

FOCUSED POSTPARTUM CARE (FOCUSED - PPC):

An integrated postpartum care, education, and support model for women in Ghana

Technical Report



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ABBREVIATIONS

AWHONN	Association of Women’s Health, Obstetric, and Neonatal Nurses
CSSR	Center for Social Science Research
EPDS	Edinburgh Postnatal Depression Scale
Focused-PPC	Focused Postpartum Care
GHS	Ghana Health Service
ICC	Intraclass Correlation Coefficient
LMIC	Low- and Middle- Income Countries
MANOVA	Multivariate Analysis of Variance
MMR	Maternal Mortality Ratio
NGO	Non-Governmental Organization
NHIS	National Health Insurance Scheme
NICU	Neonatal Intensive Care Unit
NMCN	Nurses and Midwives Council
PAHO	Pan American Health Organization
PBWS	Post-Birth Warning Signs
PNC	Post-Natal Care
PSI	Postpartum Support International
PSS	Perceived Stress Scale
RCT	Randomized Controlled Trial
RHDS-NM	Readiness for Hospital Discharge Scale-New Mother
SSA	Sub-Saharan Africa
UN	United Nations
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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EXECUTIVE SUMMARY

Maternal morbidity and mortality are some of the most pressing global health issues. In Sub-Saharan Africa, and more specifically in Ghana, where maternal mortality is relatively high, there remains an urgent need to address maternal deaths and improve maternal health. The postpartum period or the period after birth poses significant risk to the life and wellbeing of a mother. However, with adequate care, the health of postpartum women can be maintained and most postpartum deaths can be prevented. In this report, we present the methodology, results, and implications of a parallel Randomized Controlled Trial (RCT), in which we implemented a new, integrated model of postpartum care, termed Focused-Postpartum Care (Focused-PPC) across four health facilities in Tamale, Ghana. The Focused-PPC intervention incorporated three vital aspects of postpartum care, delivered in a group setting, meant to positively impact maternal health outcomes: 1) recommended health assessments by trained midwives at specific time points postpartum, 2) education sessions following a novel, standardized curriculum, and 3) peer support from other postpartum women. These three aspects of care were implemented through Focused-PPC sessions, each involving eight postpartum women, held at 1-2 weeks post-birth, six weeks post-birth, and monthly thereafter for up to one year post-birth. This model of care differed from the current standard of care, received by the control group, in that it included more frequent and consistent clinical assessment, more comprehensive and standardized education, and built-in peer support. All participant data were collected via interviewer-administered electronic surveys. The main outcomes monitored throughout this study were: knowledge of post-birth warning signs, postpartum health status (including measures of clinical data and mental health screening), and postpartum health behaviors. We also collected data related to the feasibility/acceptability, and satisfaction of the intervention itself. The results reported here indicate that participants receiving the Focused-PPC intervention experienced notable benefits when compared to the control group, including: enhanced knowledge of post-birth warning signs, increased confidence in their ability to recognize complications, less mental health burdens over time, and higher uptake of favorable health behaviors such as healthy diet and family planning. Overall, we found Focused-PPC to be a feasible, evidence-based standard of care with great potential to improve maternal outcomes. With the information in this report, we pose hope for the elimination of preventable maternal mortality and the promotion of maternal health flourishing after childbirth.



BACKGROUND

Improving maternal mortality and pregnancy - related health outcomes remains at the forefront of the global health agenda. Despite the growing body of research advancing the field of maternal and child health within the past decade (World Health Organization [WHO], 2015), women living in low and lower-middle-income countries (LMICs) disproportionately face the highest burden of maternal deaths. Particularly, countries in Sub-Saharan Africa account for 70% of global maternal mortality, with the highest number of deaths occurring in the period after birth, also known as the postpartum period (WHO, 2023). Current literature attributes maternal mortality in low-resource settings to a wide range of direct causes including complications such as hemorrhage, infection, hypertensive disorders, and obstructed labor; and, indirect causes such as pre-existing or concurrent diseases that are exacerbated by pregnancy (Alvarez et al., 2009; Hudgins et al., 2022; Neal et al. 2016; Say et al. 2014). Although there have been efforts to investigate and reduce these pregnancy-related complications, in Ghana, the maternal mortality ratio (MMR) remains high with 308 maternal deaths per 100,000 live births as of 2020 (WHO, 2017). Fortunately, most mortality from pregnancy-related causes are preventable (Pan American Health Organization [PAHO], 2023). The United Nations (UN) has set forth a target to reduce the global MMR to less than 70 per 100,000 live births by 2030. In accordance with this target, the UN's Global Strategy for Women's, Children's, and Adolescents' Health –in place from 2016 till 2030– has a goal of ending preventable maternal and child deaths by working towards universal access to maternal healthcare which allows for every woman to not only “survive” but also to “thrive” to reach their full potential (Lythgoe et al., 2021). In order for Ghana and other countries in Sub-Saharan Africa (SSA) to reach the UN's 2030 vision of maternal flourishing, there must be an increased effort to ensure the health and wellbeing of women before, during, and particularly after pregnancy.

Although the postpartum period poses substantial risks which are associated with maternal morbidity and mortality, postpartum care is not always prioritized by mothers or healthcare providers. The postpartum period is defined as the time from one hour after delivery of the placenta to six weeks (42 days) after delivery (WHO, 2010). It is also important to note maternal mortality occurring after six weeks and up to one year after birth are considered late maternal deaths (Kassebaum et al., 2016). In most SSA countries, maternal mortality remains high across the entirety of the postpartum period, in part due to lingering physiological effects of pregnancy,

psychosocial vulnerability related but not limited to low household income or intimate partner violence, and other health conditions such as anemia or HIV worsened by pregnancy (Aboagye et al., 2022; Chersich et al., 2009; Mlambo et al., 2023; Ssentongo et al., 2020). To address the risks present after birth, postpartum care commonly includes components of education, prevention, or treatment related to vaginal pain, vaginal bleeding/discharge, fundal height, breastfeeding, nutrition and exercise, breast engorgement, bladder and bowel function, sexual relations and contraception, and mental health (Lopez-Gonzalez & Kopparapu, 2022; WHO, 2013). Postpartum checkups in SSA often include midwives measuring vital signs and conducting further tests based on a woman's medical history; enabling providers to detect women who are at the highest risk for complications such as postpartum hemorrhage, puerperal infection, postpartum preeclampsia, thromboembolism, or sepsis (Benova et al., 2019).

The majority (50% to 71%) of maternal deaths occur during the postpartum period, as opposed to during childbirth and delivery; and, obstetric complications are the leading causes of maternal deaths in the postpartum period (Alvarez et al., 2009; Say et al., 2014). In sub-Saharan Africa, the leading causes of maternal deaths from direct obstetric complications are hemorrhage, hypertension, and sepsis (Say et al., 2014). Nearly all maternal deaths caused by these complications can be prevented; therefore, a continuum of comprehensive, educational, and respectful care extending after pregnancy and childbirth is critical for all women. In SSA, care provided to women after birth does not always fulfill and address these educational, support, and clinical needs in an integrative and time sensitive manner (Adams et al., 2017; Benova et al., 2019). Patient education that enables and empowers women to make informed decisions about their care after childbirth has been regarded by women in SSA as an essential part of postpartum care (Lythgoe et al., 2021). In Ghana, women are expected to independently manage their postpartum care after 48 hours post-delivery (Ghana Statistical Service & Ghana Health Service, 2017). When information on pregnancy-related complications is not routinely provided to a woman during perinatal care, her ability to recognize potential complications and seek out necessary healthcare services is hindered (Nikiéma et al., 2009). Comprehensive patient education for mothers regarding postpartum recovery can lead to timely identification of signs and symptoms associated with potential complications (D'Oria et al., 2016; Marcus, 2014; Nikiéma et al., 2009). This timely identification can ultimately influence a woman's decision

to seek out emergency treatment, preventing delays in care which can cause adverse maternal outcomes (Mgawadere et al., 2017; Sk et al., 2019). A study in Kenya revealed that women who received mobile messages detailing danger signs and general postpartum topics were 1.6 times more likely to be able to list at least 1 danger sign and 3.51 times more likely to seek treatment if they experienced any postpartum danger signs (Jones et al., 2020). Further, women value education which provides them with the information necessary to make informed decisions as an essential part of postpartum care (Colombini et al., 2014; Jolly et al., 2019; Zamawe et al., 2015). Patient education is widely accepted as a low-cost, effective intervention that improves health outcomes (Joint Commission, 2010; Marcus, 2014), and is thus an important provision to reduce maternal mortality and morbidity rates (Kleppel et al., 2016).

In addition to meeting the educational needs of postpartum women, the standard of postpartum care should also be respectful in nature and adapted with cultural sensitivity depending on the setting. Respectful and sensitive treatment, along with kindness displayed by healthcare workers is an attribute which encourages more women to access subsequent postpartum care (Adams, 2019; Bohren et al., 2015; Kanengoni et al., 2019; Lygothe et al., 2021). Several studies have shown that women value being treated with dignity and respect above the level and years of experience that a healthcare provider has (Colombini et al., 2014; Jolly et al., 2019). When women experience disrespect or power imbalances with a healthcare provider, they will be less likely to value any information disseminated to them and less likely to seek subsequent postpartum care (Kanengoni et al., 2019). Women may also be less likely and more hesitant to ask questions regarding their symptoms or experiences if they are not in an environment with respectful or compassionate providers who are attentive to their needs (McMahon et al., 2015). With the heightened psychosocial stressors associated with pregnancy, postpartum care should also include components or points of access to social support. Identifying partners, family members, peers, or other ways to mobilize social support has been proven instrumental in reducing early postpartum depressive symptoms, and enhancing a mother's postpartum recovery (Negron et al., 2013).

Despite the crucial nature of postpartum care to a woman's health, there are often barriers in receiving this type of care. In LMICs, not all women who deliver in health facilities receive the recommended postpartum clinical assessments nor at the recommended time points (Adams et al., 2017; Wang

et al., 2011). In a study of postpartum care within health facilities in rural Malawi, women often received partial clinical assessments from midwives before discharge from a health facility. Specifically, only 16% of women received all six clinical assessments of blood pressure, temperature, abdominal examination, vaginal examination/bleeding, breast examination/soreness, and baby examination – while 11% of women received no clinical assessments in totality (Adams et al., 2017). Further, in a study of adolescent married women in Nigeria, only 32% of women in the study received postpartum care within 42 days after delivery—a very low percentage which suggests poor postpartum care utilization among this vulnerable demographic of women (Rai et al., 2008). In a previous study analyzing levels, timing, and providers of postnatal care in eight countries within SSA, there was heterogeneity in postpartum coverage, with suboptimal and widely differing levels of postpartum clinical care (Benova et al., 2019). It was also found that women who received a cesarean operation or delivered at a public hospital were more likely to receive a postpartum checkup in comparison to women who delivered at lower-level public facilities with a nurse/midwife (Benova et al., 2019). It is recommended that women receive postpartum care in a healthcare facility for at least 24 hours after birth and then at 48-72 hours, 7-14 days, and six weeks after birth (WHO, 2013)

To date, there has been a lack of focus on interventions and programs which effectively integrate quality postpartum care, education, and support for mothers. The lack of comprehensive postpartum care for the mother contributes to maternal deaths and poor maternal health outcomes. There is an urgent need for an integrated postpartum care delivery model that is comprehensive and meets clinical care, education, and support needs of mothers. Thus, our project implemented an innovation entitled *Focused-Postpartum Care (Focused-PPC): an integrated postpartum care, education, and support model for postpartum women in Ghana*. Our model, delivered in a group setting to facilitate peer support, included clinical assessments and timeframes recommended by the WHO and adopted by Ghana Health Service (GHS), and included an evidence-based postpartum education curriculum. In working towards the UN's global health goals, the Focused-PPC model promotes healthier mothers and increases their capacity for flourishing after childbirth.

