

Contextual Determinants Of Vaccination Dropout Among Children Aged 12 To 23 Months In The City Of Kisangani, DR Congo

Ependja Towaka Antoine^{1,2}, Losimba Likwela Joris²,
Jean Panda Lukongo², Baelo Foyo Vif¹

¹Yangambi Higher Institute of Medical Techniques, Tshopo province, DR Congo
²Department of Public Health, Faculty of Medicine and Pharmacy, University of Kisangani, Tshopo Province, DR Congo

Abstract

Background : Vaccination reluctance is a major threat to public health. It has been widely studied in developed countries, but much less so in DR Congo. This study aims to analyze contextual determinants in order to identify predictors associated with vaccine dropout among children aged 12 to 23 months in Kisangani.

Materials and Methods : A cross-sectional observational study was conducted from October 25, 2022 to February 18, 2023 among mothers of 336 children aged 12 to 23 months in Kisangani. A pre-tested and administered questionnaire was used for data collection based on three-stage cluster sampling. Analyses were performed on STATA 13 using stepwise logistic regression with a threshold of 0.05.

Results : We observed that contextual variables such as lack of trust in health facilities, presence of a controversial vaccine in the community, culture, waiting time, mother's occupation and lack of trust in pharmaceutical industries showed a significant association with the abandonment of early childhood vaccination in Kisangani ($p < 0.05$).

Conclusion : Thus, health zones need to focus communication interventions on educating and informing mothers about routine infant vaccination to dispel misconceptions and build confidence in vaccines.

Key words : Immunization, vaccine, vaccine hesitancy, early childhood, Kisangani

Date of Submission: 20-09-2023

Date of acceptance: 30-09-2023

I. Introduction

Vaccination hesitancy is a real threat to global health, as stated by the World Health Organization (WHO). This is one of the major challenges facing childhood immunization today [1,2].

According to WHO and UNICEF, 23 million children did not receive basic vaccines as part of routine immunization services in 2020, 3.7 million more than in 2019. This comprehensive set of global child immunization figures - the latest and first to officially reflect service interruptions worldwide attributable to COVID-19 - shows that most countries have experienced declines in child immunization rates. And yet, vaccine efficacy is only possible if the vast majority of the population is vaccinated [3,4].

The literature reports an increase in the intensity, variety and impact of public opinion on vaccination. In a study conducted in the USA, 77% of parents surveyed said they had concerns about one or more vaccines. A study conducted between 2011 and 2012 to assess confidence in vaccines in 144 countries around the world, reported 69% favorable or neutral opinions versus 31% unfavorable. In another survey of confidence in vaccinating children in five countries, the proportion of hesitant parents was 24.5% in the UK, 13.9% in Pakistan, 12.5% in India, 8.4% in Nigeria and 7.4% in Georgia [5,6,7].

David Miko et al. conducted a study on the qualitative assessment of vaccine hesitancy in Romania in 2019. The objectives pursued by this survey were to assess the prevalence and particularities of vaccine hesitancy in the population of parents in the city of Cluj-Napoca, and to discover its underlying factors. As a result of their work, they identified the media, leaders, lobbies and the perception of the pharmaceutical industry among the contextual influences on vaccine hesitancy. Individual and group influences were dominated by beliefs, knowledge and (perceived) risk/benefit. Risk/benefit (rational) and health practitioners (reliability, competence) dominated questions specific to vaccines and vaccination. Among respondents, varicella vaccine elicited 35% hesitation, measles vaccine 27.7%, human papillomavirus 24.1% and mumps vaccine 23.4% [8].

In sub-Saharan Africa, Gebeyehu et al. report that 4.4 million children die every year from communicable diseases that could be prevented by vaccination. This situation is associated with inadequate, insufficient and poor vaccination coverage [9].

In Burkina Faso, Schoeps et al reported varying influences of place of residence on adherence to the schedule of different vaccines. In this study, children living in rural areas were less likely to adhere to the BCG schedule than those living in urban areas; the opposite was observed for the third dose of pentavalent and for VAR [10]. In another study carried out in Ethiopia, children living in urban areas were almost twice as likely to be fully vaccinated as those living in rural areas [11]; while in other studies carried out in East Africa and Libya, no influence of place of residence (urban or rural) on children's vaccination status was found [12,13].

Similarly, while incomplete childhood immunization has often been associated with young maternal age [13 - 15], and low socio-economic status [14 - 17], a study in Kenya identified older mothers, and another in Burkina Faso identified high socio-economic status [10], as risk factors for sub-optimal immunization. Others, however, found no significant association with maternal age [12,14] or household socio-economic level [12,13].

In the Democratic Republic of Congo, studies to identify the determinants of children's vaccination status have been carried out in Muanda, Goma, Kinshasa and Lubumbashi. These studies reported a high probability of being fully vaccinated, associated with the mother's experience of vaccine-preventable diseases [10,16,18], the mother's high level of knowledge about vaccination, the mother's high level of education [15], the father's involvement and the availability of a vaccination card [11,16].

