Intimate Partner Communication and Early Stimulation during Pregnancy in Northern Ghana

by

Jessica Mackness
Duke Global Health Institute
Duke University

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Approved:

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Joy Noel Baumgartner, Advisor

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Eve Puffer

_____

Lavanya Vasudevan

Thesis submitted in partial fulfillment of
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ABSTRACT

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Abstract

Background: Global research on early childhood development is growing; however, there is still an evidence gap regarding how caregiver characteristics can affect a child's development. Early childhood development begins at conception and family environment can influence the development of a child in utero. This study focused on the maternal-fetal relationship during pregnancy and how it is influenced by caregiver characteristics, specifically intimate partner communication. The aim of this study was to describe the maternal-fetal relationship through a series of bonding activities called early stimulation behaviors and to examine the relationship between early stimulation behaviors during pregnancy and intimate partner communication.

Methods: Study data are from a pre-intervention survey of a cluster randomized trial in two districts of Northern Ghana. A total of 376 pregnant women were enrolled at baseline with informed consent. Intimate partner communication was assessed using the Constructive Communication Subscale, derived from the Relationship Quality Index. Early stimulation behaviors were the primary outcome and was evaluated using four maternal-fetal bonding activities. A generalized linear mixed model with random effects was used for bivariate and multivariable analyses.

Results: Touching and talking was the most frequently performed early stimulation behavior by expectant mothers. Experiences of higher levels of intimate partner

communication, physical intimate partner violence, and moderate to severe depression were positively correlated with an increase in stimulation behaviors performed by the expectant mother. Exploratory analysis showed that higher levels of emotional intimate partner violence and more frequently performed early stimulation behaviors had a positive association with intimate partner communication, while higher levels of Hope Score has a negative association. Development and evaluation of strategies to promote early stimulation behaviors during pregnancy are important for ensuring that all children research their developmental potential.

Contents

List of Tables

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1. Introduction

1.1 Early Childhood Development

In 2018, the World Health Organization (WHO), UNICEF and the World Bank published the Nurturing Care Framework to outline the importance of addressing and putting resources towards early childhood development.[1] Early childhood development (ECD) is defined as 'children's cognitive, physical, language, motor, and social and emotional development, between conception and age 8[1]. The maternal-fetal relationship, which focuses on interactions and feelings the mother has towards her unborn child, is one the first opportunities to create a nurturing relationship between caregiver and baby[2]. This relationship also opens a window for mothers to begin simple ECD behaviors during pregnancy.

In Sub-Saharan Africa, 94. 8 million children under five are at risk of not reaching their developmental potential, which is greater than all other low-to-middle income country (LMIC) regions[3]. Sub-Saharan Africa has the highest rates of stunting and extreme poverty which were used as the key indicators to determine the relative risk of each region because they are directly linked to children's development. The concept of ECD is multifaceted, as seen in the Sustainable Development Goals (SDGs) where several of the SDGs including hunger, health, education and justice have targets on malnutrition, child mortality and early learning and violence, which all aim to improve early childhood development. Focusing on policies and programs that target ECD not

only improves neonatal outcomes, but it also creates the foundation for health, well-being and productivity from childhood to adulthood [1]. Heckman (2006), showed that remedial programs for adolescents and adults are more costly than early interventions. Consequently, investing in early childhood development is the most efficient way to create the human capital needed to grow economies and eliminate extreme poverty and inequities in societies[1,4].

1.2 Early Stimulation during Pregnancy

As mentioned above, early childhood development begins at conception. The prenatal period is arguably the most overlooked time regarding ECD, and this can have serious repercussions because during this period, the brain undergoes rapid development that leads to developing neural processing capabilities and the ability to learn[5]. In utero, touch is the first sense to develop around 14 weeks gestation followed by response to sound at 22 to 26 weeks gestational age (GA) and fetuses can even start to distinguish between mother's and father's voice later in the pregnancy. Studies have shown that learning begins in the womb. When a fetus is exposed to stimuli like music and voices at 34 weeks GA, and the newborn will subsequently perceive the stimulus similarly to that experienced prenatally [5]. This demonstrates that cognitive functions like short and long-term memory begin during pregnancy.

Bonding between a mother and her unborn child has been shown to have long-term impacts on the child's development. A systematic review of maternal-fetal

attachment and infant developmental outcomes suggested that there is some evidence that higher maternal and baby bonding during pregnancy is related to higher developmental outcomes for that unborn child[6]. The papers included in the review all used the Prenatal Attachment Inventory (PAI), Maternal-Fetal Attachment Scale (MFAS), or the Maternal Antenatal scale subscale to assess the quality of the maternal-fetal relationship. In addition, the review found that infants had more positive responses to new places, persons, and events when their mother had more positive feelings and thoughts towards the unborn child during pregnancy. There are several ways for mothers to bond with their unborn child during pregnancy; simple activities like touching and talking to her belly or any activity she finds joyous like a prenatal yoga class or reading out loud. In resource limited settings, activities like touching and talking to the belly, as well as, singing and dancing might be more common because they can be done anytime and independently. All of these parental bonding activities, regardless of setting, have been shown to enhance maternal-fetal attachment, especially at higher gestational ages when the expectant mother can feel the movement of their child[7,8]. A few studies have suggested that lower maternal- fetal attachment is associated with suboptimal developmental outcomes; however, these studies were of low quality and results must be interpreted with caution[6]. More robust research is needed to determine if the maternal-fetal attachment has an impact on the development of the child.

