

Information Design To Improve Service Delivery: Experimental Evidence from Guinea-Bissau.

Pre-Analysis Plan^{*}

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Abstract

Poor staff motivation can hinder the delivery of public services. We study how to design information to motivate front-line service providers in a field experiment with Community Health Workers in Guinea-Bissau. Study participants attend a one-day training workshop. We randomly assign half to a module conveying information about program effectiveness which blends *scientific* evidence with culturally relevant *anecdotes*. We measure effects on beliefs updating, learning, and motivation to exert effort in a real effort task. This involves phoning households to collect health information and deliver recommendations. We then investigate potential mechanisms via several follow-up surveys. Also, we track participants' performance in their role as CHWs in the months after the workshop. Finally, we follow up with households to measure downstream health outcomes.

JEL codes: O12, D83, D91, I15

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1 Introduction

1.1 Motivation

Front-line service providers play a crucial role in the delivery of public services. In low- and middle-income countries, population access to public services often depends on their presence. Improving their performance is a recurrent challenge (Finan, Olken, and Pande, 2017).

Most service delivery programs aim at enhancing the well-being of their target communities. Yet, evidence about the program’s effectiveness may not always be available. So, front-line service providers may fail to appreciate the value of their work. As a consequence, they may lose motivation to exert effort. This study tests whether communicating evidence about the program’s effectiveness can motivate front-line service providers.¹ Additionally, it describes how they update their baseline beliefs in the face of the new evidence (Delavande, 2014).²

Recent literature studies how impact evaluations influence the beliefs and decisions of politicians (Hjort et al., 2021) and policy professionals (Vivalt and Coville, 2020; Banuri, Dercon, and Gauri, 2019).³ Complementary literature shows that donors do not react to evidence of program effectiveness (Metzger and Günther, 2019b). Furthermore, shifting focus from the problem to its solution may decrease donations (Metzger and Günther, 2019a). Finally, communicating evidence may reduce smaller donors’ contributions (Karlan and Wood, 2017) by turning off their warm glow (Andreoni, 1990).

Front-line service providers may differ from politicians, policy professionals, and donors in essential dimensions. First, they may have a bottom-up perspective about the policy instead of a top-down one. Second, they may lack the skills needed to correctly decipher and interpret quantitative evidence. Finally, low levels of trust in institutions may cast doubts on the evidence provided.

This study focuses on front-line health service providers, specifically Community Health Workers (henceforth, CHWs). Over the past decades, CHWs programs facilitated the prevention and treatment of prevalent health problems in low- and middle-income countries - see Haines et al. (2007), Christopher et al. (2011) and Gilmore and McAuliffe (2013). As a result, many deaths have been avoided (Björkman Nyqvist et al., 2019).

The context of the study is Guinea-Bissau. Since 2017, CHWs have contributed to improving maternal, newborn, and child health in the country. This effort aligns with the World Health Organization policy⁴ and recent efforts across Sub-Saharan Africa - see the [One Million Community Health Workers Campaign](#). Guinea-Bissau is one of the poorest countries in the world. More than two-thirds of the population lives below the poverty line. Its GDP per capita in current USD was 727.5 in 2020, ranking 247 in 261 countries (World Bank, 2020). The country’s life expectancy is 58.3 years, lower than the average in Sub-Saharan Africa (World Bank, 2019b). The national health system faces persistent challenges related to inadequate supply of health workers, low public spending, and poor infrastructure (World Bank, 2019a). In the country persist high maternal and infant morbidity and mortality.⁵

CHWs in Guinea-Bissau, as in many other contexts, are typically community members. They perform door-to-door household visits to link their communities to the health system while directly providing selected health services.⁶ They operate in a volunteering regime with a small monthly allowance proportional to the number of

¹We define *effectiveness* as the average change in the relevant indicators induced by the program. Efficiency informs whether other interventions could have led to the same result while being cheaper.

²An influential literature studied how perceived future returns influence investments in education (Nguyen, 2008; Jensen, 2010; Kaufmann, 2014).

³Impact evaluations present potential caveats which may backfire with front-line service providers. First, publication bias may lead to exaggerating the effectiveness of policies (Dunning et al., 2019; Casey, Glennerster, and Miguel, 2012; Ioannidis, 2005). Second, the impact of government programs may differ from that of academic or non-governmental ones (Vivalt, 2020). Third, external validity, both in transporting and scaling up policy, poses significant challenges (Williams, 2020). Finally, impact evaluations may lack the granularity relevant to front-line service providers.

