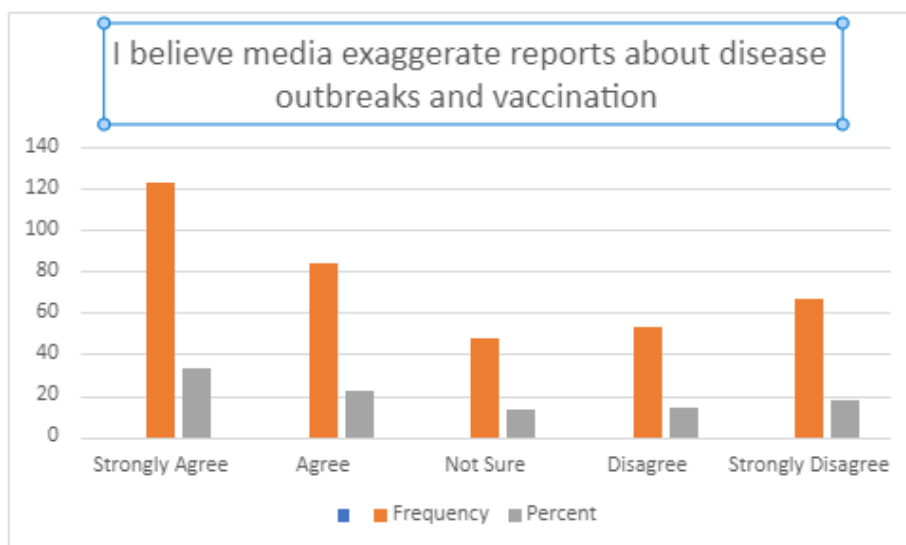

Figure 1. I Believe Media Exaggerate Reports about Disease Outbreaks and Vaccination

The horizontal (x) axis represents the categories (responses); The vertical (y) axis represents a value for those categories. In the graph above, the values are percentages and frequencies. Parents/guardians (32.80%) strongly agreed, and 22.40% agreed that the media exaggerates reports about disease outbreaks. While 12.80% were not sure, 14.13% disagreed and 17.87 that the media does not exaggerate reports about disease outbreaks. Some Mothers further explained that the Nigerian government is using the media to exaggerate reports about COVID – 19 so as to get funding from the international community. Some mothers at Oworoshoki health centre and General hospital Gbagada do not believe that there is COVID – 19 and were not taking proper safety measures as seen at R Jolad hospital, where most mothers were so cautious, wore nose masks, maintained social distancing, were seen with sanitizers which they were often using for themselves and children. This is where the level of education plays an important role in the level of knowledge and attitude towards epidemics and vaccination.

Table 3. Respondent's Knowledge of Epidemics and vaccination

Respondents	Frequency n = 375	Percentage (%)
I believe it is important for my child to receive all vaccinations		
Strongly agree	318	84.80
Agree	48	12.80
Not sure	4	1.07
Disagree	2	0.53
Strongly disagree	3	0.80
I believe politicians should be role models that encourage vaccination	5	1.33
Strongly agree	-	-
Agree	232	61.87
Not sure	81	21.60
Disagree	22	5.87
Strongly disagree	23	6.13
I still believe there could be a link between MMR vaccination and Autism	17	4.53
Strongly agree	79	21.07
Agree	68	18.13
Not sure	190	50.67
Disagree	15	4.00
Strongly disagree	23	6.13
It worries me that vaccinations are irreversible	110	29.33
Strongly agree	85	22.67
Agree	65	17.33
Not sure	81	21.60
Disagree	71	18.93
Strongly disagree	73	19.47
I worry about possible side effects of vaccination		
Strongly agree	104	27.73

Agree	92	24.53
Not sure	42	11.20
Disagree	75	20.00
Strongly disagree	62	16.53
Media report on vaccination encourages me to vaccinate my child	85	22.67
Strongly agree	208	55.47
Agree	112	29.87
Not sure	18	4.80
Disagree	22	5.87
Strongly Disagree	15	4.00
I believe vaccination programmes are worthwhile		
Strongly Agree	266	70.93
Agree	96	25.60
Not sure	8	2.13
Disagree	4	1.07
Strongly disagree	1	0.27
Do you make decision for your child's vaccination?	9	2.40
Yes	354	94.40
No	21	5.60

More than half of parents/guardians (27.73% and 24.53%) strongly agree and agree respectively, that they worry about the possible side effects of vaccination. Only 11% were not sure if they worried or not. This is a negative vaccination dilemma that needs intervention.