JUSTIFICATION

It is recommended that women receive postpartum care in a healthcare facility for at least 24 hours after birth and then at 48-72 hours, 7-14 days, and six weeks after birth (WHO, 2013). Postpartum care should include examination of vaginal bleeding, discharge, uterine contraction, fundal height, urine void, breast tenderness, and assessment of vital signs (WHO, 2013). While it has been noted that not all women who deliver in health facilities in developing countries receive these postpartum assessments at the recommended times, even those who are seen are not guaranteed to receive this full range of care and assessment (WHO & UNICEF, 2010). Experience from our prior work in the setting revealed there is considerable focus on the newborn during postnatal care visits, with critical lapses in the care of the mother. In order to effectively reduce maternal morbidity and mortality, adequate postpartum care of the mother is vital.

It is also critical that postpartum women have the knowledge necessary to recognize complications that may occur in the absence of a healthcare provider, because complications are often unpredictable and require rapid response (WHO & UNICEF, 2010). Timely recognition of postpartum complications expedites care-seeking and improves maternal outcomes. Previous studies in developing countries examining women's knowledge of postpartum complication warning signs have shown the inadequacy of knowledge in this area (Amenu et al., 2016; Bintabara et al., 2017; Dangura, 2020; Wassihun et al., 2020). Additionally, in an assessment of 245 midwives in Tamale, Ghana, it was found that the majority did not educate their patients on potential complications, nor did they feel confident enough in their own knowledge to relay this information (Adams & Sladek, 2022). There is a great need for improvement in women's knowledge of post-birth warning signs and their postpartum health. Educating women on their own bodies is a crucial step towards reducing morbidity and mortality as a result of pregnancy and birth.

Peer support is another aspect of postpartum care that is critical in improving maternal outcomes, but is often overlooked. Providing a space where women can support others in similar stages of motherhood has the potential to improve the mental health of postpartum women and forge lasting relationships. Group prenatal care models have been shown to improve both pregnancy outcomes and maternal satisfaction with care (Lathrop, 2013; Magriples et al., 2015; Ten Hoop-Bender et al., 2014). In the postpartum period, group treatment and peer support programs have been shown to

improve postpartum depression and prevent postpartum depression (Dennis, 2003; Dennis, 2010; Montgomery et al., 2012; Prevatt et al., 2018).

In order to appropriately assess the needs of the community and identify perceived gaps in postpartum care, we held focus group discussions in the setting in which this intervention was to take place, involving postpartum women in communities who attend postnatal care at the four health centers we planned to work with. Through these discussions, we found that women reported: baby-focused care during the postpartum period, inadequate knowledge of post-birth warning signs, barriers to accessing postpartum care, struggles with mental health after birth, and a need for improved postpartum education (Adams, 2022; Adams et al., 2023). These results clearly established the need to develop a more integrated, mother-centered model of care in this setting, and thereby greatly informed the development of our intervention.

To address the noted gaps in care and incorporate the most important aspects of care, we implemented an integrated group model of postpartum care entitled Focused-PPC. This intervention was the first of its kind, integrating a year-long curriculum of comprehensive education on postpartum care, clinical evaluation by trained healthcare professionals, and peer support offered through group sessions with other postpartum mothers. The Focused-PPC model of care was tailored to address the unique needs of postpartum women as time progressed following delivery. All components of this intervention are evidence-based and were designed to directly improve maternal outcomes.

METHODS

The Focused-Postpartum Care Intervention

The Focused - Postpartum Care (Focused - PPC) intervention involved the provision of integrated postnatal care and newborn care in a group setting. Each Focused-PPC group consisted of 8 postpartum women, two trained and registered midwives, and a project assistant. Midwives provided care to these groups of women and their infants through sessions held at 1-2 weeks, 6 weeks, and monthly thereafter for up to 1 year postpartum following the GHS postnatal care and child welfare clinic schedule.

During Focused - PPC sessions, midwives and project assistants followed a detailed curriculum designed by our research team to address women's

specific needs at each phase of the postpartum period. These session facilitators were trained via an evidence-based post-birth education program developed by the Association of Women’s Health, Obstetric, and Neonatal Nurses (AWHONN, 2021). Additionally, midwives were trained in perinatal mental health via a program established by Postpartum Support International (PSI) (PSI, 2022). Each Focused-PPC session incorporated recommended clinical assessments and health counseling for approximately 15 minutes, followed by an hour of targeted education and peer support. Translated audio and visual educational materials were used to support the content taught in Focused-PPC sessions. Participants were also encouraged to voice their personal concerns and share their unique experiences in the vulnerable time after birth.

Study Design

We implemented a Randomized Controlled Trial (RCT) that was parallel in design with balanced randomization (1:1) across 4 health centers in Tamale, Ghana: Choggu Health Center, Kanvilli Health Center, Bagabaga Health Center, and Kalpohin Health Center. To determine a ppropriate sample size, a power analysis was performed for a MANOVA with repeated measures and between factors with 3 timepoints for measurement. Using a power level of 80%, a 5% level of significance, and a Cohen’s f of .15 for an effect size between small and medium, the adequate sample size was deemed to be 192 participants (Cohen, 1988). Thus, a total of 48 participants were recruited from each health center. At each facility, participants were randomly assigned into 3 Focused-PPC Intervention groups and 3 control groups.

Intervention groups received the Focused - PPC integrated model of care, described above, during sessions held at 1-2 weeks, 6 weeks, and monthly thereafter for up to 1 year postpartum. Control groups received the standard postnatal care regimen currently practiced in the health centers. This standard involved individual postnatal care visits at the health center within 14 days after birth, at 6 weeks after birth, and monthly thereafter at child welfare clinics for up to one year after birth. It is important to note that the current standard of practice for postnatal care involves considerable focus on newborn care with critical lapses in the care of the mother.

Recruitment / Participants

Women were eligible to participate in this study if they were 18 years of age or older, admitted to the postnatal ward after birth, had a live newborn

not admitted to the NICU, were able to speak and understand English or Dagbani, and had the capacity to provide informed consent.

Due to the nature of the study, participants assigned to intervention groups were required to have given birth within the same week or two. Therefore, participants were recruited for the study during their third trimester of pregnancy, and randomization into the intervention (Focused-PPC) and control groups occurred after each woman had given birth.

Project assistants conducted face-to-face recruitment in the health centers using a script which provided a description of the study's design, eligibility criteria, and voluntary nature. Women were approached during the waiting period prior to entering the consulting room for antenatal care appointments. All health center Covid-19 protocols were adhered to. If an eligible patient agreed to participate in the study, they were provided with contact information for the project and also provided their name and contact information to the project assistant for follow-up. Those interested were instructed to contact a project assistant upon delivery in order to be enrolled into the study; however, project assistants also followed up with participants as their estimated due dates approached. Following delivery, participants were formally enrolled into the study and randomly assigned to either the control group or Focused-PPC intervention group.

Randomization / Data Collection

After birth, project assistants met with eligible participants at discharge in a safe, designated spot at the health facility where they obtained consent and completed a baseline survey. After completion of the baseline survey, participants were informed of the Focused-PPC schedule and enrolled into a group based on randomized and equal allocation (1:1) to either intervention or control. Allocation was implemented according to a computer-generated list of random numbers allocating group sizes of 8. The allocation was generated by a data scientist at the University of Notre Dame Center for Social Science Research (CSSR). Project assistants recruited and enrolled participants but were unaware of the participant's allocation until after the woman had given birth. The data analyst provided participant allocations to the project manager to set up Focused-PPC groups and schedule sessions. Due to the nature of the study, there was no blinding.

Data collection for the study was primarily conducted via electronic surveys. Subsequent to the baseline survey, additional surveys were conducted at 1-2 weeks, 6 weeks, 3 months, 6 months, and 12 months from

baseline. All surveys were interviewer-administered by project assistants and recorded electronically on tablets using a secure database system. Strict procedures were followed to protect participants' confidentiality. A detailed breakdown of study design, recruitment, enrollment, and data collection can be found in the appendix in **Table 1**.

Outcomes / Follow-Up

Several outcome measures were assessed across the intervention and control groups. Independent variables measured among all participants included demographic data, obstetric history, and readiness for hospital discharge. The primary outcome of the study was knowledge of post-birth warning signs (PBWS). We hypothesized that the Focused-PPC group would have higher knowledge of PBWS than the control group at every time-point measured and that the Focused-PPC group will have a larger increase in knowledge of post-birth warning signs between time-points. The secondary outcome was postpartum health behaviors, including postnatal care attendance, dietary habits, breastfeeding practices, and family planning uptake. We expected that these outcomes would differ between the Focused-PPC and control groups. Other descriptive outcomes included measures of postpartum health status, including depression, stress, complications, and vital signs. Additionally, we evaluated the feasibility, acceptability and satisfaction of the Focused-PPC interventions via endline focus group discussions with the midwives who implemented Focused-PPC sessions and with each group of participants assigned to the Focused-PPC intervention. Further details of measured outcomes and timepoints for data collection are presented in **Table 2** in the appendix.

Several health outcomes were monitored by the research team across the course of the study in order to identify the need for appropriate follow-up care. For example, postnatal care attendance was monitored in order to promptly contact and follow-up with those who did not attend sessions or appointments. Postpartum depression scores were tracked and analyzed regularly in order to identify any participants at risk for depression or suicide, and any concerning mental health issues were immediately brought to the attention of project assistants and midwives. Participants were consistently assessed for any postpartum complications and treated accordingly by midwives. Vital signs monitored by midwives via clinical assessment and concerning values were treated accordingly. Specifically, protocols were in place for cases of elevated blood pressure.

Data Analysis

A multilevel model (diagram shown in **Table 3**) was created with interactions for Location, Allocation, and Time which were all fixed effects. Random intercepts were included for participants. Other fixed effects in the model included level of education, whether it was the participants first pregnancy, and whether the participant had a monthly income. The time variable was handled as a categorical piecewise change over time. Time points are not equally spaced and without having a hypothesized form of how time would affect the outcome it is cumbersome to run as continuous. Multiple imputation is used via the mice package in R (doi:10.18637/jss.v045.i03) to create complete cases for modeling. Overall, the demographic variables are not significant in the model but the interaction of Allocation, Location, and Time is. Intraclass Correlation Coefficient (ICC) is reported at each level for the null model, but note that in the full model time and location were treated as fixed categorical variables so only participant level ICC is reported.

