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Exploring the Influence of Nudge-Based and Fear-Based Communication on Attitudes and Behavioral Responses: A Study of Burkinabe Mothers' Perspectives on the Infant Malaria Vaccine

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Fear, Nudges, Communication, Persuasion, Vaccine.

ABSTRACT

In Burkina Faso, malaria causes the death of several individuals, mostly children aged 0 to 5 years. Vaccination is one of the most effective means to fight malaria. Communication based on nudges and fear-based communication are used to raise awareness among individuals to get vaccinated. However, the literature on the use of these two communication registers has quite divergent results. The objective of this research is to study the influence of communication based on nudges and fear on the attitude and behavior of Burkinabe mothers to vaccinate their children. We used a qualitative methodology through a sample of 20 mothers for data collection. The results indicate that both forms of communication favorably influence the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine. Communication based on fear is more effective compared to communication based on nudges. We recommend that health ministries communicate more by using fear and nudges to get mothers to agree to vaccinate their children

1. INTRODUCTION

In Burkina Faso, malaria is an endemic disease and the entire population is exposed to the risk of infection. According to the Ministry of Health, the country recorded more than 11,000,000 cases of malaria in 2022 and approximately 4,000 people died, including 3,000 children under 5 years of age. Dalinpuo and Nassè (2020) have shown that it is important to provide a social protection to children, especially those who are vunerable. Thus, vaccination is one of the most effective public health tools that can individually and collectively avoid complications and mortality caused by infectious diseases (Nguefack et al., 2018). Faced with these multiple victims caused by malaria, several health organizations around the world have embarked on vaccine research to prevent the disease. The result of more than 40 years of research through trial phases conducted in certain African countries, the RTS, S vaccine against malaria has been developed. This vaccine was introduced in Burkina Faso on February 5, 2024 through an initial pilot phase which will consist of vaccinating approximately 220,000 children aged between 0 and 5 years. An awareness campaign was implemented by health authorities to encourage mothers to massively vaccinate their children. However, mothers are still hesitant to have their children vaccinated against malaria. Vaccine hesitancy refers to a delay in accepting or refusing to have one's child vaccinated despite the availability of the vaccine (Bhopal and Nielsen, 2021; Dubé et al., 2015). During the COVID 19 pandemic, a study conducted by Sallam (2021) reveals a very low acceptance rate for vaccination linked to a lack of confidence in the vaccine. Communication is necessary

to favorably influence the attitude and behavior of mothers towards the new childhood malaria vaccine launched by the Burkinabe health authorities. In social marketing, several communication registers are used to design awareness messages, including fear and nudges. The majority of research in behavior change communication highlights a positive effect of fear-inducing messages (Boster et al., 2021; Floyd et al., 2000; Tannenbaum et al., 2015; Moussaoui et al., 2021). However, there are discrepancies in the literature on the effectiveness of using fear to change individuals' behavior. Indeed, Chinese people who are from a collectivist culture have a positive attitude towards the vaccine and a favorable intention to get vaccinated when they are subjected to fear-inducing communication (Chen et al., 2021; Li et al., 2023; Yé et al., 2021; Wang et al., 2023). Conversely, fear-based messages are not effective in getting Americans who are of an individualistic culture to get vaccinated (Borah, 2023; Carcioppolo et al., 2017; Chen et al., 2022; Hong and Hashimoto, 2023; Kim et al., 2022; Taber et al., 2023). Based on these controversies, additional research is needed to better understand the effect of persuasive communication using fear on individuals' attitudes and behaviors. While the use of fear is certainly effective in some circumstances, in other cases, other alternatives should be used to promote communication success (Achour and Gharbi, 2017). Among these alternatives is nudge-based communication. This communication method is considered a gentle and non-threatening method for getting individuals to adopt behaviors that are beneficial to their well-being. Ledderer et al. (2020) through a systematic review of the literature on nudges, found that out of 66 published articles, 42 articles advocated favorably for the use of nudges in the context of communication for behavior change. However, it should be noted that some research questions the appropriateness of using nudges in the context of communication for individual behavior change. Thus, Muller (2017) believes that communication focused on nudges is akin to a feeling of manipulation, especially if it includes false figures. Dora and Kahn (2011) found that the effect of nudges can be limited and even generate effects opposite to those desired. For Chenjin and Hasrina (2023) and Jia and Mustapha (2023), a communication that uses nudges is not always effective.

