Pre-Analysis Plan for "Helping Families Help Themselves: Effects of an SMS Parental and Stress Management Intervention"

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Abstract

The COVID-19 pandemic and its associated economic and social repercussions have increased parental stress and raised concerns about increased child maltreatment. School closures and reduced access to social care services make the situation even more precarious for at-risk children. In this context, designing accessible digital tools that help reduce stress and improve household functioning is essential to minimize maltreatment risk and its negative consequences on child development. Using an individual-level randomized control trial design with 3,103 caregivers, we plan to assess the impact of a free high-dosage intervention delivered over two months to caregivers residing with children aged eight years or younger in El Salvador. The messages contain information, exercises, videos, and links to additional content that caregivers can access on-demand. This document outlines the pre-analysis plan to estimate the intervention's causal effect on caregivers' stress, depression, anxiety, impulsivity, and the quality of caregiver-child interactions.

Keywords: Mental health, stress management, positive parenting, child maltreatment

JEL Codes: J13, J22, I24, I12, J12, J16

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1. Overview of the Intervention and Theory of Change

The COVID-19 pandemic brought a variety of new challenges to families. In a context of high stress, social isolation, and disrupted family dynamics, providing caregivers with guidance to better cope with parenting duties can be an efficient policy to mitigate the risks of violence against children. However, social isolation limits the possibilities of offering traditional in-person courses and programs to improve parenting practices. In this context, this research aims to evaluate the impact of a digital (phone-based) intervention that supports caregivers with stress management and positive parenting techniques in El Salvador.

The intervention consists of 27 digital messages with information and exercises on stress management and positive parenting techniques. The content includes videos, animations, infographics, short texts, and links to a web blog with additional information and exercises on these two subjects. Glasswing International, an NGO with extensive experience in stress-coping programs, designed and implemented the intervention.

We plan to evaluate the intervention's causal impact using information from 3,103 caregivers residing with children aged eight years or younger in El Salvador. We enrolled participants using three alternatives: social media, Glasswing International's network, and messages sent to clients of one of the largest mobile phone providers in El Salvador. We randomly assigned all enrolled caregivers who met the study's eligibility criteria to either the treatment or the control group with equal probability. Participants enrolled in the treatment group received the intervention for seven weeks (up to 4 messages per week). Using self-reported information collected after the intervention, we will measure the intervention's impact on caregivers' mental health, parenting skills, and child maltreatment or abuse.

Growing evidence identifies the pandemic's mental health consequences as a major public health concern. Previous studies from high-income countries reveal that digital health interventions can be effective in addressing mental health issues. However, there is limited evidence of the effects of such policies in low and middle-income countries (LMICs), where there has been a relatively recent rapid spread of digital technologies (Naslund et al., 2017; Kola, 2020). Our project aims to address this gap in the literature by estimating the effects of a digital health intervention on mental health in El Salvador. Overall, our objective is to answer the following research questions:

1. Does this digital stress management and positive parenting intervention for caregivers im-

prove their mental health in the COVID-19 context?

2. Does this digital stress management and positive parenting intervention for caregivers have a direct effect on the quality of caregiver-child interactions during COVID-19?

This pre-analysis plan (PAP) outlines the main research questions, additional hypotheses, and empirical specifications that we will use to analyze the intervention. This PAP was completed by the authors before completing the endline survey and accessing the data, and can thus serve as a useful reference in evaluating the study results.

1.1 Overview of the Intervention

The positive parenting and stress management program is one of Glasswing International's main initiatives. Glasswing International is an NGO founded in El Salvador in 2007 and currently working in seven Central American countries on education, health, community empowerment, and employment and entrepreneurship programs.[1] After the pandemic onset, Glasswing International partnered with our team to give the program a digital format compatible with stay-at-home orders and social distancing requirements. The importance of adapting and delivering the intervention during the pandemic was motivated by existing evidence on the pandemic's potential effects on mental health and, subsequently, child maltreatment and the potential benefits of specific strategies to improve parenting skills and mental health. The intervention seeks to help caregivers recognize their own emotions, establish structures and consistent schedules, and use coping strategies to reduce mental distress and the risk of violent behavior (Humphreys et al., 2020; Szabo et al., 2020). If effective, the intervention will generate small behavioral changes that can gradually transform caregivers' parenting skills (Coyne et al., 2020).