The majority of parents/guardians (55.47% + 29.87%) strongly agree plus agree that media reports on vaccination programmes encourage them to vaccinate their children. This means that media plays a key role in vaccination campaigns, awareness and intervention and should be promoted more to achieve the goal of ensuring all children are vaccinated properly.
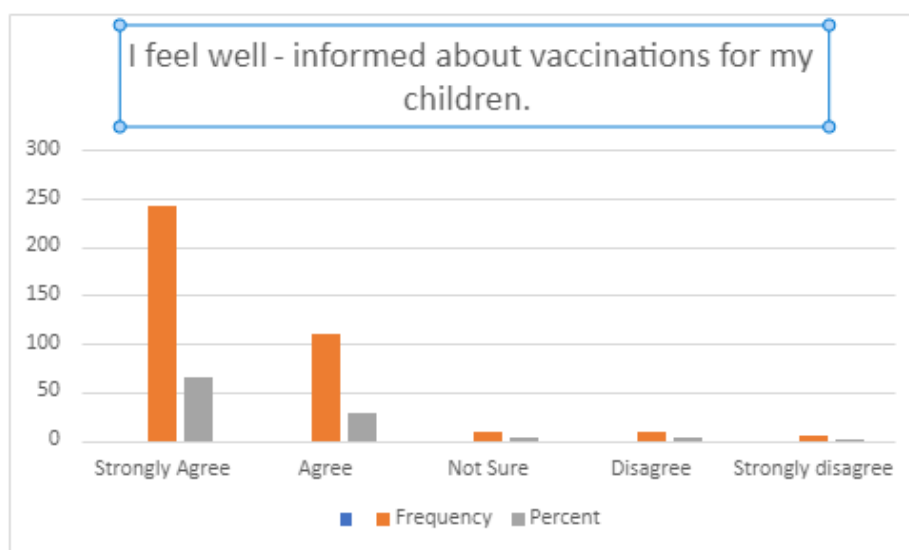

Figure 2. I Feel well - Informed about Vaccinations for my Children.

The horizontal (x) axis represents the categories (responses); The vertical (y) axis represents a value for those categories. In the graph above, the values are percentages and frequencies. Approximately sixty – five percent of the respondents strongly feel and 29.07% feel that they are well informed about vaccinations for their children, while only 1.33 strongly felt, 2.40% they were not well informed about vaccinations for their children and 2.40% were not sure if they felt informed or not about vaccinations.

The majority of the respondents (94.40%) were responsible for making a decision for their children's immunization, like remembering the next appointment, bring the child/children to the hospital for immunization, keeping the immunization card properly and making payment for vaccination while only 5.60% were not responsible for making a decision for their children's immunization because they need the Husband to make payment for vaccination, give his consent and drive to wife and child/children to the hospital for immunization.

Highest level of Education of Respondent * I Believe it is important for my Child to Receive all the Necessary Vaccinations

Chi-square tests = 73.50, P value = 0.000.

This means that there was a significant positive association between the level of education and knowledge of parents on epidemics and vaccination. The level of education of parents had an influence on their knowledge of epidemics and vaccination uptake.

Highest Level of Education of Respondent * I believe Media exaggerate Reports about Disease Outbreaks and Vaccination

Chi-square tests = 29.26, P value = 0.004.

This means that there was a significant association between the level of education and knowledge of parents on epidemics and vaccination. The level of education of parents had an influence on their knowledge in terms of

if they believe they believe media exaggerated reports about disease outbreaks and vaccination.

Highest level of Education of Respondent * I feel well-informed about vaccinations for my children

Chi-square tests = 31.24, P value = 0.002.