It should be noted that the majority of research separately evaluates the effectiveness of nudge-based and fear-based communication. To our knowledge, there is no research comparing the effectiveness of these two communication styles. This gap can be filled through this research.

Based on the above development, the main research question of this paper is: what is the influence of nudge-based communication and fear-based communication on the attitude and behavior of mothers towards the infant malaria vaccine in Burkina Faso? The first specific question related to this paper is: what is the influence of nudge-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine? We will focus on answering the second specific question below: what is the influence of fear-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine? The third specific question of this research is: what comparison can be made of the effectiveness between nudge-based communication and fear-based communication on the behavior and attitude of Burkinabe mothers towards the infant malaria vaccine? The general objective of our research is to study the influence of nudge-based communication and fear-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine. The first specific objective is to analyze the effect of nudge-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine. The second specific objective is to verify the influence of fear-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine. The third specific objective is to conduct a comparative study of the effectiveness of nudge-based communication and fear-based communication on the attitude and behavior of Burkinabe mothers towards the infant malaria vaccine.

The expected contribution of this paper is threefold. On a theoretical level, this research will enrich the ongoing debate on the appropriateness of using either fear or nudges in the field of communication for behavior change. It will also allow for a comparison of the two communication registers, which to our knowledge has not yet been studied in the literature. On a societal level, this research will help guide the Burkinabe government on how to communicate in order to mobilize as many mothers as possible to vaccinate their children. Finally, on a managerial level, this research will be able to inform civil society actors working in awareness-raising to create effective content using fear or nudges.

This paper is constructed in four parts: literature review, methodology, presentation of results and discussion and implications.

2. LITERATURE REVIEW.

In this section, we first present a summary of the work on fear-based communication. Second, we will review the state of the art on nudges in the context of behavior change communication.

2.1 Use of fear in behavior change communication

In social marketing, public health prevention campaigns help persuade consumers to abandon harmful behavior or join a noble cause. Fear is one of the commonly used methods to induce behavioral changes in individuals (Gallopel et al., 2013). According to Marchioli (2006), fear appeal consists of arousing in the receiver a feeling of fear through the presentation of a serious threat and a relevant and realistic danger. There are several theoretical models of fear appeal. One of the most recent models is the extended parallel processes model proposed by Witte (1992; 1998). According to this model, a persuasive message based on fear has two parts. The first part is the perceived threat which presents the severity and vulnerability of

the target to the threat. The second part relates to the perceived effectiveness. It indicates effective recommendations allowing the target to avoid the danger and the ease of implementing these recommendations. This section also emphasizes the target's ability to implement the recommendations. Witte's model (1992; 1998) provides explanations for the conditions of failure or success of threatening persuasive messages. In the case where the perceived threat is lower than the perceived effectiveness, the target manages to protect themselves from the danger and accepts the recommendations. Thus, the threat conveyed by the message creates fear in the target, but this fear is mitigated by the target's sense of self-efficacy. This is the control of danger and the process is described as cognitive. Conversely, if the perceived threat is greater than the perceived effectiveness, the persuasive message is rejected by the target. Faced with such a message, individuals resist persuasion by controlling their fear through denial, devaluation of the credibility of the source of the message and the adoption of behavior contrary to what is conveyed in the persuasive message. It is the control of fear and this process is called emotional. Witte (1998) concludes that any persuasion campaign using fear is effective provided that it presents a serious threat and indicates effective solutions to be implemented by the individual to deal with this threat.

The majority of empirical studies conducted on the use of fear to combat public health problems show a positive effect. A meta-analysis synthesis conducted by Witte and Allen (2000) reveals that out of 93 studies conducted, 80 conclude that the stronger the fear felt by the individual, the higher their intention to change behavior. Another meta-analysis conducted by Tannnenbaum (2015) shows that in the majority of cases, the use of fear is effective in the context of behavior change communication.