The program consists of two components: (i) stress coping skills development and (ii) positive parenting techniques. The first component aims to provide materials to show how to identify and deal with physical, cognitive, emotional, and behavioral stress manifestations, which will help participants effectively manage daily life's stressors (with an emphasis on those that can intensify during the lockdown). This component's content is delivered through messages about 12 topics oriented to understand better the stress and its most frequent physical and emotional

[1] Glasswing International's website (https://glasswing.org/) provides more information on the NGO's programs. (accessed January 29, 2021)

consequences. This component includes exercises and techniques for meditation, breathing, self-control, stretching, progressive break, and emotional freedom.

The second component aims to provide caregivers with knowledge regarding positive parenting practices and basic family life concepts. Messages provide different content to help caregivers reflect on their emotions and actions. Positive discipline is based on the idea that parents can learn to interact with their children through positive actions and mutual respect.[2] It consists of the capacity to conduct a child's behavior through the frequent use of anticipation, negotiation, and perspective. It is a competence that caregivers can develop, which helps them avoid controlling children's conduct through punishment and teaching children how to regulate their emotions.

The positive discipline component includes content that combines the following three key elements developed by Durrant (2013) across 15 topics:

- Understanding how the children think, feel and behave, and what they need at each development stage.
- Bringing warmness and structure to the parent-child interaction. Warmness refers to emotional security, verbal and physical effect, respect, sensibility, and empathy to respond to children's needs. At the same time, the structure is related to stating clear guidelines to guide children's behavior.
- Answering accordingly to children's needs along their development stages through warm and structured practices. The materials include activities such as positive management of children's emotions, better communication, family coexistence, self-control, and recommendations for an optimal family environment to help caregivers with their responses.

1.2. Theory of Change

The theory of change underlying the project builds on evidence about practices to improve mental health, the link between mental health and impulsive violent behavior, and parenting techniques to foster child development. Emotions such as stress, anxiety, or frustration affect the quality of interactions between parents and children, potentially leading to violent or harmful interactions

[2]This initial concept was developed by Adler and Dreikurs (1920), who stated that behavioral problems occur to children with no or too many limits. Later, different authors developed and extended this methodology. Nelsen (2007), for instance, argues that families are either really strict and very controlling, or too permissive, limiting children to learn how to develop responsibilities.

(Cluver et al., 2020; Renzetti, 2009; UNICEF, 2020, 2017). Interventions that help parents better cope with these emotions can improve the relationship between parents and their children (Knerr et al., 2013; Cluver et al., 2018) and reduce child risk maltreatment.

The ultimate objective of the intervention is to lead to less violent relationships between children and their caregivers. The core of the intervention's theory of change is that providing caregivers with information on stress-coping and positive parenting techniques can help them:

1. Identify stressors and their effects on themselves and their children.
2. Use the provided strategies to better cope with these stressors.
3. Understand that some of their actions and attitudes are forms of non-positive parenting.
4. Adopt positive parenting techniques.

These expected changes have the potential to reduce violent interaction through two channels. First, better stress-coping strategies can help reduce stress and stress-induced violent reactions against children. Second, learning about positive parenting can increase awareness about the harmful effects of violent interactions and provide caregivers with alternative tools to discipline their children. In short, we expect the intervention to improve caregivers' mental health, change their attitudes about child maltreatment, and teach them positive parenting techniques. These changes should act as mediators to reduce the likelihood of abusing or maltreating their children.

2. Research Design, Hypothesis, and Measurement

2.1 Experimental design

We randomly assigned all enrolled caregivers who met the study's eligibility criteria to either the treatment or the control group with equal probability. We promoted the study through three channels: social media (Facebook), SMS sent by a mobile telephone provider (Tigo), and Glasswing International's network. The study's eligibility criteria required caregivers to be 45 years or younger and live in the same house with a child eight years old or younger. They also needed to provide their consent to receive digital messages and to participate in the study. Caregivers assigned to the treatment groups received the intervention, which -as explained above- consisted

of 27 SMS and WhatsApp messages sent over two months. Caregivers in the control group did not receive any intervention material. The random assignment provides a source of exogenous variation that allows us to identify the intervention's impact credibly. Four weeks after the intervention ended, we started collecting a follow-up survey among individuals in the control and the treatment group.