1.3 Family Environment and Maternal Relationships

According to the WHO Nurturing Care Framework, there are several factors that can threaten early childhood development. The biggest threats are poor mental health of caregivers, extreme poverty, food insecurity, gender inequities, violence within the home or community, and environmental toxins[1]. Mental health of the caregivers, food insecurity within the home, and violence between intimate partners were explored further in this study. The feeling of hope is known to have a role in the mental well-being of individuals and can even act as a protection against stress and illness, therefore it was also examined[9,10].

There has been extensive research on early childhood development and the importance of good caregiver mental health, but there is still a research gap regarding how other caregiver characteristics such as relationship quality can affect a child's development either directly or indirectly[7,11]. Communication between romantic partners can be a strong predictor of relationship quality. This is especially true for destructive communication behaviors which are linked to lower relationship satisfaction and higher rates of divorce or break-ups[12,13]. Intimate partner communication, along with conflict and commitment are considered three fundamental aspects to a successful relationship because they lead to a sense of safety in a romantic relationship[12].

Communication between couples can affect the overall environment that children are raised in. The literature reflects how an unhealthy family environment can have long-term negative effects on a child's psychosocial development. In Repetti et al., they define

risky families and environments as those ‘characterized by conflict and aggression and by relationships that are cold, unsupportive, and neglectful’[14]. The term ‘nurturing care,’ as outlined in the WHO’s framework, specifically refers to conditions that protect children from threats and allows for opportunities for responsive and emotionally supportive caregiving, which cannot be achieved in a risky family environment.

Destructive family environments can negatively impact the mental health of caregivers and can have long-term effects on a child’s development[1]. In low-to-middle income countries, there is a higher prevalence of perinatal mental disorders because of increased risk factors like socioeconomic stress, normative views on intimate partner violence and even unplanned and unwanted pregnancies[15]. Maternal mental health during pregnancy can play a major role on maternal-fetal bonding and consequently can lead to preterm birth, low birthweight, and poor infant growth and reduced cognitive development[16]. Intimate partner violence (IPV) is one known factor to affect the mental health of women[1,17]. Twenty-eight percent of women agreed that that a husband is justified in beating his wife if she did one or more of the following behaviors: burns the food, goes out without telling him, neglects the children, refuses to have sexual intercourse. There is a strong association between mental health and IPV, especially during pregnancy when incidences of violence can increase[18]. Experiences of IPV are theoretically related to the construct of relationship quality among romantic partners and could be associated with poor caregiver mental health. Like early childhood development, relationship quality among romantic partners is complex and is affected by

several factors and could influence all aspects of pregnancy and raising a child. Other factors that have been shown to impact marital quality are decision making, age of both partners, and communication[19].

There have been recent studies that have explored feelings of intimate partner attachment as a predictor of maternal-fetal relationships, but results have been mixed and have exclusively taken place in high-income settings[20,21]. These studies have focused on dimensional measures of romantic attachment like security, responsive caregiving, and avoidance, but fail to highlight the underlying determinate of these behaviors, like conflict and communication. The purpose of this paper is to focus on pregnant women's relationship quality via intimate partner communication and associated factors that could potentially lead to fewer stimulation behaviors during pregnancy.

The overall goal of this study is to better understand foundational aspects of partner relationships and how it correlates to the maternal- fetal relationship in a low-income setting. The first aim of this paper is to describe early stimulation behaviors during pregnancy among Ghanaian women in the northern region. The second and third aims are to describe romantic partner communication using the Constructive Communication subscale and determine the correlation between intimate partner communication and early stimulation behaviors using bivariate and multivariable analyses. The last aim is exploratory and looks at other factors associated with the Constructive Communication subscale and to describe their relationship. Through the findings from this paper, we hope to inform future programs in LMICs about the role of

strengthened communication between romantic partners, and its effects on creating a nurturing family environment, with the overarching goal of helping children to reach their full developmental potential.

2. Methods

2.1 Study Overview

This study uses pre-intervention baseline data from a parent study that was designed as a longitudinal, cluster randomized control trial (NCT03665246) to evaluate the impact of a maternal mental health/ECD intervention called *Integrated Mothers and Babies Course (iMBC)*[22,23]. The course uses cognitive behavior therapy (CBT) to help mothers better navigate their thoughts during pregnancy to improve their overall mood, and consequently be a better caregiver. The study was a collaboration between Duke University and Catholic Relief Services (CRS). CRS served as the in-country organization facilitating the intervention along with approval and support from the Ghana Health Service. IMBC is part of CRS' Rural Emergency Health Service and Transport (REST II) project that aims to scale-up community-based approaches to health services for improved maternal, newborn, child health, and nutrition practices (MNCHN). One of the main activities of REST II is Community Surveillance and Targeted Education Sessions (C-Pres). These sessions are delivered in a group setting of about 20-25 women and promote the uptake of key MNCHN behaviors like the exclusive breastfeeding and proper nutrition during pregnancy. C-PrES sessions were delivered by community health volunteers called model mothers, either bi-weekly or monthly. CRS used a subsample of C-PrES groups to implement the iMBC program content, thereby creating control and intervention groups. Women in the iMBC course received all the same information as the

C-PrES group, but with added information on stressors during pregnancy and how to better manage those stressors to decrease the risk of future depression. See Appendix B for a detailed timeline of the overall study.