This means that there was a significant association between religion and the knowledge of parents on epidemics and vaccination. The religion of parents had an influence on their knowledge in terms of if they feel well informed about vaccinations for their children

Which Hospital do you use for the Vaccine? * It Worries me that Vaccinations are Irreversible

Chi-square tests = 121.47, P value = 0.000.

This means that there was a significant association between the choice of hospital and the knowledge of parents on epidemics and vaccination. The choice of the hospital of parents had an influence in terms of if they worry that vaccination is irreversible.

Which Hospital do you use for the Vaccine? * I Worry about the Possible Side Effects of Vaccination

Chi-square tests = 36.95, P value = 0.012.

This means that there was a significant association between the choice of hospital and the knowledge of parents on epidemics and vaccination. The choice of the hospital of parents had an influence in terms of if they worry about the possible side effects of vaccination.

Which Hospital do you use for Vaccine? * Media Report on vaccination Programmes Encourage me to Vaccine, my Child

Chi-square tests = 31.41, P value = 0.050

This means that there was a significant association between the choice of hospital and the knowledge of parents on epidemics and vaccination. The choice of the hospital of parents had an influence in terms of media reports encourages them to vaccinate their children.

Section C: Healthy practices

Table 4. Level of Importance for keeping Children Healthy - Healthy Practices for Child/Children

Healthy practices (in percentage)	Not at all important	Somehow important	Important	Quite important	Very important	Extremely important
Brushing their teeth twice a day	2.67	7.20	4.80	7.20	12.00	66.13
Eating healthy food	0.00	0.27	0.53	1.60	3.73	98.87
Getting enough sleep	0.27	0.80	1.33	2.40	5.60	89.60
Getting outside each day	6.13	4.53	13.60	14.67	12.53	48.53
Getting plenty of physical activity	1.33	0.53	3.20	6.40	14.13	74.40
Getting their vaccines on time	0.00	0.80	0.27	2.67	5.07	91.20
Having a safe and happy home life	1.07	0.00	0.80	1.60	3.73	92.80
Having regular dentist and doctor check-ups	9.33	4.27	4.80	8.53	12.27	60.80
Taking vitamins and/or nutritional supplements	1.33	1.07	1.87	5.60	10.40	79.73
Washing their hands regularly	0.53	0.00	0.27	2.40	7.73	89.07
Wearing nose mask regularly in public	11.20	1.33	2.40	3.47	8.27	73.33

From Table 4 above, 66.13% of parents/guardians felt it was extremely important to brush their child's/children's teeth twice a day. Only 2.67% felt it was not at all important to brush their children's teeth twice daily because sometimes they get home tired from work very late at night. The majority (93.87%) felt it was extremely important for their child/children to eat good food so as to enhance growth and build immunity. It is good to note that none of the parents/guardians said it was not at all important.

Most (89.60%) of parents/guardians which is majority felt it was extremely important for their child/children to get enough sleep which is the best form of rest and enable their parents/guardians to rest especially nursing mothers. Only 48.53% of parents/ guardians felt it was extremely important for their child/children to get outside each day. This is because of the current Covid–19 pandemic and lockdown measure. Majority of parents/ guardians (74.40%) felt it was extremely important for their child/children to get plenty physical activity so as to prevent obesity amongst their children.

Almost all of parents/guardians (91.20%) felt it was extremely important for their child/children to get their vaccines on time and non said it was not at all important. Majority (92.80%) of parents/guardians felt it was extremely important to have a safe and happy home while 1.07% said it was not at all

important. This practice is good for the mental and physical health if all family members.

It was amazing to note that 60.80% felt it was extremely important to go for doctor's check-ups for their children, but parents don't practice this as required, and 9.33% of parents/guardians felt it was not at all important. Approximately eighty percent of parents/guardians felt it was extremely important for their children to take vitamins and/or nutritional supplements. Eighty-nine percent felt it was extremely important for their child/children to wash their hands regularly so as to prevent contracting diseases. This is a very good practice. Approximately seventy-three percent of parents/guardians ensure that their child/children wear nose masks.