⁴Refer to: ‘[Global Strategy on Human Resources for Health: Workforce 2030](#),’ (WHO, 2016); ‘[WHO Guideline on Health Policy and System Support to Optimize Community Health Worker Programmes](#),’ (WHO, 2018).

⁵Guinea-Bissau scored 8th globally for Neonatal Mortality Rate with 35.1 deaths per 1,000 live births (2019), 9th for Maternal Mortality Rate with 667 deaths per 100,000 live births (2017), and 20th for Under 5 Mortality Rate with 78.5 deaths per 1,000 live births (2019) (World Bank, 2019b).

⁶The International Labour Organization offers the following definition: ‘CHWs provide health education and referrals for a wide range of services, and provide support and assistance to communities, families and individuals with preventive health measures and gaining access to appropriate curative health and social services. They create a bridge between providers of health, social and community services and communities that may have difficulty in accessing these services.’ There is however a range of definitions employed in practice - see Olaniran et al. (2017).

households visited.⁷ The path to professionalization has proved to be successful in other contexts.⁸ However, it is not affordable in many low-income countries without significant inflows of foreign aid (Taylor, Griffiths, and Lilford, 2017). The context of this study is representative of many other CHWs programs in the region. There is a general interest in finding effective and sustainable mechanisms to incentivize CHWs (Fracchia, Molina-Millán, and Vicente, 2021; Khan, 2020; Björkman Nyqvist et al., 2019; Ashraf, Bandiera, and Lee, 2014; Ashraf, Bandiera, and Jack, 2014). We see a similar interest in other categories of front-line service providers, such as school teachers (Duflo, Hanna, and Ryan, 2012; Glewwe, Ilias, and Kremer, 2010; Chaudhury et al., 2006) or tax collectors (Khan, Khwaja, and Olken, 2016).

1.2 Research Questions

- Can evidence about target indicators and the program’s contribution to their evolution facilitate training of front-line service providers, i.e., CHWs? In particular, do CHWs absorb and retain more information on the health practices covered during training?
- Can evidence about target indicators and the program’s contribution to their evolution motivate front-line service providers, i.e., CHWs? In particular, do CHWs exert more effort when promoting health practices with target households?
- When provided with new evidence, how do CHWs update beliefs about target indicators and the program’s contribution to their evolution?

2 Research Strategy

2.1 Sampling

2.1.1 Sampling Frame

We work in two rural health regions⁹ of Guinea-Bissau, i.e., Farim and Oio. The Farim health region has five health areas, ninety-three villages with at least one CHW - see Table 1, and a total of one hundred and thirty-nine CHWs. The Oio health region has ten health areas, two hundred and eighty-six villages with at least one CHW - see Table 2, and a total of four hundred and sixty-three CHWs.

Table 1: Health Areas with at least one CHW in Farim

	N (1)	Percent (2)	Cumulative (3)
Binta	13	13.98	13.98
Candjambari	14	15.05	29.03
Cuntima	27	29.03	58.06
Farim	29	31.18	89.25
Guidadje	10	10.75	100.00

Note. Column (1) reports the number of villages per health area with at least one CHW. Column (2) reports their percent share. Columns (3) reports their cumulative percent share.

⁷Data for 34 Sub-Saharan African countries on 322,199 CHWs show that 69 percent of these workers do not receive a regular salary and 46 percent do not receive any monetary compensation. Data Tool, One Million Community Health Workers Campaign, 2019.

⁸See for instance Zambruni et al. (2017) and ‘WHO Guideline on Health Policy and System Support to Optimize Community Health Worker Programmes,’ (WHO, 2018).

⁹The health regions in the country are: Bafatá, Bijagós, Biombo, Bolama, Cacheu, Farim, Gabu, Oio, Quinara, Bissau Autonomous Sector, and Tombali. Importantly, Farim and Oio form the Oio administrative region while Bolama and Bijagós form the Bolama/Bijagós administrative region.

Table 2: Health Areas in the Oio Health Region

	N (1)	Percent (2)	Cumulative (3)
Binar	29	10.14	10.14
Bissora	42	14.69	24.83
Encheia	29	10.14	34.97
Ga-Mamudo	17	5.94	40.91
Mansaba	31	10.84	51.75
Mansoa	51	17.83	69.58
Mores	14	4.90	74.48
Nhacra	32	11.19	85.66
Olossato	31	10.84	96.50
Portugol	10	3.50	100.00

Note. Column (1) reports the number of villages per health area with at least one CHW. Column (2) reports their percent share. Columns (3) reports their cumulative percent share.