Fear appeals are effective in eliciting healthy public health behaviors such as agreeing to cancer screening or vaccination (Boster et al., 2021). Fear is an effective communication method to lead individuals to have a strong intention to change their harmful behavior (Moussaoui et al., 2021).

In a recent systematic review of the literature, Limbu and Hufmann (2024) found that in most cases, the use of fear increases risk perception and a positive attitude toward vaccination. However, these authors conclude that fear appeals have little influence on individuals' intentions to get vaccinated. A threatening tone reduces both the perception of communication quality (Liu et al., 2022) and the risk of not getting vaccinated (Gursoy et al., 2022). According to Limbu and Hufmann (2024), the effectiveness of persuasive messages using fear varies depending on cultural contexts. Thus, fear-based communication has no effect on the intentions of Americans from an individualistic culture to get vaccinated (Borah, 2023; Chen et al., 2022; Hong and Hashimoto, 2023; Taber et al., 2023; Carcioppolo et al., 2017; Kim et al., 2022). In contrast, fear-based awareness campaigns have a positive influence on the intentions of Chinese from a collectivist culture to get vaccinated (Chen et al., 2021; Li et al., 2023; Yé et al., 2021; Wang et al., 2023).

After summarizing the literature on fear and persuasion, the following lines discuss the state of the art in nudge-based communication.

2.2 The contribution of nudges to the effectiveness of communication for behavior change

To influence individual behavior, public authorities traditionally have several tools at their disposal, including information and awareness campaigns, taxation, or legislation (Muller, 2017). For the past ten years, a new tool called "nudges" has been used in social marketing to change individual behavior. This concept was theorized by Sunstein and Thaler (2008), who postulate that behavioral changes do not only involve sanctions and constraints, but can also be achieved through a form of implicit incentive to action. It is defined as a gentle method to inspire the right decision. It is a revolutionary way to encourage individuals to make a better decision to change behavior based on the findings of behavioral economics (Thaler, 2018). Rather than threatening, nudges encourage individuals to adopt responsible behavior through recommendations. Nudges have been applied in various fields to modify individual behavior (Jia and Mustapha, 2023). Examples include environmental preservation (Ayres *et al.*, 2013 ; Bataoui and Gerard, 2020) and vaccination promotion (Korn et al., 2018; Li and Chapman, 2013; Sasaki et al., 2022). In public health communication, the use of the nudge technique is based on the concept of framing effect developed by Tversky and Kahneman (1981). According to these authors, a health communication message can present two types of framing: a so-called "negative" or "loss" framing and a "positive" or "gain" framing. A framing is said to be " negative" or "loss" when the awareness message highlights the consequences of not following a recommendation for risky behavior. Conversely, "positive" or "gain" framing consists of conveying in the message the benefits for an individual when they adopt a behavior aimed at protecting them. In this case, nudge-based communication favors "positive" framing. Empirically, Dai et al. (2021) tested a communication using informational nudges on individuals' acceptance to be vaccinated against COVID-19. The results indicate that announcing in the persuasive message that a COVID-19 vaccine has just been made available to those who wish to be vaccinated significantly increased the proportion of individuals who have been vaccinated. Informational nudges also highlight the decisions and behaviors of other members of society in order to positively influence the behavior of those who are still hesitant. This form of nudges is called "social comparison nudges" and is effective in promoting energy saving and charitable donations (Allcott, 2011).

Sasaki (2022) conducted a research to test the effectiveness of "social comparison" informative nudges, "gain"-focused informative nudges, and "loss"-focused informative nudges on Japanese people's acceptance of getting vaccinated against COVID-19. The results show that communications focused on "social comparison" informative nudges and "gain"-focused informative nudges are more effective in getting Japanese people to get vaccinated against COVID-19. Communication

focused on "loss"-focused informative nudges should be avoided because it provokes negative reactions among Japanese people.

3. RESEARCH METHODOLOGY

We present the research methodology in two parts. The first part concerns the presentation of the sample and the data collection method. The second part relates to the data collection and processing technique.