Incomplete vaccination of infants was also associated with the father's high level of education, missed vaccination opportunities [19], the child's male sex, and young, separated or single mothers [15]. Other factors were also identified, including parental neglect, poorly organized vaccination services, geographical inaccessibility of health facilities, financial inaccessibility of vaccination services, habits and customs [20], regular absence of the mother from the household and poor reception at the vaccination site [21].

In Tshopo province, the drop-out rate of 17.6% in 2021 is higher than the threshold of minus 10% tolerated by the WHO [22]. This is indicative of the weakness of the vaccination program's effective management. Indeed, the results of the immunization coverage survey showed that 25.7% of mothers do not have an immunization card. With regard to BCG and VAR, the survey showed vaccination coverage of 19.7% and 43.2% respectively, based on the vaccination card and the mother's declaration. Only 11.3% of children were fully vaccinated for all 13 antigens. The proportion of children who received no vaccine rose from 24.6% in 2020 to 44.3% in 2021[23]. As a result, the number of children affected by the measles epidemic rose from 2,626 cases and 66 deaths in 2022 to 7,693 cases and 196 deaths in week 20 of 2023[24].

Incomplete vaccination of children is a major problem in the health zones of the city of Kisangani. The reasons for this are diverse and linked to the specific features of each health zone. Ignorance of these reasons prevents the development of appropriate and effective strategies to improve routine EPI coverage.

The drop-out rate for early childhood vaccinations in the city of Kisangani was considered worrying, at 17.5%, compared with the threshold of less than 10% tolerated by the WHO. On average, BCG and VAR vaccination coverage was 57.3% and 30.9% respectively in 2020. As a result, the city has suffered from an upsurge in measles epidemics, and morbidity and mortality from vaccine-preventable diseases.

To our knowledge, no study, qualitative or quantitative, has examined the determinants of early childhood immunization drop-out in Kisangani to gain a holistic understanding of the contextual influences associated with this phenomenon. It is within this framework that we initiated this study to analyze contextual determinants in order to identify predictors associated with vaccination dropout among children aged 12 to 23 months in the city of Kisangani in the Democratic Republic of Congo.

II. Materials and methods

This cross-sectional observational-analytical study was conducted in Kisangani from October 25, 2022 to February 18, 2023. It covered a population of 43,606 children aged 12 to 23 months.

Inclusion criteria : This study included children living in Kisangani, aged 12 to 23 months during the survey period, whose mothers agreed to answer our survey questionnaire.

Non-inclusion criteria :

- All children residing in Kisangani, aged less than 12 months or more than 23 completed months during the survey period.

- All children residing in Kisangani, aged between 12 and 23 months during the survey period, whose mothers did not consent to answer our survey questionnaire.

Exclusion criteria : Children living in Kisangani, aged between 12 and 23 months during the survey period, whose mothers abruptly interrupted the interview for reasons of personal convenience, were excluded from the study.

Sampling : To obtain representative data for the city of Kisangani, three-stage probability cluster sampling was conducted in 5 health areas. The health areas formed clusters, while the primary sampling unit was the household.

Sampling was carried out in three stages :

- 1st stage : in each health zone, two clusters were selected by a simple random draw based on the exhaustive list of health areas ;
- 2nd stage : in each selected health area, 30% of avenues/neighborhoods were selected by simple random draw based on the exhaustive list of avenues/neighborhoods ;
- 3rd stage : in each health area, the selected avenues/neighborhoods formed the sampling frame. A systematic draw of households proportional to the number of children aged 12 to 23 months was carried out on the basis of a plot survey prepared by the interviewers.

The minimum sample size was calculated on the basis of the average vaccination drop-out rate of 17.5% obtained during the 2021 vaccination coverage survey in the city of Kisangani. The confidence coefficient was set at 1.96 for a confidence level of 95%, a cluster effect of 1.5 and the degree of precision at 5%. The minimum sample size obtained was increased by 1% to take account of non-responses, i.e. 336 children aged 12 to 23 months.

Table 1 : Distribution by health zone of children aged 12 to 23 months in the city of Kisangani in 2022

Health zones	Total population	Children 12 - 23 months	Allocation factor	Sample
Mangobo	256 791	9 244	0.21	71
Tshopo	178 305	6 419	0.15	50
Kabondo	204 753	7 371	0.17	57
Makiso – Kis	388 064	13 970	0.32	108
Lubunga	183 376	6 602	0.15	50
Total	1 211 289	43 606	1.00	336

Study variables

Vaccination abandonment is the variable to be explained in this research. Independent variables : communication and media, influential leaders, historical factors, socio-cultural factors, political factors, barriers, pharmaceutical industries.

Operational definitions of variables

1° Vaccination drop-out : This is the situation of a child who has had at least one contact with vaccination services and who has not completed the full series of six contacts before his or her first birthday. In our study, this refers to children aged 12 to 23 months who received BCG and who did not receive VAR.

2° Contextual determinants : These are a set of determinants arising from historical, socio-cultural, environmental, health system, economic and political influences. The following variables were taken into account

- Communication and media : These are the media and social media likely to create positive or negative sentiment towards vaccination. They can be used as opinion leaders to influence mothers of children aged 12 to 23 months.