2.1 Randomization

We used a stratified individual-level randomization. We stratified the group of 3,103 individuals who completed the baseline survey based on two criteria:

- Gender: We expect differences in stress and parenting skills by gender. We will assess the heterogeneous effects of the intervention based on the caregiver's gender. There are 3,103 individuals, of which 59.94% are female.
- Enrollment modality: We enrolled participants using three alternatives: (i) dissemination through Facebook, (ii) enrollment through the Glasswing International's communities network, and (iii) dissemination through SMS and WhatsApp messages sent to Tigo clients.[3] As we show in Table 1, this last group constitutes our main sample. Given the potential differences between individuals contacted through these channels, we stratified the sample based on the enrollment modality to ensure treatment and control groups had an equal proportion of each of them.

Table 1: Summary of stratification sample

	Mode of Data Collection			**Total**
	Facebook	Glasswing Communities	SMS/WhatsApp	
	Female Caregiver			
	747	78	1035	1860
	Male Caregiver			
	312	11	920	1243
Total	1,059	89	1,955	3,103

[3]Tigo is one of the largest mobile phone providers in El Salvador.

Table 1 provides the size of each stratum in the sample. We did the random assignment on September 22, 2020, after concluding the baseline data collection with 3,103 respondents. We use a self-coded program in Stata 16. The two groups were balanced across several observable characteristics, including age, education, type of household composition, employment status before the quarantine, age of the children, income vulnerability of the household, primary outcomes, secondary and explorative outcomes.[4] Overall, our treatment and control sample is balanced in all 48 variables.

2.3 Hypotheses and Measurement of the Main Outcome Variables

This subsection describes our primary, secondary, and exploratory outcomes. This section describes each outcome as well as their measurement and treatment in the analysis.

We expect the intervention to directly improve treated individuals' mental health and indirectly increase their positive parenting habits. Treated individuals who engage with the material will have information to identify and better cope with stressors. This information—and the exercises proposed throughout the intervention—should allow them to practice techniques, such as mediation or mindfulness, to reduce stress and anxiety. They will also learn about positive parenting principles and techniques. We expect this learning to help them incorporate new positive parenting habits.

First, to evaluate the program's causal impact, we need individuals in the treatment group to take-up the intervention. To examine take-up, we collected information throughout the intervention about aggregate message readership and on the user experience and knowledge acquisition on a subset of respondents. These data are not subject to PAP since we analyzed it before submitting the PAP. We outline below our hypothesis. In Section 3.5., we describe in more detail the data analysis conducted outside of the PAP.

Hypothesis 1 —Compliance: Caregivers take up the intervention: The first hypothesis is that a considerable fraction of individuals in the treatment group received the intervention and engaged with the delivered material. We sent the material via SMS and WhatsApp messages. The material consists of videos, infographics, and short texts with information and exercises on stress-coping and positive parenting techniques. We expect individuals to view or read the material and practice some of the exercises. This first step is necessary for the intervention to impact behaviors and

[4] We define these outcomes categories in the next subsection.

attitudes. We tracked take-up using aggregate information on messages' reception and viewership. After examining hypothesis 1, we plan to analyze the effects on primary, secondary, and exploratory outcomes.

A. Primary Outcomes

We will measure the intervention's impact on six primary outcomes that are direct targets of the intervention.

Mental Health Status: We will measure this effect using mental health and impulsiveness indexes:

- *Hypothesis 2 – Improvement of caregivers mental health*. To measure mental health, we use the Depression, Anxiety and Stress Scale (DASS)-21 instrument. Following Lovibond and Lovibond (1996), depression is characterized by hopelessness, devaluation of life, lack of interest, and anhedonia. Stress is the degree to which an individual shows nervous arousal, difficulty in relaxing, impatience, and ease in getting agitated or irritable. Anxiety is characterized by a state of intense, excessive, and persistent worry and nervousness. The instrument includes a total of 21 items, divided into three sub-scales. Each item has a 0-3 points scale. The total score is the sum of all items corresponding to each sub category - i.e. of stress, anxiety and depression- multiplied by two. The first outcome of interest will consist of the standardized measure of the total score. We follow the literature and create an additional three indexes for each sub-category of mental health status to test the effects on stress, anxiety, and depression, with each index constituting one of the six primary outcomes.