3.1 Presentation of the sample and the data collection method

The sample for this research is convenience. It consists of 20 women with children aged between 0 and 5 years and was obtained through the snowball method in accordance with the saturation principle. The average age of the women in the sample is 28 years and is made up of students, housewives and workers in public and private administration. The choice of this sample is justified by the fact that the government of Burkina Faso launched the first malaria vaccination campaign on February 6, 2024 with the aim of reaching 220,000 children aged 0 to 5 years for a pilot phase. For this research, we carried out experiments, at the end of which, we collected the data. To do this, two types of stimuli were created with the help of a computer graphics designer: a stimulus centered on the notion of nudges and another stimulus focused on fear. The first stimulus on nudges (stimulus 1 in the appendix) was designed based on the work of Sasaki (2022). The message is informative and focuses on the benefits provided by the malaria vaccine. It also indicates the significant number of mothers who have already agreed to vaccinate their children (social comparison) and invites other mothers to do the same. The image shows many women lined up in single file with their children to receive their doses.

Based on Witte's model (1992; 1998), the second stimulus (stimulus 2 in the appendix) was developed and focused on the severity of the threat and the effectiveness of the recommendations to address it. This stimulus shows the image of a sick and dying child lying on a hospital bed and suffering from malaria under the helpless gaze of his mother. It contains numerical information taken from the statistics of the Burkinabe Ministry of Health on the number of children aged 0 to 5 years who have died from malaria. This persuasive message mentions the existence of an effective vaccine to protect children against malaria. Both stimuli were printed in color on A4 paper for conducting interviews. A conclusive pretest was carried out to ensure, above all, that stimulus 2 conveyed fear.

After presenting the two stimuli to each of the mothers, they were then subjected to interviews. As this research is qualitative and exploratory in nature, the data collection technique used is the semi-directive individual interview in face-to-face mode. We opted for this interview mode because it allows us to address very specific themes in depth (Evrard, Pras and Roux, 2005). The interviews took place in the workplace and at home in the city of Ouagadougou. Each interview lasted on average 1 hour. The interviews were recorded for transcription purposes.

3.2 Presentation of the interview guide and the data analysis technique

An interview guide (Appendix 3) was designed to serve as a framework for conducting semi-structured interviews. The purpose of the research and information on the socio-demographic characteristics of the respondents are presented in the introductory section. The first part of the interview guide deals with mothers' knowledge of malaria and the existence of the vaccine in Burkina Faso. The second part relates to mothers' attitude and behavior towards nudge-based communication (stimulus 1). The third part concerns mothers' attitude and behavior towards fear-based communication (stimulus 2). The fourth part deals with the comparative effect of mothers' attitude and behavior towards nudge-based and fear-based communications. In this section, respondents are asked to make a comparative analysis of the influence of the two stimuli. They must make choices by specifying the most effective and the least effective of the two types of communication.

The semi-structured interviews recorded during data collection were fully transcribed into Word. Thematic content analysis with NVivo 12 software was used as the analysis method. This software is a tool dedicated to qualitative research and allows you to organize and find meaningful content in semi-structured interviews. To properly conduct the content analysis, we carried out a coding based on the four themes of the interview guide. Each theme has subthemes.

After coding, we conducted word frequency queries for the sub-themes to analyze their frequency of occurrence in the respondents' speech. We also used keyword clouds to visualize the weight of words used by respondents for each sub-theme. Finally, we extracted the verbatim statements of the respondents by sub-themes for illustration in the presentation of the results.

4. PRESENTATION AND ANALYSIS OF RESULTS

We present the results in four parts. The first part reports on respondents' knowledge of malaria and the existence of the vaccine. The second part deals with the influence of nudge-based communication on mothers' attitudes and behaviors toward the infant malaria vaccine. The third part shows the effect of fear-based communication on mothers' attitudes and behaviors toward the infant malaria vaccine. The fourth part relates to the comparative effectiveness of nudge-based and fear-based communication on mothers' attitudes and behaviors toward the infant malaria vaccine.

4.1 Mothers' knowledge about malaria vaccine and malaria.

We sought to determine whether respondents had ever heard of the existence of the malaria vaccine. The results of this

research indicate that the majority of women surveyed were unaware of the existence of a malaria vaccine in Burkina Faso. Table 1 presents the word frequency in mothers' discourse regarding the sub-theme of knowledge about the malaria vaccine.