- Influential leaders : These are local leaders, influential personalities, religious leaders, teachers and health workers who have an important influence on the acceptance of vaccination by mothers of children aged 12 to 23 months.

- Historical factors : These are past negative events that can erode a mother's confidence and have an impact on her child's acceptance of the vaccine.

- Socio-cultural factors : Cultural, religious and gender-related factors likely to influence the mother to abandon vaccination of her child.

- Political factors : Abandonment of vaccination by the mother as a result of an immunization program forced on her by the political authorities.

- Obstacles : Waiting time and lifestyle may influence the mother's decision to abandon vaccination. Waiting time is the time taken by a mother to attend a vaccination session, from the time she arrives until she receives the vaccine for her child. Long waiting times can discourage the mother from continuing with the vaccination, and are also incompatible with mothers who are busy with other, mainly commercial, activities.

- Pharmaceutical industries : Mothers mistrust vaccine manufacturers because of a lack of transparency.

Data collection

For data collection, we developed a survey questionnaire administered to mothers of children aged 12 to 23 months. These questions provided us with information on the contextual determinants of mothers of children aged 12 to 23 months associated with dropping out of vaccination. This survey questionnaire was submitted to the management team and experts from the Kisangani Expanded Program on Immunization for critical analysis, in order to check the wording, coherence and congruence of the questions asked.

Statistical analysis of data

The data collected was entered into Excel and then exported to STATA 13 for statistical analysis.

To identify links between dependent and independent variables, we used contingency tables and Pearson's Chi-square test. The strength of associations was estimated using raw ORs, while any probability value below 5% was considered statistically significant.

To account for potential confounding factors, we used a logistic regression model, including variables that showed a significant association at the 5% threshold in bivariate analysis using a stepwise degressive approach. The risk factors retained in the final model were presented with their Wald Chi-square p-values, as well as the adjusted ORs derived from the model and their 95% Confidence Intervals.

Ethical considerations

The ethical considerations of the research were respected. The research project protocol and questionnaire were approved by the supervisory team and the ethics committee of the Faculty of Medicine and Pharmacy of the University of Kisangani. The survey was conducted in accordance with their requirements.

Mothers with children aged 12 to 23 months were interviewed individually in their households. The researcher, after introducing himself and explaining the purpose of the study, gave a brief overview of the survey, explaining what they had to do as informants. They were informed that their participation was not compulsory. In addition, the questionnaire had to be completed anonymously, and each respondent was identified by a code. Verbal consent was obtained each time, and willingness to complete the questionnaire was considered another form of tacit consent. Data confidentiality, voluntary participation and the possibility of withdrawing from the study at any time without prejudice were observed.

III.Results

Contextual determinants

Table 2 shows that 46.1% of mothers of children aged 12 to 23 months trust other sources of information, such as radio, television, social networks, the Internet, school and church. Health facilities are the least trusted source for 33.6% of mothers. The controversial vaccine was recognized by 38.1% of mothers surveyed, while 51.8% said their leaders were not in favor of vaccination. With regard to the anti-vaccine community, 42% of mothers affirmed this. Over 90% of mothers of children incorrectly stated that vaccinating girls is more important than boys, and vice versa. Mothers who only accept the administration of vaccines for their child by a vaccinator of their choice accounted for 25.6%. It was noted that 32.4% had already refused to give their children a vaccine recommended by the Congolese government. The study revealed that 29.2% of mothers do not trust the pharmaceutical industries that supply vaccines. More than half of mothers of children said that waiting time and the mother's occupation were the reasons for abandoning early childhood vaccination.

Table 2 : Distribution of contextual determinants of vaccination dropout among children aged 12 to 23 months in Kisangani in 2022 (n=336)

Variables	Categories	Staff	%
Source of confidence			
	Health training	181	53.9
	Others (Church, school...)	185	46.1
Crisis of confidence			
	Health training	113	33.6
	Other (Internet, school...)	223	66.4
Controversial vaccine			
	Yes	128	38.1
	No	208	61.9
Vaccine-friendly leaders			
	Yes	162	48.2
	No	174	51.8
Anti-vaccine community			
	Yes	141	42.0
	No	195	58.0
Girls' vaccination			
	Yes	318	94.6
	No	18	5.4
Boys' vaccination			
	Yes	313	93.2
	No	23	6.8
Culture			
	Yes	86	25.6
	No	250	74.4

Table 2 (continued) :Distribution of contextual determinants of vaccination dropout among children aged 12 to 23 months in Kisangani in 2022 (n=336)

Variables	Categories	Staff	%
Refusing a recommended vaccine	Yes	109	32.4
	No	227	67.6
Waiting times	Yes	178	53.0
	No	158	47.0
Occupation	Yes	178	53.0
	No	158	47.0
Pharmaceuticals industry	Yes	238	70.8
	No	98	29.2

Bivariate analysis

At the end of the bivariate analysis, the belief that vaccinating boys is more important than vaccinating girls and the lack of trust in the pharmaceutical industries that supply vaccines showed a significant association with BCG, VAR vaccination and vaccine refusal ($p < 0.05$). However, the following contextual determinants were significantly associated with VAR vaccination and vaccine refusal : the presence of a controversial vaccine in the community, refusal to accept certain vaccines in the community in the past, culture, waiting time and prevention of receiving a vaccine for one's child due to occupation. Lack of trust in health facilities for information about vaccines, the view that vaccinating girls is more important than boys, and refusal to accept a vaccine recommended by the Congolese government showed a significant association with BCG vaccination. The absence of a favorable leader for infant vaccination was also significantly associated with refusal to vaccinate. On the other hand, acceptance of health facilities as the most trusted source of vaccine information showed no significant association with vaccine refusal ($p > 0.05$).

