

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

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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. 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 on 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.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 for 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 regions of Guinea-Bissau, i.e., Farim and Oio. Farim has five health areas. A total of ninety-three villages have at least one CHW - see Table 1. The region has a total of one hundred and thirty-nine CHWs. Oio has ten health areas. A total of two hundred and eighty-six villages have at least one CHW - see Table 2. Oio has a total of four hundred and sixty-three CHWs.

Table 1: Health Areas in the Farim Health Region

	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).

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.

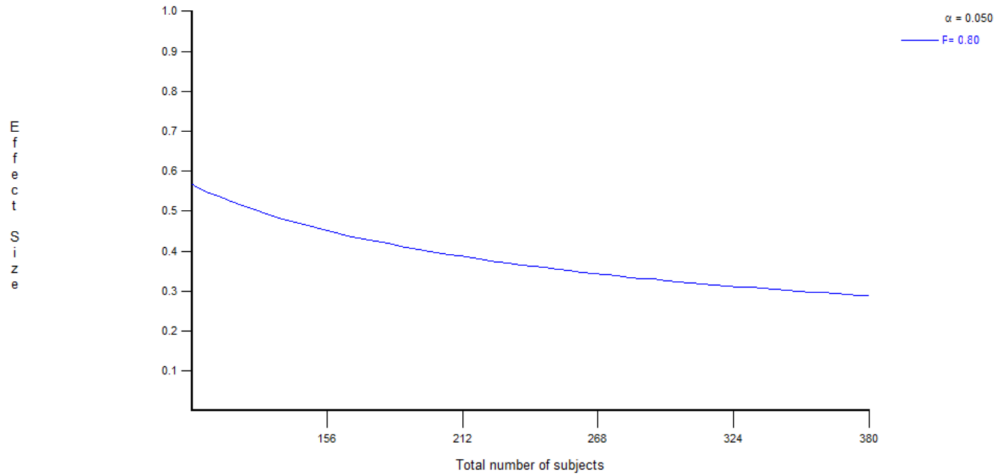
Villages in our sample have an average distance of thirteen km from the attributed health center. Fifteen percent are at less than five km, thirty-two percent between five and ten km, thirty-four percent between 10 and 20 km, nineteen percent at more than 20 km from the health center. Each village has 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 show that we will 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 region, health area, distance from the health center⁹, and number of CHWs in the village.¹⁰ We then randomly split each

⁹The 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.

¹⁰The specific variable takes value 1 if the village has only one CHW, 2 if the village has more than one CHW.

pair between *Treatment* and *Control*.

We rank CHWs, 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 the analysis of the evolution of MICS indicator between 2014 and 2019. In particular, it focuses on those which were identified as targets for 2019 by the program. From them, we select i) mortality under 5, ii) percentage of pregnant women who completed at least four pre-natal checks, and iii) 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 one of the MICS indicators. In this sense, it aims at helping participants to picture how the evolution of health indicators may translate in real life.

2.1.4 Attrition from the Sample

We expect an attrition close to zero for the outcomes measured during the workshop. In fact, we do not expect participants to abandon the workshop before its end. We expect a positive value for attrition for the outcomes measured in the follow-up phone interviews. Based on attrition estimates of Fracchia, Molina-Millán, and Vicente (2021), we expect the 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 largely rural, while their was urban. Second, we will follow up with participants by phone, while they interviewed them face-to-face. This 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 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 next steps of the study. We will sensitizing them on the importance of keep participating. We will ask them for additional phone numbers to increase the probability to reach them in the future. We will keep track of the attempts to track down each participant (Behaghel et al., 2015).

2.2 Experimental workshop

2.2.1 Baseline survey

The baseline survey is composed by 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 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 answer. This instruments has been extensively piloted. Existing evidence points at 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 data availability.

The second module consists in a pre-test on prenatal care. We designed the test around standard CHWs program’s 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 exactly thirty minutes to complete the test.

The third module ask 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, (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 by 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 in a post-test on prenatal care, replicating the pre-test. The test will be self-administer using pen and paper. Each participant will have exactly thirty minutes to complete the test.