Section D: Attitudes towards Epidemics and Vaccination

Table 5. How Important do you Feel it is for your Child to Receive Vaccinations to Protect him/her against the Following

Diseases	Not at all important	Somehow important	Important	Quite important	Very important	Extremely important
Blood infections	2.40%	0.00%	0.27%	2.67%	6.40%	88.27%
Chicken Pox	3.20%	0.27%	0.27%	1.07%	4.27%	90.93%
Cholera	4.53%	0.53%	0.00%	1.07%	5.87%	88.00%
Diphtheria	1.07%	0.00%	0.80%	1.33%	7.73%	89.07%
Ear infections	2.67%	0.00%	0.80%	2.67%	6.93%	86.93%
Flu	7.20%	0.53%	1.07%	1.60%	6.13%	83.47%
Hepatitis A	4.27%	0.00%	0.53%	1.33%	3.20%	90.67%
Hepatitis B	1.60%	0.27%	0.00%	0.80%	4.00%	93.33%
HPV	8.00%	0.27%	0.27%	1.60%	4.27%	85.60%
Measles	1.33%	0.53%	0.00%	1.07%	4.00%	93.07%
Meningitis	1.07%	0.53%	0.27%	0.53%	4.53%	93.07%
Mumps	1.07	0.27%	0.53%	1.87%	4.53%	91.73%
Pneumonia	1.87%	0.00%	0.80%	1.07%	4.80%	91.47%
Polio	0.80%	0.00%	0.53%	0.53%	4.53%	93.60%
Rotavirus	4.80%	0.00%	0.53%	0.80%	5.07%	88.80%
Tetanus	0.80%	0.00%	0.53%	1.33%	4.53%	92.80%
Whooping Cough	1.07%	0.27%	0.80%	0.80%	3.73%	93.33%

Table 6. Respondents Attitude towards Epidemics and Vaccination

Respondents	Frequency n = 375	Percentage (%)
How concerned are you that your child could still contract a vaccine-preventable disease for which he or she has been vaccinated for?		
Not at all concerned	76	20.27
Somehow concerned	42	11.20
Quite concerned	50	13.33
Totally concerned	172	45.87
Not sure/it depends on	35	9.33
How likely do you think it is that one or more childhood vaccines may cause long term negative side effects?	5	1.33
Not at all likely	132	35.20

Somehow likely	36	9.60
Quite likely	47	12.53
Totally likely	71	18.93
Not sure/ it depends on	89	23.73
How concerned are you that your own child may contract a vaccine – preventable disease and suffer a serious reaction to the disease?		
Not at all concerned	80	21.33
Somehow concerned	33	8.80
Quite concerned	44	11.73
Totally concerned	164	43.73
Not sure/it depends on	54	14.40
How concerned are you that your own child may experience a bad reaction to a childhood vaccine?		
Not at all concerned	77	20.53
Somehow concerned	37	9.87
Quite concerned	48	12.80
Totally concerned	163	43.47
Not sure/it depends on	50	13.33

Less than half (45.87%) of parents/guardians were totally concerned that their child/children could still contract a disease for which he or she has been vaccinated. Some parents further explained that some children that have taken measles and chickenpox vaccination still had measles afterwards. It is amazing that 20.27% of parents were not concerned that their child/children could still contract a disease for which he or she has been vaccinated.

Approximately forty-three percent of parents/guardians were totally concerned that their own child may experience a bad reaction to a childhood vaccine, while 20.53% were not at all concerned and 13.33% were not sure/it depends. This is a negative vaccination dilemma.

Table 7. In Nigeria, a Doctor or Nurse who is Administering a Childhood Vaccine must get Informed Consent from the Parent or Caregiver Accompanying the Child. How Well - Informed do you Feel about the Risks of the Following Vaccines

Vaccines	Not at all informed	Somehow informed	Informed	Quite informed	Very informed	Extremely informed
Cholera	8.27%	1.07%	2.93%	8.00%	7.73%	72.00%
Diphtheria	6.13%	1.07%	4.00%	8.80%	8.00%	72.00%
Flu	10.67%	1.07%	3.20%	8.53%	6.93%	69.60%
Hepatitis A	6.93%	0.80%	3.20%	7.20%	5.87%	76.00%
Hepatitis B	4.80%	0.80%	2.93%	8.00%	7.47%	76.00%
HPV	13.33%	1.33%	3.73%	8.53%	7.20%	65.87%
Measles	4.27%	1.33%	1.87%	6.40%	8.27%	77.87%
Mumps	5.87%	1.60%	4.00%	8.53%	8.00%	72.00%
Pertussis (Whopping cough)	4.53%	1.33%	2.93%	7.73%	7.20%	76.27%
Pneumonia	5.07%	2.13%	3.20%	6.13%	7.73%	75.73%