Multivariate analysis using simple logistic regression

Multivariate analyses using simple logistic regression focused on the independent variables significantly associated with vaccination drop-out in the bivariate analyses ($p < 0.05$).

A significant association was found between vaccination abandonment and the following contextual determinants : crisis of confidence ($p < 0.01$), controversial vaccine ($p < 0.00$), vaccination of girls ($p < 0.03$), vaccination of boys ($p < 0.00$), culture ($p < 0.04$), waiting time ($p < 0.00$) and pharmaceutical industry ($p < 0.00$). No association was found with pro-vaccine leaders, anti-vaccine community or refusal to vaccinate during the mass campaign.

Table 3 : Univariate logistic regression of contextual determinants associated with early childhood vaccination dropout in Kisangani

Variables		BCG		VAR		Vaccination refusal	
		p	[IC _{95%}]	p	[IC _{95%}]	p	[IC _{95%}]
Crisis of confidence	Yes	0.01	[0.2-1.7]	-		-	
	No						
Controversial vaccine	Yes	-		0.00	[0.4-1.7]	0.00	[0.5-1.6]
	No						
Girls' vaccination	Yes	0.03	[0.1-2.3]	-		-	
	No						
Boys' vaccination	Yes	0.07	[-0.1-2]	-		0.00	[0.5-2.7]
	No						
Culture	Yes	-		0.04	[0.1-1.3]	-	
	No						
Waiting time	Yes	-		0.06	[0.1-1.4]	0.00	[0.5-1.9]
	No						
Occupation	Yes	-		-		0.00	[0.4-1.8]
	No						
Pharmaceuticals industry	Yes	0.00	[0.2-1.7]	0.00	[0.5-1.8]	0.04	[0.1-1.2]
	No						

Multivariate analysis using multiple logistic regression

After adjustment, the following contextual determinants showed a significant association with vaccine abandonment : crisis of confidence, controversial vaccine, more girls than boys vaccinated and vice versa, culture, waiting time, mother's occupation and lack of confidence in the pharmaceutical industries supplying

vaccines. Pro-vaccination leaders, anti-vaccination community, refusal to vaccinate during mass campaign lost their association with abandonment of vaccination. The results are presented in Table 4.

Table 4 : Multivariate logistic regression of contextual determinants associated with abandonment of early childhood vaccination in Kisangani

Variables	BCG		VAR		Vaccination refusal	
	p	ORa[IC _{95%}]	p	ORa[IC _{95%}]	p	ORa[IC _{95%}]
Crisis of confidence	0.02	2.5 [1.2-5.2]	-	1	-	1
Controversial vaccine	-	1	0.00	3 [1.6-5.6]	0.00	3 [1.7-5.1]
Girls' vaccination	0.02	4.0 [1.3-12]	-	1	-	1
Boys' vaccination	-	1	-	1	0.00	5.1 [1.6-15]
Culture	-	1	0.02	2.2 [1.1-4.3]	-	1
Waiting time	-	1	-	1	0.00	3.5 [1.7-6.9]
Occupation	-	1	-	1	0.00	3.1 [1.6-6.3]
Pharmaceuticals industry	0.00	3.1 [1.5-6.5]	0.00	3.5 [1.8-6.7]	0.04	1.8 [1.1-3.4]

Children of mothers who say that vaccinating boys is more important than girls are 5 times more likely to drop out, followed by those who say the opposite. Children of mothers who don't trust vaccine manufacturers are 3.5 times more likely to drop out of early childhood vaccination than those from mothers who do. Refusal to vaccinate is 3.5 times more likely to be due to waiting times, and 3 times more likely to be due to the presence of a controversial vaccine in the community and the mother's occupation being perceived as an obstacle to her child's vaccination. This risk is 2.5 times greater due to a lack of confidence in the information provided by health structures on child immunization. The chance of a child dropping out as a result of the culture of accepting only vaccinators from his or her tribe or religion is 2.2 times higher in mothers who affirm this than in those who reject it.

IV. Discussion

Communication and media

Lack of trust in health facilities is also an important predictor of child immunization (Table 4). Children of mothers who are less trusting of health facilities to receive immunization information are 2.5 times more likely to abandon immunization than those of mothers who have identified other less trusting sources such as the internet, social networks, church, school. This may be explained by differences in social norms, cultural beliefs, geography, quality and coverage of health services and other infrastructures.

A study conducted in Cameroon by Ba Pouth showed that mothers who did not attend any vaccination education talks at the vaccination center (p=0.0363) did not complete their children's immunization schedule [25].