Table 3. Multilevel Model Diagram

Sub-index	Level	Variables
I	Location	Health facility
J	Participant	Education Income First pregnancy Allocation
K	Time	Time

Dependent variable:
Total PBWS Score

FINDINGS / RESULTS

Participant Characteristics / Obstetric History

Participant's demographic characteristics (summarized in **Table 4**) and obstetric history (summarized in **Table 5**) were very similar in both control and FPPC groups showing that the randomization was successful. Overall, nearly all women were married, half did not attend school, and half had a source of income. Only one fifth of women attended either tertiary or vocational school. Additionally, nearly all women delivered their baby vaginally with help from a midwife or nurse, as opposed to delivering via surgical operation. For most women, this was not their first pregnancy - most had been pregnant once before and many women had another child. Nearly all women reported having gone for weighing / antenatal care during their pregnancy, planned to breastfeed, and were told to return to a health facility after giving birth. Control and Focused-PPC participants were told to return to health facilities at around the same frequency and intervals after giving birth.

Table 4. Participant Demographic Characteristics

Question	Value	Control	FPPC
Location	Bagabaga	24	24
	Choggu	24	24
	Kalpohini	24	24
	Kanvilli	24	24
What is your marital status?	Never Married / Single	0	0
	Currently Married	95	95
	Divorced / Separated	0	0
	Widowed	0	0
	NA	1	1
What is the highest level of education you have completed?	Did not attend school	45	39
	Primary School	28	21
	Secondary School	16	23
	Tertiary / Vocational School	6	12
	NA	1	1
Do you have a source of income?	Yes	45	57
	No	49	38
	NA	2	1

Table 5. Participant Obstetric History

Question	Value	Control	FPPC
Was this baby delivered normally or through operation?	Normal delivery	92	92
	Operation (Cesarean)	3	1
	NA	1	3
At the time of your delivery, who helped you?	Doctor	5	3
	Midwife or Nurse	93	94
	Other (Please specify)	1	0
	Patient Attendant	1	1
	Your Family Member	2	1
Was this your first pregnancy?	Yes	36	31
	No	57	63
	NA	3	2
How many times have you been pregnant, including this pregnancy?	1	37	33
	2	20	23
	3	16	14
	4	14	9
	5	4	8
	6	1	5
	7	0	2
	8	1	0
	NA	3	2
	How many children do you have living, including this child?	1	1
2		21	24
3		18	15
4		13	9
5		1	8
6		2	4
7		0	1
8		1	0
NA		39	32

Table 5. Participant Obstetric History Cont.

Question	Value	Control	FPPC
Were you going for weighing when you were pregnant?	Yes	95	93
	No	0	1
	NA	1	2
What kind of food do you plan to feed your newborn in the first six months?	Breast feeding	92	90
	Feeds prepared for children (Formula)	1	2
	Both	1	1
	NA	2	3
Did they inform you to return to a health facility for check-up after delivery?	Yes	92	89
	No	3	5
	NA	1	2
What time were you asked to return for a check-up after delivery?	3 days after delivery	30	29
	Between 7 - 14 days after delivery	44	57
	6 weeks after delivery	14	20
	When the mother or baby is not well OR when the mother or baby has a problem	28	29
	Other (specify)	1	0
	They never asked me to come	1	1

The Readiness for Hospital Discharge Scale - New Mother (RHDS-NM) was also given to participants after giving birth to assess their readiness for discharge. Following Adams et al. (2022), factor analysis was used to create four succinct scales: coping, expected support, knowledge, and personal status, shown in **Table 6**. Each scale shows how ready women are for discharge based on different aspects of readiness. Overall, women answered fairly similarly to each other on each subscale. The largest difference in responses came from women in Kalpohini.

Table 6. ObRHDS Factor Scores Averages and Standard Deviations

Factor	Bagabaga	Choggu	Kalpohini	Kanvilli
Coping	6.6(0.9)	6.8(1)	7.8(0.7)	6.9(1)
Expected Support	6.8(0.7)	7.1(1.1)	9.1(0.8)	7.7(1.1)
Knowledge	6.7(1.3)	7.2(1.3)	7.8(1.1)	7.3(1.4)
Personal Status	8.1(0.7)	7.9(0.9)	8.8(0.6)	8.4(0.8)

Knowledge of Post-Birth Warning Signs

Both Focused - PPC participants and control participants initially did not identify most of the Post-Birth Warning Signs (PBWS), with the sole exception of severe bleeding which 79% of participants identified at baseline. By the 1-2 week check-in, the control group's knowledge stayed the same, but the Focused-PPC groups were identifying many more of the warning signs. At the 3 month check-in, Focused-PPC groups were overwhelmingly able to identify all warning signs and they retained this knowledge through to the 6 month check-in. On the contrary, the control group identified warning signs less frequently at each subsequent check-in and by the 6 month check-in nearly 10% of them could not identify any of the PBWS. **Table 7** shows the individual signs identified by control and Focused-PPC at each check-in point.

Table 7. Identification of Individual Warning Signs

Sign	Baseline		1-2 Weeks		3 month		6 month	
	Control n=96	FPPC n=96	Control n=88	FPPC n=84	Control n=90	FPPC n=79	Control n=88	FPPC n=76
Pain in chest	51%	46.9%	51.1%	82.1%	40%	100%	42%	98.7%
Obstructed breathing / shortness of breath	38.5%	34.4%	47.7%	71.4%	32.2%	100%	26.1%	94.7%
Seizures / convulsions / twitching	35.4%	33.3%	35.2%	58.3%	21.1%	98.7%	17%	97.4%
Thoughts of hurting yourself	29.2%	31.2%	35.2%	67.9%	13.3%	97.5%	20.5%	97.4%
Severe bleeding	79.2%	79.2%	80.7%	96.4%	75.6%	100%	62.5%	98.7%
Incision taking long to heal	41.7%	45.8%	45.5%	70.2%	33.3%	98.7%	22.7%	93.4%
Swollen leg / pain in leg	32.3%	28.1%	31.8%	46.4%	12.2%	98.7%	13.6%	96.1%
Fever/ High Temperature	49%	51%	52.3%	78.6%	40%	98.7%	47.7%	96.1%
Severe Headache	55.2%	55.2%	52.3%	84.5%	46.7%	98.7%	47.7%	97.4%
None of above	7.3%	8.3%	5.7%	1.2%	3.3%	0%	10.2%	0%

Results from the multilevel model show that the three-way interaction of allocation, location, and time is significant, in addition to each two-way interaction and main effects. Since the three-way interaction is significant, the effects of location, allocation, and time are inextricably linked and need to be interpreted all together. **Table 8** shows the term significance of the model. Full model results can be found in **Table 9** in the appendix.

Table 8. Multilevel Model Term Significance

model term	df1	df2	F.ratio	p.value
Allocation	1	179.20	583.972	<.0001
Time	3	551.91	45.147	<.0001
Location	3	179.13	184.139	<.0001
Education	3	179.63	2.126	0.0985
Income	1	183.38	0.066	0.7978
First Pregnancy	1	186.86	0.667	0.4151
Allocation:Time	3	551.96	141.021	<.0001
Allocation:Location	3	179.08	11.384	<.0001
Time:Location	9	551.92	50.219	<.0001
Allocation:Time:Location	9	551.92	6.789	<.0001

Figure 1 shows the estimated marginal means from the multilevel model of PBWS for all health center's control and Focused-PPC groups at each check-in. In Choggu, all participants regardless of Allocation had a fairly high knowledge of PBWS at the baseline. This knowledge was maintained through the first check in at 1-2 weeks after delivery in both groups, but by the 3 month mark the Control group could no longer identify as many warning signs as the Focused-PPC group. At both the 3 and 6 month mark, the Focused-PPC group was able to identify significantly more (nearly all) PBWS compared to the Control group whose ability to identify PBWS decreased to around 2-3 PBWS. Choggu participants had high knowledge of PBWS in the beginning, but the lack of reinforcement of this knowledge over time led to the control group's decrease in ability to identify PBWS.

In Bagabaga, all participants started out at the baseline only able to identify around 1-2 PBWS on average. From the first check in at 1-2 weeks through the most recent check in at 6 months, the Focused-PPC group demonstrated a significant increase in identifying PBWS. On the other hand, the control group's knowledge did not increase; knowledge of PBWS stayed the same throughout the study.

Similarly, Kalpohini and Kanvilli's participants' ability to identify PBWS was low at the baseline but the Focused-PPC participants' ability significantly increased over time. The only difference was that the control group's ability to identify PBWS fluctuated as it increased from baseline to 3 months and then back down at the 6 month mark.

Figure 1. Average Number of Warning Signs Identified



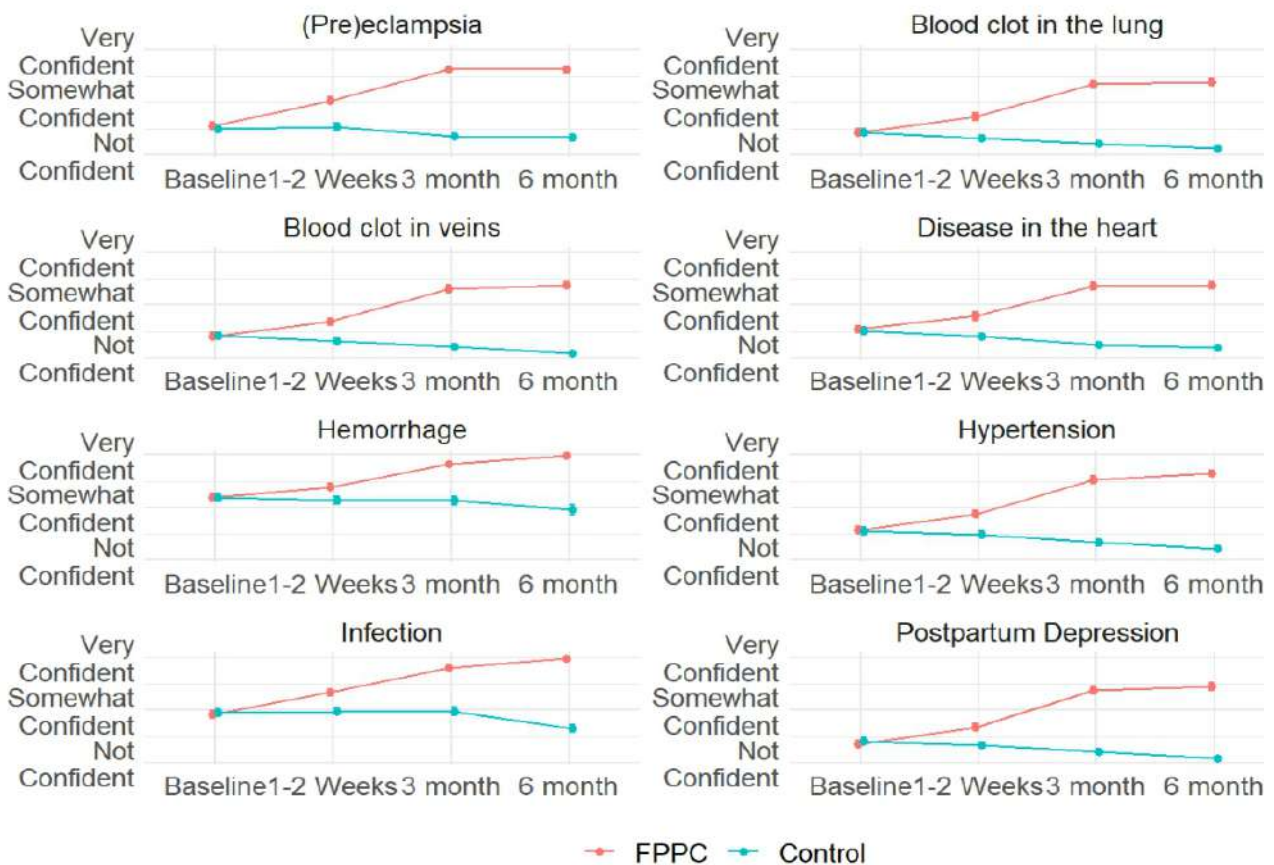
Confidence to Recognize Complications

At baseline, Focused - PPC and control participants were equally confident in their ability to recognize each warning sign. With the exception of infection and hemorrhage which participants felt somewhat confident in recognizing at baseline, participants were less than somewhat confident in recognizing each warning sign. As the study continued, the control participants became less confident in their ability to recognize every warning sign. By the 6 month check-in, the average control participant felt not confident in recognizing blood clots in veins, blood clots in lungs, disease in the heart, hypertension, and

postpartum depression. Control participants on average only retained somewhat similar levels of confidence in recognizing hemorrhage and infection at the 6 month check-in. The Focused-PPC participants became more confident in their ability to recognize every warning sign starting at the first check-in. By the 3 month check-in, Focused-PPC participants seemed to nearly reach their peak confidence in ability to recognize each warning sign, evidenced by the much smaller increase in confidence between the 3 month and 6 month check-ins. For identifying hemorrhage and infections, the warning signs participants felt the most confident recognizing at baseline, Focused-PPC participants felt very confident on average in their ability to recognize these warning signs by the 6 month check-in. In contrast to control participants, Focused-PPC participants at 6 months felt more than somewhat confident on average in their ability to recognize blood clots in veins, blood clots in lungs, disease in the heart, hypertension, and postpartum depression.