Polio	4.53%	1.33%	1.87%	7.20%	5.87%	79.20%
Rotavirus	10.40%	0.80%	2.67%	6.13%	8.53%	71.47%
Rubella	6.40%	1.07%	3.47%	7.73%	6.67%	74.67%
Tetanus	4.80%	1.33%	2.93%	8.27%	6.13%	76.53%
Varicella (Chicken Pox)	8.53%	0.53%	2.40%	7.47%	5.87%	75.20%

Table 8. How Well Informed do you Feel about the Benefits of the Following Vaccines

Vaccines	Not at all informed	Somehow informed	Informed	Quite informed	Very informed	Extremely informed
Cholera	6.67%	0.00%|	2.13%	4.53%	9.07%	77.60%
Diphtheria	4.80%	0.27%	1.60%	6.13%	10.40%	76.80%
Flu	9.60%	0.53%	2.13%	5.60%	9.07%	73.07%
Hepatitis A	6.13%	0.27%	1.60%	5.87%	8.27%	77.87%
Hepatitis B	4.00%	0.53%	1.33%	5.07%	6.67%	82.40%
HPV	11.20%	0.53%	1.07%	5.60%	9.87%	71.73%
Measles	4.53%	0.80%	1.07%	4.80%	6.93%	81.87%
Mumps	5.60%	0.27%	2.93%	6.13%	10.40%	74.67%
Pertussis (Whopping cough)	3.20%	0.80%	2.40%	5.07%	9.60%	78.93%
Pneumonia	4.27%	0.53%	2.13%	6.13%	9.07%	77.87%
Polio	2.67%	1.07%	2.13%	4.00%	8.27%	81.87%
Rotavirus	8.00%	0.00%	2.67%	4.00%	8.00%	77.33%
Rubella	4.80%	0.00%	3.47%	5.87%	8.80%	77.07%
Tetanus	2.67%	0.80%	2.67%	4.00%	8.27%	81.60%
Varicella (Chicken Pox)	5.60%	0.53%	1.87%	4.00%	9.87%	78.13%

The majority (87.20%) of parents/guardians indicated that it would be extremely helpful, and 10.13% of parents/guardians said it would be quite helpful to have more information about the benefits and possible health risks of childhood vaccines, with statistics and data that are complete, easy to understand and not biased to sway your decision in a certain direction.

Table 9. How Well Informed do you Feel about the Health Risks Related to Contracting the Following Diseases

Diseases	Not at all informed	Somehow informed	Informed	Quite informed	Very informed	Extremely informed
Blood infections	4.80%	0.53%	2.67%	8.27%	10.13%	73.60%
Chicken Pox	4.80%	0.53%	2.135	6.40%	10.13%	76.00%
Cholera	7.47%	0.80%	1.60%	7.20%	9.60%	73.33%
Diphtheria	4.80%	1.33%	2.67%	10.13%	8.80%	72.27%
Ear Infections	4.53%	1.07%	3.20%	7.47%	10.67%	73.07%
Flu	8.53%	0.53%	2.93%	8.00%	9.07%	70.93%
Hepatitis A	6.13%	1.07%	1.87%	6.40%	8.80%	75.73%

Hepatitis B	3.20%	1.07%	2.13%	6.13%	8.53%	78.93%
HPV	11.73%	0.80%	2.67%	7.73%	10.40%	66.67%
Measles	3.20%	0.27%	1.87%	7.73%	9.07%	77.87%
Meningitis	3.47%	1.33%	2.13%	8.00%	9.60%	75.47%
Mumps	3.47%	1.87%	3.20%	8.27%	9.87%	73.33%
Pneumonia	3.47%	1.07%	3.47%	7.20%	9.07%	75.73%
Polio	2.40%	0.80%	1.87%	5.87%	8.00%	81.07%
Rotavirus	7.47%	0.80%	1.87%	7.73%	8.80%	73.33%
Tetanus	2.40%	1.33%	2.40%	6.13%	9.07%	78.67%
Whooping cough	2.67%	0.80%	1.87%	6.93%	9.33%	78.40%