2.2 Setting

Pre-intervention baseline data was collected in September 2018, with the intervention taking place between December 2018 and June 2019. The study took place in 32 communities in the West Mamprusi Municipality and the Nabdam District of Northern Ghana. These areas are considered rural populations where a majority of the residents are in the lowest wealth quantile[18]. These districts were chosen because of their high under-5 mortality rate with 111 deaths per 1,000 live births[24].

2.3 Participants

The target population was pregnant women during baseline enrollment. The study enrolled women who were pregnant at baseline, 16 years or older, attended C-PrES groups at the time of the baseline survey and planned to maintain residence in the community for at least six months. Mothers who were not pregnant, younger than 16, did not attend C-PrES groups and planned to travel to another area were excluded from the study. To achieve a power of at least 82%, it was calculated that a sample size of 144 in group one and 80 in group two, which was obtained by sampling 16 clusters with an

average of 9 subjects in group one and 16 clusters with an average of 5 subjects in group 2, was needed. This data is part of a longitudinal study with follow-up data collection at immediate post-intervention and 6 months post-intervention. To ensure the power remains above 80% even with loss to follow-up between data collection times, a sample size of 200 participants per arm was determined, with a maximum of 400 total participants.

2.4 Procedures

The study is a cluster randomized trial in two districts of Northern Ghana. Before the survey was collected, all participants gave their informed consent via signature or thumbprint with a witness. Data was collected via self-report questionnaire on a tablet-based platform and administered by research assistants who spoke the local language, Mampruli and Nabt. Data was captured by a data collection application called CommCare by Dimagi (CRS held an active license for our use). The Duke research team created and designed the survey on CommCare and pre-tested it before it was published for the study. All research enumerators were fully trained on how to navigate the application and properly administer the survey.

All surveys were conducted at the participant's home or at another agreed upon location within the community with the help of enumerators. The enumerators took an online ethics training and attended a one-week training with the Duke team to certify

ethical data collection practices. Surveys were administered in a private location to ensure confidentiality. All surveys were translated and conducted in the language appropriate to the community. Mothers who participated in the survey were compensated with two bars of soap.

There was no risk of physical harm or discomfort to the mothers, but there was a potential for mothers to feel upset when answering questions related to domestic violence or their mental health. To ensure the wellbeing of the participants, research assistants were trained to reiterate the voluntary nature of the study and gave the mothers the choice to skip questions that they were not comfortable answering. Additionally, if participants endorsed suicidal ideations, research staff would give a referral to district social welfare and mental health officers for further support per guidelines from the Ghana Health Service for appropriate mental health follow-up procedures. If participants indicated domestic violence, they were given a choice if they wanted a referral to the Domestic Violence and Victim Support Unit through the District Gender Officer.

2.5 Ethical Approval

This study was approved by the ethical review boards at Duke University Campus IRB (ID# 2019-0020) and the Navrongo Health Research Centre Institutional Review Board (ID # NHRCIRB314).

2.6 Measures

2.6.1 Early Stimulation Behaviors during Pregnancy

The main outcome variable for this study was pregnancy stimulation behaviors performed by the pregnant women towards their pregnant belly. These behaviors included touching/talking to her belly, singing songs, dancing, and talking to her belly about family. These were example stimulation behaviors that Catholic Relief Services used in their Early Childhood Development programmatic materials. As part of the original survey, two additional questions were asked regarding whether the father touches/talks to the expectant mother's belly and if other children touch/talk to the belly (also part of CRS program materials). It was decided to not include these two questions in analysis because there were several confounding factors such as living situation, parity and relationship status that could interfere with the results. Response categories for each of the maternal early stimulation behaviors were 'Never', 'Rarely', 'Sometimes', and 'Frequently' and each was scored 0-3 respectively. Because several of the individual items had low cell counts, there were issues in estimation and potential non-convergence. Additionally, when factor analysis was performed for each of the four behaviors, results indicated that they lent themselves well to combining into one continuous score because factor analysis showed that they all load highly into one factor. Because there was only one factor the total score can be weighted by the factor loadings. The scores were

transformed into a weighted composite score and analyzed as a continuous variable which a range from 0 to 8.

