**Using Barrier Analysis to Inform Behavior Change Communication Strategy**


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Explanatory behavior change theories and models were adopted in health behavior to understand its determinants in order to better influence behaviors for a healthy community. Based on these explanatory theories and models, public health professionals use them to develop health interventions (Glanz and Rimer, 2005, p.5). For instance, awareness of toothache severity could be a determinant for some people to make a decision about a healthy behavior such as brushing their teeth regularly. So, if the level of this awareness is low, health behavior professionals try to raise awareness. However, there are many potential determinants and the professionals try to bring them to acceptable levels by influencing them in the appropriate direction.

Gielen and MacDonald (2002) summarized Green and Kruter's PRECEDE-PROCEED framework model as a tool to develop health behavior strategies.  They note that health planners should identify the determinants that are strongly associated with the behavior or health problem of interest and the most changeable (pp. 416-418). This approach will help health planners to identify and plan the most cost-effective health behavior interventions.

The barrier analysis approach, which draws its roots from several available cognitive-behavioral theories and models, brings a progress in the field application of health behavior sciences while including quantitative doers and non doers comparison. By identifying which potential determinants are actually powerful determinants for a specific behavior among specific target populations, the comparison of doers and non doers, barrier analysis approach provides sound information to public health practitioners in orienting efforts to address the most effective behavioral determinants when designing or reviewing their public health interventions (Davis, 2004). Additionally, comparing non doers with doers considers the changeability criterion suggested by Gielen and Mac Donald in 2002. Based on the idea of comparing two population

groups (doers and non doers), we will borrow statistical techniques which are frequently used in epidemiology to make comparisons more scientific and detect the presence or lack of association between behavior and its potential determinants suggested by theories. Furthermore, this quantitative barrier analysis can be easily conducted in few days and with a simplified toolkit that can be used by field practitioners.

In this paper, I will accomplish two objectives. First, I will do a review of the main behavioral theories and models underlying barrier analysis as well as doers and non doers comparison techniques. I will discuss the ecological model, the social cognitive theory, the theory of planned behavior/reasoned action, the health belief model (HBM), and the doers and non doers analysis. Then, I will present the barrier analysis methodology and behavior change communication planning through a case study on exclusive breastfeeding practice among biological mothers of children aged 0-5.9 months.

## Behavior Change Theories Underlying Barrier Analysis

Behavior change process is very complicated involving many factors interacting with each other at different levels. Many researchers study behavior change at some level while trying to explain or predict its determinants, process and outcome by developing different theories. Glanz and Rimer (2005) published through the National Cancer Institute a monograph entitled Theory at a Glance, A Guide for Health Promotion Practice that reviews behavior theories and asserts that theory help planners to move beyond intuition to design and evaluate health behavior and health promotion interventions based on understanding of behavior. The barrier analysis uses a mixture of behavior theories to identify barriers to behavior change and design behavior change strategy and interventions. This monograph notes that "using theory as a foundation for program planning and development is consistent with the current emphasis on using evidence-based interventions in public health, behavioral medicine, and medicine" (Glanz and Rimer, 2005, p.5).

Glanz and Rimer (2005) categorize theories in explanatory theory and change theory. Some theories describe the reasons why a problem exists. Health belief model and the theory of planned behavior are examples of explanatory theories. They help public health promoters identify and find potential ways to influence factors that contribute to a health problem. However, some other theories help in planning health interventions. Change theories help identify concepts that can be translated into program messages and strategies. Moreover, they help in the program evaluation by identifying intermediary steps and outcomes of the behavior change process. The Glanz and Rimer's monograph (2005, p.5) notes that community organization and diffusion of innovations are examples of change theories. In the same page, the Glanz and Rimer's monograph says that "Change theory helps program planners to be explicit

about their assumptions for why a program will work".  Barrier analysis is more focused on explanatory theory while recognizing change theories.


Social-Ecological Model

Although barrier analysis approach helps to develop behavior change communication (BCC) at individual and interpersonal levels, it acknowledges ecological perspectives of behavior change emphasizing the interaction between, and interdependence of, factors within and across broader levels of a health problem. Glanz and Rimer (2005, p.10) note that "Two key concepts of the ecological perspective help to identify intervention points for promoting health: first, behavior both affects, and is affected by, multiple levels of influence; second, individual behavior both shapes, and is shaped by, the social environment (reciprocal causation)". In social-ecological models, health behavior is determined by multi-level factors from the individual to a broader context. It has five levels: intrapersonal/individual, interpersonal, institutional/ organizational, community, and structure and public policy level as shown in figure 1.

Figure 1: The Socio-Ecological Model



From:

"Socio-Ecological Model--Looking Beyond the Individual", retrieved August 27, 2010 at

http://www.balancedweightmanagement.com/TheSocio-EcologicalModel.htm

At the individual or intrapersonal level, knowledge, attitudes, beliefs, skills, biologic and historical factors play important roles in predicting behavior (McLeroy et al, winter 1988 ; Glanz and Rimer, 2005). They increase or reduce the likelihood of adopting a certain behavior. Some of these individual factors can be age, sex, education, income, or previous experiences. For example, suppose a woman delays getting a recommended mammogram. At the individual level, her inaction may be due to fears of finding out she has cancer (Glanz and Rimer, 2005). Interventions that can be done at this level are providing information. Also, it is important to define the target population through these personal characteristics. Interventions at this level can be multiple such as education programs, mass media, support groups, organizational incentives, or peer counseling (McLeroy et al, 1988, p.356).

The second level is interpersonal. Individuals are social beings. Relationships with peers, intimate partners, and family members can increase or reduce the likelihood of healthy behavior adoption (CDC, 2010). To continue the example of delaying the mammogram, the woman's doctor may neglect to tell her that she should get the test, or she may have friends who say they do not believe it is important to get a mammogram (Glanz and Rimer, 2005). For an African woman where the gender relationship is imbalanced, the husband influences her decision to adopt specific behavior. Steil'diary (as cited in Crawford and Unger, 2000) noted that many factors are associated with husband dominance in marriage. It is important to identify individuals who influence individual opinions or decisions regarding adopting a specific behavior. Although, social norms are generated at the institutional and community level, they operate at this level (The California Department of Public Health, 2010). These influential individuals should be used to provide informational, emotional or instrumental supports to the primary target population of BCC intervention (McLeroy et al., 1988, p357). Emotional support involves the provision of empathy, love, trust and caring while instrumental support involves the provision of tangible aid and services to a person in need. Also, informational support is the provision of useful advice, suggestions, and information to address a person's problems while appraisal support involves the provision of information that can be sued for self-evaluation purposes. (Heaney and Israel, 2002, p.186).

At the institutional/organizational level, the model considers institutions and organizations that we are networking with, formal and informal rules and regulations for operations (McLeroy et al, Winter 1988). These institutions are composed of assemblies of primary interpersonal associations. They can be our churches, workplaces or community based organizations to which we belong. Members of these groups operate under the same set of rules

and policies that guide their behaviors. Interventions at this level can influence the behavior of individuals. Groups can provide social supports to each of its individual members.

The community is another level that the model considers. It covers all individuals, institutions and organizations that collectively weave the societal fabric, the physical environment and the public policies and laws that influence and shape behaviors. It can be defined based on proximity as geographic location or possession of certain beliefs that produce affiliation: geographic, neighborhood, religious, professional proximities. Many social norms and standards are generated and shared at the community level. Deviance from these norms and standards may be directly or indirectly sanctioned by the whole community. However, deviance can be positive or negative according to the healthy behavior to be promoted. Setting a public agenda and developing coalition through advocacy to community leaders can be important at this level (The California Department of Public Health, 2010). Table 1 summarizes the levels of influence of social-ecological model.

Table 1. An Ecological Perspective: Levels of Influence.

| Concept | Definition |
| --- | --- |
| **Intrapersonal Level** | Individual characteristics that influence behavior, such as knowledge, attitudes, beliefs, and personality traits |
| **Interpersonal Level** | Interpersonal processes and primary groups, including family, friends, and peers that provide social identity, support, and role definition |
| **Community Level** Institutional Factors | Rules, regulations, policies, and informal structures, which may constrain or promote recommended behaviors |
| Community Factors | Social networks and norms, or standards, which exist as formal or informal among individuals, groups, and organizations |
| Public Policy | Local, state, and federal policies and laws that regulate or support healthy actions and practices for disease prevention, early detection, control, and management |

From Glanz and Rimer, 2005, p.11

Behavior theories that focus on intrapersonal and interpersonal levels can be classified broadly within cognitive-behavioral theories. They include social cognitive theory (SCT), health belief model (HBM), theory of planned behavior (TPB), and stages of change theories. They have some similarities. Glanz and Rimer (2005) note that three key concepts cut across these theories:

1) Behavior is mediated by cognitions; that is, what people know and think affects how they act.

2) Knowledge is necessary for, but not sufficient to produce, most behavior changes.

3) Perceptions, motivations, skills, and the social environment are key influences on behavior."

Social Cognitive Theory

Social cognitive theory (SCT) helps to understand behavior change at the interpersonal level although it acknowledges that individuals exist within and are influenced by a social environment (Glanz and Rimer, 2005). It explores the reciprocal interactions of people and their environments, and the psychosocial determinants of health behavior. SCT is an improvement of the social learning theory (SLT) which asserts that people learn not only from their own experiences, but by observing that of others and the benefits of those actions. This emphasizes the importance of the construct of observational learning or modeling. SCT was born from SLT by adding the self-efficacy construct. Therefore, based on SCT, self-efficacy, goals and outcome expectancies are the main factors that affect the likelihood that a person will change a health behavior (Glanz and Rimer, 2005).

According to SCT, individuals must believe in their capacity to perform the health behavior (self-efficacy) and have strong perception of an incentive to do so (outcome expectancies), (Kritsonis, 2004-2005). Therefore, the individual's positive expectations of the

behavior should outweigh their negative expectations. Moreover, the expectations might be classified as having immediate benefits or long term benefits. However, these expectations can be filtered by the perception of ability to implement the recommended health behavior (Kritsonis, 2004-2005).