The two regions have three hundred and seventy-nine villages with at least one CHW and a total of six hundred and two CHWs. The universe of villages and CHWs are eligible to participate in the study.

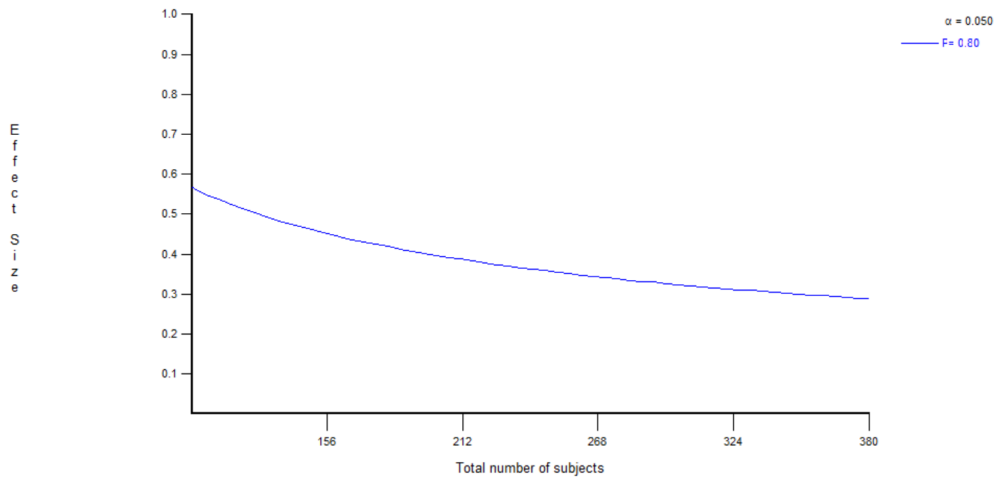
Villages in our sample have an average distance of thirteen km from the attributed health center. Fifteen percent are at less than five km, thirty-two percent between five and ten km, thirty-four percent between 10 and 20 km, and nineteen percent at more than 20 km from the health center. Each village has an average of 1.6 CHWs. Ninety-four percent of CHWs are male.

We target a total sample of three hundred and seventy-nine CHWs, one per village currently benefiting from the CHWs program. This represents sixty-three percent of the total CHWs in the two regions.

2.1.2 Statistical Power

We invite one CHW from each of the three hundred and seventy-nine villages with at least one CHW. We hence conduct power calculations at the individual level. We set alpha at the 0.05 level. We set statistical power at the 0.8 level. Figure 1 shows analyzing be able to detect an effect size of 0.3 sd.

Figure 1: Single Level Trial - Minimum detectable effect size vs. N



2.1.3 Assignment to Treatment

We assign selected villages to either *Treatment* and *Control*. We create pairs of villages stratifying on health region, health area, distance from the health center¹⁰, and number of CHWs in the village.¹¹ We then randomly split

¹⁰The specific variable takes value 1 if the distance is less than five km, 2 if between five and ten km, 3 if between 10 and 20 km, 4 if at more than 20 km.

¹¹The specific variable takes value 1 if the village has only one CHW, 2 if the village has more than one CHW.

each pair between *Treatment* and *Control*.

We rank CHWs randomly, sorting by sex, within each village in the sample. The first-ranked CHW within a village is selected to participate in the study. The remaining ones are selected as substitutes, according to their ranking. Sixty-five percent of villages have only one CHW and, therefore, no substitute.

The *Treatment* group receives an experimental module conveying evidence on health indicators and the program’s contribution to their evolution over time. It does so by blending *scientific* evidence with culturally relevant *anecdotes*. The scientific evidence is drawn from two sources. The first is the official program evaluation report commissioned by the UNICEF Country Office in Guinea-Bissau. This evaluation is centered around analyzing the evolution of the MICS indicator between 2014 and 2019. In particular, it focuses on those identified as targets for 2019 by the program. From them, we select i) mortality under 5, ii) the percentage of pregnant women who completed at least four prenatal checks, and iii) the percentage of women who gave birth assisted by trained personnel. The second source is Björkman Nyqvist et al. (2019), from which we present their result on under-5 child mortality. The anecdotal story describes the life of a family during a period paralleling the MICS indicator for mortality under 5. In this sense, it aims at helping participants to picture how the evolution of health indicators may translate in real life.