The majority (78.93%) of parents/guardians indicated that it would be extremely helpful, 12.27% said it would be quite helpful, 5.07% didn't know if they were sure or not, and 3.20% felt it would be somehow helpful to have more information about the prevalence of the vaccine preventable childhood diseases in your LGA/in Lagos state.

Table 10. How Concerned are you about the Possible Risks and Reactions Related to the Following Vaccines?

Vaccines (in %)	Not at all Concerned	Somehow Concerned	Concerned	Quite Concerned	Very concerned	Extremely concerned
Cholera	15.47	2.67	2.67	5.07	9.87	64.27
DPTP – Hib (5-in-1)	8.27	2.40	3.73	5.07	8.00	72.53
dTap (diphtheria, tetanus, pertussis)	9.33	2.40	2.93	5.33	9.33	70.67
Flu	17.07	2.67	2.13	5.87	8.80	63.47
Hepatitis B	10.40	2.13	1.60	5.60	9.33	70.93
HPV	16.27	2.13	2.13	6.40	7.73	65.33
Meningococcal	9.60	2.67	1.87	6.40	8.53	70.93
MMR (Mumps, Measles, Rubella)	8.00	2.40	2.93	6.13	9.33	71.20
Pneumonia	9.33	1.87	2.40	6.67	9.33	70.40
Polio	9.87	2.13	2.13	5.33	8.53	72.00
Rotavirus	15.73	1.60	2.40	5.33	8.00	66.93
Varicella (Chicken Pox)	14.13	2.40	1.87	5.07	9.07	67.47

Table 11. What are the most Important Factors you Consider when Deciding to get your Child Vaccinated?

Most important factors to consider for child vaccination (in %)	Not at all important	Somewhat important	Important	Very important	Extremely important
Doctor recommendation	2.67	1.07	9.87	13.87	72.53
Effectiveness of the vaccine	11.20	0.53	8.00	13.60	66.67
Personal experience with the disease	32.53	4.00	10.67	10.93	41.87
Public health nurse recommendation	8.27	3.20	8.53	11.20	68.80

Recommendation by trusted friend/family	49.33	6.67	11.73	8.53	23.73
Requirement by school/daycare	16.53	5.07	13.07	15.47	49.87
Risk level of the disease	25.33	2.13	6.93	12.27	53.33
Safety of the vaccine	9.07	0.53	7.47	14.13	68.80
Seriousness of the disease	16.00	0.80	8.00	14.93	60.27
Side effects of the disease	26.40	1.07	6.67	12.27	53.60
Side effects of the vaccine	25.87	1.07	6.40	14.13	52.53

We also found out that most schools in Lagos do not request children's vaccination/immunization cards before enrolment but are mandatory in Abuja.

The mean, modal age and standard deviation parents/guardians gave for their oldest child/children were 2.21 years, 1 – 6 years and 0.94.

To the Best of your Knowledge and Memory, which of the Following Vaccinations has your Oldest Child had?

Parents/guardians yes that their oldest child/children have received 5-in-1 - Diphtheria, Tetanus, Pertussis, Polio, Hib (recommended at 2, 4, 6 & 18 months) (99.73%), MMR - Mumps, measles, rubella (recommended at 12 months and 2 or 5 years) (92.53%), Hepatitis B (recommended at 2, 4 and 6 months or pre-teen) (99.73%), Pneumococcal (recommended at 2, 4, 6 and 12 months) (97.33%), Meningococcal C (recommended 3 doses starting before 12 months) (88.80%). While parents/guardians no that their oldest child/children have not received Varicella - chickenpox (recommended at 12 months) (64.80%), Influenza/Flu (recommended 1 to 2 doses between 6 and 23 months) (78.93%), HPV - Human Papilloma Virus (recommended for girls in Grades 6 and 9) (95.47%), Cholera (from 12 months) (72.53%), Rotavirus (recommended 2 doses at 6 weeks and 10 weeks) (65.33%).