Individuals can increase self-efficacy by setting incremental goals, contracting behavior and monitoring and reinforcement. Goals can be set gradually based on the level of self-efficacy. Setting a very high goal an individual cannot achieve will have an adverse effect. That will reduce the self-efficacy. Also, it is important if the individual sets a formal contract in terms of behavior by specifying goals and rewards. Finally, monitoring goal achievement and rewarding will push individuals to do more and more (Glanz and Rimer, 2005). Table 2 summarizes SCT concepts.

Table 2: The Social Cognitive Theory

| Concept | Definition | Potential Change Strategies |
|---------|-----------|----------------------------|
| Reciprocal determinism | The dynamic interaction of the person, behavior, and the environment in which the behavior is performed | Consider multiple ways to promote behavior change, including making adjustments to the environment or influencing personal attitudes |
| Behavioral capability | Knowledge and skill to perform a given behavior | Promote mastery learning through skills training |
| Expectations | Anticipated outcomes of a behavior | Model positive outcomes of healthful behavior |
| Self-efficacy | Confidence in one's ability to take action and overcome barriers | Approach behavior change in small steps to ensure success; be specific about the desired change |
| Observational learning (modeling) | Behavioral acquisition that occurs by watching the actions and outcomes of others' behavior | Offer credible role models who perform the targeted behavior |
| Reinforcements | Responses to a person's behavior that increase or decrease the likelihood of reoccurrence | Promote self-initiated rewards and incentives |

From Glanz and Rimer, 2005,p. 20

<u>Theory of Planned Behavior/ Reasoned Action</u>

In the theory of reasoned action, the main determinant of behavior is the intention which is determined by three factors: the attitude of the individual, the subjective norms and the perceived behavior control (Glanz and Rimer, 2005). The attitude is the result of process of awareness and assessment of available options or actions. Attitude has two components: the evaluation and the strength of the belief. The evaluation relates to the favorability or unfavorability of an attitude that can be translated in positive or negative perceptions of particular actions or conditions. The belief strength is the likelihood that an attitude is true.

Based on the two components of the attitude, the theory of reasoned actions suggests the following options:

- strengthen the evaluation and the belief strength of an attitude that supports the persuasive goal

- weaken the evaluation and the belief strength of an attitude that opposes the persuasive goal

- create a new attitude with a belief strength and evaluation that supports the persuasive goal

- remind our audience of a forgotten attitude with a belief strength and evaluation that supports the persuasive goal ("Theory of Reasoned Action", 2010)

However, this theory recognizes the gap between attitude and behavior. Before acting, a human being considers the perception of people who s/he perceives important in his/her life. This belief about how people will view his or her action is called the subjective norms that can be assimilated to a perceived social acceptability of the action. Subjective norms have also two components: the normative beliefs and the motivation to comply. Normative beliefs are what an individual thinks others want or expect him or her to do while his or action depends on how important to him or her it is to do what people expect ("Theory of Reasoned Action", 2010).
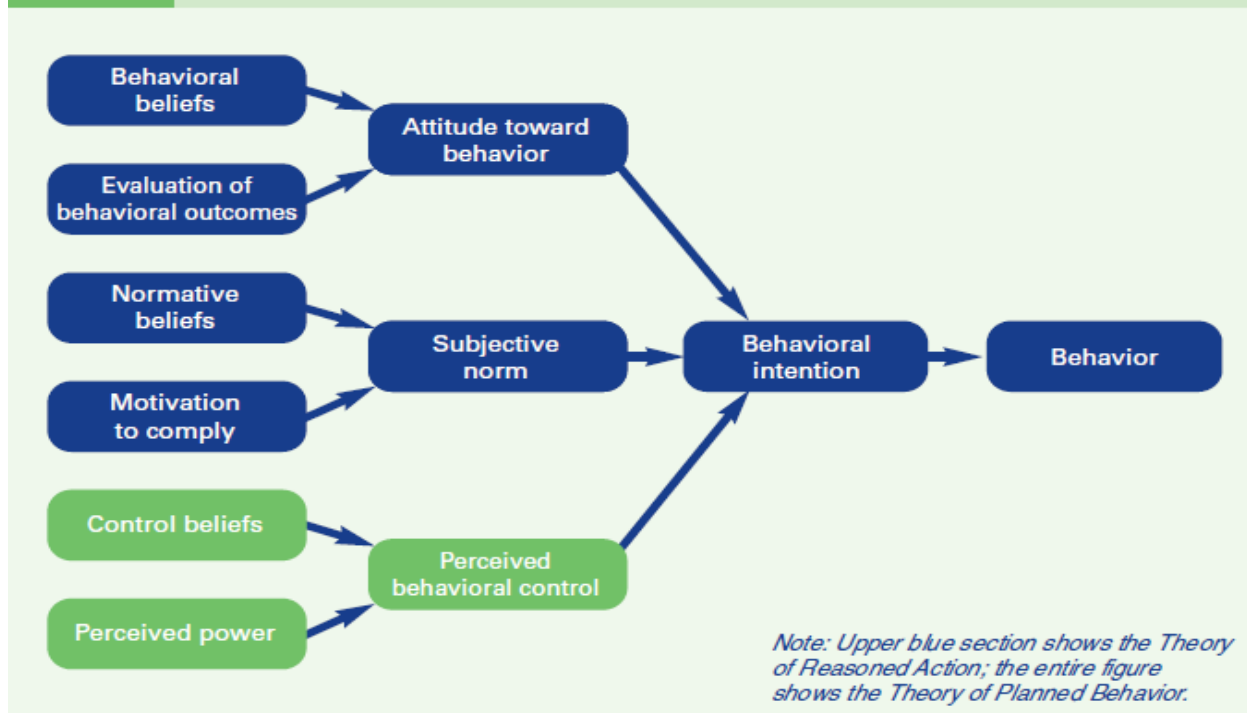
Based on the two components of the subjective norms, the TPB suggests professionals to:

- strengthen a normative belief that supports the persuasive goal

- increase the motivation to comply with a norm that supports the persuasive goal

- reduce a normative belief that opposes the persuasive goal

- reduce the motivation to comply with a norm that opposes the persuasive goal

- create a new subjective norm that supports the persuasive goal

- remind the audience of a forgotten subjective norm that supports the persuasive goal ("Theory of Reasoned Action", 2010),

Finally, a positive attitude coupled with "approval" from those important people, cannot be transformed into a behavior unless there is enough perception of behavioral control. The individual should normally be confident enough that s/he has sufficient skills and means to implement the behavior. Francis et al (2004, p.9) note that perceived behavioral control is determined by two components: how much a person has a control over the behavior (control beliefs) and how confident s/he feels about being able to perform or not perform the behaviour (perceived power). Glanz and Rimer (2005, p.18), note that the presence or lack of things that will make it easier or harder (control beliefs), to perform the behavior affect the perceived behavioral control. This is similar to the self-efficacy determinant that we found in social cognitive theory and will see again in health belief model. Figure 3 summarizes the TRA/TPB.

**Figure 3. Theory of Reasoned Action and Theory of Planned Behavior**

Note: Upper blue section shows the Theory of Reasoned Action; the entire figure shows the Theory of Planned Behavior.

From Glanz and Rimer, 2005, p.18

Health Belief Model (HBM)

The HBM is a social psychological model attempting to adopt a systematic approach to explain and predict health behavior. It received some evolvement and improvement since its first application in the 1950s. Based on HBM, the determinants of health behavior can be divided in three categories: individual perceptions (perceived severity and perceived susceptibility), modifying factors, the cues for action, and the likelihood of action (perceived benefits and perceived barriers) (Glanz and Rimer, 2005).

Perceived susceptibility is the perception of the likelihood that a condition can happen to the person's life. The higher the perceived susceptibility the more likely a person is to take action. Additionally, the perceived severity pertains to the beliefs of the severity or the

consequences of a condition. Again, the higher the perceived severity the more likely a person is to take action. A heightened state of severity is required before perceived susceptibility becomes a powerful predictor. In that situation, perceived susceptibility will be a stronger predictor of intention to engage in health-related behaviors than it will be a predictor of an actual engagement in health-related behaviors (Janz, Champion and Strecher, 2002, p.61). Together, the two determinants form the perceived threat. Although, their potential influence on behavior change is evident many studies note they do not explain all behaviors (Tuner, 2004).

The perceived benefits must outweigh the perceived barriers. The construct of perceived benefits is an opinion of the value or the usefulness of a behavior. It may include the construct of outcome expectancies from SCT or perceived action efficacy. When an individual has a high belief that the new behavior will decrease his/her chance of developing a disease, s/he is more likely to adopt it. Also, it includes other positives attributes of the action or non health-related benefits (Janz, Champion and Strecher, 2002, p.48).The construct of perceived barriers is the opinion about the difficulties and obstacles that an individual has to pass through when performing the new behavior. Perceived benefits and barriers will be stronger predictors of behavior change when perceived threat is high than it is low (Janz, Champion and Strecher, 2002, p.61).

Another construct of the HBM is the cues for action which are events that help individuals to remember and move them to change their behavior. Cues for action may be people or things around them that activate their readiness to change. They will have a greater influence on behavior when perceived threat is great (Janz, Champion and Strecher, 2002, p.61). Also, HBM also includes the construct of self-efficacy which becomes recently ubiquitous for all cognitive-behavioral theories. Self-efficacy will be a particularly strong determinant of behaviors

that require significant skills to perform (Janz, Champion and Strecher, 2002, p.61). Finally, HBM considers other variables that influence the four major constructs (perceived severity, perceived susceptibility, perceived benefits and perceived barriers) called modifying factors. They could be socioeconomic and demographic variables. Unfortunately, researchers have difficulty measuring the impact of modifying variables in behavior change.

Across all studies and behaviors, perceived barriers construct was the most powerful single predictor of the HBM. Perceived susceptibility was a stronger predictor of preventive health behavior than perceived benefits although both of them were overall very important. Overall, perceived severity was the least powerful determinant. However, it was strongly associated with sick-role behavior. (Janz, Champion and Strecher, 2002). Table 3 summarizes HBM concepts.