The *Control* group receives a placebo module to keep the structure of the workshop comparable to the treatment group. The module talks about mangoes and their use in local cuisine. As it is mango season in Guinea-Bissau, it is common for people to talk about different types of this fruit and their use.

2.1.4 Attrition from the Sample

We expect a value of attrition close to zero for the outcomes measured during the workshop as we do not anticipate participants to abandon the workshop before its end. We expect positive attrition for the outcomes measured in the follow-up phone interviews. Based on Fracchia, Molina-Millán, and Vicente (2021) attrition estimates, we expect that around fifteen percent of the sample will attrit. We may expect the attrition in our sample to differ from the one in Fracchia, Molina-Millán, and Vicente (2021). First, our sample is mainly rural, opposite to theirs. Second, we will follow up with participants by phone while they interviewed face-to-face. Our approach presents both advantages and disadvantages. On the one hand, it may make follow-up easier even if CHWs are busy or moved. On the other hand, Farim and Oio have limited access to electricity, and the mobile phone signal is often sub-optimal, which may interfere with communication.

We will adopt several strategies to prevent/remedy sample attrition. During the Workshop, we will inform participants about the study’s next steps. We will sensitize them on the importance of keep participating. We will ask them for additional phone numbers to increase the probability of reaching them in the future. We will keep track of the attempts to track down each participant (Behaghel et al., 2015). We do not anticipate different values for attrition between the treatment and control groups.

2.2 Experimental Workshop

2.2.1 Baseline Survey

The baseline survey comprises three modules, which participants will complete before receiving the training intervention. The first module elicits participants’ prior beliefs about health indicators in the Farim and Oio regions for 2019, the last year for which exist complete and reliable health indicators. The main focus will be on pregnant women, for whom we will elicit beliefs on the percentage who (i) completed the four recommended prenatal checks before giving birth, (ii) gave birth attended by qualified health care personnel, and (iii) gave birth at the health center. We will also elicit beliefs on the percentage of new mothers who completed all the recommended postnatal checks and the percentage of newborns who received all the recommended vaccines on time. Moreover, we elicit beliefs on the extent to which the evolution of each health indicator in the region of Oio and Farim is attributable to the CHWs program. We will employ a visual aid to elicit subjective expectations Delavande, Giné, and McKenzie (2011). Specifically, we will use a modified ruler to allow respondents to clearly indicate their answers. This instrument has been extensively piloted. Existing evidence points to the dependence of current beliefs on past behaviors (Delavande and Kohler, 2009; Delavande, 2014). We will not be able to control for past CHW’s performance due to data availability.

The second module consists of a pre-test on prenatal care. We designed the test around standard CHWs program material under the supervision of medical doctors and nurses experienced with the CHWs program. Hence, CHWs should at least be familiar with its content. The test will be self-administer using pen and paper. Each participant will have precisely thirty minutes to complete the test.

The third module asks participants about their current engagement in the program. Questions include: (i) participant's tenure as CHW, (ii) number of villages attributed, (iii) number of households attributed, (iv) time allocation in the CHW activity, and (iv) participation in health campaigns.

2.2.2 Follow-up Survey

Right after the training intervention, CHWs participate in a follow-up survey. The follow-up survey is composed of four modules. The first module elicits participants' posterior beliefs, replicating the baseline module. We will elicit these beliefs employing the same visual aid used during baseline.

The second module consists of a post-test on prenatal care, replicating the pre-test. The test will be self-administer using pen and paper. Each participant will have precisely thirty minutes to complete the test.

The third module asks about intentions to participate in the program in the future at the extensive and intensive margin. In particular, questions include intentions (i) to stay in the program, (ii) in terms of days and hours per day working as CHW during the following week, (iii) in terms of the number of households to visit during the following week, (iv) to participate in next monthly meeting, (v) to deliver the next monthly report. Moreover, it measures trust in data submitted by CHWs in other and own health areas.

The fourth module includes questions on motivation. We cover several dimensions of motivation: (i) perceived recognition within the health system, (ii) mission motivation, (iii) fit with the role, (iv) extrinsic motivation, (v) social recognition motivation, (vi) prosocial motivation. On top of that, the treatment group answers additional questions on perceptions about the indicators presented during the treatment module. In particular, we measure whether respondents think the indicators showed represent the reality of their village.

2.2.3 Real-effort Task

We invite participants to perform a real-effort task. The task consists in phoning a pre-defined sample of twenty households. When inviting CHWs to participate in the workshop, research assistants specifically ask them to prepare a list of 20 households. The criteria to select the households will be the presence of, in order of priority: i) a pregnant woman, ii) a woman who recently gave birth, and (iii) a woman of fertile age. During the real-effort task, participants will be asked to call households from number 1 until number 20. Notably, participants determined the ranking autonomously before the day of the workshop and before the treatment administration. In this sense, we expect it to be orthogonal to treatment assignment.