Figure 2 shows the average confidence in recognizing each warning sign at check-ins throughout the duration of the study for control and Focused-PPC participants.

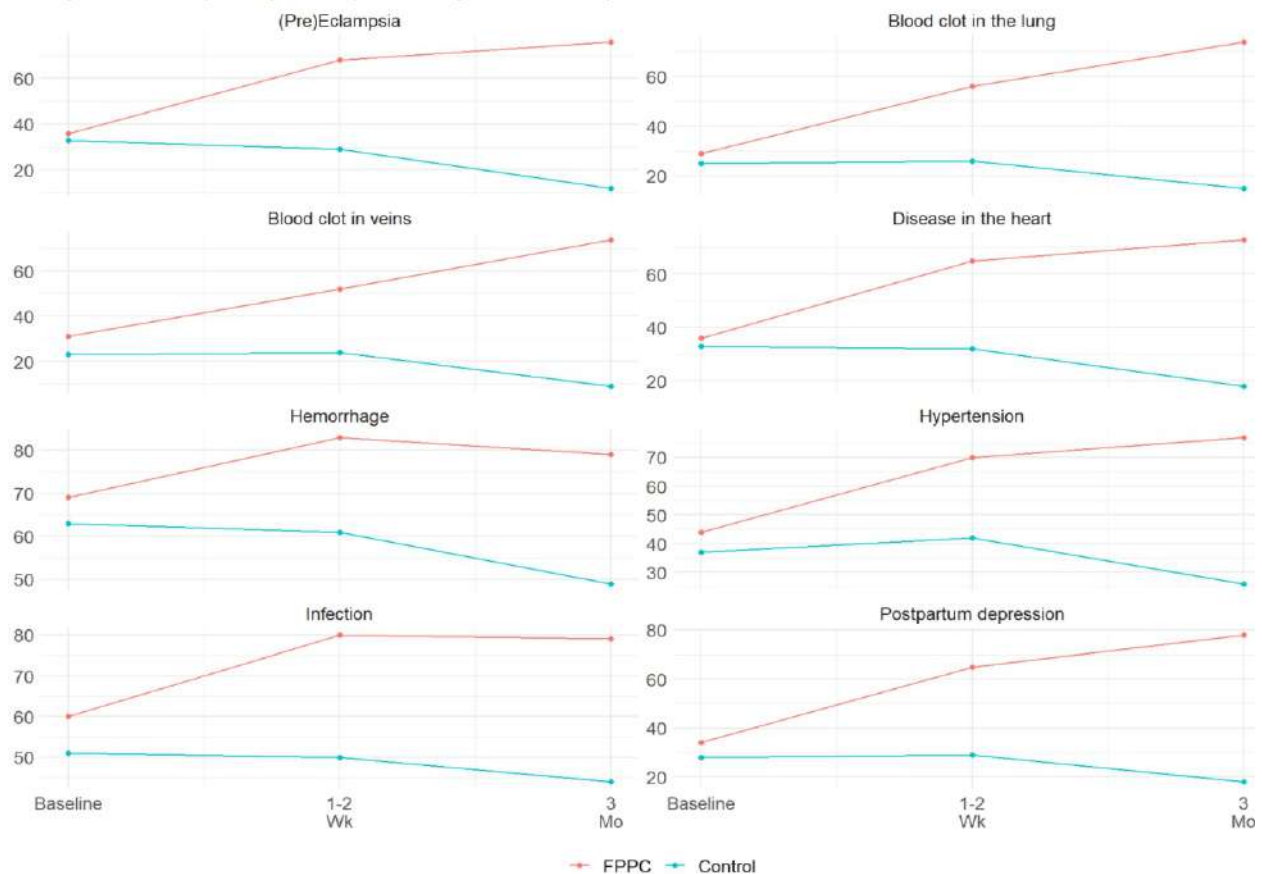
Figure 2. Participants Average Confidence in Their Ability to Recognize Complications



Education on Complications

Participants were asked at baseline, 1-2 weeks, and 3 months whether a nurse or midwife discussed complications with them, what topics they were talked to about, and if a nurse or midwife had advised them where to go if they experienced any complications. At baseline, there were about the same number of participants from both the control (17) and Focused-PPC (11) that reported midwives/nurses/trained staff did not advise or teach them about danger signs of serious complications after birth and reported not being told where to go if they had any complications (12 control and 8 Focused-PPC). At the 1-2 week check-in, 13 control participants and 1 Focused-PPC participant were sure they did not receive any information about complications and 12 control and 1 Focused-PPC participant were unsure if they received information on serious complications. At each timepoint after the baseline, more Focused-PPC participants than control participants reported midwives/nurses/trained staff advised or taught them about danger signs of serious complications after birth and where to go if they experienced any complications. After the baseline, more Focused-PPC participants recalled the topics on complications as having been discussed with them than control participants. **Figure 3** shows the frequency of each complication topic discussed with participants.

Figure 3. Frequency of Topics Taught to Participants



Complications Experienced

Out of all the participants in the study, only 5 gave birth to a newborn that needed to be admitted to the NICU at birth and only 4 gave birth through a Cesarean section. None of the participants delivered via vacuum extraction. Most women gave birth around 38 weeks pregnant, although the earliest birth was at 31 weeks and the latest was recorded at 43 weeks. 5 women reported experiencing serious health problems related to the delivery and 2 further elaborated that the health problems were severe bleeding and low hemoglobin while another 2 stated they did not remember.

At the 1-2 week check-in, only 5 participants (4 in control and 1 in Focused-PPC) stated they had experienced serious health problems since going home with their baby after delivery. They went on to state their problems were pain in the chest, severe headache or vision changes, and 4 of the 5 stated they also had other issues not listed. Only 2 participants continued answering questions on the serious health problems they experienced at this point and both said they developed the problems while at home and that they did seek assistance at a pharmacy the same week they noticed the problem.

Only 1 participant reported experiencing serious health issues at the 6 week and 3 month check-ins. In both instances the participant said the issue was a severe headache or vision changes and that they noticed the issue at home and sought assistance. At the 6 week check-in they went to the pharmacy on the same day they noticed the problem. Whereas at the 3 month check-in the participant sought help at a hospital or clinic the day after noticing the problem.

Three participants stated they experienced serious health problems at the 6 month check-in, but only 2 elaborated further. 12 month check-ins also had 2 participants state they experienced serious health problems. At both check-ins the participants said their health problems were severe headaches or vision changes that they noticed at home and went for assistance at either the pharmacy or hospital/clinic.

Complications experienced by participants were rare, but when they were noted every participant regardless of allocation stated they sought assistance for their problems. All women with problems went to either a pharmacy or hospital/clinic for assistance within a week of noticing the problems. The most common problem that participants mentioned having was related to severe headaches or vision problems.

Postpartum Health Behaviors

Attendance. Postnatal care (PNC) visits were planned to occur every month starting at two months postpartum in addition to six weeks and 1-2 weeks postpartum. These visits are not normally required, so women assigned to the control group were not expected to show up and their attendance was not recorded by any project assistant or midwife. On the other hand, women in the Focused-PPC groups were expected to show up for these visits and their attendance was taken at each visit. At each check-in survey, participants were asked to self-report which PNC visits they attended. The self-reported attendance for Focused-PPC was found to be off when compared to the recorded attendance - women tended to over-report their attendance to these visits. From baseline to 6 months, we found an average discrepancy rate of 13.04% for PNC attendance among Focused-PPC participants, where all discrepancies represented a participant reporting attendance when their attendance was not actually recorded by our project team. Since we could not compare the control group's self-reported attendance to a verified attendance record, we report the results of their self-reported answers given in the surveys in comparison to the Focused-PPC's verified attendance in **Table 10**. We expect the control groups' actual attendance to be lower than the self-reported attendance in Table 10.