Table3:HBM  Concepts and Potential Change Strategies

| Concept | Definition | Potential Change Strategies |
|---|---|---|
| Perceived susceptibility | Beliefs about the chances of getting a condition | • Define what populations(s) are at risk and their levels of risk<br>• Tailor risk information based on an individual's characteristics or behaviors<br>• Help the individual develop an accurate perception of his or her own risk |
| Perceived severity | Beliefs about the seriousness of a condition and its consequences | • Specify the consequences of a condition and recommended action |
| Perceived benefits | Beliefs about the effectiveness of taking action to reduce risk or seriousness | • Explain how, where, and when to take action and what the potential positive results will be |
| Perceived barriers | Beliefs about the material and psychological costs of taking action | • Offer reassurance, incentives, and assistance; correct misinformation |
| Cues to action | Factors that activate "readiness to change" | • Provide "how to" information, promote awareness, and employ reminder systems |
| Self-efficacy | Confidence in one's ability to take action | • Provide training and guidance in performing action<br>• Use progressive goal setting<br>• Give verbal reinforcement<br>• Demonstrate desired behaviors |

From Glanz and Rimer, 2005, p.14

Considered Key Concepts for our Barrier Analysis:

The proposed barrier analysis method focuses on the individual and interpersonal level of the social ecological model. The health behavior determinants considered in this approach were drawn from the main constructs of the above three cognitive value- expectancy theories: health belief model, theory of planned behavior, and the social learning theory. It retains eight determinants: perceived severity, perceived susceptibility, positive and negative attributes of the action, perceived action efficacy; perceived self efficacy including control beliefs, perceived social acceptability, the perception of divine will, and cues to action (See Table 4).

Table 4. Barrier Analysis Measured Constructs and their Root Behavior Change Theories

| Constructs to be measured | Behavior change Theories | Specific constructs in the behavior change theory |
|---|---|---|
| Perceived susceptibility and Perceived severity | Health Belief Model | Perceived susceptibility and Perceived severity |
| Cues to action | Health Belief Model | Cues to action |
| Behavioral beliefs ; Perceived advantages which may include perceived action efficacy ; disadvantages of the behavior | Health Belief Model | Perceived benefits which may include perceived action efficacy ; Perceived barriers |
| | Social Learning Theory | Outcome expectancies which may include perceived action efficacy ; environmental constraints |
| | Theory of Planned Behavior Theory | Behavioral beliefs ; Perceived advantages which may include perceived action efficacy ; disadvantages of the behavior; Outcome evaluation |
| Perceived self efficacy; Control beliefs: make it easier or harder | Health Belief Model | Perceived self-efficacy; Perceived (capability) barriers |
| | Theory of Planned Behavior | Perceived behavioral control ; Control beliefs: make it easier / harder |
| | Social Learning Theory | Perceived self-efficacy |
| Perceived Social Acceptability and Perceived divine will | Theory of Planned Behavior | Normative beliefs; Subjective Norms; Reference groups for normative beliefs |
| | Social Learning Theory | Influential persons for an observational learning |

Perception of divine will was introduced based on the Food for the Hungry field

experience and other program manager. It happens that perception of divine will is a very

powerful determinant that influences individual's decisions regarding adopting a behavior or not.

Davis (2004) distinguishes perception of divine will from perceived social acceptability which is

a more powerful type of relationship than that with other people in the society.

<u>Doers and Non Doers Comparison</u>

A big innovation added to behavior theories is the introduction of some tools and techniques from epidemiology and statistics to assess the strength of association between behavior determinants (exposure) and the health behavior of interest (disease). We have to acknowledge the work of Academy for Education Development in sharing its resources on doers and non doers analysis. It is a qualitative way to compare the characteristics between doers and non doers based on data collected through focus group discussion and trying to identify the differences between the two groups (AED, 2004). We keep the idea but in the barrier analysis we are proposing here we introduce a quantitative approach as promoted by Food For the Hungry International and derived from the tools originally developed by Thomas Davis in 2004. It looks like a case-control study design which examines a relation of an exposure to a certain disease. We identify a group of individuals with that disease (called cases) and, for purposes of comparison, a group of people without that disease (called controls) (Gordis, 2009).

In this quantitative barrier analysis, we will introduce the principle of statistical inference comparing two "same" populations with two different behavioral outcomes and investigate their exposure to each of the potential behavior determinants that we identified based on the former health behavior theories. This will allow us in practice to see how strong each potential determinant to the behavior for a specific population is as well as to be sure of their changeability at a given time so that it deserves our efforts during our intervention. Trying to address all potential determinants without detecting the most powerful and changeable could be a waste of time and efforts in a context where resources are very limited.

This comparison is based on hypothesis testing that is moving away from theories to real world practice. As explained by Moore & MacCabe (2004), in hypothesis testing, we need to state the assumption or null hypothesis ($H_0$) and state an alternative hypothesis ($H_a$), first. Then, we assume that $H_0$ is true. Afterward, we need to collect evidence through a sample. Also, we need to compute a test statistic, then the p-value and/or confidence of intervals. Based on the p-value or confidence intervals we can conclude if there is enough evidence against $H_0$.

The statistical problem is the following: is there any association between a potential behavior determinant and an actual behavior? All the behavioral theories we learned so far talk about potential behavior determinants. Behavior theories tell us the existence of a cause and effect relationship between determinants and a behavior. Classic surveys such as Knowledge, Practices and Coverage surveys measure only some determinants and behaviors at a certain point of time. Based on the results, health promoters try to develop interventions that may increase or decrease potential behavior determinants without a clear knowledge of the change power of each determinant to a given behavior.

In a barrier analysis survey, we have to compare mostly two categorical variables. The existence of association between such variables may be tested by using two main approaches: comparing two proportions or using two-way tables[1]. We can compare the proportions of the same exposure variable between two populations with different outcomes. We may test the difference in proportions or the ratio of the two proportions. In this paper, we will present here the two-way table which can be used for two categorical variables that can be used for multiple subcategory variables. This is a big advantage from the comparison of two proportions. However, we cannot do a two-tailed test. That means our test is unidirectional. The explanatory behavior theories we are using suggest to us the direction of each determinant.

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[1] For non categorical variables different statistical methods can be used instead.

Let's take two dichotomous variables to illustrate a two-way table. The first variable is the health behavior determinant and the second is the desired behavior.

So, when we assume that there is no association and $H_0$ is true, we will have the marginals ($n_1$, $n_2$, $m_1$, $m_2$) fixed because the two variables are independent. Hence, it is easy to calculate the expected value in the remaining cells (see Table 5).

Table 5: Example of a Two-Ways Table

|  | Doers | Non Doers | Total |
|---|---|---|---|
| With determinant | $n_{11}$ | $n_{12}$ | $n_1$ |
| Without determinant | $n_{21}$ | $n_{22}$ | $n_2$ |
| Total | $m_1$ | $m_2$ | N |

Expected cell count = (row total x column total)/Table total

The idea of the hypothesis testing here is to compare the observed counts with the expected counts. So, if they are very different, we have enough evidence that it is not likely due to chance i.e. there is an evidence of association.

The statistic test we will use is the Chi-square that will compare the observed and the expected value under the assumption there is no association.

$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$   The two-way table with r rows, c columns

$H_0$: no association ; $H_a$: any association. If $H_0$ is true, the $X^2$ has approximately a Chi-Square $\chi^2$ distribution with (r-1)(c-1) degrees of freedom. Then, we can compute the p-value and

Confidence of Interval (CI). Sample size requirements for a 2x2 table are all four expected cell counts must be 5 or more. For bigger tables, the average of expected counts is 5 or more, and the smallest expected count is 1 or more.

## Barrier Analysis: an Approach to Design BCC strategy and planning
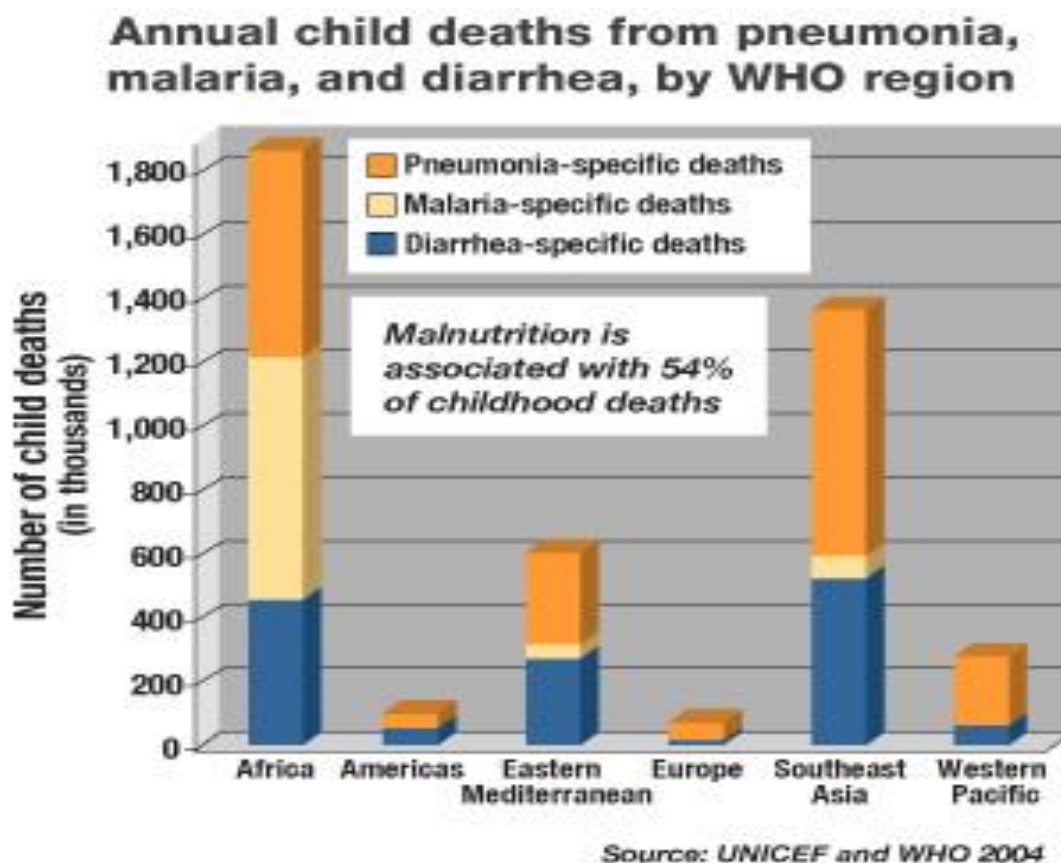
The barrier analysis approach I will present here considers all the behavior theories discussed. Briefly, it is a rapid assessment method helping health professionals to identify the most influential determinant(s) among eight determinants of a health behavior at intrapersonal and interpersonal levels. Based on those powerful determinants, they can plan behavior change communication (BCC) strategy and create an action plan to promote healthy behavior among a specific population. Although it acknowledges that broader levels like the community does influence and is influenced by the individuals according to the ecological model, the barrier analysis presented here will not address the physical and political environment. I will explain the study design and then discuss results based on one behavior of interest to illustrate the data use for BCC planning.

