Perinatal Depression in Rural Ghana:

Burden, Determinants, Consequences, and Impact of a Community-Based Intervention.

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Statement of authorship/declaration

I Benedict Weobong, affirm that the work presented in this thesis is my own, and any other information derived from both published and unpublished work has been duly acknowledged.

Signed:

Date**:**

Acknowledgements

"He has made all things beautiful in His time, and He has also set eternity in the hearts of men; yet they cannot fathom what God has done from beginning to end" (Ecclesiastis 3:11). Permit me to delve into the realm of my christian faith, but these words spoken several thousands of years ago fittingly describe all the emotions and passion that have come about as I take the first step into the world of academia and research. This could not have materialised without the involvement of many distinguished and very admirable people, I could not even begin to mention all of them in the little space and window I have. Nevertheless, some notable individuals and groups deserve to be recognised.

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Dedication

To the ever loving memory of Godfrey and Ophelia Weobong, both of whom I/we sorely miss. I know you have been watching!

Prologue

This thesis is a compilation of research findings on the topic of perinatal depression in the low and middle income country (LMIC), Ghana. The thesis is presented in the "Research Paper Style", rather than the "Book Style" as provided in section 15.5 of the LSHTM Research Degree Handbook. The presentation of the findings is to tell a coherent story of the epidemiology of perinatal depression.

The thesis is thus structured with this in mind and has four main sections. The introduction in section A contains two chapters. Background to the PhD project, rationale, aims, and conceptual framework for the PhD are presented in chapter 1. In chapter 2, a narrative of relevant literature in perinatal depression, including gaps is presented. This transitions into section B of the thesis where an overview of the methodology employed in this project is presented. This section contains chapters 3 and 4 which outlines the setting of the research project and data collection procedures.

Section C is where the story of the findings through prepared research articles is presented. Preceding this is an overview chapter (5) describing the background characteristics of the study population, denominators, and brief psychometric properties of the depression tool used in this PhD. At the beginning of the coherent story I present in chapters 6 and 7, the burden and determinants of antenatal and postnatal depression. Then in chapters 8 and 9, I discuss the consequences of antenatal and of postnatal depression on the health of the mother and baby. Finally, I present in chapter 10 findings from a home-visits intervention (NewHints) with the potential to reduce the burden of postnatal depression among recently delivered mothers.

In the last section of the thesis (section D), I present a general summary of my findings, suggest an agenda for future work, and discuss programmatic implications of the findings in chapter 11.

Abstract

The relative lack of research in mental health in low and middle income countries is symptomatic of the 10/90 gap in general health research where only 10% of the world's expenditure on health research is dedicated to the poorest 90% of the world's population. Globally there has been modest declines in both maternal and child deaths but there are still wide disparities between developed and developing countries; as the total number of under 5 deaths has declined, from 11.6 million in 1990 to 7.2 million in 2011, the proportion of deaths occurring in sub-Saharan Africa has increased from 33% in 1990 to 49% in 2011, and the region also bears the biggest burden (>50%) of maternal deaths. Innovations to reducing this burden are urgently needed in parallel with intensified efforts to increase coverage of proven effective maternal and child health interventions. One such innovation might be to include a focus on eliciting contextual determinants, and preventing and/or treating perinatal depression that is depression occurring during pregnancy or after birth, since there is some evidence suggesting that this is associated with adverse effects on infant health and development, and maternal health.

This thesis is designed to add to this sparse evidence base by providing data on the burden of antenatal and postnatal depression in rural Ghana, examining determinants of this burden, investigating the links between perinatal depression and maternal and child health outcomes, and evaluating whether a home-visits intervention had reduced this burden. The research was undertaken within seven contiguous districts of the Brong Ahafo region of Ghana between January 2008 and July 2009. All women of reproductive age in these districts were part of a surveillance system supporting two randomised controlled trials that involved 4-weekly visits by resident fieldworkers who collected data on socio-demographics, obstetric histories, pregnancies, births, deaths and infant and maternal health. The research for this PhD involved training the surveillance field workers to also administer the depression module of the Patient Health Questionnaire screening tool (PHQ-9) to pregnant women and recently delivered mothers between 4-12 weeks after birth.

21135 pregnant women and 18356 recently delivered women were screened for depression, 13929 of whom were screened at both time points. The prevalence of postnatal depression (PND) was 3.8% (95% CI 3.5%, 4.1%), comprising 0.1% (95% CI: 0.08%-0.1%) who met criteria for major depression and 3.7% (95% CI: 3.4%-3.9%) for minor depression. The prevalence of antenatal depression (AND) was much higher 9.9% (95% CI: 9.5%-10.3%); 12.5% of these cases persisted into the postnatal period and accounted for 34.4% of postnatal cases.

The following determinants were identified for antenatal depression: maternal age 30 years or older, never married, lower wealth status, non-Catholic religion, non-indigenous ethnicity, unplanned pregnancy, and previous pregnancy loss.

And the following were identified for postnatal depression: never married, non-indigenous ethnicity, AND, season of delivery, peripartum/postpartum complications, newborn ill-health, still birth or neonatal death. Determinants were similar for 'new' cases of postnatal depression and for cases where depression was also detected antenatally.

AND was found to be associated with the following consequences: prolonged labour, postpartum complications, peripartum complications, CS/instrumental delivery, severe newborn illness, and bed net non-use during pregnancy. PND was associated with increased risk of infant mortality up to six months (rate ratio [RR], 2·83 (1·56-5·16) and 12 months (RR, 1·79 (1·04-3·09) of age. Postnatal depression was also associated with increased risk of infant morbidity.

Home-visits by community volunteers aimed at preventing neonatal deaths had no impact on attenuating prevalence of postnatal depression (relative risk [RR] 0.99 (95% CI 0.65, 1.50; p=0.96).

This is the first large cohort study in SSA to provide evidence of determinants and consequences of perinatal depression, rather than studying the more general common mental disorder which include depression. The conclusions reached in this PhD are:1) Most risk factors of postnatal depression relate to adverse birth outcomes of the mother and/or baby, whereas those of antenatal depression are sociodemographic and pregnancy-specific, 2) Both antenatal

and postnatal depression may have deleterious effects on the health of the mother and/or on child health and survival, 3) A case for clinical interventions for depression is established both during pregnancy and after birth, 4) Though often self-limiting, tackling antenatal depression could prevent up to a third of the burden of postnatal depression, 5) The timely implementation of such interventions using existing primary care structures may provide an important adjunct to improving maternal health and child health and survival efforts.

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List of abbreviations/Acronyms:

PND	Postnatal Depression
AND	Antenatal Depression
PPD	Postpartum Depression
SSA	Sub-Saharan Africa
LAMIC/LMIC	Low and Middle-Income Countries
HIC	High-Income Countries
PHQ-9	Patient Health Questionnaire-9
EPDS	Edinburgh Postnatal Depression Scale
CPRS	Comprehensive Psychopathological Rating Scale
DSM-IV	Diagnostic and Statistical Manual version IV
ICD-10	International Classification of Diseases, 10th Edition
DSM-IV TR	Diagnostic and Statistical Manual version IV: Text Revision
BDI	Beck's Depression Inventory
SCID	Structured clinical Interview for Depression
RDT	Research Diagnostic Tool
CIDI	Composite International Diagnostic Inventory
GDHS	Ghana Health and Demographic Survey
SPI	Goldberg's Standardized Psychiatric Interview
LBW	Low Birth Weight
NewHinTs	Newborn Home Intervention Trial
RCT	Randomized Controlled Trial
IoP	Institute of Psychiatry
LSHTM	London School of Hygiene and Tropical Medicine
DON	Depression in ObaapaVitA and NewHinTs
ObaapaVitA	Obaapa Vitamin A Trial
DON_PP	DON Postpartum
DON_PREG	DON Pregnancy
IEC	Institutional Ethics Committee
PMR	Perinatal Mortality Ratio
IMR	Infant Mortality Rate
MMR	Maternal Mortality Ratio
DfID	Department for International Development
PRT	Psychiatric Research Trust
SNL	Saving Newborn Lives
WHO	World Health Organisation

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Section A

Chapter 1: Background, Rationale, Aims, Conceptual Framework for PhD

1.1 Background:

1.1.1 DON Study

In this thesis the acronym 'DON' will feature prominently. This is the popular name of the study culminating in providing data for this PhD on perinatal depression, that is depression that occurs during pregnancy and/or after the baby is born. 'DON' stands for '**D**epression in **O**baapaVitA and **N**EWHINTS'. DON is thus a perinatal depression cohort study nested within the **O**baapaVitA and **N**EWHINTS' trials in the Brong-Ahafo region of Ghana[1, 2]. It aimed to: (1) describe the epidemiology of perinatal depression; (2) to ascertain the association between perinatal depression and adverse consequences for maternal and child health; (3) to evaluate the impact of a psycho-educational home visits intervention to prevent newborn deaths on attenuating perinatal depression.

1.1.2 Works Leading up to the DON Cohort Study

Epidemiological research work in the area of perinatal mental health in Ghana started at the Kintampo Health Research Centre (KHRC) in 2005 as a project for my MSc in Research Methods at the Institute of Psychiatry for which I received a research training fellowship grant from the Wellcome Trust. I started off the research agenda with a cross-cultural adaptation of screening scales for postnatal depression for my MSc project. This involved the following: Patient Health Questionnaire (PHQ-9), Edinburgh Postnatal Depression Scale (EPDS), and the Self-Reporting Questionnaire (SRQ-20). My approach to cross-cultural adaptation of these screening tools involved a rigorous translation into Twi using both bilingual and bi-cultural expertise from Ghana and UK and was in keeping with Prince's recommended three steps when attempting to validate measures across cultures[3]. I therefore preceeded the testing of the screening tools by checking the cultural relevance of the

construct of morbid unhappiness in a cross section of various categories of women: grand mothers, postnatal mothers and antenatal mothers in a qualitative study. I also checked the comprehensibility of the items on the questionnaires with particular focus on the phrasing of the questions. Shortly following on the heels of this initial qualitative exploration of the construct of psychological distress during pregnancy and following child birth, I collaborated with an MPH student from the School of Public Health, University of Ghana to explore further the concept and causal factors through qualitative techniques. In both studies, the concept of morbid unhappiness was recognized and appreciated, but there was no agreement on a single term describing it. Participants referred to the concept as the 'worrying sickness' or 'thinking sickness', which are consistent with other reports in Africa or non-Western regions underscoring the fact that the concept of depression does exist but a single term describing it is non-existent[4, 5].

The MSc work laid the foundation for the DON cohort study designed to investigate and describe the epidemiology of perinatal depression and also test the possibility of using a psycho-educational intervention to promote perinatal mental health in a large sample.

1.1.3 Motivating Experiences

In shaping the interest to conduct this investigation, field experiences recorded during the cross-cultural adaptation of screening tools played a key role. During one of my interviews with a recently delivered mother, her baby who was then in the room (the interview was conducted outside) started crying unceasingly. But for constant pleas from me for the woman to attend to the baby, she would have remained adamant and uncaring. This woman showed clear signs of morbid unhappiness during the interview. It was at this point that I wondered what the scale of morbid unhappiness was and what the fate of such new born babies could be, if they (new born) would not be attended to even in such overt distress situations.

1.2 Perinatal Depression: Definition and Aetiology

1.2.1 Defining Perinatal Depression

Perinatal depression encompasses depression experienced by women either during pregnancy (antenatal depression) or after they have given birth (postnatal depression). Traditionally, definitions of postnatal depression are backed by two existing diagnostic systems: the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV TR)[6], and the International Statistical Classification of Diseases and Related Health Problems (ICD-10)[7]. Thus, whilst the DSM-IV recognizes postnatal depression as a major/minor depressive disorder, with onset at four weeks postnatally, the ICD-10 recognizes postnatal depression as a mild mental and behavioural disorder commencing within six weeks postnatally[8]. Irrespective of these two positions, common clinical manifestations of depression during pregnancy or after birth are: depressed mood, markedly diminished pleasure in almost all previously enjoyable activities, insomnia or hyper insomnia, significant weight loss or weight gain, psychomotor agitation or retardation, loss of energy, feelings of worthlessness and excessive guilt, reduced self-esteem and self-confidence, difficulty in concentration, and suicidal ideation[6, 7].

It is important to note that presentation of perinatal depression does not differ from that among women in the general population, though the particular postnatal period is likely to confer a threefold increase in risk[9, 10] and may contribute towards the notion that perinatal depression is a sub-type of general depression[11]. Similarly, in a recent meta-analysis estimates of antenatal depression in the second and third trimesters were double those in the general adult population[12]. These patterns of pregnancy and after birth period vulnerability notwithstanding, the overwhelming position in the discourse surrounding perinatal depression is that it is not a specific discrete, phenomenologically different disorder from depression occurring at other times, and the use of the term does not indicate that such depression always develops [at pregnancy] or after delivery or is necessarily caused by the specific stress of childbirth[13] or pregnancy. Admittedly, severe symptoms of depression may be particularly experienced during the special period of [pregnancy] and after birth because of the psychological and social

ramifications of [pregnancy] or infant care[14], though normal pregnancy and after birth symptoms may confound genuine depression symptoms.

Whether pregnancy and birth are particularly special periods or not, the current view point is that these periods should be viewed as general stressors of life, like any other 'life event' which can trigger an attack of illness across the whole spectrum of psychiatric disorders[15].

1.2.2 Historical Perspectives

Contrary to widely held opinion that work in the area of perinatal psychiatric morbidity has only recently emerged as a psychiatric sub-specialty, an extensive documentation of knowledge of psychiatric disorders of women during and following pregnancy dates as far back as 1858 in the work of Louis-Victor Marce[16]. Marce's contribution to modern psychiatry provides historical evidence that as early as the mid-eighteenth century, risk factors and consequences of perinatal mood disorders were already documented. This is encapsulated in the following quote:

"Where subjects are predisposed to mental illness through either hereditary antecedents, previous illnesses, or through an excessive nervous susceptibility, pregnancy, delivery and lactation can have disastrous repercussions."[17].

Marce also noted that the majority (62.5%) of clinically important mental illness in pregnancy was likely to be *depressive (melancholia),* and such symptoms tended to be self-limiting and disappear as pregnancy progressed. These observations accord remarkably well with contemporary findings particularly in sub-Saharan Africa[18-20] and high-income countries[21, 22]. For such women, Marce recommended physicians provided reassurance as well as close monitoring for later recurrence of episodes. Indeed, Marce also disputed the view that pregnancy had beneficial effects on women's mental health and strongly advised against pregnancy as means of treatment for women who were already mentally ill[16].

1.2.3 Aetiology

Though the aetiology of depression is unknown, various plausible aetiological pathways have been identified. Explanatory models for the explanation of the aetiology have been proposed from biological and psychological perspectives [23]. The biological model outlines various physiological changes during the perinatal period, and posits that such depression results from six underlining mechanisms[23]: nutritional deficiencies, iron-deficiency anaemia, hormonal fluctuations, abnormality in biopterin/neopterin levels, alterations in Hypothalamic-Pituitary-Adrenal (HPA) axis, and alterations in neurotransmitter levels. On the other hand the psychological perspective argues that cognitive, behavioural, learned helplessness, and self-control factors contribute to such depressive states during pregnancy and after delivery[24].

1.3 Theoretical Background to Thesis

The research presented in this thesis took into consideration issues of cross-cultural psychiatry[25, 26], where measuring perinatal pychiatric morbidity from a culture's perspective has been advocated. Thus, there was the need to culturally adapt a tool that allows for 'emic' (derived from within the culture) conceptualizations of perinatal psychiatric morbidity[27]

Using tools from the West with 'etic' (from outside the culture) understandings can be fraught with measurement error because the meaning of words can be affected by a range of social and cultural factors[28]. The reason for doing this was not to place 'emic' conceptualisations over and above the use of international or widely used diagnostic tools or vice-versa but to avoid the assumptions of cross-cultural equivalence inherent in quantitative research instruments[29]. Thus, our decision to use the semi-structured Comprehensive Psychopatholigical Rating Scale[30] in the validation study, was to allow for questions to be asked and responses intepreted by a local clinician without direct reference to Western concepts, constructs or diagnostic nosologies. Aiming to achieve semantic equivalence especially in situations where translation of screening/diagnostic batteries is inevitable is key to ensuring cross-cultural comparisons across sites.

This approach to cross-cultural psychiatry has been previously cited in work carried out in sub-Saharan Africa (SSA). In Zimbabwe for instance, the word 'depression' is used to illustrate an illness which is characterized by emotional symptoms[31]. Patel et al therefore argue that it is very vital to understand the cultural connotations of depressive symptoms used by patients in order to avoid any confusion with Western nosologies. Further to this, in their cross-cultural qualitative study of postnatal depression, Oates and colleagues argued that in order to avoid the assumptions of cross-cultural equivalence inherent in quantitative research instruments and the questionnaire method, qualitative methods were the appropriate way to explore and gain understanding of attitudes and beliefs of women and those involved in caring for them[29]. Having said this, it could well be that the symptoms of depression are fairly universal and measuring tools developed in a given context can be used in others provided that conceptual translation is maintained[31].

Beyond establishing 'emic' conceptualisations of perinatal psychiatric morbidity, other theoretical assumptions guiding this thesis are those advocated by the new movement for global mental health' (www.globalmentalhealth.org). One of the driving arguments of this movement posits that maternal mental health is a critical mediator between social adversity and poor infant growth. Thus, the link between perinatal depression and adverse infant outcomes is especially strong in low socio-economic populations where women face greater adversities and are less empowered[32]. In considering these links however, another school of thought argues that because the pathways have not been consistent in different populations, socio-economic and socio-cultural factors may interact in determining the effect of maternal mental health on child survival[33].As a result the movement advocates for more research in low and middle-income countries.

The search light is thus on the public health burden of perinatal psychiatric morbidity on child and maternal health outcomes in settings where maternal and child health programmes/interventions are lacking, and also because only research that is conducted locally can be expected to affect awareness and lead to new policy development[34].

A contextual understanding of the epidemiology of burden, determinants, consequences and the formulation of culturally appropriate interventions targeting perinatal depression is therefore key.

1.4 Rationale: Need for Studies in SSA and Relevance of the DON Study to the Child and Maternal MDGs 4&5

Sub-Saharan Africa (SSA) is a geographical or political term used to describe the area of the African continent which lies south of the Sahara, or those African countries which are fully or partially located south of the Sahara[35]. It contrasts with North Africa, which is considered a part of the Arab world. Sub-Saharan Africa faces serious political, economic and social challenges. With an annual rate of growth of 2.3 per cent, and the current population of over one billion, another one billion is expected to be added by 2044[36]. And despite improved economic performance in recent years, the overall gross domestic product growth rate is below the 6 to 8 per cent that is required over a 10-year period in order to achieve the Millennium Development Goals (MDGs)[37].

Globally, under 5 child mortality has been declining at a rate of just over 2% per annum since 1990, the baseline year for the MDGs, with evidence of accelerating decline in many regions including sub-Saharan Africa since 2000[38]. Similarly, globally there has been a modest and encouraging progress in reducing maternal deaths with an average of 2% per annum decline in the maternal mortality ratio between 1990 and 2010[39]. There are still wide disparities between developed and developing countries and between regions, with sub-Saharan Africa accounting for a disproportionate and increasing burden of both under 5 and maternal deaths. As the total number of under 5 deaths has declined, from 11.6 million in 1990 to 7.2 million in 2011, the proportion of deaths occurring in sub-Saharan Africa has increased from 33% in 1990 to 49% in 2011[40]. Furthermore sub-Saharan Africa accounts for 56% of maternal deaths (162,000 out of 287,000)[39] and the region is generally not on track to reach either the fourth MDG on child mortality or the fifth on maternal mortality.

Innovations to reducing this burden are urgently needed in parallel with intensified efforts to increase coverage of proven effective maternal and child health interventions. One such innovation might be to include a focus on preventing and/or treating perinatal depression[34] since there is some evidence suggesting that this is associated with adverse effects on infant and child health and development[34, 41, 42], maternal health[43-48] and even child survival[49, 50].

This thesis aims to add to this sparse evidence base by investigating the links between perinatal depression and both maternal and child health outcomes in rural Ghana, as well as adding to the relatively limited evidence base on the burden of perinatal depression in sub-Saharan Africa.

1.5 Aim, Objectives & Conceptual Framework

The overall aim of this PhD was to contribute original contextual knowledge concerning the links between perinatal depression and maternal, newborn and infant health in rural Ghana. The specific objectives are guided by the conceptual framework in figure 1.1 and are arranged in table 1.1 by the five contributing papers.

Table 1.1: Objectives of this PhD Considered Under Each Research Paper of the PhD

Paper	Objectives
1. Prevalence and determinants of antenatal depression among pregnant women in a predominantly rural population in Ghana. **(Research paper 1)**	1.1 To describe the prevalence of antenatal depression (DSM-IV maj/min) 1.2 To assess socio-demographic/socio-economic, obstetric history, and pregnancy-related risk factors of prevalent antenatal depression.
2. Determinants of postnatal depression **(Research paper 2)**	2.1 To describe the prevalence of postnatal depression (DSM-IV maj/min) 2.2 The estimate the proportion of postnatal depression cases that are antenatal cases and the proportion that are new. 2.3 To estimate the proportion of antenatal cases that persist after birth 2.4 To assess socio-demographic/socio-economic, obstetric history, pregnancy/birth/baby-related risk factors of prevalent postnatal depression. 2.5 To compare the risk factor profile of women with onset postnatal depression and persistence antenatal depression. 2.6 To assess socio-demographic/socio-economic, obstetric history, pregnancy/birth/baby-related risk factors of persistence antenatal depression.
3. The consequences of antenatal depression on birth, neonatal, and maternal outcomes, including pregnancy behaviours and child survival practices in rural Ghana. **(Research paper 3)**	3.1 To assess the association between antenatal depression and **birth and neonatal outcomes** (neonatal deaths, still births, preterm birth, low birth weight, and newborn illness). 3.2 To assess the association between antenatal depression and **maternal outcomes** (peripartum and postpartum complications, prolonged labour, and non-vaginal delivery). 3.3 To assess the association between antenatal depression and **pregnancy behaviours and child survival practices** (antenatal care attendance, bed net use during pregnancy, delivering at health facility, delayed initiation of breast feeding, non-exclusive breastfeeding since birth, and bed net use since birth).
4. The consequences of postnatal depression on infant mortality and morbidity among recently delivered mothers in rural Ghana. **(Research paper 4)**	4.1 To assess the association between postnatal depression and; infant mortality up to six and twelve months of age, and infant morbidity. 4.2 To assess the association between postnatal depression alone or antenatal depression alone, or both antenatal and postnatal depression and; infant mortality up to six months after birth, and infant morbidity.
5. To assess whether the NEWHINTS home visit intervention trial reduced prevalence of postnatal depression. **(Research paper 5)**	5.1 To compare the prevalence of postnatal depression between NEWHINTS intervention and control zones.

The conceptual framework was also used to guide the literature review in Chapter 2. The middle column shows the burden of perinatal depression which encompasses antenatal depression and postnatal depression. As explained earlier in section 1.2.1, these are not phenomenologically different and symptom presentation is the same. Worthy of note however is that antenatal depression is a strong contributor to the burden of postnatal depression.

The left hand column shows the determinants of perinatal depression that will be considered in this PhD. There are 3 groups: socio-demographic/socio-economic, pregnancy-related, and birth/baby-related factors. The first two groups are potential determinants of antenatal depression (paper 1) and all three groups together with antenatal depression are potential determinants of postnatal depression (paper 2). As described in the literature review in the next chapter, there are other potential determinants that have not been included, in particular social support, partner violence, and previous psychopathology; these were beyond the scope of the DON study.

The right hand column shows the consequences of antenatal depression (paper 3), some of which (birth and neonatal/maternal outcomes) also double as determinants of postnatal depression, and consequences of postnatal depression (paper 4) which include infant deaths and infant illness.

The box at the bottom of the framework summarises approaches to tackling perinatal depression (see chapter 2, section 2.6). These include the use of both pharmacological and psychological/psychosocial interventions (treatment/prevention) that can be delivered at the clinic/hospital or community using either professionals or community health workers. Paper 5 in this thesis evaluates the impact of the Newhints home visits intervention on postnatal depression. The home visits were carried out by community volunteers who were trained to visit pregnant women twice during their pregnancy and three times in the first week after birth in order to promote essential newborn care practices, and to assess newborns for danger signs and to refer if any present. As illustrated in figure 1.4, the promotion of newborn care practices

adopted a counselling, problem solving psycho-education informed approach. It was therefore postulated that these two approaches (assessment for danger signs and health promotion) could potentially reduce the likelihood that a woman became depressed postnatally because of enhanced self-esteem, improved mastery of skills and carrying out tasks, and improved health and survival of the baby. Reduced postnatal depression in conjunction with treatments that target the mother-infant relationship may contribute towards improvement in survival of baby.

Figure 1.1: Conceptual Framework of PhD

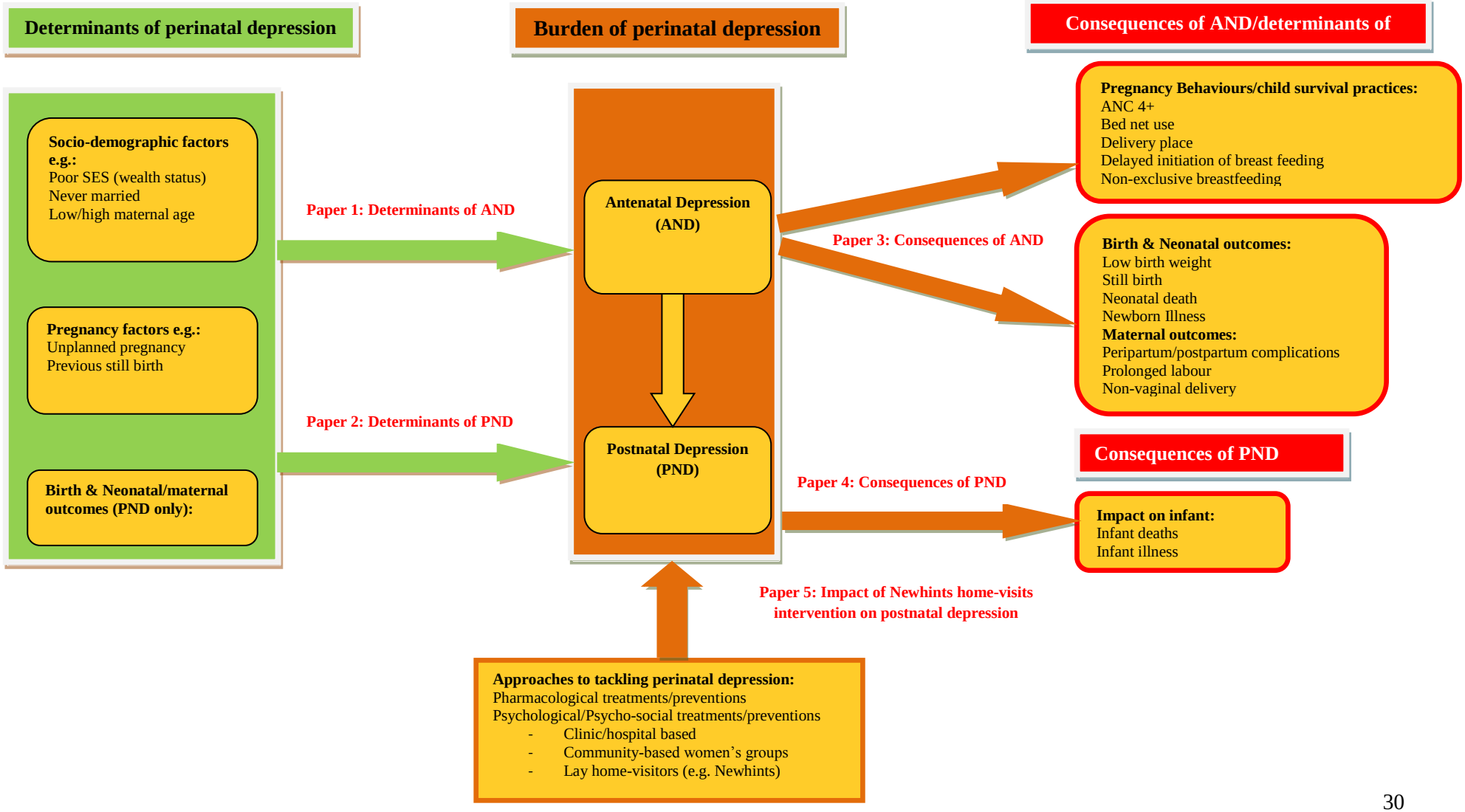
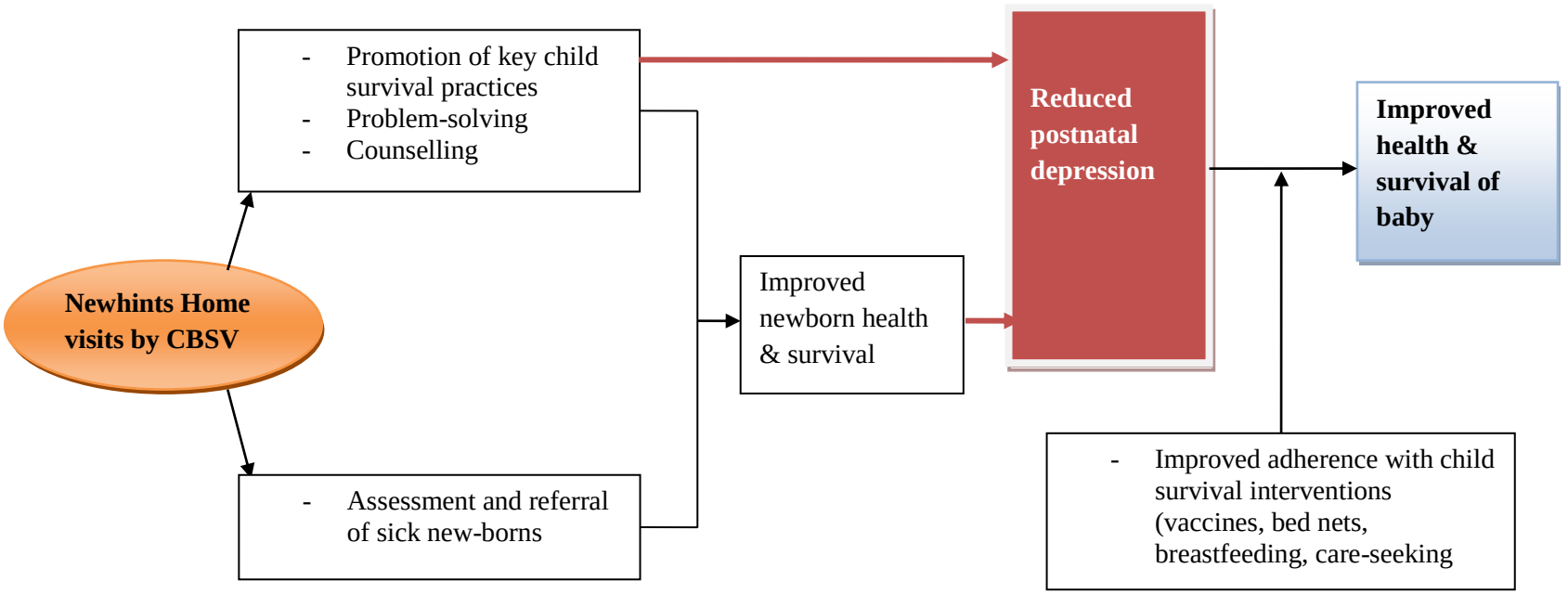


Figure 1.2: Bio-psychosocial Model of Home-visits Intervention, PND and Mother/child Survival



1.6 Role of Author

The author of this PhD was involved in both the ObaapaVitA and Newhints trials in different capacities; member of the trial management team (TMT) on the ObaapaVitA and Newhints trials, and head of supervision on the Newhints trial. In both roles the author participated in the day-to-day running of the trials, and was particularly involved in designing and implementing the supervisory system for the Newhints trial. The author also trained and supervised community based volunteers (CBSVs) to make five home-visits to pregnant and recently delivered mothers; two during pregnancy and three after birth.

The PhD was conceptualised by the author with input from the supervisor of this PhD. The author designed the data collection forms for collecting depression data, designed training manuals, and trained and supervised about 400 data collectors in screening women for antenatal and postnatal depression using the PHQ-9.

All analysis of the PhD data were conducted by the author, including preparation of draft manuscripts covering the five papers contained in this PhD. The primary supervisor and co-supervisor provided main comments and input towards the development of the papers, but all other authors listed also provided comments.

1.7 References to Chapter 1

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2. Chapter 2: Literature Review

The review is structured based on the conceptual framework of this thesis to cover:

- Measuring perinatal depression
- Burden of perinatal depression
- Determinants of perinatal depression
- Consequences of perinatal depression for the health of the mother and baby
- Approaches to tackling perinatal depression

In addition, a brief review of the epidemiology of perinatal and non-perinatal depression Ghana is provided.

2.1 Search Strategy

The Pubmed database was searched with the following MeSH search terms to ensure as many articles as possible would be identified. For perinatal depression the following search terms were used:

Depression[Title/Abstract] AND Antenatal [Title/Abstract] OR postnatal[Title/Abstract] OR perinatal[Title/Abstract] OR antepartum[Title/Abstract] OR postpartum[Title/Abstract])

For determinants of perinatal depression, the MeSH terms for depression together with the following were used:

Causes[Title/Abstract] OR determinants[Title/Abstract] OR risk factors[Title/Abstract] OR correlates[Title/Abstract]

For consequences of perinatal depression, the MeSH terms for depression together with the following were used:

Consequences [Title/Abstract] OR effects [Title/Abstract]

For measuring tools for perinatal depression, the MeSH terms for depression together with the following were used:

Measuring [Title/Abstract] OR screening[Title/Abstract] OR diagnosis[Title/Abstract]

For approaches to tackling perinatal depression, the MeSH terms for depression together with the following were used:

Home visiting intervention [Title/abstract] OR home-based intervention [Title/abstract] OR home visit intervention [Title/abstract] OR paraprofessional intervention [Title/abstract] OR psycho educational intervention [Title/abstract] OR psychosocial intervention [Title/abstract] OR women's groups intervention [Title/abstract] OR community-based intervention [Title/abstract] OR treatment [Title/abstract] OR prevention [Title/abstract]

No time frame restrictions were included. Additional studies were located through careful inspection of the reference sections of relevant papers and reviews.

2.2 Measuring Perinatal Depression

Diagnostic tools or criteria are often regarded as 'gold standard' for measuring depression and other psychiatric disorders. The frequently used diagnostic tools for perinatal depression are: the Composite International Diagnostic Interview (CIDI)[1], Schedules for Clinical Assessments in Neuropsychiatry (SCAN)[2-4], Structured Clinical Interview for Depression –SCID[5] and Goldberg's Standardized Psychiatric Interview (SPI)[6]. However their feasibility and practicability in large-scale epidemiological studies has been questioned[7, 8].

As a result, a number of non-diagnostic screening tools have been developed and in use. Indeed the use of screening tools have been found to increase the detection of depression in clinical practice[9], albeit the detection could just be limited to particular subgroups of depressed women[10]. Compared to diagnostic measures, self-reports have an advantage of objectivity. Choice of outcome is likely to have a strong influence on recorded prevalence[11] with many previous studies reporting high prevalence of common mental disorders, often ascertained with a symptom screening tool, although evidence from the reviews on this point is inconclusive[11-13].

By and large most of the tools designed for screening or diagnosis of perinatal depression have been developed in the West. This phenomenon has imposed a great deal of challenges to

researchers in non-western regions as the tools have to be adapted and validated before they can be used. For instance, the Edinburgh Postnatal Depression Scale (EPDS)[14] which arguably is the most frequently used perinatal depression screening tool has been widely validated[15-18] and has shown good psychometric properties in most studies. This notwithstanding due to methodological differences in study designs, language and varying diagnostic criteria applied, there is reasonable uncertainty regarding comparability between estimates of the different EPDS versions[15, 18]. In the Africa region it has recorded a few validation studies in Uganda[14], Morocco[19], Nigeria[20], South Africa[21] , Zimbabwe[22], Ethiopia[23, 24], and Ghana[25], among others. Other tools such as the Self-Reporting Questionnaire SRQ-20[26], K10[27], Becks's Depression Inventory BDI[28] and the Patient Health Questionnaire PHQ-9[29] among others have also been used in research. All these tools have their limitations and strengths. For example though the EPDS has been extensively validated, it performed poorly in Ethiopia[30]. Indeed, its construct and criterion validity has been questioned when compared to other screening scales such as the PHQ-9 and SRQ-20[25, 30]. Further to this, while there was a deliberate attempt not to include somatic symptoms in the EPDS[14] so as to avoid somatic bias resulting from normal after delivery physical complaints which mimic some symptoms of PND, this omission could be a disadvantage in developing world settings where somatic symptoms are considered to be a common presentation for common mental disorder (CMD)[31, 32] . Similarly, the BDI has proven to have poor validity when applied on postnatal women[33].

Though less widely used as a screening tool for depression in the perinatal period, the PHQ-9 has been found to be more robust in detecting depression symptomology in the postnatal period in Ghana than the EPDS[25], but not in other settings[34, 35]. Nevertheless, the PHQ-9 has the potential to be a dual-purpose instrument, in that with nine items it establishes something approximating to clinical depressive diagnosis as well as symptom scale indicating severity[29, 36]. This is because the diagnoses of the PHQ-9 are based on the criteria for major depression according to DSM-IV(TR)[37]. An advantage of a screening instrument based on these operational definitions of mental disorders is that it offers the possibility of improving standardization and comparisons across studies [36]. Further to this, because of its criteria-based structure, it may even

be an interesting diagnostic tool in the research of population-based samples where face-to-face diagnostic interviews are not available[36]. The algorithm that provides for an initial diagnosis requires that for major depressive disorder, at least five out of the nine questions are indicated more than half the days, one of which must either indicate depression or anhedonia (loss of interest or pleasure). And for minor depression, at least four out of nine, one of which must either indicate depression or anhedonia (loss of interest or pleasure). When used as a continuous measure, scores of between 5 and 9 suggest mild depression, and above 9 suggests moderate to severe depression. In its initial review, a score of 10 or higher had a sensitivity and specificity of 88%[29], and is recommended as the cut-off score for a diagnosis. In a recent systematic review of the diagnostic accuracy of the PHQ-9 among the general adult population involving 40 studies from HIC, it recorded a modest sensitivity of 77%, but was reasonably highly specific (94%) [38]. Among studies in Asia, the PHQ-9 recorded a sensitivity of 86% and specificity of 77% among older (>60 years) patients in primary care in China[39], sensitivity of 84% and specificity of 77% at a cut-off score of 9 and above in a primary health clinic in Thailand[40], and a sensitivity of 92% and specificity of 90.7% at a cut-off score of 4 and above, using a modified version in a large urban population-based cohort in India[41]. It appears to date, the PHQ-9 has not been validated within the specific perinatal period in Asia. In SSA, only three studies have reported on the utility of the PHQ-9 among the general adult population in measuring depression, and all found good psychometric properties[25, 42, 43]. Only one of these studies evaluated the use of the PHQ-9 among predominantly illiterate recently delivered women, and found a sensitivity of 94% and specificity of 75%[25]. **Table 2.1** provides a summary of validation studies of the PHQ-9 in LMIC.

In sum, though cross-cultural standardization challenges present in the use of screening tools, they have been effective in identifying women with symptoms of depression in different cultures[15]. In any case technically, a screening tool is only valid in the setting it was validated, and may only be considered valid and useful to be used in other places if conditions such as the prevalence of the condition are similar and comparable[44]. In addition, though choice of outcome measure is likely to have a strong influence on recorded prevalence (self-report screening tools

other than diagnostic tools are known to report high prevalence), the current evidence on this is inconclusive.

Table 2.1: Criterion Validation Studies of the PHQ-9 in Low and Middle Income Countries

Author (year)	Country	Sample	Sample size	Timing	Gold standard	AUROC	Cut-off score	Sensitivity	Specificity	[1]Youden's index
Adewuya et al. (2006)	Nigeria	University students	512	NA	DSM-IV (MINI)	0.99	5	0.89	0.99	0.88
Weobong et al. (2009)	Ghana	Community-based postnatal women between 4 and 11 weeks.	160	Between 4 and 11 weeks	CPRS 'case'	0.90	5	0.94	0.75	0.69
*Monahan et al. 2009	Kenya	Adults living with HIV/AIDS	347	N/A	Construct validity ascertained with General Health Perception Rating schedule	0.97	3	0.85	0.95	0.80
Chen et al. (2010)	China	Older patients at primary care	364 (77 interviewed with SCID)	NA	DSM-IV (SCID)	0.92	3	0.84	0.90	0.74
Lotrakul et al (2008)	Thailand	Outpatient clinic attendees	279	NA	DSM-IV (MINI)	0.89	9	0.84	0.77	0.61
Poongothai et al. (2009)	India	Population-based	200	NA	PHQ-9	0.98	4	0.92	0.90	0.82

*modified version of the PHQ-9 (PHQ-12): incorporation bias likely

[1] measure of overall test performance (sensitivity+specificity-1)

2.3 Epidemiology of Perinatal Depression

2.3.1 Incidence, Prevalence, and Persistence of Antenatal Depression (AND)

Perhaps one of the main contributors to the 10/90 gap in global health research is in the area of maternal mental health, with most of the research concentrated in Western developed countries. Aside these regional imbalances, there are also imbalances in research activity within the area of perinatal mental health. Thus, compared with postnatal depression, antenatal depression has been less widely researched[45] partly because of the misconception that women are hormonally protected from psychological disturbances during pregnancy[46, 47]. This trend is global and the African region is no exception.

This notwithstanding, in the only systematic review of perinatal mental disorder in Africa, the prevalence of AND in 12 studies (N=2341) together report a mean weighted prevalence of 11.3% (9.5%-13.1%)[45], which is comparable to the estimates of 10.2% (95% CI 7.0%-14.2%) reported in reviews of Antenatal Depression in HIC[17], but not in non-SSA LAMIC South Asia (25%-48%)[48, 49] and South America settings (37%)[50] which report relatively high estimates. The variations in prevalence estimates have been attributed to: choice of screening measure, use of different cut-off points, timing of assessments, choice of study population and socio-cultural practices. Choice of outcome is likely to have a strong influence on recorded prevalence with many studies in low and middle income countries reporting the prevalence of common mental disorders, often ascertained with a symptom screening tool[11]. Furthermore, cross-cultural adaptation of tools developed in Western populations and used in SSA and non-SSA LAMIC in defining depression without detailed attention to cross-cultural adaptation may constitute a categorical fallacy[51, 52] and could account for some of the differences in prevalence estimates reported. Variations in timing of assessment may however not explain the differences in prevalence. Thus, in their meta-analysis involving 21 studies (N=19,284) in HIC, the prevalence for depression estimated at varying stages; 7.4% (95% CI 2.2, 12.6) at first trimester, 12.8% (95% CI, 10.7, 14.8) at second trimester and 12.0% (95% CI 7.4, 16.7) at third trimester during pregnancy[53], did not seem to vary. Indeed, given the substantial overlap of the 95% confidence

intervals of these estimates, it has been argued that the prevalence of depression during pregnancy cannot be said to differ significantly by trimester [17].