2.6.2 Intimate Partner Communication: Constructive Communication Subscale

The primary exposure was relationship quality, which was measured via a seven-item communication subscale, derived from the Relationship Quality Index (RQI)[25]. The RQI has been tested in Malawi; however, there is still a need to validate the tool and the Constructive Communication Subscale in other contexts. The Constructive Communication subscale is divided into a three-question constructive and a four-question destructive scale. Responses were on a 5-point Likert scale, ranging from very unlikely (0) to very likely (5). Scale scores ranged from -17 to 11. The sum of the four items assessing destructive communication behaviors was subtracted from the sum of the three items assessing constructive communication behaviors to create the total intimate partner communication score[26]. The three items assessing constructive communication were: couples discuss problems, expressing feelings to each other, and suggest possible solutions and compromises. The four items assessing deconstructive communication were: couples blame each other, threaten each other with negative consequences, male partner calls the woman names and attacks her character, and female partner calls the man names and attacks his character.

2.6.3 Mental Health

Mental health of a caregiver is known to lead to poor early childhood development outcomes for their child[1]. The mental health of participants was evaluated using the PHQ-9. The PHQ-9 is a nine item self-report questionnaire used to screen for depression symptoms[27]. This tool has been validated in several low-to-middle income countries, as well as in pregnant populations[28]. Scores are categorized into 'None', 'Mild', 'Moderate', 'Moderately Severe' and 'Severe'. For the purpose of this study we dichotomized the score into 'None to Mild' and 'Moderate to Severe' depression symptoms during data cleaning and analysis. The Cronbach's alpha for the PHQ-9 was 0.825, indicating high internal consistency.

2.6.4 Household Hunger

Household hunger was evaluated using the Household Hunger Scale (HHS). This scale has been validated in several LMICs and is used as an indicator to measure household hunger in food insecure areas[29]. Four initial questions were asked to assess if anyone in the household in the past 30 days has gone a whole day and night without eating, gone to sleep hungry, if there has been no food of any kind in the house to eat due to lack of resources to get food, and if the respondent worries about not having enough food. The responses to these questions were either 'Yes", 'No', or 'No Response'. If the participant answered yes to any of the 4 previous questions, then another question asking how often this particular event happened with responses: 'Rarely (1-2 times)', 'Sometimes (3-10

times)' and 'Often (more than 10 times)'. During data cleaning, responses were categorized into 'Little to No Hunger', 'Moderate Hunger' and 'Moderate to Severe Hunger'.

2.6.5 Intimate Partner Violence

DHS data from Ghana indicates a high prevalence of intimate partner violence (IPV), with the highest rate in the northern region[30]. For this study, 23 questions, taken from the Ghana DHS IPV module, covering four different forms of IPV: controlling behaviors, physical, sexual and emotional, were asked to participants in a private location. Answers ranged from frequently to never and allowed for a no response option. Responses were dichotomized into yes or no for analysis.

2.6.6 Hope

Hope of the participants was measured using the 12-question Herth Hope Index and analyzed as a continuous variable with score ranging from 12 to 48, with higher score indicating higher feelings of hopefulness. The Cronbach's alpha for the hope measure was 0.795, indicating high internal consistency.

2.7 Data Management and Analysis

All researchers involved in cleaning and data analysis used de-identified data. During data collection, all participants were given a dyad-id to de-identify them for data analysis. The data collection platform, CommCare, can be used offline and store the data while out

of range from cellular connection. Data can then be transferred to the database once wireless connection is established. Once data was uploaded and synced with the main database, an Excel document was downloaded from CommCare. This Excel file was then uploaded into STATA version 13 and cleaned for analysis by the Duke research team.

As described in section 2.6.1, pregnancy stimulation behaviors were transformed into a continuous variable. This decision was made to ensure that we limited the chance of potential non-convergence and any estimation issues. There is no current literature on what is considered optimal amounts of maternal-fetal bonding activities, so for the purpose of this study we did not want to assign arbitrary cut-offs.

A generalized linear mixed model with random effects was used for the bivariate and multivariable analysis. This model was specifically chosen because of the clustered nature of the data. For the bivariate model, the correlation between the early stimulation factor score and each covariate was evaluated. The multivariable model was determined by including both *a priori* variables and excluding non-significant variables at the p-value level of 0.10 [8,31]. A generalized linear mixed model with random effects was also used for exploratory analysis of variables associated with intimate partner communication via the Constructive Communication Subscale. A bivariate model was run with all the same covariates as before, but with intimate partner communication as the main outcome variables. A multivariable model was then run with all the significant covariates.

3. Results

3.1 Description of Sample-Demographics

A total of 376 women were enrolled at baseline, a sufficient number to reach our goal of 80% power. The second column of Table 2 shows the socio-demographics of the study population. A majority of the women who participated in the study were between 16 and 34 years of age and have had two or more children. A little less than half of the woman have never attended school. Almost 80% of participants have had more than one previous birth. Ninety percent of women were living with their romantic partner. About 20% of the women reported having moderate to severe depression symptoms in the past three months One-third of women reported having experienced controlling behaviors by their partners. Forty-three percent experienced emotional, 27% physical and 19% sexual forms of IPV. Twenty-seven percent of women reported having moderate to severe household hunger within the past 4 weeks. The mean hope score was normally distributed with a mean score of 38.1 a range of 27 to 48.

3.2 Description of Early Stimulation Behaviors

Table 1 shows the overall frequency of early stimulation behaviors performed by all 376 participants. Forty-six percent of expectant mothers reported that they frequently or sometimes touch and talk to their belly. Singing and dancing was performed sometimes

or frequently by about 18% and 26% of women, respectively. Less than 15% of expectant mothers reported sometimes or frequently telling about family to their child in utero. Touching and talking to the belly was the most performed attachment behaviors, while telling about family was the least performed.