Table 10. Frequency of PNC Visits

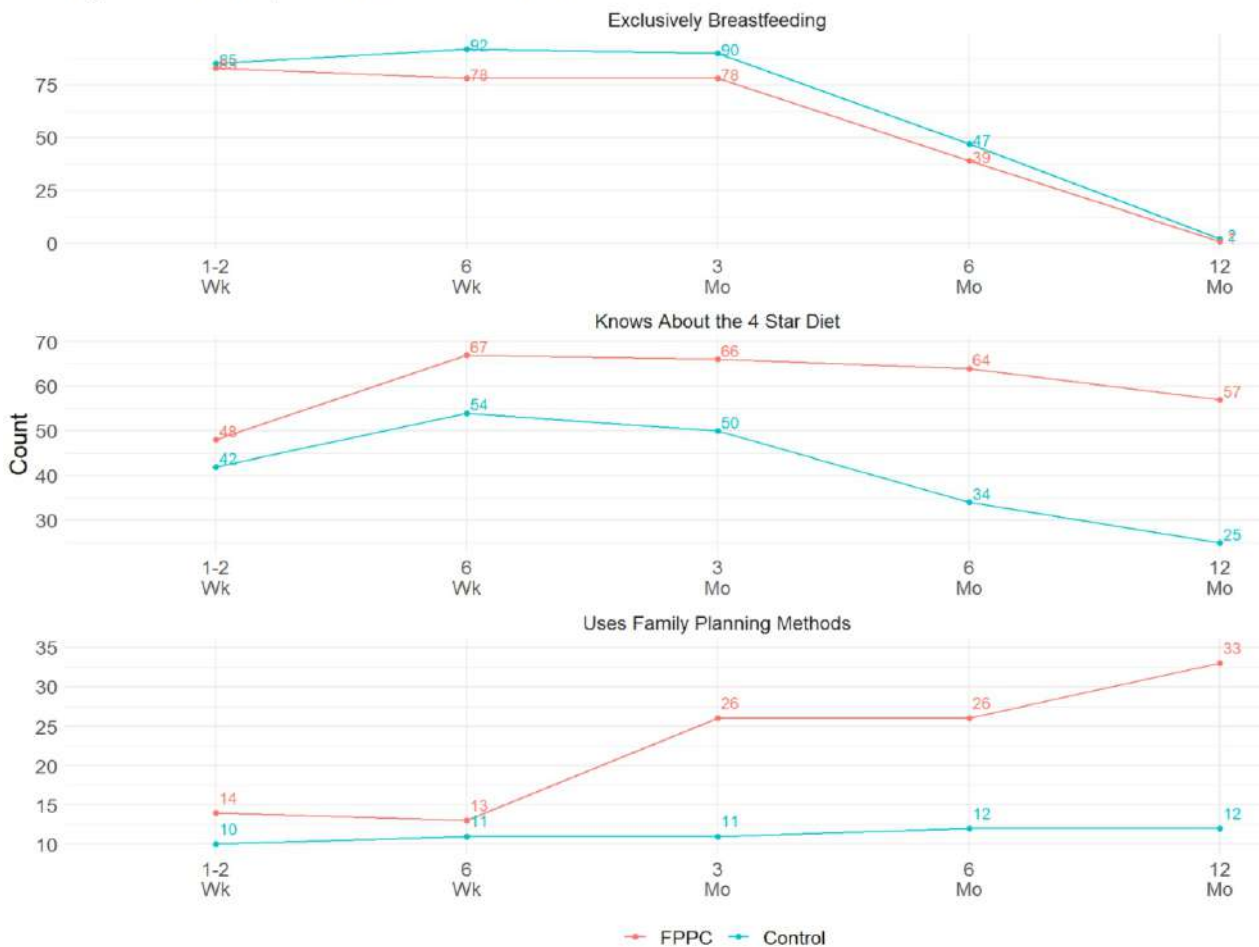
Allocation	1-2 weeks	6 weeks	2 months	3 months	4 months	5 months	6 months
Control Self-Reported Attendance	80	78	71	67	72	72	70
Focused-PPC Verified Attendance	77	76	74	74	71	67	72

Nutrition. More Focused - PPC participants reported knowing about the 4-star diet at each timepoint than control participants. Control and Focused-PPC participants reported eating the 4 star diet 3-4 days a week at their 1-2 week and 6 week check-ins. After that, the control participants maintained the diet at the same weekly frequency until their 12 month check-ins where most reported no longer following the diet. Focused-PPC participants increased the frequency of eating the 4 star diet to 5-6 days a week by their 6 week check-ins. At the 3 month check-ins a quarter of the Focused-PPC participants followed the diet every day, with another third of participants eating the diet at least 3-4 days a week. At their 6 month and 12 month check-ins, Focused-PPC participants mainly reported following the diet either every day or 3-4 days a week.

Family Planning. More Focused - PPC participants reported using family planning methods at each timepoint than control participants. Despite the majority of women reporting that they definitely did not want to get pregnant within the next 6 months and that they would be very or extremely upset and worried if they did get pregnant within the next 6 months, most control participants did not use any family planning methods throughout the study. On the contrary, over the course of the study more Focused-PPC women reported using family planning methods at each check-in, ending at nearly a third of Focused-PPC participants using a family planning method by the 12 month check-in.

Breastfeeding. Although breastfeeding was discussed in Focused -PPC groups, there were less Focused-PPC participants than control participants that exclusively breastfed at each check-in point. These results were relatively unexpected, as we anticipated that rates of exclusive breastfeeding would be higher among those in the intervention group. We intend to gather more context surrounding this data via our end-line focus group discussions, in which we will ask Focused-PPC participants what factors impeded their ability or willingness to maintain exclusive breastfeeding. Further, we suppose that these findings may be the result of self-reporting/social biases, especially among the control group. For instance, we suspect that those in the control group over-reported their PNC attendance, and we suspect this may also be the case for their self-reporting of exclusive breastfeeding. Participants' health behaviors, including breastfeeding, nutrition, and family planning, are plotted by allocation in **Figure 4**.

Figure 4. Participant's Health Behaviors Over Time



Overall Health/Health Behaviors

Overall health behaviors are fairly similar between Focused -PPC and control participants. **Table 11** in the appendix gives a thorough summary of all postpartum health behaviors throughout the study. Nearly all women in both Focused-PPC and control reported not drinking, smoking, nor using any drugs throughout the study. Additionally, nearly all women reported that smoking was not allowed anywhere inside their homes. While initially answered similarly between control and Focused-PPC participants, by 3 months control and Focused-PPC participants behaviors deviated when reporting if they did any exercise. Half of Focused-PPC participants reported doing some form of exercise compared to only 14% of control participants. This continued through both the 6 month and 12 month check-ins with a larger percentage of women in Focused-PPC reported exercising compared to how many control participants reported exercising. Although women in both control and Focused-PPC groups answered that they at least sporadically took

vitamins, both groups had less women report taking them all together throughout the study. **Table 11** in the appendix gives full summaries of the postpartum behaviors between control and FPPC groups.

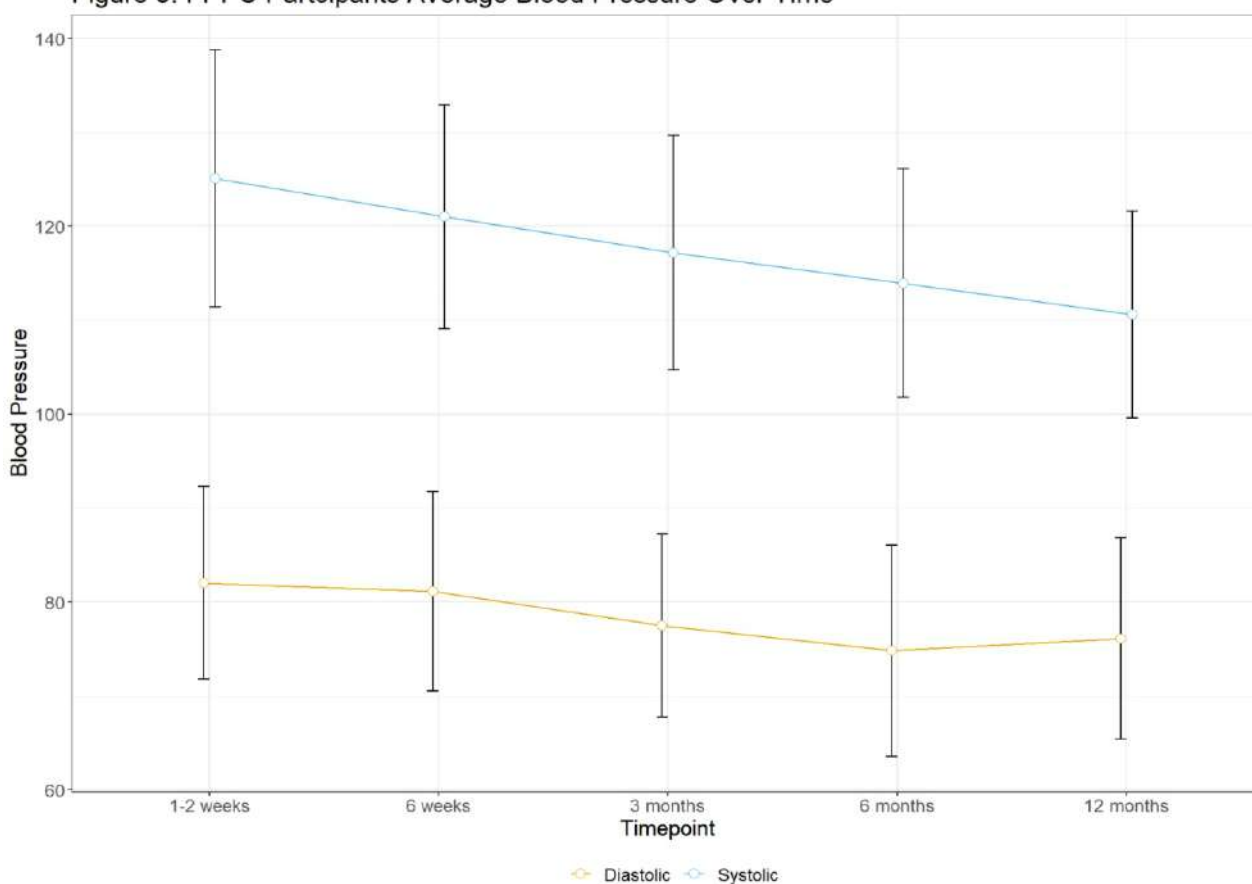
Clinical Assessments. In the Focused-PPC group, participants received the full range of recommended clinical assessments from midwives at 2 weeks and 6 weeks post-birth. These head-to-toe assessments included evaluation of participants’ breasts, uterus, bladder, bowel, lochia, episiotomy, extremities, emotional state, cultural needs, pain, and labs/medication when necessary. Further, vital signs, including blood pressure, temperature, respirations, heart rate, and weight were measured among Focused-PPC participants up to 12 months post-birth.

When first starting the study, nearly half of all Focused-PPC participants had high blood pressure. By 6 months, only a quarter still had high blood pressure, and by the end of the study that number decreased to only 13% of Focused-PPC participants. **Table 12** shows the change in participants with high blood pressure over time while **Figure 5** shows the average recorded blood pressure change over time.

Table 12. Count FPPC Participants with High Blood Pressure

Timepoint	n
1-2 Weeks	46
6 Weeks	41
3 Months	31
6 Months	21
12 Months	13

Figure 5. FPPC Participants Average Blood Pressure Over Time



Postpartum Mental Health. Stress and depression were measured over time using the Perceived Stress Scale (PSS) and Edinburgh Postnatal Depression Scale (EPDS). The average scores and their standard deviations are presented in **Tables 13** and **14** respectively, and **Table 15** shows the number of participants that scored as potentially having depression and those that answered positively when considering self-harm. **Figure 6** shows average stress scores over time by allocation and **Figure 7** shows average depression scores over time by allocation. MANOVA was used to model scores with allocation, time, and location (as well as their second order interactions) as independent variables. Overall, perceived stress and EPDS are linked with allocation over time ($F=6.180$, $p.value<.0001$; $F=5.274$, $p.value=.0001$, respectively) and location over time ($F=17.441$, $p.value<.0001$; $F=9.495$, $p.value<.0001$; respectively). Focused-PPC participants had significantly lower perceived stress scores at the 3 and 6 month check-ins and significantly lower EPDS at the 3 month check-in. Facilities that spiked in stress and

depression scores would show lower scores by the next check-in. **Tables 16** and **17** show the model results for PSS and EPDS respectively.