In terms of incidence of AND, few authors in the world have investigated it, and none in SSA. The ascertainment of onset AND is challenging to establish because of the chronic, remitting and relapsing nature of depression. Correctly measuring onset during pregnancy would require that pregnant women are either assessed at or before conception. The ability to do this may be logistically and ethically challenging. Nevertheless, in a systematic review of studies in HIC, the incidence from two studies of 11.3%(7.8%-16.3%) at first trimester was reported[54]. In the same meta-analysis Gavin and colleagues reported that 14.5% of pregnant women have a new episode of major or minor depression and 7.5% have a new episode of major depression[54]. These compare closely to the prevalence of AND reported from SSA and HIC.

In terms of antenatal depression persisting into the postnatal period, the evidence is quite varied. Authors have found lower estimates of persistent antenatal depression in SSA: 21.4% in Ethiopia[55]; 10% in Nigeria[56]; 22% in Uganda[57]; and 46.3% in Zimbabwe[58], and developed countries: 12%-35% in USA[59-61]; 1.7% in UK[62]; and 24% in Sweden[63], compared with South Asia with strikingly high persistence estimates: 30%-56% in Pakistan[48, 64]; 66% in India[65].

2.3.2 Incidence and Prevalence of Postnatal Depression (PND)

Admittedly, there has been more research on postnatal depression than antenatal depression. The evidence on the prevalence of PND varies greatly because of the use of different assessment tools (diagnostic and self-reports) and different times of symptom assessment. Generally, prevalence estimates of PND from a systematic review in SSA [18.3% (17.5%-19.1%)][45] and large cohort and multi-country studies in non-SSA LAMIC (South Asia/South America) (16.8%-63.3%)[13, 48, 49, 66-70], are higher than reported in reviews in HIC [13%(12.3%-13.4%)[71]; 12.9%(10.6%-15.8%)[17, 54]]. Again issues pertaining to trans-cultural variations in expressing PND and construct validity of measurements used in non-Western settings could explain these regional variations in prevalence. For example the strikingly high estimates reported in non-SSA, mostly Asian countries may be attributed to the unique role of some

cultural practices such as prescribed periods of confinement where the mother is expected to adhere to certain rituals and practices and receive help from mother-in-laws and significant others[72, 73]. As argued by Klainin and colleagues, such practices may present as a double-edged sword, where in one instance they are protective of the onset of postnatal depression and in another strand, they could actually be catalysts for interpersonal conflict and tension thus increasing the risk of depression[72]. Indeed, some studies suggest that postpartum rituals in Japan[74], Vietnam[75], Malaysia[76], Hong Kong[77], and Singapore[78] may not provide significant psychological benefits for the new mothers, albeit others found some significant psychological benefits[79].

Furthermore, though the 13% prevalence reported by O'Hara and colleagues is notable and continues to attract widespread citations, most of the literature reviewed was published before 1994, where definitions of major depression were broader and lacked precision[17]. In terms of incidence of postnatal depression, very few reports exist in general[54] and in SSA in particular, only five authors from three studies provided prospective accounts of incidence. Three of the authors reported onset estimates based on the same primary study, but with different study outcomes. The estimates in SSA(2.4%-9.0%)[55, 80-82] and non-SSA South Asia (4%-11%)[65, 83, 84] are comparable but lower than HIC (14.5%)[54]. The proportion of prevalent postnatal depression accounted for by new onset cases in SSA was as follows: 45% in Ethiopia[55], 19% in Zimbabwe[82], and 77% in Uganda[57]. In HIC, it is observed that majority of the cases of prevalent postnatal depression are new onset[54], and this is similar to the patterns observed in SSA.

In general measuring incidence of depression is quite challenging, given the insidious nature of its onset. Depression runs a relapsing and remitting course and therefore an 'incident' case may just represent an individual who has had several previous episodes that went undetected. As a consequence one would argue that incidence of depression is just as good as prevalence.

In sum, based on studies that investigated both antenatal and postnatal depression in SSA, the Asian region, and South America **(appendix 2)**, a picture emerges suggesting comparable prevalence, albeit reports from high income countries indicate prevalence is higher in

pregnancy[62, 85]. In general, estimates of perinatal depression are higher in SSA and other non-SSA LMIC than in HIC. The relatively high levels noted in these regions may be partly explained by women's exposure to multiple depression-related risk[86, 87] such as conflicts, disasters, migration, violence, and HIV/AIDS[88]. Notwithstanding the likely reasons for the high levels of antenatal depression in SSA, compared to the estimates in South Asia, most of the prevalence is self-limiting and very few women remain depressed by the time they give birth.

2.3.3 Epidemiology of the Course of Perinatal Depression

Arguably, there continues to be a relative lack of convergence in the information about the duration and course of perinatal depression. Even within the two main diagnostic and disease classification resources, there is disagreement on the timing of the onset of postnatal depression. It is also not clear how long an episode lasts and how recurrence/relapse episodes may be correctly identified and measured. An appreciation of these concepts and how they apply to non-hard outcomes such as depression is important for the development of effective interventions.

This section provides the evidence on various schools of thought on the duration and onset of perinatal depression

2.3.3.1 Onset

Onset defines the time perinatal depression starts; it can be either new or a previous experience recurring. Defining and ascertaining onset can be quite challenging because it can be influenced by women's expectation of what is 'normal' adjustment[10]. It gets more complicated due to the variability in presentation and symptoms, especially in general practice if women are unaware their symptoms are due to depression or if somatic symptoms predominate[89, 90] or is due to normal physical and biological changes associated with pregnancy and child bearing. Correctly establishing onset has direct implications on accuracy of diagnosis. Due to the methodological challenges inherent with correctly ascertaining onset during pregnancy, the debate on onset is mostly limited to postnatal depression.

Timing of the onset of postnatal depression has frequently been debated in the literature, and prescriptions outlined in the DSM-IV and ICD-10 classification manuals have been questioned[91]. Whilst the DSM-IV defines postpartum onset when an episode begins from the 4th week[37], the ICD-10 has extended this window to 6 weeks[92]. The result of this has been a plethora of inconsistent reports[93] which has made it challenging to conduct any form of meta-analysis of the onset of postnatal depression[94]. The importance of clarifying the onset of perinatal depression is helpful in planning appropriate cost-effective interventions within the limits of tight mental health budgets. For example, even though there is clear converging evidence pointing to the fact that depressive symptoms during pregnancy persisted into the postnatal period[62, 95, 96], it is not clear when and at what stage women become depressed only after delivery. This is because in the study by Stowe and colleagues, though participants fulfilled the criteria for major depression during the first year following birth, a third of them did not experience onset within the first 6 weeks postnatal; suggesting onset of postnatal depression may be later than 6 weeks[62, 91]. Other studies report more 'new' cases in the first three months postpartum compared to six and twelve months[97, 98].

The arguments for correctly establishing onset are particularly relevant when using self-report depression screening measures, where the use of cut-offs determines severity of psychopathology. For example, Matthey has questioned the basis for using high scores on the EPDS as indicative of probable depression when the scale is only able to predict only half of those high scorers to have confirmed depression[99], thereby calling into question the onset estimates of the unconfirmed depression. As a result of these limitations in self-report measures and the difficulties in ascertaining onset correctly, Ballestrem and colleagues suggest that doing the EPDS on two occasions, three weeks apart differentiates women with depressive mood from women with PND[100]. For example, they found that only 3.7% of women scored high 3 weeks later from 17% at 6-8 weeks. A probable explanation for this observation is that majority of women with high scores at 6-8 weeks could be experiencing transient-causing depressive mood and not PND, and reporting such estimates as onset at 6-8 weeks may be inaccurate.

In ascertaining the timing of onset, it may also be necessary to consider other factors that are specific to the woman. Thus, in their study of onset of postnatal depression, Stowe and colleagues observed that there were more single mothers in the pregnancy onset group compared with the postnatal onset group[101]. Apart from this, onset has also been implicated in explaining issues of recurrence and whether there are subtypes of postnatal depression. For example, women with new onset depression (de novo PND) are more likely to experience future episodes of PND; those with previous experience of PND are likely to experience general adult depression and not PND[102-104].

In summary, onset of antenatal or postnatal depression maybe quite difficult to define accurately as a result of differences in measurement methodology, the character of depression and, the mother's expectations of normality. Nonetheless, even though there is variability in the definitions of onset, there is compelling agreement within researchers that depressive symptoms during pregnancy were associated with continued complaints of depression in the postnatal period, with an onset of later than first 6 weeks postpartum, albeit the symptoms could be transient.

2.3.3.2 Duration

Similar to the onset dynamics of depression, duration of antenatal or postnatal depression has been found to vary widely in studies because of differences in follow-up assessment time points specified, characteristics of postnatal sample studied, severity of illness and previous exposure to perinatal depression. Duration of postnatal depression has been found to vary in different studies from several weeks to months, and severe episodes may persist for years[14]. Typically, the depression has to be present continuously for a period of no less than 2 weeks before it fulfils the criteria for major or minor depression[37]. From the 2 weeks window, depression can last for at least 12 months for PND and as long as possible within the period of pregnancy for AND. Thus, while duration can last up to over six months[105] and one year[106], others can only last up to six months, but certainly not more than one year[97] for PND. In the midst of these varying time scales, some authors conjecture that duration generally lasts between two and three months[95, 98, 102, 105], with a mean duration of 3.3 weeks[95].

It has been found however, that most episodes of PND remit within two to six months, although in severe cases a significant proportion of women will remain depressed throughout the postnatal year if left untreated[107, 108]. A recent review of studies from developed countries concluded that in about 30% women with postnatal depression, symptoms persist for up to a year after giving birth[109].

Contrary to onset dynamics of perinatal depression which is more relevant to PND, the discourse on duration of an episode may only be helpful in determining persistence of antenatal depression and not onset of postnatal depression (not depressed at pregnancy, depressed after birth), particularly in the last trimester. Going by the proposed scales of the duration of depression, women found depressed in the last trimester are most likely going to remain depressed up to the point of birth. When these women are diagnosed as depressed postpartum based on the criteria for onset of PND, then we may argue that such women were chronically depressed from the last trimester of pregnancy. The same line of thought may not be applied for the case of onset PND because we are unable to determine the likelihood of remaining not depressed within the last three months of pregnancy. It does appear therefore that barring the insidious nature of depression, the accuracy with which persistence depression (duration) is measured is enhanced if the timing between assessments during pregnancy and after delivery is short, and the last trimester may be best suited for this. Indeed in a recent study in Pakistan, independent predictors of persistent depression selected by multiple logistic regression included high score on the SRQ in the third trimester of pregnancy[48].

In sum, duration of perinatal depression is variable and very dependent on severity of episodes. While episodes can last throughout the period of pregnancy, postnatal depression would usually last between three to six months, but can last up to a year. Estimating duration is particularly challenging due to the remitting and relapsing chronic nature of depression. Duration could however be estimated with some degree of precision when measuring persistence antenatal depression into the postnatal period, particularly from the last trimester.

2.3.3.3 Recurrence

After one postnatal episode the risk of recurrence, defined as an episode of illness meeting criteria for major depression as defined in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. , is 25%[110]. Recurrence rates however are amenable to variation and can usually be misleading and relapse in particular can be quite problematic to define. Some authors may simply be observing and reporting a continuation of an earlier depressive episode[10]. This notwithstanding, compelling evidence from longitudinal studies supports the claim that women who experience postnatal depression for the first time are at an increased risk for further episodes in the future (usually over five years), especially after subsequent deliveries[111-113]. Risk of recurrence has also been attributed to drug discontinuation, because as many as 85.5% of pregnant women who discontinued their mood stabilizers had their depression recur, compared to 37% of those who continued[114].

In terms of relapse rates, studies have presented quite varying reports. For example women have between 30% to 50% risk of relapse after exposure to major depression[102, 115, 116]. These relapse rates have been explained by vulnerability factors related to demands of motherhood. Thus, women who perceive child-bearing as demanding and stressful are more likely to report higher rates of PND after delivery than those with positive maternal attitude even if the depression is recurrent[102-104].

In sum, recurrence estimates are similarly difficult to estimate because it may just be a continuation of a previous episode. What is obvious is that risk of relapse is increased following previous exposure, and this is usually brought about by vulnerability factors related to motherhood.

2.4 Determinants of Perinatal Depression

Though the aetiology of perinatal depression remains unknown, research in this area has tended to provide evidence on factors that are associated with an increased risk. The contributions of these factors to perinatal depression have largely been conceptualised under a bio-psychosocial model. Thus, an inter-play of vulnerability, precipitating and maintenance factors of perinatal depression has been reported in the literature[117]. Indeed the notion of these factors may help explain why some women experience perinatal depression while others in similar conditions do not[118]. In a recent systematic review of determinants of perinatal depression, it is suggested that risk factors have been little studied in low and middle income countries, with few prospective or population-based studies[11]. The review's authors concluded that there is evidence of links between perinatal common mental disorders (CMD), social and economic disadvantage and gender-based factors, particularly gender-based violence. However, a significant limitation of the review, with respect to determinants, was the failure to distinguish between factors associated with antenatal and postnatal common mental disorder, and for postnatal CMD, between factors associated with persistence of antenatal disorder and those associated with 'new' postnatal onset. It is important to distinguish factors associated with the persistence of antenatal depression from those associated with perinatal onset[65] given that these may contribute almost equally to prevalent postnatal depression.

In this section, determinants of AND and PND are discussed. The discussion also highlights risk factors that influence the course of perinatal depression.

2.4.1 Determinants of Antenatal Depression

A recent systematic review of studies of the prevalence and determinants of common perinatal mental disorders in low and middle income countries, identified a paucity of research, with only 8% of such countries covered[11]. Furthermore very few studies had been conducted in community or population settings, for example only three of the 13 studies of the prevalence of antenatal common mental disorder, and only one of the six from SSA. Authors have tended to group AND risk factors into: psychosocial, socio-demographic and biologic/pregnancy factors.

Psychosocial factors

Essentially, psychosocial factors such as lack of social support or a supportive partner have consistently predicted the risk of AND in a precipitating capacity across different regions of the world[47, 48, 64, 119-122] and have also been found to contribute to maintenance/persistence of AND[48, 63, 123, 124]. The evidence pertaining to other psychosocial factors across different regions of the world is however mixed. Thus while low self-esteem has been implicated in studies in HIC[117], no such associations were found in SSA and non-SSA LAMIC. And though domestic violence or marital conflict experienced by the woman is associated with increased risk of prevalent AND in HIC[47, 121, 122, 125] the evidence is less compelling in SSA (only two studies reported an association)[30, 126]and non-SSA LAMIC[127], probably because of difficulties in eliciting responses on such sensitive topics in settings were little support/encouragement is assured women who make such disclosures.

Socio-demographic factors

Consistent socio-demographic determinants reported across the different regional blocks are: low socio-economic status (SES) and marital status (being single/separated)[47, 119], though overwhelming evidence from SSA does not support poor socio-economic status as a determinant of antenatal depression[12]. Being in a polygynous marriage however is an important factor in SSA. This is a culture specific issue given that polygyny is widely practiced in some African countries and has been reported as a potential source of marital disharmony and friction[119], which are important vulnerability and maintaining factors for an increased risk in antenatal depression.

Biologic/pregnancy factors

Compared to HIC and non-SSA LAMIC, few pregnancy related factors seem to predict risk of AND in SSA. Thus, apart from increased parity, all other pregnancy related/obstetric history risk factors are not associated with increased risk of AND in a recent systematic review in SSA[12]. On the contrary consistent risk factors such as: unplanned pregnancy, previous still birth,

previous history of depression, physical health problems, family history of psychiatric disorder and antenatal anxiety have been implicated in HIC[47, 128] and non-SSA LAMIC settings[48, 129].

2.4.2 Determinants of Postnatal Depression

In general the construction of risk factor profiles for PND have also been grouped into: psychosocial, socio-demographic and biologic/pregnancy and birth, though the latter has been little investigated in SSA and non_SSA LAMIC. Having said this, recent studies from Asia seem to suggest and focus on traditional/cultural practices as a special group of risk/protective factors, though the evidence is limited and inconclusive.

Psychosocial variables

Factors with psychosocial underpinnings seem to be more consistent predictors of PND across SSA, non-SSA LAMIC and HIC. Social support has been implicated as an influencing factor on PND. Thus, women who lacked social support[12, 71, 72] and those who had a poor relationship with their partner[12, 71, 124, 130, 131] were more vulnerable to postnatal depression. A poor/hostile relationship with the mother-in-law/family[12, 72] and marital conflict[12, 72] are precipitating risk factors for PND in SSA and non-SSA LAMIC. These findings are indicative of the effect of the stressful environment of childbirth and the mother's ability to cope with her other roles at home. Low self-esteem and poor self-image have also emerged as strong vulnerability factors for PND in HIC and non-SSA LAMIC[130, 132], but these have been less studied in SSA. What has been studied and found to be uniquely relevant in SSA and non-SSA LAMIC is the issue of autonomy.

Women in these settings have less autonomy and fewer opportunities in education and employment, and very often have less control over personal decisions such as the use of contraception to plan pregnancies[123]. This is against the backdrop that feelings of self-control are reliably and consistently associated with positive psychological outcomes[133] and a positive birth experience[134, 135]. Female gender disadvantage and lack of autonomy may therefore be

other vulnerability factors for perinatal depression, given their association with general common mental disorder[136].

Socio-demographic variables

In general apart from the largely consistent finding of the association between poor SES or economic difficulties/poverty and risk of PND[11, 47, 72, 130], literature on other socio-demographic determinants is inconclusive. Nonetheless, being a single mother or being in a polygynous relationship are strongly associated with risk of PND in SSA and non-SSA LAMIC[137-139]. The evidence regarding the age of the mother and risk of PND is however mixed; whilst young maternal age is associated in some SSA countries[140, 141] and Asia[142], other SSA[81, 143, 144], and Asian settings report no association[83, 145-148]. Given the weight and balance of the evidence, it does appear young maternal age may not be a consistent risk factor for postnatal depression.

Gender-based socio-demographic variables such as the sex of the newborn is a consistent precipitating factor for PND in non-SSA LAMIC[65, 73, 76, 78, 79, 123, 149], and some SSA countries[137, 141], but not in HIC. For example the existence of a poor marital relationship may act as a vulnerability factor, which in the light of a provoking element such as the birth of a girl (precipitating factor), triggers a depressive episode. On the other hand, the birth of a boy may act as a protective factor even for mothers who live in an unhappy marital situation. This is a cultural argument in that a male child has the potential to contribute to the family economy, provide old-age support for the parents, earn a daughter-in-law upon marriage and continue the family blood line[73, 142]. Thus women get blamed when they give birth to a girl and experience ridicule and hostility from their husbands and mother-in-laws[77, 150, 151].

Biologic/pregnancy and birth

Consistent putative risk factors for postnatal depression that have been implicated in SSA, non-SSA LAMIC and HIC are; antenatal depression, low birth weight, pre-term delivery, still birth, foetal/perinatal death or infant death[71, 84, 124, 130, 131, 137, 149, 152-155]. Indeed AND is an important mediator between other risk factors and PND[117]. The evidence for the relationship between other biologic factors and PND is however mixed. Thus, whilst previous psychopathology

experienced by the mother is a consistently strong risk factor for PND in HIC and non-SSA LAMIC regions[65, 71, 83, 84, 130, 131, 152], the evidence is less convincing in SSA, possibly because of less reliable or non-existent psychiatric history data. On the contrary, whilst pregnancy complications and caesarian section are common risk factors to both SSA and non-SSA[72, 137-139], the evidence is less compelling in HIC[156, 157], possibly because of better maternal and child care facilities. Unplanned pregnancy is however generally observed as a common risk factor for postnatal depression in different world regions. While early postpartum mood disorder has been found to predict PND in SSA and HIC[106, 158-164] the same may not be indicated in non-SSA LAMIC. Though quite challenging to tease out due to the co-morbid nature of affective perinatal mental illness, three meta-analyses in HIC have backed the claim that anxiety symptoms during pregnancy predict postnatal depression[71, 130, 131].

As has been reported earlier, research in biologic risk factors of perinatal depression is still at the developmental stages in SSA and non-SSA LAMIC settings. What is interesting and appears distinct in SSA and non-SSA regions is that new but limited evidence suggests that cultural practices at birth operate in the form of a double-edged sword and could potentially protect the woman or increase her risk of PND. Thus, practices such as prescribed confinement periods between 30 to 40 days, restricted activities and diets and practical/emotional support from family members especially the mother-in-law, though regarded as protective factors [165], could serve as major sources of interpersonal conflicts and emotional frustrations to the woman[72], especially when those practices are not followed through[55]. These seemingly counterproductive practices could possibly explain the high prevalence of perinatal depression reported in non-SSA LAMIC Asian regions.

Aside the widely reported putative determinants of PND discussed, recent research in the area of risk factors for PND have tended to focus on special groups of postnatal women and variables that occur more commonly and have not been previously considered in meta-analysis. Thus, findings from a recent systematic review involving 26 studies and 2,392 mothers of preterm infants in HIC, suggest that such special group of mothers are at a higher risk of depression, with continued risk throughout the first postnatal year for mothers with very-low-

birth-weight infants[166]. Aside this finding, exposure to multiple births proffered 43% greater odds of having moderate to severe depression at nine months, compared with mothers with single births[167]. In addition, early maternal separation lasting 3.5 days or more increased the risk of PND[168]. Also, recent technological advances such as the use of ultrasound scanning have been found to increase or decrease levels of anxiety[133], which in itself is a predictor of perinatal depression. Sick leave during pregnancy and number of visits to the antenatal clinic have also been found to be strongly associated with the risk of postnatal depression[169]. Furthermore, the evidence linking endocrine flactuations, nutritional deficiencies, neuro-transmitter alterations and increased risk of postnatal mood disorder has been widely reported in HIC[170]. There is also some evidence suggesting a familial component to PND[171], which results in a more than three-fold increase in risk of PND in siblings from relatives with recurrent major depressive disorder. This finding however has to be tested further in a more systematic prospective approach using larger numbers.

2.4.3 Determinants of the Course of Perinatal Depression

Few authors have employed prospective designs to investigate risk factors for the persistence of antenatal depression and onset of postnatal depression. Essentially, psychosocial factors such as social support or a supportive partner have consistently predicted the risk of maintenance/persistence of AND[48, 63, 124]. Similarly socio-demographic factors such as poor SES has consistently predicted persistence antenatal depression in HIC and non-SSA LMIC[48, 172], but may not in SSA[173]. Furthermore, high antenatal depression score is perhaps the most consistent determinant of persistence antenatal depression[48, 156]. And though less widely researched, maternal and infant poor health is known to be associated with persistence antenatal depression in HIC settings[174].

In SSA in particular only one prospective study provides an account of determinants of persistence antenatal depression. This study conducted in Ethiopia on a modest sample focussed on only socio-cultural risk factors and found that failure to adhere to celebratory cultural practices after birth predicted persistence antenatal depression[55]. The only other study that came

close to investigating this had design challenges (combination of cross-sectional, prospective, retrospective) and was unable to explore factors that predicted onset or persistence depression[81].

The limited number of prospective studies for persistence antenatal depression is similar for the determinants of onset postnatal depression. A recent systematic review on perinatal common mental disorder involving 51 LMIC whilst providing evidence of links between perinatal common mental disorders (CMD), social and economic disadvantage and gender-based factors, particularly gender-based violence[11], failed to distinguish between factors associated with prevalent postnatal common mental disorder, and those associated with new perinatal onset. In SSA the evidence is virtually non-existent with only one study that has reported on factors associated with onset postnatal CMD using a prospective design; non-completion of protective cultural practices was a risk factor for onset postnatal depression in Ethiopia[55]. Evidence mostly from non-SSA LMIC Asian region suggest culture-bound risk factors such as male gender bind is consistently reported as a risk factor for onset postnatal depression when the immediate previous child is female[65, 73, 83, 123, 142], though this may not be important in SSA[55, 58, 81]. In terms of socio-demographic factors a meta-analysis report suggest that low socioeconomic status is associated with new onset general adult depressive episodes , though the effect size and the strength of the relationship was weaker than persistent depression and only three studies from SSA were included[175].

In conclusion, though there are variations in the prevalence of postnatal depression, most of the risk factors are similar in different regions of the world, except in south Asia and SSA where socio-cultural factors and the high burden of perinatal mortality and infant morbidity appear to play a significant role in these settings. This notwithstanding, influence of infant morbidity on risk of postnatal common mental disorders in lower-middle income and low-middle income countries has been little studied[176]. The literature is not also clear on the specific roles of risk/protective factors towards the incidence of PND, prevalence of PND or persistence AND, largely because of the lack of prospective studies. Given the low persistence estimates of antenatal depression and high proportion of onset postnatal depression among prevalent postnatal depression in SSA, it would be helpful to elicit factors that enhance resilience during

pregnancy and those that promote vulnerability after birth. Cultural practices during pregnancy and childbirth could form the next generation of the risk factor profile in SSA and Asia, but further research is needed to firmly establish this.

2.5 Consequences of Perinatal Depression for the Health of the Mother and Baby

By and large most studies that investigated consequences of perinatal depression employed the use of cohort designs, though some studies engaged small to moderate sample sizes, thus resulting in challenges in detecting small differences.

2.5.1 Consequences of Antenatal Depression

Newborn, Infant and maternal physical health

Albeit few studies have investigated antenatal maternal mental health, there is a gradual attention being drawn to the public health significance of antenatal depression because of its consequences on maternal and infant health. Thus, research evidence from recent cohort studies from India, Pakistan, Ethiopia, and Brazil suggest that antenatal depression is associated with risk of low birth weight[177, 178], underweight and stunting, and frequent diarrhea[127, 178-180], prolonged labour and delayed initiation of breastfeeding[30]. The evidence regarding LBW in SSA is similar to findings in south Asia and other findings from low and middle income settings[181], although non-significant effect on LBW was reported in Ethiopia (RR=2.3, 95% CI 0.9-6.2)[30]. Similar evidence has been reported in HIC where AND is associated with restricted fetal growth[182-184](especially in women of low SES[185]) , LBW[186], premature birth[187] , small for gestational age babies[188] and developmental delays[189], though these findings were not replicated in other studies[190, 191]. Some downstream intergenerational effects have also been reported in HIC. Thus, children born of women who were depressed during pregnancy were almost four times more likely to become depressed at 16 years[192].

Aside the well known finding that antenatal depression is the most consistent predictor of postnatal depression, it is also associated with: poor maternal self-care and nutrition, lack of sleep, inadequate antenatal care and increased exposure to alcohol and drugs have been

identified[193]. There appears however that there is little evidence linking antenatal depression and severe peripartum and postpartum complications in LMIC, though there is evidence supporting the association between antenatal depression and maternal illness, planned caesarean delivery and epidural analgesia during labour in HIC[194].

2.5.2 Consequences of Postnatal Depression

Infant, Child, and Maternal Physical Health

The public health consequences of PND are being increasingly recognized from a large volume of research literature around the world. Indeed Psychiatric morbidity in the perinatal period is recognized as an indirect cause of maternal deaths-including late maternal deaths,(citing suicide as the commonest route[195, 196 92, 195, 197]), increase in health service use[123] and hospitalization[198] in HIC . In a Taiwanese national registry linkage study, maternal depression in the year after birth was independently associated with a 1·5-fold increased mortality risk for the index child up to 5 years old[199] .In an Ethiopian historical cohort study[200] the 561 children of women who had been screened for depression in the previous year, and who were born within one year of their mother's assessment were followed up for mortality up to the age of three years; there was a borderline association between maternal depression and child mortality , and possible interactions with mothers' experiences of physical and emotional abuse. No studies to date appear to have assessed the impact of depression in the immediate postnatal period upon infant mortality in the first year of life.

Furthermore, some evidence from SSA and non-SSA LAMIC suggests that PND or common mental disorder is associated with increased numbers of infant diarrhoeal episodes [178], infant under-nutrition [201-206] and impaired infant growth[201, 207-209]. Some of these consequences perhaps provide plausible reasons why postnatal depression may be associated with infant deaths.

Contrary to these consistent body of literature however, authors in a recent cohort study involving five countries across Europe (N=929) found no evidence of an association between PND and infant impaired growth[210]. Similar findings of no association were noted between maternal common mental disorder and stunting and underweight status in infants aged 6 and 18

months in Ethiopia and Peru, but this study was limited by its cross-sectional design[207]. And in a recent study in Brazil, persistence postnatal depression at 12, 24, and 48 months did not predict elevated risk of impaired child growth[211]. Some authors in SSA also failed to replicate these findings[204, 212, 213].

Some authors in the field have recognized the ecological variations in the link between postnatal depression or common mental disorder and infant poor growth outcomes[13]. Whereas the body of evidence is less compelling in SSA, the evidence from South Asia is quite robust. Possible reasons for these ecological disparities have been attributed to: different psychosocial experiences and practices, interactions between socioeconomic and cultural factors, genetic factors, and different breastfeeding practices[13].

Infant cognitive, emotional, and behavioural development

There is also compelling evidence mostly from HIC[214-218] , and a few from LMIC[206, 219] that PND is associated with increased prevalence of behavioural and emotional problems in children. Similarly, findings from many studies in HIC suggest that PND is associated with long-term cognitive functioning deficits in the child, particularly when depression is chronic and socio-economic difficulties are rife[220]. Relatively few reports from LMIC exist, but there is emerging evidence that PND is associated with poor mental scores in children[201, 221, 222]. Given the limited studies from LMIC, it is premature to conclude on the effect of PND on infant development, but given that socio-economic hardship appears to moderate this association in HIC, it is particularly relevant in LMIC that this is explored further. The plausible mechanisms explaining the effect of PND on cognitive development are varied, and the strong evidence that poor growth is associated with impaired cognitive development[223] is one of them. Poor growth is therefore likely to be an important mediator in the relationship between PND and impaired cognitive development, particularly in regions with high burden of infant physical growth impairment.

Child survival interventions

Evidence from both HIC and LMICs (Brazil, Nigeria, Pakistan) shows that postnatal depression is also associated with early cessation of breast-feeding[224-227], suboptimal breastfeeding and a reduction in adherence to child-health promotion and prevention measures[179, 228-230]. The evidence linking maternal depression and breast-feeding challenges may not be entirely conclusive in LMIC given that two studies from Brazil[227] and Turkey[231] found that both depressed and non-depressed mothers presented with similar rates of breast-feeding in the first four months after birth.

In sum, the evidence for the impact of maternal depression during pregnancy is less researched than the impact of PND. There is quite robust evidence in south Asia linking depression during pregnancy and risk of low birth weight, but the pattern is less convincing in SSA though the magnitude of increased risk on low birth weight in the only study in SSA is comparable to global estimates and south Asia. The links between maternal PND and poor child growth appear to be universal, but its impact on non-physical child development and maternal health in SSA is an area needing research. Further to this, despite the body of evidence linking maternal perinatal depression and poor birth outcomes, child under-nutrition, stunting, illness episodes, and poor uptake of key child survival interventions, which may suggest a plausible association with infant mortality in the immediate postnatal period, this evidence is quite patchy. This is the period of maximum vulnerability for child deaths, as well as a critical time for mother-child bonding, and when the demands of providing good quality nurturance and care are most challenging for the mother.

2.6 Approaches to Tackling Perinatal Depression

Existing interventions for the treatment and/or prevention of perinatal depression have employed various pharmacologic and psychological (e.g. Cognitive Behavioural Therapy-CBT, Interpersonal Psychotherapy-IPT, non-directive counselling) or psychosocial approaches (support groups, health visitor home-visiting, antenatal/postnatal classes). Such psycho-social interventions have long been proposed by researchers as appropriate for low and middle-income

countries (LMIC)[232] and recently by the world health organisation through the Mental Health Gap Action Programme (mhGAP)[233].

The first two columns in table 2.2 show the evidence on the impact of various approaches to tackling antenatal and postnatal depression. The last column illustrates the evidence to tackling general depression.

2.6.1 Antenatal Depression

Treatment

Psychological/psychosocial

In general, the evidence from a Cochrane systematic review is inconclusive on the role of psychosocial/psychological interventions for the treatment of antenatal depression as the evidence stems from only one small clinical trial from the United States of America which met inclusion criteria[234]. Going by this trial however, there is evidence suggesting a significant decrease in the risk of antenatal depression when interpersonal psychotherapy is used, compared to care as usual[235].

Pharmacologic Approaches

Selective serotonin re-uptake inhibitors (SSRIs) and Tricyclic antidepressants (TCAs) are among the commonly used antidepressants. TCAs have been around for much longer than SSRIs or other antidepressants and may have carried the notion that they are the safest choice in treating antenatal depression [236]. Following the introduction of SSRIs in the 1980s, emerging evidence suggest that compared to TCAs, they have better efficacy, tolerability, and safety[237]. Other authors also argue that when used in the general population, SSRIs are much safer especially in overdose and have referred to the continual use of TCAs as 'scandalous' [238]. However, in spite of the widespread use of SSRIs during pregnancy, there are still conflicting views on the safety of these drugs during pregnancy[237], and whether any particular SSRI is safer than the other when it comes to fetal risk[239].

Reported effects of antidepressants identified in the literature are: congenital anomalies, miscarriages, preterm delivery, neonatal effects, persistent pulmonary hypertension of the newborn (PPHN), and neurodevelopmental effects.

A recent literature review of the risk-benefit analysis of SSRIs use in human pregnancy identified that most observational studies (19 out of 34) did not show an increase in the overall risk of major congenital malformations with SSRIs in general, though several of them (9 out of 34) have suggested that the use of SSRI paroxetine may be associated with a small increased risk for cardiovascular malformations[237]. The evidence from three recently published meta-analyses on the association between paroxetine use in pregnancy and risk of cardiovascular malformations have however not been consistent; first trimester paroxetine exposure was associated with a significant increase in cardiac anomalies in Bar-Oz et al meta-analysis[240], an increased risk of combined cardiac defects and aggregated congenital defects in Wurst et al meta-analysis[241], but there was no increased risk of congenital malformations associated with paroxetine use in O'Brien et al's meta-analysis[242]. In terms of the impact of SSRIs on miscarriages, two meta-analysis identified an increased risk. Hemel et al reported a 45% increased risk, and there were no differences on the effect posed by different antipressants [RR 1.45 (95% CI 1.19 to 1.77) n=3567][243]. Similarly Rahimi and colleagues reported an odds ratio of 1.7 (95% CI 1.3 to 2.2) [n=950]; this meta-analysis included two studies with paroxetine and venlafaxine as the antidepressants[244]. The association between SSRIs and preterm births has also been reported in one meta-analysis of nine cohort studies that showed an increased odds in preterm births OR 2.2 (95% CI 1.6 to 2.6) and three times increased odds of Neonatal Intensive Care Unit/Special Care Nursery admissions; OR 3.30 (95% CI 1.45 to 7.54)[245].

A picture emerges from the forgoing that the use of any antidepressants during pregnancy may not be absolutely safe and any decision to employ pharmacologic interventions should be supported by the benefits/risks ratio, and these should be guided by a patient-centred approach. It is common knowledge that most women prefer non-pharmacologic interventions[240], but there might be the need to intervene with anti-depressants in some cases. Indeed given the consequences of uncontrolled depression during pregnancy discussed in section 2.5.1, plus the

potential risk of relapse of major depression during pregnancy following antidepressant discontinuation[241, 242] , and the proven efficacy and relative safety of SSRIs over tricyclic depressants in the treatment of depression [243, 244], the current view point based on two reviews is that benefits of prenatal antidepressants far outweigh the risk of leaving antenatal depression untreated[236, 238] .

Prevention

There are currently no reports on the role of preventive approaches to tackling antenatal depression. Most of the evidence points to approaches to preventing postnatal depression which are usually started during pregnancy.

2.6.2 Postnatal Depression

Treatment

Psychological/psychosocial

Based on a Cochrane meta-analysis involving ten trials from HIC (N=956) there is evidence suggesting that psychosocial and psychological interventions are not only an effective treatment option for women suffering from postnatal depression, at least in the short term[245], but are also the most preferred option. The long-term effectiveness however remains unclear. There is also evidence of their effectiveness in low and middle income countries such as rural Pakistan where a large-scale RCT using cognitive behavioural therapy principles delivered by community health workers, compared with enhanced usual care, halved rates of postnatal depression[246]. Indeed, there was also a reduction in maternal reports of rates of diarrhoea, and most women completed courses of immunisation for their children. Reductions in the burden of postnatal depression was however not commensurate with improvements in infant growth within the limited period of evaluation.

Pharmacologic Approaches

Based on synthesised evidence from a Cochrane review, it is inappropriate to recommend antidepressant treatment for postnatal depression because only one small trial from USA met inclusion criteria[247]. Indeed, in this trial fluoxetine was not found to be superior to CBT in treating postnatal depression[248]. A further concern noted in this review is that as far as the safety of antidepressants is concerned, there is little data on the safety of breastfeeding for the infant.

Prevention

Psychological/psychosocial

As mentioned, most preventive interventions for postnatal depression commence during pregnancy. Evidence from a Cochrane review involving 15 trials (14 HIC; 1 LMIC), suggest that overall psychosocial/psychological interventions do not stop the development of postnatal depression[249]. However, studies that provided intensive postpartum professional support, targeted 'at-risk' women, were individual-based as opposed to group, or had only a postnatal component, were more effective in preventing postnatal depression. Within LMIC, the evidence has also been mixed, and only four community-based studies have been reported. Thus, whilst a maternal and child health women's groups intervention in India (Jharkhand and Orissa) reduced moderate postnatal depression by 57% in the third year following implementation[250], and a preventive support guidance in parenting intervention in South Africa reduced maternal depressed mood[251], and a more general intervention targeting child rearing and parenting self-esteem among mothers of undernourished children in Jamaica lead to improvements in maternal depressive symptoms[252], a supportive home-visits intervention targeted at 'at-risk' women in India (Goa) did not provide any additional benefits in preventing postnatal depression[253].

The literature on the use of psychological interventions such as mother support or women's groups and home-based interventions to prevent/treat maternal depression is undoubtedly scanty. Whilst the evidence relating the use of health professionals in the treatment/prevention of CMD through home-visits is convincing[254-258], the effectiveness of lay health workers is

equivocal. Lay home-visitors reduced depression levels from studies in Asia[246], Africa[251, 259] and Western countries[260], but other authors report no such benefits[261, 262].

The mechanism by which home visits may be expected to improve mental health is that home visits are known to improve the quality of the home environment, parenting skills and uptake of childhood immunizations[263], which are catalysts for assured mental well-being. Despite these inconclusive findings, it is generally known that interventions that rely on non-specialist health workers and low-cost technologies and strategies can deliver equally effective mental health interventions[264] particularly in LMIC.

Furthermore, the case has to be made that though the use of professionals is likely to guarantee the effectiveness of community-based psychosocial/pharmacologic interventions, their involvement is costly and likely to be limited[262], especially in developing countries[265]. It is therefore imperative that other less expensive resources such as the use of lay people or volunteers are explored. Indeed, these paraprofessionals or local community resource could be relatively attractive. In addition, it is possible that some families may be more likely to engage with preventive support from an informal source[266].

Pharmacologic Approaches

A Cochrane review suggests that there is no clear evidence for the use of antidepressants as a prophylactic in the prevention of postnatal depression as only two trials from HIC (USA) met inclusion requirements[267]. The two trials showed mixed evidence of effect; nortriptyline was not superior to placebo[268], but sertraline was effective in reducing recurrent postpartum depression and increases the time to relapse[269]. Both trials were limited by small sample sizes.

In conclusion, irrespective of the delivery channel, there are effective, locally feasible, and affordable approaches for tackling depression in low-income and middle-income countries[270 271]. Admittedly, though there is increasing evidence that such treatments for mental health are feasible and effective, the evidence supporting the effectiveness of integrating these into routine care settings in LMIC is lacking[272]. Reassuringly, there is some evidence supporting the effectiveness of integrating mental health into such routine primary care health-care programmes[273-277], and community care[278], but more evidence is required. The completion of current projects such as the Sustainable Programme Incorporating Nutrition and Games (SPRING) trial in South Asia, the Philani Plus Mentor Mother community health visiting programme in South Africa, the South Asian Hub for Advocacy, Research and Education on mental health (SHARE), and the Programme For Improving Mental Health Care (PRIME) research consortium, may provide important evidence on how to proceed with such cross-fertilisation schemes at the community level.