- *Hypothesis 3 — Reduction of caregivers impulsiveness*. Impulsiveness broadly refers to an individual's tendency to act suddenly without thinking carefully about her actions' consequences. The psychology literature links this tendency to difficulties in planning, thinking carefully, enjoying challenging mental tasks and focusing on the tasks at hand, and inclinations towards acting on the spur of the moment and having racing thoughts (Patton et al., 1995). Recent studies have found suggestive evidence on how behavioral interventions to reduce automatic responses (a form of impulsive behaviors) can reduce criminal activity and violence (Heller et al., 2017; Dinarte and Egana-delSol, 2019). We use the self-report instrument of Barratt Impulsiveness Scale BIS-11 (Patton et al., 1995)) to measure impulsiveness. It includes 15 items, each of them with a 1-4 points scale. The outcome will be the sum of all

items and will take a value between 15 and 60 points. The greater the index, the higher the impulsiveness level. As our measure of impulsiveness, we will use a standardized value of this index.

Parenting Skills - Actions: Positive child-caregiver interactions are critical for a child's emotional and social well being (Cox and Harter, 2003). We focus on whether caregivers support children's learning and generate a stimulating environment for their development. We hypothesize that the intervention has a direct impact on parenting skills through its effects in the quality of interactions with their children.

- *Hypothesis 4 — Improvement of Caregiver-Child Interactions*: We expect the intervention to improve the interactions between children and their caregivers. This outcome is critical since positive caregiver-child interactions can be positively associated with children's emotional and social well-being (Cox and Harter, 2003). To collect this information, we use the Family Care Indicators instrument developed by UNICEF (Kariger et al., 2012). Specifically, we use the ten questions related to support for learning/stimulating environment and setting limits domains. Our outcome of interest will be one (standardized) index using information from these two sets of items.

B. Secondary Outcomes

Parenting Skills - Child Behaviour and Social Norms: We expect the intervention's impact on parenting skills and stress management to subsequently change caregivers' attitudes on corporal punishment and children's observed behavior. We test for these indirect effects on two secondary outcomes:

- *Hypothesis 6 — Improvement in norms regarding tolerance of violent parenting practices*: We expect the intervention to make caregivers revisit their attitudes towards violent disciplinary practices against children. Caregivers who resort to violent practices do not necessarily do it with the deliberate intention of causing harm or injury to the child. Instead, their use might stem from anger, frustration, or limited familiarity with non-violent methods (UNICEF, 2017). The expected changes in caregivers' emotional well-being and parenting habits—the primary outcomes—should increase their ability to employ non-violent disciplinary practices.

To measure attitudes, we use an index of attitudes towards violence against children following the International Society for the Prevention of Child Abuse and Neglect (ISPCAN) screening tool. We also combine this information with the tolerance towards hypothetical situations presented in two vignettes. Each respondent answer is coded into dummies from a 5 point Likert scale. Our main measure will be one joint standardized index of the responses in the ISPCAN module and the vignettes.

- *Hypothesis 6 — Observed child behavior is healthier*: We measure child behaviors through the lens of the caregiver. This outcome will be measured using the internalizing/externalizing behaviors sections of the Parent/Caregiver Report Survey developed by the World Bank. This section includes seven items that are reported by the caregiver. The outcome of interest will be one (standardized) index of these items.

C. Additional Exploratory Outcomes

Finally, we also identify two additional exploratory outcomes that might capture additional effects of the intervention.

1. *Hypothesis 7 — Reduction in the use of violent parenting technique*: We use two instruments to measure child disciplining habits from caregivers. First, we adapt the ISPCAN's Child Abuse screening tool and develop a shorter instrument with 11 items. The outcome will be the sum of all 11 items. The greater the index, the higher the perpetuation of violence. We acknowledge that self-reports can be affected by social desirability bias, particularly when they refer to sensitive information. To overcome this issue, we will complement self-reports with vignettes. We will present two fictional stories about regular parent-child interactions. After each story, we ask nine questions about parenting practices, and respondents respond using a 5-point Likert scale. The outcome will be the sum of all items separated by positive or negative discipline habits.