Figure 6. Average Participant Perceived Stress Scores Over Time

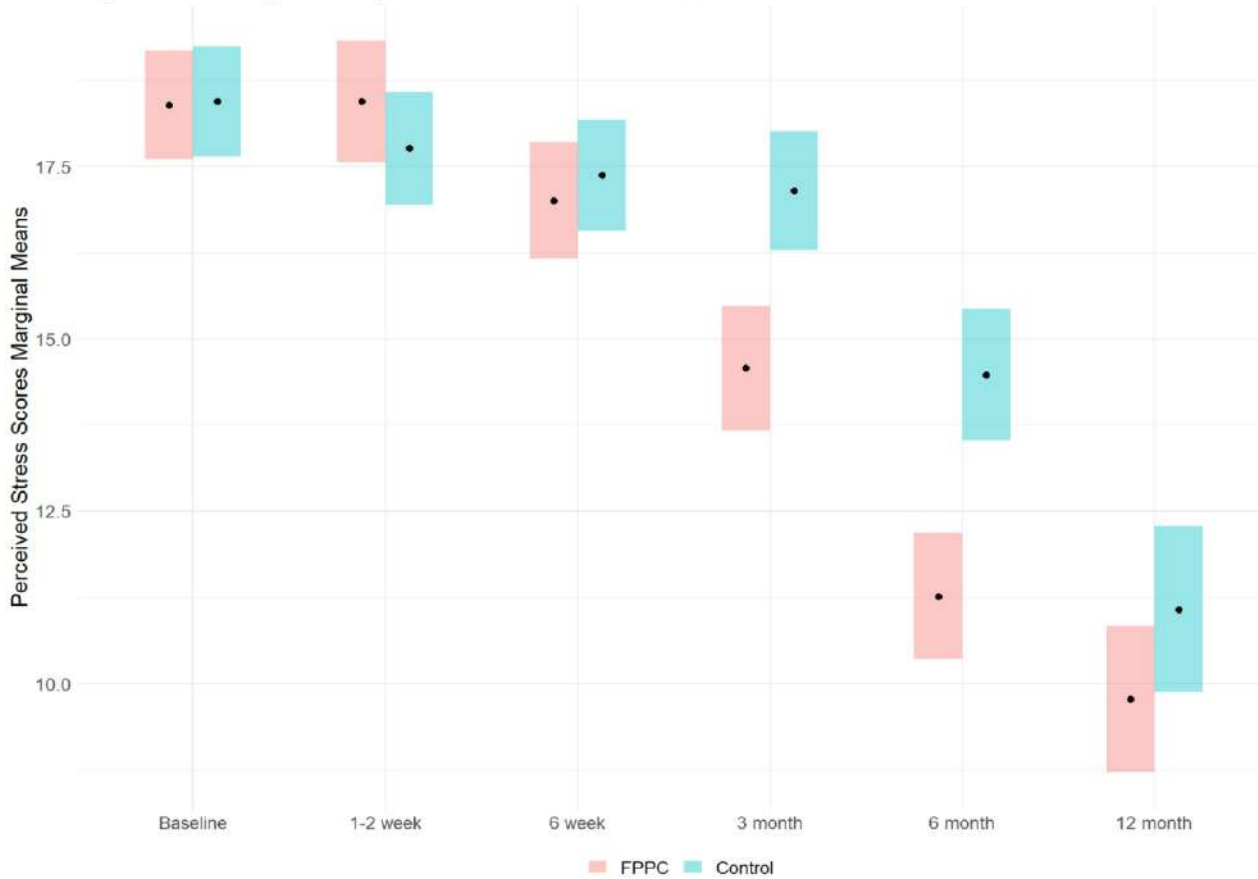


Figure 7. Average Participant Edinburgh Postnatal Depression Scores Over Time

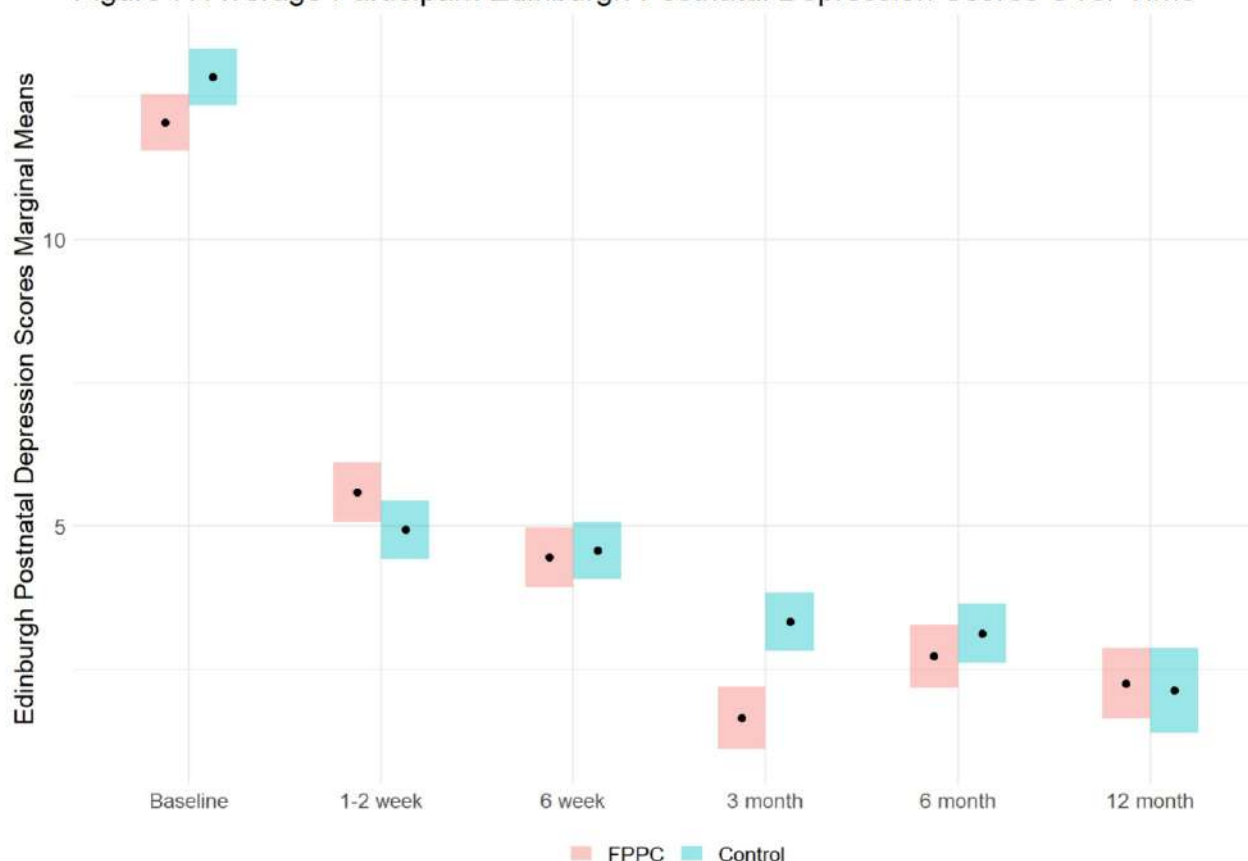


Table 13. Perceived Stress Scores

Time	Bagabaga		Choggu		Kalpohini		Kanvilli	
	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC
Baseline	19.58(1.95)	18.71(2.33)	19.7(0.7)	20.04(0.71)	18.09(3.1)	18.04(3.85)	16.45(3.91)	16.5(4.03)
1-2 week	18.04(2.74)	18.13(2.14)	19.9(0.46)	19.95(0.22)	17.09(4.62)	18.31(2.47)	16.32(5.64)	17.68(2.95)
6 week	18.04(2.1)	17.2(2.46)	20(0)	20(0)	15(4.83)	11.56(5.45)	16.43(3.7)	18.23(3.77)
3 month	16.45(3.86)	13.56(4.78)	19.59(0.8)	17.78(0.65)	16(4.67)	11.38(6.18)	16.35(4.69)	15.5(4.58)
6 month	12.06(4.09)	8.62(3.47)	15.54(6.95)	11.73(6.47)	16.05(4.76)	13(5.89)	14.62(4.44)	11.2(6.5)
12 month	13.46(5.25)	10.65(5.4)	4.06(1.39)	4.13(1.25)	17.12(2.71)	14.64(5.43)	10.91(3.45)	9.67(4.7)

Table 14. Edinburgh Postnatal Depression Scores

Time	Bagabaga		Choggu		Kalpohini		Kanvilli	
	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC
Baseline	12.92(2.5)	11.62(2.02)	17.21(3.78)	14.38(4.35)	10.46(3.43)	9.46(3.35)	10.75(3.42)	12.71(2.73)
1-2 week	5.04(2.07)	6.04(1.94)	7.89(3.02)	7.62(3.01)	2.78(1.59)	3.44(3.54)	4.09(3.1)	5.3(2.27)
6 week	4.58(2)	4.64(2.72)	5.71(2.31)	4.9(2.12)	2.65(2.95)	1.63(1.12)	5.38(3.68)	6.67(2.88)
3 month	2.96(2.59)	1.52(1.83)	5.39(2.87)	1.94(1.66)	1.26(1.79)	0.4(1.06)	3.73(3.09)	2.87(2.07)
6 month	2.69(0.87)	2.24(0.44)	4.04(2.73)	2.5(0.73)	2.33(0.92)	2.65(1.58)	3.54(1.72)	3.68(2.44)
12 month	3(1.29)	2.53(0.62)	2.44(0.98)	2.07(0.26)	2.77(1.03)	2.08(0.29)	2.36(0.5)	2.53(1.06)

Table 15. Edinburgh Postnatal Depression Outstanding Scores

Time	Possibly Depressed		Danger to Self	
	Control	FPPC	Control	FPPC
Baseline	71	71	3	8
1-2 week	8	11	0	1
6 week	7	4	2	1
3 month	5	0	0	0
6 month	2	1	1	0
12 month	0	0	0	0

Table 16. Perceived Stress Scores Model Term Significance

model term	df1	df2	F.ratio	p.value
Allocation	1	192.3	12.073	0.0006
Time	5	777.5	84.060	<.0001
Location	3	183.0	1.999	0.1158
Allocation:Time	5	777.2	6.180	<.0001
Allocation:Location	3	174.4	1.649	0.1799
Time:Location	15	772.3	17.441	<.0001

**Table 17. Edinburgh Postnatal Depression Scores
Model Term Significance**

model term	df1	df2	F.ratio	p.value
Allocation	1	191.7	3.107	0.0795
Time	5	775.6	514.373	<.0001
Location	3	183.3	30.915	<.0001
Allocation:Time	5	775.3	5.274	0.0001
Allocation:Location	3	175.7	5.819	0.0008
Time:Location	15	770.8	9.495	<.0001

Feasibility and Satisfaction with Focused-PPC

We report the preliminary results of the 12 month surveys. Of the 59 Focused-PPC participants that have currently taken the survey, many skipped answering feasibility and satisfaction questions. For example, only 6 answered how satisfied with their clinical care and only 8 answered how satisfied they were with the education they received. In both cases, all respondents reported being satisfied. Yet when asked what they were satisfied with and dissatisfied with about the Focused-PPC study, many more participants gave their opinions. An overwhelming majority of the participants listed being satisfied with the information provided and the peer support. Additionally, the 6 participants that listed otherwise followed up saying they were satisfied with the clinical assessments. On the other hand, the length of the sessions seemed to be the only point of contention among participants. When asked to clarify what the 4 participants who answered “other” disliked, they answered disliking the lateness or absence of their peers. 57 of the 59 Focused-PPC participants that finished their 12-month surveys said that they liked the group format for learning about postpartum care. In their final notes on the survey, 22 participants gave additional feedback on the study. Most expressed their satisfaction with the study and commented how much they benefitted and would like it to continue, while 2 mentioned wanting the study to include transportation or adjusted meeting times.