### Barrier Analysis Design:

Our organization is intervening in two territories of the District of Tanganyika in Democratic Republic of Congo. Based on former formative research, a three year project proposal was approved by Food For Peace, a branch of USAID. To improve human capabilities of vulnerable households in the area of intervention is one of the two strategic objectives of the project. This strategic objective has two foci: inducing behavior change by targeting mothers through training, education, and inputs; and providing increased availability of safe water sources and sanitation facilities which can be organized around three expected results (ER). Our BCC strategy development using barrier analysis means to guide the first expected result: Improved use of essential nutrition actions (ENAs) by pregnant women and mothers of young children (Food For the Hungry/DRC, 2008).

Like all studies, barrier analysis starts with a document review about the target population and its characteristics. In February 2009, we conducted a baseline survey to have a snapshot of the situation before our intervention. It will help us to design more specific studies and to evaluate the outcomes and impact of our intervention later. Like in many developing countries, children less than five years are severely affected by malnutrition. 28.8% and 29.2% of children aged respectively 0-59 months and 0-23 months are underweight (WAZ<-2). However, according to WHO and UNICEF in 2004, malnutrition is associated with 54% of death of children less than five years in the world (see figure 4).

Figure 4: Annual Child Deaths from Pneumonia, Malaria, Diarrhea and Malnutrition



Breast milk alone is a natural and sufficient food for children less than six months. WHO and UNICEF recommend lactating women to continue breastfeeding their child up to 24 months

starting to introduce progressively complementary food from the sixth month while the breast milk is not enough for children's growth. To prevent malnutrition, exclusive breastfeeding for children aged less than six month is one of the Essential Nutrition Actions which are recommended by WHO and UNICEF as well as the Congolese Ministry of Health. According to our baseline survey, only 28.4% of beneficiary children 0-5.9months were exclusively breastfed in the last 24 hours. A published research in developing countries by Lancet in 2003 demonstrated breastfeeding practice prevents 13% of deaths for children under five (see Table 6).

***Define the Objective, Behavior and Target Group:***

An initial assessment must be conducted to have a better understanding of the current health status of a community. Health status is usually determined by many factors which pertain to either the environment system and/or to some behaviors of specific population groups. When health professionals want to improve the current health status of a specific sub population, they must formulate the desired health status as the goal of the intervention. This goal/objective formulation will help them to assess later the impact and effectiveness of the intervention (European Commission, 2002; Gielen and MacDonald, 2002).

Since we will focus on behavior change communication strategy development, we will focus on the development of messages promoting the targeted behavior as well as corresponding channels. Therefore, we have to identify a behavior we need to focus on. Francis et al. (2004) note that it is very important to specify the behavior in terms of Target, Action, Context and Time (TACT). Here, our behavior is "Exclusive Breastfeeding of children aged 0-5.9 months (on demand day and night)". The specific objective for this behavior is to increase the percentage of

beneficiary children 0-5.9 months who were exclusively breastfed in the last 24 hours to 80% by

the end of the project (Indicator Performance Tracking Table). Based on our baseline survey,

98% of caregivers are biological mothers. Thus, we decided to focus on biological mothers of

children aged 0 to 5.9 months as the primary target group. The barrier analysis may inform us on

secondary and tertiary target groups.

Table 6: Under-5 deaths that could be prevented in the 42 countries with 90% of worldwide child deaths in 2000 through achievement of universal coverage with individual interventions

| | Estimated under-5 deaths prevented | |
| --- | --- | --- |
| | Number of deaths ($\sim 10^3$) | Proportion of all deaths |
| **Preventive interventions** | | |
| Breastfeeding | 1301 | 13% |
| Insecticide-treated materials | 691 | 7% |
| Complementary feeding | 587 | 6% |
| Zinc | 459(351)* | 5%  (4%)* |
| Clean delivery | 411 | 4% |
| Hib vaccine | 403 | 4% |
| Water, sanitation, hygiene | 326 | 3% |
| Antenatal steroids | 264 | 3% |
| Newborn temperature management | 227(0)* | 2%  (0%)* |
| Vitamin A | 225(176)* | 2%  (2%)* |
| Tetanus toxoid | 161 | 2% |
| Nevirapine and replacement feeding | 150 | 2% |
| Antibiotics for premature rupture of membranes | 133(0)* | 1%  (0%)* |
| Measles vaccine | 103 | 1% |
| Antimalarial intermittent preventive treatment in pregnancy | 22 | <1% |
| **Treatment interventions** | | |
| Oral rehydration therapy | 1477 | 15% |
| Antibiotics for sepsis | 583 | 6% |
| Antibiotics for pneumonia | 577 | 6% |
| Antimalarials | 467 | 5% |
| Zinc | 394 | 4% |
| Newborn resuscitation | 359(0)* | 4%  (0%)* |
| Antibiotics for dysentery | 310 | 3% |
| Vitamin A | 8 | <1% |

Source: Jones G, Steketee R, Bhutta Z, Morris S. and the Bellagio Child Survival Study Group. "How many child deaths can we prevent this year?" Lancet 2003; 362: 65-71

*Develop the Behavior Questions*

By applying the doers and non doers method, we need to distinguish clearly who can be classified as practicing the behavior in question and non practicing (outcome behavior) and who are exposed to a behavioral determinant and who are not (exposure). This step is very critical since we need to reduce biases and confounders. Selection bias may be the result of the process of either study population identification or preferential selection of participants. Also, it may be from respondents as a self-selection bias or the process of selecting participants itself. Due to personal motivation, some participants may want to be selected as participants even if they do not meet the selection criteria as doers or non doers. Researchers must develop and apply clear, objective and specific case definitions and selection criteria when recruiting participants. Also, having a very low non response rate contributes to reducing selection biases. (Bayona & Olsen, 2004, p.21; Gordis, 2009, p.247).

Public health promoters must assess the possibility of recruiting doers for the study. If it is not practical to find enough doers for the behavior of interest, it may be more useful to conduct focus groups only among non doers or loosen the case definition. Performing focus groups among non doers only may provide richer information about the health behavior determinants. "It is sometimes difficult to find 30 "doers" of a particular behavior. In this case, it would probably be more appropriate to use barrier analysis through focus groups of non doers. In that way, you can get richer details on barriers. Since you would not have a comparison group, there

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would be fewer benefits of a quantitative study." (Davis, 2004). Loosening the case definition may be another option but may increase non differential misclassification bias, another type of information bias. (Aschengrau, 2003; Bayona & Olsen, 2004; Gordis, 2009, p.249).

For our case study, we defined as a doer: biological mothers of children aged 6 to 11 months who gave only breast milk without other liquids when those children were aged 0 to 5.9 months. Non doers are biological mothers of children aged 6 to 11 months who did not give only breast milk, without other liquids when those children were aged 0 to 5.9 months. To be considered as a real doer, mothers must have practiced exclusive breastfeeding during the whole first six months of their children. We chose only biological mothers since 98.0% of caregivers are biological (baseline study, Feb. 2009). Also, to reduce recall bias, we limited participants to mothers who have children aged 6-11 months at the survey period.

According to our baseline survey, we can find approximately one doer to every three non doers (ratio doer/non doer =1:3) among mothers with children aged 0-5.9 months. We assume the same for all mothers with children more than six months but less than one year who are supposed to have experienced the 0-5.9 month motherhood a few months earlier. This ratio suggests the appropriateness of the quantitative approach that we will apply in this proposed barrier analysis method.

*Sampling Methodology:*

Random sampling method is the best way to avoid other selection biases and confounders. The simple random sampling (SRS) is the ideal way to select units from the survey universe. Most studies do not use SRS due to non availability of sampling frame and its expensive cost during implementation (Espeut, 2001). Cluster sampling is a more efficient

random sampling method to overcome the challenge of SRS (Espeut, 2001; Magnani, 1997; Moore & MacCabe, 2004). In cluster sampling, clusters are randomly selected from the general population. Then, individuals within each cluster must be randomly selected (Espeut, 2001; Magnani, 1997). Since the doers and non doers approach requires the comparison of the two populations, we will take from the general population two subpopulations of doers and non doers.