The real-effort task will last one hour. All participants will start at the same time. After one hour, no new phone call will be allowed. However, those who will be on a phone call will be allowed to complete it at a normal pace. Participants will first administer a brief demographic survey module. They will then promote a module on prenatal care, which follows a simple structure. First, the CHW asks a specific question about prenatal care, e.g., the recommended minimum number of prenatal checks. She then registers the respondent's answer. Hence, she promotes a pre-scripted message which conveys the correct answer. Importantly, this module is the subject of the refresher training, which follows the same structure.

The real-effort task is developed autonomously based on the CHWs' routine activities. As it is the first time CHWs perform this specific task, our research assistants will exemplify it through a brief live representation. Moreover, two participants will attempt to replicate the example given by the research assistants. After these initial tests, each participant will perform the real-effort task autonomously and isolated from others.

This real-effort task will allow us to have both quantitative and qualitative measures of effort. Quantity-wise, CHWs will fill a summary sheet with a brief self-assessment, including the number of total attempts, failed ones, and successful ones. Research assistants then verify the total number of attempts in the phone call register, which is cleared before the real-effort task.¹² Quality-wise, each research assistant has a pre-defined set of CHWs to evaluate using a survey module. The module asks research assistants to mark each component of the call from

¹²The mobile phones used can register up to 50 attempts.

1 to 20.¹³ It has one main shortcoming: it does not allow for measuring the cost of effort. We expect it, however, to be balanced across treatment groups.

2.3 Phone survey

2.3.1 CHWs Follow-up

We will follow up over the phone with participants one month after the workshop. We will measure participation in the program both at the extensive and intensive margin. We will administer a simplified version of the workshop's post-test to address knowledge retention. Finally, we will measure motivation by employing a streamlined version of the workshop's follow-up questionnaire. We will include questions to bound possible experiment demand effects for each dimension measured. Depending on access to additional funding, we may follow up multiple times in the months following the workshop.

2.3.2 Households Follow-up

We will follow up over the phone with a sample of the households contacted one month after the workshop. The phone survey will include a simple post-test on the prenatal care module conveyed by CHWs during the workshop. Moreover, we will measure satisfaction with the CHWs program, taken from (Fracchia, Molina-Millán, and Vicente, 2021). Depending on access to additional funding, we may follow up multiple times in the months following the workshop.

2.4 Program Monitoring Data

We will gather all existing program data on CHWs activity in the health regions of Farim and Oio. The program should collect (i) dropout rates; (ii) CHWs' status, i.e., active or inactive; (iii) share of monthly reports submitted;¹⁴ (iv) test scores in examinations taken during monthly meetings; (v) and supervisors' evaluations of CHWs' performance.¹⁵

The program currently faces a shortage of resources and personnel, which disrupted its capacity to monitor CHWs' activity and collect data. We hope that they will be able to improve the situation in the future and thus resume program monitoring activities.

2.5 Data Processing

All data will be treated confidentially by the data collectors. All data will be made anonymous before starting data analysis. We will begin data processing after the conclusion of the experimental workshops, and it will last until the conclusion of the data collection process. The data processing will entail merging various data sources, always keeping the single CHW as the unit of analysis. We will perform simple OLS differences and ANCOVA, depending on the relevant outcome variable. The data will be made anonymous before starting the analysis so that the Principal Investigator will be the only one to be able to identify respondents in the data. The Principal Investigator will have ownership over the processed data. The data will be stored digitally, both online and offline. We will destroy all physical data collection tools. We will erase the local memory of the digital data collection tools.

3 Empirical Analysis

3.1 Outcome Variables

- CHWs' beliefs [Experimental workshop]

¹³The grades in schools in Guinea-Bissau span from 1 to 20.

¹⁴CHWs are expected to submit a monthly report with self-reported information on the number of households visited, and a headcount of children and pregnant women tracked and treated.

¹⁵The CHWs are organized by health area. Each health area has a supervisor from the National Health System who oversees their activity.