Table 2.2: Summary of Evidence on Approaches to Tackling Perinatal Depression

	Antenatal depression interventions	Postnatal depression interventions	General adult depression
PREVENTATIVE	None	***1. Psychological/psychosocial*** - Based on a Cochrane review involving 15 trials (14 HIC; 1 LMIC (China) , overall psychosocial/psychologic interventions do not reduce the number of women who develop postnatal depression (RR 0.81, 95% CI 0.65 to 1.02)[248] . However… o Studies that provided intensive postpartum support provided by health professionals provided beneficial results (RR 0.68, 95% CI 0.55 to 0.84). o Selective intervention targeted at 'at-risk' women also assisted in preventing postnatal depression (RR 0.67, 95% CI 0.51 to 0.84). o Interventions with only a postnatal component were more beneficial (RR 0.76, 95% CI 0.58 to 0.98), than those that incorporated an antenatal component. o Individual-based interventions appear to be more beneficial (RR 0.76, 95% CI 0.59 to 1.00) than group-based interventions o Multiple visits/contacts to the woman did not appear to be of any relative benefit. o Maternal and child health women's groups intervention in India reduced postnatal depression at the third year following implementation[249]. o Supportive home-visits targeted at pregnant women at risk of postnatal depression delivered by an experienced mother, did not provide any additional benefits in preventing postnatal depression in India (Goa)[252] o Preventative and support guidance in parenting by lay women home-visitors had no impact on prevalence of depressive disorder at six months, but did reduce maternal depressed mood in South Africa[250] o Brief antenatal CBT group therapy RCT in Australia showed no superiority over control group (information booklet)[278]	***1. Psychological/psychosocial*** - Mindfulness-Based Cognitive Therapy (MBCT) significantly reduces rates of depressive relapse and recurrence in HIC[279, 280] - Structured school-based physical activity programme in Chile had no impact on change in depression scores[281] - Optimism programme among school children in China showed fewer depressive symptoms at 3-months[282] - Rational emotive therapy among surgical patients reduced depression levels[283]. - Community-based multicomponent interventions comprising information materials, educational-institution interventions and, in rural contexts, community peer interventions among youth (16-24) in India, resulted in significantly lower depression[284]

	Antenatal depression interventions	Postnatal depression interventions	General adult depression
		2. Pharmacotherapy - Based on a Cochrane review, there is no clear evidence for the use of antidepressants as a prophylactic in the prevention of postnatal depression based on mixed evidence from only two trials in HIC (USA)[266]. - The two trials cited in this review showed mixed evidence of effect: the first trial used a tricylic antidepressant (nortriptyline), and showed no superiority over placebo; the second trial involved a selective reuptake inhibitor (sertraline) and showed to be effective both in reducing the incidence recurrent postpartum depression and increasing the time to relapse. - Both trials were limited by small sample sizes.	
CURATIVE	***1. Psychological/psychosocial*** - Based on a Cochrane review, the evidence is inconclusive to allow any recommendations on the use of interpersonal psychotherapy for the treatment of antenatal depression because only 1 trial from HIC (USA) examined this[244]. - The only study mentioned in this review however did report a significant decrease in risk of depression **(IPT)** (RR 0.46; 95% CI 0.26, 0.83), compared to care as usual[235]. The trial was also limited by small sample size. ***2. Pharmacotherapy*** - In a recent review 57 studies showed no cardiac malformations, compared to 22 that indicated malformations[236] - A meta-analysis identified increased risk with combined cardiac defects in first trimester exposure to anti-depressants (paroxetine)[cardiac defects odds ratio 1.46 (95% CI, 1.17-1.82); aggregated congenital anomalies OR 1.24 (95% CI, 1.08-1.43)][237] - A systematic review identified increased risk of preterm birth, neonatal adaptation difficulties, and persistent pulmonary hypertension of the new born following exposure to anti-depressants[239]. - Two reviews conclude that the benefits of prenatal anti-depressants far outweigh the risk of leaving antenatal depression untreated[236, 238]This review concludes that the benefits of prenatal anti-depressants far outweigh the risk of leaving antenatal depression untreated[238]	***1. Psychological/psychosocial*** - Based on a Cochrane review involving 10 trials (n=956), there is evidence primarily from HIC to suggest the effectiveness of psychosocial/psychological interventions for the treatment of postnatal depression in the short term[244]. - Interpersonal psychotherapy is efficacious/effective in the treatment of postnatal depression in HIC[289] - Cognitive behavioural therapy and non-directive counseling is effective in treating postnatal depression in HIC[290]. - Cognitive behavioural therapy is effective in treating postnatal depression in LMIC[245]. - Health visitor-led non-directive counseling is effective in treating postnatal depression in HIC[291, 292]. - Peer support is effective in treating postnatal depression in HIC[293]. ***2. Pharmacotherapy*** - Based on a Cochrane review, it is not possible to make any recommendations for antidepressant treatment for postnatal depression because only one and small trial from HIC met inclusion criteria (Hoffbrand 2001). - In the only study mentioned in this review, the effect of antidepressant fluoxetine was not superior to CBT in treating postnatal depression. - There is also little data on the safety of breastfeeding for the infant (Hoffbrand 2001-Review)	***1. Psychological/psychosocial*** - The efficacy of psychological treatments have a moderate (g=0.67) posttreatment effect[294]. - Interpersonal psychotherapy has superior efficacy over CBT[295] - Lay health counselors are effective in reducing levels of CMD at 6 months following intervention among patients attending public health facilities in India[269]. - Psychoeducational intervention plus antidepressant for severe cases in Chile resulted in 70% recovery compared to placebo[232]. - Psycho-educational group intervention among women in Mexico showed an improvement in both arms, but these were not different between the arms at 4 months[296]. ***2. Pharmacotherapy*** - Evidence from a meta-analysis involving 75 RCTs show antidepressants use results in a 50% response compared to 30% response with placebo[297] .

	Antenatal depression interventions	Postnatal depression interventions	General adult depression
	3. Interventions other than psychosocial/psychological or pharmacologic - Based on a Cochrane review, the evidence is inconclusive to allow any recommendations on the use of non-pharmacologic somatic interventions for the treatment of antenatal depression because only 1 trial from HIC (USA) examined this[285] . - The only study mentioned in this review did not report a significant decrease in risk of depression **(maternal massage)** (RR 0.8; 95% CI 0.25, 2.53), compared to depression-specific acupuncture[286]. The trial was also limited by a small sample size and relative homogeneity. - Other interventions such as use of bright light therapy have shown no significant benefits[287, 288].		

2.7 Perinatal Depression in Ghana

Published literature on the epidemiology of perinatal depression in Ghana is almost non-existent. To date only three published epidemiological studies on PND in Ghana are reported. The first was a cross-cultural adaptation of screening tools for PND, among 160 recently delivered mothers. The screening tools validated in this study were: EPDS, PHQ-9 and SRQ-20. The PHQ-9 was found to be more robust in detecting PND and thus seem a preferred tool for screening perinatal depression in the study area. The prevalence of any common mental disorder based on the local clinician's gold-standard criterion diagnosis was 9.6%, and prevalence of PND based on symptom scores on a self-report was 30.6%[25]. The second was a prospective cohort study that sought to ascertain for the first time the synergistic association between maternal postnatal depression among HIV positive mothers and risk of infant diarrhoeal episodes[298]. The prevalence of PND based on symptom scores on the EPDS was 10%. The authors found a two-fold risk of infant diarrhoel episodes with mothers who were both HIV positive and depressed. Mothers whose HIV status was unknown but depressed also had their infants at a three-fold increase risk of diarrhoe. Though this was a cohort design the analysis did not adjust for infant HIV status, and PND was inappropriately measured as early as 10 days after birth. In the third study (under review), Gold and colleagues measured the prevalence and determinants of postnatal depression among a select group of mothers of sick infants (N=153)[299]. Based on PHQ-9 symptom scores, the authors report strikingly high prevalence of depression in mothers; 70% for any score above five, suggestive of any depression, 33% mild depression, 27% moderate depression, 10% moderate-severe depression. Risk factors associated with depression after birth were: intimate partner violence, expectations of social support, and poor self-rated health of the mother. Though the authors failed to acknowledge the implications of the relatively small sample size on the prevalence estimates reported, it is important these are interpreted with caution given the likely lack of precision, accuracy, and variability inherent in small samples for the purposes of epidemiological research. In another study(unpublished) in rural Ghana, which employed qualitative and quantitative methodology to ascertain the concept

of morbid unhappiness in the period after birth, the women interviewed recognized the concept and acknowledged its presence and negative impact[300].

2.8 Non-perinatal Depression in Ghana

There is a serious dearth of mental health research in Ghana, and published peer-reviewed literature on depression is scanty. Most of the limited evidence is from clinic-based case review studies. Nonetheless, the cross-country study (5 countries) on global ageing and adult health (SAGE) reports a prevalence of DSM-IV major depression of 4.5%, of which 92% are not treated[301].

As far as specific primary studies in Ghana are concerned, in a hospital records (over a 7 year period) review study of psychiatric morbidity among adolescents, depression was prevalent in 17.5%[302]. The aetiology of the disorders found in this study was mainly attributed to the biological events and personality growth that occurs around the period of adolescence. And among the elderly attending an out-patient psychiatric hospital, retrospective accounts of psychiatric morbidity put depressive symptoms as the most frequently diagnosed disorder[303]. In a qualitative exploration of women's mental health among a cross-section of the stakeholder groups, respondents identified the concept of morbid unhappiness and indicated women are more prone to 'hidden' mental disorders such as depression or milder forms of psychosis, and this was mainly blamed on issues of inherent vulnerability, witchcraft and gender disadvantage[304]. Similarly, in a study of the social and clinical characteristics of depression among women in Ghana, stress was mainly manifested through somatisation disorder[305].

In a study of the association between bullying in secondary schools (teenagers) and psychological health, students who were bullied had an almost two-fold odds of having a sign of depression (1.97 95% CI, 1.75-2.21), or suicidal ideation (1.72 95% CI, 1.45-2.05)[306].

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2.9 Conclusions/Gaps

- Dearth of research in perinatal mental health in developing countries, with only 8% of low and middle income countries covered (only one study in Ghana).
- Few studies in LMIC conducted in community or population settings, for example only three of the 13 studies of the prevalence of antenatal common mental disorder, and only one of the six from SSA.
- Little to non-existent research in biologic risk factors for perinatal depression in SSA.
- Almost nonexistent literature on specific risk factors for the course and outcome of perinatal depression.
- Knowledge gap in risk factors pertaining to special categories of pregnant and delivered women such as teenagers or adolescents.
- Few and often under-powered research on consequences of perinatal depression on neonatal, infant and maternal health.
- Few lay home-visits interventions on improving mental health outcomes in mothers during pregnancy and after birth in the world; almost non-existent in SSA.

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Section B

3. Chapter 3: Country Profile: Geography, Economy, Health and Study Setting

3.1 Geography, Governance and Economy

3.1.1 Geography and Governance

Ghana (formally the Gold coast) is one of the 16 countries in West Africa and covers a total surface area of 239,460 square kilometres. It is an Anglophone country and shares boundaries with Burkina Faso in the North, Cote d'Ivoire in the West and Togo in the East. In terms of international and regional integration, Ghana is a member of the United Nations (UN), the Common Wealth of nations, the African Union (AU) and the Economic Committee of West African states (ECOWAS). As a consequence Ghana has signed on to numerous international treaties and subjects itself to the cannons of international law and justice, and universal human rights.

Ghana is located in the tropical belt of the world and thus has a tropical climate with temperatures and rainfall pattern changes due to elevation and distance from the coastal belt. The average annual temperature is about 26ºC (79ºF), but could reach highs above 35ºC (95ºF) in the north and transitional belt. There are two distinct seasons, though these vary between the north and south of the country; rainy season that spans the months April to November; dry season that runs between December and March. Annual rainfall ranges from about 1,015millimetres (40 inches) in the north to about 2,030 millimetres (80 inches) in the southwest. The *harmattan*, a dry desert wind, is common during the dry season in Ghana and lowers the humidity thus creating very warm days and cool nights in the north.

Ghana embraces a multi-party democratic system of governance and has successfully undergone three consecutive presidential and parliamentary elections since 1992. The seat of government is located in the Greater Accra region (the capital) but there are nine (9) additional regions under which are 170 districts which serve as a conduit in executing central government's policies at the grass root or local government level.

3.1.2 Economy

Ghana has for the past years embarked on various structural adjustment programmes (SAP), and economic recovery initiatives such as the Ghana Poverty Reduction Strategy I & II, Highly Indebted Poor Country (HIPC) initiative and Ghana Vision 2020. In 2007, the Livelihood Empowerment Against Poverty Programme (LEAP) was introduced, and in 2008 individuals identified as poor started receiving monthly allowances. All these were geared towards ameliorating economic challenges and ensuring that Ghana attains official middle income status by 2020. It does appear these efforts have paid dividends as Ghana is currently classified by the World Bank as a lower middle income country[1].

The domestic economy revolves around subsistence agriculture, which accounts for 34% of gross domestic product (GDP), and employs 50% of the work force, mainly small landholders[2]. The average per capita income stands at US$572, with 18.2% of the population living in extreme poverty[1], a decline from the 26.8% in 1999[3]. It does appear therefore that Ghana is on course to halve the millennium development goal of poverty reduction by 2015.

3.2 Demographic and Reproductive Health

3.2.1 Demographic and Socio-Economic Indicators

The population of Ghana has been steadily increasing over the years and this may have resulted in disparities in some key socio-economic, socio-demographic as well as fertility indicators. Estimates from the recent Ghana Health and Demographic Survey[4], are that 31% of women have never been to school, about an equal proportion have some primary or have completed primary school, and 36% have some secondary or have completed secondary school; a meagre 3% of women have attained higher than secondary school education. Urban women are more likely to be educated (52%) than rural (27 %) women. In terms of sex, males (median 5.4 years) are more likely to be educated than females (median 3.7 years) at all levels of education. Overall however there has been some improvement in the proportion of the population with no education since the last GDHS survey in 2003. For example, the proportion of females with no

[1] The Ghana Living Standards Survey derives two nutrition-based lines of poverty. Extreme poverty is based on a poverty line of 927 Ghana cedis ($572 in 2006 poverty line), per adult per year (GPRS, 2006).

education dropped from 37 % in 2003 to 31 % in 2008 and the median number of years of schooling for females nearly doubled from 2.1 to 3.7 years. And the proportion of males with no education dropped from 26% to 22%, with the median years of schooling increasing from 3.9 to 5.4 years within the same period.

Access to drinking water, electricity and clean sanitation are important indicators of improved socio-economic status. In Ghana the major source of drinking water for rural households is tube wells or boreholes (48%) with only 0.2% having access to a public tap or standpipe as their main source of drinking water. Quick access to water appears not to differ between rural and urban areas as, nine in ten urban households and nearly eight in ten rural households spend less than 30 minutes to obtain water from their nearest source of drinking water. Traditionally adult females age 15 and above are more likely to collect drinking water for the household than men and children, and this pattern is more prevalent in rural (56%) than urban areas (31%). Surprisingly, there is little difference between urban and rural households in access to improved sources of drinking water (79% vs 76 %).

The proportion of the population with access to improved toilet facilities in Ghana is only 11%. The differences between urban-rural residences are wide. Thus, 16% of urban households compared to only 7% of rural households use their own improved toilet facilities. In general, nearly 18% of households have no toilet facilities and this is more prevalent in rural areas (30 %) than in urban areas (6 %).

Access to electricity is unevenly distributed between rural and urban settlements. 85% of households in urban areas have electricity, compared with 38% of the households in rural areas. Overall, six in ten households in Ghana had electricity by 2008 and this is an improvement over the past five years (since last GDHS in 2003), especially among rural households (48% in all households and 24 % in rural households in 2003).

Another proxy indicator of socio-economic position is the quality of the material used in constructing the floor of the dwelling. It may also double as a health indicator as it is a likely route for disease transmission. Most households in Ghana (85%) do have good quality finished

floors, with only 14% characterized by rudimentary or natural flooring (earth, sand, or mixed mud with dung).Strikingly rural households are much more likely to have cement floors (65%) than urban households (56%). The second most common flooring material in rural areas is earth and sand (22%).

The number of rooms used for sleeping is a measure of household level population density and could indicate the risk of contracting respiratory, air-borne and skin diseases, particularly in children. The average household size in Ghana is 3.7, and only 15% of households in Ghana have three or more rooms for sleeping, with most (60%) with only one room. Interestingly, households in rural areas have a greater proportion (17%) of three rooms or more for sleeping than those in urban areas (12%).

3.2.2 Reproductive Health

3.2.2.1 Fertility Indicators

The general fertility rate in Ghana (GFR) is 136 births for every 1000 women. The total fertility rate (TFR) of 4.0 births per woman is however one of the lowest in SSA, though quite varied within country and between rural and urban populations. Compared to rural areas (4.9 births) the rate in urban settlements (3.1births) is lower. This is to be expected though it does appear the intensification of reproductive health education is making an impact as the present rate in rural areas reflects a reduction from 5.6 births in 2002. Interventions put in place to control the fertility rate in Ghana appear to be effective as the set target of 4.0 was achieved two years before the projected date of 2010.

In Ghana, whilst childbearing outside marriage is not uncommon, voluntary childlessness is uncommon and currently married women with no live births are likely to be those who have challenges conceiving. Unplanned pregnancies are still common in Ghana and this has been the pattern for more than twenty years. Overall, 14% of births in Ghana are unwanted, while 23% are mistimed (wanted later).

3.2.2.2 Birth Spacing

The median birth interval in Ghana is 40 months and increases with increasing age, and this has remained static over the past five years since 2008. Between rural and urban populations, the interval is longer among urban women (44 months) than among rural women (38 months).

3.2.2.3 Antenatal Care

Antenatal care attendance in Ghana is relatively high and has seen a marked improvement over the past two decades, with over 95% of women having received antenatal care from a health professional (doctor, nurse, midwife, or community health officer). Coverage of Tetanus toxoid (TT) vaccination to pregnant women is however not very encouraging, with only a little over half (56%) of women in Ghana vaccinated.

3.2.2.4 Postnatal Care

In contrast to high antenatal care coverage only 67 percent of women who have a live birth receive postnatal care within two days of delivery, and only 7 percent receive postnatal care 3-41 days after delivery. About 23 percent never receive postnatal care. Childhood vaccination is however high with 79% fully immunized between 1 and 2 years (the youngest cohort of children who have reached the age by which they should be fully immunized), and at least 96% getting BCG and first dose of DPT and polio vaccines.

3.2.2.5 Breastfeeding Practices

Breastfeeding is practised widely in Ghana, with a phenomenal 98% of children having been breastfed for some period of time. Of this proportion, over half of infants were put to the breast within one hour of birth, and 82% started breastfeeding within the first day. This notwithstanding, coverage (63%) of exclusive breastfeeding within the first 6 months is not encouraging.

3.2.2.6 Childhood Mortality

Childhood mortality in Ghana has declined over the past 20 years. Under-five mortality rate decreased from 111 per 1,000 live births for the 4 year period preceding the 2003 GDHS to 80

per 1,000 during the same period prior to the 2008 GDHS, with over 60% of these deaths occurring in the first year of life. Infant mortality is 50 deaths per 1,000 live births and neonatal mortality is 30 deaths per 1,000 live births in the most recent five-year period, while postneonatal mortality is 21 deaths per 1,000 live births. Neonatal deaths account for 60 percent of the deaths in infancy.

3.3 Mental Health in Ghana

It is estimated that of the about 21.6 million people living in Ghana (based on last census in 2000), 650,000 are suffering from a severe mental disorder and a further 2,166, 000 (10%)[5] are suffering from a moderate to mild mental disorder, with only 2% able to get treatment[6].

Ghana, just as many other SSA countries has considerable structural, institutional and human capacity challenges regarding mental health services. A recent situational review of mental health services in Ghana revealed a number of challenges facing the provision of mental health services. These challenges are discussed below in the key areas of policy, services, human-resources, funding, and opportunities.

3.3.1.1 Policy and Legislation

The blue print regarding mental health delivery in Ghana was recently (2012) passed by parliament and is awaiting presidential assent into law. Prior to this mental health policy in Ghana was driven by the Asylum ordinance of 1888 and the mental health decree of 1972, which were reformulated in 1994 and revised in 2000. These prior 'legislations' were inadequate in scope and thus failed to provide the needed support for the advancement of universal mental health in Ghana, and did not provide for current best practices in mental health[7] . These policies emphasized the decentralization of mental health services and the development of community mental health care but very little progress was made in terms of implementation. Other limitations of these prior 'legislations' are that they did not provide for inter-sectoral collaboration, and there is poor evidence base due to little mental health epidemiological research. Indeed at present there is no regulatory body for institutions providing

care for the mentally ill, and hence neither systematic monitoring of human rights and quality of care within psychiatric institutions nor unorthodox (traditional and faith healers) outlets does exist[7].

It is hoped that the new law among other things, will protect and promote the rights of the mentally ill, set up mechanisms for early identification of mental distress at primary care, discourage institutionalized care and provide the training and development of human capacity.

3.3.1.2 Mental Health Services

Before the coming into being of the reformulated Asylum ordinance of 1888 and the mental health decree of 1972, access to psychiatric services was mainly provided by only three (3) state-owned psychiatric hospitals. These are located mainly in the south of the country and thus resulted in a skewed non-universal access to mental health care. Apart from the overstretched infrastructure as a result of over subscription for mental health services, people from the northern part of the country had to travel long hours (aprox. 11 hours by road) to access care at the national facilities.

The reformulation provided for moves towards de-centralization of mental health care with the opening of psychiatric units in the regional hospitals and the establishment of community psychiatric nursing services within 68 districts. Services have been integrated into the health programs of all the Regional and District Health Management Teams where community psychiatric nurses (CPN) are at post. Other private sector initiatives through NGOs and other agencies to enhance the community detection of mental illness and provide treatment also exist.

This notwithstanding, there is little progress towards the decentralization of mental health care in Ghana [7]. Thus, though the regional hospitals were empowered to provide specialist referral services, the pressure on the three state-owned hospitals still remains because they continue to provide specialized inpatient care and users are still ignorant about the availability of the services at the regional hospitals. Furthermore, community-based mental health services are provided in only about half of the districts in the country and there are insufficient numbers of CPNs and other mental health professionals within primary care[7].

In Ghana treatment for mental health is predominantly drug-based and curative, with little to no psychosocial interventions[7]. In addition, services are primarily focused on treatment for severe mental disorders such as psychosis and schizophrenia, with little attention on depression and other common mental disorders.

The current mental health bill that is awaiting presidential assent is definitely an improvement over the reformulated decrees of 1888 and 1972, and will provide the necessary legislative and financial backing to ensure mental health services are equitably distributed.

3.3.1.3 Human Resources

Despite an increase in the number of training places available for psychiatric nurses and other health professionals such as medical assistants, there remains a lack of human resources within mental health services, including inpatient hospitals and community services [7]. For instance there are only seven (7) fully-trained specialist psychiatrists currently practising in country. The reasons for this trend have been attributed to stigma, low priority of mental health, and fears of violence [7]. There are also very few specialists in psychosocial interventions and little opportunity for continuous professional development for mental health professionals.

3.3.1.4 Funding

Currently funding for mental health services in Ghana receives relatively little attention and thus receives a very small allocation from the overall health sector budget[7]. Unfortunately the decentralization clause in the reformulated prior 'legislations' failed to ensure that the necessary monetary resource allocation for community mental health care reaches the district health management directorates. As a consequence, and coupled with competing communicable diseases, focused interventions budgets for mental health specific activities are conspicuously missing in their activity plans.

Further to this, though the government in the year 2003 by legislative instrument ACT 650 and LI 1809 provided every resident with the opportunity to take an insurance cover for health-related issues, treatment for mentally ill people with physical ill health conditions is not covered by the insurance.

3.3.1.5 Opportunities

The state of mental health services in Ghana is not as gloomy as to be irrecoverable. In fact there are a number of encouraging opportunities for the improvement of mental health care. For instance there is widespread acknowledgement at the macro (national) level of the need for de-centralization of mental health service provision and the development of community-based services, indicating that there would be support from policy makers for further implementation. Closely backing this widespread acknowledgement is the new mental health bill, and which should signal a new standard for mental health care in Ghana and provide a mandate for improved services. In addition, there has been considerable collaboration and support for mental health in recent years from international agencies such as the Royal Netherlands Embassy and the World Health Organization. There has also been a growth in the number of both international and local NGOs such as BasicNeeds and Mental Health Society of Ghana working in Ghana in the field of mental health.

3.4 Study Setting: Data Collection Site

The PhD research took place within seven contiguous districts of the Brong Ahafo Region of Ghana during the conduct of two consecutive large community-based cluster randomised controlled trials: ObaapaVitA and Newhints trials. The ObaapaVitA trial sought to reduce the burden of maternal deaths through weekly supplementation of all women of reproductive age with low doses of Vitamin A, through a sophisticated surveillance system. The Newhints trial aimed to prevent newborn deaths through home-visits during pregnancy and first week after birth by community based health workers, also utilising the surveillance system that was set up for the ObaapaVitA trial. Both trials were based at the Kintampo Health Research Centre, one of three Ghana Health Services health research institutions. Figure 3.1 shows a map of Ghana depicting the seven districts of the DON PhD research study.

The Brong Ahafo Region, formerly a part of the Ashanti Region, was created in April 1959. It covers an area of 39,557 square kilometres and shares boundaries with the Northern Region to

the north, the Ashanti and Western Regions to the south, the Volta Region to the east, the Eastern Region to the southeast and La Cote d'Ivoire to the west.

It has 19 administrative districts, with Sunyani as the regional capital. The region lies in the transitional zone of Ghana; the southern part lies in the forest zone and is a major cocoa and timber producing area and the northern part of the region lies in the savannah zone and is a major grain and tuber-producing region. At the last census in 2010, the region recorded a population of 2,282,128, indicating an intercensal growth rate of 2.2%.

The climate is tropical in nature, with high temperatures averaging 23.9^{o}C (75^{o}F) and a double maxima rainfall pattern. Rainfall ranges, from an average of 1000 millimeters/year in the northern parts to 1400/year millimeters in the southern parts. As a consequence the area has two main vegetation types; the moist semi-deciduous forest, mostly in the southern and south-eastern parts, and the guinea savannah woodland, which is predominant in the north.

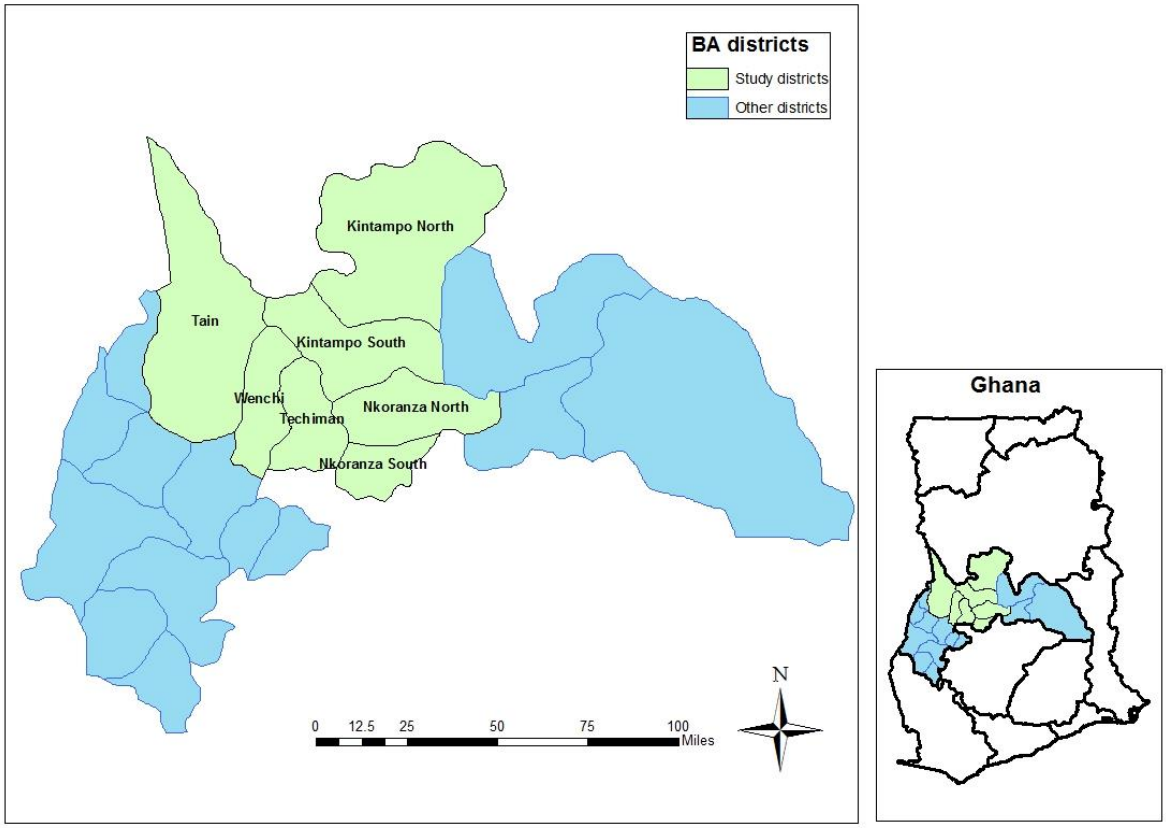
The seven districts within which the DON study was conducted are: Kintampo North, Kintampo South, Techiman, Nkoranza North, Nkoranza South, Wenchi and Tain districts. These are contiguous and predominantly rural and together cover an area of 12,000 square kilometres, and a population of 750,000. The area has one urban district town and three peri-urban ones; the other district capitals are rural. Based on reports by the Ghana Poverty Reduction Strategy-II, despite overall reductions in extreme poverty (<$1.25/day) from 26.8% in 1998/99 to 18.2% in 2005/06, the level of extreme poverty in the Brong Ahafo region is one of the highest in the country (14.9%). Educational attainment is low with about 34% of the adult population of men and women being illiterate.

There are 340 communities with over 77,000 compounds built either of mud with thatched roof or cement. The settlements are predominantly rural with over 80% of residents living in rural communities in dispersed villages. There are predominantly more Christians (75%) than Muslims (18%), and though the area is diverse in ethnicity, the indigenous ethnic groups (Akans/Bonos/Mos/Bandas) are predominant (54%). Twi (the local language) is spoken and understood by over 90% of the population.

In total, there are about 68 health facilities made up of nine hospitals (3 privately owned) and a good number of level 'B' health facilities and maternity homes.

Based on data from the ObaapaVitA and Newhints trials, the Perinatal Mortality Rate (PMR) is 55/1000 live births, and neonatal mortality rate is 31/1000 live births. Sixty six infant deaths (IMR) occur in 1000 child-years, and the pregnancy-related Mortality Ratio is 377/100,000 pregnancies[8].

Figure 3.1: Map of Study Area



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4. Chapter 4: Methods

4.1 Overview of Design

The DON study that was designed for this PhD was nested within a 4-weekly surveillance system supporting two community trials: The ObaapaVitA and Newhints trials. These trials ran consecutively from 2000 to 2010, and collected information on: pregnancies, births, and infant and maternal deaths, through a 4-weekly population-based surveillance system. The DON depression assessments were carried out from January 2008 to early August 2009 **(see figure 4.1)**. The ObaapaVitA trial sought to reduce maternal mortality through weekly vitamin-A supplementation of women of reproductive age, and the Newhints trial aimed to assess the impact of home-visits by community volunteers on neonatal mortality.

Figure 4.2 illustrates the 4-weekly visits and the time points DON depression and surveillance data were collected. Thus, when a pregnancy is reported, a DON pregnancy assessment is conducted at the next 4-weekly visit. Similarly, when a birth is reported, a DON postnatal assessment is conducted at the next visit to the woman. The figure also shows the timing of the surveillance forms that provided data for this thesis; these are described in **section 4.3**.

4.2 DON Data Collection Procedure

4.2.1 Measure of Depression

The measure of probable antenatal or postnatal depression is based on a depression screening module of the Patient Health Questionnaire (PHQ-9)[1]developed as part of the Primary Care Evaluation of Mental Disorders (PRIME-MD)[2] instrument. The PRIME-MD is the first screening instrument designed for use in primary care that actually diagnoses specific disorders using diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition (DSM-III-R) and Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). The PHQ-9 may therefore be regarded as a semi-clinical diagnostic screening tool.

The benefits of using the PHQ-9 have been described in the literature review in **section 2.2**. The core reasons for selecting the PHQ-9 are that it is psychometrically robust and allows for an approximation to DSM-IV diagnosis of major/minor depression, and is easy to administer. We had previously tested the criterion validity of the PHQ-9 questions in the same setting, comparing a score of 5+ against the gold standard of a local clinician's structured clinical diagnosis of common mental disorder[3]. The complete report on the adaptation and validation of the PHQ-9 is provided in **appendix 1**.

The PHQ-9 has nine questions that enquire about the nine symptom-based criteria for a diagnosis of DSM-IV depression, including duration and severity. A copy of the form is provided in **appendix 3**. Each of the nine questions has uniform response options and only symptoms that have been present for at least half the time in the previous two weeks are rated positively. The PHQ-9 allows for DSM-IV clinimetric criteria to be applied to the scores obtained. The PHQ-9 also includes a global question on disability which is rated 0 to 3, with 3 being the highest rating of disability. This global disability question is only enquired when any of the PHQ-9 depression screening items are indicated, and covers four domains of disability: self-care, getting along, life activities, and participation. In contrast with other symptom based scale scores, these criteria therefore identify individuals with persistent and pervasive symptoms, characteristic of a clinically significant depressive episode.

Though the cultural adaptation of the PHQ-9 questions was against the gold standard of a local clinician's structured clinical diagnosis of common mental disorder[3], in this study I sought to identify clinically significant depressive episodes, and therefore used the PHQ-9 item ratings to give an approximation to DSM-IV major or minor depression diagnostic categories. Thus, for the purposes of this PhD, depression outcome/exposure (major or minor) was defined as an indication of two or more symptoms on the PHQ-9, one of which must either be depression or anhedonia (loss of interest or pleasure).

4.2.2 PHQ-9 Training, Supervision and Quality Control

Approximately 400 field workers and their supervisors were trained on the administration of the PHQ-9 in December 2007. The training covered a background to the study, informed consent process and ethical conduct, the administration of the PHQ-9, and problem-solving techniques using Information, Education and Communication (IEC) material. Strategies employed in the training included; interactive lectures, mock interviews, group discussions and practice exercises. The procedures for consenting in DON were also discussed. Training was conducted by the author of this PhD, with support from senior field staff and lasted four weeks. There were four separate training sessions (one per week) for field staff at each of the four main trial districts (Kintampo, Nkoranza, Techiman, Wenchi), and each training session lasted approximately three (3) hours. After the main training in December 2007, refresher training was provided in early January 2008, just before the commencement of data collection in late January 2008.

Fieldworkers and supervisors on the RCTs have enormous experience in conducting field surveys using the questionnaire method and their wealth of experience helped in ensuring the training process was smooth. However, because DON introduced a fairly specialised area and a deviation from the routine surveillance they have been involved in, important attention was given to the level of detail in explaining how screening for mental disorders is done. As a result ample time was allotted to the session on questionnaire administration and trainees went through mock interviews to ensure that they achieved this new skill. In keeping with the modus operandi of screening questionnaires, standardization in the way the screening questions were asked by field workers was obtained by applying the following rules:

1. Ensure questions are read out just as appear on the questionnaire

2. Avoid interpreting questions to participants

3. Ensure all response options available to the participant are read out

4. Avoid probing participants for explanation of responses.

As a consequence the DON directly observed supervision form (DON_DOS) was designed to capture compliance to the criteria listed above. The data collected sought to serve two main purposes: provide immediate feedback to the fieldworker on his/her interviewing skills and to report on levels of standardisation among field workers, and thus quality of data collected by lay interviewers. Field supervisors administered the form to116 fieldworkers who were selected randomly from each of the sites of the trial.

Another quality control measure that was instituted involved regular meetings with the data manager to primarily check the quality of the data. This was done by running appropriate commands to check score distribution by comparing screening results from FWs. Essentially the focus was to check if field workers were allocating ratings arbitrarily, and if that suggested possible interviewer challenges that needed to be addressed. Thus, if a fieldworker recorded consistently high scores or low scores compared to another field worker within the same cluster, these patterns were flagged and follow up visits made to the field to verify the patterns. It is important to note here that in as much as this exercise was meant to provide initial clues of possible challenges with data quality, circumspection was upheld to ensure that it did not result in manipulation of field workers or the data collected to obtain consistency in data patterns. The exercise was also an opportunity to identify and refer women who were likely to be depressed but not referred by fieldworkers to the author of this PhD as per protocol, for treatment support routinely provided by community psychiatric nurses of the Ministry of Health of Ghana.

4.2.3 DON Postnatal Data

Resident fieldworkers were responsible for a fieldwork area (FWA) of four contiguous clusters of compounds, visiting women in one cluster per week over a 4-weekly cycle. Each week, fieldworkers receive an updated record of women to be visited that week, and their pregnancy status, arranged by compound.

The two DON questionnaires incorporating the PHQ-9 were introduced in the routine surveillance system from late January 2008 with the DON_PREG and late April 2008 with the

DON_PP (**see Figure 4.2**). The initial plan was to recruit only pregnancies and follow them through till after birth with a DON_PP assessment, but this was later revised after two months, in other to optimize DON_PP data, to also recruit current births resulting from pregnancies captured before the start of DON_PREG recruitment, and on very rare instances, women recruited into the trials with a birth.

Pregnant women identified through the surveillance system were recruited into the DON study after obtaining informed consent in the presence of a witness. The DON Pregnancy form (DON_PREG) included extra questions on factors related to the current pregnancy (pregnancy preparedness, sex preference and pre-knowledge of unborn baby's sex through scanning or 'other means') and was administered between three and nine months gestation. The DON postnatal form was administered at the birth visit after a birth is reported.

4.3 Surveillance Data Used in DON

Table 4.1 provides a summary of the source and genre of data involved in answering each objective of this PhD. **Figure 4.2** shows the time points at which these forms were administered relative to the DON depression assessments.

PROFILE form: This was administered the first time a pregnancy is identified. It includes information on: socio-demographic/socio-economic indicators, including obstetric history and pregnancy factors. For example data on socioeconomic status (SES) is collected around: a) mother's educational level, b) head of household educational level, maternal/paternal occupational status, c) land and house ownership, d) ownership of a range of household, transport and agricultural assets e) Housing quality (overcrowding, materials used in construction of house, electricity and water supplies and sanitation facilities. An index of the wealth status of the household was derived from principal components analysis of 42 questions on household assets, sanitation and household quality indicators[4]. Women were then ranked according to their wealth index, and assigned to wealth quintiles with quintile 1 containing the least wealthy and quintile 5 the wealthiest. The data collected from these forms was used for the analysis of determinants of antenatal and postnatal depression, and as potential confounders in the analyses of consequences.

MONTH_PREG form: This form was administered monthly once a pregnancy is reported and ends when a birth occurs. It elicits information on: the status and outcome of the pregnancy, mortality, and general morbidity.

BIRTH form: This is administered when a birth is reported. This form collects information on: obstetric/pregnancy factors (prolonged labour, obstructed labour, post-partum/peripartum complications, and Caesarean Section (CS)/instrumental delivery); birth outcome (pre-term, post-term, stillbirth, child death; baby factors (multiple births, birth weight, severe newborn illness, and key child survival practices (breastfeeding, immunizations, use of bed net, drying and wrapping, delayed bathing and skin-to-skin care).

INFANT form: This is administered at every visit from the one after the birth is recorded until the baby attains one year of age. The form collects information on mortality, morbidity, and infant survival interventions. Data collected from these forms was used for the purposes of measuring both the consequences of perinatal depression and determinants of postnatal depression.

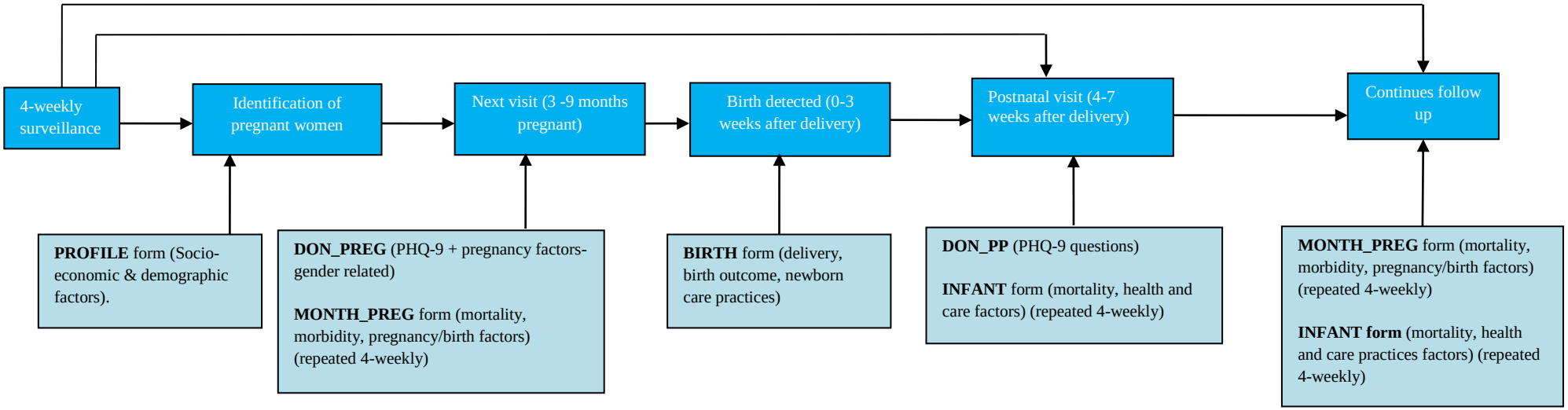
Table 4.1: Source and Genre of Data for Analysis of Each Objective

Data type	Objective/outcomes	Source/form	Data collected
Impact of home visits on Postnatal Depression	○ To assess the impact of home-visits on postnatal depression	○ DON_PP form ○ BIRTH form	○ Depression scores ○ CBSV visits
Burden of Perinatal Depression	○ To measure the prevalence of DSM-IV antenatal and postnatal depression ○ To measure the onset of postnatal depression and persistence antenatal depression	○ DON_PP form ○ DON_PREG form	○ Depression scores
Determinants of Antenatal Depression	○ To assess the role of sociodemographic/socioeconomic factors ○ To assess the role of pregnancy-related and obstetric history	○ DON_PREG form ○ PROFILE form	○ Depression scores ○ Socio-demographic information ○ Socio-economic information ○ Pregnancy/obstetric history
Risk factors for Postnatal Depression, (including onset postnatal depression and persistence antenatal depression)	○ To assess the role of sociodemographic/socioeconomic factors ○ To assess the role of pregnancy/birth-related factors ○ To assess the role of infant factors ○ To assess the role of environmental factors such as season of birth	○ DON_PP form ○ DON_PREG form ○ PROFILE form ○ BIRTH form ○ POSTPARTUM form ○ MONTH_PREG form	○ Depression scores ○ Socio-demographic information ○ Socio-economic information ○ Pregnancy/birth related information ○ Infant factors
Consequences of Antenatal Depression	○ To assess the effect on poor perinatal outcomes (neonatal, preterm, still birth) ○ To assess the effect on low birth weight ○ To assess the effect on peripartum/postpartum complications ○ To assess the effect on baby ill health within a month after delivery ○ To assess the effect on timely initiation of breast feeding ○ To assess the effect on bed net use during pregnancy	○ DON_PREG form ○ PROFILE form ○ BIRTH form ○ POSTPARTUM form	○ Depression scores ○ Socio-demographic information ○ Socio-economic information ○ Birth outcome ○ Neonatal mortality ○ Birth weight ○ Peripartum/postpartum complications ○ Child survival interventions/practices
Consequences of Postnatal Depression	○ To assess the effect on infant mortality and morbidity ○ To assess the effect on exclusive breast feeding ○ To assess the effect on bed net use after birth	○ DON_PP form ○ DON_PREG form ○ PROFILE form ○ INFANT form	○ Depression scores ○ Socio-demographic information ○ Socio-economic information ○ Mortality/morbidity ○ Child survival interventions/practices

Table 4.2: Timing of DON Study within ObaapaVitA and Newhints Trials

Activity	MONTH & YEAR																								
	Jan 2000 – Nov. 2007	2007	2008												2009										
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ghana Vitamin A supplementation Maternal Mortality trial (ObaapavitA)																									
▪ Implementation																									
Ghana Newborn Home Intervention Study (Newhints Trial)																									
▪ Phase 1 training																									
▪ Phase 2 training																									
▪ Refresher training																									
▪ Implementation																									
▪ Evaluation cohort																									
The DON study																									
▪ Training																									
▪ Refresher training																									
▪ Evaluation period																									

Figure 4.1: Recruitment Schedule for Data Collection



4.4 The Newhints Trial

Newhints is a cluster randomised- controlled intervention trial (cRCT) that aimed to develop a feasible and sustainable home-visits intervention and evaluate the impact of the home visits by community based surveillance volunteers (CBSVs) in pregnancy and first week of life on neonatal mortality. The clusters are Newhints zones which correspond to supervisory units of about 8-12 CBSVs. There were 98 Newhints zones in total; 49 zones randomised for implementation of the Newhints intervention, with the other 49 zones acting as controls. The intervention lasted for one and a half years starting in 2008, but outcome information was collected till end of 2009. Within this period, DON depression data was also collected, but only till the end of July 2009. An overview of the intervention package and role of the surveillance system is discussed below.