On the subject of controversial vaccines in the community (Table 4), Ward and colleagues observed that vaccination controversies relayed in social networks around the world, notably on the possibility of infertility, or the propensity to cause a slow and sure death [26] raise the broader issue of vaccine side effects and safety of use.

Today, the phenomenon of resistance and reluctance towards vaccines is facilitated, among other things, by the growing influence of the Internet [60], where all opinions can be shared "horizontally" and all information, verified or not, is widely dispersed. What's more, the Internet has the unique ability to rapidly amplify the spread of information. This characteristic can become a difficult problem for public health forces when the information shared is unclear, conflicts with the scientific consensus or is simply wrong [27].

Family and friends also play a role in the transmission of vaccination information and in decision-making. Certainly, people who don't have access to the Internet can be influenced by those who do. They can have them view video or other messages on their own phones. Two surveys carried out in 2020 in all regions of Mali, including Gao, confirmed that the use of the Internet and social networks had become widespread in the country, encouraged by the spread of cell phones. Thus, 79.4% of those surveyed said they had easy access to the Internet, and the top 5 applications used were WhatsApp (29.7% of respondents), Facebook (26.0%), YouTube (16.7%), Instagram (6.3%) and Twitter (4.8%). According to the findings of health workers, most messages against vaccination circulated in the form of video and written messages on the WhatsApp and Facebook networks in Gao, Mali. [28].

Regular exposure to vaccination messages through the media or community sources has been identified as a factor in promoting vaccination in Nigeria, India and Bangladesh [29,30].

Exposure to particularly negative media reports on vaccination has been a barrier in Taiwan [31] and Canada [32].

However, it was estimated in 2012 that 2.4 billion people had access to the internet. This represents an explosive increase of 56.6% compared with 2000. Even more worrying is the growing trend to seek health information from user-generated sites (Web 2.0), such as online discussion groups and blogs, rather than more traditional, evidence-based vaccine information sites. The Internet has also been cited as one of the main sources of vaccination information for parents in studies conducted in different countries [33].

Barriers to vaccination

Waiting time is a major obstacle to vaccination dropout among children aged 12 to 23 months in Kisangani (Table 4). This factor is linked to the organization of the vaccination post and session. It has also been found in Cameroon to be the main reason why children are not vaccinated [25].

The culture

This relatively stable set of shared values, beliefs and practices within a community can be a criterion for differentiating one community from another. The result in this study (Table 4) is similar to other studies that have reported cultural, religious and community belief systems as potential barriers or deterrents to vaccination in Africa [34 - 36].

To echo the research questions and cultural sensitivity approach, we elucidate the results comparatively. One of the most notable distinctions between the two corpora is that personal experience of vaccination occupies a large place in the Twitter semantic network. However, Weibo users rarely mentioned the personal experience and feelings of vaccination. This narrative divergence may be partly attributed to the inherent difference between individualism and collectivism. Luo et al reported that people from individualistic societies are relatively autonomous and independent of groups ; they always place their personal goals above the goals of the group. People in collectivist cultures are likely to interact closely with their groups and prioritize group goals. [37]

Furthermore, when integrating individualism versus collectivism in the context of health communication, Lu et al asserted that individualistic cultures endorse self-sufficiency and personal control over health risks. In contrast, collectivist cultures emphasize interdependence and external social norms to manage health risks. In this logic, individualists are inclined to make vaccination decisions of their own free will. They also have more freedom to express their thoughts and attitudes on the basis of self-determined health behaviors. For collectivists, they need to be strongly integrated into their environment. Because of the restrictions imposed by norms and group pressure, they are more likely to hide individualized feelings and dispositional thoughts to remain consistent with others or avoid negative social sanctions [38,39]. In addition, China's somewhat compulsory group vaccination program has contributed to this disparity [40].

According to Ajzen's theory of planned behavior as described by Luo et al. people's behavior is significantly affected by normative beliefs and subjective norms. People are very likely to follow perceived social norms and the actions of significant others to reach a behavioral decision, which is quite remarkable in collectivist cultures. Perceived injunction norms are positively related to behavioral intention for Chinese respondents, but do not work for American respondents. Living in a country deeply influenced by collectivism, the Chinese are inclined to follow community rules and hide their personal experience [37].

In the case of vaccination of girls and boys (Table 4), this is due to cultural beliefs. Indeed, in a study carried out in Yahisuli, Ependja et al reported that according to Bantu culture, a boy is the heir of the family, especially if he is the first-born. Consequently, parents have a moral obligation to protect him from certain dubious practices that could affect his fertility. Allusion is made to rumors that vaccines cause sterility. This can lead to girls being more likely to take part in the vaccination program. [41].

Perception of the pharmaceutical industry

Lack of trust in vaccine manufacturers (Table 4) has also been supported by other researchers as a factor associated with the abandonment of early childhood vaccination.