- Measure of the correctness of beliefs on each health indicator, e.g., the difference between baseline beliefs on MICS data. [Continuous variable taking non-negative values]
- Measure of beliefs updating for each health indicator, e.g., the difference between baseline and follow-up values. [Continuous variable taking non-negative values]
- Measure of beliefs updating for CHWs program contribution to health indicators' evolution, e.g., the difference between baseline and follow-up values. [Continuous variable taking non-negative values]
- CHWs' pre and post-test [Experimental workshop]
 - Total grade in the post-test. [Continuous variable taking values from 0 to 20]
 - Grade improvement between pre and post-test. [Continuous variable taking values from 0 to 20]
- CHWs' motivation [Experimental workshop]
 - Perceived *recognition* by different actors within the CHWs program: (i) households, (ii) other CHWs, (iii) program supervisor, (iv) the head of health area, (v) doctors, nurses, and health technicians at the health center, (vi) regional health directorate, (vii) Ministry of Public Health. [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
 - Index measuring *mission* motivation ([Khan, 2020](#)). [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
 - Index measuring perceived *fit* with the role. [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
 - Index measuring *extrinsic* motivation. [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
 - Index measuring social *recognition* motivation. [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
 - Index measuring *prosocial impact* motivation ([Grant and Campbell, 2007](#)). [Variable using a 5-item Likert scale that takes the values 1 'Strongly disagree,' 2 'Disagree,' 3 'Neither agree nor disagree,' 4 'Agree,' and 5 'Strongly agree' to measure agreement]
- CHWs' intentions to participate in the program [Experimental workshop]
 - Number of households planned to visit over the next week. [Continuous variable taking non-negative values]
 - Workdays as CHW planned over the next week. [Continuous variable taking values from 1 to 7]
 - Work hours per day as CHW planned over the next week. [Continuous variable taking values from 1 to 8]
 - Intention to participate in the next program monthly meeting. [Indicator variable that takes a value of 1 if the respondent intends to participate]
 - Intention to deliver the report in the next monthly meeting. [Indicator variable that takes a value of 1 if the respondent intends to deliver the report]
- CHWs' performance in the real-effort task [Experimental workshop]
 - Total number of attempts. [Continuous variable taking non-negative values]
 - Number of completed phone calls. [Continuous variable taking non-negative values]
 - Total grade in the evaluation of CHWs' performance in asking questions of prenatal care to the household during the phone call. [Categorical variable taking values from 0 to 20]

- Total grade in the evaluation of CHWs in promoting messages on prenatal care during the phone call. [Categorical variable taking values from 0 to 20]
- CHWs’ participation in the program [Phone survey]
 - Number of households visited during the past week. [Continuous variable taking non-negative values]
 - Days worked in the program during the past week. [Continuous variable taking values from 1 to 7]
 - Hours worked in the program per day during the past week. [Continuous variable taking values from 1 to 8]
 - Participation in the last program monthly meeting. [Indicator variable that takes a value of 1 if respondent participated]
 - Delivery of the report in the last month’s meeting. [Indicator variable that takes a value of 1 if respondent delivered the report]
- CHWs’ beliefs [Phone survey]
 - Measure of the correctness of beliefs on each health indicator, e.g., the difference between baseline beliefs and MICS data. [Continuous variable taking non-negative values]
 - Measure of beliefs updating for each health indicator, e.g., the difference between phone survey and workshop follow-up values. [Continuous variable taking non-negative values]
 - Beliefs on CHWs program contribution to the health indicator’s evolution. [Continuous variable taking non-negative values]
- CHWs’ follow-up post-test [Phone survey]
 - Total grade in the post-test. [Continuous variable taking values from 1 to 20]
- CHWs’ participation in the program. [Program monitoring data]
 - Number of households visited during the past month. [Continuous variable taking non-negative values]
 - Participation in the last program monthly meeting. [Indicator variable that takes a value of 1 if respondent participated]
 - Delivery of the report in the past monthly meeting. [Indicator variable that takes a value of 1 if respondent delivered the report]
- Households’ follow-up post-test [Phone survey]
 - Total grade in the post-test. [Continuous variable taking values from 1 to 20]
- Households’ satisfaction with the program [Phone survey]
 - Index measuring households’ *satisfaction* with the program ([Fracchia, Molina-Millán, and Vicente, 2021](#)). [Variable using a 5-item Likert scale that takes the values 1 ‘Strongly disagree,’ 2 ‘Disagree,’ 3 ‘Neither agree nor disagree,’ 4 ‘Agree,’ and 5 ‘Strongly agree’ to measure agreement]

3.2 Balancing Checks

We will check the balance between treatment and control group over a set of individual characteristics collected during the workshop. It is important to note that the program currently has little administrative data on CHWs. Hence, we could not conduct balancing checks on many individual characteristics at the randomization stage. Table 3 reports the balancing checks at the randomization stage for (i) village distance from the health center, (ii) number of CHWs in the village, and (iii) CWH’s sex. The invitation to the workshop is identical for the treatment and control groups. Hence, we expect participation to be orthogonal to treatment assignment.