Table 1 : Frequency of keywords in mothers' knowledge of malaria vaccine.

Word	Length	Number	Weighted percentage (%)
No	3	11	3.12
Yes	3	9	2.83

Source : Data from our interviews extracted from Nvivo 12

Analysis of this table shows that the number of occurrences of the word "no" is 11 compared to 9 for the word "yes". Thus, the content of the respondents' speech indicates that the existence of the childhood malaria vaccine is not sufficiently popularized among the population. This is evidenced by the following verbatim statements from the interviewees: " *No, to tell you the truth, it was right away with you that I learned about the existence of a malaria vaccine for children aged 0 to 5 years."* (Interview 13, 26-year-old mother). Another respondent adds: " *No, to tell you the truth, I am not aware that the State has made a malaria vaccine available in Burkina Faso."* (Interview 20, 25-year-old mother). As for those who claim to know about the existence of the malaria vaccine, some have no information on its availability and accessibility. : " *Yes, I am aware of the existence of the malaria vaccine for children, but I am not aware of its availability and accessibility.* » (Interview 1, 28-year-old mother).

We sought to find out if among those who claim to know about the vaccine, some had already vaccinated their children. Analysis of the results of our research indicates that none of them agreed to vaccinate their child due to doubts about the vaccine's effectiveness: " *No, because for me, when something new comes out, you have to be careful. So I wait and observe first and I will listen to those who have vaccinated their children give testimonies on the vaccine's effectiveness first."* (Interview 19, 22-year-old mother)

In the following lines, we note that the Burkinabe government has not sufficiently communicated the existence of the infant malaria vaccine. Due to the vaccine's newness, health services must reassure mothers of its effectiveness.

4.2 The influence of nudges on mothers' attitudes and behavior toward infant malaria vaccine.

We presented the respondents with stimulus 1, a nudge-based communication. We then collected information on their attitudes and behaviors toward the vaccine after viewing the stimulus. First, we sought to determine whether this message helped them understand the need to vaccinate their child against malaria.

The results from the analysis of word frequencies taken from the Nvivo 12 software indicate that the word "yes" has an occurrence of 14, the word "vaccinate" has an occurrence of 14, and the word "necessity" has an occurrence of 11. This means that nudge-based communication allows the vast majority of mothers to understand the need to vaccinate their children against malaria: "yes, *this message allows me to understand the need to vaccinate my little boy because I see many mothers with their children who are lined up for the vaccine."* (Interview 2, 30-year-old mother).

In a second step, we sought to determine whether mothers liked this awareness-raising message using nudges. Analysis of the results shows that the majority of respondents liked this awareness-raising message. Indeed, the word "yes" appears 20 times and the word "liked" appears 16 times in the content of the mothers' speech. This indicates that almost all 20 mothers in the sample favorably appreciated the nudge-based stimulus.

Thirdly, the discussions focused on the influence of stimulus 1 on the behavior of mothers in having their children vaccinated against malaria.

Table 2 presents the frequency of keywords in the respondents' discourse regarding the influence of nudge-based communication on mothers' behavior.

Table 2 : Frequency of keywords concerning the influence of nudges on mothers' behavior towards the infant malaria vaccine.

Word	Length	Number	Weighted percentage (%)
Vaccinate	8	23	3.29
Yes	3	16	2.52
Bring me	8	9	1.29

No	3	5	0.72

Source : Data from our interviews extracted from Nvivo 12

The analysis of this table indicates that the word "yes" has a frequency of occurrence of 16 and that of the word "no" has an occurrence of 5 in the content of the respondents' discourse. This shows that nudge-based communication leads mothers to decide to vaccinate their children against malaria. A few verbatims illustrate this: " *Yes, tomorrow I will inquire at the clinic to see if they offer this vaccine so that I can vaccinate my child.* " (Interview 6, 22-year-old mother). One of the reasons that pushed mothers to decide to vaccinate their children after receiving the awareness message is the fact that the message highlights that thousands of women have already vaccinated their children: " *It can lead me to decide to vaccinate my child because there are people who have already taken the initiative to vaccinate their children. And they trust the vaccine. So it can also lead me to vaccinate my child.* " (Interview 3, 32-year-old mother).