Indeed, participants in a study carried out in Romania by David Miko et al. expressed concerns about the conflicts of interest and ethics of pharmaceutical companies: the lure of financial gain was often perceived as overriding the public health interests of the population, lack of trust in pharmaceutical companies, vaccine manufacturers are not held accountable for adverse reactions, vaccination does not certainly put the child's health first, parents are afraid that vaccines are substandard and may be counterfeit. Although they consider vaccines important, they do not trust the institutions that manufacture them [8].

With specific reference to Romania, some people also expressed doubts about the products they had access to in their part of the world, particularly low-quality products that do not meet European standards [8].

In a literature review by Kennedy Obohewemu et al on parental reluctance to vaccinate in childhood and prediction of vaccination, nine of the thirty-four studies included showed that parents distrusted the pharmaceutical industries, believing that economic interests influenced vaccination policy. Parents felt that the pharmaceutical industry should act in the best interests of the public. Lack of trust in pharmaceutical companies was therefore seen as an obstacle to vaccination. Parents who question the intentions of pharmaceutical companies can lead to low public acceptance of vaccines [42]. Therefore, it is important to examine how parents perceive the pharmaceutical sector as a major factor in the distrust that leads to vaccine refusal.

The present study did not identify the influence of community leaders, community refusal to accept certain vaccines and refusal of a government-recommended vaccine as determinants of early childhood vaccine abandonment in the study population. This contradicts other articles on the subject, which have identified them as a major predictor of negative attitudes towards science and scientific culture [43].

Study limits

The lack of cooperation from certain households, the unavailability of mothers due to the survey schedule and the difficulty of translating the questionnaire into Lingala or Swahili, with the risk of distorting its content, were observed in this work.

The study population is essentially made up of children whose mothers agreed to answer our survey questionnaire. This is not representative of the parent population, although mothers are the main people responsible for children's health in our context. But in a patriarchal society where men decide almost everything in the family, not interviewing the men in our sample could be an important limitation.

A further limitation is due to the fact that this study was carried out during the COVID-19 pandemic and its mediatized corollaries on its various vaccines. This may also have biased our findings on dropout during non-pandemic periods.

Despite these limitations, this study demonstrates that dropping out of early childhood vaccination is complex, with mothers facing different combinations of obstacles during their child's vaccination journey. However, they in no way detract from the scientific value of this work, which for the first time in Kisangani tested the WHO expert advisory working group questionnaire on immunization.

V. Conclusion

This study enabled us to analyze the contextual determinants of early childhood vaccination dropout and identify its main influences in the city of Kisangani, in order to provide verifiable information on the phenomenon to members of the scientific community. The abandonment of vaccination is not negligible in Kisangani, because of its consequences on vaccination status, morbidity, mortality and the occurrence of epidemics. It should be investigated in greater depth in the future, along with its determinants, through quantitative and qualitative studies at national level. Understanding today's mothers means convincing tomorrow's mothers. Mothers' choices and attitudes will shape the vaccination coverage of the next generation, and influence their children's attitudes to vaccination.

Contextual variables such as lack of trust in health facilities, the presence of a controversial vaccine in the community, culture, waiting time, the mother's occupation and lack of trust in the pharmaceutical industry, showed a significant association with the abandonment of early childhood vaccination.

Thus, health zones in the city of Kisangani need to focus communication interventions on educating and informing mothers about routine infant vaccination to dispel misconceptions and build confidence in vaccines.

Funding : This study did not receive specific funding from any public, commercial or non-profit agency.

Authors' contributions and responsibilities : All authors attest to compliance with the criteria of the International Committee of Medical Journal Editors (ICMJE) with regard to their contribution to the article. All authors contributed to the conduct of this research and to the drafting of the manuscript. They have all read and approved the final version.

Declaration of links of interest : The authors declare that they have no links of interest.

References

- [1]. Who. Ten Threats To Global Health In 2019. [Accessed November 14, 2022]. Available From : <https://www.who.int/emergencies/ten-to-global-health-in-2019>.
- [2]. Dubé E, Vivion M, Macdonald Ne. Vaccine Hesitancy, Vaccine Refusal And The Anti-Vaccine Movement : Influence, Impact And Implications. *Expert Rev Vaccines*. 2015 ; 14 : 99–117.
- [3]. Oms Et Unicef. Vaccines And Vaccinations. Accessed December 17, 2022. Url : <https://www.who.int/fr/news/item/covid-19-pandemic-leads-to-major-backslip>
- [4]. Nguéfack F, Ngwanou Dh, Chiabi A, Mah E, Wafeu G, Mengnjo M Et Al. Determinants And Reasons For Not Fully Vaccinating Children Hospitalized In Two Pediatric Reference Hospitals In Yaounde. *Health Sci. Dis.* April – May – June 2018 ; 19 (2) : 81 – 88
- [5]. Gowda C, Schaffer Se, Kopec K, Markel A, Dempsey Af. Does The Relative Importance Of Mmr Vaccine Concerns Differ By Degree Of Parental Vaccine Hesitancy ? An Exploratory Study. *Hum Vaccin Immunother*. 2013 Feb ; 8(2) : 430 – 6.