2. *Hypothesis 8 — Caregivers express interest in additional materials of the intervention*: We evaluate whether participants willingness to receive additional materials increases after the treatment. We offer individuals access to additional one-to-one meetings with trained staff from Glasswing International. To measure willingness to receive additional materials, we create

a dummy for whether participants declare wanting to receive additional items and if they register to attend such meetings.

3. Estimation Strategy

3.1 Main Estimation Equation

We use a Randomized Control Trial (RCT) to identify the intervention's causal impact on our outcomes of interest. The main identification assumption is that, had there been no intervention, our outcomes of interest would be, on average, statistically equal between caregivers assigned to the treatment and control groups. To support the validity of the assumption, we collected data on caregivers' pre-intervention characteristics. We found no difference in the means for 48 baseline characteristics - at a 5-percent or lower significance level.

To analyse the effects of the intervention we will estimate the interventions' impact by comparing the post-treatment means between treatment and control individuals for our outcomes of interest. We will use a linear regression model estimated by Ordinary Least Squares (OLS). Our basic model is given by equation 1 at the caregiver level i:

$$Y_i = \delta D_i + \sum_{j}^{n} \beta_j X_{ji} + S_i + \epsilon_i \tag{1}$$

where δ represents our coefficient of interest (ITT), and D_i is an indicator function that takes value 1 if the caregiver was assigned to treatment and zero otherwise. Y_i represents an outcome from our set of primary, secondary outcomes and exploratory outcomes defined in Section 2.3. S_i corresponds to the strata fixed-effects. $X_j i$ is a vector of j covariates measured at baseline, including the outcome level at baseline and a missing-value-at-baseline indicator if needed (see section 3.4C). Our identification strategy does not require to include covariates (X). However, we plan to do so to increase our estimates' precision and further enhance the validity of our empirical strategy (explicitly controlling for potential confounders). We plan to discuss the results' robustness to changes in the set of covariates (X). Since the randomization was done at the individual level and we do not expect any natural clusters in our sample, we plan to estimate and report heteroskedasticity-robust standard errors.

3.2. Heterogeneous Effects

The intervention focuses on stress-coping strategies and parenting techniques targeted to adults who frequently interact with children. In El Salvador, children usually spend more time with their mothers, who are commonly responsible for their discipline. Furthermore, a recent survey from El Salvador shows that mothers are the most common violence perpetrators against children, probably explained by their more frequent interaction. We thus expect the intervention to have a greater impact among female caregivers (relative to male caregivers).

We will test heterogeneous effects across genders. To do so, we will estimate an extended linear model with one more term, given by the product of an additional coefficient and a dummy variable resulting from the interaction of our treatment indicator and a female indicator. We will construct the female indicator using data on the respondent's self-reported gender (taking value 1 for female respondents and 0, otherwise). This extended model will allow us to test whether the intervention's effect is statistically different between male and female caregivers.

3.3 Multiple Outcomes and Multiple Hypothesis Testing

We will employ two different strategies to deal with the rich set of outcome measures. First, we will group the related outcome measures into an index as per the definition of each outcome described in Section 2.3. Second, to correct for multiple hypotheses testing, we will use a step-down procedure to adjust p-values for the false discovery rate (FDR) among groups of outcomes and report the resulting "q-values" (Benjamini et al., 2006). We will adjust for multiple hypothesis testing within primary outcomes and within secondary outcome groups, but not across them.

3.4. Variations from the intended sample size

A. Attrition

Attrition is generally a major concern when conducting phone surveys and the current pandemic augmented the uncertainty about what researchers should expect regarding attrition rates. We anticipate an attrition rate for the short-term follow-up survey of 30%. We expect that the rate should not be larger than that for the following reasons. First, this is a short intervention (2 months), and attrition rates are usually higher for longer interventions. Second, within this short period,

we engaged with caregivers twice: during the intervention (through the knowledge assimilation short-survey described in Section 3.5.) and soon after it was completed through the follow-up survey. Finally, to motivate parents to provide information during the follow-up survey, we will give them a small monetary incentive (US$ 1.5). Based on a similar approach we employed to collect data at baseline, this incentive effectively reduces sample attrition.