If you did not Fully Follow the Recommended Nigeria Immunization Schedule for your Oldest Child, What were your Reasons?

The reasons parents/guardians gave for not following the recommended Nigerian immunization schedule for their oldest child were: At Oworoshoki health centre some secondary vaccines were not available like Rotavirus, cholera, Flu, HPV, Hepatitis A and Chicken pox vaccine. Some babies were newborn, 2, months, 3 months, 6 months, 9 months, 10 months, 11 months old and could not take vaccines that are not for their ages. Some said Because of their child's studies, some parents were ignorant, misinformed and not aware of some vaccines like Cholera, Flu and HPV. Some complained of Cost, Financial constraints, lack of funds and time to take permission from work, and some could not find my child vaccination card, a mother said that immunization is not very important, Lack of knowledge of rotavirus benefits. Attitude of health workers discourage mothers from going to hospitals to vaccinate their children same as fear of contracting Covid – 19.

The mean, modal age and standard deviation parents/guardians gave for their youngest child/children were 1.55 years, 0 – 12 months and 0.69. Total number of youngest children was 280.

To the Best of your Knowledge and Memory, which of the Following Vaccinations has your Youngest Child had?

Parents/guardians yes that their youngest child/children have received 5-in-1 - Diphtheria, Tetanus, Pertussis, Polio, Hib (recommended at 2, 4, 6 & 18 months) (99.64%), MMR - Mumps, measles, rubella (recommended at 12 months and 2 or 5 years) (77.86%), Hepatitis B (recommended at 2, 4 and 6 months or pre-teen) (98.93%), Pneumococcal (recommended at 2, 4, 6 and 12 months) (98.33%), Meningococcal C (recommended 3 doses starting before 12 months) (76.79%). While parents/guardians no that their youngest child/children have not received Varicella - chickenpox (recommended at 12 months) (71.43%), Influenza/Flu (recommended 1 to 2 doses between 6 and 23 months) (76.79%), HPV - Human Papilloma Virus (recommended for girls in Grades 6 and 9) (96.43%), Cholera (from 12 months) (77.14%), Rotavirus (recommended 2 doses at 6 weeks and 10 weeks) (62.86%).

If you did not Fully Follow the Recommended Nigerian Immunization Schedule for your Youngest Child, what were your Reasons?

The reasons parents/guardians gave for not following the recommended Nigerian immunization schedule for their youngest child were: At Oworoshoki Health centre some secondary vaccines were not available like Rotavirus, cholera, Flu, HPV, Hepatitis A and Chicken pox vaccine. Some babies were newborn, 2, months, 3 months, 6 months, 9 months, 10 months, 11 months old and could not take vaccines that are not for their ages. Some said Because of their child's studies, some parents were ignorant, misinformed and not aware of some vaccines like Cholera, Flu and HPV. Some complained of Cost, Financial constraint, lack of funds and time to take permission from work, some could not find my child vaccination card, a mother said that immunization is not very important, Lack of knowledge of rotavirus benefits. Attitude of health workers discourages mothers from going to hospitals to vaccinate their children, same as fear of contracting Covid–19. Some mothers had Busy schedules, were tired and had no time, while some mothers said Pneumococcal was not available many years ago both at Oworoshoki health centre and General Hospital. Some could not get their children vaccinated because of the Covid-19 lockdown.

Have you Heard of Covid -19 Vaccine?

The majority (87.73%) of parents/guardians have heard of COVID – 19 vaccines, while 12.27% of parents/guardians have not heard of COVID – 19 vaccines.

Will you Give your Child Covid - 19 Vaccines if Available?

More than half (53.07%) percent said they won't vaccinate their children if COVID – 19 Vaccine is available, while 46.93% of mothers agreed to give their children COVID – 19 vaccines if available.

If yes/no to Vaccinate your Children with Covid – 19 Vaccine give Reasons

Yes, reasons feedback: "Safety first, if it is given for free, I will ensure my child takes it. If it is a preventive vaccine, then it's a welcomed initiative.