- [6]. Kennedy A, Lavail K, Nowak G, Basket M, Kennedy Ba, Lavail K Et Al. Confidence About Vaccines In The United States : Understanding Parent's Perceptions. *Health Affairs*. 2011 ; 30 (6) : 1151–9.
- [7]. Larson Hj, Schulz Ws, Tucker Jd, Smith Dmd. Measuring Vaccine Confidence : Introducing A Global Vaccine Confidence Index. *Plos Currents Outbreaks*. 2015 Feb 25. Edition 1.
- [8]. Miko D, Costache C, Colosi Ha, Neculicioiu V And Colosi Ia. Qualitative Assessment Of Vaccine Hesitancy In Romania. *Medicina (Kaunas)*. 2019 Jun 17 ;55(6) :282.
- [9]. Gebeyehu Na, Asmare Ag, Dagnaw Tk, And Birhan Ab . Vaccination Dropout Among Children In Sub-Saharan Africa : Systematic Review And Meta-Analysis. *Hum Vaccin Immunother*. 2022; 18(7): 2145810 – 21.
- [10]. Schoeps A, Ouédraogo N, Kagoné M, Sié A, Müller O, Becher H. Sociod-Demographic Determinants Of Timely Adherence To Bcg, Penta3, Measles, And Complete Vaccination Schedule In Burkina Faso. *Vaccine* 2014 ; 32 (1) : 96–102.
- [11]. Kassahun Mb, Biks Ga, Teferra As. Level Of Immunization Coverage And Associated Factors Among Children Aged 12-23 Months In Lay Armachiho District, North Gondar Zone, Northwest Ethiopia : A Community Based Cross Sectional Study. *Bmc Research Notes*. 2015 ; 8 : 239.
- [12]. Canavan Me, Sipsma Hl, Kassie Gm, Bradley Eh. Correlates Of Complete Childhood Vaccination In East African Countries. *Plos One*. 2014 ;9(4) : 957 – 9.
- [13]. Emmanuel Ow, Samuel Aa, Lydia Hk. Determinants Of Childhood Vaccination Completion At Peri-Urban Hospital In Kenya, December 2013-January 2014 : A Case Control Study. *Pan African Medical Journal*. 2015 ; 20 : 277.
- [14]. Russo G, Miglietta A, Pezzotti P, Biguioh Rm, Mayaka Gb, Sobze Ms, Et Al. Vaccine Coverage And Determinants Of Incomplete Vaccination In Children Aged 12 – 23 Months In Dschang, West Region, Cameroon : A Cross-Sectional Survey During A Polio Outbreak. *Bmc Public Health* ; 2015 ; 15 : 630.
- [15]. Kabudi Am, Lutala Pm, Kazadi Jm, Bardella Ij. Prevalence And Associated Factors Of Partially/Non-Immunization Of Under-Five In Goma City, Democratic Republic Of Congo: A Community-Based Cross-Sectional Survey. *Pan African Medical Journal*. 2015; 20:38.
- [16]. Mutua Mk, Kimani-Murage E, Ettarh Rr. Childhood Vaccination In Informal Urban Settlements In Nairobi, Kenya : Who Gets Vaccinated? *Bmc Public Health*. 2011 ;11 :6.
- [17]. Lakew Y, Bekele A, Biadgilign S. Factors Influencing Full Immunization Coverage Among 12–23 Months Of Age Children In Ethiopia: Evidence From The National Demographic And Health Survey In 2011. *Bmc Public Health*. 2015 ;15 (1) :728.
- [18]. Ministry Of Public Health. Survey On The Availability And Operational Capacity Of Health Services In The Democratic Republic Of Congo. Kinshasa ; 2014.
- [19]. Kaozi J-D. Factors Associated With Non-Completion Of The Immunization Schedule For Children Aged 12 To 23 Months In The Barumbu Health Zone. [Master's Thesis In Public Health]. Kinshasa University School Of Public Health : Kinshasa ; 2014.
- [20]. Kulonda T. Predictive Analysis Of Factors Determining Non-Completeness Of The Immunization Schedule For Children Aged 12 To 23 Months Using The Bayesian Approach (Case Of The Kisenso Health Zone). [Master's Thesis In Public Health]. Kinshasa University School Of Public Health : Kinshasa ; 2015.
- [21]. Kiyimbi P. Déterminants De Non Achèvement Du Calendrier Vaccinal Des Enfants De 12 A 23 Mois Dans La Zone De Santé De Muanda. [Master's Thesis In Public Health]. Kinshasa University School Of Public Health : Kinshasa ; 2012.
- [22]. Who. Global Routine Immunization Strategies And Practices : Supplementary Document To The Global Vaccine Action Plan. [Internet]. France ; 2016. [Accessed 12/03/2023]. Available From : [Apps.Who.Int/Iris/Bitstream/10665/206454/1/9789242510102_Fre.Pdf](https://apps.who.int/iris/bitstream/10665/206454/1/9789242510102_fre.pdf)
- [23]. Study Report : Survey Of Vaccination Coverage Among Children Aged 6-23 Months In The Democratic Republic Of Congo In 2021. Kinshasa ; Août 2022
- [24]. Tshopo Provincial Health Division. Annual Activity Report 2022. Kisangani ; 2023
- [25]. Ba Pouth Bsf, Kazambu D, Delissaint D, Kobela M. Vaccination Coverage And Factors Associated With Vaccine Non-Completeness In Children Aged 12 To 23 Months In The Djoungolo-Cameroon Health District In 2012. *Pan African Medical Journal*. 2014 ; 17 :91
- [26]. Ward Jk, Peretti-Watel P, Bocquier A, Seror V, Verger P. Vaccine Hesitancy And Coercion: All Eyes On France. *Nat Immunol*. 2019 Oct ;20(10) : 1257-1259.
- [27]. Jung M. Challenges Of Vaccinations In The Era Of New Media Communication. *Health Care Manag*. 2018 ;37 :1–5.
- [28]. Kebe At, Diarra B, Diallo H, Ballam A, Sangho A, Migliani R, Thonneau P. Vaccine Hesitancy And Its Determinants Among Parents Of Children Under Five In The City Of Gao, Mali In 2021. *Pamj - One Health*. 2022 ;9(14).
- [29]. Patra N. A Probe Into The Ways To Stimulate Childhood Immunization In India : Findings From National Family Health Survey-III. *Int J Child Adolescent Health* 2012 ;5(1) :65–84.
- [30]. Larson Hj, Jarrett C, Eckersberger E, Smith Dm, Paterson P. Understanding Vaccine Hesitancy Around Vaccines And Vaccination From A Global Perspective : A Systematic Review Of Published Literature, 2007–2012. *Vaccine*. 2014 Apr 17 ;32(19) :2150 – 9
- [31]. Chen M, Wang R, Schneider Jk, Tsai C, Jiang Dd, Hung M, Et Al. Using The Health Belief Model To Understand Caregiver Factors Influencing Childhood Influenza Vaccinations. *J Community Health Nurs* 2011 ;28(January (1)) :29–40.
- [32]. Morin A, Lemaitre T, Farrands A, Carrier N, Gagneur A. Maternal Knowledge, Attitudes And Beliefs Regarding Gastroenteritis And Rotavirus Vaccine Before Implementing Vaccination Program : Which Key Messages In Light Of A New Immunization Program ? *Vaccine* 2012 ;30 :5921–7.
- [33]. Dube E, Vivion M And Macdonald Ne. Vaccine Hesitancy, Vaccine Refusal And The Anti-Vaccine Movement : Influence, Impact And Implications. *Expert Rev. Vaccines*. 2015 ; 14(1) : 99–117
- [34]. Adamu Aa, Essoh Ta, Adeyanju Gc, Jalo Ri, Saleh Y, Aplogan A, Et Al. Factors In Hesitancy Towards Recommended Childhood Vaccines In African Contexts : A Review Of The Literature From Kenya, Malawi And Ethiopia. *Expert Rev Vaccines*. 2021 ; 20 : 611–21.
- [35]. Goldstein S, Macdonald Ne, Guirguis S. Health Communication And Vaccine Hesitancy. *Vaccin*. 2015 ; 33 : 4212–4.
- [36]. Madhi Sa, Rees H. Special Focus On Challenges And Opportunities For Vaccine Development And Use In Africa. *Hum Vaccin Immunother*. 2018 ; 14 :2335 – 9.
- [37]. Luo C, Chen A, Cui B, Et Liao W. Exploring Public Perceptions Of The Covid-19 Vaccine Online From A Cultural Perspective: Semantic Network Analysis Of Two Social Media Platforms In The Us And China. *Telemat Inform*. 2021 December; 65: 101712.
- [38]. Lu L, Liu J, Yuan Yc. Health Information Seeking Behaviors And Source Preferences Between Chinese And U.S. Populations. *J. Santé Commun*. 2020 ; 25(6) :490-500.