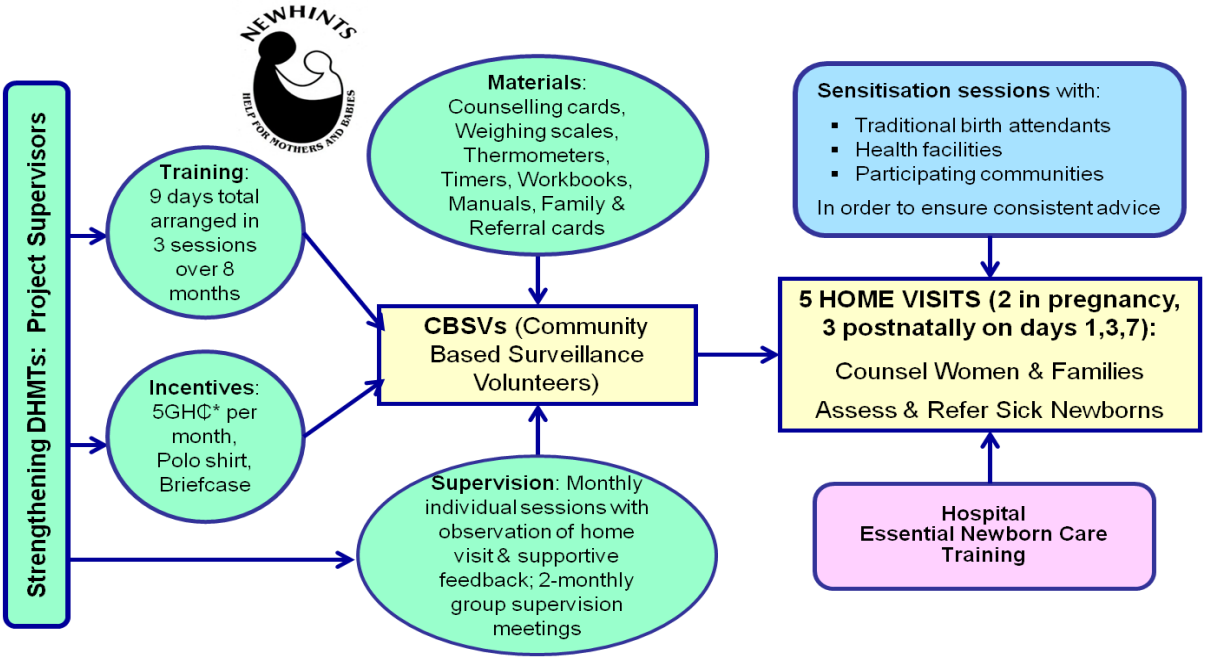
4.4.1 Newhints Intervention

Newhints is an integrated intervention package (**Figure 4.3**), based on extensive formative research [6] and developed and implemented in close collaboration with the District Health Management Teams (DHMTs) of the 7 trial districts. The core component was training the CBSVs in the 49 intervention zones to identify pregnant women in their community and to conduct five focussed home visits, two during pregnancy and three after birth on days 1, 3 and 7. The content of each visit and an overview of all the intervention components are given in the published trial protocol[7]. The visits involved family members as well as the pregnant woman and used storytelling and a counselling and problem solving approach concerning key gaps in care practices identified during the formative research. They were trained in providing supportive counselling, and establishing and maintaining rapport. At each visit, the CBSV provided directive counselling on essential newborn care practices, and problem-solved around any barriers the mother/family perceived in carrying out a behaviour using a story-telling approach. In a typical visit, the CBSV showed a set of counselling cards with pictures, specific to the theme of each visit and would first ask the mother/family their interpretation of the card. Following this, the CBSV then explained the message behind the card using a story-telling

approach after which the CBSV checked with the mother/family if they are able to carry out the assignment conveyed by the card. At this point, the CBSV either provided appropriate praise and encouragement when the mother/family agrees to carry out the behaviour, or helped the mother/family to identify practical solutions to any perceived barriers that could hinder the adoption of the behaviour targeted. This process is repeated at each visit and in addition, at subsequent visits, the CBSV checked if the behaviours are carried out and to continue the process of problem-solving. At the first visit after birth, the CBSV weighs the baby, and advises mothers of low birth weight (LBW) babies (<2500g) about a package of special care comprising skin to skin contact, frequent breastfeeding, wiping rather than bathing the baby, and special attention to hygiene; applying the principles of positive and negative reinforcement, and problem solving techniques. The CBSVs also refer any very LBW babies (<1500g) to hospital. In addition, the CBSVs assess all babies at each of the three postnatal visits and refer to hospital any baby who has one or more of the following danger signs: not able to feed since birth or stopped feeding well; convulsed or fitted since birth; fast breathing: two counts of 60 breaths or more in one minute; chest in-drawing; high temperature: 37.5˚C or more; very low temperature: 35.4˚C or less; only moves when stimulated; yellow soles; pus from umbilical stump or red umbilical stump; pus from eyes; and boils with pus.

Other important components of the intervention delivery involved garnering community support through extensive health facility sensitization activities, strengthening essential newborn care at the hospitals within the trial area, providing monetary incentives to CBSVs, and structured supportive supervision to CBSVs and their supervisors.

Figure 4.2: Newhints Integrated Intervention Package



*Ghana cedis (1 GH₵ approximately equal to 1 US$ during trial); **Adapted from the "Newhints" impact paper (Kirkwood 2012)

4.4.2 Newhints Control Zone

Pregnant women and newborns living in the control zones continued to benefit from the routine maternal and child health (MCH) care that was available, which includes: antenatal clinics (ANC), Infant Welfare Clinics (IWC), access to free delivery with skilled attendants, access to traditional birth attendant (TBA) delivery and care, and routine interactions with CBSVs concerning outreach MCH and immunisation clinics. In addition control zones benefitted from the hospital essential newborn care strengthening and health facility sensitisation that covered all facilities in the trial area.

4.4.3 Impact Evaluation

Data for evaluation of Newhints on neonatal mortality were based on births. Impact of Newhints on postnatal depression was based on the sub-set of recently delivered mothers with a postnatal depression assessment.

4.5 Analysis Plan

Detailed analysis methods are presented for each research paper in section C of this thesis. All analyses were conducted in STATA 11 using: a) logistic regression models to examine determinants and consequences of perinatal depression; b) Poisson regression models to examine mortality consequences of postnatal depression and; c) random effects logistic regression models to assess impact of Newhints intervention on postnatal depression. Effect sizes are reported as crude and adjusted relative risks (aRR) with 95% confidence intervals and p-values estimated using the marginal standardization technique with the 95% confidence intervals for the ratios estimated via the delta method[8].

It is worthy of mention that though the impact of the Newhints intervention on reducing postnatal depression is presented last in the sequence of the research papers in this PhD, this analysis was conducted first. The reason for conducting this analysis first was to ascertain whether there was any significant impact of the Newhints intervention on the burden of postnatal depression, in which case all other analysis would have taken this into consideration and either restrict to only the control zones or adjust for the effect of the intervention. As demonstrated in this research paper, there was no impact of the intervention on postnatal depression; analysis on all other objectives of the PhD proceeded without maintaining any special restrictions.

4.6 Ethical Conduct of Study

The DON protocol received scientific and ethical approval from Institutional review boards/committees (IRB/IECs) of KHRC and London School of Hygiene and Tropical Medicine (LSHTM).

Eligible women on the RCTs were approached for their consent to be part of DON, in the presence of a witness (for illiterate women), after explaining the purpose and expectations in including extra questions on mental health well-being to the routine surveillance data collection. For women who were pregnant at the time of recruitment, they were offered the opportunity to undergo two (2) sets of interviews; one at pregnancy and the other when they have given birth. For those women who had given birth at the time of recruitment and were not previously consented, they were asked to undergo only one interview. In both cases, eligible women were also asked for their consent for their data that is collected on routine surveillance questionnaires to be used for DON specific analysis. The consent forms used are attached in **appendix 3**. Fieldworkers were trained to alert the author of this PhD if they became concerned that any woman was severely distressed or in danger of harm. Women identified as needing attention were visited by WB, re-assessed and if appropriate encouraged to go to community psychiatric nurses serving the four main towns of the study area for further depression evaluation and treatment.

4.7 References to Chapter 4

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2. Spitzer, R.L., et al., *Utility of a new procedure for diagnosing mental disorders in primary care. The PRIME-MD 1000 study.* JAMA, 1994. **272**(22): p. 1749-56.
3. Weobong, B., et al., *The comparative validity of screening scales for postnatal common mental disorder in Kintampo, Ghana.* Journal of Affective Disorders, 2009. **113**(1-2): p. 109-117.
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8. Localio, A.R., D.J. Margolis, and J.A. Berlin, *Relative risks and confidence intervals were easily computed indirectly from multivariable logistic regression.* J Clin Epidemiol, 2007. **60**(9): p. 874-82.

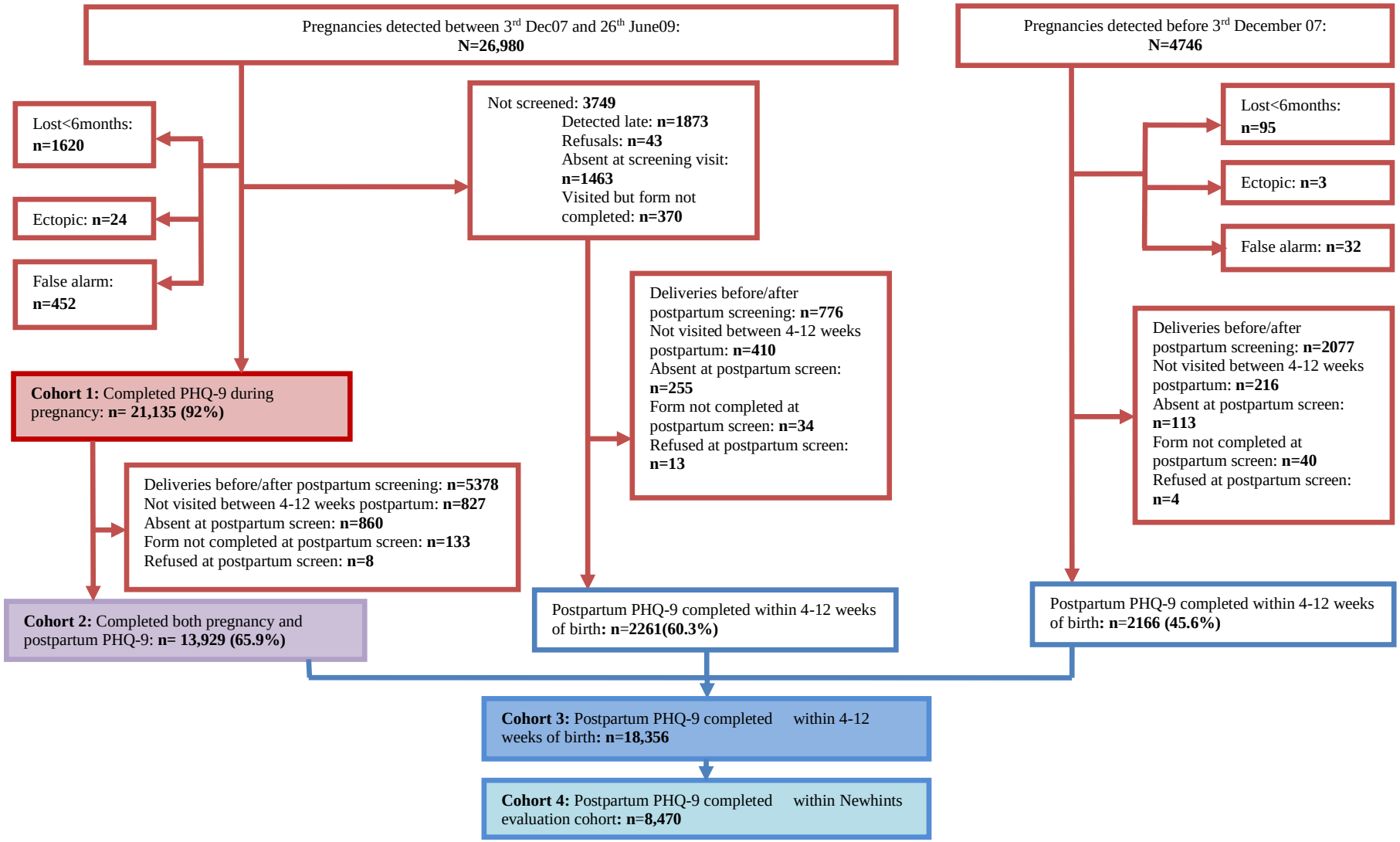
Section C

5. Chapter 5: Study Population and PHQ-9 Results

5.1 Flow Chart and Denominators

Figure 5.1 shows the flow chart for the study. The left hand side of the diagram shows the total number of women who completed the PHQ-9 during pregnancy (n=21,135) **(cohort 1)** based on all eligible pregnancies reported between 3rd December 2007 and 26th June 2009 (N=26,980); pregnancies that were lost before six months, ectopic, or false alarm were excluded. False alarm is said to occur when a woman reports as pregnant but at the next visit she reports she is no longer pregnant. This usually occurs due to late menstruation. Of these 13,929 (65.9%) **(cohort 2)** also completed a postpartum PHQ-9. The right hand side starts with all pregnancies that were ineligible because these were detected before 3rd December 2007. There were two more groups of women who had a postnatal depression assessment. The second group shown in the middle of the diagram were 2261 (60.3%) of the 3749 women eligible but not screened during pregnancy. The third group were women eligible for postpartum screening which started on 24th March 2008 , but not for pregnancy screening as these pregnancies were detected before 3rd December 2007. The following pregnancy visit was therefore scheduled before the DON study started. These women shown on the right hand side of the diagram were 2166 (45.6%) out of 4746. Combining these three groups of women gives a total of 18, 356 with a postnatal depression assessment **(cohort 3)**. Of these 8470 were in the Newhints evaluation cohort **(cohort 4)**.

Figure 5.1: Recruitment Profile for DON



5.2 Socio-Demographic Characteristics of Study Population and Prevalence of Antenatal and Postnatal Depression

Detailed background characteristics for the study population are provided in the research papers in chapters 6 and 7. In general the population was predominantly rural (70%) and the modal age group was 20-29 (53%). Almost all the women were married (91%), majority had some education (64%), and most belonged to the Christian faith (68%). Majority (57%) belonged to non-indigenous ethnic groups. More than half (53%) had planned their pregnancy and for 23% of them, this was their first pregnancy.

5.2.1.1 Prevalence of Antenatal Depression

Table 5.1 is based on cohort 2, the 13,929 women who had both depression assessments. This shows that 1339 [9.6% (95% CI, 9.1%, 10.1%)] of women were depressed antenatally. Of these, 0.6% (n=83) (95% CI, 0.5%, 0.7%) met criteria for major depression and 9.0% (n=1256) (95% CI, 8.5, 9.5) met criteria for minor depression.

5.2.1.2 Prevalence of Postnatal Depression

The prevalence of postnatal depression was 3.5% (n=486) (95% CI, 3.2%, 3.8%). Of these, 0.1% (n=18) (95% CI, 0.07%, 0.2%) met criteria for major depression and 3.4% (n=468) (95% CI, 3.1%, 3.6%) met criteria for minor depression.

5.2.1.3 Association between Antenatal and Postnatal Depression

The table also shows the association between antenatal and postnatal depression. Among those not depressed at antenatal assessment 2.5% (n=319) (95% CI: 2.3%, 2.8%) were depressed at postnatal assessment (onset postnatal depression). Among those depressed at antenatal assessment, 12.5% (n=167) (95% CI, 10.7%, 14.2%) were also depressed at postnatal assessment (persistence antenatal depression).

Overall 167 (65.6%) of the 486 women depressed postnatally were onset cases, and only 34.4% had been depressed during pregnancy.

Table 5.1: Prevalence of Antenatal and Postnatal Depression Among Women Assessed for Both

	Depressed at postnatal assessment (%)	Not depressed at postnatal assessment (%)	Total
Depressed at antenatal assessment	167 **(12.5%)**	1172 (87.5%)	1339 (9.6%)
Not depressed at antenatal assessment	319 **(2.5%)**	12271 (97.5%)	12590 (90.4%)
Total	486 **(3.5%)**	13443 (96.5%)	**13,929 (100.0%)**

5.3 PHQ-9: Item Frequencies and Scores

Figure 5.1 shows the distribution of total scores for antenatal and postnatal assessments. As can be seen these were higher in pregnancy (50th centile 2, 75th centile 4, 90th centile 6, range 0 to 27) than after birth (50th centile 0, 75th centile 2, 90th centile 4, range 0 to 19).

The prevalence of each PHQ-9 symptom item among those assessed as having major/minor depression for both antenatal and postnatal depression is presented in **figure 5.2**. A symptom is scored positive if it was present for at least half the time in the previous two weeks. This is equivalent to a score of 2 or 3 for the item. There was an almost perfect agreement in the pattern of symptoms that contribute towards antenatal or postnatal depression; the exception was feelings of tiredness which was slightly higher antenatally than postnatally.

Figure 5.2: Comparison of PHQ-9 Total Scores Between Women Screened for Both Antenatal and Postnatal Depression

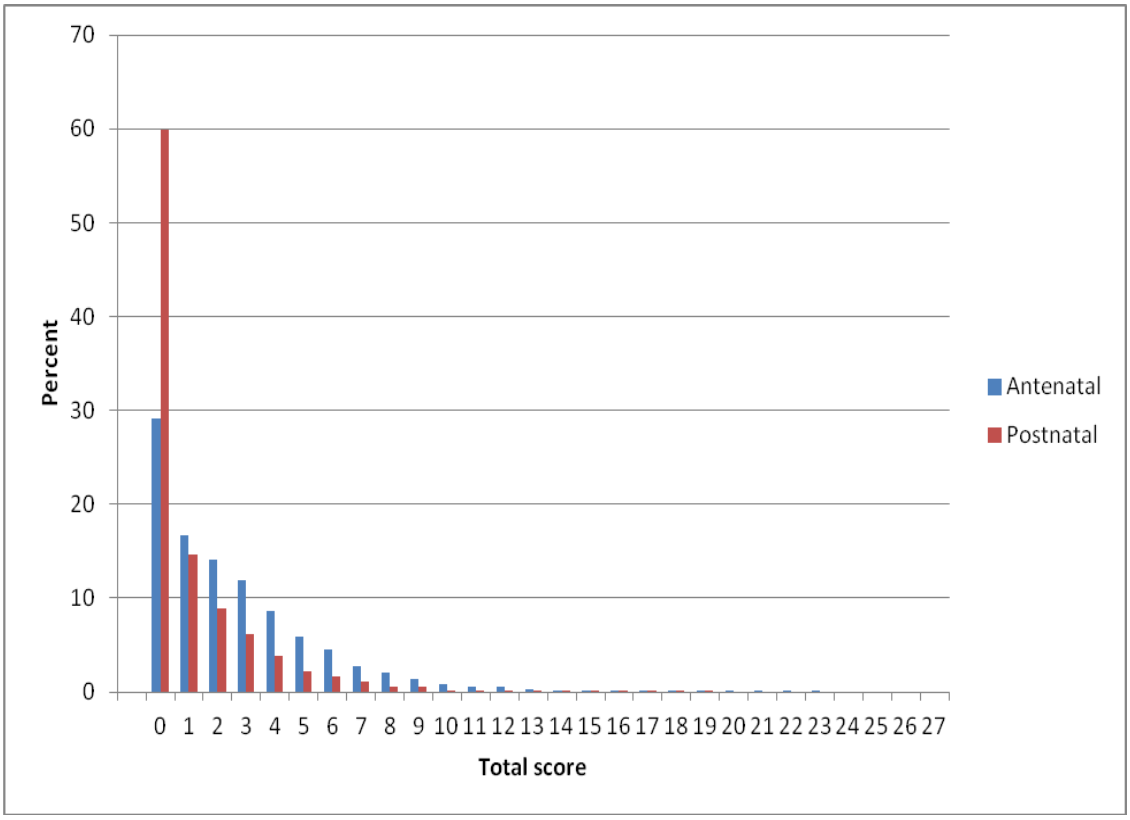
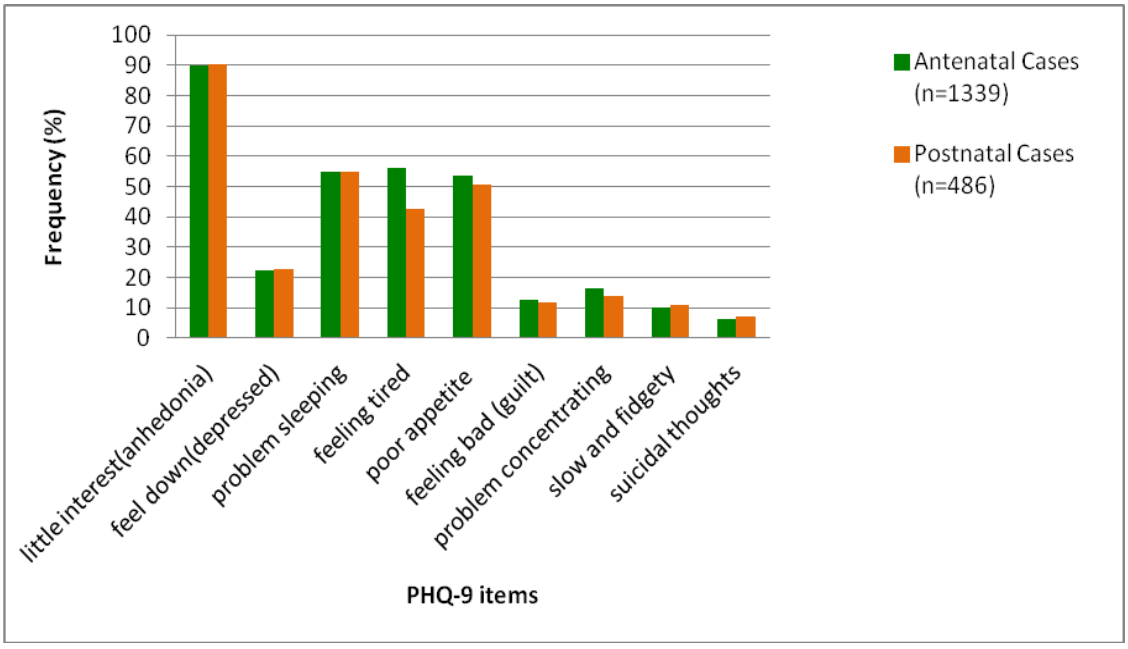


Figure 5.3: Comparison of PHQ-9 Item Frequency and DSM-IV Caseness between Women Screened for both Antenatal and Postnatal Depression



6. Chapter 6- Research Paper 1: Prevalence and Determinants of Antenatal Depression Among Pregnant Women in a Predominantly Rural Population in Ghana: The DON Population-based Study.

Cover sheet for each 'research paper' included in a research thesis

1. For a 'research paper' already published
   1.1. Where was the work published?
   _____N/A_____
   1.2. When was the work published?
   _____N/A_____
   1.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion
   _____N/A_____
   1.3. Was the work subject to academic peer review?
   ___N/A_____
   1.4. Have you retained the copyright for the work? __N/A___
   If yes, attach evidence of retention
   If no, or if the work is being included in its published format, attach evidence of permission from copyright holder (publisher or other author) to include work

2. For a 'research paper' prepared for publication but not yet published
   2.1. Where is the work intended to be published? **Journal of Affective Disorders**
   2.2. List the paper's authors in the intended authorship order

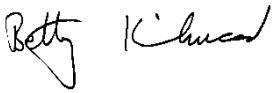
***Benedict Weobong, Martin Prince, Augustinus HA ten Asbroek, Seyi Soremekun, Samuel Danso , Seth Owusu-Agyei, Betty R. Kirkwood**

   2.3.Stage of publication – **Not yet submitted**

3. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

The candidate had a major role in all aspects of the DON study including conceptualisation, design, and conduct. He carried out all analyses and was responsible for writing this paper.

Candidate's signature _____

Supervisor or senior author's signature to confirm role as stated in (3) 

6.1 Abstract

Background: While depression during pregnancy is one of the strongest risk factors for postnatal depression, it has been comparatively little studied, particularly in sub-Saharan Africa. We set out to determine the prevalence and determinants of antenatal depression in a predominantly rural setting in Ghana.

Methods: We conducted a population-based cohort study involving 4-weeklyvisits to 23,011 pregnant women and assessed their depression status during pregnancy using the Patient Health Questionnaire (PHQ-9) to derive a DSM-IV diagnosis of major/minor depression. Information on demographic factors, indicators of social and economic disadvantage, and previous obstetric history were also collected. Effect sizes are reported as relative risks [RR] with 95% confidence intervals and p-values.

Results: The PHQ-9 was administered to 21,135 (91.4%) of eligible pregnant women. The prevalence of antenatal depression was 9.9% (n=2086, 95% CI, 9.5%-10.3%). Determinants of antenatal depression were: maternal age 30 years or older (RR 1.16, p=0.002), never married (1.34, p<0.001), lower wealth status (1.30, p<0.001), non-Catholic religion, non-indigenous ethnicity (1.15, p=0.008), unplanned pregnancy (1.55, p<0.001), and previous stillbirth (1.30, p<0.001).

Limitations: We did not assess women for physical health during pregnancy, and lacked information on some potentially relevant psychosocial factors such as intimate partner violence.

Conclusion: Prevalence of antenatal depression, applying clinical criteria, is similar to that seen in high income countries. Factors related to chronic social and economic disadvantage are among the most important determinants. Population-level interventions that address these problems among women of reproductive age may be the most effective strategy for reducing the prevalence and impact of depression in pregnancy.

6.2 Introduction

Depression during pregnancy (antenatal depression) has been much less widely studied than depression in the postpartum period (postnatal depression). From studies that have focussed on antenatal depression as a specific category of common mental disorders, recent systematic reviews indicate that prevalence is similar to that of postnatal depression (11% vs 13%) in high income countries (HIC)(Gavin et al., 2005) , though the picture in sub-Saharan Africa (11.3% vs 18.3%)(Sawyer et al., 2010) may be different. Antenatal psychological morbidity is one of the strongest predictors of postnatal depression, and a substantial proportion of women with a clinically significant common mental disorder in the postnatal period, also have poor mental health antenatally. The salience of poor maternal mental health in pregnancy is further supported by associations with low birth weight (Grote et al., 2010, Patel and Prince, 2006, Rahman et al., 2007a), stunting(Rahman et al., 2007b),frequent diarrhoea(Rahman et al., 2007b, Ross et al., 2011), prolonged duration of labour and delayed initiation of breastfeeding (Hanlon et al., 2009), and preterm births (Grote et al., 2010).

A recent systematic review of studies of the prevalence and determinants of common perinatal mental disorders in low and middle income countries identified a paucity of research, with only 8% of such countries covered (Fisher, 2012). Very few studies had been conducted in community or population settings; only three of the 13 studies of the prevalence of antenatal common mental disorder, and only one of the six from sub-Saharan Africa (SSA) were population based. In addition, a significant limitation of the review was the failure to distinguish between factors associated with antenatal and postnatal common mental disorder. The review's authors concluded that there was evidence of links between perinatal (antenatal/postnatal) common mental disorders, and social and economic disadvantage and gender-based factors, particularly gender-based

violence. While associations between such factors and prevalent antenatal CMD have been reported from many world regions (Fisher et al., 2004, Fisher et al., 2007, Ryan et al., 2005, Lusskin et al., 2007, Ferri et al., 2007), the evidence from SSA is both limited and equivocal (Sawyer et al., 2010, Hanlon, 2010).

In this paper we present estimates of the burden of antenatal depression and factors associated with this burden in a large population-based cohort of pregnant women in the Brong Ahafo region of Ghana. These women were study participants of two cluster-randomised controlled trials.

6.3 Materials and Methods

Design

DON is a cohort study of perinatal **D**epression nested within the **O**baapaVitA(Kirkwood et al., 2010a) and **N**ewhints (Kirkwood et al., 2010b) trials in Ghana. These trials ran consecutively from the year 2000 to 2010, and collected information on pregnancies, births, and infant and maternal deaths, through a 4-weekly population-based surveillance system. The ObaapaVitA trial sought to reduce maternal mortality through weekly vitamin-A supplementation of women of reproductive age, and the Newhints trial aimed to assess the impact of home-visits by community volunteers on neonatal mortality.

DON took place within seven contiguous districts of the Brong Ahafo Region of Ghana. The study area covers a population of about 700,000(GHS, 2011) with more than 120,000 women of reproductive age, and more than 15,000 pregnancies each year. Mental health services are very limited, provided by community psychiatric nurses in the four largest towns (populations of 40,000) of the study area. Many people with mental health needs seek help with traditional and spiritual healers (Ae-Ngibise et al., 2010).

Participants

All pregnant women identified at a 4-weekly surveillance visit between 3rd December 2007 and 26th June 2009 were eligible to take part in the DON study and to have an antenatal depression assessment at the next 4-weekly visit providing they gave informed consent and were still pregnant.

Outcome Measure

Our outcome measure was the presence of either major or minor depression, assessed using the depression module of the Primary Care Evaluation of Mental Disorders (PRIME-MD)(Spitzer et al., 1994) Patient Health Questionnaire (PHQ-9). The PHQ-9 is a structured questionnaire that enquires after the nine symptom-based criteria for a diagnosis of DSM-IV depression, including their duration and severity (Kroenke et al., 2001) . This approach allows an approximation to the DSM-IV criteria for major or minor depression, for which only symptoms that have been present for at least half the time in the last two weeks are rated positively. Either depression or anhedonia (loss of interest or pleasure) must be rated, with a total of five or more symptoms for major depression and two to four symptoms for minor depression. In contrast with other symptom based scale scores, these criteria therefore identify individuals with persistent and pervasive symptoms, characteristic of a clinically significant depressive episode.

Determinants

Information collected on potential determinants of antenatal depression included: mother's age at recruitment, education, employment status, marital status, religion and ethnicity; pregnancy or obstetric related factors, namely whether the current pregnancy was planned or not, parity, previous still births, and previous pregnancy loss; and any other previous deaths of children.

An index of the wealth status of the household was derived from principal components analysis of 42 questions on household assets, sanitation and household quality indicators (Vyas and Kumaranayake, 2006). Women were then ranked according to their wealth index, and assigned to wealth quintiles with quintile 1 containing the least wealthy and quintile 5 the wealthiest (O'Donnell, 2008).

Statistical Methods

Analyses were conducted using STATA 11 (STATA, 2009) using logistic regression models to examine associations between potential determinants and antenatal depression. As characteristics of pregnant women were comparable for intervention and control arms in both the ObaapaVitA(Kirkwood et al., 2010a) and Newhints(Kirkwood et al., 2010b) trials, and as neither intervention was postulated to impact on antenatal depression, intervention status was not included. Our approach was first to assess the association of each socio-demographic/socio-economic factor. All factors associated with $p<0.1$ in the univariate models were included in a multivariable regression model at the first stage. Factors that remained statistically significant predictors of depression outcome were noted. At the second stage, each pregnancy/ obstetric related factor was adjusted for all socio-demographic/socio-economic factors that remained significant at the first stage. At the third stage, those with $p<0.1$ in stages one and two were included in further multivariable analysis, and only factors that remained significant were noted. A final multivariable model was then fitted with only those that remained significant.

Effect sizes are reported as crude and adjusted relative risks (aRR) estimated using the marginal standardization technique with 95% confidence intervals estimated via the delta method (Localio et al., 2007).

Ethical Considerations

Ethical approval for the study was granted by the ethics committees of the Kintampo Health Research Centre where the study was hosted, and the London School of Hygiene and Tropical Medicine. Fieldworkers were trained to alert the principal investigator (WB) if they became concerned that any woman was severely distressed or in danger of harm. Women identified as needing attention were visited by WB, re-assessed and if appropriate encouraged to go to community psychiatric nurses serving the four main towns of the study area for further depression evaluation and treatment.

6.4 Results

Figure 6.1 shows the recruitment profile. Between 3rd December 2007 and 25th June 2009, 26,980 pregnant women were identified, of whom 23,011 were eligible for depression assessment. Of these 21,135 (92%) completed the depression screen; 43 (0.2%) declined to participate, 1463 (6.4%) were temporarily absent at the surveillance visit, and 370 (1.6%) did not have a depression form completed although they were visited. Just two women were reported as being of concern to the fieldworker; both were recommended to seek attention from the community psychiatric nurses but neither complied. Data on potential determinants of antenatal depression was available for almost all women completing the depression screen (99%). Background characteristics of women included or excluded in analysis were generally comparable except that more than half of the women (57%) with missing information on antenatal depression status were older (30+) (see online table 6.1).

Table 6.1 shows the population was predominantly rural (70%), most women were in their second trimester when the pregnancy was identified and the antenatal assessment completed (53%), and the modal age group was 25-29 (53%). One in three women had no formal education, and almost all were married or co-habiting (91%).

The overall prevalence of major or minor depression at the pregnancy assessment was 9.9% (n=2086) (95% CI, 9.5%-10.3%); the prevalence of major depression was 0.6% (95% CI, 0.5%-0.7%) and 9.3% (95% CI, 8.9%-9.7%) met the criterion for minor depression.

Table 6.1 also shows that all factors except occupation status had crude associations with antenatal depression, with the following independently associated: older maternal age, not married or cohabiting, lower wealth, non-catholic religion, and to a lesser extent non-indigenous ethnicity. These were retained for the further multivariable analysis with pregnancy/ obstetric-related factors shown in **table 6.2**. The following factors were significantly associated: grand multiparity; unplanned pregnancy; experience of a previous pregnancy loss; and birth spacing greater than three years. These factors, except birth spacing (for which data were incomplete) were included in a further multivariable model involving all significant pregnancy/ obstetric-related and socio-demographic/socio-economic determinants**.** With the exception of parity, all factors remained associated with increased risk of antenatal depression. These were fitted into a final parsimonious multivariable model (**table 6.3)** and independent associations were noted with maternal age 30 years or older, never married, lower wealth quintile, non-Catholic religion, non-indigenous ethnicity, unplanned pregnancy, and previous pregnancy loss.

6.5 Discussion

We set out to ascertain prevalence and determinants of probable DSM-IV depression during pregnancy in a large population-based study. Our data suggest that in a predominantly rural population of pregnant women in Ghana, the prevalence is similar to that seen in high income countries and previous SSA studies, and that factors related to social and economic disadvantage, together with previous obstetric history, are the main determinants of prevalent antenatal depression.

Our study has several strengths. Our sample (n=21135) is significantly larger than previous studies in LMIC, increasing power and precision. The study is population-based, with a very high antenatal depression screening completion rate (92%). We used clinical criteria to define antenatal depression with a locally validated measure.

Our study also has some limitations. While some exposures were unlikely to be caused by antenatal depression (e.g. previous pregnancy loss, still birth and dead children), for others (e.g. wealth, single parenthood, unplanned pregnancy) the direction of causality cannot be clarified because of the often chronic remitting and relapsing nature of depression. Our inferences are therefore generally limited to the observation of the clustering of these factors with prevalent antenatal depression in our setting. In addition, recall of such events may be affected by the mother's current depression status, and could lead to bias. We also note that women had regular 4-weekly visits from resident fieldworkers enquiring about the pregnancy, the birth, and the health of the infant; these visits that may have resulted in important friendship bonds and rapport, in themselves may have had a positive benefit on the mental well-being of women and so there is a possibility this may have reduced the risk of depression. In addition our measure of antenatal depression was not originally validated in the antenatal period and given that one study suggests depression in pregnancy and postnatal period show significantly

different symptom profiles(Kammerer et al., 2009), we may not exclude the effect of misclassification bias in our prevalence estimate. We had limited information regarding the health and nutritional status of the mother during pregnancy, for example lacking information on malaria episodes, body mass index, gestational diabetes and anaemia (Hanlon et al., 2009, Rochat et al., 2011), and also lacked information on potentially important psychosocial risk factors for antenatal depression including limited social support and intimate partner violence (Hartley et al., 2011, Adewuya et al., 2007, Hanlon et al., 2010, Deyessa et al., 2009).

The estimates of depression during pregnancy vary across different regions in SSA. However, with a weighted prevalence of 11.3% (9.5%-13.1%) presented in a systematic review in SSA (Sawyer et al., 2010), our clinically significant estimate of 9.9% is within this range and similar to that reported in reviews in HIC (Gavin et al., 2005), but somewhat lower than some estimates from non-SSA, particularly south Asian LMIC settings (Rahman and Creed, 2007). Choice of outcome is likely to have a strong influence on observed prevalence (Fisher, 2012) with many previous studies reporting the prevalence of common mental disorders, often ascertained with a symptom screening tool, rather than a diagnostic tool. We had previously validated the cultural appropriateness of the PHQ-9 questions in the same setting, comparing a score of 5+ against the gold standard of a local clinician's semi-structured clinical diagnosis of common mental disorder(Weobong et al., 2009). In this study we sought to identify clinically significant depressive episodes, and therefore used the PHQ-9 item ratings to give an approximation to DSM-IV major or minor depression diagnostic categories (Kroenke et al., 2001, Martin et al., 2006). As expected this gave a lower prevalence than using the PHQ-9 CMD 5+ score (9.9% compared to 19.2%). The relatively low estimate may also indicate positive mental health in our population; all women of reproductive age in the study districts were subject to regular 4-weekly contacts by

community-based field research workers (data collectors) for the ObaapaVitA and NEWHINTS trials, and this may conceivably have impacted positively on their mental health.

The cross-sectional determinants of antenatal depression provide an insight into the social contexts in which depression in pregnancy is likely to be found, but do not permit causal attributions. Prospective studies to ascertain antenatal risk factors are difficult to design and conduct. A picture emerges of long-standing psychosocial adversity; it is likely therefore that many of these women will have been at increased risk of adverse mental health before their pregnancy. Some pregnancy related factors may compound chronic social and economic disadvantage; thus being single and pregnant is associated with economic hardships and stigmatisation (Patel et al., 2002), particularly in traditional African settings (Hanlon et al., 2010, Adewuya et al., 2007). Worries regarding the outcome of the pregnancy may also be important (Essen et al., 2000, Andajani-Sutjahjo et al., 2007, Chapman, 2004), consistent with our finding that a previous experience of losing a pregnancy is correlated with antenatal depression. These pregnancy-related vulnerability factors have been reported in previous studies in SSA (Sawyer et al., 2010) and HIC (Lancaster et al., 2010, Bolton et al., 2003). Findings on the effect of maternal age have been inconsistent, particularly in SSA(Sawyer et al., 2010). An association with younger maternal age was reported in Nigeria (Abiodun et al., 1993) and in a peri-urban South African setting (Hartley et al., 2011). Our finding of an association with older maternal age is consistent with evidence from Zimbabwe (Nhiwatiwa et al., 1998) and Ethiopia (Hanlon et al., 2009), and suggests possible effects of difficulties in conceiving, coupled with the anxiety of obstetric and pregnancy complications associated with advanced maternal age(Cleary-Goldman et al., 2005, Treacy et al., 2006). Women with a wider birth spacing (perhaps also linked to problems conceiving) were also at an increased risk of antenatal depression in our study.

There may also be a cultural tendency to stigmatise women who conceive later in life, particularly multiparous women.

Our findings suggesting strong and independent associations with unplanned pregnancy highlights the important role of decision making on mental well-being in a predominantly patriarchal population, where women usually have limited involvement in decisions regarding reproductive health (Patel et al., 2002). This observation is partly influenced by socio-cultural factors, and in this study the characteristically dominant male influence commonly seen in the non-indigenous tribes of northern descent in Ghana, may also have partly accounted for the high prevalence of antenatal depression among women from these ethnic groups. The non-indigenous in our population though in the majority, constitute a collection of small ethnic groups who migrated in search of improved living conditions. Economic and social adversities are therefore common, and the additional demands of pregnancy may contribute to an increased risk of depression.

In summary, ours is the largest ever population-based study in SSA of the prevalence and determinants of antenatal depression. The case for clinical intervention is not yet clearly established, given that other studies from SSA have shown a pronounced tendency for spontaneous remission with relatively few cases persisting into the postnatal period (Aderibigbe et al., 1993, Cox et al., 1993, Collin et al., 2006, Hanlon, 2010). Nevertheless, this raises important questions as to how to intervene on the at-risk group given that other studies from SSA have demonstrated its association with prolonged duration of labour and delayed initiation of breastfeeding (Hanlon et al., 2009), including strong consequences on maternal and infant morbidity demonstrated in our other report (Weobong, 2012). Arguably, while all pregnant women may benefit from treatment, not all pregnant women presenting with depressive symptoms may require treatment particularly within resource constrained settings. The costs of unsolicited treatment have been shown to be high and recommendations for universal

screening have been challenged even in well resourced settings (Paulden et al., 2009). Defining the course and predictors of the outcome of antenatal depression are important objectives planned for further analysis. Given its broad social determinants, integrated population level interventions targeted at improving the mental well-being of women of reproductive age in general may be the most effective approach for reducing the prevalence and impact of antenatal depression. For example, programmes that promote women's empowerment and emancipation such as community self-help groups may offer additional mental health benefits (Tripathy et al., 2010, Cohen et al., 2012).

Authors' Contribution

WB conducted all analysis and wrote the paper with input from MP and BRK, and later reviewed by all authors. WB, MP, and BRK designed the study. WB, GTA, SS, and OA conducted the study. SS and SD managed the data.

Conflict of Interest

All authors declare they have no conflict of interest in the development of this report.