We will further assess the feasibility/acceptability and satisfaction of the Focused-PPC intervention via end-line focus group discussions with both participants and midwives. These guided discussions will allow the opportunity for honest and open-ended feedback regarding the structure and implementation of Focused-PPC, and will have time dedicated to asking

participants and midwives about their suggestions and recommendations to improve the intervention. Additionally, we will utilize these sessions to further measure participants’ satisfaction with various components of Focused-PPC. We will use the data gathered from these focus groups to create reports regarding our recommended alterations to or maintenance of the intervention in order to achieve sustainability.

Table 18. Satisfaction with FPPC Study

	Satisfied	Disliked
Length of Sessions	17	12
Information Provided	54	7
Peer Support	43	3
Other	6	4

IMPLICATIONS

Through this RCT, we aimed to delineate an improved model of postpartum care for women in Ghana. There is a fundamental lapse in care for the mother after delivery, where most of the attention from healthcare providers gets diverted to the newborn baby. While this is important to ensure the health of the newborn, there is still a grave need for care of the mother. Without a healthy mother, the health and wellbeing of her baby is simultaneously put at risk. Therefore, the Focused-PPC intervention was the first of its kind to integrate recommended clinical care, a targeted education curriculum, and peer support into a model of postpartum care delivered over an entire year after birth. This intervention was developed to combat maternal morbidity and mortality in Ghana; and, more specifically, was meant to reduce preventable maternal deaths and promote the quality of mothers’ lives post-birth. Focused-PPC was uniquely designed to meet the needs of the community and utilize the resources already available in the locations we served. Strong collaboration among a local NGO (Savana Signatures), midwives, and health centers in Tamale allowed for successful community engagement, recruitment, and implementation of this new mode of care. We found that healthcare professionals were qualified and willing to provide care in this manner. Additionally, it was cost-effective and feasible to provide the resources necessary for this model of care.

In contrast with the current standard of individual postpartum care, the Focused-PPC intervention allowed for women to receive postpartum care in a group setting. Specifically, women were placed in a group consisting of eight postpartum women and their newborn babies. The main justification for this mode of delivery was to allow peer support to flourish among women living through similar experiences. We found that the group approach allowed for more honest and extensive discussions among women and was well-appreciated by participants. Participants, as well as project staff members, reported a strong sense of community and companionship emerged in this format. Additionally, delivering postpartum care in a group model can save time and resources for healthcare professionals who aim to improve maternal outcomes, as it allows for the provision of individual assessment of mothers and their children at one time point rather than at a separate appointment for each.

In terms of health assessments, women participating in Focused -PPC received the full range of clinical assessments generally recommended across the globe and those usually performed by midwives post-birth in Ghana. Our intervention differed in that physical and mental health assessments were provided to every woman and were conducted up to one year after birth. The infrastructure necessary to conduct physical assessments were already in place, and we utilized these resources to provide more comprehensive and consistent clinical care postpartum. On the other hand, mental health assessments are often not prioritized after birth, and not many resources exist in the setting for evaluating or treating mental health. Therefore, the midwives delivering the Focused-PPC model of care received specialized mental health training in order to enhance their ability to care for the mental health of postpartum women. This training was extensive and cost-effective, and ensured that midwives were able to promptly identify, discuss, and manage mental health concerns among Focused-PPC participants. It is important to note that if a woman required more intensive mental health care or referral than a midwife was able to provide, a referral was made; however, there remains a significant lack of counseling and psychiatric services available.

Through the Focused -PPC intervention, we successfully implemented individual physical and mental health assessments at several time points from delivery up until one year after birth. Women received head-to-toe assessments for the first two months postpartum, and continued to receive assessments of vital signs and mental health screening every month until one year. In this way, we were able to quickly identify any pressing health issues. For example, several participants had elevated blood pressure readings at

different timepoints in the study, but were able to be promptly treated by midwives. A high number of participants experienced elevated stress levels, especially in the first months postpartum, and were counseled by midwives regarding ways to mitigate this issue. We believe that this, along with the trust and peer support nurtured in the group setting, contributed to our findings which showed that participants in the intervention group experienced more decreases in their stress levels as time progressed. Additionally, we noted several participants at high risk of depression and some with suicidal ideation throughout the course of the study. In these instances, women were able to be provided with immediate support and counseling, and referred to further care depending on intensity of circumstances. Overall, these findings demonstrate that postpartum women face a variety of concerns with their physical and mental health across the year after birth, yet there is great potential to intervene. Many of the concerns identified among Focused-PPC participants may not have been otherwise addressed within the current standard of care, thereby missing the opportunity to combat maternal morbidity and eventual mortality in this vulnerable time period.

In terms of education, all Focused - PPC sessions followed a comprehensive education curriculum. This curriculum was designed to address specific needs of the community, identified via a needs assessment, and to cover the most important topics related to post-birth safety and recovery, as determined by a panel of medical and research experts. This comprehensive education curriculum allowed for an easy-to-follow, standardized model of teaching in which a plethora of valuable health knowledge can be delivered over time, rather than all at once. Often, the majority of postpartum education is delivered very quickly after birth, addressing all topics at once. Our model differed in that education was spaced apart and topics were addressed at relevant timepoints. We found this mode of education straightforward to implement, and beneficial for participants as they progressed through the postpartum period. Education content was translated into audio and visual resources and presented in the local language for engagement and better understanding.

Evidence of the impact of our targeted education curriculum were seen in improved health behaviors and increased knowledge among Focused-PPC participants as compared to the control group. For instance, some of the main education topics presented to women were warning signs of life-threatening complications post-birth; and, we found that, over time, knowledge of post-

birth warning signs continued to increase in the Focused-PPC group while knowledge generally decreased in the control group. Additionally, we saw that by three months postpartum, nearly all Focused-PPC participants could identify every warning sign of potential complications, and this knowledge was maintained thereafter. Another important topic educated on during Focused-PPC sessions was proper nutrition and the 4-star diet. We found that markedly more Focused-PPC participants-maintained knowledge of the 4-star diet and practiced proper nutrition practices than those in the control group. Lastly, midwives spent significant effort educating on family planning practices; and, promisingly, we noted that participants in Focused-PPC were more likely than those in the control group to implement family planning methods across the course of the study. These results yield assuring implications that targeted education delivered in this setting can contribute to improved health behaviors and outcomes.

Overall, our study demonstrated that a structured group model of postpartum care including education, health assessments, and peer support for new mothers can diminish many of the negative effects that may accompany childbirth and the postpartum period. Ultimately, we believe the findings presented here imply that the Focused-PPC model of care has tremendous potential to enhance knowledge, improve health behaviors, and reduce maternal morbidity and mortality in Ghana.

Policy Recommendations

This study presents the Focused - Postpartum Care intervention as a new and innovative model of integrating education, health assessments, and peer support into postpartum care for mothers. Results of this study have the capacity to inform the development of evidence-based policies and recommendations regarding an improved standard of postpartum care in Ghana, other countries in Sub-Saharan Africa, and beyond. Adopting Focused-PPC into the existing maternal healthcare system in Ghana requires policymakers to recognize the importance of postpartum care in relation to overall maternal health—understanding how continuous, timely, and comprehensive care plays an integral role in preventing maternal morbidity and mortality. With the goal of ensuring future generations of healthy mothers, the need for creative and equitable policy solutions which address the components of Focused-PPC are urgent. Potential policy pathways for meeting this goal include 1) strengthening midwifery education and training to provide adequate services and information to mothers in the postpartum

period, 2) expanding accessibility to postpartum care visits which extend up to one year after birth, and 3) promoting a coalition of clinical and peer-based support by investing in community-based resources which empower new mothers through this monumental transition of life.

Improving the current practices for providing person - centered maternity care in the postpartum period begins with ensuring that midwives— Ghana’s primary health care providers —are not only aware, but thoroughly trained in delivering the Focused-PPC detailed in this study. Specifically, policymakers should consider integrating the components of Focused-PPC as a part of the required curriculum for training midwives within the Nurses and Midwives Council of Ghana (NMC). The NMC is the sole regulatory body of nursing and midwifery education, training, practice, and professional conduct of nursing and midwifery personnel in Ghana (NMC). In order to expand midwives' scope of practice to deliver Focused-PPC, the NMC should consider an updated curriculum which prioritizes midwives' knowledge of proper physical assessments, and mental health screening within the postpartum period. This may include lessons on recognizing abnormal vital signs which fall outside the normal ranges during the weeks and months after birth as defined by the WHO (WHO, 2020). Training on maternal mental health screening should also be required within midwives’ pre-service curricula. This will enable midwives to make accurate assessments of women who present with symptoms of depression, which is critical for those women to be properly directed to subsequent treatment and resources. It is also crucial that the NMC, in accordance with Ghana’s National Reproductive Health Service Policy and Standards, teach midwives to deliver and disseminate information regarding postpartum care effectively to mothers. Topics discussed within the education component of Focused-PPC—such as family planning or proper self-care after birth—are often sensitive conversations which must be regarded with a high level of respect, empathy, and patience for every woman and their individual circumstances. Midwives’ ability to respectfully communicate information on post-birth warning signs for potential complications, mental health following birth, and family-planning strategies all at recommended timepoints, will enable mothers to partake in health-seeking behaviors which may improve health outcomes. It is important to note however, that cementing Focused-PPC as an integral component of training for midwives in Ghana will require immense support and increased funding from the Ghana Health Service—a branch under the Ministry of Health of Ghana which implements government policies on healthcare. A potential avenue that should be considered would be

efforts to expand the budget allocated to the NMC of Ghana. Prioritizing maternal health throughout the postpartum period, begins by investing in quality, up-to-date, and evidence-based midwifery education which equips midwives to confidently deliver all aspects of Focused-PPC.

Policymakers should also consider efforts to increase postpartum service utilization by expanding accessibility for particularly vulnerable women in Ghana and increasing the duration in which postpartum care is provided. In order for midwives to deliver lifesaving education and comprehensive clinical assessments, women must be made aware of postpartum services early during their pregnancy and have the opportunity to access care. Evidence from the Ghana Demographic and Health Survey in 2014 contends that mothers living in rural areas are least likely to receive postnatal check-ups relative to other demographics (GSS et al., 2015). This trend has been linked to the increased distance rural women have to travel to reach healthcare centers (Dotse-Gborgbortsi et al., 2020). In order to mitigate this disparity, the government must consider increasing the number of maternal healthcare facilities within rural settings. Additionally, communities with high poverty rates have lower postnatal care service utilization than communities with low poverty rates (Dankwah et al., 2021). Despite the free maternal health policy created under the National Health Insurance Scheme (NHIS) in Ghana in 2008, women often still have to make out of pocket payments for maternal health services (Dalinjong et al., 2018). To ease the financial burden associated with maternal health care, and promote utilization of postpartum healthcare services, the NHIS should work to reduce and eliminate all extra out of pocket expenditures– a task which requires increased funding to the Ghanaian health sector.

Although an increased focus should be placed on women in these marginalized groups, postpartum care visits for all women must be a continuous rather than isolated event. Currently, the Ghana National Reproductive Health Policy and Standards defines the postnatal period beginning at the end of delivery and ending six weeks after delivery (Republic of Ghana, & Ghana Health Service, 2014). In following the methodology of this study, postpartum care and NHIS coverage should be extended up to one year after birth.