- [39]. Lu L, Liu J, Yuan Yc. Cultural Differences In Cancer Information Acquisition : Cancer Risk Perceptions, Fatalistic Beliefs, And Worry As Predictors Of Cancer Information Seeking And Avoidance In The U.S. And China. *Santé Commun.* 2020 :1–10.
- [40]. Sun W, Yu J, Yang W, Yan X, Qiang L, Xia K. China Vaccinates Key Groups Against Covid-19. *Xinhua Net.* [Accessed September 13, 2022]. Excerpt From [Http://Www.Xinhuanet.Com/English/2021-01/04/C_139641409.Htm](http://www.xinhuanet.com/english/2021-01/04/c_139641409.htm).
- [41]. Ependja Ta, Baelo Fv And Baombolia Lz. Behaviors Of Yahisuli's Parents In Early Childhood Immunization In 2018. *Open Science Journal.* May 2021 ; 6(2) :1 – 14
- [42]. Kennedy O , Christie-De Jong E ,Et Ling J. Parental Reluctance To Vaccinate In Childhood And Prediction Of Vaccination: A Systematic Review. *Prim Health Care Res Dev.* 2022 ; 23 : E68.
- [43]. Mcphetres J, Zuckerman M. Religiosity Predicts Negative Attitudes Towards Science And Lower Levels Of Science Literacy. *Plos One.* 2018 ;13 : E0207125.