Table 1: Early Stimulation Behaviors Performed by Pregnant Women (N=376)

Parameter	Total n (%)
Touching and/or talking to the belly	
Never	159 (42.3)
Rarely	43 (11.4)
Sometimes	133 (35.4)
Frequently	41 (10.9)
Singing	
Never	269 (71.5)
Rarely	40 (10.6)
Sometimes	58 (15.4)
Frequently	9 (2.4)
Telling about family	
Never	285 (75.8)
Rarely	36 (9.6)
Sometimes	50 (13.3)
Frequently	5 (1.3)
Dancing	
Never	241 (64.1)
Rarely	39 (10.4)
Sometimes	89 (23.7)
Frequently	7 (1.9)

3.3 Description of Intimate Partner Communication during Pregnancy

Data on intimate partner communication was normally distributed with a skewness of -0.02 and a kurtosis of 3.33. Cronbach's alpha for the seven-question scale was 0.76, showing high internal consistency. The mean intimate partner communication score was -3.90 with a range of -14 to 6 and a standard deviation of 3.45. A majority of women reported having average partner communication.

3.4 Bivariate and Multivariable Models to Estimate Predictors of Early Stimulation Behaviors during Pregnancy

A generalized linear mixed model with random effects was used to run bivariate and multivariable analysis. In the bivariate model, early stimulation behaviors were moderately correlated with moderate to severe depression (*p-value 0.052*), reported experiences of physical IPV (*p-value 0.056*), and higher intimate partner communication (*p-value 0.049*); see Table 2 for results. Moderate to severe depression had a beta coefficient value of 0.411 (*C.I -0.004,0.825*) and physical IPV had a coefficient of 0.346 (*C.I -0.009,0.701*). In the multivariable model, only physical IPV remained significant (*p-value 0.075*) and had a coefficient of 0.331 (*C.I -0.034,0.697*), indicating a positive trending correlation with early stimulation behaviors. Intimate partner communication and depression were no longer significantly associated; see Table 2 for results.

Table 2: Mixed Effects linear regression of early stimulation behaviors factor score with socio-demographic factors as main predictors

		Bivariate		Multivariable	
Variable	**Total n (%)**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
Age:			0.784		0.443
16-24	151 (40.2)	REF		REF	
25-34	156 (41.5)	0.121 (-0.229,0.471)		0.313 (-0.185,0.811)	
35-50	69 (18.4)	0.030 (-0.415,0.474)		0.374 (-0.294,1.042)	
Education (ever attended)			0.294		0.283
Yes	193 (51.3)	0.181 (-0.157,0.519)		0.202 (-0.167,0.571)	
Parity			0.821		0.464
1	82 (21.8)	REF		REF	
2-3	128 (34.0)	0.103 (-0.331,0.537)		0.075 (-0.406,0.555)	
4+	166 (44.2)	-0.005 (-0.419,0.408)		-0.223 (-0.872, 0.425)	
Relationship Status			0.578		0.280
Not living with romantic partner	38 (10.1)	REF		REF	
Living with romantic partner	338 (89.9)	-0.148 (-0.672,0.375)		-0.197 (-0.748,0.354)	
Depression (PHQ-9)			0.052		0.123
None to Mild	302 (80.3)	REF		REF	
Moderate to Severe	74 (19.7)	0.411 (-0.004,0.825)		0.334 (-0.091,0.759)	
IPV (past 12 months)					
Controlling Behaviors	282 (75.0)	0.188 (-0.181,0.557)	0.317	--	--
Emotional	162 (43.1)	0.217 (-0.104,0.539)	0.185	--	--
Physical	102 (27.1)	0.346 (-0.009,0.701)	0.056	0.331 (-0.034,0.697)	0.075
Sexual	71 (18.9)	0.241 (-0.167.0.650)	0.246	--	--
Household Hunger			0.339	--	--
Little to None	247 (72.9)	REF		--	
Moderate	95 (25.3)	0.161 (-0.214,0.535)		--	
Severe	7 (1.9)	0.763 (-0.408,1.934)		--	
Hope Score	38.1 (3.8)		0.487	--	--
	27-48	0.015 (-0.027,0.057)		--	
Intimate Partner Communication (Mean, S.D)	-3.90 (3.45)		0.049		0.100
Min and Max	-14 - 6	0.049 (0.000,0.094)		0.040 (-0.008,0.087)	
ICC	0.214				

3.5 Factors Associated with Intimate Partner Communication

Exploratory analysis was conducted to determine if there were other factors associated with intimate partner communication via the Constructive Communication subscale. A bivariate analysis using a generalized linear mixed model with random effects was performed on all previous covariates from Table 2. Emotional intimate partner violence had a p-value of 0.002 and a coefficient of 1.115 (*C.I 0.424,1.808*). The total hope score had a p-value of 0.001 and a coefficient of -0.147 (*C.I -0.237, -0.057*). Lastly, early stimulation behaviors had a p-value of 0.039 and a coefficient of 0.227 (*C.I 0.011,0.0442*) in the bivariate model. An adjusted multivariate model was run, and all three covariates remained significant at the 0.05 alpha level.