Table 3: Balance across treatment arms

	N	Control mean	Treatment
	(1)	(2)	(3)
Village distance from health center (km)	379	13.4	-0.51 (0.82)
Number of CHWs in the village	379	1.66	-0.15 (0.11)
CHW's sex (female = 1)	379	0.047	2.9e-18 (0)

Note. Column (1) reports the number of villages per health area with at least one CHW. Column (2) reports their percent share. Columns (3) reports their cumulative percent share.

3.3 Treatment Effects

To estimate treatment effects on real-effort task outcomes, we consider the following specification:

$$y_i = \alpha + \beta_1 T_i + X_i' \gamma + \epsilon_{ib} \quad (1)$$

where y_i is the outcome of interest (assumed to be measured so that higher values signify better outcomes). The treatment indicator is a binary variable taking a value of 1 if the CHW is assigned to the treatment group and 0 otherwise. X_i is a set of controls including socio-demographic characteristics and the strata indicators used for randomization. Finally, ϵ_i is an idiosyncratic error term assumed to be clustered at the village level.

To estimate treatment effects on beliefs updating and knowledge measures, we compare pre and post-intervention levels. When the baseline values of the outcome variables are available, we will employ ANCOVA and DID models:

1. ANCOVA:

$$y_i = \alpha + \beta_1 T_i + X_i' \gamma + \delta y_{i0} + \epsilon_{ib} \quad (2)$$

where y_{i0} is the baseline value of the dependent variable.

2. DID:

$$y_{it} = \alpha + \beta_1 T_i + \beta_1^A T_i * A + X_i' \gamma + \delta A + \epsilon_{ib} \quad (3)$$

where y_{it} is the outcome variable for CHW i at time t , and A is a binary variable that takes a value of 1 if t is equal to baseline and 0 otherwise.

We will include

3.4 Heterogeneous Effects

We will also estimate heterogeneous effects on the treatment based on the following dimensions.

1. CHWs' socio-demographic characteristics:

- (a) Gender
- (b) Marital status
- (c) Household head status
- (d) Having children
- (e) Having children under 5
- (f) Religion
- (g) Ethnicity

- (h) Language
 - (i) Highest level of education attained
 - (j) Enrollment in school in the current academic year
 - (k) Employment status in the past 12 months
 - (l) Business ownership
2. CHWs' baseline engagement in the CHWs program:
- (a) Tenure in the CHWs program
 - (b) Number of villages assigned
 - (c) Number of households assigned
 - (d) Having received the program's training
 - (e) Days per week devoted to CHW activities
 - (f) Hours per day devoted to CHW activities
 - (g) Number of households visited at least once during the last month
 - (h) Being from an health area on strike
3. CHWs' baseline beliefs:
- (a) Beliefs on target health indicators
 - (b) Beliefs on the program contribution to the evolution of target health indicators
4. CHWs' baseline knowledge levels:
- (a) Grades in the pre-test

3.5 Standard Error Adjustments

In our baseline specification, we will cluster standard errors at the village level. We will also conduct robustness checks clustering standard errors at the session's level.

To address false positives from multiple hypothesis testing, we will aggregate multiple variables into indexes. We will create an index for each of our primary outcomes of interest. For the beliefs updating outcomes, we will create an index aggregating beliefs updating coefficients for each health indicator. We will do the same for beliefs on the CHWs program's contribution to health indicators' evolution. Moreover, we will create two indexes aggregating the distance between the elicited beliefs and the correct indicators at baseline and follow-up. The indexes for the pre and post-test will represent the total grade in each. For the motivation questions, we will aggregate questions in indexes according to the motivation dimension they measure. In particular, we will create indexes for (i) perceived recognition within the health system, (ii) mission motivation, (iii) fit with the role, (iv) extrinsic motivation, (v) social recognition motivation, (vi) prosocial motivation. For the real-effort task outcomes, we will create separate indexes for the quantity and quality of calls. To measure quantity, we will aggregate different measures of the number of attempts: self-reported and measures on the mobile phone. We will create two indexes to measure the quality of calls. First, we will aggregate the evaluation of all questions on prenatal care in one index. Second, we will aggregate the assessment of all messages on prenatal care in another index.