Finally, in order for Focused - PPC to become highly integrated within societal practices as well as government healthcare policy, support rooted within the community must be adequately funded and advocated for. One of

the innovations of Focused-PPC is the peer-support group based sessions which allow for women to share their honest experiences, and express their healthcare needs and concerns. To increase this service utilization, policymakers should work to build support from within the community—potentially by sharing testimonials of women’s experience in the peer support group setting and also how information received from Focused-PPC worked to prevent negative health outcomes. Additional funding should also be allocated to family-planning resources such as contraception, and mental health resources that can be easily accessed within the community. Although it is most important for midwives to be trained in the education, clinical care, and peer-support components of Focused-PPC, local leaders, community health workers, adolescent women, and friends and family of new mothers should also be informed on the importance of postpartum care. Disseminating information on post-birth maternal healthcare has the potential for those within the community to encourage women to seek out critical care during the postpartum period.

Ultimately, the quantitative and qualitative data collected from this Focused-PPC study can advise policymakers in making informed decisions on how to improve maternal mortality and morbidity in Ghana and beyond. The formation of evidence-based policies regarding the quality and length of postpartum care has the potential to promote safe motherhood by informing midwives and mothers of proper care and potential risks associated with the postpartum period. To continue making progress towards the UN’s goal of ending preventable maternal deaths, efforts to adequately finance and build community support for policies aimed at improving postpartum care is essential.

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APPENDIX

Table 1. Study Design

Recruitment of potential participants			
Enrollment of eligible participants			
Informed Consent and Baseline survey			
Random assignment into intervention and control groups			
Health Center	# of Participants	Intervention	Control
Kanvilli	48	24 (3 groups of 8)	24
Choggu	48	24 (3 groups of 8)	24
Kalpohin	48	24 (3 groups of 8)	24
Bagabaga	48	24 (3 groups of 8)	24
Focused-PPC (Intervention Group)		Standard PNC (Control Group)	
Focused-PPC care		Usual care	
Focus group discussions at end		X	
Interviewer administered surveys at certain time-points (see table 2)			

Table 2. Outcomes/Evaluation

Variables	Measurement	Baseli ne	1- 2 w k	6 w k	3 m o	6 m o	12 mo
Independe nt variables and potential Covariates	Demographic questions Obstetric history questions Readiness for Hospital Discharge Scale – New Mother Form	X					
Knowledge of post- birth warning signs	Investigator developed questions based on common post-birth complications	X	X		X	X	
Postpartum health behaviors	Specific questions assessing health behaviors will be tailored to time-frame postpartum. Will include attendance to visits		X	X	X	X	X
Postpartum health status	Edinburgh Postnatal Depression Scale Perceived Stress Scale Questions on complications experienced and other questions on health status as appropriate to time-frame after delivery Measures of blood pressure, temperature, pulse, weight	X	X	X	X	X	X
Feasibility, acceptabilit y, satisfaction	Focus groups with midwives and each group of participants in Focused-PPC intervention using focus group guide.						At exit

Table 9. Multilevel Model Results

	Value of Category	Null (n=192) Coefficient (SE)	Model (n=192) Coefficient (SE)
Location-level Variables			
Location	Bagabaga		<i>Reference</i>
	Choggu		6.82 (0.44)
	Kalpohini		-0.01 (0.44)
	Kanvilli		2.13 (0.44)
Participant-Level Variables			
Education			
	Did Not Attend School		<i>Reference</i>
	Primary School		0.06(0.17)
	Secondary School		0.39(0.20)
	Tertiary/Vocational School		0.51(0.24)
Income			
	No		
	Yes		-0.04(0.15)
First Pregnancy			
	No		<i>Reference</i>
	Yes		-0.13(0.16)
Allocation			
	Control		<i>Reference</i>
	FPPC		-0.10(0.44)

Allocation:Location

FPPC:Choggu	0.25(0.63)
FPPC:Kalpohini	-0.26(0.62)
FPPC:Kanvilli	0.59(0.66)

Time-Level Variables

Time	Baseline	<i>Reference</i>
	1-2 Weeks	-0.25(0.43)
	3 Months	-0.14(0.47)
	6 Months	-0.39(0.45)

Allocation:Time

FPPC:1-2 Weeks	3.54(0.61)
FPPC:3 Months	7.22(0.64)
FPPC:6 Months	7.10(0.69)

Time:Location

1-2 Weeks:Choggu	-0.04(0.63)
3 Months:Choggu	-5.53(0.65)
6 Months:Choggu	-5.79(0.63)
1-2 Weeks:Kalpohini	0.67(0.62)
3 Months:Kalpohini	1.11(0.65)
6 Months:Kalpohini	0.47(0.63)
1-2 Weeks:Kanvilli	1.47(0.62)
3 Months:Kanvilli	1.22(0.64)
6 Months:Kanvilli	1.89(0.62)

Allocation:Time:Location

	FPPC:1-2 Weeks:Choggu	-3.16(0.90)
	FPPC:3 Months:Choggu	-1.55(0.89)
	FPPC:6 Months:Choggu	-0.88(0.97)
	FPPC:1-2 Weeks:Kalpohini	-1.20(0.89)
	FPPC:3 Months:Kalpohini	-1.95(1.09)
	FPPC:6 Months:Kalpohini	-0.99(0.91)
	FPPC:1-2 Weeks:Kanvilli	-1.44(0.91)
	FPPC:3 Months:Kanvilli	-4.13(0.91)
	FPPC:6 Months:Kanvilli	-4.29(1.00)
ICC Location	0.268	-
ICC Participant within Location	0.159	0.038
ICC Time within Participant	0.042	-
AIC	3406.2	2866.4

Table 11. PostPartum Health Behaviors

Behavior	1-2 Week		6 Week		3 month		6 month		12 month		
	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC	
Feeding baby	Exclusive breastfeeding	85	83	92	78	90	78	47	39	2	1
	Breastfeeding and other (please specify):	2	1	2	0	0	1	41	37	55	57
	Baby foods (please specify):	0	0	0	0	0	0	0	0	2	0
	Formula feeding (NAM1)	0	0	1	0	0	0	0	0	0	0
	NA	1	0	0	7	0	0	0	0	0	1
Drink alcohol	Yes	2	3	2	1	2	4	0	0	0	0
	No	86	81	92	77	88	75	88	76	58	59
	NA	0	0	1	7	0	0	0	0	1	0
Number of drinks per day	0	0	1	0	0	0	0	0	0	0	0
	NA	88	83	95	85	90	79	88	76	59	59
Number of drinks per week	I did not drink at all	88	84	94	77	90	79	88	76	58	59
	14+ drinks	0	0	0	0	0	0	0	0	1	0
	NA	0	0	1	8	0	0	0	0	0	0
Smoke or use tobacco	No	88	84	95	78	90	79	88	76	59	59
	NA	0	0	0	7	0	0	0	0	0	0
Smoking rules in house	No one is allowed to smoke anywhere inside my home	83	78	90	74	80	74	81	75	55	56
	Smoking is allowed in some rooms or at some times	3	4	2	1	8	3	6	0	4	2
	Smoking is permitted anywhere inside my house	1	1	1	3	2	0	1	1	0	0
	NA	1	1	2	7	0	2	0	0	0	1
Drug use	Yes	1	1	1	0	0	0	0	0	0	0
	No	86	83	91	78	90	79	88	76	58	58
	NA	1	0	3	7	0	0	0	0	1	1

Table 11. PostPartum Health Behaviors Cont

Behavior		1-2 Week		6 Week		3 month		6 month		12 month	
		Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC
Vitamin consumption frequency	Every day of the week	29	33	28	27	41	42	25	21	12	17
	4 – 6 times a week	17	20	15	21	8	12	1	9	3	2
	1 – 3 times a week	16	18	19	8	12	6	9	4	2	1
	I do not take a multivitamins, prenatal vitamin, or folic acid vitamins at all	25	13	33	22	28	18	53	41	42	39
Physical activity	NA	1	0	0	7	1	1	0	1	0	0
	Yes	31	27	29	30	12	39	17	24	10	15
	No	54	53	65	45	74	38	60	44	39	34
	Don't know/Not sure	1	1	1	1	3	2	10	7	8	9
	Refused	0	3	0	1	0	0	1	1	2	0
How worried if she gets pregnant within the next 6 months	NA	2	0	0	8	1	0	0	0	0	1
	Extremely	58	56	66	60	58	69	34	55	13	33
	Very	26	27	26	16	29	9	37	14	26	21
	Moderately	2	1	1	1	2	0	12	3	15	0
	Not very	0	0	1	0	0	0	2	3	3	2
	Not at all	0	0	1	1	1	0	1	0	1	3
How upset if she gets pregnant within the next 6 months	NA	2	0	0	7	0	1	2	1	1	0
	Extremely	52	52	65	53	54	66	35	52	11	31
	Very	32	28	27	21	33	12	37	16	28	23
	Moderately	2	2	3	1	1	0	10	4	12	1
	Not very	0	0	0	1	0	0	3	3	6	0
	Not at all	0	0	0	2	0	0	1	0	1	4
	NA	2	2	0	7	2	1	2	1	1	0

Table 11. PostPartum Health Behaviors Cont

Behavior		1-2 Week		6 Week		3 month		6 month		12 month	
		Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC	Control	FPPC
How likely she gets pregnant within the next 6 months	Extremely	1	1	0	0	0	0	0	0	0	0
	Very	0	0	1	1	0	0	3	1	0	4
	Moderately	2	3	3	1	4	1	1	4	8	1
	Not very	23	15	23	12	25	7	36	24	27	15
	Not at all	61	65	67	64	61	71	48	46	24	39
	NA	1	0	1	7	0	0	0	1	0	0
To what extent she wants to get pregnant within the next 6 months	Definitely yes	1	0	0	0	0	0	1	0	0	0
	Possibly yes	0	0	1	0	0	0	3	1	1	2
	Unsure	7	3	5	4	5	0	14	5	16	10
	Probably no	7	5	17	3	21	5	22	22	13	11
	Definitely no	72	76	72	71	64	73	47	48	29	36
	NA	1	0	0	7	0	1	1	0	0	0
Use family planning methods	Yes	10	14	11	13	11	26	12	26	12	33
	No	68	68	79	61	69	48	63	47	43	23
	Refused	9	2	5	4	10	4	13	3	4	3
	NA	1	0	0	7	0	1	0	0	0	0
Family planning methods used	Condoms (for you male partner)	36	36	32	19	23	23	13	25	5	9
	Spermicide	1	0	0	0	0	0	0	0	0	0
	NA	51	48	63	66	67	56	75	51	54	50
Know About 4 Star Diet	Yes	42	48	54	67	50	66	34	64	25	57
	No	44	36	41	10	40	13	54	12	34	2
	NA	2	0	0	8	0	0	0	0	0	0
Frequency eating 4 Star Diet	Everyday of the week	6	12	6	9	3	24	3	29	1	30
	5-6 days a week	7	9	4	21	8	15	5	9	2	4
	3-4 days a week	20	20	29	22	28	18	21	19	10	16
	1-2 days a week	5	6	12	12	8	6	4	6	7	2
	I have not been able to eat 4-star diet	3	1	3	3	3	3	1	1	5	5
	NA	47	36	41	18	40	13	54	12	34	2

The logo graphic consists of a dark blue square with a white border, tilted slightly to the right. This square is overlaid by two overlapping, light blue-outlined rectangles, also tilted to the right, creating a layered effect.

Savana Signatures

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