Table 3: Exploratory Analysis of Factors Associated with the Intimate Partner Communication as measured by the Constructive Communication Subscale

Maternal Variables	**Estimate (95% CI)**	**P-Value**	**Estimate (95% CI)**	**P-Value**
	Bivariate		**Multivariable**	
Early Stimulation Behaviors	0.227(0.011,0.442)	0.039	0.215 (0.004,0.427)	0.046
Experienced Emotional IPV	1.115(0.424,1.808)	0.002	0.901(0.204,1.598)	0.011
Hope Score	-0.147(-0.237, -0.057)	0.001	-0.131(-0.221,-0.041	0.005

*All other covariates from Table 2 were run. Only significant results are shown in Table 3.

4. Discussion

The purpose of this study was to help illuminate factors associated with early stimulation behaviors during pregnancy and how it relates to improving early childhood development outcomes. The study population demographics, including education, number of children, marital status and age, all reflected similar characteristics of those documented in the 2017 Ghana Maternal Health Survey at the regional level, making this study population representative of the region[30]. Regarding measurement of early stimulation behaviors during pregnancy, touching and talking to the belly was the most frequently performed early stimulation behavior, with almost 50% of mothers reporting they did this behavior frequently or sometimes. It appears that this particular behavior is more widely recognized as an indicator of attachment because it is seen in tools like the Maternal Fetal Attachment Scale and the Prenatal Attachment Inventory, both of which have questions related to the mother touching or talking to her belly as a way to assess the level of maternal-fetal attachment[2,32]. The three other behaviors: singing, dancing and telling about family, were overwhelmingly performed never or rarely by expectant mothers, suggesting that they might not be good indicators and/or culturally relevant. There is sparse research on how frequently pregnancy stimulation behaviors should be performed or what specific behaviors lead to optimal developmental outcomes; however, there is some evidence to suggest that these types of behaviors may lead to higher maternal-fetal attachment[7]. Higher maternal-fetal attachment can lead to a stronger maternal-infant relationship and the maternal ability to care for and create a nurturing environment for

her child, all of which can potentially lead to a reduced risk of developmental delays[1,8]. In order to better to understand factors associated with early stimulation behaviors, we looked at number of potential covariates, in particular, intimate partner communication as the main predictor.

Intimate partner communication showed a slight significant correlation with early stimulation behaviors. As partner communication increased, so did the frequency of the bonding behaviors performed by the expectant-mothers. This finding aligns with other literature, which suggests that communication is foundational to a healthy relationship and a healthy relationship can lead to caregivers having better mental health[1,12,14]. When we adjust for other covariates, there is still a positive correlation between intimate partner communication and early stimulation behaviors, but not at a significance level of 0.05. While the p-values do not fall within the standardized 0.05 alpha level, these results are still potentially informative for future inquiry, as they are trending in the intended direction. Current literature has made a case for accepting p-values that do not fall at or below the 0.05 significance level, but instead encourage thoughtful research and being open to results that might be useful for informing future studies.

Bivariate analysis showed that incidence of physical intimate partner violence was significantly correlated with early stimulation behaviors. This is also the case for in the multivariable model. Even though the results were not significant at a 0.05 level, they are still helpful for generating hypotheses for future research. There were high rates of intimate partner violence across all four categories: controlling behaviors, emotional,

physical and sexual. Controlling behaviors and emotional IPV were the most frequently experienced forms of violence. One study that looked at the prevalence of IPV in the Central region of Ghana reported much lower rates of all four forms of IPV and found that physical and sexual IPV were the most experienced by women in the area[34]. These contrasting findings could be due to the difference between the Central and Northern regions of the country. The Central region of Ghana is more urban, while the Northern region is more rural and these areas tend to be less educated, poorer and have more married women. Those three factors are shown to be associated with an increase in approval of physical violence[18]. Future studies should be conducted to examine the prevalence of IPV among all ten regions individually.

This study additionally looked at incidence of maternal mental health, reflected by depression symptoms during pregnancy. Twenty percent of women reported symptoms that indicated moderate to severe depression. This number is extremely high, but concurrent with other studies using the PHQ-9 to screen mothers for probable depression in Ghana[28]. More severe depression had a significant association with an increase in early stimulation behaviors in the bivariate model but was lost in the multivariable model.

Moreover, we hypothesized that household hunger and hope might have a significant correlation with early stimulation behaviors, especially in the bivariate model. Hopefulness and/or lack of food security could be influential factors of an individual's stress and mental well-being and therefore thought to impact both intimate partner communication and performing early stimulation behaviors[1,38]. This is a point for further

research and exploration of caregiver characteristics that influence maternal-fetal bonding.