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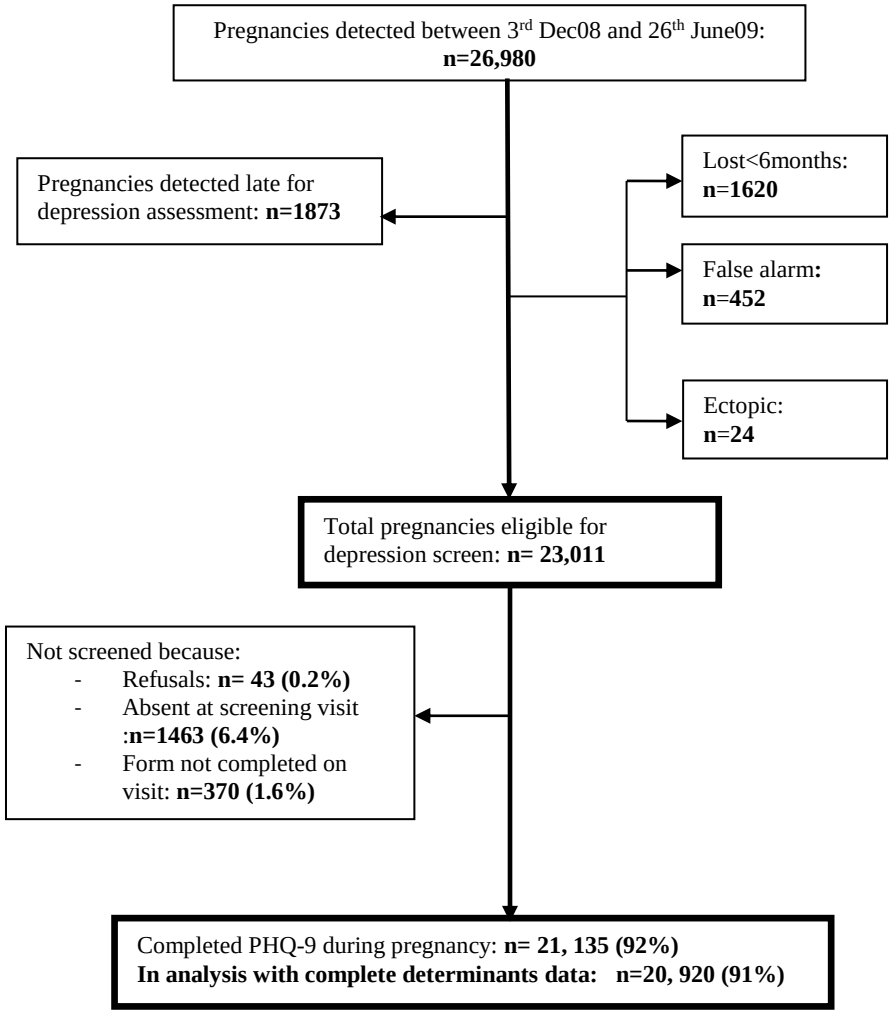
WEOBONG, B., PRINCE, M., TEN ASBROEK, G., SOREMEKUN, S., DANSO, S., MANU, A., HILL, Z., OWUSU-AGYEI, S., KIRKWOOD, BR 2012. Association of Antenatal Depression with Adverse Consequences for the Mother and Newborn in Rural Ghana: findings from the DON population-based cohort study. Submitted.

Figure 6.1: Recruitment Profile of Participants in the Study



Online Table 6.1: Socio-demographic Characteristics of Women Included and Excluded from Analysis of Determinants of Antenatal Depression.

	In analysis: n=20920	Excluded	
		Pregnancy PHQ-9 not completed: n=1876	Missing data: n=215
Mother's age			
15-19	11.2%	11.6%	4.7%
20-29	52.9%	53.2%	35.6%
30+	35.5%	33.2%	56.7%
No data	-	2.0%	43.3%
Marital status			
Married	57.6%	54.1%	30.2%
Living together	33.1%	33.9%	20.5%
Widow/ divorced	2.4%	3.1%	0.5%
Single, unmarried	6.5%	6.9%	5.1%
No data	-	2.0%	43.7%
Highest educational level reached			
Sec/post-secondary	6.8%	6.2%	4.7%
Pre-secondary	37.5%	33.9%	20.0%
Primary	20.4%	20.4%	13.9%
None	34.8%	37.5%	13.5%
No data	-	2.0%	47.9%
Wealth quintile			
1st (least wealthy)	20.1%	20.4%	-
2nd	19.6%	21.2%	0.5%
3rd	19.6%	19.4%	-
4th	19.9%	17.6%	-
5th (wealthiest)	19.9%	17.7%	0.5%
No data	-	3.8%	99.1%
Religion			
Catholic	21.4%	21.8%	4.7%
Protestant	46.2%	45.5%	4.7%
Muslim	23.9%	20.7%	7.4%
Traditional/other	7.6%	8.3%	1.4%
No data	-	3.7%	81.9%
Ethnicity			
Indigenous	43.1%	40.0%	27.4%
Non-Indigenous	56.5%	57.9%	29.3%
No data	-	2.0%	43.3%

Table 6.1: Sample Characteristics and Association of Socio-economic/socio-demographic Determinants with Risk of Antenatal Depression Among Women in Ghana

	N (*%) of women		n (%)with major/minor antenatal depression		Univariate RR (95% CI)	p-value	Adjusted RR_1(95% CI)	p-value
Overall	20, 920 (100%)		2060 (9.9%)					
Predictor								
Mother's age								
15-19	2360	(11.3)	239	(10.1)	1.11 (0.97-1.27)	0.001	1.01 (0.87-1.16)	0.002
20-29	11097	(53.0)	1011	(9.1)	1		1	
30+	7463	(35.7)	812	(10.9)	1.19 (1.09-1.30)		1.21 (1.11-1.33)	
Marital status								
Married	12103	(57.9)	1181	(9.8)	1	0.002	1	0.001
Living together	6948	(33.2)	651	(9.4)	0.96 (0.88-1.05)		1.07 (0.97-1.19)	
Widow/ divorced	508	(2.4)	54	(10.6)	1.09 (0.84-1.41)		1.20 (0.92-1.56)	
Single, unmarried	1361	(6.5)	174	(12.8)	1.31 (1.13-1.52)		1.46 (1.24-1.72)	
Highest educational level reached								
Sec/post-secondary	1425	(6.8)	130	(9.1)	1	0.001	1	0.754
Pre-secondary	7872	(37.6)	704	(8.9)	0.98 (0.82-1.17)		0.91 (0.76-1.09)	
Primary	4291	(20.5)	434	(10.1)	1.11 (0.92-1.34)		0.95 (0.79-1.16)	
None	7332	(35.1)	792	(10.8)	1.18 (0.99-1.41)		0.94 (0.77-1.14)	
Wealth quintile								
1st (least wealthy)	4240	(20.3)	478	(11.3)	1.37 (1.20-1.56)	<0.001	1.30 (1.09-1.55)	0.015
2nd	4142	(19.8)	457	(11.0)	1.34 (1.17-1.53)		1.26 (1.07-1.49)	
3rd	4134	(19.7)	411	(9.9)	1.20 (1.05-1.38)		1.17 (1.00-1.37)	
4th	4201	(20.1)	367	(8.7)	1.06 (0.92-1.22)		1.04 (0.90-1.21)	
5th (wealthiest)	4203	(20.1)	347	(8.3)	1		1	
Occupation status of woman							-	-
Works outside home	15128	(72.3)	1460	(9.7)	1	0.121		
Not working outside home	5792	(27.7)	600	(10.4)	1.07 (0.98,1.17)			
Type of residence								
Urban	6520	(31.2)	581	(8.9)	1	0.002	1	0.861
Rural	14400	(68.8)	1479	(10.3)	1.15 (1.05-1.26)		1.01 (0.90-1.14)	
Religion								
Catholic	4510	(21.6)	397	(8.8)	1	<0.001	1	0.002
Protestant	9763	(46.7)	924	(9.5)	1.08 (0.96-1.20)		1.15 (1.02-1.30)	
Muslim	5053	(24.2)	549	(10.9)	1.23 (1.09-1.40)		1.24 (1.09-1.42)	
Traditional/other	1594	(7.6)	190	(11.9)	1.35 (1.15-1.59)		1.30 (1.10-1.54)	
Ethnicity								
Indigenous	9046	(43.2)	810	(8.9)	1	<0.001	1	0.097
Non-Indigenous	11874	(56.8)	1250	(10.5)	1.18 (1.08-1.28)		1.10 (0.98-1.23)	

******percentages may not total up to 100 because of rounding; **RR_1**: adjusted for each socio-economic/demographic factor with p<0.1 in univariate models.

Table 6.2: Sample Characteristics and Association of Pregnancy/ obstetric-related Factors with Risk of Antenatal Depression Among Women in Ghana.

	N (*%) of women		n (%) with major/minor antenatal depression		Adjusted RR_2(95% CI)	p-value
Overall	21, 135 (100%)		2086	(9.9%)		
Predictor						
Pregnancy Plan						
Yes Planned	11384	(54.4)	901	(7.9)	1	<0.001
Did not Plan	9536	(45.6)	1159	(12.2)	1.55 (1.42-1.69)	
Multiple pregnancy						
Singleton	20466	(97.8)	2006	(9.8)	1	0.129
Multiple	454	(2.2)	54	(11.9)	1.22 (0.97-1.57)	
Parity						
Multiparous	15948	(76.2)	1612	(10.1)	1	0.056
Primiparous	4972	(23.8)	448	(9.0)	0.88 (0.77-1.00)	
****Birth Spacing**						
Normal (2-3yrs)	7630	(36.5)	736	(9.7)	1	0.072
Too close (<2 yrs)	1470	(7.0)	145	(9.9)	1.04 (0.88-1.24)	
Too wide (>3yrs)	5742	(27.5)	610	(10.6)	1.13 (1.02-1.25)	
No data	6078	(29.1)	569	(9.4)	-	
Previous Still Birth						
No previous still birth	19375	(92.6)	1911	(9.9)	1	0.477
One/more	1545	(7.4)	149	(9.6)	0.94 (0.80-1.11)	
Previous pregnancy loss						
No	17137	(81.2)	1612	(9.4)	1	<0.001
Yes	3783	(18.1)	448	(11.8)	1.29 (1.17-1.42)	
Previous dead children						
No	16492	(78.8)	1570	(9.5)	1	0.170
Yes	4428	(21.2)	490	(11.1)	1.07 (0.97-1.19)	

RR_2: Each biologic/pregnancy related factor adjusted for all socio-economic/demographic/ cultural factors with p<0.1 identified in table 1 **(RR_1); *** percentages may not total up to 100 because of rounding; **Data incomplete for the population studied, so not included in final model.

Table 6.3: Final Multivariable Model of Independent Determinants of Antenatal Depression

Risk factor	Relative Risk (95% CI)	p-value
	Socio-demographic factors	
Woman's age		
25-29	1	
15-19	0.93 (0.81-1.08)	0.358
30+	1.16 (1.06-1.27)	0.002
Marital status		
Married	1	
Living together	1.01 (0.91-1.12)	0.855
Widow/ divorced	1.12 (0.86-1.45)	0.405
Single, unmarried	1.34 (1.14-1.58)	<0.001
Wealth quintile		
1st (least wealthy)	1.30 (1.13-1.50)	<0.001
2nd	1.24 (1.08-1.42)	0.002
3rd	1.13 (0.98-1.30)	0.086
4th	1.02 (0.88-1.17)	0.806
5th (wealthiest)	1	
Religion		
Catholic	1	
Protestant	1.13 (1.00-1.27)	0.042
Muslim	1.23 (1.08-1.40)	0.001
Traditional/other	1.28 (1.09-1.51)	0.003
Ethnicity		
Indigenous	1	0.008
Non-Indigenous	1.15 (1.04-1.28)	
	Pregnancy-related factors	
Pregnancy Plan		
Yes Planned	1	
Did not Plan	1.55 (1.43-1.69)	<0.001
Previous pregnancy loss		
No	1	
Yes	1.30 (1.18-1.43)	<0.001

7. Chapter 7- Research Paper 2: Determinants of Postnatal Depression in Rural Ghana: Findings from the DON Population-based Cohort Study.

Cover sheet for each 'research paper' included in a research thesis

4. For a 'research paper' already published
   4.1. Where was the work published?
   _____N/A_____
   4.2. When was the work published?
   _____N/A_____
   4.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion
   _____N/A_____
   4.3. Was the work subject to academic peer review?
   ___N/A_____
   4.4. Have you retained the copyright for the work? __N/A___
   If yes, attach evidence of retention
   If no, or if the work is being included in its published format, attach evidence of permission from copyright holder (publisher or other author) to include work

5. For a 'research paper' prepared for publication but not yet published
   5.1. Where is the work intended to be published? **International Journal of Epidemiology**
   5.2. List the paper's authors in the intended authorship order

***Benedict Weobong, Martin Prince, Augustinus HA ten Asbroek, Seyi Soremekun, Samuel Danso , Seth Owusu-Agyei, Betty R. Kirkwood**

   5.3.Stage of publication – **Not yet submitted**

6. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

The candidate had a major role in all aspects of the DON study including conceptualisation, design, and conduct. He carried out all analyses and was responsible for writing this paper.

Candidate's signature _____

Supervisor or senior author's signature to confirm role as stated in (3) 

7.1 Abstract

Background: Risk factors for postnatal depression (PND), one of the most common pervasive complications of child-bearing, are poorly understood in Africa. A recent systematic review of 31 studies found that the strongest predictors are social and economic disadvantage and gender-based factors; only six of these studies were community based, and almost all were in South Asia.

Methods: The DON study was nested within a surveillance system involving 4-weekly visits to all women of reproductive age to identify pregnancies and collect data on births and deaths. We screened women for depression during pregnancy and after birth using the Patient Health Questionnaire (PHQ-9) to identify those with DSM-IV major or minor depression. Information was also collected on a range of determinants relating to the mother, birth and baby, which were examined using logistic regression; effect sizes reported as relative risks with 95% confidence intervals.

Results: A total of 13,929 women were screened both during pregnancy and after birth between March 2008 and August 2009, of whom 13,360 (95.9%) had complete data on potential determinants. Two hundred and fifty five (3.8%, 95% CI: 3.5%, 4.1%) had PND. Antenatal depression was the strongest determinant accounting for 34.4% of PND cases. Other determinants were season of delivery, peripartum/postpartum complications, newborn ill-health, still birth or neonatal death.

Conclusion: In this setting although most AND resolves, more than a third of women with PND also had AND. Adverse birth and baby-related outcomes are the main other determinants. We recommend that programmes detect and treat depression during pregnancy and provide support to women with adverse birth outcomes.

Key words: postnatal, depression, onset, peripartum complications, postpartum complications infant ill health, sub-Saharan Africa.

7.2 Introduction

Postnatal depression is widely known as one of the most common pervasive complications of child-bearing[1]. Contrary to previously held views that postnatal depression is a Western developed country concept,[2] its burden is higher in developing countries 19.8% (19.5%-20.0%) than in developed economies 12.9%(10.6%-15.8%).[3] Several studies reported adverse consequences on child survival[4], attachment[5] growth and development,[6-8] and the health-related quality of life of the mother.[9]

A recent systematic review of risk factors for antenatal and postnatal common mental disorders (CMD) in low and middle-income countries found that the strongest predictors are social and economic disadvantage and gender-based factors, particularly gender-based violence.[10] Only six of the 31 studies in this review with information on risk factors were community-based, and almost all were in South Asia. The exception was a study in Ethiopia which reported on risk factors for antenatal common mental disorders, and also on the impact of antenatal CMD on poor perinatal outcomes.[11] This together with two other cohort studies from Ethiopia,[12] and urban South Africa[13] were the only community-based studies identified from SSA.

In this paper, we report findings on determinants of postnatal depression in a large population-based cohort study in rural Ghana, and examine whether women with onset postnatal depression differ from those who were also depressed during pregnancy. Finally, we examine determinants associated with antenatal depression persisting into the postnatal period.

7.3 Materials and Methods

Design

DON is a cohort study of perinatal **D**epression nested within the **O**baapaVitA[14] and **N**ewhints[15] trials in Ghana. The trials ran consecutively from the year 2000 to 2010; the ObaapaVitA trial (2000 – 2008) evaluated the effect of weekly supplementation of small doses of vitamin-A to women of reproductive age on maternal mortality, and the Newhints trial (2008 – 2010) evaluated the impact of home-visits by community health workers on neonatal mortality. Women whose pregnancies were identified through the 4-weekly surveillance between 3rd December 2007 and 26th June 2009, were offered the option of participating in the DON study, and antenatal depression assessments were conducted at the next 4-weekly visit following identification of the pregnancy (usually between 3-9 months). Postnatal depression assessments were offered to all women whose deliveries were ascertained (usually within 0-3 weeks) between 24th March 2008 and 11th July 2009 and were conducted at the next 4-weekly visit after the birth is identified.

Study Area

The DON study was conducted in seven contiguous districts of the Brong Ahafo region and covers a population of about 700,000[16] with more than 120,000 women of reproductive age, and more than 15,000 pregnancies are recorded within the study area each year. The area has four government assisted hospitals located within four large towns (populations of over 40,000) of the seven districts. There are several other private health providers and health centres located at strategic locations within the rural areas. Mental health services are only provided at the four large towns by community psychiatric nurses, though occasional outreach clinic services are provided for those who cannot access the towns because of distance. As a result many people with mental disorders seek help with the traditional healers or spiritual churches.[17]

Data Collection

Data was collected every four weeks from the surveillance system of the two trials as previously described. When a pregnancy is first detected, profile information is collected comprising socio-demographic and socio-economic indicators, including reproductive, obstetric history, birth and

pregnancy factors. A pregnancy depression assessment is conducted at the next 4-weekly visit following the identification of the pregnancy. Subsequent surveillance visits are conducted every 4-weeks and information is obtained on the status of the woman (dead/alive), whether she is still pregnant, and any morbidity requiring treatment outside the home or hospitalization. When a birth is reported, information is collected regarding the pregnancy, delivery, the baby (or babies), and newborn care practices. At the next scheduled 4-weekly visit, the recently delivered woman is assessed for depression.

The assessments of antenatal and postnatal depression were made by administering the 9 item Patient Health Questionnaire (PHQ-9), which is based on the depression module of the Primary Care Evaluation of Mental Disorders (PRIME-MD)[18, 19] The PHQ-9 is a structured questionnaire that enquires after the nine symptom based criteria for a diagnosis of DSM-IV[20] depression, including their duration and severity.

Outcome Measure

The main outcome is prevalence of postnatal depression restricted to women assessed between 4-12 weeks after birth, with cases classified according to depression status at the antenatal assessment as either onset postnatal depression or persistent antenatal depression. A secondary outcome is the proportion of antenatal cases of depression that persist postnatally.

Depression (major or minor) is defined as having occurred when at least two symptoms on the PHQ-9 are reported as present for at least half the time in the last two weeks; these must include depression and/or anhedonia (loss of interest or pleasure). A total of five or more symptoms is considered to indicate major depression and two to four symptoms minor depression. In contrast with other symptom based scale scores, these criteria therefore identify individuals with persistent and pervasive symptoms, characteristic of a clinically significant depressive episode. A related indicator is PHQ-9 score which has a maximum of 27 if all symptoms were reported as present for all of the time in the past 2 weeks.

Potential Determinants

Socio-demographic/socio-economic information:

Maternal characteristics (age, marital status, education level, employment status, ethnicity, religion, area of residence),

An index of the wealth status of the household was derived from principal components analysis of 42 questions on household assets, sanitation and household quality indicators[21]. Women were then ranked according to their wealth index, and assigned to wealth quintiles with quintile 1 containing the least wealthy and quintile 5 the wealthiest[22].

Obstetric history and Pregnancy related factors:

Previous still birth, previous pregnancy loss, birth spacing, parity, current pregnancy (planned or unplanned).

Birth-related

Season of birth (dry or rainy); place of delivery (health facility/home); prolonged duration of labour (>24hr); mode of delivery (natural / caesarean section/instrumentation); timing of delivery (term, preterm, post term); multiple births; any severe peripartum complications (tear in vagina, loss of consciousness, heavy bleeding, surgery, blood transfusion, umbilical cord prolapse, meconium); any severe postpartum complications (heavy bleeding/large blood clots, hot body, smelly vaginal discharge, leaking urine/faeces, mastitis, and other problems)

Baby-related

Birth weight (<2.5kg); perceived size of baby (average or larger, smaller than average); delayed initiation of breastfeeding (> 12hr) ; baby's sex (used in conjunction with partner's sex preference to classify gender-bind, defined as expressing a preference for a boy, but being delivered of a girl; woman's understanding of partner's preference for the sex of the baby; severe newborn illness reported by the mother at the birth visit ; still birth/ live birth but baby dies before postnatal depression assessment/ baby alive at postnatal depression assessment.

Statistical Methods

Analyses were conducted using STATA 11,[23] and restricted to those who were assessed for depression both antenatally and postnatally. Characteristics of those in the analysis were tabulated and compared with those excluded from the analysis sub-divided by reason for exclusion.

Determinants of postnatal depression were assessed using logistic regression in multiple stages. We first assessed the influence of all socio-demographic and socio-economic exposures in univariate models. All factors with $p<0.1$ in the univariate models were then included in a multivariable regression model at this first stage. Factors that remained statistically significant ($p<0.1$) predictors of depression outcome were noted and used in the second stage. At the second stage, each obstetric history, pregnancy-related, birth-related, or baby factor was investigated adjusting for all socio-demographic and socio-economic factors that remained significant at the first stage, in a multivariable model. At the third stage all socio-demographic and socio-economic, obstetric history, pregnancy-related, birth-related, or baby factors that remained statistically significant ($p<0.1$) at stages one and two, including antenatal depression, were included in a further multivariable model, and only factors that remained significant were noted. These were then entered into a final multivariable model. Intervention status in the ObaapaVitA and Newhints trials was not examined in the models as vitamin A supplementation during pregnancy was not expected to influence postnatal depression, and as the analysis of the Newhints trial cohort showed that the Newhints home-visits intervention had no impact on postnatal depression[24]. Finally, a secondary analysis used logistic regression to assess whether the onset cases of postnatal depression differed from cases persisting from the antenatal period with respect to any of the determinants examined.

Determinants for persistence antenatal depression were also examined in stages as described, including adjustment for antenatal PHQ-9 depression score in the final model. Effect sizes are reported as crude and adjusted relative risks (aRR) estimated using the marginal standardization technique with 95% confidence intervals for the ratios estimated via the delta method.[25]

Ethical Considerations

Ethical approval for the DON study was granted by the ethics committees of the Kintampo Health Research Centre and the London School of Hygiene and Tropical Medicine. Study participants were approached for informed consent for participation in the study. Fieldworkers were trained to alert the principal investigator (WB) if they became concerned that any woman was severely distressed or in danger of harm. Women identified as needing attention were visited by WB, re-assessed and if appropriate encouraged to go to community psychiatric nurses serving the four main towns of the study area for further depression evaluation and treatment

7.4 Results

Figure 7.1 shows that 21 283 deliveries were identified between 24th March 2008 and 11th July 2009. Of these, 18 356 (86%) completed depression screen after birth; 26 (0.1%) declined to participate, 1454 (7%) were not present at the screening visit, the screening form was not completed on visit for 208 (0.9%), and 1244 (6%) were visited for screening but outside the operationally defined period of four to 12 weeks after birth. Just two pregnant women and one recently delivered woman were reported as being of concern to the fieldworker; all were recommended to seek attention from the community psychiatric nurses but none complied. Of the 18 356 screened postnatally, 13 929 (76%) had also been screened during pregnancy, the majority of whom 13360 (95.9%) had complete information on all potential determinants.

Tables 7.1-7.2 show that the population was predominantly rural (71%), 36% had no formal education, and women aged 25-29 were in the majority (52%). Most (91%) of the women were either married or co-habiting and majority (57%) belonged to non-indigenous ethnic groups. More than half (53%) had planned their pregnancy and for 23% of them, this was their first pregnancy. Background characteristics of excluded groups were similar to those included in this analysis, except higher proportions of the modal age group (62.5%), secondary/post-secondary education (11.5%), and wealthiest wealth quintile (27.0%), who were excluded because postpartum depression assessment was completed outside the time frame of 4-12 weeks (online table 7.1)

Prevalence of Perinatal Depression

The overall prevalence of depression (major or minor) at the postnatal assessment was 3.8% (95% CI: 3.5%, 4.1%), comprising 0.1% (95% CI: 0.08%-0.1%) who met the criteria for major depression and 3.7% (95% CI, 3.4%-3.9%) who met criteria for minor depression. The overall prevalence at the antenatal assessment point was much higher (9.6%); 12.5% of these cases persisted into the postnatal period accounting for 34.4% of postnatal cases.

Determinants for Postnatal Depression

All socio-demographic and socio-economic factors apart from maternal age, area of residence, and occupation status, had crude associations with postnatal depression **(table 7.1)**. After mutual adjustment only the following two remained independently associated: not married and non-indigenous ethnic group. The factors related to obstetric history, pregnancy, birth, and the baby that were associated with risk of postnatal depression after adjusting for the two factors identified in stage one are shown in **table 7.2;** the largest relative risk was for antenatal depression, followed by newborn illness, adverse birth outcome (still births, deaths before depression assessment), preterm delivery, self-reported postpartum and peripartum complications, delivery in the dry season, unplanned pregnancy, experience of a previous still birth, and delayed initiation of breastfeeding, in that order. These factors were included in further multivariable analysis with marital status and ethnic group**.** All the factors apart from preterm delivery, unplanned pregnancy, and delayed initiation of breastfeeding remained associated with postnatal depression. All factors that remained significant were entered into a final multivariable model and independent associations are shown in **table 7.3;** being depressed at the pregnancy assessment had the largest relative risk, followed by newborn illness since birth, adverse birth outcome (still births, deaths before depression assessment), non-indigenous ethnic group, self-reported postpartum complications, never married, giving birth in the dry season, previous still birth, and self-reported peripartum complications.

Comparing Women with Onset and Persistent Cases of Postnatal Depression

Online **Tables 7.2-7.3** show that apart from the obvious differences of whether or not they were depressed antenatally, onset and persistent cases of postnatal depression had similar levels of exposure to almost all determinants explored. The exceptions were a lower prevalence of peripartum complications among persistent cases compared to onset cases, and some suggestion of differences with wealth status, area of residence, and sex preference of the baby, although the overall p-values showed marginal effects at most (p=0.126, 0.054, and 0.082 respectively).

Determinants for Antenatal Depression Persisting Postnatally

Table 7.4 shows the final model for the determinants independently associated with antenatal depression persisting into the postnatal period. These were: adverse birth outcome (still births, deaths before depression assessment), severe newborn illness, Catholic religious faith, and pregnancy depression scores of nine and above.

7.5 Discussion

Our results suggest that antenatal depression (AND) is the strongest determinant of postnatal depression (PND) accounting for 34% of postnatal cases. Adverse events and outcomes linked to birth and the survival of the baby also emerged as strong predictors, as did previous stillbirths and season of birth. Indicators of social and economic adversity, that were strongly associated with the prevalence of AND in our other report[26] are less convincingly implicated as risk factors for PND; only being unmarried and from a non-indigenous ethnic group were included in our final model.

The study is prospective, and population-based, with high baseline response rates (94%), and modest loss to follow-up (7.6% for persistence and 6.9% for onset). The analysis of determinants of PND was based on 13,360 women, and that of the determinants of persistent depression on 1,280 women with AND. Both samples are an order of magnitude larger than any previously studied in a sub-Saharan African setting, giving adequate power to identify modest

risk associations. We defined depression with a locally validated measure applying clinical criteria and examined a wide range of determinants.

However, we acknowledge several limitations: we lacked information on social support[1, 27, 28] and intimate partner violence[27, 29], both of which have been shown to be linked to postnatal depression; we cannot exclude respondent bias, such as an effect of maternal depression upon the mothers' recall of morbidity; timing of depression assessments was variable. We also note that women had regular 4-weekly visits from resident fieldworkers enquiring about the pregnancy, the birth, and the health of the infant; these visits may be regarded as a form of social support and so there is a possibility this may have reduced the risk of depression. In retrospect, we could have ascertained from qualitative interviews whether women felt comfortable being asked those questions from persons they have known and built friendship bonds with for some reasonable length of time.

Prevalence of Postnatal Depression

The prevalence of postnatal depression has previously been noted to be higher in SSA 18.3% (95% CI 17.5%-19.1%)[27] than HIC 12.9% (95% CI 10.6%-15.8%),[3] but lower than the high estimates reported in non-SSA south Asia (19%-28%),[30-32] and South America (35%-50%).[33] We had previously tested the criterion validity of the PHQ-9 questions in the same setting, comparing a score of 5+ against the gold standard of a local clinician's structured clinical diagnosis of common mental disorder[34]. In this study we sought to identify clinically significant depressive episodes, and therefore used the PHQ-9 item ratings to give an approximation to DSM-IV major or minor depression diagnostic categories. [20, 35] As expected this gave a lower prevalence than using the PHQ-9 CMD 5+ score (3.5% compared to 6.7%). Either way, the prevalence observed in our setting is lower than previous estimates for SSA, but compares with the general trend of high recovery and low onset estimates reported in other SSA settings.[36-39]. This low prevalence may be partly due to the effect of regular 4-weekly visits by surveillance fieldworkers.

Determinants for Postnatal Depression

In general our results suggesting strong and independent associations of birth-related maternal physical ill health and death or poor health of the newborn with postnatal depression are consistent with cross-sectional associations reported by some authors in Uganda,[40], India,[41] New Haven USA,[42] and Australia,[43] but not in other high income countries.[44, 45] This suggests that health care providers should provide support mechanisms to this group of women and not ignore the worries emanating from complications suffered by the mother once a healthy delivery is secured.[42]

In some ethnic groups in Ghana, a still-birth is regarded as a 'spirit' child and the belief as in other cultures around the world is that such an event is the natural selection of a baby not meant to be part of the world of the living[46, 47]. As a consequence no open mourning (burial/funeral) takes place and the woman is not meant to view such an occurrence as a misfortune[48]. However, having a stillbirth was found to be strongly associated with increased risk of postnatal depression, in contrast to this cultural construct.

Though our findings point to the important role of obstetric and postnatal factors, together with antenatal depression as predictors of prevalent postnatal depression, the few background socio-demographic determinants identified are consistent with findings from other studies. Thus having a baby outside marriage has been reported as a risk factor in previous works in Nigeria.[49, 50] .Poor socio-economic status was not, however associated with postnatal depression in our study, contrasting with the strong associations with persistent antenatal depression observed in studies in South Asia[51] and HIC.[52] This may be explained by the self-limiting nature of antenatal depression in our setting.

It is worthy of note that the current still-birth effect is associated with prevalent postnatal depression and persistence antenatal depression. We conjecture this is because of previous experience of still birth and worries of a reoccurrence in this current pregnancy may have started during pregnancy. Male gender bind has been consistently reported to be an independent risk factor for postnatal depression in Asia[30, 31, 41, 53, 54]. This finding was not replicated in our

study, nor by others in SSA.[12, 36, 38] Although there is limited evidence from SSA, it is becoming clearer that sex preference issues are more important in the Asian region, where the male to female population ratio supports the existence of culturally ingrained preference for males over females.[55]

A link between seasonality and affective disorders has been widely reported in Western developed countries,[56-60] and attributed to the effects of climate and lack of sunshine on circadian rhythms. These mechanisms would not be relevant to tropical and equatorial regions. Notwithstanding, we found that giving birth in the dry season (harmattan) is associated with an increased risk of postnatal depression. The strong dust-bearing winds that prevail during harmattan, coupled with the onset of warm temperatures (>30°C) may result in increased child care challenges and susceptibility of the child to illness episodes such as malaria, upper respiratory tract infections, and pneumonia.

Are Determinants for Onset and Persistence Depression Different?

A further aim of this investigation was to tease out whether determinants for onset postnatal depression are different from predictors of persistence antenatal depression into the postnatal period. The answer to this is no as the same determinants are common to both. Only two factors showed marginal differences which are most likely due to chance given the multiple number of tests conducted. A companion analysis investigating determinants for antenatal depression within the same setting identified strong socio-demographic and socio-economic predictors.[26] However, the analysis presented here shows that once a woman is depressed antenatally, the factors most likely to keep her depressed are adverse outcomes for the baby, either illness or death. The only socio-demographic factor that appeared to play a role was religion, but we do not have data in this report to explain the findings observed.

Implications

In sum our study is the first largest cohort in SSA to investigate determinants for prevalent postnatal depression and to further understand what factors keep women depressed after birth once depressed at pregnancy, and whether such factors are different from those that make a

woman depressed only after giving birth. Common determinants are shared between overall postnatal depression, onset, and persistence depression. An intervention targeted at any one of these is therefore likely to benefit the others. In this study and other SSA settings where antenatal depression resolves spontaneously, 12.5% of women who remained depressed accounted for just over a third of all postnatal depression cases. The implications are that interventions are more likely to be effective and beneficial if targeted at the postnatal period. Nevertheless, given that our results suggest that antenatal depression is the strongest predictor of postnatal depression, and is associated with poor maternal and infant health in the immediate after birth in this setting[61], it may be necessary to treat during pregnancy, and by so doing prevent a third of women who would become depressed after birth, or prevent antenatal depression through population-level interventions that address chronic social and economic disadvantage.

Authors' Contribution

WB conducted all analysis and wrote the paper with input from MP and BRK, and later reviewed by all authors. WB, MP, and BRK designed the study. WB, GTA, SS, and OA conducted the study. SS and SD managed the data.

7.5.1 Conflict of Interest

All authors declare they have no conflict of interest in the development of this report.

7.5.2 Acknowledgements

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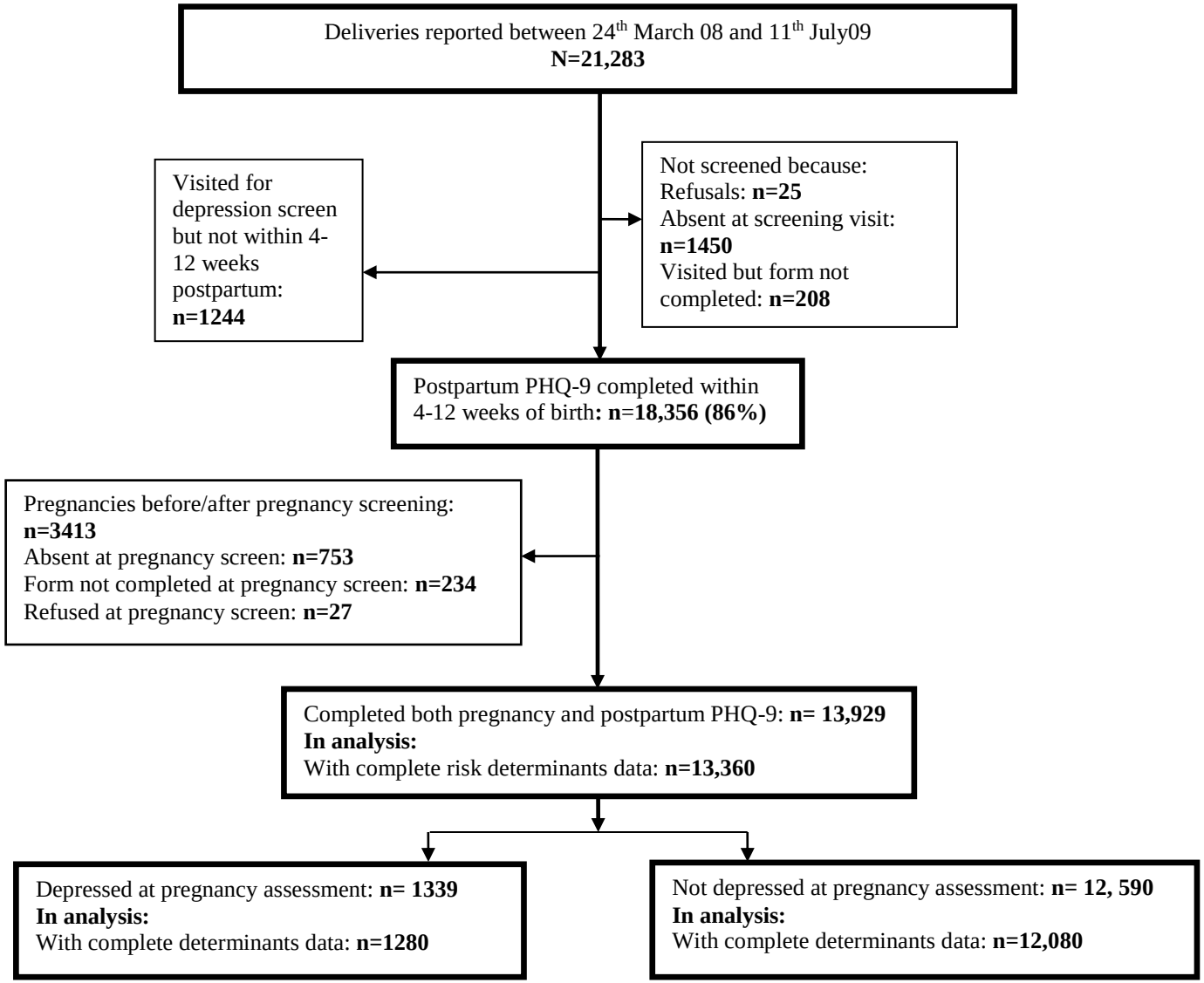
Figure 7.1: Recruitment Profile of Participants in the Study



Online Table 7.1: Socio-demographic Characteristics of Women Included and Excluded from Analysis of Determinants of Postnatal Depression.

Characteristic	In analysis: n=13360	Excluded			
		Postpartum PHQ-9 not completed: n=1683	Postpartum PHQ-9 completed outside time frame: n=1244	Pregnancy PHQ-9 not completed: n=4427	Missing data: n=569
Mother's age					
15-19	11.3%	12.5%	11.7%	10.5%	9.8%
20-29	52.1%	58.4%	62.5%	54.8%	51.7%
30+	36.3%	28.5%	25.3%	34.3%	30.6%
No data	-	0.6%	0.5%	0.4%	7.9%
Marital status					
Married	57.8%	54.7%	53.1%	58.6%	49.0%
Living together	33.0%	34.4%	36.9%	32.8%	34.3%
Widow/ divorced	2.4%	2.6%	2.4%	2.7%	2.3%
Single, unmarried	6.5%	7.7%	7.2%	5.8%	6.3%
No data	-	0.6%	0.5%	0.4%	8.1%
Highest educational level reached					
Sec/post-secondary	6.1%	8.7%	11.5%	6.1%	4.8%
Pre-secondary	37.4%	35.1%	39.8%	37.6%	30.1%
Primary	20.3%	20.4%	19.7%	20.3%	20.0%
None	35.8%	35.1%	28.5%	35.6%	36.2%
No data	-	0.6%	0.5%	0.4%	8.9%
Wealth quintile					
1st (least wealthy)	20.7%	17.4%	14.3%	20.3%	19.3%
2nd	20.8%	16.9%	12.8%	20.7%	16.9%
3rd	20.0%	18.6%	16.6%	20.5%	15.6%
4th	19.4%	21.1%	18.3%	18.8%	14.4%
5th (wealthiest)	18.4%	23.5%	27.0%	17.9%	16.5%
No data	-	2.6%	11.0%	1.9%	17.2%
Religion					
Catholic	21.4%	21.1%	19.9%	20.7%	20.2%
Protestant	46.2%	42.9%	44.5%	46.7%	37.3%
Muslim	24.1%	25.8%	19.5%	23.4%	21.1%
Traditional/other	7.7%	8.0%	5.2%	7.5%	7.9%
No data	-	2.2%	10.9%	1.7%	13.5%
Ethnicity					
Indigenous	43.1%	39.0%	47.0%	41.9%	38.3%
Non-Indigenous	56.5%	60.4%	52.5%	57.7%	53.8%
No data	-	0.6%	0.5%	0.4%	7.9%

Table 7.1: Sample Characteristics and Association of Socio-economic/socio-demographic Factors with Risk of Prevalent Postnatal Depression Among Women in Ghana.

	N (*%) of women		n (%)with major/minor postnatal depression		Univariate RR (95% CI)	p-value	Adjusted RR_1(95% CI)	p-value
Overall	13360	(100%)	455	(3.4%)				
Predictor								
Mother's age								
15-19	1511	(11.3)	52	(3.4)	1.00 (0.74,1.34)	0.992	-	-
20-29	6962	(52.1)	239	(3.4)	1			
30+	4887	(36.6)	164	(3.4)	0.99 (0.81,1.20)			
Marital status								
Married	7768	(58.1)	253	(3.3)	1	0.084	1	0.018
Living together	4406	(32.9)	148	(3.4)	1.04 (0.85,1.27)		1.19 (0.96,1.48)	
Widow/ divorced	315	(2.4)	11	(3.5)	1.06 (0.59,1.92)		1.18 (0.65,2.15)	
Single, unmarried	871	(6.5)	43	(4.9)	1.52 (1.11,2.08)		1.67 (1.21,2.31)	
Highest educational level reached								
Sec/post-secondary	827	(6.2)	22	(2.7)	1		1	
Pre-secondary	5044	(37.8)	141	(2.8)	1.05 (0.68,1.64)	0.003	0.95 (0.61,1.49)	0.448
Primary	2708	(20.3)	98	(3.6)	1.40 (0.89,2.21)		1.13 (0.71,1.81)	
None	5781	(35.8)	194	(4.1)	1.53 (0.99,2.36)		1.16 (0.72,1.86)	
Wealth quintile								
1st (least wealthy)	2776	(20.8)	118	(4.3)	1.91 (1.39,2.61)	0.001	1.46 (1.03,2.03)	0.258
2nd	2798	(20.9)	108	(3.9)	1.71 (1.24,2.35)		1.41 (1.01,1.97)	
3rd	2699	(20.2)	87	(3.2)	1.44 (1.04,2.01)		1.29 (0.92,1.82)	
4th	2798	(20.9)	86	(3.3)	1.45 (1.04,2.02)		1.36 (0.97,1.91)	
5th (wealthiest)	2469	(18.5)	56	(2.3)	1		1	
Occupation status of woman							-	-
Works outside home	9629	(72.1)	313	(3.3)	1	0.140		
Not working outside home	3731	(27.1)	142	(3.8)	1.16 (0.95, 1.41)			
Type of residence								-
Urban	4089	(29.4)	128	(3.1)	1	0.176	-	
Rural	9840	(70.6)	358	(3.6)	1.15 (0.94,1.41)			
Religion								
Catholic	2870	(21.5)	106	(3.7)	1	0.044	1	0.609
Protestant	6226	(46.6)	187	(3.0)	0.82 (0.65,1.03)		0.98 (0.76,1.25)	
Muslim	3236	(24.2)	116	(3.6)	0.98 (0.76,1.27)		0.94 (0.72,1.23)	
Traditional/other	1028	(7.7)	46	(4.5)	1.24 (0.88,1.73)		1.19 (0.84,1.67)	
Ethnicity								
Indigenous	5791	(43.4)	165	(2.7)	1	<0.001	1	0.008
Non-Indigenous	7569	(56.7)	319	(4.1)	1.50 (1.24,1.81)		1.39 (1.09,1.78)	

*percentages may not total up to 100 because of rounding.