4 Hypotheses

Our intervention provides evidence about target indicators and the program's contribution to their evolution to front-line service providers, i.e., CHWs. We hypothesize that our intervention increases CHWs' motivation. We expect this increase in motivation to manifest in several dimensions. First, we hypothesize that our intervention facilitates CHWs' training. Hence, CHWs may absorb and retain more from the refresher training following the intervention. Thus, we expect CHWs assigned to treatment to show larger improvements in knowledge than those assigned to the control group. Second, we hypothesize that our intervention leads to an increase in CHWs'

efforts. Hence, we expect CHWs assigned to treatment to exert more effort in the real-effort task. This consists in promoting the health practices over the phone to target households. As a downstream result, we hypothesize that households contacted by CHWs assigned to treatment during the real-effort task present higher knowledge of the health practices promoted. Finally, we hypothesize that our intervention leads CHWs to exert more effort in the program, both at the extensive and intensive margin.

5 Research Team

The principal investigator is Mattia Fracchia, Nova School of Business and Economics – Universidade Nova de Lisboa, and NOVAFRICA. The principal investigator defined the research questions. He designed the study, including the identification strategy, interventions, sampling, and randomization. Also, he sought and obtained funding. He will coordinate the fieldwork and data collection. Moreover, he will carry out the data cleaning, processing, and analysis. Finally, he will write the resulting academic article and policy report.

The field activities will be implemented by [NOVAFRICA](#) field team in Guinea-Bissau. NOVAFRICA has been working since 2016 to contribute to the achievement of Sustainable Development Goal 3 in the country.¹⁶ It has already conducted field several experiments in this sense. [Fracchia, Molina-Millán, and Vicente \(2021\)](#) studied non-monetary incentives for CHWs in the capital city, Bissau. Caerio, Coutts, Molina-Millán, and Vicente (ongoing) investigate how networks influence the uptake of community-based health insurance. Álvarez-Pereira, Coutts, Molina-Millán, and Vicente (ongoing) explore the interplay between modern and traditional health beliefs in determining the demand for health services.

The project coordinator will manage partnerships with local institutions and oversee the full implementation and data collection process. Two field supervisors will supervise a team each. Teams are composed of three research assistants and one trainer. Of the three research assistants, two will participate in the workshops, while one will stay at the office to phone CHWs to remind them of the invitation to the workshop and give support to the field teams. The trainer will deliver training and facilitate the workshop activities. A selection of the members of the field teams will then conduct the follow-up phone survey.

6 Deliverables

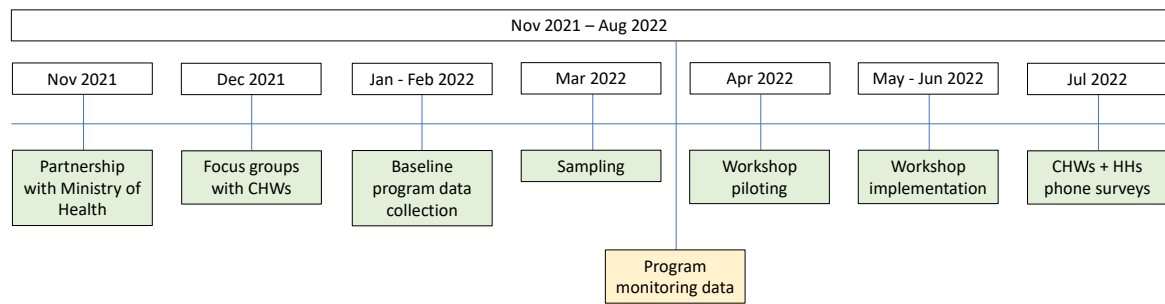
The main product resulting from this study will be a scientific article, which the principal investigator aims to publish in a top journal in economics. Additionally, the study will generate a policy brief for the Ministry of Health and implementing partners to inform policymaking. The lead author of all deliverables will be the principal investigator.

7 Calendar

The entire study will take 10 months. This study is conducted in partnership with the Regional Health Directorates of Farim and Oio. The timing of the study is particularly relevant. The national strategy for community health recently transitioned from a model centered around the role of NGOs to one integrated into the national health system. [Figure 2](#) summarizes the main steps of the study timeline.

¹⁶Countries such as Guinea-Bissau, with low population and high cost of conducting research, tend to have little research. As a result, local policy-makers have access to a limited context-specific evidence base ([Porteous, 2020](#)).

Figure 2: Timeline



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