These results are particularly interesting because we would inherently think that maternal-fetal bonding would increase when the caregiver is in a positive state of mind and relationship; however, this is not what the results show. The data appears to indicate that those women who more frequently engage in early stimulation behaviors are also those who experience higher levels of physical intimate partner violence and symptoms of moderate to severe depression. There could be several reasons for this response. One theory would suggest that the mother is trying to protect her unborn child from harm in cases of IPV, and therefore, touches and holds her belly as a way to reduce the fetus' exposure to physical violence[35]. Physical intimate partner violence is known to cause negative birth outcomes and an increase risk of a stillbirth[36]. Another potential reason for an increase in early stimulation behaviors when a mother is faced with physical or mental difficulties could be that it is a coping mechanism for the women. The expectant mother might feel the most connected emotionally to her unborn child and therefore turns to that maternal-fetal relationship for reassurance. This reasoning is supported by attachment theory that states that attachment involves seeking care from someone who can provide security and comfort[20,37]. This theory is usually used to describe the unborn child's relationship to their mother; however, in this case, the expectant mother is seeking comfort and a sense of protection from her unborn child, when she is faced with hardships in her life. This is a novel hypothesis because all literature surrounding the

maternal-fetal relationship has not looked at this kind of attachment seeking behavior. In the multivariate model, when all factors were accounted for, physical IPV remained significant. Or, there is another unknown factor at play here and more qualitative research could help identify an underlying relationship if this quantitate finding holds true in future studies as well.

Intimate partner communication was looked at independently in an exploratory analysis as dependent variable and emotional IPV, hope, and early stimulation behaviors were significantly correlated both in the bivariate and multivariate model. The positive correlation with early stimulation supports initial finding of association between these behaviors and intimate partner communication in Table 1. In this model however, there was a greater significance and a stronger correlation between higher couple communication and an increase in frequency of early stimulation behaviors. This could be due to more awareness and excitement around the unborn baby, and subsequently leading to more communication between partners because they feel closer to each other and they are planning for the child's future. We see that emotional IPV also had a conflicting result like physical IPV had with early stimulation. Additionally, the Hope Score showed a contradictory result as well; as hope increased, intimate partner communication decreased. Emotional IPV is associated with destructive communication between couples; however, the Constructive Communication Subscale include a constructive communication component. More research should be done looking at the

correlation of constructive and destructive communication on incidence of emotional IPV.

4.1 Implications for policy and practice

Even though touching and talking to the belly was performed by almost 50% of the participants, there is still an opportunity to increase the frequency of early stimulation behaviors during pregnancy. A majority of programs during the prenatal period focus on adequate nutrition and maternal mental health in hopes of increasing positive birth outcomes and promoting a nurturing environment. Encouraging and bringing awareness of the benefits of early stimulation behaviors to increase maternal-fetal attachment, can also have the same positive benefits as these other parental programs. Another way to reach the greatest number of expectant mothers, is to introduce messages about early stimulation behaviors during first the antenatal care (ANC) visit. By incorporating this into ANC visits, mothers can be reached early on in their pregnancy and start engaging with their unborn child sooner.

Based on the socio-demographic data, there was a high incidence of intimate partner violence, among all four categories: emotional, physical, sexual and controlling behaviors. Because of this finding, more programs should address the detriments of IPV during pregnancy and the threat it has towards a nurturing environment after delivery.

4.2 Implications for further research

Little is known about how frequently or what kinds of early stimulation behaviors during pregnancy result in the best developmental outcomes for children. Future longitudinal studies should be conducted to explore developmental outcomes in children with differing frequency of maternal-fetal bonding behaviors during varying gestational ages. Tools like the Maternal Fetal Attachment Scale (MFAS, Prenatal Attachment Inventory (PAI) and the Maternal Antenatal Attachment Scale (MAAS) can be used to measure not only physical behaviors, but the levels of positive feelings mothers have towards their unborn child[39]. However, none of these tools have been validated in a low-income country setting and should be explored in further research. Additional research should allow for open-ended questions asking the mother how they bond or connect with their child during pregnancy in order to obtain local socio-cultural normative data.

Further research is needed to better understand the relationship between intimate partner communication and early stimulation behaviors. A more comprehensive communication scale or relationship quality tool could be used to get a more dynamic understanding of intimate partner communication and quality during pregnancy. In addition, future studies on early childhood development could explore if different factors play a more significant role during different stages (i.e. prenatal, post-natal, first year). Additionally, while there is a great amount of literature on intimate partner communication in a high-income country setting, there needs to be further research looking at communication and relationship quality in low- and middle-income countries.

4.3 Study Strengths and Limitations

The data for this paper was collected using a robust form of data collection, a cluster randomized control trial and used a mixed model with random effects for analysis. This ensured that potential biases were limited as the variance between clusters was accounted for. In addition, this was a large study population of 376 participants, which helped reduce the bias between clusters. This study also collected a large amount of data on several aspects of early childhood development and maternal characteristics that has not previously been done in the Northern Region of Ghana.

This study was limited by the measurement tools used to collect data on the exposure and outcome variables. Intimate partner communication was evaluated by the Constructive Communication Scale, which only uses 7 questions total to assess the overall complex nature of communication between partners. In addition, only four questions were asked to assess maternal-fetal bonding activities. Moreover, these scales are susceptible to reporting bias. Many women might under report the amount of IPV they face out of fear and retaliation from their partner if confidentiality with the study enumerator was broken. Regarding the Constructive Communication Subscale, women might under report how much they blame their partners and over report how much their partners blame them. Future studies should use more comprehensive scales to evaluate intimate partner communication and early stimulation behaviors.