Based on a small survey we conducted just before the barrier analysis study estimating the eight (08) main indicators, 45% of mothers think that their 0-5.9 month children can be malnourished when they are not exclusively breastfeed. Therefore, as sample sizes, we chose 45 Doers and 45 Non Doers to detect 25% difference between the two groups assuming standard parameters of 95% level of significance and 80% power, and by aligning with the most demanding proportion of 45% (see Appendix 1). For one-sided test, the formula that can be used to identify the same sample size for the two groups is the following (Sarriot et al, 1999):

$N1=N2=D*([Z_\alpha \sqrt{[2pq]}+ Z_\beta \sqrt{[p1q1 + p2q2]} ]^2/(p1-p2)^2)$

We will use the simplified version of this formula (Magnani, 1997; Sarriot et al, 1999):

$N1=N2 = D [(Z_\alpha + Z_\beta)2 * (P1 (1 - P1) + P2 (1 - P2)) /(P2 - P1)2]$

N1=N2 = required minimum sample size per survey round or comparison group

D = design effect

P1 = the estimated level of an indicator measured as a proportion for the control area

P2 = the expected level of the indicator either at some future date or for the project area such that the quantity (P2 - P1) is the size of the magnitude of change it is desired to be able to detect

$Z_\alpha$ = the Z-score corresponding to the degree of confidence with which it is desired to be able to conclude that an observed change of size (P2 - P1) would not have occurred by chance (α - the

level of statistical significance), and

Zβ = the z-score corresponding to the degree of confidence with which it is desired to be certain of detecting a change of size (P2 - P1) if one actually occurred (β -statistical power).

Our project intervention covers two territories (Kalemie and Moba) of the District of Tanganyika. We selected 45 doers and 45 non doers from each territory so that we had 90 doers and 90 non doers in total from both territories.

To select sampling units, we only used two-stage cluster sampling since we have the numbers of mothers with children aged 0-23 months per village based on a former census used during baseline. "When measures of cluster size are available, the statistically most efficient two-stage cluster design is one in which (1) clusters are selected with probability-proportional-to-size (PPS) at the first stage of sample selection and (2) a constant number of households is chosen from each cluster at the second stage." (Magnani, 1997, p.24). At first stage, we randomly selected 23 villages (clusters) by using probability proportional to size method.

Then, at each selected village, two sampling unit per cluster and, as a result, the problem of homogeneity is almost negligible. We assume that the design effect D=1. Additionally, when we took the two units in each cluster, we choose the next fifth from the first selected central household through a random walk as applied in Expanded Program Immunization method. Based on the definitions of doers and non doers, selection criteria were developed. Screening questions were asked at the beginning of each interview to select participants during the random-walk.

Develop Questions about Determinants

At this stage, we need to measure the determinants we identified based on cognitive-behavioral theories: perceived susceptibility, perceived severity, perceived advantages, perceived

disadvantages, perceived action efficacy, perceived self-efficacy and control beliefs, social

acceptability (social norms), perception of divine will, and cues for action (See Table 4). Since

we chose to conduct a survey to compare those determinants between doers and non doers, we

need to develop a questionnaire form and administer it among respondents from the two groups.

A non accurate measurement will create information biases (Bayona & Olsen, 2004). One group

may remember differently exposure than the other group (recall bias). Or, interviewers may

administer questions differently between the two groups (interviewer bias). Therefore, we need

to apply all techniques in questionnaire development and administration to avoid observation

errors that we cannot control after the survey.

Information bias may occur from the questionnaire, or from the respondents or from the

interviewers. The bad wording of a question may create systematic errors in answers. As a result,

we have to spend time in identifying key questions to measure each determinant. Also,

respondents may understand the questions differently. It should reflect the social context, using

local words and terms and be administered in the local language (Espeut, 2001). We used a

standard questionnaire in English based on previous experience of Food for the Hungry, and then

we just translated it in French. Another bias could be social desirability. Respondents want to

provide answers that are expected by the others or the society and try to satisfy the interviewer

by providing the expected answers even if they do not actually reflect reality. A pre-test was

conducted among women with the same characteristics of our target population to see how

people understand and detect potential biases. Then, we reviewed and finalized the questionnaire

(see Appendix 2) to reduce bias.

The interviewers may incorrectly conduct interviews by, for instance, not probing or

rephrasing some questions. Another frequent mistake is not spending enough time to put the

interviewees in confidence or not asking for their informed consent. These frequent mistakes reduce the quality of the data collection because they create systematic errors from the interviewers or ignore some basic ethics in statistical surveys. To avoid all these potential problems, we trained the data collectors in the barrier analysis first and also in data collection skills. Moreover, we explained to them the objective of each question and the pretest session was an opportunity for them to master each question of the questionnaire. Finally, we assigned supervisors to supervise enumerators during questionnaire administration and at the end of each day, they reviewed each questionnaire. Errors identified by supervisors were immediately addressed in the field by going back to the respondents. The non response rate is 0% as it was during the baseline survey.

To process data collected for this barrier analysis, we can use statistical software. Additionally, there is an excel file format with formulas that can be used if there is no access to statistical software. Using this, the team has to perform manual tabulation of each answer. For our project, we chose EPI-Info software to process and analyze data. We developed a data entry screen in the "make view" menu (see Appendix 3) and trained two data entry agents. We controlled data quality by doing an exploratory analysis. When we find some outliers we come back to the questionnaire sheet to check the data. Errors detected at this level must be fixed by asking the appropriate supervisor to get back to the respondent. Supervisors facilitated the coding of some open ended questions such as benefits and barriers to the behavior among enumerators. Coding forms were provided for each exercise (see Appendix 4).

Main significant results for Exclusive Breastfeeding behavior for 0-5.9 months children

   a-   **Global analysis: both territories**

### Perceived Susceptibility

There is a significant difference between the two groups although the perceived susceptibility is relatively high. (OR=0.24, p-value =0.000284). Doers are 4 times more likely to perceive that their children less than six months are susceptible to malnutrition if they do not exclusively breastfed these children than non doers. Thus, we can say that perceived susceptibility can be of interest if we want to promote exclusive breastfeeding.

### Perceived Severity

There is no difference between the two groups. Both groups have a very high perceived severity of malnutrition. Both the two groups perceive that malnutrition is a severe disease which may lead to death. 97% of each group thinks that malnutrition is a serious disease. Also 96% and 92% of respectively doers and non doers think that a child can die due to malnutrition. So, perceived severity is not a worthy determinant to address in order to change exclusive breastfeeding practice among mothers. In addition, it is already very high.

### Behavioral beliefs

There is a difference between the two groups for the perceived advantage of preventing child illness from exclusive breastfeeding (OR=0.42, p-value=0.00420). Doers are 2.4 times more likely to perceive the child illness prevention advantage due to exclusive breastfeeding than non doers. Therefore, emphasizing the benefit of child illness prevention from exclusive breastfeeding may facilitate behavior change. Some other benefits like complete food for children were cited by some mothers but did not show enough evidence for behavior change.

No significant perceived disadvantage was identified. Few biological mothers (11.11%), mainly in Moba think that exclusive breastfeeding makes children sick. In Moba, it raises up to (12.22%). However, in Moba, there is no difference among the two groups while non doers were more likely to perceive this disadvantage in Kalemie than doers (OR=9.51; P_value=0,0139).

*Perceived Action Efficacy*

There is a significant difference between the two groups (OR=0.32, p-value=0.00068). Doers are 3.12 times more likely to think exclusively breastfeeding their children less than 6 months prevents them from malnutrition than non doers. The percentages of mothers who think that practicing exclusive breastfeeding will help their children avoid malnutrition are 81% and 58% respectively for doers and non doers. This result confirms conclusion of the social cognitive theory about the importance of the individual's positive expectations of the behavior in motivating the action as long as they outweigh their negative expectation (Kritsonis, 2004-2005).

*Perceived Self-Efficacy*

There is a difference between the two populations (OR=0.18, p-value=0.000003). On perceived self-efficacy, doers are 5.6 times more likely to think they could exclusively breastfed their children less than 6 months with their current skills and resources than non doers. This conclusion supports Bandura who considers the perceived self-efficacy as the most important determinant in behavior change and why it becomes a nearly ubiquitous construct in health behavior theories (Glanz and Rimer, 2005, p.21).

**Control beliefs:**

Household food security (especially for lactating women), enough breast milk production, healthy mothers, and healthy children were identified as things that make exclusive

breastfeeding easier. The opposite will make it harder. However, globally, we did not find any difference between doers and non doers except for healthy children perception. We notice significant difference between doers and non doers on that unhealthy children make exclusive breastfeeding harder (OR=2.2, p-value=0.0127). Non doers are 2.2 times more likely to think that the child's sickness makes exclusive breastfeeding more difficult than doers.

Both doers and non doers mothers think that women should eat more than usual to produce milk. However, "insufficient breast milk is an extremely rare condition even for malnourished women." (Deller, 2006). So, acting on this barrier would not change non doers to become doers.

*Perceived Social Acceptability (Social Norms)*

Both groups think that no social norm prevents them from practicing exclusive breastfeeding for their children less than 6 months. Also, the majority of people around them has approved or would approve of them practicing exclusive breastfeeding for their children 0 to 5.9 months. Moreover, we noticed that husbands, health agents at primary health centers, mothers, and neighbors are generally reported to socially support mothers to exclusively breastfeed their 0-5.9 month children. However, data only show a difference between the two groups for the approval of the husbands (OR=0.43, p-value = 0.0131). Doers are 2.3 times more likely to think that their husbands would approve of them practicing breastfeeding exclusively than non doers.

The question Q12 (Would most of the people that you know approve (or would have approved) of you exclusively breastfeeding (NAME)?) tries to measure directly the perceived social norms. However, it does not emphasize about people that the biological mothers care, as a result, it does not really consider the concept of motivation to comply which is important to shift from

normative beliefs to subjective norms. We would suggest a review of this question in the future.

Francis et al (2004) propose the following options to directly measure social norms:

a. Most people who are important to me think that:

I should 1… 2… 3… 4… 5… 6… 7  I should not practice [the behavior]

b. It is expected of me that I practice [behavior]

Strongly disagree 1… 2… 3… 4… 5… 6… 7 Strongly agree

c. I feel under social pressure to practice [the behavior]

Strongly disagree 1… 2… 3… 4… 5… 6… 7 Strongly agree

d. People who are important to me want me to practice [the behavior]

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

To be more analytical, it may also be useful to indirectly measure the subjective norms by first conducting elicitation interview through a qualitative research, common normative beliefs about the behavior and reference groups. Then, use quantitative method to assess the strength of belief for each common normative belief and the motivation to comply.