4.3 The effect of fear on mothers' attitudes and behavior toward infant malaria vaccine.

The third theme of the interview guide concerns the effect of fear communication on mothers' attitudes and behaviors toward the childhood malaria vaccine. After presenting stimulus 2 to the respondents, we sought to determine whether this form of communication helped them understand the need to vaccinate their children against malaria. The frequency of keywords from the content of mothers' discourse regarding this sub-theme is presented in Table 3.

Table 3: Frequency of keywords concerning the content of respondents' discourse on the effect of fear on understanding the need to vaccinate their child.

Word	Length	Number	Weighted percentage (%)
Yes	3	19	2.36
Vaccinate	8	18	2.23
Need	9	14	1.74

Source : Data from our interviews extracted from Nvivo 12

From the analysis of this table, it emerges that the content of the respondents' discourse is strongly dominated by the word "yes" through a frequency of appearance of 19. This means that communication focused on fear positively influences the understanding of the need for mothers to vaccinate their children. Thus, the severity of the threat conveyed by stimulus 2 allows mothers to understand that vaccinating their child against malaria is necessary: " *Yes, we see a mother with her sick child in the hospital, and this shows the serious risks of not vaccinating her child* " (Interview 6, 22-year-old mother). The statistics appearing on the fear-based stimulus allow mothers to reassure themselves that the childhood malaria vaccine is necessary: " *Oh yes, I didn't know malaria was so serious. More than 4,000 deaths in one year, including 3,000 children aged 0 to 5, are recorded in Burkina Faso. This is very touching and helps us understand the need to vaccinate our children against malaria."*

The second sub-theme allows us to know if the mothers liked the fear-based awareness message. The results of the content analysis of the respondents' discourse indicate that the mothers unanimously liked this form of communication: " *Yes, I liked this message because it's scary and fear is more helpful. Especially we women, we are too sensitive to these kinds of shocking messages. "* (Interview 18, 30-year-old mother).

In the last sub-theme, we sought to understand the influence of fear on the behavior of mothers to agree to have their children vaccinated against malaria. The analysis of the results of the semi-structured interviews highlights for this sub-theme, an occurrence of 23 for the word "yes". This means that the word "yes" strongly emerged in the discourse of the 20 mothers interviewed. Thus, arousing fear in mothers is effective in getting them to decide to vaccinate their children. Some verbatim statements highlight the reasons for the effectiveness of this form of communication: " *Yes, clearly, this awareness message can lead me to decide to vaccinate my child because it is sad, very sad to see a child dying from malaria when the vaccine could save their life. I told you that prevention is better than cure.* " (Interview 19, 22-year-old mother). One mother finds this message very persuasive; " *Yes, this message can obviously lead me to decide to vaccinate my child against malaria. The main reason is that this message is very clear about the cases of deaths linked to malaria, while the vaccine protects children.* " (Interview 4, 31-year-old mother).

In the following lines, we will compare the effectiveness of communication using nudges with that conveying fear on the attitude and behavior of mothers towards the infant malaria vaccine.

4.4 Comparative effectiveness of communication using nudges and fear on mothers' behavior and attitude toward infant malaria vaccine.

In this section, we conduct a comparative study of the influence of the two communication registers (nudges vs. fear) on the

attitude and behavior of mothers towards the infant malaria vaccine.

We asked the respondents to choose the stimulus they preferred the most from the two stimuli and to give their reasons. The results of the content analysis of the mothers' discourse revealed an occurrence of 18 for the number "2" which represents the number assigned to the stimulus focused on fear and an occurrence of 3 for the number "1" representing the number assigned to the stimulus designed on the basis of nudges. This means that the majority of mothers prefer fearful communication more than nudge communication. A few verbatim statements from the respondents' discourse allow us to understand the main reasons for this choice: " *I prefer number 2 because it makes me to be aware of the danger of malaria and the importance of vaccinating my child."* (Interview 11, 32-year-old mother). Another respondent justifies her preference for stimulus 2 because the danger is well presented: " *I prefer message number 2 because it highlights the danger of malaria, which seems more urgent to communicate." »* (Interview 7, 28-year-old mother).