RR_1: adjusted for each socio-economic/demographic factor with p<0.1 in univariate models

Table 7.2: Sample Characteristics and Association of Obstetric History/Pregnancy/Birth/Baby-related Factors with Risk of Postnatal Depression Among Women in Ghana

	N (*%) of women		n (%) with major/minor postnatal depression		Adjusted RR_2(95% CI)	p-value
Overall	13360	(100)	455	(3.4)		
Predictor						
Antenatal Depression						
No	12080	(90.4)	301	(2.5)	1	<0.001
Yes	1280	(9.6)	154	(12.0)	4.75 (3.95,5.75)	
Previous Still Birth						
None	12404	(92.8)	411	(3.3)	1	0.023
One/more	956	(7.2)	44	(4.6)	1.42 (1.05,1.93)	
Parity						
Multiparous	10332	(77.3)	366	(3.4)	1	0.844
Primiparous	3038	(22.7)	118	(3.7)	1.02 (0.81,1.29)	
^Birth Spacing						
Normal (2-3yrs)	5030	(37.7)	161	(3.2)	1	0.709
Too close (<2 yrs)	977	(7.3)	27	(2.8)	0.88 (0.59,1.31)	
Too wide (>3yrs)	3713	(27.8)	104	(2.8)	0.92 (0.72,1.17)	
No data	3640	(27.3)	163	(4.5)	-	
Pregnancy Plan						
Yes Planned	7078	(52.9)	235	(3.2)	1	0.015
Did not Plan	6282	(47.0)	251	(3.8)	1.26 (1.05,1.51)	
Sex Preference of partner						
No preference	5978	(44.8)	214	(3.4)	1	0.542
Girl	1355	(10.1)	41	(2.9)	0.94 (0.67,1.32)	
Boy	4439	(33.2)	157	(3.4)	1.02 (0.83,1.27)	
Not sure	1588	(11.9)	74	(4.5)	1.20 (0.97,1.57)	
Gender-bind(wanting a boy, getting a girl)						
No	11196	(83.8)	407	(3.5)	1	
Yes	2164	(16.2)	78	(3.5)	1.09 (0.86,1.39)	0.462
Season of Birth						
May-Oct (Rainy)	7395	(55.4)	223	(3.0)	1	0.006
Nov-April (Dry)	5965	(44.7)	232	(3.9)	1.29 (1.08,1.54)	
Place of delivery						
Health facility	8735	(65.4)	284	(3.3)	1	0.531
Home	4625	(34.6)	171	(3.7)	1.06 (0.88,1.28)	
Mode of Delivery						
Normal	12520	(93.7)	419	(3.4)	1	0.091
Instrument/ CS	840	(6.3)	36	(4.3)	1.33 (0.96,1.86)	
Timing of Delivery						
On time	11026	(82.5)	372	(3.3)	1	
Early	266	(1.9)	21	(6.6)	1.79 (1.08,2.95)	0.023
Late	2068	(15.5)	86	(4.0)	1.23 (0.97,1.55)	0.086

RR_2: each biologic/pregnancy related factor adjusted for all socio-economic/demographic factors with p<0.1 identified in table 1 (RR_1)

*percentages may not total up to 100 because of rounding

^Data available only on a sub-sample of the population studied (on deliveries in 2008).

Table 7-2 cont

	N (*%) of women		n (%) with major/minor postnatal depression		Adjusted RR_2(95% CI)	p-value
Overall	13360	(100)	455	(3.4)		
Predictor						
^Duration of labour						
Less than 24 hrs	5588	(41.8)	206	(3.7)	1	0.045
More than 24hrs	684	(5.1)	35	(5.1)	1.43 (1.01,2.03)	
No data	7088	(53.1)	214	(3.0)	-	
Birth Outcome						
Baby alive at depression assessment	12779	(95.7)	408	(3.2)	1	<0.001
Still Birth	254	(1.9)	18	(7.1)	2.26 (1.43,3.55)	
Deaths before depression assessment	327	(2.5)	21	(8.9)	2.47 (1.67,3.67)	
Baby's Sex						
Male	6843	(51.2)	229	(3.4)	1	0.623
Female	6517	(48.8)	226	(3.5)	1.05 (0.87,1.25)	
Multiple Births						
Singleton	13075	(97.9)	446	(3.4)	1	0.839
More than one	285	(2.1)	9	(3.2)	0.94 (0.49,1.79)	
Delayed initiation of breastfeeding						
Within 12 hours	10787	(80.7)	365	(3.3)	1	0.090
After 12 hours	2573	(19.3)	121	(4.3)	1.20 (0.97,1.49)	
^^Birth Weight (kg)						
2.5+	6648	(49.8)	196	(2.9)	1	0.823
<2.5	589	(4.4)	19	(3.2)	1.05 (0.66,1.67)	
No data	6123	(45.8)	240	(3.9)	-	
Perceived size of baby						
Average or larger	12599	(94.3)	426	(3.4)	1	0.653
Smaller than average	761	(5.7)	29	(3.8)	1.09 (0.75,1.57)	
Peripartum complications						
No	6153	(46.1)	172	(2.8)	1	<0.001
Yes	7207	(53.9)	383	(3.9)	1.43 (1.19,1.72)	
Postpartum complications						
No	8492	(63.6)	245	(2.7)	1	<0.001
Yes	4868	(36.4)	241	(4.6)	1.65 (1.38,1.98)	
Newborn severe illness						
No	13130	(98.2)	427	(3.3)	1	<0.001
Yes	230	(1.8)	28	(12.2)	3.88 (2.70,5.56)	

RR_2: each biologic/pregnancy related factor adjusted for all socio-economic/demographic factors with p<0.1 identified in table 1 (RR_1)

*percentages may not total up to 100 because of rounding.

^^Data available only on a sub-sample of the population studied (hospital deliveries)

Table 7.3: Final Multivariable Logistic Regression Model of Factors Independently Associated with Postnatal Depression Among Women in Rural Ghana.

Risk factor	Adjusted relative risk (95% CI)	P value	Overall p-value
Socio-demographic factors			
Marital status			
Married	1		
Living together	1.15 (0.94, 1.41)	0.180	
Widow/ divorced	1.13 (0.63, 2.02)	0.690	0.075
Single	1.50 (1.10, 2.05)	0.011	
Ethnicity			
Indigenous	1		
Non-Indigenous	1.50 (1.23,1.83)	<0.001	<0.001
Obstetric history/Birth/baby/Biologic factors			
Antenatal Depression			
No	1		
Yes	4.42 (3.66, 5.32)	<0.001	<0.001
Previous Still Birth			
None	1	0.028	0.028
One/more	1.40 (1.04, 1.88)		
Season of Birth			
May-Oct (Rainy)	1		
Nov-April (Dry)	1.31 (1.09, 1.56)	0.003	0.003
Birth Outcome			
Baby alive at depression assessment	1		
Still Birth	1.93 (1.23, 3.02)	0.004	<0.001
Deaths before depression assessment	2.52 (1.77, 3.58)	<0.001	
Postpartum complications			
No	1		
Yes	1.35 (1.12,1.62)	0.001	0.001
Peripartum complications			
No	1		
Yes	1.20 (1.00, 1.45)	0.050	0.050
Newborn severe illness			
No	1		
Yes	3.06 (2.13, 4.39)	<0.001	<0.001

Table 7.4: Final Multivariable Logistic Regression Model of Risk Factors for Persistence Antenatal Depression Among Women with Antenatal Depression in Rural Ghana.

Determinant	n (%) with major/minor persistence antenatal depression	Relative Risk (95% CI)	P value	Overall p-value
Obstetric history/Birth/baby/Biologic factors				
Newborn severe illness				
No	144 (11.6)	1		
Yes	10 (27.8)	2.22 (1.30-3.81)	0.004	0.004
Birth Outcome				
Baby alive at depression assessment	137 (11.3)	1		
Still Birth	9 (25.0)	2.01 (1.12-3.61)	0.020	0.009
Deaths before depression assessment	8 (24.2)	2.18 (1.20-3.96)	0.010	
Previous Still Birth				
No**ne**	139 (11.6)	1		
One or more	15 (17.7)	1.44 (0.89-2.33)	0.134	0.134
Antenatal depression severity				
PHQ-9 score 5	8 (6.2)	1		
PHQ-9 score 6	22 (10.6)	1.71 (0.79-3.70)	0.171	
PHQ-9 score 7-8	33 (8.9)	1.31 (0.62-2.76)	0.479	0.001
PHQ-9 score 9-10	47 (18.0)	2.73 (1.34-5.59)	0.006	
PHQ-9 score 11+	44 (16.9)	2.56 (1.25-5.26)	0.011	
Socio-demographic factors				
Religion				
Catholic	251 (17.1)	1		
Protestant	59 (10.5)	0.60 (0.42-0.85)	0.005	0.015
Muslim	36 (10.1)	0.55 (0.37-0.53)	0.004	
Traditional/other	16 (14.3)	0.77 (0.46-1.29)	0.317	

Online Table 7.2: Comparing Persistent cases with Onset Postnatal Depression with Respect to Background Socio-demographic/socio-economic Factors among Women in Rural Ghana.

	n (*%)with major/minor onset postnatal depression		n (*%)with major/minor persistence antenatal depression		Persistent vs Onset Univariate RR (95% CI)	p-value	Overall p-value
Overall	301	(66.2)	154	(33.9)			
Predictor							
Mother's age							
15-19	31	(10.3)	21	(13.6)	1.29 (0.88,1.88)	0.193	0.406
20-29	164	(54.5)	75	(48.7)	1		
30+	106	(35.2)	58	(37.7)	1.13 (0.85,1.49)	0.401	
Marital status							
Married	164	(54.5)	89	(57.8)	1		
Living together	106	(35.2)	42	(27.3)	0.81 (0.59,1.10)	0.169	0.258
Widow/ divorced	6	(1.9)	5	(3.3)	1.29 (0.66,2.52)	0.452	
Single, unmarried	25	(8.3)	18	(11.7)	1.19 (0.81,1.76)	0.382	
Highest educational level reached							
Sec/post-secondary	13	(4.3)	9	(5.8)	1		
Pre-secondary	97	(32.2)	44	(28.6)	0.76 (0.44,1.33)	0.342	0.647
Primary	61	(20.3)	37	(24.0)	0.92 (0.53,1.62)	0.780	
None	130	(43.2)	64	(41.6)	0.81 (0.47,1.38)	0.436	
Wealth quintile							
1st (least wealthy)	75	(24.9)	43	(27.9)	1.78 (0.97,3.25)	0.062	0.126
2nd	65	(21.6)	43	(27.9)	1.58 (0.85,2.92)	0.145	
3rd	60	(19.9)	27	(17.5)	2.03 (1.14,3.61)	0.017	
4th	56	(18.6)	30	(19.5)	1.86 (1.04,3.32)	0.037	
5th (wealthiest)	45	(14.9)	11	(7.1)	1		
Occupation status of woman							
Works outside home	205	(68.1)	108	(70.1)	1		
Not working outside home	96	(31.9)	46	(29.9)	0.94 (0.71,1.25)	0.661	0.661
Type of residence							
Urban	89	(29.6)	32	(20.8)	1		
Rural	212	(70.4)	122	(79.2)	1.38 (0.99,1.92)	0.054	0.054
Religion							
Catholic	63	(20.9)	43	(27.9)	1		
Protestant	128	(42.5)	59	(38.3)	0.78 (0.57,1.06)	0.115	0.394
Muslim	80	(26.6)	36	(23.4)	0.77 (0.54,1.09)	0.140	
Traditional/other	30	(9.9)	16	(10.4)	0.86 (0.54,1.36)	0.510	
Ethnicity							
Indigenous	104	(34.6)	50	(32.5)	1		
Non-Indigenous	197	(65.5)	104	(67.5)	1.06 (0.81,1.40)	0.658	0.658

*percentages may not total up to 100 because of rounding

^data available only on a sub-sample of the population studied (only deliveries in 2008)

Online Table 7.3: Comparing Persistent Cases with Onset Postnatal Depression with Respect to Obstetric History/Pregnancy/Birth/Baby-Related Factors Among Women in Rural Ghana.

	n (*%) with major/minor onset postnatal depression		n (*%) with major/minor persistent antenatal depression		Univariate RR (95% CI)	p-value	Overall p-value
Overall	301	(66.2)	154	(33.9)			
Predictor							
Previous Still Birth							
None	272	(90.4)	139	(90.3)	1	0.971	0.971
One/more	29	(9.6)	15	(9.7)	1.01 (0.65, 1.55)		
Parity						0.719	0.719
Multiparous	224	(74.4)	117	(75.9)	1		
Primiparous	77	(25.6)	37	(24.0)	0.95 (0.70, 1.28)		
^Birth Spacing							
Normal (2-3yrs)	106	(35.2)	55	(35.7)	1		
Too close (<2 yrs)	20	(6.6)	7	(4.6)	0.76 (0.39, 1.49)	0.422	0.588
Too wide (>3yrs)	66	(21.9)	38	(24.7)	1.07 (0.77, 1.49)	0.691	
No data	109	(36.2)	54	(35.1)	-		
Pregnancy Plan							
Yes	150	(49.8)	67	(43.5)	1	0.203	0.203
No	151	(50.2)	87	(56.5)	1.18 (0.91, 1.54)		
Sex Preference of partner							
No preference	141	(46.8)	58	(37.7)	1		
Girl	29	(9.6)	10	(6.5)	0.88 (0.49,1.57)	0.663	0.082
Boy	92	(30.6)	57	(37.0)	1.31 (0.97,1.77)	0.073	
Not sure	39	(12.9)	29	(18.3)	1.46 (1.03,2.08)	0.033	
Gender-bind(wanting a boy, getting a girl)							
No	255	(84.7)	122	(70.2)	1		
Yes	46	(15.3)	32	(20.8)	1.27 (0.94,1.72)	0.125	0.125
Season of Birth							
May-Oct (Rainy)	140	(46.5)	83	(53.9)	1		
Nov-April (Dry)	161	(53.5)	71	(46.1)	0.82 (0.64,1.06)	0.137	0.137
Place of delivery							
Health facility	188	(62.5)	96	(62.3)	1		
Home	113	(37.5)	58	(37.7)	1.00 (0.77, 1.31)	0.980	0.980
Timing of Delivery							
On time	238	(79.1)	120	(77.9)	1		
Early	10	(3.3)	5	(3.6)	0.99 (0.48,2.06)	0.988	0.949
Late	53	(17.6)	29	(18.3)	1.06 (0.76,1.46)	0.748	
Mode of Delivery							
Normal	278	(92.4)	141	(91.6)	1		
Instrument/ CS	23	(7.6)	13	(8.4)	1.07 (0.68,1.69)	0.761	0.761
^Duration of labour							
Less than 24 hrs	130	(43.2)	76	(49.4)	1		
More than 24hrs	26	(8.6)	9	(5.8)	0.70 (0.39,1.26)	0.231	0.231
No data	145	(48.2)	69	(44.8)	-		
Birth Outcome							
Baby alive at depression assessment	271	(90.0)	137	(88.9)	1		
Still Birth	9	(2.9)	9	(5.8)	1.49 (0.92,2.41)	0.105	0.281
Deaths before depression assessment	21	(6.9)	8	(5.2)	0.82 (0.45,1.50)	0.524	
^^Birth Weight Outcome (kg)							
2.5+	137	(45.5)	61	(36.5)	1		
<2.5	14	(4.7)	6	(3.6)	0.87 (0.40,1.91)	0.736	0.736
No data	150	(49.8)	100	(59.9)	-		
Perceived size of baby							
Average or larger	282	(93.7)	144	(93.5)	1		
Smaller than average	19	(6.3)	10	(6.5)	1.12 (0.71,1.77)	0.627	0.627
Baby's Sex							
Male	155	(51.5)	74	(48.1)	1		
Female	146	(48.5)	80	(51.9)	1.10 (0.85,1.42)	0.487	0.487
Delayed initiation of breastfeeding							
Within 12 hours	232	(77.1)	117	(75.9)	1		
After 12 hours	69	(22.9)	37	(24.0)	1.04 (0.77,1.40)	0.791	0.791
Peripartum complications							
No	103	(34.2)	69	(44.8)	1		
Yes	198	(65.8)	85	(55.2)	0.75 (0.58,0.97)	0.026	0.026
Postpartum complications							
No	147	(48.8)	84	(54.6)	1		
Yes	154	(51.2)	77	(45.5)	0.86 (0.66,1.11)	0.251	0.251
Newborn severe illness							
No	283	(94.0)	144	(93.5)	1	0.827	0.827
Yes	18	(5.9)	10	(6.5)	1.06 (0.63,1.77)		

*percentages may not total up to 100 because of rounding

^data available only on a sub-sample of the population studied (only deliveries in 2008)

8. Chapter 8- Research Paper 3: Association of Antenatal Depression with Adverse Consequences for the Mother and Newborn in Rural Ghana: Findings from the DON Population-based Cohort Study.

Cover sheet for each 'research paper' included in a research thesis

7. For a 'research paper' already published
   7.1. Where was the work published?
   _____N/A_____
   7.2. When was the work published?
   _____N/A_____
   7.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion
   _____N/A_____
   7.3. Was the work subject to academic peer review?
   ___N/A_____
   7.4. Have you retained the copyright for the work? __N/A___
   If yes, attach evidence of retention
   If no, or if the work is being included in its published format, attach evidence of permission from copyright holder (publisher or other author) to include work

8. For a 'research paper' prepared for publication but not yet published
   8.1. Where is the work intended to be published? ***PLoSMed***
   8.2. List the paper's authors in the intended authorship order

***Benedict Weobong, Martin Prince, Augustinus HA ten Asbroek, Seyi Soremekun, Samuel Danso , Alexander Manu, Zelee Hill, Seth Owusu-Agyei, Betty R. Kirkwood**

   8.3.Stage of publication – **Not yet submitted**

9. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

The candidate had a major role in all aspects of the DON study including conceptualisation, design, and conduct. He carried out all analyses and was responsible for writing this paper.

Candidate's signature _____

Supervisor or senior author's signature to confirm role as stated in (3) 

8.1 Abstract

Background

Whilst there is compelling evidence of an almost 2-fold increased risk of still births, and suggestive evidence of increased mortality among offspring of mothers with psychotic disorders, only three studies have addressed the role of depression during pregnancy on survival of the baby. We examined these associations in a large cohort of pregnant women in Ghana.

Methods

We conducted a population-based cohort study involving 23,011 pregnant women using the locally validated depression module of the Patient Health Questionnaire (PHQ-9). Our exposure was DSM-IV major/minor antenatal depression (AND) derived from PHQ-9 scores. The outcomes were of three types: adverse baby outcomes, adverse maternal outcomes, and uptake of key newborn care practices. Analysis excluded multiple births. The association between AND and each of the outcomes was examined using logistic regression adjusting for a priori confounders. Effect sizes are reported as relative risks with 95% confidence intervals and p-values.

Results

20679 (89.6%) pregnant women completed the PHQ-9. The prevalence of AND was 9.9% (n=2032) (95% confidence interval 9.4%-10.2%). This was associated with: prolonged labour (RR 1.25, 95% CI 1.02-1.53); peripartum complications (RR 1.11, 95% CI 1.07-1.15);postpartum complications (RR 1.27, 96% CI 1.21-1.34); CS/instrumental delivery (RR 1.19, 95% CI 1.02-1.40); newborn illness (RR 1.52, 95% CI 1.16-1.99); and bed net non-use during pregnancy (RR 0.93, 95% CI 0.89-0.98), but not neonatal deaths, still births, low birth weight, immediate breast feeding initiation, or exclusive breastfeeding. It was marginally associated with preterm births (RR 1.32, 95% CI 0.98-1.76).

Conclusion

This paper has contributed important evidence on the role of poor maternal mental health as a potential contributor to maternal and infant morbidity. Non-pharmacological treatment anchored on primary care delivery structures is recommended as an immediate step. We further recommend that trials are designed to assess if treating antenatal depression results in improved maternal and newborn outcomes.

8.2 Introduction

Global efforts to reduce the burden of neonatal deaths appear to be yielding positive results with a 1.7 per annum decline rate since 1990[1]. Nevertheless, sub-Saharan Africa (SSA) has the highest neonatal mortality rate and still accounts for a third of the global deaths as a result of the slow progress in decline[1]. Over 60% of preterm births occur in SSA and South Asia[2], accounting for 27% of all neonatal deaths[3]. Closely related are still births which are similar in numbers to neonatal deaths with 76% occurring in SSA and South Asia[4], but invisible on global policy agendas such as the Millennium Development Goals[5].

Whilst there is compelling evidence of an almost 2-fold increased risk of still births (meta-analysis RR 1.89; 95% CI 1.36-2.62), and suggestive evidence of increased mortality among offspring of mothers with psychotic disorders[6], only three studies in Ethiopia[7], Brazil[8] and the Netherlands[9] have addressed the role of common mental disorders during pregnancy on survival of the baby. All three studies recorded non-statistically significant increased risk of stillbirths or, in the case of the Netherlands, child losses (including stillbirths). The relative risks were; 1.7 (95% CI 0.6-5.5) in Ethiopia, 1.3(95% CI 0.8-1.9) in the Netherlands, and 1.3(95% CI 0.4-5.1) in Brazil; all had wide confidence intervals which included 1. Only the study in Ethiopia assessed neonatal mortality and there was no evidence of any increased risk associated with antenatal depression (RR 0.8; 95% CI 0.2-3.0).

There is, however, strong evidence linking antenatal depression and other adverse birth outcomes such as preterm births (RR 1.13, 95% CI 1.06-1.21) and low birth weight (RR 1.18, 95% CI 1.07-1.30) as reported in a recent meta-analysis involving 26 studies from high income settings and three from low income settings[10]. There was marked heterogeneity of these effect estimates with higher effect sizes for low birth weight (LBW) (RR=2.06, 95% CI 1.43-2.93) in the studies from low income countries. This review did not include studies from SSA. The more recent study in Ethiopia mentioned above found a similar, although non-significant effect, on LBW (RR=2.3, 95% CI 0.9-6.2), and increased risks for delayed initiation of breastfeeding (more than 8 hours) (RR=2.8, 95% CI 1.3-6.1) and prolonged labour (more than 24 hours) (RR=1.6, 95% CI 1.0-2.6)[7]. There is also evidence from mostly high income settings

suggesting that antenatal depression is associated with; poor maternal self-care and nutrition, lack of sleep, and inadequate antenatal care[11].

This paper presents findings from DON, a large cohort study conducted in Ghana to address the relative lack of evidence from SSA concerning the burden, determinants, and adverse consequences of perinatal depression. It includes findings on the association of antenatal depression with both adverse baby and maternal outcomes including birth complications, prolonged labour, and assisted delivery. Finally we present associations with uptake of key newborn care practices.

8.3 Materials and Methods

DON is a cohort study of antenatal and postnatal **D**epression nested within the **O**baapaVitA[12] and **N**ewhints[13] trials in Ghana, conducted within seven contiguous predominantly rural districts in the Brong Ahafo Region. The trials ran consecutively from 2000 to 2009 and collected information on pregnancies, births, and infant and maternal deaths, based on a 4-weekly population-based surveillance system. The ObaapaVitA trial sought to reduce maternal mortality through weekly vitamin-A supplementation of women of reproductive age, and the Newhints trial aimed to assess the impact of home-visits by community health volunteers on neonatal mortality. The area has a population of about 700,000[14] with more than 120,000 women of reproductive age, and more than 15,000 births a year. There are four large towns (minimum population size of 40,000), with district hospitals. The perinatal mortality rate is 55/1000 live/still births, the neonatal mortality rate is 32/1000 live births, and the stillbirth rate is 31/1000 births[12]. Access to 'conventional' mental health services is limited and help for mental ill health is widely provided by traditional healers and spiritual/healing churches[15].

DON was carried out from late January 2008 to early August 2009 and comprised depression assessments in the 4-weekly surveillance visits following identification of pregnancy and in the visits following reporting of a delivery. The analysis in this paper focuses on the consequences of antenatal depression for the mother and baby.

Data Collection

All women of reproductive age were visited at home every 4-weeks by a locally-resident field worker. When a pregnancy was first reported, information was collected on: socio-demographic and socio-economic indicators, including obstetric history. A DON pregnancy depression assessment was then conducted at the following 4-weekly visit using the Patient Health Questionnaire (PHQ-9). At the first visit after the delivery was reported, information was collected on the pregnancy, delivery, any complications, the baby (or babies), and new born care practices.

Exposure

The presence of antenatal depression (major or minor), assessed using the depression module of the Primary Care Evaluation of Mental Disorders (PRIME-MD)[16, 17] Patient Health Questionnaire (PHQ-9)[18]. The PHQ-9 is a short structured questionnaire that enquires about the nine symptom based criteria for a diagnosis of DSM-IV[18] depression, including duration and severity. This approach allows an approximation to the DSM-IV criteria for major or minor depression, for which only symptoms that have been present for at least half the time in the last two weeks are rated positively. Either depression or anhedonia (loss of interest or pleasure) must be rated, with a total of five or more symptoms for major depression and two to four symptoms for minor depression. In contrast with other symptom based scale scores, these criteria therefore identify individuals with persistent and pervasive symptoms, characteristic of a clinically significant depressive episode.

Outcomes

There are three types of outcome and these were all reported by the mother. The first is adverse baby outcomes, which covered: neonatal deaths and still births, preterm deliveries, and any illness that the mother had thought was serious or severe, and LBW (<2.5kg). Birth weight was extracted by fieldworkers from the birth cards given to mothers who delivered in facilities; it was not therefore available for babies delivered at home.

The second type of outcome is adverse maternal outcomes pertaining to the birth. Women were asked about serious problems they may have experienced during labour/soon after birth or since

birth. These were: assisted deliveries (caesarean section and/or instrumental delivery), prolonged labour (23+hrs), peripartum complications (tear in vagina, loss of consciousness, heavy bleeding from vagina, surgery to repair or remove the womb, blood transfusion), and postpartum complications (heavy bleeding/large blood clots from vagina, hot body, smelly vaginal discharge, leaking urine/faeces, mastitis, and any other problem not mentioned by the field worker). Field workers are trained to enquire after these experiences with relevant examples. For example, mastitis is explained as a breast infection that is swollen, painful, or has a discharge, also known as 'pompo' in the local language. The list of questions was based on standard maternal morbidity questions which were adapted and piloted in 2000 when the surveillance system was established.

The third type is uptake of key newborn care practices: attending at least 4 antenatal care sessions, initiating breast feeding within an hour of birth, exclusively breast feeding within the first month based on the mother's account of breast feeding in the last 24 hours.

Statistical Analyses

Analyses were based on women who had a DON depression screening during pregnancy, and their babies, and were restricted to singletons. The association between antenatal depression and each of the outcomes was carried out using logistic regression models adjusting for a priori confounders (as listed in the relevant results tables). As characteristics of pregnant women were comparable for intervention and control arms in both the ObaapaVitA[12] and Newhints[13] trials, and as neither intervention was postulated to impact on antenatal depression, intervention status was not included. Effect sizes are reported as relative risks, with 95% confidence intervals and p-values using the marginal standardization technique to estimate these from odds ratios via the delta method[19]. All analysis were conducted using STATA 11[20].

Ethical Considerations

Ethical approval for the study was granted by the ethics committees of the Kintampo Health Research Centre and the London School of Hygiene and Tropical Medicine. Informed consent was obtained from all participants. Fieldworkers were trained to alert the principal investigator (WB) if they became concerned that any woman was severely distressed or in danger of harm.

Women identified as needing attention were visited by WB, re-assessed and if appropriate encouraged to go to community psychiatric nurses serving the four main towns of the study area for further depression evaluation and treatment

8.4 Results

Figure 8.1 shows the recruitment profile. Between 3rd December 2007 and 25th June 2009, 26,980 pregnant women were identified, of whom 23,011 were eligible for depression assessment. Of these 20,679 (90%) pregnant women with a singleton birth (live/still) completed the depression screen. This is the denominator used for analyses looking at adverse maternal outcomes and pregnancy behaviours, and still births. Forty-three (0.2%) declined to participate, 1463 (6.4%) were temporarily absent at the surveillance visit, and 370 (1.6%) did not have a depression form completed although they were visited. Just two women were reported to WB as being of concern by the fieldworker; both were recommended to seek attention from the community psychiatric nurses but neither complied. Background characteristics of those not met and screened were comparable to those in the analysis (see companion paper[21]). Three other denominators are also shown: the number of live births with known neonatal survival status (19,670) used for determination of neonatal mortality, the number surviving past the first 24hours (19,890) used for estimation of initiation of breast feeding, and the number of babies still alive at birth visit (19,613) used for exclusive breast feeding, bed net use, and severe newborn illness outcomes.

The prevalence of DSM-IV major or minor depression during pregnancy was 9.9% (n=2032) (95% confidence interval 9.4%-10.2%); the prevalence of major depression was 0.6% (95% CI, 0.5%-0.7%) and 9.3% (95% CI, 8.9%-9.7%) met the criterion for minor depression. Detailed profile of study participants is given in a companion paper[21]. In brief the population was predominantly rural (70%) and the modal age group was 20-29 (53%). Almost all the women were married (91%), most had some education (64%), and most belonged to the Christian faith (68%).

Risk of Adverse Perinatal and Neonatal Outcomes

Table 8.1 shows that only severe newborn illness (Adjusted RR 1.52, 95% CI 1.16-1.99) was significantly increased among mothers with antenatal depression. The evidence for the association between antenatal depression and risk of preterm delivery (Adjusted RR 1.32, 95% CI 0.98-1.76) was weak. There was no evidence of associations with neonatal mortality, still birth, or LBW.

Risk of Adverse Maternal Outcomes

Table 8.2 shows the risk of adverse maternal outcomes associated with antenatal depression. Risk of severe peripartum complications (Adjusted RR 1.11, 95% CI 1.07-1.15 p<0.001); postpartum complications (Adjusted RR 1.27, 95% CI 1.21-1.34 p<0.001); caesarean section and/or instrumental delivery (Adjusted RR 1.19, 95% CI 1.02-1.40 p=0.032); and prolonged duration of labour (Adjusted RR 1.25, 95% CI 1.02-1.53 p=0.028), were all significantly elevated among mothers with antenatal depression. Further analysis showed that four of the eight peripartum complications were more likely to be reported by depressed women antenatally (**online table 8.1);** these were heavy bleeding (Adjusted RR 1.27, 95% CI 1.18-1.38 p<0.001), tear in the vagina (Adjusted RR 1.19, 95% CI 1.08-1.30 p<0.001), placenta replacement (Adjusted RR 1.17, 95% CI 1.06-1.29 p=0.002), and convulsions (Adjusted RR 1.74, 95% CI 1.04-2.93 p=0.036) . Further analysis also showed that postpartum complications reported were significantly elevated among antenatally depressed women ,with the biggest effects on hot body (Adjusted RR 1.52, 95% CI 1.34-1.72 p<0.001), other serious complications (Adjusted RR 1.49, 95% CI 1.29-1.73 p<0.001), and leaking urine/faeces (Adjusted RR 1.39, 95% CI 1.14-1.70 p=0.001) (**online table 8.2)**.

Risk of Pregnancy Behaviours and Newborn Care Practices

Table 8.3 shows that women with antenatal depression were significantly less likely to have reported using a bed net during pregnancy (Adjusted RR 0.93, 95% CI 0.89-0.98 p=0.005). There was however no evidence that they were less likely to put their neonate under a bed net (Adjusted RR 1.01, 95% CI 0.98-1.04 p=0.479). There was also no evidence of association

between antenatal depression and antenatal care attendance, delivering at a health facility, immediate initiation of breastfeeding, or exclusive breastfeeding within the neonatal period.

8.5 Discussion

This is the largest cohort study that has yet been conducted in low income settings of the effects of antenatal depression on adverse outcomes for the mother and baby. After adjustment for confounders, antenatal depression was not found to be associated with neonatal deaths, still births, low birth weight, delayed initiation of breastfeeding, or non-exclusive breastfeeding in the neonatal period, delivering at a health facility, or optimal antenatal care attendance. However, antenatal depression was associated with a 25% increase in 24+ hours prolonged labour, 11% severe peripartum and 27% postpartum complications, 50% severe newborn illness, and 7% less bed net non-use during pregnancy. It was also marginally associated with a 32% increase risk of preterm deliveries (p=0.065).

Strengths and weaknesses of the study

Our report is strengthened by several factors. We employed an unprecedentedly large cohort of 20,679 pregnant women, applied clinimetric criterion for depression using a validated tool, ascertained outcomes blind to exposures because the data collectors were not aware of the study hypothesis, and recorded a high antenatal depression screening response rate of 92%.

Possible weaknesses are our self-reported morbidity outcomes may have been influenced by the mother's depression status; however 87% of women depressed antenatally were not depressed at their postpartum assessment. Furthermore, although we accounted for several confounders in our analyses, we did not have data on maternal Body Mass Index and intimate partner violence during pregnancy both of which are known to be associated with both adverse perinatal outcomes[22, 23] and antenatal depression[7, 8, 24, 25]. In addition our measure of antenatal depression was not originally validated in the antenatal period and given that one study suggests depression in pregnancy and postnatal period show significantly different symptom profiles[26], the prevalence of the exposure may have been underestimated.

Comparison with other studies

The evidence on the association between antenatal depression and poor perinatal outcomes including the survival of the baby is scanty. For example the only study in SSA to have examined the association between antenatal depression and neonatal mortality in Ethiopia showed no evidence of any increased risk[7], and this is consistent with our finding. We also found no evidence for an increased risk of still births among antenatally depressed women, and our point estimate of 1.06 was lower than those reported in Ethiopia (1.7)[7], Brazil (1.3)[8], and the Netherlands (1.3)[9] all of which also had wide confidence intervals including one. Our non-significant increased risk of preterm births (1.32) is higher than the meta-analysis estimate of 1.13 from low income settings[10].

Our negative finding on LBW, is in contrast to the increased risks found in other cohort studies in developing countries in Ethiopia[7], India[26], Pakistan[27], and Brazil[8]. One difference between these studies and ours is that our estimate is restricted to women delivering in facilities; however this is unlikely to explain the difference because a high proportion (67%) delivered in the facilities and this was the same for depressed and non-depressed women.

Our study did not also replicate the positive association between antenatal common mental disorder and delayed initiation of breastfeeding in Ethiopia (2.8, 95% CI 1.3-6.1)[7]. Our findings may be due to the fact that breastfeeding uptake within the immediate postnatal period is generally high in our setting (86% were exclusively breast feeding within a month of delivery).

Though perinatal depression has been shown to affect the health-related quality of life of the mother[28] , there are few accounts of its association with specific serious medical complications during labour or soon after delivery. Our finding of an association with both severe peripartum and postpartum complications suggests that poor maternal mental health may have a role as a potential contributor to maternal deaths in regions of high burden.

Implications

Although antenatal depression in our setting and SSA in general may be self-limiting [30-32], it may have serious consequences for both the mother and baby, and should be treated. Bearing in mind however the potential risks of pharmacological treatment in pregnancy[33, 34], we would recommend psychosocial/psychological treatment options as the first step for women with antenatal depression as prescribed in the mental health gap action programme guidelines (mhGAP-IG)[35]. Specific findings reported in this paper also suggest that identification of depression in pregnancy should inform closer antenatal and delivery care whereby mothers are encouraged to deliver at health facilities equipped to deal with obstetric complications. Further, given recent evidence suggesting that therapies that target the mother-infant relationship are efficacious in tackling detrimental consequences for children of depressed mothers [36], studies/trials are urgently required to examine whether treating antenatal depression in conjunction with improving the quality of obstetric care would lead to improved birth outcomes.

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What is already known about this topic?

Antenatal depression is associated with:

- Low birth weight/ stunted growth particularly in south Asia
- Preterm births
- Prolonged labour
- Postnatal depression
- Poor maternal self-care and nutrition

What this study adds

Antenatal depression is associated with:

- Severe newborn illness
- Bed net non-use during pregnancy
- Severe peripartum and postpartum complications
- Instrumental/caesarean section

Figure 8.1: Recruitment Profile

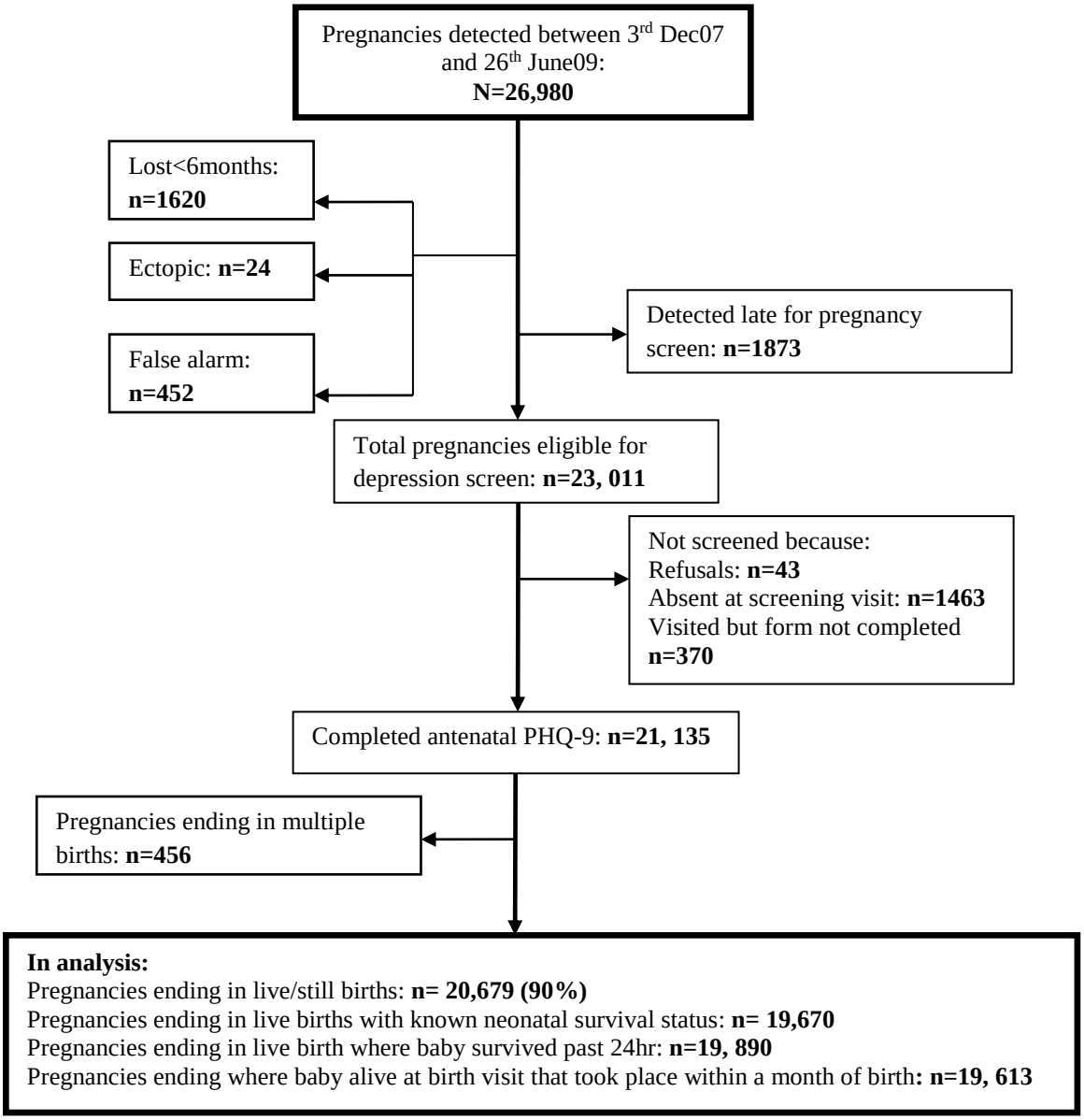

Table 8.1: Effect of Antenatal Depression on Risk of Adverse Perinatal/neonatal Outcomes.

Outcome	Number of babies	n (% with outcome)	Crude Relative risk (95%CI)	Adjusted Relative risk (95%CI)	p-value
†Neonatal mortality					
Not Depressed group	17424	421 (2.4%)	1	1	
Depressed group	1883	47 (2.5%)	1.03 (0.77-1.39)	1.02 (0.76-1.37)	0.918
#Still births					
Not Depressed group	18358	453 (2.5%)	1	1	
Depressed group	1995	54 (2.7%)	1.10 (0.83-1.45)	1.06 (0.80-1.40)	0.673
##Preterm births					
Not Depressed group	15290	369 (2.4%)	1	1	
Depressed group	1590	50 (3.1%)	1.30 (0.97-1.74)	1.32 (0.98-1.76)	0.065
*** Low birth weight**					
Not Depressed group	9917	702 (7.1%)	1	1	
Depressed group	1031	65 (6.3%)	0.89 (0.70-1.14)	0.87 (0.69-1.11)	0.262
##Severe Newborn illness					
Not Depressed group	17479	369 (2.1%)	1	1	
Depressed group	1890	60 (3.2%)	1.50 (1.15-1.96)	1.52 (1.16-1.99)	0.002

† Expressed ‰ live births, restricted to babies with survival status at end of neonatal period known (424 neonates were lost to 28 day follow up). Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, perceived birth weight, baby's sex, initiation of breastfeeding, and delivery place.
# Expressed ‰ live+still births. Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, previous still birth, baby's sex, and malaria
*data available only for hospital deliveries. Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, preterm birth, and malaria.

Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, baby's sex, and malaria.

Table 8.2: Effect of Antenatal Depression on Poor Birth Outcomes Including Morbidity among Mothers with Singleton Births.

Outcome	Number of women with a singleton birth and depression record (n)	n (% with outcome)	Crude Relative risk (95%CI)	Adjusted Relative risk (95%CI)	p-value
‡Peripartum complications					
Not Depressed group	18095	9901 (54.7%)	1	1	
Depressed group	1962	1184 (60.4%)	1.10 (1.06-1.15)	1.11 (1.07-1.15)	<0.001
‡Postpartum complications					
Not Depressed group	18198	6516 (35.8%)	1	1	
Depressed group	1970	917 (46.6%)	1.30 (1.24-1.37)	1.27 (1.21-1.34)	<0.001
†*Prolonged labour (24+ hours)					
Not Depressed group	5994	650 (10.8%)	1	1	
Depressed group	696	94 (13.5%)	1.25 (1.02-1.52)	1.25 (1.02-1.53)	0.028
***CS and/or Instrumental delivery**					
Not Depressed group	18462	1254 (6.8%)	1	1	
Depressed group	2006	152 (7.6%)	1.12 (0.95-1.31)	1.19 (1.02-1.40)	0.032

‡Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, previous mode of delivery, delivery place, and preterm birth.
*Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, and parity,
†data available only on a sub-sample of the cohort studied.