No reasons feedback: "Because i feel it has not passed through clinical trials, I am not yet sure of the effectiveness of the vaccines, it is not important".

Discussion

The proportion of parents living in Kosofe and Shomolu Local Government Area that are currently using vaccination is very high and vaccination hesitancy for the primary vaccine is very low. This is because the media also had influence on parents' knowledge, attitude towards epidemics and vaccination, plus healthy practices. We are accepting the Null Hypothesis that "High cost gives rise to non-linear responses in vaccine uptake and there may be other significant determinants like level of education,

religion, media, choice and decision of the head of a family which determine epidemics and vaccination dilemma".

Cost, if not addressed, can undermine several components of vaccination delivery, including vaccine acceptance. Improving vaccination cost is therefore crucial to achieving better vaccination outcomes as well as the greater goal of knowledgeable caregivers and communities – important contributors to improving child health in many settings. The affordable cost could improve uptake of childhood vaccination, address incomplete vaccination, further strengthen routine immunization programmes, and encourage the use of new and underused vaccines. Ideally, vaccination cost should complement and boost other immunization components, such as service provision, quality of care, capacity-building, communication and the skills of health personnel, and disease notification and surveillance [30].

Conclusion

Some mothers at Oworoshoki health centre and General hospital Gbagada did not believe that there is COVID – 19 and were not taking proper safety measures as seen at R Jolad hospital, where most mothers were so cautious, wore nose masks, maintained social distancing, were seen with sanitizers which they were often using for themselves and children. Level of education plays an important role in the level of knowledge and attitude towards epidemics and vaccination. Income and Cost of vaccine affect vaccination uptake because of the present economic situation in Nigeria. Media plays a key role in vaccination campaigns, awareness and intervention and should be promoted more to achieve the goal of ensuring all children are vaccinated properly. Doctor's and Public Health Nurse have a major role to play in terms of influencing parents/guardians. Vaccination uptake.

Recommendations

Based on the major conclusions, the following recommendations for improving the knowledge of epidemics and vaccination are very important.

1. Information on epidemics and vaccination must be made available to parents/guardians through mass media.
2. Government should make some vaccines like Rotavirus, cholera, and chickenpox vaccine free.
3. There is a need the for Nigerian primary health care development agency (NPHCDA). The Ministry of Health, NCDC, NAFDAC, Public Health specialists, WHO, UNICEF, Non-Governmental Organizations and other agencies related to epidemics and vaccination to be directly or indirectly involved in the training of parents/guardians on knowledge of epidemics, vaccination and healthy practices especially regular Dental and Doctor's checkups. This training should involve use of posters, drama, songs, campaign and increasing frequency of calls /SMS and social media (Twitter, Facebook, Instagram, Whatsapp, Youtube, Linkedin etc.) to notify parents/guardians on epidemics and vaccination.
4. Various stakeholders like Community leaders, Church leaders, health workers like Doctors, and Public Health Nurse needs to promote vaccination uptake by leading by example in their various communities.
5. Schools/Daycares in Lagos must ensure that requirement of a vaccination/Immunization card is mandatory before admission is finalized.
6. Health insurance companies should cover for secondary vaccines so as to enable children enrolled under their insurance package to be properly vaccinated.

Contribution to Knowledge

1. The dilemma as regards to MMR vaccination.
2. Absence of Chicken pox, cholera and rotavirus vaccine in government hospitals and health centres.
3. Attitude of parents towards children's vaccine-preventable diseases and Covid – 19.
4. The perception of parents as regards to COVID – 19 vaccination acceptance and hesitancy for their children.

Limitation of Study

The study only focused on approved vaccines available at the time of the study. Therefore, Malaria vaccines was not included in the questionnaire given to the respondents.

Suggestion for Future Research

This research didn't focus on Malaria vaccination therefore, I suggest that research should be conducted to forecast the proposed malaria vaccination Dilemma.

Strength of the Research

The survey tool (Questionnaire) was well designed to study the epidemics and vaccination dilemma properly.

Weakness of the Study

It was a health facility-based research, and most of our respondents were females.

Conflicts of Interest

The author declares no conflict of interest.

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