The third module asks about intentions to participate in the program in the future, both 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 following week, (iii) in terms of number of households to visited during 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 forth module includes questions on motivation. We cover several dimension 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 presented are representative of 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, in order of priority: i) having a pregnant woman, ii) having a new mother, (iii) having a woman in fertile age. During the real-effort task, participants will be asked to call households starting from number 1 and following until number 20. Importantly, the ranking was determined prior to the day of the workshop and prior to 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 on a normal pace. During each phone call, participants will first administer a brief demographic survey module. They will then promote a module on pre-natal care. The module follows a simple structure. First, the CHW asks a specific question about pre-natal care, e.g. the recommended minimum number of pre-natal checks. She then register 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 exact structure.

The real-effort task is developed autonomously based on the CHWs' routine activities. As it is the first time that CHWs perform this specific task, our research assistants will exemplify it through a brief live representation. Moreover, two volunteers among participants will attempt to replicate the example given by the research assistants. After this 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, failed, and successful attempts. The total number of attempts is then verified by research assistants in the phone call register, which is cleared before the real-effort task.¹¹ Quality-wise, each research assistants has a pre-defined set of CHWs to evaluate using a survey module. The module asks research assistants to mark each component of both the call from 1 to 20¹² It has one main short-coming: it does not allow to measure the cost of effort. We expect it, however, to be balance across treatment groups.

¹¹The mobile phones used can register up to 50 attempts.

¹²Grades in schools in Guinea-Bissau span from 1 to 20.

2.3 Phone survey

2.3.1 CHWs follow-up

We will follow-up over the phone with CHWs who participated in the workshops. We will measure their participation in the program both at the extensive and intensive margin. To address knowledge retention, we will administer a simplified version of the post-test they took during the workshop. Finally, we will measure their motivation employing a simplified version of the questionnaire used during the workshop. For each dimension measured, we will include questions to bound possible experiment demand effects.

2.3.2 Households follow-up

We will follow-up with a sample of the households contacted during the workshop. The phone survey will include a simple post-test on the prenatal care module received during the workshop. Moreover, we will measure satisfaction the CHWs program, taken from (Fracchia, Molina-Millán, and Vicente, 2021).

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 is currently facing a shortage of resources and personnel, which disrupted its capacity to collect administrative data. We hope that they will be able to improve the situation in the future and thus be able to access information about CHWs' 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 start data processing after the conclusion of the experimental workshops and will last until the conclusion of the data collection process. The data processing will entail the merging of various data sources, always keeping the single CHW as the unit of analysis. I will perform simple OLS differences and ANCOVA, depending of 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. All physical data collection tools will be destroyed. The local memory of the digital data collection tools will be erased.

3 Empirical Analysis

3.1 Variables

- CHWs' baseline participation in the program [Experimental workshop]
 - Number of households visited during the past month. [Continuous variable taking non-negative values]
 - Days worked in the program on average. [Continuous variable taking values from 1 to 7]
 - Hours worked in the program per day on average. [Continuous variable taking values from 1 to 8]
- CHWs' beliefs [Experimental workshop]
 - Index for correctness of beliefs on each health indicator. [Continuous variable taking non-negative values]
 - Beliefs updating for each health indicator. [Continuous variable taking non-negative values]
 - Beliefs updating for CHWs program contribution to health indicators' evolution. [Continuous variable taking non-negative values]
- CHWs' pre and post-test [Experimental workshop]
 - Total grade in the post-test. [Continuous variable taking values from 1 to 20]

- Grade improvement between pre and post-test. [Continuous variable taking values from 1 to 20]
- CHWs' motivation [Experimental workshop]
 - Perceived *recognition* by different actors within the CHWs program: (i) households, (ii) other CHWs, (iii) program supervisor, (iv) 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]
 - Days planned to work in the program over the next week. [Continuous variable taking values from 1 to 7]
 - Planned hours to work in the program per day over the next week. [Continuous variable taking values from 1 to 8]
 - Intention to participate in next program monthly meeting. [Indicator variable that takes value of 1 if respondent participated]
 - Intention to deliver the report in next month meeting. [Indicator variable that takes value of 1 if respondent delivered 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]
 - Index aggregating evaluation of questions asked. [Categorical variable taking values from 1 to 20]
 - Index aggregating evaluation of messages promoted. [Categorical variable taking values from 1 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 last program monthly meeting. [Indicator variable that takes value of 1 if respondent participated]