During the interviews, we asked respondents to choose the most effective stimulus that would lead them to decide to vaccinate their children against malaria. Table 4 presents the frequencies of keywords from the respondents' discourse regarding the most effective stimulus.

Table 4: Frequency of keywords from respondents' discourse on the choice of the most effective stimulus.

Word	Length	Number	Weighted percentage (%)
2	1	20	3.85
Fear	4	8	1.54

Source : Data from our interviews extracted from Nvivo 12

The analysis of the results from the table below shows that the frequency of occurrence of the number "2" which represents the fear-based stimulus is 20. This shows that the majority of respondents chose fear-based communication as the most effective in getting them to vaccinate their children against malaria.

The main reasons for the effectiveness of fear-based communication compared to nudge-based communication are shown in Table 5:

Table 5 : Excerpts from some verbatim statements on the reasons for the effectiveness of fear-based communication compared to nudge-based communication.

Reasons	Verbatim
A challenging and touching message.	*"It's obviously always message number 2 that is the most effective in getting me to vaccinate my child against malaria. This message is really challenging and very touching.* " (Interview 17, 29-year-old mother)
Statistics on the number of victims caused by malaria.	*"Number 2, because this image shows the number of deaths, and I think that's the most important. Out of 4,000 people infected with malaria, 3,000 children under 5 died. So that can encourage people to vaccinate their children." (Interview 5, 23-year-old mother)*
Fear aroused	*The most effective one for me was number 2 because it scared me, and I'm sensitive to fear. (Interview 18, 30-year-old mother)*

Source : Data from our interviews extracted from Nvivo 12

This table shows that the figures on deaths caused by malaria in children aged 0 to 5 years and the image of the dying child lying on the hospital bed under the helpless gaze of his mother aroused a lot of fear in the respondents. This fear induced by the stimulus led the mothers to choose this persuasive message as being the most effective that could lead them to vaccinate their children against malaria.

We finally asked the mothers which of the two persuasive messages they would choose to raise awareness among their peers about vaccinating their children. The results indicate that the vast majority of respondents chose fear-based communication over nudge-based communication. One respondent believes that mothers need to be shocked to get them to take action in favor of the malaria vaccine: " *I would choose image 2 to raise awareness among those around me. It shows how serious malaria is for children, and it's shocking. I think it's more likely to be accepted than image 1. There, you just see women lined up having their children vaccinated. Nothing indicates how dangerous malaria is for children, and you don't see the seriousness of the disease. Yet you have to shock to get people to take action."* (Interview 12, 28-year-old mother)

5. DISCUSSION AND IMPLICATIONS

We first discuss the results of our research and secondly, we highlight the implications.

5.1 Discussion of results

The literature shows that nudge-based communication can positively change individuals' behavior in the field of environmental preservation (Ayres *et al.,* 2013 ; Bataoui and Gerard, 2020). In the context of vaccination promotion, nudges can positively influence individuals' behavior to get vaccinated (Korn et al., 2018; Li and Chapman, 2013; Sasaki et al., 2022). In a study on the COVID 19 vaccine, Sasaki et al. (2022) found that communication using informative social comparison nudges and informative gain-focused nudges had a positive effect on Japanese people's behavior to vaccinate children against malaria. The results of our research converge with the results of the studies mentioned above. Thus, our research shows that nudge-based communication is positively appreciated by respondents. This form of communication allows mothers to understand the need to vaccinate their children against malaria. It also leads mothers to decide to vaccinate their children. However, the results of this research contradict those of Jia and Mustapha (2023) who postulate that communication using nudges is not always effective.

Our results on the effect of fear on mothers' behavior are also in line with the extended model of parallel processes proposed by Witte (1992; 1998). Thus, according to this model, any persuasion campaign using fear is effective if it presents a serious threat and indicates effective solutions to be implemented by the individual to deal with this threat. The results of our research showed that fear-based communication allows mothers to become aware of the need to vaccinate children against malaria. This stimulus mentions the availability in Burkina Faso of an effective vaccine against malaria in children. The mothers then showed a favorable attitude towards this form of communication and decided to have their children vaccinated against malaria. Our results also converge with those of Chen et al., 2021; Li et al., 2023; Yé et al., 2021; Wang et al., 2023 who found that fear has a positive effect on the intention of Chinese people to get vaccinated. However, our results contradict the work of Borah, 2023; Carcioppolo et al., 2017; Chen et al., 2022; Hong and Hashimoto, 2023; Kim et al., 2022; Taber et al., 2023 who found that fear has no effect on the intention of Americans to get vaccinated.