### *Perception of Divine Will*

There was significant difference between the two groups for the perceived divine will (OR=0.20, p-value=0.0000053). Doers are 5 times more likely to perceive that God/ the gods would approve of them practicing exclusive breastfeeding than non doers. Based on our baseline survey in February 2009, 83% of caregivers in our area of intervention believe in God/gods/fate and 73% are Christians. The church leaders and traditional leaders can play a significant role in promoting exclusive breastfeeding and facilitating the move of non doers to doers.

*Cues to Action*

Data showed there is a significant difference between the two populations (OR=8.61, p-value=0.00000001). On cues for action, the percentages of mothers who think it would be difficult for them to remember not to give their children anything other than breast milk during the day if they want to exclusively breastfeed them are 10% and 49% respectively for doers and non doers. Finding a strategy and activities to help lactating mothers to remember each step and the frequencies of exclusive breastfeeding will facilitate practice.

**b- Differential analysis:**

*Results per territory:*

Globally, there are not too many differences in terms of association between exclusive breastfeeding behavior and its potential determinants between Kalemie and Moba territories. However, while the test was not significant in Moba, in Kalemie the results suggest existence of association for the following points: control beliefs (child illness and breast milk insufficiency), the behavioral belief of child illness prevention and the behavioral belief of child illness promotion, perceived social acceptability and the husband's approval for the behavior adoption.

In Kalemie non doers are 2.67 times and 2.81 times more likely to think that the child illness (OR=2.67; P_value=0.0384) and breast milk insufficiency (OR= 4; P_value=0.01123) respectively makes the exclusive breastfeeding practice more difficult than doers. Also, doers are 3.7 times more likely to think that their husbands would approve of them to breastfeed exclusively during the first six months of birth than non doers (OR=0.27; P_value=0.0044). Conversely, non doers are more likely to think that their husbands would disapprove of them to practice exclusive breastfeeding. In terms of behavioral beliefs or perceived benefits, doers are

2.78 times more likely to believe that the practice of exclusive breastfeeding during the first six months of birth prevent child illness than non doers (OR=0.36; P_value=0.019). Another finding about social acceptability is that doers are 2.78 times more likely to perceive that most of the people that they know have approved of them exclusively breastfeeding their 0 to 5.9 months children than non doers (OR=0.36; P_value=0.0342).

### *Results per age group of biological mothers*

Glanz and Rimer (2005) note that at the interpersonal level, theories of health behavior assume individuals exist within, and are influenced by, a social environment including family members, coworkers, friends, health professionals, and others. These theories affirm that the opinions, thoughts, behavior, advice, and support of the people surrounding an individual influence his or her feelings and behavior, and the individual has a reciprocal effect on those people. In line with that assumption, the social cognitive theory which is one of many theories focusing at the interpersonal level, talks about the concept of the observational learning (modeling).

Based on this learning process, we assume that age, which means experience, may affect beliefs (exposure) and by turns behaviors (outcome). Therefore, age factor may be a potential confounder. After exploring age distribution of the interviewed biological mothers, we noticed similarity between doers and non doers, except in the 25-29 years and 30-34 age intervals (see Figure 6). After performing the same test by age interval, we always fail to reject the alternative hypothesis of difference existence between doer and non doer groups based on the considered health behavior determinants. We must notice that we did not have enough sub sample sizes. Therefore, in a similar application of barrier analysis, we recommend the adoption of a matched case control study design when we suspect potential confounders like age or other factors.

Matching ensures that any difference between cases (doers) and controls (non doers) cannot be a result of differences in the matching variables (Bland and Altman, 1994).

**Figure 6: Age Distribution of the Interviewed Biological Mothers of 6-11month Children**



Use of Results:

*Selecting Priority Target Audiences*

Our project objective is to prevent children 0-5.9 months from malnutrition which is associated with a big proportion of child death. Exclusive breastfeeding is a preventive behavior that is the focus of our BCC strategy. The primary target audience is the group of individuals who are supposed to directly perform the healthy behavior. In our case, we have the biological mothers of 0-5.9 month children. Secondary target audience is composed of husbands, mothers and peers. Husbands must be specifically targeted to understand the preventive behavior. According to the data, difference between doers and non doers in terms of husband approval is more pronounced in Kalemie than Moba. Based on the above interpersonal theories, husbands should be sensitized to provide supports, particularly emotional and instrumental supports, for their lactating wives. Also, mothers and peers should bring these social supports to the lactating

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women. Finally, religious leaders based on the importance of per ceived God's will among our primary target audience and health agents at health centers (reported by 24% of respondents as reference) are tertiary target audience.

*Activities of Interest Based on the theories used in barrier analysis and the data results*

According to the above cognitive theories, health behavior education is a key strategy to change beliefs in favor to behavior change (McLeroy et al, 1988, p.356). Health education and the social supports (emotional, informational, instrumental and appraisal) should be provided by influential individuals through social network. Also, according to the social cognitive theory, these influential individuals should play role model positions. Therefore, creating group supports and education will be a key intervention in our area intervention.

According to our experience in developing country rural areas, a voluntary lay health worker cannot support more than 15 people to be effective. Therefore, we can organize pregnant women and lactating women in support groups of 10 to 15 women. Each group will elect one opinion leader from group members. These opinion leaders will be trained by the program to become lay health workers and will go back to their individual groups to provide health education and behave as the role models within the support groups. Interpersonal communication like home visits, counseling, and group discussions will be the main techniques for lay health workers. However, culture friendly mass communication through radios, cultural events, campaigns, public relations, etc. may help as well.

Another opportunity for support group establishment is faith-based organizations. We have identified the importance of divine will perception making us think that religious leaders can be a tertiary target group. An advocacy followed by behavior education should be conducted

specifically for religious leaders. They can be a channel of communication in favor of the exclusive breastfeeding by using biblical, Quran or other traditional references.

Essential nutrition actions, specifically optimal breastfeeding should be integrated in the essential activity package at primary health centers. Advocacy must be conducted to the local health authority. Also, health agents should be trained to provide informational and appraisal supports to pregnant women during antenatal visits and lactating women during postnatal visits.

*Axes of the Messages*

Our messages must be built around the behavioral determinants of interest identified during the barrier analysis and culturally friendly.

Increasing perceived susceptibility:

The message should focus on the fact that every child aged of 0-5.9 months, including one's child could become malnourished if they are not exclusively breastfed. This message can be supported by appraisal supports provided through support groups, health agent contacts and testimonies from people in close relationships or in neighborhood whose 0-5.9 month children experienced malnutrition while not practicing exclusive breastfeeding. Reconverted doers and lay health workers can play role models through support group networks. Although the data show a high perceived severity of malnutrition, maintaining message communication should be provided reinforcing that malnutrition is a very serious disease that may lead to 0-5.9 month child death if they are not exclusively breastfed.

Increasing perceived advantages and reducing the perceived disadvantages of exclusive breastfeeding:

The main message should emphasize that exclusively breastfeeding children less than 6 months will protect them from childhood illness. Telling that this practice makes children sick is a myth. Informational supports and testimonies from converted doers, lay health workers and health workers at health center will help to deliver this message. Target women will have an opportunity to compare the child health status of doers and non doers in their neighborhood.

Increasing perceived action-efficacy:

Exclusive breastfeeding of children less than six months prevent malnutrition is the message for increasing perceived action-efficacy. Again, informational supports and testimonies from converted doers, lay health workers and health workers at health centers will help to deliver this message. Target women will have an opportunity to compare the child health status of doers and non doers in their neighborhood.

Increasing perceived self-efficacy:

As suggested by the above theories, to increase self efficacy, messages and actions should be focused on the control beliefs: on training, what makes the practice easier and what makes it harder. Data show that food security, health status of breastfeeding mothers and the breastfed children, and breast milk insufficiency are mostly cited factors perceived to make exclusive breastfeeding easier or harder. These findings may suggest we need to reinforce breastfeeding skills, information, emotional and instrumental support in food access, breast milk production, feeding of sick child, health and mother nutrition, and breastfeeding even if the mothers are sick.

Teaching mothers breastfeeding techniques, especially those that facilitate breast milk production is a focus of the health education and messages. Among breastfeeding techniques facilitating breast milk production are: early breastfeeding, breastfeeding the baby on demand,

good attachment, childhood illness danger signs for seeking health care, etc. Additional to trainings, here are some few messages that can be developed:

Breastfeeding messages for primary target audience:

- Mothers, start breastfeeding your newborn children within one hour of birth

- Mothers, exclusive breastfeed your infants on demand, day and night during the six first months of life

- Mothers, when breastfeeding your child, make sure of his or her good attachment

- Mothers, keep exclusively breastfeeding your 0-5.9 months children even when you are sick

- Mothers, keep exclusively breastfeeding your 0-5.9 months sick children

Maternal health and nutrition messages for primary and secondary target audiences:

- Breastfeeding mothers should eat nutritious foods and greater quantity for their health and their baby, give them adequate food.

- Breastfeeding mothers should be healthy to facilitate exclusive breastfeeding practice, provide them appropriate health care.

Promote food security and crop diversification to general population:

- Household diet diversity means healthy household, please diversify crop production and daily diet

To address this environmental constraint of food insecurity prevailing within the rural community, instrumental supports from community network and/or from special interventions are critical. This type of intervention is beyond the individual behavior change communication.

Finally, to maintain and increase perceived self-efficacy, lay health workers should congratulate mothers when they achieve progressive steps toward a permanent change. Moreover, they can organize a series of graduation ceremonies for certain achievements within the community.

Increasing perceived social acceptability (social norms):

Messages should target the primary audience and the general population to maintain or increase social acceptability promotion among pregnant and lactating women that the society approves of them to practice exclusive breastfeeding

. Messages to the primary audience and the general population:

- Exclusive breastfeeding of children during the first six months of life protects them against childhood illness. Let's support mothers in practicing exclusive breastfeeding.
- Mothers, we love you and your babies, exclusively breastfeed your infants during the first six months of life.