Online Table 8.1: Effect of Antenatal Depression on Risk of Specific Peripartum Complications

Outcome	Number with depression record (n)	n (% with outcome)	Crude Relative risk (95%CI)	*Adjusted Relative risk (95%CI)	p-value
Heavy bleeding					
Not Depressed group	18203	3866 (21.2%)	1	1	
Depressed group	1972	554 (28.1%)	1.32 (1.23-1.43)	1.27 (1.18-1.38)	<0.001
Tear in vagina					
Not Depressed group	18200	3043 (16.7%)	1	1	
Depressed group	1975	378 (19.1%)	1.14 (1.04-1.26)	1.19 (1.08-1.30)	<0.001
Placenta replacement					
Not Depressed group	17978	2823 (15.7%)	1	1	
Depressed group	1943	354 (18.2%)	1.16 (1.05-1.28)	1.17 (1.06-1.29)	0.002
Convulsions					
Not Depressed group	18206	86 (0.5%)	1	1	
Depressed group	1973	17 (0.9%)	1.82 (1.09-3.06)	1.74 (1.04-2.93)	0.036
Loss of consciousness					
Not Depressed group	18012	271 (1.5%)	1	1	
Depressed group	1945	41 (2.1%)	1.31 (0.94-1.82)	1.36 (0.99-1.89)	0.062
IV drip					
Not Depressed group	18224	4633 (25.4%)	1	1	
Depressed group	1975	499 (25.3%)	0.99 (0.92-1.08)	1.03 (0.96-1.11)	0.362
Surgery					
Not Depressed group	18152	711 (3.9%)	1	1	
Depressed group	1968	76 (3.8%)	0.99 (0.78-1.24)	0.99 (0.79-1.24)	0.910
Blood transfusion					
Not Depressed group	18219	377 (2.1%)	1	1	
Depressed group	1975	41 (2.1%)	1.00 (1.73-1.38)	0.99 (0.72-1.35)	0.926

*adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, previous mode of delivery, delivery place, perceived size of baby, and preterm birth.

Online Table 8.2: Effect of Antenatal Depression on Risk of Specific Postpartum Complications

Outcome	Number with depression record (n)	n (% with outcome)	Crude Relative risk (95%CI)	*Adjusted Relative risk (95%CI)	p-value
Hot body					
Not Depressed group	18219	1522 (8.4%)	1	1	
Depressed group	1975	261 (13.2%)	1.58 (1.40-1.79)	1.52 (1.34-1.72)	<0.001
Other problems					
Not Depressed group	18224	1114 (6.1%)	1	1	
Depressed group	1975	189 (9.6%)	1.57 (1.35-1.81)	1.49 (1.29-1.73)	<0.001
Leaking urine/faeces					
Not Depressed group	18214	707 (3.9%)	1	1	
Depressed group	1971	104 (5.3%)	1.36 (1.11-1.66)	1.39 (1.14-1.70)	0.001
Mastitis					
Not Depressed group	18223	1106 (6.1%)	1	1	
Depressed group	1975	170 (8.6%)	1.42 (1.22-1.66)	1.38 (1.18-1.61)	<0.001
Large clots/heavy bleeding					
Not Depressed group	18203	3444 (18.9%)	1	1	
Depressed group	1973	505 (25.6%)	1.35 (1.25-1.47)	1.32 (1.21-1.43)	<0.001
Vaginal discharge					
Not Depressed group	18196	1090 (5.9%)	1	1	
Depressed group	1971	156 (7.9%)	1.32 (1.12-1.55)	1.27 (1.08-1.50)	0.003

*adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, previous mode of delivery, place of delivery, and preterm birth.

Table 8.3: Effect of Antenatal Depression on the Uptake of Selected Key Newborn Care Practices.

Outcome	Number with depression record (n)	n (% with outcome)	Crude Relative risk (95%CI)	Adjusted Relative risk (95%CI)	p-value
##Antenatal care attendance (>4 times)					
Not Depressed group	18115	12973 (71.6%)	1	1	
Depressed group	1965	1374 (69.9%)	0.98 (0.95-1.01)	1.01 (0.98-1.03)	0.625
##Bed net use during pregnancy					
Not Depressed group	18452	9174 (49.7%)	1	1	
Depressed group	2003	929 (46.4%)	0.93 (0.89-0.98)	0.93 (0.89-0.98)	0.005
## Delivering at health facility					
Not Depressed group	18462	12465 (67.5%)	1	1	
Depressed group	2006	1293 (64.5%)	0.95 (0.92-0.99)	1.00 (0.97-1.03)	0.905
##*Bed net use for baby					
Not Depressed group	12918	9797 (75.8%)	1	1	
Depressed group	1425	1079 (75.7%)	1.00 (0.97-1.03)	1.01 (0.98-1.04)	0.479
#Initiation of breast feeding (<1hour)**					
Not Depressed group	13098	6109 (46.4%)	1	1	
Depressed group	1443	654 (45.3%)	0.97 (0.92-1.03)	1.00 (0.95-1.06)	0.897
##*Exclusive Breast Feeding					
Not Depressed group	12918	11255 (87.1%)	1	1	
Depressed group	1425	1233 (86.5%)	0.99 (0.97-1.02)	0.99 (0.97-1.02)	0.609

adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, parity, place of delivery, and mode of delivery.

Adjusted for: woman's age, education, wealth quintile, marital status, area of residence, ethnicity, religion, and parity.

* Number of singleton live babies within 4 weeks of delivery

**All singleton live births up to 24h after birth, and visited within 4 weeks of delivery.

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9. Chapter 9- Research Paper 4: Association of Postnatal Depression with Increase Infant Mortality and Morbidity: findings from the DON Population-based Cohort Study in Rural Ghana.

Cover sheet for each 'research paper' included in a research thesis

10. For a 'research paper' already published
    - 10.1. Where was the work published?
      _____N/A_____
    - 10.2. When was the work published?
      _____N/A_____
      - 10.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion
        _____N/A_____
    - 10.3. Was the work subject to academic peer review?
      ___N/A_____
    - 10.4. Have you retained the copyright for the work? __N/A___
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11. For a 'research paper' prepared for publication but not yet published
    - 11.1. Where is the work intended to be published? **Lancet**
    - 11.2. List the paper's authors in the intended authorship order

Benedict Weobong, Martin Prince, Augustinus HA ten Asbroek, Seyi Soremekun, Lu Gram, Samuel Danso, Seeba Amenga-Etego, Seth Owusu-Agyei, Betty R. Kirkwood

Stage of publication – **Not yet submitted**

12. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

The candidate had a major role in all aspects of the DON study including conceptualisation, design, and conduct. He carried out all analyses and was responsible for writing this paper.

Candidate's signature _____

Supervisor or senior author's signature to confirm role as stated in (3) 

9.1 Abstract

Background: No studies to date appear to have assessed the impact of depression in the immediate postnatal period upon subsequent infant mortality. This is the period of maximum vulnerability for child deaths, and a critical time for mother-child bonding.

Methods DON is a population-based prospective cohort study nested within a surveillance system involving 4-weekly visits to all women of reproductive age in 7 districts in the Brong Ahafo Region of Ghana. Women were assessed during pregnancy and between 4-12 weeks after birth using the depression module of the Patient Health Questionnaire (PHQ) to identify those with DSM-IV major or minor depression. Analyses were restricted to singletons alive at the time of the postnatal depression (PND) assessment. The main outcome was infant deaths up to six months of age. Secondary outcomes were deaths up to 12 months of age and infant morbidity. We used Poisson regression models for mortality analyses and mixed effects regression models for morbidity outcomes to account for repeated 4-weekly observations. Effect sizes are reported as either rate or risk ratios with 95% confidence intervals.

Findings The analysis is based on 16,560 singletons who were followed for a total of 67,457·4 infant months from the time of their mothers' PND assessment and 130 infant deaths. The prevalence of PND was 3·5% (n=591, 95% CI, 3·2%-3·7. PND was associated with an almost 3-fold increased risk of mortality up to six months (adjusted rate ratio [RR], 2·83 (1·56-5·16); p=0·001). The RR up to 12 months was 1·79 (1·04-3·09; p=0·035). Postnatal depression was also associated with increased risk of infant morbidity.

Interpretation This is the first large cohort study to examine the link between maternal postnatal depression and subsequent infant mortality in low income countries. Implementation of the World Health Organisation's Mental Health Gap Action Programme (mhGAP) to scale up packages of care integrated with maternal health is encouraged as an important adjunct to child survival efforts.

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9.2 Introduction

Maternal depression, a common and debilitating mental disorder, is known to be associated with adverse effects on infant and child health and development.[1-3] While there is clear evidence of increased risk of still birth, and suggestive evidence of increased mortality among offspring of mothers with serious mental illnesses (psychotic disorders),[4] the evidence pertaining specifically to the impact of maternal depression on infant survival is limited and inconclusive.

In a Taiwanese national registry linkage study, maternal depression in the year after birth was independently associated with a subsequent 1·5-fold [95% confidence interval (CI) 1·2-1·9] increased mortality risk for children up to 5 years old. [5] In an Ethiopian cohort study,[6] the 561 children of women who had been screened for depression in the previous year, and who were born within one year of their mother's assessment were followed up for mortality up to the age of three years; there was a borderline association between antenatal maternal depression and child mortality (RR 2·3, 95% CI 1·0-4·9), and a greater mortality risk when combined with mothers' experiences of physical (RR 4·0, 95% CI 1·6-10·1) or emotional (RR 3·7, 95% CI 1·3-10·4) abuse. No studies to date appear to have assessed the impact of depression in the immediate postnatal period upon subsequent infant mortality. This is the period of maximum vulnerability for child deaths[7], and a critical time for mother-child bonding[8] when the demands of providing good quality nurturance and care are most challenging for the mother.

In this paper we present findings on the association between postnatal depression and subsequent infant mortality and morbidity from the DON study carried out to assess the burden, determinants and consequences of antenatal and postnatal depression in rural Ghana.

9.3 Materials and Methods

Study Design

DON is a cohort study of perinatal **D**epression nested within the **O**baapaVitA[9] and **N**ewhints[10] cluster randomised controlled trials (RCT) conducted in seven contiguous districts in the Brong Ahafo Region of Ghana. The ObaapaVitA trial evaluated the effect of weekly vitamin A supplementation of women of reproductive age on maternal mortality, and the Newhints trial assessed the impact of home-visits by lay community health volunteers on neonatal mortality. These trials were supported by 4-weekly home surveillance of women of reproductive age to identify pregnancies, births and infant and maternal deaths. DON was carried out from late January 2008 to early August 2009 and comprised depression assessments in the 4-weekly surveillance visits following identification of pregnancy and in the visits following reporting of a delivery.

Setting

The study area covers a population of about 700,000[11] with more than 120,000 women of reproductive age,[10] and more than 15, 000 births a year. The infant mortality rate is 63/1000 child-years and the neonatal mortality rate is 31/1000 live births.[9] The area is predominantly rural, but has four medium-sized towns (populations of at least 40,000). Access to orthodox mental health services is limited and help for mental ill health is generally provided by traditional healers and spiritual/healing churches.[12]

Participants

Participants were mothers who had a live birth reported between 24th March 2008 and 11th July 2009, who were screened for postnatal depression between four to 12 weeks postpartum, and whose infants survived to this point.

Data Collection

Data was collected through the surveillance system supporting the ObaapaVitA and Newhints trials in which all women of reproductive age were visited every 4 weeks by resident fieldworkers and data collected on pregnancies, births, and deaths.. Background socio-demographic, socio-economic, pregnancy and obstetric history data was collected when a pregnancy was identified, and a pregnancy depression assessment was conducted at the next 4-weekly visit. Information about the pregnancy, delivery, the baby (or babies), and the newborn care practices was collected at the first visit after the birth. A postnatal assessment was carried out at the following 4-weekly visit. Subsequent 4-weekly visits collected data on the infant until their first birthday.

Exposure

Our exposure was probable Diagnostic and Statistical Manual for Mental Disorders, 4th edition (DSM-IV)[13] major or minor depression, ascertained using the Patient Health Questionnaire (PHQ-9)[14] a structured questionnaire that enquires about the occurrence, duration, and intensity of nine symptoms. Symptoms reported as present for at least half the time in the previous two weeks are rated positively. Either depression or anhedonia (loss of interest or pleasure) must be rated, with a total of five or more symptoms for major depression and two to four symptoms for minor depression. In contrast with symptom based scale scores, these criteria therefore identify individuals with persistent and pervasive symptoms, characteristic of a clinically significant depressive episode.

Outcomes

The primary outcome was all-cause early infant mortality expressed per 1000 infant-months of follow up from the time of postnatal assessment to six months of age. The secondary outcomes were a) all-cause infant mortality from the time of postnatal assessment to 12 months of age, and b) reported infant morbidity from the time of the postnatal DON assessment to 12 months of age. Morbidity indicators were: any ill health on the day of visit; any serious illness in the

past month requiring care-seeking outside the home; and occurrence in the past 24 hours of diarrhoea, vomiting, cough, fever and frequent crying.

Potential confounders

A priori potential confounders were: maternal characteristics (age, marital status, education status, occupation, ethnicity, religion and rural or urban residence); pregnancy and obstetric variables (parity, pre-term delivery and mode of delivery); and infant characteristics (sex, and perceived size of baby as a proxy for birth weight). Household wealth status was derived from principal components analysis of 42 questions on household assets, sanitation and household quality indicators[15]. Women were then ranked according to their wealth index, and assigned to wealth quintiles with quintile 1 containing the least wealthy and quintile 5 the wealthiest[16]. Intervention status was not included as prevalence of postnatal depression was comparable in intervention and control arms of the Newhints trial that was postulated to have an impact on postnatal depression.

Statistical Methods

Multiple births were excluded from all analyses. Poisson regression was used to examine the association between postnatal depression and infant mortality, adjusting for a priori potential confounders listed above. In order to account for the possible influence of reverse causality from deaths that occurred close to ascertainment of postnatal depression status, we conducted sensitivity analyses excluding those deaths that occurred firstly within one week and secondly within 30 days after postnatal depression assessment.

Additional analyses compared infant mortality between: women not depressed at either antenatal or postnatal assessments, women depressed only at antenatal assessment, women depressed only at postnatal assessment, and those depressed at both. Kaplan-Meier survivor function was used to plot cumulative infant survival graphs for the four groups from birth until six months of age, excluding any deaths that occurred before the postnatal depression depression assessment.

For the association between postnatal depression and infant morbidity, we used mixed effects repeated measures logistic regression models with random intercept at the infant level, including the same potential confounders mentioned above, plus month of visit. The delta-method was applied to predict risk ratios (RR) with 95% confidence intervals for individuals with zero random effect using the marginal standardization technique[17]. All analyses were conducted using STATA 11.[18]

Ethical Considerations

Ethical approval for the DON study was granted by the ethics committees of the Kintampo Health Research Centre and the London School of Hygiene and Tropical Medicine. Informed consent (by signature or thumbprint) was obtained for each woman. Fieldworkers were trained to alert the principal investigator (WB) if they became concerned that any woman was severely distressed or in danger of harm. Women identified as needing attention were visited by WB, re-assessed and if appropriate encouraged to go to community psychiatric nurses serving the four main towns of the study area for further depression evaluation and treatment.

Role of Funding Source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

9.4 Results

Figure 9·1 summarises the recruitment profile. 21,283 deliveries were identified through 4-weekly surveillance visits between 24th March 2008 and 11th July 2009. Of these, 18,356 mothers (86%) completed the PHQ-9 depression screen after birth (live/still birth) between four and 12 weeks; 1450 (7%) were absent at the screening visit, 208 (1%) women were visited but PHQ-9 was not completed, 1244 (5·8%) were screened but not within four and 12 weeks, and 25 (0·1%) declined to participate. After excluding still births, multiple births, infant deaths that occurred before postnatal depression assessment, and mothers who died after postnatal depression assessment, 17,032 were eligible for analyses. Of these 16,560 (97%) mother-infant pairs had complete information on all potential confounders, contributing 130 infant deaths and 67457·4 infant months of follow up to the analysis. Of these, 12,618 had also been screened for depression during pregnancy.

Only two pregnant women and one recently delivered woman were reported to WB as being of concern by the fieldworker; all were recommended to seek attention from the community psychiatric nurses but none complied.

The prevalence of DSM-IV postnatal depression was 3·5% (n=591) (95% CI, 3·2-3·7). Detailed profile of study participants is provided in a companion paper[19]. In brief, the population was predominantly rural (70%), 90% percent of the mothers were married or cohabiting, and 36% had no formal education.

Postnatal depression and risk of infant death

All-cause infant mortality from the time of postnatal depression assessment up to six months of age (adjusted RR 2·83, 95% CI 1·56-5·13) was almost 3 times higher among infants of

depressed mothers compared to those not depressed, and almost 2-fold up to 12 months of age (adjusted RR 1·79, 95% CI 1·04-3·09) (Table 9·1). The effect to six months was similar when infant deaths occurring within seven days or within 30 days of the date of the postnatal depression assessment were excluded.

Figure 9·2 shows the infant survival curves up to six months of age excluding babies who died before the time of the postnatal depression assessment for four groups of depression. As can be seen survival is lowest for infants of mothers with postnatal depression compared to those with no depression or those with only antenatal depression. This is confirmed by Poisson regression analysis (online table 9·1) which showed that infant mortality among offspring of mothers depressed antenatally but not postnatally was similar to that of offspring of mothers who were not depressed at either assessment point (adjusted RR 1·32, 95% CI 0·68-2·56 p=0·408). In contrast, infant mortality was substantially higher for offspring of mothers with postnatal depression, whether they also had antenatal depression (adjusted RR 3·19, 95% CI 0·99-10·17 p=0·050), or not.

Risk of infant morbidity

Table 9·2 shows increased risks associated with postnatal depression for all infant morbidity indicators. Additional analysis indicated that these increased risks of infant morbidity were also apparent for women with antenatal depression only, although with generally smaller effect sizes than those for either postnatal depression only, or for those with both antenatal and postnatal depression (see online table 9·2).

9.5 Discussion

We found that maternal postnatal depression was associated with subsequent increased risk of infant mortality up to six months and up to 12 months of age, and with increased infant morbidity. Analysis of the separate effects of antenatal and postnatal depression suggests that the postnatal period may be critical for infant survival; the offspring of mothers with antenatal depression who had recovered by the postnatal assessment did not experience an increased mortality risk. In contrast the offspring of mothers with antenatal but not postnatal depression

were also reported as having increased morbidity, although at generally lower levels than those mothers with postnatal depression. We estimate that 63·2% of early infant deaths among depressed mothers are attributable to their depression. This translates to a population attributable fraction of 5·8% of all early infant deaths in the population which has a relatively low prevalence of postnatal depression of 3·5%.

Our results are consistent with recent findings from a large national register linkage study in Taiwan.[5] However, our study is unique in focussing on depression over the immediate postnatal period, and upon infant mortality in the first six months of life. Other strengths are that: we employed a large prospective cohort, measured depression exposure using a validated and standardised tool and encountered few refusals.

Despite the prospective design we cannot exclude respondent bias, particularly an effect of maternal depression upon the mothers' reports of infant morbidity. We also acknowledge the challenges in establishing causality, given the often chronic, remitting and relapsing nature of depression. Further, timing of depression assessments was variable.

There are several possible reasons to explain why postnatal depression may be associated with infant deaths. First we cannot rule out reverse causality in this study. Thus, a mother's depression may have been triggered by their infant's severe or terminal illness, and the subsequent death of the infant may not be confidently attributed to depression. Reassuringly, sensitivity analyses that excluded infant deaths that occurred one week, or four weeks after the depression assessment showed similar findings. Nevertheless, causality can be convincingly demonstrated by a trial showing that treating postnatal depression results in improved infant survival.

Panel: Research in Context

Systematic Review

We searched PubMed with the terms "postnatal depression", "infant mortality", "infant death", "consequences perinatal outcomes", and "infant health" with no time restrictions· We selected only publications in English and assessed the evidence on the basis of the epidemiological quality of the reports.

The evidence pertaining to the impact of maternal postnatal depression on child survival is limited and thus inconclusive as only two cohort studies from Taiwan showing strong evidence of association and another from Ethiopia showing borderline significance, are reported. In both studies the impact of maternal depression in the year after birth was assessed. No studies to date appear to have assessed the impact of depression in the immediate postnatal period upon infant mortality in the first year of life.

Interpretation

This large population based study shows that a higher mortality in infants is associated with depression in the immediate postnatal period. Though unique in methodology, our study compares with previous linkage and cohort studies in Taiwan and Ethiopia, thus reinforces the evidence of association between maternal depression and child mortality. Our findings show that in terms of perinatal mental health, postnatal depression, rather than antenatal depression is the main risk factor for infant deaths in low and middle income settings and infant illness may explain this association.

However, the strong and independent associations with morbidity observed in this report and by other authors in Africa,[20] south Asia,[21, 22] and HIC[23, 24] provide evidence of the biological plausibility to our findings. Potential mechanisms include: poor mother-infant interaction,[25] reduced stimulation,[26] inability to prevent injuries,[27, 28]and poor adherence to child survival interventions[21, 29] including childhood immunisations,[22] good hygiene behaviours such as hand-washing before feeding and safe food preparation and storage,[30] and prompt care-seeking for childhood illnesses.[1]

Our study is the first large population-based cohort from sub-Saharan Africa to investigate the association between postnatal depression and infant survival, supported by a plausible mechanism indicated by associations with infant illness. We have reported robust findings of public health significance, but would encourage further testing of this hypothesis in other

settings to improve the external validity of our findings. In the meantime, there is a strong case to intervene in mothers who are depressed. Aside from the effect upon infants the disorder has been shown to be associated with considerable disability and reduced quality of life for the mother[31], and affects the family[32]. Our findings provide support for the detection and treatment of clinically significant depression in the postnatal period, and re-echoes the call to address maternal depression as a human rights issue needing urgent attention.[33]

Evidence for the successful integration of mental health in primary care using lay community human resources abounds,[1, 34, 35] and models for scale up have been provided by the World Health Organisation through its Mental Health Gap Action Programme (mhGAP).[36] The mhGAP primary care guidelines on tackling perinatal depression require that antidepressants should be avoided as far as practicable, but recommend as a first step the need to address psychosocial stressors and reactivate social networks through psychological and psychosocial interventions such as interpersonal psychotherapy, behavioural activation, or cognitive behavioural therapy, in addition to an effective referral and supervision support from specialists.

We recommend that trials are urgently needed to evaluate the impact of different strategies to tackle postnatal depression. We further recommend that these trials should include infant mortality as an outcome to clarify whether the association found is causal, and to test whether treating postnatal depression in conjunction with improving the care-giving environment as is suggested by other authors[37], leads to improved infant survival. Tackling postnatal depression may therefore have a role to play in achieving the millennium development goal for child survival as well as being essential for optimal child development.

Acknowledgements:

We thank the women who consented to be part of this study and for their time. The surveillance team who collected and supervised the collection of the data are duly commended for their hard work. We also want to thank the mental health unit of the Kintampo Health Research Centre for their role in training field staff.

Authors' Contribution

WB conducted all analysis and wrote the paper with input from MP and BRK, and later reviewed by all authors. WB, MP, and BRK designed the study. WB, GTA, SS, and OA conducted the study. SS and LG managed the data and conducted some of the analyses.

Conflict of Interest

All authors declare they have no conflict of interest in the development of this report.

Figure 9·1: Flow Chart on Postnatal Depression Screening within Cohort.

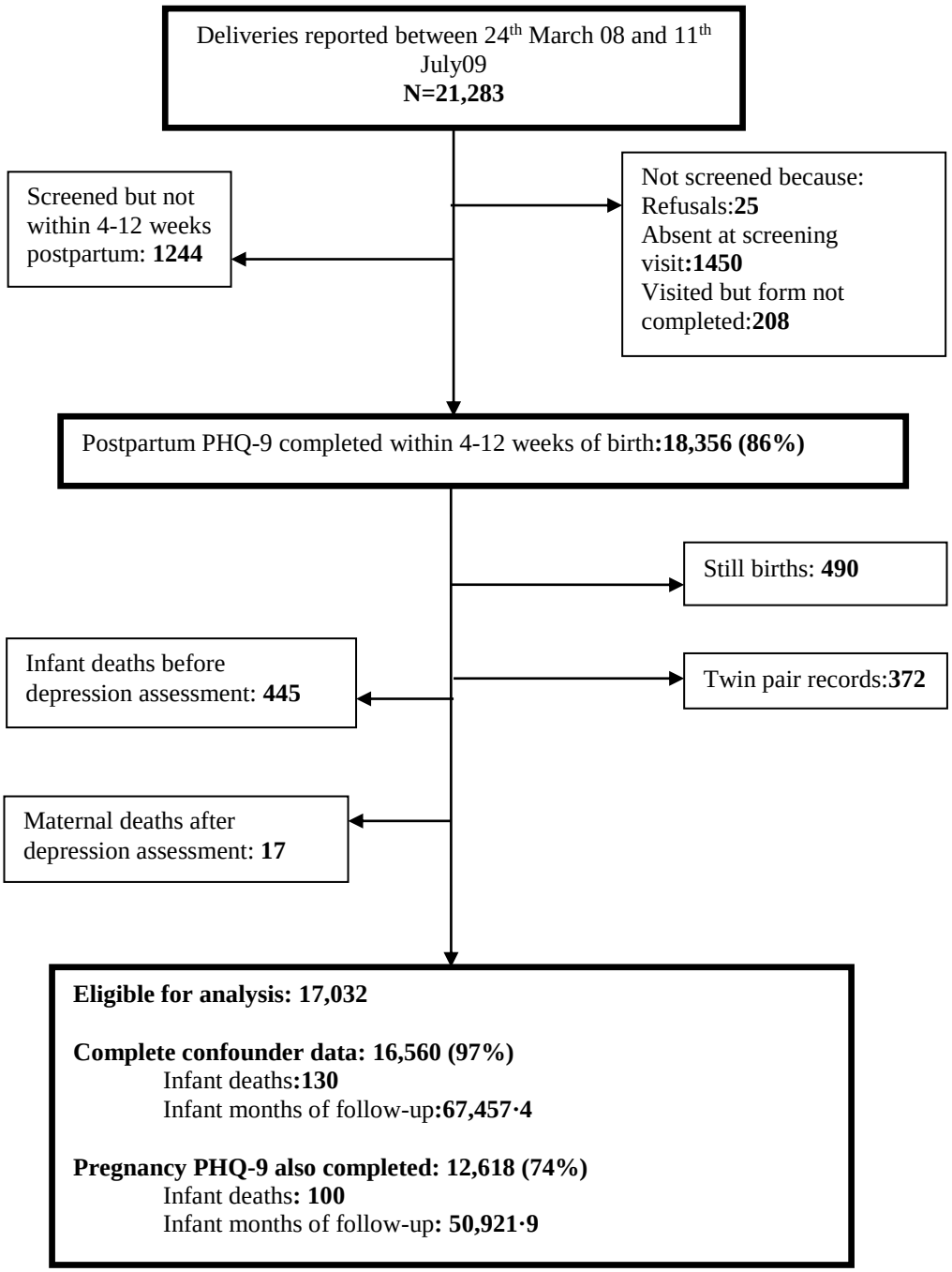
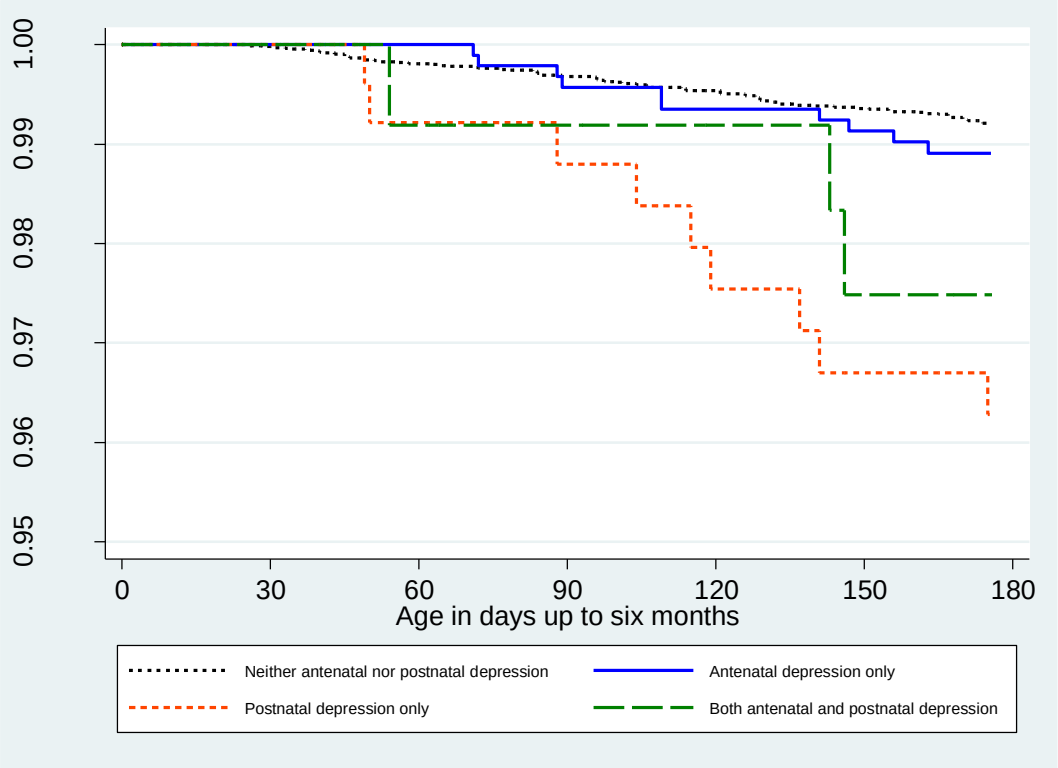


Figure 9·2: Child Survival by Presence of Antenatal and/or Postnatal Depression up to Six Months of Age, Restricted to Babies Alive at the Time of the Postnatal Depression Assessment.



Postnatal depression	*No· Infants (n)	Total infant months of follow up	Infant deaths	Incidence mortality rate(per 1000 infant months)	Crude Rate Ratio (95% CI)	‡Adjusted Rate Ratio (95% CI)	p-value
Infant mortality from time of postnatal depression assessment to 6 months of age							
Not depressed	15995	65081·4	118	1·86	1	1	0·001
Depressed	565	2376·1	12	5·28	2·83 (1·56-5·13)	2·83 (1·56-5·16)	
Infant mortality from time of postnatal depression assessment to 12 months of age							
Not depressed	15995	110587·8	198	1·79			0·035
Depressed	565	4158·3	14	3·36	1·88 (1·09-3·23)	1·79 (1·04-3·09)	
Infant mortality from 7 days after postnatal depression assessment to 6 months of age							
Not depressed	15989	63336·9	112	1·77	1	1	0·002
Depressed	564	2269·3	11	4·85	2·74 (1·47-5·09)	2·73 (1·46-5·09)	
Infant mortality from 30 days after postnatal depression assessment to 6 months of age							
Not depressed group	15959	63198·4	82	1·29	1	1	0·001
Depressed group	562	2259·9	9	3·98	3·07 (1·54-6·11)	3·17 (1·58-6·34)	
*Infants at postnatal depression assessment							
‡ adjusted for: mother's age, education, marital status, wealth quintile, ethnicity, religion, area of residence, parity, early parturition, mode of delivery, perceived size of baby.							

Table 9·1:Association of Postnatal Depression with Infant Mortality.

Outcome	*Number of infants	Number of visits (n)	†% of visits	Crude Risk Ratio (95% CI)	‡Adjusted Risk Ratio (95% CI)	p-value
Any ill health on day of visit						
Not depressed	15986	112233	12·7	1	1	<0·001
Depressed	564	4101	21·5	1·90 (1·69 - 2·10)	1·70 (1·53 - 1·88)	
Any serious illness in past month requiring care-seeking						
Not depressed	15986	112230	11·7	1	1	<0·001
Depressed	564	4101	14·6	1·35 (1·20 - 1·50)	1.34 (1.19 - 1.49)	
¶Diarrhoea within past 24 hours						
Not depressed group	9875	47877	6·4	1	1	<0·001
Depressed group	391	1991	12·1	2·17 (1·73 - 2·60)	1·80 (1·45 - 2·14)	
¶Vomiting within past 24 hours						
Not depressed group	8395	8395	4·6	1	1	0·007
Depressed group	304	304	9·9	2·15 (1·39 - 2·91)	1·98 (1·26 - 2·71)	
¶Fever within past 24 hours						
Not depressed group	9875	47878	8·5	1	1	<0·001
Depressed group	391	1991	15·0	2·10 (1·72 - 2·47)	1·80 (1·49 - 2·11)	
¶Cough within past 24 hours						
Not depressed group	9875	47877	14·0	1	1	<0·001
Depressed group	391	1991	20·2	1·60 (1·36 - 1·84)	1·49 (1·28 - 1·70)	
¶Persistent crying within past 24 hours						
Not depressed group	8396	8396	3·4	1	1	0.003
Depressed group	304	304	9·2	2·72 (1·71 - 3·73)	2·46 (1·48 - 3·43)	

*Number of infants who survived till mother's postnatal depression assessment.

¶Based on approximately two month's worth of data.

†Following postnatal depression assessment, at which the infant morbidity outcome was reported as having occurred in the previous 24 hours up to 12 months.

‡ adjusted for: mother's age, education, marital status, wealth quintile, ethnicity, religion, area of residence, parity, early parturition, mode of delivery, perceived size of baby.

Table 9·2: Association Between Maternal Postnatal Depression and Infant Morbidity.

Course of depression across perinatal period	*Number of infants (n)	Total infant months of follow up	Infant deaths	Incidence/1000 infant months	Crude Rate Ratio (95% CI)	‡Adjusted Rate Ratio (95% CI)	p-value
Not depressed at either assessment point	11162	43959·0	78	1·77	1	1	
Depressed at antenatal assessment only	1056	4150·9	10	2·41	1·36 (0·70-2·62)	1·32 (0·68-2·56)	0.408
Depressed at postnatal assessment only	262	1069·9	9	8·41	4·74 (2·38-9·45)	4·80 (2·39-9·63)	<0.001
Depressed at both assessment points	138	534·1	3	5·62	3·16 (0·99-10·03)	3·19 (0·99-10·17)	0.050
Total	12618	49713·9	100				

*Infants of mothers assessed both during pregnancy and postnatally.

‡ adjusted for: mother's age, education, marital status, wealth quintile, ethnicity, religion, area of residence, parity, early parturition, mode of delivery, perceived size of baby.

Online Table 9·1: Effect of Antenatal and/or Postnatal depression on Infant Mortality Up to Six Months

Course of depression across perinatal period	*Number of infants	Number of visits (n)	†% of visits	Crude Relative Risk (95% CI)	‡Adjusted Relative Risk (95% CI)	p-value
Any ill health on day of visit						
Not depressed at either assessment point	11160	72332	11·1	1	1	
Depressed at antenatal assessment only	1056	7120	16·1	1·54 (1·39 - 1·68)	1·43 (1·30 - 1·55)	<0·001
Depressed at postnatal assessment only	262	1710	18·1	1·78 (1·47 - 2·08)	1·63 (1·36 - 1·89)	<0·001
Depressed at both assessment points	138	909	21·8	2·26 (1·77 - 2·75)	1·98 (1·57 - 2·38)	<0·001
Any serious illness in past month requiring care-seeking						
Not depressed at either assessment point	11160	72330	11·4	1	1	
Depressed at antenatal assessment only	1056	7120	14·1	1·27 (1·16 - 1·39)	1·25 (1·14 - 1·35)	<0·001
Depressed at postnatal assessment only	262	1710	16·8	1·55 (1·31 - 1·79)	1·54 (1·29 - 1·78)	<0·001
Depressed at both assessment points	138	949	14·9	1·41 (1·09 - 1·72)	1·39 (1·08 - 1·69)	0·014
¶Diarrhoea within past 24 hours						
Not depressed at either assessment point	6282	25799	5·9	1	1	
Depressed at antenatal assessment only	646	2862	8·3	1·53 (1·23 - 1·82)	1·41 (1·14 - 1·67)	0·003
Depressed at postnatal assessment only	161	633	12·8	2·55 (1·69 - 3·40)	2·14 (1·44 - 2·84)	<0·001
Depressed at both assessment points	86	389	14·7	2·89 (1·68 - 4·09)	2·34 (1·39 - 3·29)	0·006
Vomiting within past 24 hours						
Not depressed at either assessment point	5510	5510	4·2	1	1	
Depressed at antenatal assessment only	544	544	8·1	1·92 (1·33 - 2·52)	1·71 (1·15 - 2·26)	0·012
Depressed at postnatal assessment only	127	127	11·0	2·62 (1·28 - 3·95)	2·51 (1·19 - 3·83)	0·025
Depressed at both assessment points	72	72	9·7	2·31 (0·66 - 3·96)	1·97 (0·53 - 3·41)	0·187
Fever within past 24 hours						
Not depressed at either assessment point	5510	5510	8·9	1	1	
Depressed at antenatal assessment only	544	544	13·9	1·58 (1·16 - 2·00)	1·45 (1·10 - 1·79)	0·011
Depressed at postnatal assessment only	127	127	19·7	2·26 (1·23 - 3·29)	1·96 (1·20 - 2·72)	0·013
Depressed at both assessment points	72	72	11·1	1·25 (0·40 - 2·10)	1·13 (0·39 - 1·87)	0·723
¶Cough within past 24 hours						
Not depressed at either assessment point	6282	25799	13·6	1	1	
Depressed at antenatal assessment only	646	2862	18·9	1·48 (1·28 - 1·68)	1·40 (1·23 - 1·58)	<0.001
Depressed at postnatal assessment only	161	633	20·9	1·71 (1·27 - 2·14)	1·57 (1·19 - 1·94)	0.003
Depressed at both assessment points	86	389	22·6	1·93 (1·33 - 2·53)	1·71 (1·21 - 2·22)	0.005
¶Persistent crying within past 24 hours						
Not depressed at either assessment point	5510	5510	3·3	1	1	

Depressed at antenatal assessment only	544	544	4·8	1·45 (0·87 - 2·04)	1·35 (0·80 - 1·90)	0.212
Depressed at postnatal assessment only	127	127	10·2	3·12 (1·45 - 4·78)	2·85 (1·27 - 4·42)	0·022
Depressed at both assessment points	72	72	8·3	2·54 (0·56 - 4·51)	2·35 (0·47 - 4·23)	0·160

*Number of infants who survived till postnatal depression assessment and whose mothers were assessed also at pregnancy

¶Based on approximately two month's worth of data.

†Following postnatal depression assessment, at which the infant morbidity outcome was reported as having occurred in the previous 24 hours up to 12 months. ‡ adjusted for: mother's age, education, marital status, wealth quintile, ethnicity, religion, area of residence, parity, early parturition, mode of delivery, perceived size of baby, sex of baby.

Online Table 9·2: Association Between Antenatal and/or Postnatal depression and Infant Morbidity

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10. Chapter 10- Research Paper 5: Impact of the 'Newhints' Home visits Intervention Trial on Postnatal Depression in Rural Ghana.

Cover sheet for each 'research paper' included in a research thesis

13. For a 'research paper' already published

13.1. Where was the work published? _____N/A_____

13.2. When was the work published? _____N/A_____

13.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion

_____N/A_____

13.3. Was the work subject to academic peer review? ___N/A_____

13.4. Have you retained the copyright for the work? __N/A___

If yes, attach evidence of retention

If no, or if the work is being included in its published format, attach evidence of permission from copyright holder (publisher or other author) to include work

14. For a 'research paper' prepared for publication but not yet published

14.1. Where is the work intended to be published? **British Medical Journal**

14.2. List the paper's authors in the intended authorship order

[*]Benedict Weobong, Alexander Manu, Augustinus HA ten Asbroek, Seyi Soremekun, Thomas Gyan, Samuel Danso, Seeba Amenga-Etego, Martin Prince, Charlotte Tawiah-Agyemang, Seth Owusu-Agyei, Zelee Hill ,Betty R. Kirkwood

Stage of publication – **Not yet submitted**

15. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

The candidate had a major role in all aspects of the DON study including conceptualisation, design, and conduct. He carried out all analyses and was responsible for writing this paper.

Candidate's signature _____

Supervisor or senior author's signature to confirm role as stated in (3) 

10.1 Abstract

Background: Although the evidence for the use of psychological therapies rather than pharmacological approaches for the treatment of postnatal depression (PND) is becoming strong and preferred, only six trials including four in low and middle income settings have tested community-based approaches to prevent postnatal depression (three based on home visits, and one on women's groups); the evidence of impact has been inconclusive. We therefore included PND as a secondary outcome in the Newhints trial in Ghana of the impact of home visits on newborn deaths.

Methods: Newhints is a cluster randomised controlled trial involving 98 supervisory zones; 49 zones were randomised to receive the Newhints intervention, and 49 to act as controls. Volunteers in Newhints zones were trained to make two home-visits during pregnancy and three within the first week of birth to counsel and problem solve on key newborn care practices and to assess and refer sick babies. A random subset of women were screened at pregnancy and 4-12 weeks after birth with the depression module of the Patient Health Questionnaire (PHQ-9). Analysis was by intention to treat (ITT) using random effects logistic regression to account for the clustered design. Effect sizes are reported as risk ratios with 95% confidence intervals.

Results: 7495 recently delivered women were screened for PND. Sixty-seven percent of women in the Newhints zones received at least one visit during pregnancy and 62% at least one after birth. The prevalence of PND was 3.3% in both Newhints and control zones; the risk ratio (RR) adjusting for the clustered design was 0.99 (95% CI 0.65, 1.50; p=0.96).

Conclusion: The Newhints home visits intervention had no impact on PND in Ghana, although the home visits approach contained psycho-educational elements of Cognitive Behavioural Therapy. Preventive interventions that include targeted approaches for 'at-risk' women are more likely to be effective in preventing the PND.

10.2 Introduction

Postnatal depression has gained increasing recognition as a condition of public health concern because of its high prevalence[1, 2] and potential adverse consequences on: infant mortality[3], growth and development [4, 5]. Interventions to reduce postnatal depression may therefore have a role to play in achieving the child survival millennium development goal. However, although the evidence for the use of psychological therapies rather than pharmacological approaches for the treatment of postnatal depression is becoming strong and preferred[6-8], preventive trials are relatively few[9] and the evidence for their effectiveness is weak[10]. Most are clinic-based.