The results we obtained from the comparative study of the effectiveness of the two forms of communication highlight that fear-inducing communication is more effective on the attitude and behavior of mothers to vaccinate their children. In the literature, we have not found any research comparing the effectiveness of these two types of communication. This does not allow us to compare our results with those of previous research.

5.2 Implications

Theoretical, societal and managerial implications can be drawn from this research.

First, on a theoretical level, this research supports the validation of the extended model of parallel processes proposed by Witte (1992; 1998) in the field of vaccination in a collectivist cultural context. Indeed, Burkina Faso is a country with a collectivist culture, like China. There are certainly divergences in the literature, as studies indicate that fear is not effective in getting Americans who are from a collectivist culture to get vaccinated.

Then, on the societal level, we can list some implications that the Burkinabe government can implement through the Ministry of Health. The results of this research highlight that many mothers were unaware of the existence of an infant malaria vaccine in Burkina Faso. We ask the ministries in charge of health to intensify communication in mass media such as television, radio, and posters. Communication should also be made in the country's main local languages. Given that the malaria vaccine is new, health authorities must reassure parents who currently have doubts about its reliability. This research indicates that both forms of communication (nudges and fear) positively influence mothers' attitudes and behaviors toward the infant malaria vaccine. The Ministry of Health can communicate using nudges and fear. However, much more emphasis should be placed on fear-based communication, which is considered more effective by mothers compared to nudge-based communication.

Finally, on a managerial level, we recommend that the associations working in the field of awareness-raising for behavior change use fear and nudges as a means of communication. These associations can apply these forms of communication both in promoting vaccination and in other behaviors beneficial to the well-being of individuals (environmental protection, the fight against drug or cigarette consumption, the fight against depigmentation, etc.). We recommend that communication agencies, which are often called upon for awareness-raising advertising focused on fear and nudges, adopt the conditions of effectiveness described in the literature. Thus, reliable statistics with verifiable sources should be used to highlight the consequences of not adopting the behavior recommended in the persuasive message centered on fear.

6. CONCLUSION

This paper aims to study the influence of nudge-based communication and fear-based communication on mothers' attitudes and behaviors toward the infant malaria vaccine in Burkina Faso. Three reasons led to the choice of this theme. First, there are still disagreements in the literature on the use of fear as a means of communication for behavior change. Second, the effectiveness of nudges as a means of persuasion in social marketing is not definitively settled. Finally, to our knowledge, no research has been conducted to date to compare the effectiveness of the two communication registers on the attitudes and

behaviors of individuals in social marketing. To prepare this paper, we first conducted a literature review, which allowed us to perceive the lack of unanimity among researchers on the topic. Then, we collected data through a qualitative study. Also, the research results were presented and discussed in light of the state of the art. Finally, the contributions and implications were detailed. Overall, the results indicate that mothers have a positive attitude towards the malaria vaccine and a favorable intention to vaccinate their children when they are subjected to both nudge-based and fear-based communication. However, comparing the two communication registers reveals that fear is more effective than nudges in changing individuals' behavior. This research resulted in theoretical, societal, and managerial contributions. Our research has some limitations. The first limitation concerns the impossibility of generalizing the results. Indeed, the study is qualitative through a non-representative sample of the mother population. The second limitation lies in the fact that all the mothers interviewed are educated and live in the city of Ouagadougou, the capital of Burkina Faso. However, in Burkina Faso, a significant number of mothers live in the countryside and are not educated. In these rural areas, malaria claims many victims due to the lack of health infrastructure. The various limitations mentioned above open the way to avenues for future research. First, a quantitative study with a large sample will allow for results that can be transposed to the entire mother population. Also, previous studies must take into account the many illiterate mothers who live in rural areas with limited access to health centers

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