- Delivery of the report in the past month meeting. [Indicator variable that takes value of 1 if respondent delivered the report]
- CHWs’ beliefs [Phone survey]
 - Index for correctness of beliefs on one health indicator. [Continuous variable taking non-negative values]
 - Beliefs updating for one health indicator. [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 last program monthly meeting. [Indicator variable that takes value of 1 if respondent participated]
 - Delivery of the report in the past month meeting. [Indicator variable that takes 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 balance between treatment and control group over a set of individual characteristics that we will collect during the workshop. It is important to note that the program has currently little administrative data on CHWs. Hence, we could not conduct balancing checks on many individual characteristics at randomization stage. Table 3 reports the balancing checks at randomization stage for (i) village distance from the health center, (ii) number of CHWs in the village, (iii) CWH’s sex. The invitation to the workshop is identical for treatment and control group. Hence, we do not expect to have any differential take-up.

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 in such a way that higher values signify better outcomes). The treatment indicator is a binary variable taking value 1 if the CHW is assigned to the treatment group, and 0 otherwise. X_i is a set of controls including the strata indicators used for randomization. Finally, ϵ_i is an idiosyncratic error term assumed to be clustered at the level of the village.

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 value 1 if t is equal to baseline and 0 otherwise.

3.4 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 workshop session level.

To address false positives from multiple hypothesis testing, we will aggregate multiple variables into indexes. We will create an index for each one of our primary outcome 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 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 quantity and quality of calls. To measure quantity, we will aggregate different measures of number of attempts: self-reported and measures on the mobile phone. We will create two indexes to measure quality of calls. First, we will aggregate the evaluation of all questions on prenatal care in one index. Second, we will aggregate the evaluation of all messages on prenatal care in another index.

4 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.¹³ 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. Coutts, Molina-Millán, Pereira, and Vicente (ongoing) explore the interplay between modern and traditional health beliefs in determining the demand for health services.

The project coordinator who will manage partnerships with local institutions, oversee the whole implementation and data collection process. Two field supervisors will supervise a team each. Teams are composed by 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 the invitation to the workshop and give support to the 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.

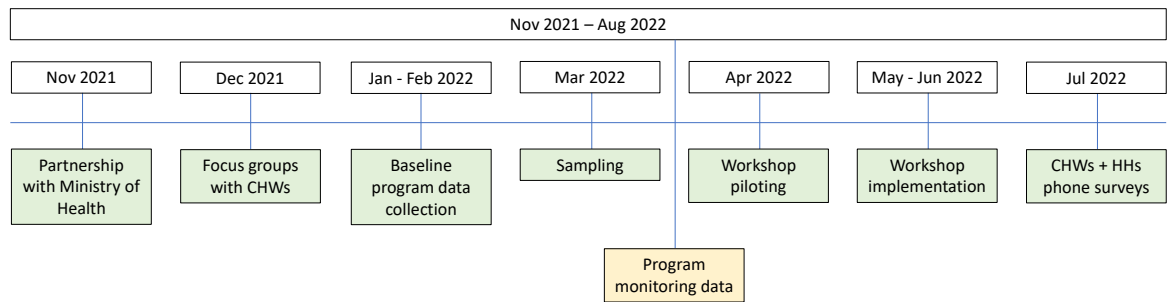
5 Deliverables

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, aimed at informing policy making. The lead author of all deliverables will be the principal investigator.

6 Calendar

The entire study will take 10 months. This study is conducted in partnership with the Regional Health Directorates of Farim and Oio.¹⁴ 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.

Figure 2: Timeline



¹³Countries 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](#)).

¹⁴The Regional Health Directorates in the country are: Bafatá, Bijagós, Biombo, Bolama, Cacheu, Farim, Gabu, Oio, Quinara, Bissau Autonomous Sector, and Tombali. Administratively, Farim is part of the Oio region while Bolama and Bijagós form the Bolama/Bijagós region.

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