Husbands, mothers and peers will be encouraged to create an enabling environment (emotional and instrumental supports) for lactating women to exclusively breastfeed their 0-5.9 month children day and night. A line of messages for that purpose may be: "for a healthy newborn, be supportive (emotional, instrumental) to lactating mothers so that they can exclusively breastfeed children less than 0-5.9 months." Also, health agents will provide health education and communication at primary health centers that will mainly focus on perceived susceptibility, perceived advantages, perceived action efficacy and perceived self efficacy. Health agents can use the pertaining messages above.

Perception of divine will.

Additionally, health educators, especially religious leaders can reinforce perceived self-efficacy and the perception of divine will by delivering messages supported by biblical verses like: God created women to be a source of life, so all women can produce enough milk for their 0-5.9 month children regardless of their socioeconomic status. Chand and Erb (2009) provided biblical verses for mother and newborn health. They suggest the following verses among many for breastfeeding: Luke 11:27; Isaiah 66:11; Numbers 11:12; Psalm 22:9, etc. While combined with the above messages, they may reinforce God's will by creating all women to be able to save life through breastfeeding.

Cues to action:

Lactating women need some cues to help them remember not to give anything other than breast milk during the first six month of the baby's life. Additional to the supports from people around them, the use of local songs pertaining to exclusive breastfeeding techniques will also remind mothers about exclusively breastfeeding their 0-5.9 month children. Associating these songs to women or children's day-to-day life may increase the likelihood of lactating women to remember it. The content of these songs should focus on the above recommended messages. . A community song competition is an easy way to identify culture friendly songs from the community and for the community.


Conclusion

We noticed from this presentation that the barrier analysis approach combines and values cognitive-behavioral theories currently available to understand the determinants of certain

behaviors of interest. It is a powerful tool for public health professionals to guide strategy design for behavior change communication. The added value that this approach brings to public health practitioners is the introduction of concepts and techniques from case-control studies to determine the powerful behavior determinants among those suggested by theories. This allows public health professionals to plan cost effective interventions for changing behavior. While we present the foundation of the barrier analysis approach in this academic paper, a very simple toolkit is available for field practitioners to conduct such analysis in a few days.

We learned from this case study that using matched case-control design and stratified case-control design may improve the precision of the barrier analysis to inform behavior change communication strategy. However, we should make a compromise between the need for precision and the cost increase generated by the increase of sample sizes or its user-friendly characteristics.

While keeping it simple for management purpose, we still recommend the review of the instrument measure (questionnaire) to better capture the main constructs recommended by our behavioral theories. Additionally, exposure dose- response may affect behavior. Therefore, we need to measure behavioral determinant on a continuous scale answers like "very strongly agree" to "not agree at all" instead of "yes or no" answers. Statistical tests of scaled answer questions will require a larger sample size as well as a higher cost of the barrier analysis. To reduce costs, we can qualitatively analyze differences between doers and non doers for the scaled answers while using quantitative analysis by grouping them to become "yes/no" answers. Moreover, the barrier analysis approach achieves its objective for management purpose by using the proposed questionnaire. However, a further investigation about the normative beliefs, the reference groups and the motivation to comply, may improve our understanding of the subjective norms.

As this barrier analysis approach focuses on intra and interpersonal level of the ecological model, theories and models emphasizing the community levels are necessary to develop and implement a more comprehensive program addressing behavior change. As Janz, Champion and Strecher (2002) noticed, permanent changes in behavior can rarely be wrought solely by direct attacks on belief systems. Even more, when the behavior of large groups is the target, interventions at societal levels (social networks, work organizations, physical environment, public policy, etc.) along with interventions at the individual level will likely prove more effective than single-level interventions. As Gielen and MacDonald (2002, p.418) note, measurable objectives should be written to evaluate changes during implementation: "how many will know, believe, or be able to do what by when?" Moreover, curricula and message development techniques are necessary to develop a training and behavior change communication materials that will be used in the field when implementing the strategy identified through a barrier analysis. Those techniques are beyond the scope of the barrier analysis even if they will certainly find information from barrier analysis very useful.

Appendix 1- Sample size (SS) determination with a confidence level 0f 95% and a power of 80%

| Keys behavior determinants | Main indicators | Proportion estimates | Sample size requirement to detect difference of | | |
|---|---|---|---|---|---|
| | | | 20% | 25% | 30% |
| Perceived severity | Percentage of mothers who think that malnutrition is a serious disease | 87.8% | 4 | | |
| Perceived susceptibility | Percentage of mothers who think that their 0-5.9 m children can be malnourished when they are not exclusively breastfeed | 45.0% | 73 | 45 | 30 |
| Perceived Action Efficacy | Percentage of mothers who think that exclusive breastfeeding their children until they are/were 6 months old would help them to avoid becoming malnourished | 69.4% | 47 | 26 | 15 |
| Perceived strength of the belief | Percentage of mothers who think that exclusive breastfeeding children during the first 6 months of life is important | 78.3% | 29 | 13 | 5 |
| Perceived Self-efficacy | Percentage of mothers who think that with their present knowledge and skills, they could exclusively breastfeed their children until s/he is 6 months old | 72.2% | 42 | 23 | 12 |
| Perceived Social Acceptability | Percentage of mothers who think that most of the people that they know would approve (or would have approved) of them exclusively breastfeeding their 0-5.9m children | 68.9% | 48 | 27 | 15 |
| Perceived Divine Will | Percentage of mothers who think that God/the god/fates approve (would approve) of them exclusively breastfeeding their children until they are six months old | 70.0% | 46 | 25 | 14 |
| Cues to action | Percentage of mothers who think that it would be not difficult at all for them to remember not to give their 0-5.9m children anything other than breast milk, including water, during the day if they wanted to exclusively breastfeed their 0-5.9m children until the children are/were six months of age | 70.6% | 45 | 25 | 14 |

**Barrier Analysis Questionnaire on**

**Exclusive Breast-Feeding**

**Mothers of Children 6-11m, Food for the Hungry**

Interviewer's Name: _____Questionnaire No.: _____

Date: ____/____/____Village: _____     GROUP: ❑ Doer   ❑ NonDoer

Age of Mother Interviewed: ____ years   Age of mother's youngest child: ____ months

First NAME of youngest child between 6-11 months of age: _____

*REFER TO THIS CHILD THROUGHOUT THE INTERVIEW*

*Discuss CONFIDENTIALITY:*

- *Purpose of study*

- *They can choose to participate or not participate in the study.  No services will be withheld nor will they be discriminated against if they choose not to participate.*

- *Everything they say will be held in strict confidence and will not be shared with anyone else.*

- *Ask the person if they wish to participate.  If not, thank them for their time.*

1.  What is your relationship to this child ( If mother, prompt biological or adoptive)

    ❑ 1. Biological mother                         ❑ 2. Adoptive mother → end questionnaire

    ❑ 3. Grandmother → end questionnaire      ❑ 4. Aunt → end questionnaire

    ❑ 5. Other (Specify:_____) → end questionnaire

2.  How old was your (NAME) when you first gave him/her something to drink other than breast

    milk?                                    _____ months

3.  How old was your child when you first gave him/her something to eat other than breastmilk?

                                    _____ months

> **If response to questions #2 and #3 are BOTH 6 months or greater**
>
> **Then mark the respondent as a DOER at the top of page one.**
>
> **If response to <u>*either*</u> question #2 or question #3 is *less* than 6 months**
>
> **then mark the respondent as a NONDOER at the top of page one.**

> **EXPLAIN:  We are conducting this study to better understand why some mothers exclusively breastfeed their children and others do not.  Exclusive breastfeeding means giving ONLY breast milk, no other types of food or liquids, including water, until the child is six months of age.**

*(Perceived Severity)*

4. How serious a disease/problem is malnutrition:  Very serious, somewhat serious, a little bit serious, or not serious at all?

   ❏ a. Very serious   ❏ b. Somewhat serious   ❏ c. Just a little bit serious   ❏ d. Not serious at all

5. Can a child die from malnutrition?

   ❏ a. Yes          ❏ b. No          ❏ c. Don't know/No Response

*(Perceived Susceptibility)*

6. Do you think a child who is less than 6 months old could become malnourished if they are not exclusively breastfed?

   ❏ a. Yes          ❏ b. Possibly          ❏ c. No          ❏ d. Don't know

7. Do you think (NAME) could become malnourished if he/she is/was not exclusively breastfed?

   ❏ a. Yes          ❏ b. Possibly          ❏ c. No          ❏ d. Don't know

*(Perceived Self-Efficacy)*

8. With your present knowledge and skills, do you think that you could exclusively breastfeed (NAME) until s/he is 6 months old? **If (NAME) is 6 months or older ask – do you think you could exclusively breastfeed your next child until s/he is 6 months old?**

   ❏ a. Yes          ❏ b. Possibly          ❏ c. No          ❏ c. Don't Know

9. What would make (or would have made) it easier for you to exclusively breastfeed (NAME)?

10. What would make it **(or have made it)** more difficult for you to exclusively breastfeed NAME)?

*(Perceived Action Efficacy)*

11. Do you think exclusively breastfeeding (NAME) until s/he is/was 6 months old would help (NAME) to avoid becoming malnourished?

    ❏ a. Yes      ❏ b. Possibly      ❏ c. No      ❏ d. Don't know

*(Perceived Social Acceptability/Social Norms)*

12. Would <u>most</u> of the people that you know approve **(or would have approved)** of you exclusively breastfeeding (NAME)?

    ❏ a. Yes      ❏ b. Possibly      ❏ c. No      ❏ d. Don't know

13. Who are the people that would <u>approve</u> **(or would have approved)** of you exclusively breastfeeding (NAME)?

    ❏ a. Husbands      ❏ b. Mother      ❏ c. Cousins      ❏ d. Neighbors

    ❏ e. Friends      ❏ f. Other   Specify_____

14. Who are the people that would <u>disapprove</u> **(or would have disapproved)** of you exclusively breastfeeding (NAME)?