Nonetheless, we will test if attrition varies significantly among treatment and control groups at the 5% level. If attrition is not significantly different across groups, we will proceed with the evaluation plans outlined above. If attrition differs across treatment and control at the 5% level, we will proceed with the evaluation plans outlined above and bound the treatment effect using (Lee, 2009).

B. Non-compliance, take up and contamination

Non-compliance can take two different forms: individuals in the treatment group who do not take-up the intervention and individuals in the control group who receive it. We expect this latter issue to be minor. However, if we detect that there was contamination across groups – through responses in the monitoring surveys (described in Section 3.5) and in the endline survey – we will state that our estimated impacts are lower bounds of the total impact of the intervention.

The intervention's take-up rate was a concern from the onset of the study. We will use aggregate information on SMS and WhatsApp messages views to assess average take-up rates. We will present these figures as part of the analysis.

C. Procedures to addressing missing data and outliers

To account for missing responses, we will implement the following procedure. First, if strictly less than 10 percent of the information is missing, we will recode the missing values for that variable to the overall mean. If more than 10 percent of values are missing, we will include a missing information dummy as an additional variable in the main estimation (missing-value-at-baseline indicator) and recode missing values to the overall mean for the continuous variables and to zero for the binary ones.[5]

[5] As an alternative, we can incorporate the information on baseline values of the outcome of interest following a similar procedure as in Krueger and Zhu (2004).

D. Procedures to addressing outcomes with limited variation

If some variables present limited variation, we will conduct the following steps. First, we will assess if such limited variation implies that 95 percent of observations have the same value within the treatment group. If so, we will omit this variable from the analysis - including all index measures. If these decisions result in excluding all variables that form an index, we will exclude the index from the evaluation.

3.5. Data analysis outside of the Pre-Analysis Plan

At the submission of this PAP, we have already collected and analyzed data gathered during the project. Below, we describe these data and their use:

- Enrollment Survey: For the recruitment of participants, we partnered with Tigo, the second largest phone company in El Salvador. Tigo sent an enrollment SMS to clients fitting the characteristics of our enrollment. In this SMS, each respondent received a link directing them to a platform inviting them to participate in the study. First, the site asked each person three questions to verify his or her eligibility for the intervention. These questions included if the respondent was the main caregiver of a child aged 0-8 years, their gender, and age. This data was kept in the records even if the respondent did not continue in the study.

- Baseline Survey: The data for the baseline survey was collected for all respondents who were eligible to participate in the study, provided their consent to participate in the survey, and completed the baseline. At the time of submitting the PAP, we analyzed these data to conduct the randomization.

- User Experience and Monitoring: After initiating the roll-out of intervention, we conducted a four-question survey on a sample of 751 respondents (in treatment and control groups). The analysis of these data is not part of the PAP as we used it to understand the intervention's take-up and assimilation during the months of implementation. These data will be used in the main analysis but not as a pre-registered primary outcome. The exclusion of these data from this pre-analysis plan responds to the need to analyze them soon after their collection and during the intervention period to monitor the intervention's reach and satisfaction. In addition to this survey, we collected information on the rate of SMS and WhatsApp messages

opened by users. We verified that approximately 70% of the individuals who received the messages opened them. We used this information to monitor the implementation of the intervention. This information will be used in the evaluation but does not constitute a primary outcome.

4. Timeline

The baseline data collection was initiated on August 10, 2020 and completed on September 20, 2020. The intervention was launched on September, 25 of 2020, after achieving a successful randomization. The intervention was completed on November, 6 2020. The endline data collection started on December 4, 2020, and is expected to be completed in February, 2021.

5. Administrative Disclosures

A. Ethics Approval

This research project's protocol was reviewed and approved by the Institutional Review Board (IRB) at the *Universidad Francisco Gavidia* in El Salvador on May, 4 2020 with the approval ID No. 003-2020.

B. Funding

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C. Declaration of interest

The authors have no conflicts of interest to report.

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