5. Conclusion

Early childhood development has been at the forefront of research in the past decade, but still very little is known about caregiver characteristics that can affect a child's optimal development. There is a need to further explore family environments and how they influence caregiver characteristics, and consequently the nurturing care given to a child. By implementing ECD programs as early as possible and by focusing on partner and family relationship quality, we would expect that the Nurturing Care Framework domain of *responsive caregiving* could be enhanced, and children may be more likely to reach their developmental milestones. By ensuring that all children reach their developmental potential, extreme poverty and inequities in society can be eliminated by increasing the human capital that is needed to grow economics and create societal change.

Appendix A

Common Terms

Maternal- fetal attachment: Interactions and feelings the mother has towards her unborn child, is one the first opportunities to create a nurturing relationship between caregiver and baby.

Early Stimulation Behaviors: Behaviors performed during pregnancy to enhance the relationship with the unborn child and to stimulate early learning.

Early Childhood Development (ECD): Children's cognitive, physical, language, motor, and social and emotional development, between conception and age.

Abbreviations

Sustainable Development Goals (SDGs)

Low-to-Middle Income Country (LMIC)

World Health Organization (WHO)

Intimate Partner Violence (IPV)

Antenatal Care (ANC)

Relationship Quality Index (RQI)

Household Hunger Scale (HHS)

Integrated Mothers and Babies Course (iMBC)

Cognitive Behavior Therapy (CBT)

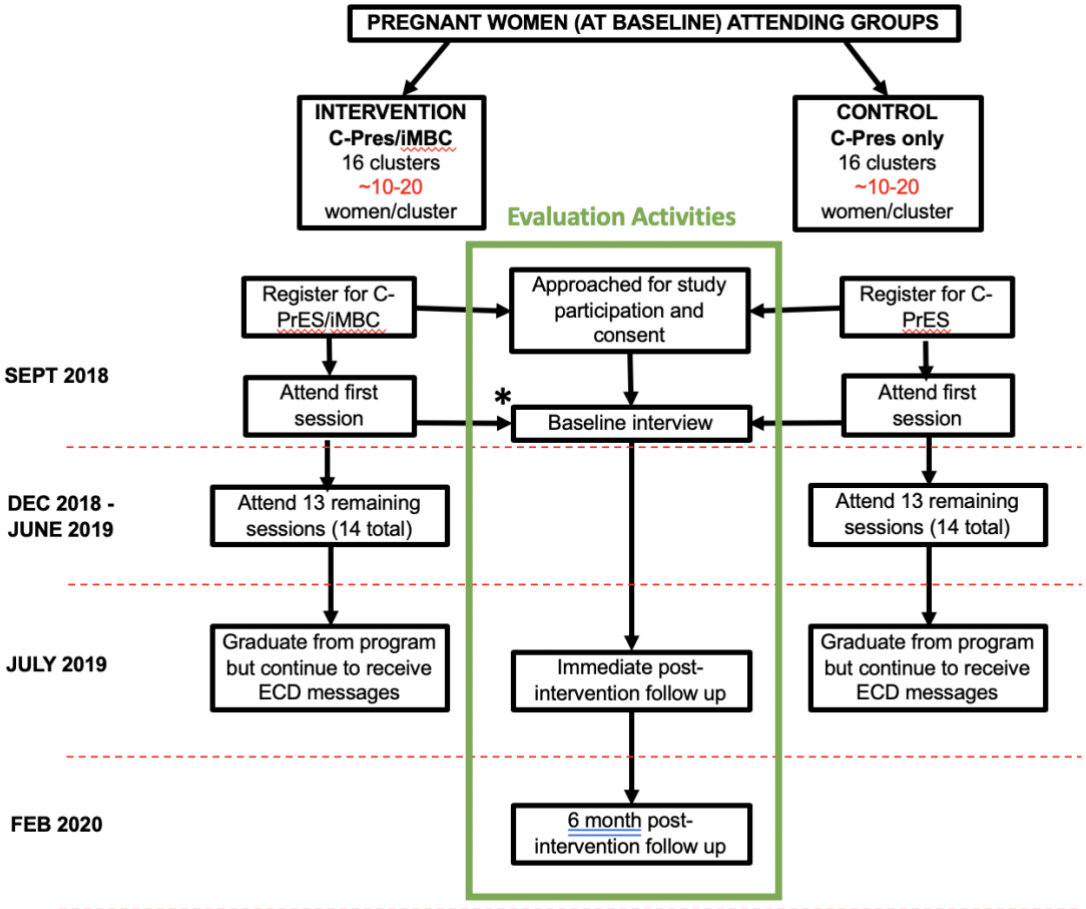
Catholic Relief Services (CRS)

Rural Emergency Health Service and Transport (REST II)

Maternal, newborn, child health, and nutrition (MNCHN).

Community Surveillance and Targeted Education Sessions (C-Pres)

Appendix B



* Pre-intervention baseline data collection.

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