    ❏ a. Husbands      ❏ b. Mother      ❏ c. Cousins      ❏ d. Neighbors

    ❏ e. Friends      ❏ f. Other   Specify_____

*(Cues to action)*

15. If you wanted to exclusively breastfeed (NAME) until s/he is/was six months of age, how difficult would it be for you to remember **not** to give (NAME) anything other than breastmilk, including water, during the day?

    ❏ a. Very difficult      ❏ b. Somewhat difficult      ❏ c. A little bit difficult      ❏ d. Not difficult

*(Perception of Divine Will)*

16. Do you think that **God/the gods/fates approve** of mothers exclusively breastfeeding their children until they are six months old?

    ❑ a. Yes      ❑ b. Possibly      ❑ c. No      ❑ d. Don't know

17. Do you think that **God/the gods/fates approve (or would approve)** of you exclusively breastfeeding (NAME) until s/he is/was six months old?

    ❑ a. Yes      ❑ b. Possibly      ❑ c. No      ❑ d. Don't know

*(Positive and Negative Attributes of Action)*

18. What are the <u>advantages</u> (or would be the advantages) of exclusive breastfeeding your child until he/she is six months old? (Write all responses below)




19. What are the <u>disadvantages</u> (or would be the disadvantages) of exclusively breastfeeding your child until he/she is six months old? (Write all responses below)




20. How <u>important</u> do you think it is to exclusively breastfeed children during the first 5 months of life? Very important, somewhat important, a little bit important or not important at all?

    ❑ a. Very important      ❑ b. Somewhat important      ❑ c. A little bit important

    ❑ d. Not important at all      ❑ e. Does not know the importance

**THANK THE RESPONDENT FOR HER TIME**

# Appendix 3- Data Entry Screen Using EPI-Info.

Appendix 4- Example of Coding guide for some open ended questions:

| | Doer count | Doer % | Non-Doer count | Non-Doer % |
|---|---|---|---|---|
| Total Doers and Non-Doers | | | | |
| | | | | |
| | | | | |
| | | | | |

Appendix 5: Few Tables of Main Results from the samples of Doers and Non doers:

Age Distribution of the 6-11month Children of Interviewed Biological Mothers

| Age (in Month) | Doers | | | Non Doers | | |
|---|---|---|---|---|---|---|
| | Count | Percent | Cumulative | Count | Percent | Cumulative |
| 6 | 14 | 15.56% | 15.56% | 18 | 20.00% | 20.00% |
| 7 | 20 | 22.22% | 37.78% | 16 | 17.78% | 37.78% |
| 8 | 9 | 10.00% | 47.78% | 15 | 16.67% | 54.44% |
| 9 | 13 | 14.44% | 62.22% | 15 | 16.67% | 71.11% |
| 10 | 12 | 13.33% | 75.56% | 9 | 10.00% | 81.11% |
| 11 | 19 | 21.11% | 96.67% | 15 | 16.67% | 97.78% |
| ND | 3 | 3.33% | 100.00% | 2 | 2.22% | 100.00% |
| Total | 90 | 100.00% | | 90 | 100.00% | |

Age Distribution of the Interviewed Biological Mothers of 6-11month Children

| Age group | Doers | | | Non Doers | | |
|---|---|---|---|---|---|---|
| | Count | Percent | Cumulative | Count | Percent | Cumulative |
| 15-19 | 8 | 8.9% | 8.9% | 13 | 14.4% | 14.4% |
| 20-24 | 22 | 24.4% | 33.3% | 26 | 28.9% | 43.3% |
| 25-29 | 32 | 35.6% | 68.9% | 15 | 16.7% | 60.0% |
| 30-34 | 11 | 12.2% | 81.1% | 22 | 24.4% | 84.4% |
| 35-39 | 15 | 16.7% | 97.8% | 10 | 11.1% | 95.6% |
| 40-44 | 2 | 2.2% | 100.0% | 4 | 4.4% | 100.0% |
| Total | 90 | 100.0% | | 90 | 100.0% | |

Perceived severity:

Q04: How serious a disease/problem is malnutrition: Very serious, somewhat serious, a little bit serious, or not serious at all?

| | Doers | Non Doers | Totals |
|---|---|---|---|
| Very serious and somewhat serious | 87 | 87 | 174 |
| a little bit serious, or not serious at all | 3 | 3 | 6 |
| Totals | 90 | 90 | 180 |

Odds ratio=1 ; P_value= 1 ; SE=0.85 CI=[0.20 ; 5.09]

Perceived severity:

Q05: Can a child die from malnutrition?

| | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 86 | 83 | 169 |
| No | 4 | 7 | 11 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.55 ; P_value=0.35 SE=0.65 ; CI= [0.16 ;1.95]

Perceived Susceptibility:

Q06: Do you think a child who is less than 6 months old could become malnourished if they are not exclusively breastfed?

| | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 75 | 49 | 124 |
| No | 15 | 41 | 56 |
| Totals | 90 | 90 | 180 |

Odds ratio= 0.24; P_value= 0.0000284 SE=0.35

CI= [0.12; 0.48]

Perceived Susceptibility:

Q07: Do you think (NAME) could become malnourished if he/she is/was not exclusively breastfed?

| | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 75 | 49 | 124 |
| No | 15 | 41 | 56 |
| Totals | 90 | 90 | 180 |

Odds ratio= 0.30; P_value= 0.0005136 SE=0.36 CI= [0.15; 0.60]

## Perceived Self-Efficacy

Q08: With your present knowledge and skills, do you think that you could exclusively breastfeed (NAME) until s/he is 6 months old? If (NAME) is 6 months or older ask – do you think you could exclusively breastfeed your next child until s/he is 6 months old?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 79 | 51 | 130 |
| No | 11 | 39 | 50 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.18; P_value=0.0000032
SE=0.39CI= [0.0.09 ;0.39]

## Control beliefs

Q09:Makes EBF easier: Adequate household food security

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 48 | 57 | 38 |
| No | 52 | 50 | 102 |
| Totals | 90 | 90 | 180 |

Odds ratio=1.51; P_value=0.1736174
SE=0.30 ; CI= [0.83 ;2.74]

## Control beliefs

Q10 : Makes EBF harder : When the child is sick

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 18 | 31 | 49 |
| No | 72 | 59 | 131 |
| Totals | 90 | 90 | 180 |

Odds ratio=2.2; P_value=0.0127
SE=0.32; CI= [1.18 ;4.11]

## Control beliefs

Q10:Makes EBF harder: Limited household food security

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 38 | 40 | 38 |
| No | 52 | 50 | 102 |
| Totals | 90 | 90 | 180 |

Odds ratio=1.09; P_value=0.7635        SE=0.30 ;
CI= [0.61 ;1.97]

Perceived Action Efficacy

Q11: Do you think exclusively breastfeeding (NAME) until s/he is/was 6 months old would help (NAME) to avoid becoming malnourished?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 73 | 52 | 125 |
| No | 17 | 38 | 55 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.32; P_value=0.0006789
SE0.34=CI= [0.16 ;0.62]

Perceived Social Acceptability (Social Norms)

Q12: Would most of the people that you know approve **(or would have approved)** of you exclusively breastfeeding (NAME)?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 73 | 52 | 125 |
| No | 17 | 38 | 55 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.66; P_value= 0.1977403          SE=0.32 ; CI= [0.35 ;1.25]

Perceived Social Acceptability (Social Norms)

Q13: Who are the people that would approve **(or would have approved)** of you exclusively breastfeeding (NAME)?  Answer:  Husband

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 72 | 57 | 129 |
| No | 18 | 33 | 51 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.43; P_value=0.0130971
SE= 0.34; CI= [0.22 ;0.84]

Cues for Action

Q15: If you wanted to exclusively breastfeed (NAME) until s/he is/was six months of age, how difficult would it be for you to remember **not** to give (NAME) anything other than breastmilk, including water, during the day? Very difficult, somewhat difficult, a little bit difficult, or not difficult at all?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Very difficult and somewhat difficult | 9 | 44 | 53 |
| a little bit difficult and not difficult at all | 81 | 46 | 127 |
| Totals | 90 | 90 | 180 |

Odds ratio=8.61; P_value=0.0000000       SE=0.41 ;CI= [3.86 ;19.22]

Perceived Divine Will

Q16: Do you think that **God approves** of mothers exclusively breastfeeding their children until they are six months old?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 77 | 49 | 126 |
| No | 13 | 41 | 54 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.30; P_value=0.0005136
SE=0.36 ;CI= [0.15 ;0.60]

Perceived advantages:

Q18:Perceived advantage of EBF = Prevent illness

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 61 | 42 | 103 |
| No | 29 | 48 | 77 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.42; P_value=0.0042048
SE=0.31; CI= [0.23 ;0.76]

Perceived Divine Will

Q17: Do you think that **God approves (or would approve)** of you exclusively breastfeeding (NAME) until s/he is/was six months old?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes and Possibly | 75 | 54 | 129 |
| No | 15 | 36 | 51 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.20; P_value=0.0000053     SE=0.37 ;CI= [0.10 ;0.41]

Perceived disadvantages:

Q19: Perceived disadvantage of EBF = Prevent illness

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Yes | 6 | 14 | 20 |
| No | 84 | 76 | 160 |
| Totals | 90 | 90 | 180 |

Odds ratio=2.58; P_value=0.0577796
SE=0.51; CI= [0.94 ;7.05]

Behavioral Belief / Strength of Belief

Q20: How important do you think it is to exclusively breastfeed children during the first 5 months of life? Very important, somewhat important, a little bit important or not important at all?

|  | Doers | Non Doers | Totals |
|---|---|---|---|
| Very difficult and somewhat difficult | 88 | 80 | 168 |
| a little bit difficult, not difficult at all and I don`t know | 2 | 10 | 12 |
| Totals | 90 | 90 | 180 |

Odds ratio=0.18; P_value=0.0168274
SE=0.79 ;CI= [0.04 ;0.86]

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