To date only six trials including four in low and middle income settings have tested community-based approaches to prevent postnatal depression (three of home-visits, and one of women's groups), and the evidence of impact has been inconclusive. In South Africa, supportive guidance in parenting by lay women home-visitors to women in the last trimester of their pregnancy, visited twice during pregnancy and weekly for the first eight weeks postpartum, had no impact on prevalence of depressive disorder at six months, but did reduce maternal depressed mood (symptom score)[11] . Similarly, in India (Goa), two supportive home-visits at pregnancy and three in the postpartum period targeted at pregnant women (approximately 32 and 36 weeks' gestation) at risk of postnatal depression, delivered by an experienced mother, did not prevent postnatal depression[12]. An improvement in maternal depressive symptoms was however reported in a home-visits intervention in Jamaica, targeting child rearing and parenting self-esteem among mothers of undernourished children[13]. Similarly a women's group intervention aimed at reducing neonatal mortality in India (Jharkhand and Orissa), reduced moderate postnatal depression by 57% but only in the third year of implementation[14]. Community-based interventions in high income countries also suggest similar inconclusive evidence; improvement in mental health in a US-based trial[15], and no benefit in two UK-based trials[16, 17]. In contrast community-based interventions using cognitive behavioural therapy in rural Pakistan[8] and a combination of psychoeducation, treatment adherence support, and pharmacotherapy approaches in Chile[18] are effective in treating symptoms of postnatal depression.

In this paper, we present results of the impact of the 'Newhints' home-visits intervention on postnatal depression in a predominantly rural population in Ghana[19]. The 'Newhints' intervention involved home-visits to pregnant and recently delivered mothers to promote newborn care practices, and to assess and refer sick babies. It used a story-telling and problem-solving approach delivered by community volunteers. The primary outcomes for the trial were newborn care practices and neonatal mortality. We postulated that this intervention might have an impact on postnatal depression as well.

10.3 Materials and Methods

Trial Design

The Newhints was a cluster randomised controlled trial conducted in seven contiguous districts of the Brong Ahafo region of Ghana. The study area covers a population of about 700,000 (GHS pooled data up to 2011)[20] with more than 120,000 women of reproductive age, and about15,000 births a year. The neonatal mortality rate was 32/1000 live births at baseline[21]. With only four community psychiatric nurses stationed in the big towns, psychiatric services are inadequate and people with mental illness often seek help from traditional/spiritual sources[22]. Details of the trial design and intervention are given in the published trial protocol[19].

The clusters were supervisory zones of between 8-12 community based surveillance volunteers (CBSVs). CBSVs were an existing cadre of volunteers who assist the district health management team with registration of births, mobilisation of the community for activities such as national immunisation days, registration of deaths, and with community child welfare outreach clinics. They had varied literacy competencies ranging from no education to high school graduates. In all there were 98 Newhints zones; 49 zones were randomised to receive the intervention and the other half acted as controls.

Intervention and Control Package

The 'Newhints' intervention is an integrated package developed after extensive formative research[23]. CBSVs in 'Newhints' intervention zones were trained to make five home visits; two during pregnancy and three within the first week after birth. They were trained in providing supportive counselling, and establishing and maintaining rapport. At each visit, the CBSV provided directive counselling on essential newborn care practices, and problem-solved around any barriers the mother/family perceived in carrying out a behaviour using a story-telling approach. In a typical visit, the CBSV showed a set of counselling cards with pictures, specific to the theme of each visit and would first ask the mother/family their interpretation of the card. Following this, the CBSV then explained the message behind the card using a story-telling approach after which the CBSV checked with the mother/family if they were able to carry out the behaviour conveyed by the card. At this point, the CBSV either provided appropriate praise and encouragement when the mother/family agrees to carry out the behaviour, or helped the mother/family to identify practical solutions to any perceived barriers that could hinder the adoption of the behaviour targeted. This process was repeated at each visit and in addition, at subsequent visits, the CBSV checked if the behaviours had been carried out and continued the process of problem-solving. At each postnatal visit, the CBSV also assessed the baby for danger signs and referred if any were present. Newhints CBSVs received monetary incentives of GH¢ 5 (approximately $5 at the time) per month. Full implementation was achieved by end of October 2008.

Pregnant women and their babies in the control zones continued to benefit from routine maternal and child health (MCH) care services available at the period of the trial, and 4-weekly visits by resident field workers. This included: antenatal care (ANC), Infant Welfare Clinics (IWC), access to free delivery and care (if signed up to the government's health insurance and free maternal care policy), and routine interactions with CBSVs concerning outreach MCH and immunisation clinics.

Depression Sub-study

The DON sub-study was set-up to evaluate the impact of the home-visits on postnatal depression, and included all pregnancies that ended in a live or stillbirth between 1st November 2008 (the month after 'Newhints' training was completed) and 11th July 2009. The evaluation was based on women who were screened for both antenatal and postnatal depression, the latter within four and 12 weeks postpartum.

Data Collection

Data collection was carried out by locally resident field workers (FWs) through 4-weekly surveillance visits. They were trained and supervised to administer the Patient Health Questionnaire (PHQ-9) antenatally at the 4-weekly surveillance visit following ascertainment of pregnancy and at the surveillance visit after the birth was reported. By design, postnatal depression screening by FWs followed home visits by CBSVs and were conducted independent and blind of each other.

Background socio-demographic and socio-economic characteristics were collected at pregnancy ascertainment on marital status, maternal education, maternal age, maternal occupation, and a range of household assets. The latter were used to construct a wealth index of the household derived from principal components analysis of 42 questions on household assets, sanitation and household quality indicators[24]. Women were then ranked according to their wealth index, and assigned to wealth quintiles with quintile 1 containing the least wealthy and quintile 5 the wealthiest[25].

Outcomes

Major or minor postnatal depression was defined by the Diagnostic and Statistical Manual for Mental Disorders, 4th edition (DSM-IV), as a total of two or more symptoms on the PHQ-9, one of which must either be depression or anhedonia (loss of interest or pleasure). The PHQ-9 is one of few screening tools that enquires about the nine symptom based criteria for the diagnosis of DSM-IV depression, including duration and severity. Only symptoms that have been persistent and pervasive within a two-week period are rated. For major depression, either depression or

anhedonia (loss of interest or pleasure) must be rated, with a total of five or more symptoms. And for minor depression two to four symptoms must be rated. In contrast with other symptom based scale scores, these criteria identify characteristics of a clinically significant depressive episode. We had previously validated the PHQ-9 in the same setting against the gold standard of a local clinician's structured clinical diagnosis[26].

Ethical Considerations

Ethical approval for the Newhints trial and the depression sub-study was granted by the ethics committees of the Kintampo Health Research Centre and the London School of Hygiene and Tropical Medicine. The trial is registered on www.clinicaltrials.gov (identifier NCT00623337)[27]. Informed consent was obtained from trial participants through a signature or thumb print, in the presence of a witness.

Statistical Methods

We carried out random effects logistic regression to account for the cluster-randomised design in an intention to treat (ITT) analysis, where ITT is defined by a woman's zone of residence. We also repeated the analysis restricted to women who were depressed during pregnancy to assess whether Newhints intervention may be able to reduce this risk as they have a high risk of depression continuing into the postnatal period. Effect sizes are reported as relative risks with 95% confidence intervals and p-values, estimated using the marginal standardization technique with the 95% confidence intervals for the ratios estimated via the delta method[28]. Analyses were conducted using STATA 11[29].

10.4 Results

Figure 10.1 shows the trial profile. The 'Newhints' evaluation cohort comprised 16,329 deliveries. 6,637 of these took place after depression assessments ended in July 2009, thus 9,692 (59.2%) had postpartum visits that were scheduled for postnatal depression screening. Out of these, 8,470 (87.9%) completed the PHQ-9 within 4-12 weeks, and only four (0.04%) declined to participate. Among those who completed the postpartum PHQ-9, 7495 (88.0%) were also screened during pregnancy. **Table 10.2** shows that women in the intervention and control arms in the depression sub-study were similar. The majority resided in rural (70%) areas, most were educated (62%), and almost all (90%) were either married or cohabiting. 67% of women were visited at least once by CBSVs during pregnancy and 62% were visited at least once within the first week of birth[21].

Table 10.3 shows that there was more antenatal depression than postnatal depression, though similar at baseline in each cohort. **Table 10.4** shows there was no evidence of benefit of the intervention on postnatal depression after adjusting for clustering; adjusted risk ratio (RR) 0.99 (95% CI 0.65, 1.50; p=0.96). We also found no evidence of an impact on the risk of postnatal depression among those depressed during pregnancy; adjusted RR 1.05 (95% CI 0.65, 1.72; p=0.83).

10.5 Discussion

The 'Newhints' home-visits intervention had no impact on DSM-IV major or minor postnatal depression among recently delivered mothers in a predominantly rural population in Ghana. Although this intervention was not specifically designed as a mental health intervention, the home-visits contained psycho-educational elements of Cognitive Behavioural Therapy (CBT). The mechanism by which home visits may be expected to improve mental health is that home visits are known to improve the quality of the home environment, parenting skills and uptake of childhood immunizations[30], and self-efficacy[31] which are catalysts for assured mental well-being. In addition our evaluation took place immediately after full implementation was achieved, and we were only able to evaluate the impact on depression in the immediate postnatal period (4-12 weeks), and any benefits may not have accrued within this relatively short period. This may explain why two previous trials: a home-visits intervention by paraprofessionals in Denver Colorado, USA and women's groups intervention in Jharkand, India improved the mental health of mothers after two years following intervention implementation[14, 15]. Further, though visit coverage based on at least one home-visit after birth was relatively high (63%), this did not appear to be an important factor for preventing postnatal depression. Lastly, arguments for the impact of floor effects due to our relatively low prevalence of postnatal depression may equally be tenable in our setting.

We acknowledge some limitations in our study: timing of assessment of outcome of postnatal depression was variable; however this was similar in Newhints and control arms. We also note that women had regular 4-weekly visits from resident fieldworkers enquiring about the pregnancy, the birth, and the health of the infant; these visits that may have resulted in important friendship bonds and rapport, in themselves may have had a positive benefit on the mental well-being of women in both Newhints and control arms, and potentially subdued any additional impact of CBSV home-visits on the risk of depression.

Nevertheless, this finding of no benefit is consistent with reports from other trials conducted in South Africa[11] , the United Kingdom[16, 17] and India[12], involving the use of lay home-visitors. In addition findings from Cochrane reviews suggest that overall psychosocial/psychological

interventions do not stop the development of postnatal depression, though studies that provided intensive postpartum professional support, targeted 'at-risk' women, were individual-based as opposed to group, or had only a postnatal component, were more effective in preventing postnatal depression[10].

In contrast, there is evidence suggesting that psychosocial and psychological interventions are not only an effective treatment option for women suffering from postnatal depression at least in the short term[8, 32], but are also efficacious in treating general depression in women in low income settings[18].

In sum, further efforts are required to identify effective prevention approaches as there is: 1) increasing evidence of the pervasive impact of postnatal depression on the health-related quality of life of the mother[33] and child survival[3, 34, 35] ; 2) prevention is better than cure particularly because of the delicate nature of the postnatal period, and the safety concerns regarding the use of antidepressants during breastfeeding, coupled with the relative cost of scaling up psychological interventions. Preventive interventions that include targeted approaches for 'at-risk' women or those who experience a difficult delivery or have a severely ill baby are more likely to be effective in preventing the onset of postnatal depression. Stepped care models may be appropriate in such cases, starting with psychosocial/psychological treatment and advice, avoiding antidepressant treatment as much as possible, as recommended in the WHO mental health gap action programme guidelines (mhGAP-IG)[36].

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Figure 10.1:Trial Profile

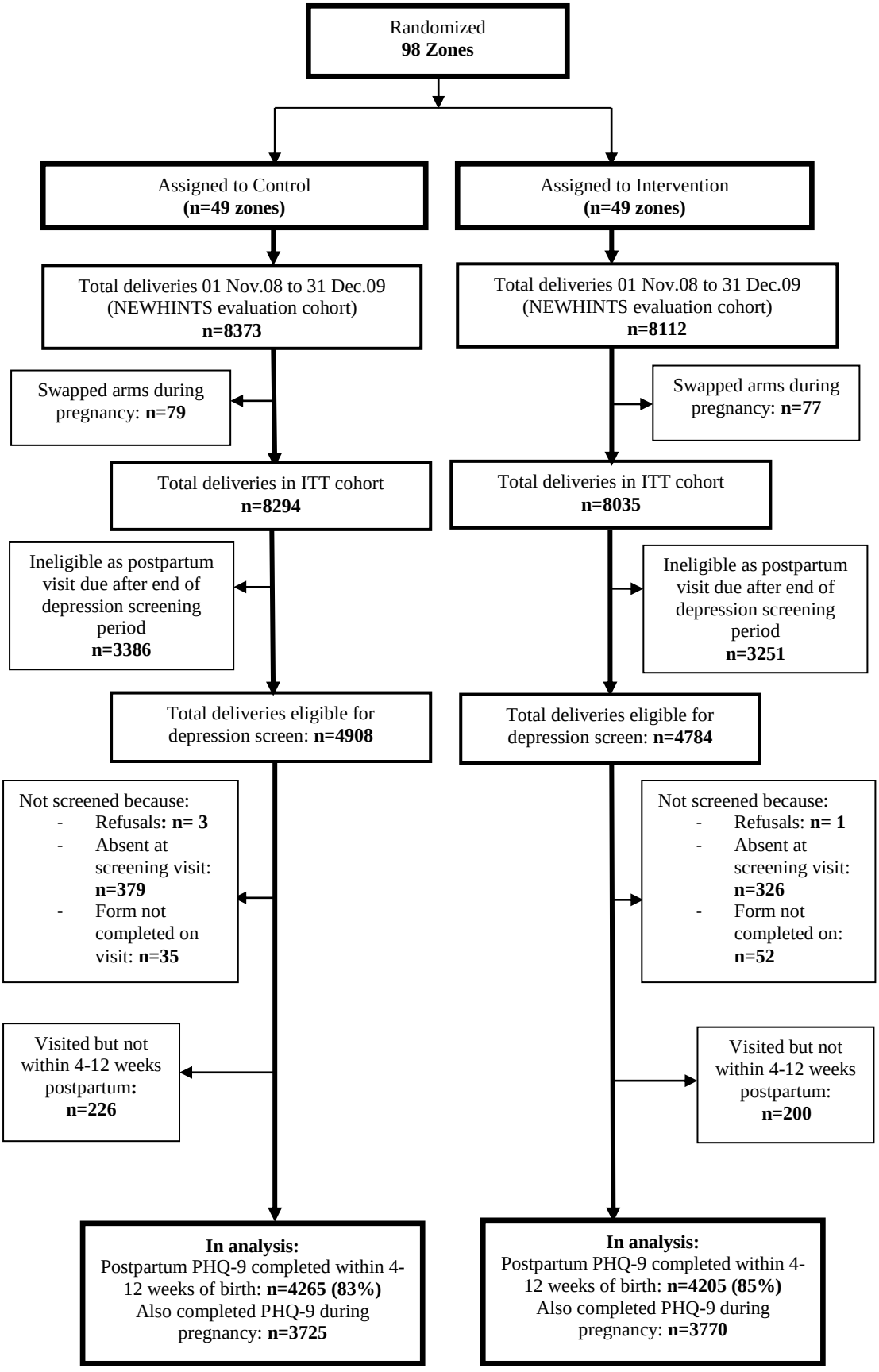

Table 10.1: Selected Trials Assessing the Effect of Community-based Interventions on Perinatal Depression

Region/type of study	Intervention/content	Study population	Levels in comparison group	Impact status
Preventive				
Africa/Asia				
Cooper et al. 2009 –RCT (South Africa)	Preventative support and guidance in parenting by lay women home-visitors	Pregnant women	15.8% at 6 months postpartum (SCID)	1. No significant reduction in prevalence of depressive disorder (X^2=0.85, p=0.36) at 6 months (12.4%). 2. Reduced maternal depressed mood (symptom score) (z=2.05, p=0.04) at 6 months (2.78%)
Hughes et al. 2009-RCT (India)	Supportive home-visits delivered by an experienced mother	Pregnant women at risk of postpartum depression	7.7% at 3 months postpartum(EPDS)	7.8% at 3 months postpartum(EPDS)
Tripathy et al. 2010-RCT (India)	Participatory action and learning on strategies to address maternal and newborn health problems through Women's groups.	Recently delivered women, 6 weeks after birth	10% at year 3 (K10)	1.57% reduction in moderate depression at year 3 (OR 0.43 95% CI 0.23-0.80) 2. No significant reduction in severe depression at year 3
HIC				
Barnes et al. 2009- Crct (UK)	Preventative informal support to parents on child care and parenting advice (Home-Start scheme-UK) by lay health worker visitors	Pregnant women	Incidence of minor/major depression (26.1%) (SCID/EPDS)	Authors report no impact on reducing incidence of minor/major depression in the supported group (32.6%), though no test of significance was reported.
Ngai et al. 2009- Quasi experiment (Hong Kong)	Childbirth psycho-education by health professionals	Pregnant women	Mean of depressive symptoms at 6 months postpartum: [7.6 (SD=4.5)] (EPDS)	Lower mean of depressive symptoms at 6 months postpartum: [(5.8, p=0.01) (SD=4.0)]
Olds et al. 2004-RCT (USA)	Preventative promotion of adaptive health behaviours and social support by paraprofessionals home-visits	Pregnant women	Mental health scores (101.2) (Psychological resources composite scale)	Paraprofessional home-visits associated with improved maternal mental health scores (99.2; p=0.03)
Wiggins et al. 2004-RCT (UK)	Preventative supportive listening by lay health home-visitors	Women with deliveries within first 9 months	Prevalence of depression at 12 and 18 months (30%) (EPDS)	No impact on reducing postnatal depression (28%) at 12 and 18 months (RR=0.86 CI 0.62 to 1.19).
Treatment				
Africa/Asia				
Rahman et al.2008- RCT (Pakistan)	Cognitive behaviour therapy (CBT)-based by lay lady home-visitors	Depressed women in third trimester	1. 53% at 6 months postpartum (SCID) 2. 59% at 12 months	1. Significantly lower prevalence of major depression (23%)at 6 (OR=0.22, CI 0.14-0.36) months postpartum 2. Significantly lower prevalence of major depression (27%) 12 (OR=0.23, CI 0.15-0.36) months postpartum
HIC				
Milgrom et al. 2005-RCT (Australia)	Group CBT, compared to group counselling and to individual counselling	Depressed mothers at 6-8 weeks postpartum	Mean EPDS score (16.6)	Data too few to analyse, but mean depression scores following CBT was 12.2, thus reduced by 4 points.
Dennis et al. 2003-Pilot RCT (Canada)	Standard community services plus peer volunteer mother to provide support via the telephone	Depressed mothers postpartum	Prevalence of depression at 9 months (52.4%-EPDS))	Significant improvement in depression (15%) at 9 months following a 2 month follow up
Sharp et al. 2010-RCT	Compared anti-depressant to community-based psychosocial non-directive counselling	First 6 postnatal months		Anti-depressant: 45% improvement Psychosocial: 20% improvement; OR [3.4 95% CI 1.8 to 6.5]

Table 10.2: Socio-demographic/socio-economic Categorical Characteristics of Trial Participants in Depression Sub-study.

Characteristic	Control zones	Newhints zones
Recently delivered women with both pregnancy and postpartum PHQ-9 data	3,725	3,770
Age group		
15-19	11.0%	10.9%
20-29	51.3%	51.9%
30+	37.6%	36.8%
No data	0.3%	0.3%
Marital status		
Married	59.9%	56.5%
Living together	30.1%	35.1%
Widow/ divorced/separated	2.3%	2.6%
Single, unmarried	7.4%	5.5%
No data	0.3%	0.3%
Highest educational level reached		
Sec/post-secondary	5.9%	5.9%
Pre-secondary	36.5%	38.8%
Primary	20.1%	21.9%
None	37.1%	33.0%
No data	0.4%	0.3%
Works outside the home		
Yes	73.0%	70.8%
No	26.7%	28.9%
No data	0.3%	0.3%
Wealth quintile		
1st (least wealthy)	20.0%	19.7%
2nd	22.0%	20.0%
3rd	19.4%	21.6%
4th	18.1%	20.4%
5th (wealthiest)	19.7%	17.2%
No data	0.8%	1.0%
Religion		
Catholic	21.2%	21.7%
Protestant	45.6%	46.4%
Muslim	25.7%	22.8%
Traditional/other	6.9%	8.3%
No data	0.5%	0.8%
Place of residence		
Urban	31.5%	26.6%
Rural	68.5%	73.4%

*percentages may not add up to 100 because of rounding

Table 10.3: Baseline Estimates of Perinatal Depression†

Depression	N(% depressed)	N(% depressed)
	Control Zones	Newhints Zones
Antenatal depression	260/2369 (10.9)	270/2360 (11.4)
Postnatal depression	81/2369 (3.4)	83/2360 (3.5)

† Baseline postnatal depression was estimated from data collected during the run-in period (January 2008-October 2008) of the trial.

Table 10.4: Effect of Home-visits on DSM-IV Major/Minor Postnatal Depression Among Recently Delivered Women (ITT)

Outcome	N(% depressed)	N(% depressed)	Crude Relative Risk (95% CI)	†Adjusted Relative Risk (95% CI)	p-value
	Control Zones	Newhints Zones			
Postnatal depression	3725 (3.3)	3770 (3.3)	1.00 (0.78,1.28)	0.99 (0.65,1.50)	0.96

†adjusted for clustering.

10.6 References to Chapter 10

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Section D

11. Chapter 11: Summary, Conclusions, and Implications

11.1 Summary of Principal Findings

11.1.1 Burden of Perinatal Depression

- The prevalence of postnatal depression in a predominantly rural and ethnically diverse population in Ghana was lower 3.8% (95% CI: 3.5%, 4.1%). This is considerably lower than estimates for SSA 18.3% (95% CI 17.5%-19.1%) and high income countries 12.9% (95% CI 10.6%-15.8%).

- It is also considerably lower than the prevalence of antenatal depression which was 9.9% (95% CI 9.5%-10.3%). This is within range of estimates reported in SSA [11.3% (9.5%-13.1%)] and high income country settings [10.2% (95% CI 7.0%-14.2%)].

- In this setting, 34% of women with postnatal depression were also depressed antenatally. Thus, 66% of postnatal depression was 'new' onset. This is in line with the general trend reported in other studies in SSA.

- The high prevalence of depression during pregnancy is mostly self-limiting and only a small proportion [12.5% (95% CI, 10.7%-14.2%)] of women remain depressed after birth. This is similar to the general trend in SSA.

11.1.2 Determinants of Perinatal Depression

- Pregnancy-specific (obstetric history, parity, planned pregnancy or not) and socio-demographic/socio-economic (maternal age, marital status, SES) factors dominate as risk factors for antenatal depression. About 1 in 3 women who were either never married or of poor wealth status were more likely to be depressed during pregnancy. Also older women (>30) and those who did not follow the Catholic faith were 15% more likely to be depressed during pregnancy. Of the pregnancy-specific factors, the

risk associated with being depressed during pregnancy if the pregnancy was unplanned was >50%, and 30% if the woman experienced a pregnancy loss.

- On the other hand, in addition to antenatal depression, birth or baby-related factors (e.g. newborn illness, still birth, postpartum/peripartum complications, season of birth), dominate as risk factors for postnatal depression. The risk of postnatal depression was particularly higher within the baby-related factors; the risk associated with increased postnatal depression was 3-fold among women whose newborn was ill, more than 2-fold among those whose baby died before the postnatal depression assessment, and >90% among those who had a still birth. Of the birth-related factors, more than a third of mothers who experienced severe complications after birth, and 20% who suffered complications during labour were more likely to have postnatal depression.

- These risk factors were similar for 'new' cases of postnatal depression and for cases where depression was also detected antenatally.

- Risk of persistent antenatal depression was >2-fold among women who had a still birth, whose baby was ill after birth, or whose baby died before the postnatal depression assessment. It was also associated with PHQ-9 score, with high scorers (9+) >2 times more likely to remain depressed after birth.

- Contrary to other consistent findings, chronic social and economic adversity defined by poor wealth status is not associated with persistence antenatal depression, probably because of the self-limiting nature of antenatal depression.

11.1.3 Consequences of Perinatal Depression

- Both antenatal and postnatal depression was associated with adverse consequences for either the mother or the baby.

- Antenatal depression was associated with a 19% increased risk of caesarean section/instrumental delivery, 11% of severe self-reported peripartum complications, 27% of postpartum complications, and 25% prolonged labour (>23h).

- In contrast, its impact on perinatal outcomes were less obvious as it was only associated with a 52% increase risk of newborn illness within the first month after birth, and marginally associated with preterm delivery. It was not associated with neonatal mortality, still births, and low birth weight. In addition, antenatal depression was not associated with delayed initiation of breastfeeding, or non-exclusive breastfeeding within the first month of the baby's life.

- Maternal postnatal depression in the immediate postnatal period was associated with an almost three-fold increase in the risk of infant mortality up to six months of age.

- Infant mortality among offspring of mothers depressed antenatally but not postnatally was similar to that of offspring of mothers who were not depressed at either assessment point (adjusted RR 1·32, 95% CI 0·68-2·56 p=0.408).

- In contrast, infant mortality was substantially higher for offspring of mothers with postnatal depression, whether they also had antenatal depression (adjusted RR 3·19, 95% CI 0·99-10·17 p=0·050), or not.

- If this association is causal, we estimate that 63.2% of early infant deaths among depressed mothers are attributable to their depression.

- This translates to a population attributable fraction of 5.8% of all early infant deaths in the population which has a relatively low prevalence of postnatal depression of 3.5%.

- Maternal postnatal depression was also associated with infant morbidity, and this appears to be the plausible pathway linking maternal depression and infant deaths.

- Antenatal but not postnatal depression were also reported as having increased morbidity, although at generally lower levels than those mothers with postnatal depression

11.1.4 Impact of 'Newhints' Intervention

- The Newhints home-visits intervention delivered by community health volunteers did not have an impact on reducing postnatal depression (RR) 0.98 (95% CI 0.67, 1.43; p=0.91).

11.2 Strengths and Limitations

11.2.1 Strengths

This PhD is unique in many ways:

- The large sample size is unprecedented in low and middle income settings, and provides adequate power to be able to examine a range of determinants and also to assess consequences for rare outcomes such as infant mortality.

- The cohort design is the best approach for assessing the 'new' onset cases of postnatal depression and persistent antenatal depression, and to ascertain causality.

- This was based on a 4-weekly surveillance covering the whole population with relatively high depression screening completion rate (>90%), and modest losses to follow up rate of 7.9%. In addition, as data were collected on relatively short 4-weekly surveillance cycle, recall challenges will be limited.

- Depression was assessed both at pregnancy and after birth using a culturally valid tool that is able to provide approximate diagnosis of DSM-IV depression. The clinimetric criterion applied in this PhD allows for comparison with global estimates of antenatal and postnatal depression, and provides the basis and justification for clinical intervention.

- The author is well acquainted with the setting where the research was conducted, trained all field data collectors and thereafter provided directly observed supervision. This ensured good quality data from motivated data collectors.

11.2.2 Limitations

- Though the PHQ-9 depression measure was able to indicate DSM-IV diagnosis of depression, it is a screening tool and is thus only able to provide 'probable' diagnosis of depression. However, it has uniform response options, short, and easy to administer and thus suitable for large scale studies.
- The measure of antenatal depression had been previously validated for recently delivered mothers but not for pregnant women. As there is some evidence that depression in pregnancy and postnatal period show significantly different symptom profiles, a possible misclassification bias in the prevalence of antenatal depression in this PhD may not be excluded. However, the symptom frequencies in our population appear to be similar for antenatal and postnatal depression.

- Depression was only assessed once during pregnancy and once after birth. Conducting repeated measures particularly at different pregnancy trimesters would also help in understanding duration dynamics of depression and the ability to be able to measure persistence antenatal depression with some degree of certainty that it is actually a continuation of an episode of depression from pregnancy to the postnatal period. In addition, the differential impact of determinants at different stages of pregnancy or the postnatal period could be better examined.

- Some key putative risk factors of perinatal depression such as social support and partner violence were not measured. Given that these are consistent independent risk factors their role in the risk factor profile generated for the women within the setting of this PhD are yet to be elucidated.

11.3 Conclusions and Recommendations

This PhD provides results from the first large scale epidemiological investigation of perinatal depression in Ghana, and the SSA region as a whole. The results raise important questions for both maternal and child health, and mental health programmes that need to be answered by future research, and have immediate implications for mental health programmes.

11.3.1 Five Main Research Areas:

- There is strong evidence for a link between antenatal depression and severe maternal morbidity. Important questions would be to understand whether this is causal and whether treating antenatal depression together with improving obstetric care could lead to a reduction in maternal morbidity.
- Similarly, would treating postnatal depression reduce the burden of infant morbidity or mortality, and lead to improved infant outcomes?
- Given that a third of women with postnatal depression were also depressed antenatally, what are the relative benefits of strategies tackling antenatal depression and/or postnatal depression in terms of adverse consequences avoided for mother and baby, and the cost-effectiveness of achieving this.
- Given the strong evidence relating birth or baby-related determinants and postnatal depression, would improving delivery and new-born health care reduce the prevalence of postnatal depression?
- Finally, it is crucial to investigate the relative advantages different community-based maternal and child health interventions have on improving the mental health of pregnant and recently delivered women. The key question is how to achieve through innovative strategies, a seamless integration of maternal mental health interventions into existing reproductive and child health care (antenatal/postnatal care) programmes, drawing on locally available professional and community resources.

11.3.2 Programmatic Implications for Mental Health Policy and Practice in sub-Saharan Africa

Table 11.1 addresses the findings of this PhD in the context of intervention strategy and development. It shows on the left hand side the specific area of perinatal depression needing attention, and on the right is the proposed intervention strategy. In the middle are the findings of this PhD that have informed the various intervention strategies.

- The clinimetric attributes of the PHQ-9 means that it can be used for the detection and subsequent treatment of perinatal depression within primary care settings. It is short, easy to administer with uniform response options, and generally acceptable to a largely illiterate population. Non-mental health professionals can easily be trained to administer the PHQ-9.

- The burden of antenatal depression though self-limiting has deleterious consequences on the health of the mother during labour, and the health of the new born as well. The burden of postnatal depression which is made up of a third of antenatal depression and two thirds of 'new' onset cases after birth, has debilitating effects on child survival and also contributes to severe childhood illness. Interventions are required to tackle both antenatal and postnatal depression. Tackling antenatal depression will effectively lessen the burden of postnatal depression by a third.

- The determinants of antenatal depression are uniquely different from those of postnatal depression. The implications are that whilst population-level non-targeted interventions are required to tackle antenatal depression through improving the socio-economic status and enhancing her ability to make decisions related to her reproductive health, selective interventions are required to tackle postnatal depression. Thus, women with delivery difficulties and sick new-borns would have to be identified and provided special care to prevent the

onset of postnatal depression. In addition, women should be encouraged to deliver at health facilities equipped to deal with obstetric care.

- The consequences of postnatal depression may be avoided if women at high-risk of developing postnatal depression are identified for selective prevention. Those whose depression is unable to be prevented could be treated with psychological/psychosocial approaches as a first option. Similarly, tackling the consequences of antenatal depression would require that interventions are either designed to prevent antenatal depression or women who are depressed at pregnancy are provided non-pharmacological treatment. Arguably, most of antenatal depression would resolve when the woman is able to negotiate a successful delivery but the fact still remains that for some women, being depressed at pregnancy results in severe peripartum/postpartum complications, including new-born illness, and these women may not be abandoned!

- Maternal and child health home-visits interventions in their 'raw' state may not provide additional mental health benefits to the mother in terms of reducing postnatal depression. It may be necessary to build-in mental health specific psychological/psychosocial interventions to such programmes.

- The findings of this PhD provide further justification for the promulgation and implementation of mental health policy and legislation that is particularly lacking in developing countries. Any such legislation will seek among other things; provide dedicated funding for a seamless integration of mental health delivery at the primary care level and put in place structures for routine screening for perinatal depression and high-risk women at antenatal and postnatal visits and to provide appropriate treatment.

- Maternal perinatal depression poses a global threat to child survival and development, and to maternal physical health. The human-rights of mothers and babies via the mental health lens is therefore in question. The United Nations

Fund for Population Activities (UNFPA), and the World Health Organisation (WHO) have recognized this threat and thus declare that 'political will, concerted action by global stakeholders, and resources are needed now to integrate maternal mental health in endeavours to achieve the Millenium Development Goals (MDG)'. The MDGs are expected to be evaluated soon, and it is my fervent hope that the role of maternal mental health in restructuring post-MDGs efforts will be given enough prominence!

- Within Ghana and the rest of the sub-Saharan Africa region, it is my conviction that these findings would help make a strong case for the provision of maternal mental health services at the primary care level. This would be done through extensive dissemination of the findings as seen from the prepared manuscripts presented in this thesis, local workshops with key stakeholders, and development of interventions appropriate at the primary care level. With a gradually increasing mobile cellular penetration, interventions delivered using the mobile phone may be the next generation of effective interventions in mental health.

Table 11.1: Summary of Study Findings and Recommendations for Intervention Strategy.

Category of Perinatal Depression	Findings	Intervention Strategy
Measurement	*Criterion validity:* 94% sensitivity; 75% specificity *Construct validity:* approximate DSM-IV diagnosis of probable depression.	Confirms clinical use of PHQ-9 to detect depression for treatment and assess impact of preventive interventions
Prevalence and course of perinatal depression	- low persistence of antenatal depression (highly self-limiting) - higher proportion of onset postnatal depression	- Intervention may be more effective when targeted at postnatal depression because most of it is 'new' onset - Nevertheless, targeting to prevent or treat antenatal depression would result in preventing a third of women who would become depressed after birth.
Determinants of antenatal depression	- Chronic social and economic disadvantage - Lack of autonomy with pregnancy decision making - Parity	- Population-level women empowerment interventions that address these problems among women of reproductive age.
Determinants of postnatal depression	- Severe maternal birth-related morbidity. - Poor birth outcomes - Newborn ill health	- Identify women for selective preventive intervention - Improve delivery and new-born health care as priority
Determinants of onset postnatal depression and persistent antenatal depression	- These are common and similar to risk factors for overall postnatal depression	- Identify women for selective prevention - Inform the content of treatment interventions at pregnancy and after birth
Consequences of postnatal depression	- Infant mortality up to six and twelve months - Infant morbidity	- Identify women for selective prevention. - Provide treatment.
Consequences of antenatal depression	- Severe maternal birth-related morbidity - Newborn ill health - Prolonged labour - Bed-net non use	- Treat women with antenatal depression using psychosocial/psychological approaches. - Prevent the onset of antenatal depression using population-level women empowerment programmes

Redacted: pp. 253-61

12. Appendix 1: PHQ - 9 Validation Study Published Report

Weobong, B; Akpalu, B; Doku, V; Owusu-Agyei, S; Hurt, L; Kirkwood, B; Prince, M; (2009)

The comparative validity of screening scales for postnatal common mental disorder in Kintampo, Ghana. Journal of affective disorders, 113 (1-2). pp. 109-17. ISSN 0165-0327

13. **Appendix 2:** Coverage of Epidemiological Studies on Perinatal Depression within Low and Middle Income Countries

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
SSA (N=37)											
DON-study	9.6%-DSM	3.8%-DSM-IV[%onset=66%]	2.5%-DSM-IV	12.4%-DSM-IV	√	√	√	√	√	√	√
Deyessa et al. 2011 (Ethiopia)	X	5.5%-ICD 10	X	X	X	X	X	X	X	√	X
Hanlon et al. 2010 (Ethiopia)	12%-SRQ20	4.6%-SRQ20. [% onset=45%]	2.4%-SRQ20.	21.4%-SRQ20	√	√	√	√	X	X	X
Servilli et al. 2010 (Ethiopia)	X	9.3%-SRQ20	X	7.3%-SRQ20	X	X	X	X	√	√	√
Medhin et al. 2010 (Ethiopia)	12%-SRQ20	5%-SRQ20	2.8%-SRQ20	23%-SRQ20	X	X	X	X	√	√	√
Ross et al. 2010 (Ethiopia)	9.2%-SRQ20	4.6%-SRQ20	2.1%-SRQ20	2.5%-SRQ20	X	X	X	X	√	√	√
Hanlon et al. 2009 (Ethiopia)	12%-SRQ20		X	X	√	X	X	X	√	X	X
Okronipa et al. 2012 (Ghana)	X	10%- EPDS	X	X	X	X	X	X	X	√	X
Stewart et al 2008 (Malawi)	X	29.9%-SRQ20	X	X	X	X	X	X	X	√	X
Ola et al. 2011 (Nigeria)	7%-SRQ-20		X	X	√	X	X	X	X	X	X
Adewuya et al. 2008 (Nigeria)	X		X	X	X	X	X	X	X	√	X
Esimai et al. 2008 (Nigeria)	10.8%-HADS		X	X	√	X	X	X	X	X	X
Ebeigbe & Akhigbe 2008 (Nigeria)	X	27.2%-EPDS	X	X	X	√	X	X	X	X	X
Adewuya et al. 2007 (Nigeria)	8.3%-DSM-IV		X	X	X	X	X	X	X	X	X
Adewuya et al. 2006(Nigeria)	X	13.5%-SADS	X	X	X	√	X	X	X	X	X
Abiodun et al.	19.1%-		X	X	√	X	X	X	X	X	X

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
1993(Nigeria)	GHQ										
Abiodun et al. 2006(Nigeria)	X	18.6% -EPDS	X	X	X	√	X	X	X	X	X
Owoeye et al. 2006 (Nigeria)	X	23%-EPDS 17.5%-ICD10	X	X	X	√	X	X	X	X	X
Ukpong & Owolabi 2006(Nigeria)	X	29.8%-BDI	X	X	X	√	X	X	X	X	X
Fatoye et al. 2006(Nigeria)	X	22.9%-ZUNG	X	X	X	√	X	X	X	X	X
Adewuya et al. 2005b(Nigeria)	*X*	*14.6%-EPDS*	*X*	*X*	*X*	√	*X*	*X*	*X*	*X*	*X*
Adewuya & Afolabi 2005 (Nigeria)	*X*	*13.4%-ZUNG*	*X*	*10%-ZUNG*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
Adewuya et al. 2005a(Nigeria)	*X*	*14.6%-SCID-NP*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
Owoeye et al. 2004 (cross-sectional) (Nigeria)	X	23%-EPDS	X	X	X	X	X	X	X	X	X
Ukpong et al. 2003 (Nigeria)	X	27.3%-GHQ	X	X	X	√	X	X	X	X	X
Uwakwe et al. 2003 (Nigeria)	X	10.7%-EPDS	X	X	X	X	X	X	X	X	X
*Aderibigbe et al. 1993 (Nigeria)	30%-GHQ	14%-GHQ	X	4.9%-GHQ	√	√	X	X	X	X	X
Rochat et al. 2011 (South Africa)	47%-DSM		X	X	X	X	X	X	X	X	X
Hartley et al. 2011 (South Africa)	39%-EPDS		X	X	√	X	X	X	X	X	X
Ramchandani et al. 2009 (South Africa)	X	16.4%-PDT	X	X	X	√	X	X	X	X	X
Madu & Roos 2006 (South Africa)	X	80%-EPDS (1 week after birth)	X	X	X	√	X	X	X	X	X
Tomlinson et al. 2005 (South Africa)	X	34.7%-SCID	X	X	X	X	X	X	X	√	X
Cooper et al. 1999 (South Africa)	X	34.7%-SCID	X	X	X	√	X	X	X	√	X
Spangenberg et al. 1991 (South Africa)	X	27.2%-BDI	X	X	X	√	X	X	X	√	X
Tomlinson et al. 2004 (South Africa)	X		X	X	X	√	X	X	X	X	X

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
Nakku et al. 2006 (Uganda)	X	6.1%-MINI	X	X	X	√	X	X	X	X	X
*Cox 1976 (Uganda)	16.7%-SPI	12.4%-SPI	X	X	√	X	X	X	X	X	X
*Cox et al.1982 (Uganda)		28.6%-SPI	?	?		√					
Cox et al.1983 (Uganda)	6.8%-ICD10	10%-ICD10	5.7%-ICD10	22%-ICD	√	√	X	X	X	X	X
Ndokera and McArthur 2010 (Zambia)	X	9.7%-SRQ20	X	X	X	X	X	X	X	√	X
Chibanda et al. 2009 (Zimbabwe)	X	33%-DSM-IV	X	X	X	X	X	X	X	X	X
*Nhiwatiwa et al. 1998 (Zimbabwe)	19%-SSQ	16%-SSQ	9%-SSQ	46.3%-SSQ	√	√	X	X	X	X	X
Asia (N=28)											
DON-study	9.6%-DSM	3.8%-DSM-IV	2.5%-DSM-IV	12.4%-DSM-IV	√	√	√	√	√	√	√
Nasreen et al. 2010 (Bangladesh)	18%-EPDS		X	X	√	X	X	X	√	X	X
Gausia et al. 2009 (Bangladesh)	33%-EPDS	22%-EPDS	9.8%-EPDS	63.8%-EPDS	X	√	X	X	X	X	X
Black et al. 2007 (Bangladesh)	X	52%-CES-D	X	X	X	√	X	X	X	√	X
Xie et al. 2007 (China)	X	17.3%-EPDS	X	X	X	√	X	X	X	X	X
Wang et al. 2003 (China)	X	43%-BDI	X	X	X	√	X	X	X	X	X
Qiao et al. 2012 (China)	11%-HADS		X	X	X	X	X	X	√	X	X
Edwards et al. 2006 (China)	X	22.4%-EPDS	X	X	X	√	X	X	X	X	X
Savarimuthu et al. 2010 (India)	X	26.3%-EPDS	X	X	X	√	X	X	X	X	X
Patel et al. 2003 (India)	X	22%-EPDS	X	X	X	X	X	X	X	√	X
Patel et al. 2002 (India)	42%-EPDS	23%-EPDS	8%-EPDS	38%-EPDS	X	√	X	X	X	X	X
Patel et al. 2003 (India)	X	23%-EPDS	X	X	X	X	X	X	X	√	X
**Patel & Prince.	X		X	X	X	X	X	X	√	X	X

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
2006 (India)											
Chandran et al. 2002(India)	16%-ICD10	19.8%-ICD10	11%-ICD10	66%-ICD10	X	√	X	X	X	X	X
Andajani-sutjahjo et al. 2003 (Indonesia)	12.5%-EPDS	66%-EPDS	X	X	X	√	X	X	X	X	X
Ho-Yen et al. 2007 (Nepal)	X	4.9%-EPDS	X	X	X	√	X	X	X	X	X
Shah et al. 2011 (Pakistan)	48.4%-EPDS		X	X	√	X	X	X	X	X	X
Husain et al. 2011 (Pakistan)	25.8%-EPDS	21.6%-EPDS	16.4%-EPDS	38.3%-EPDS	√	√	√	√	X	X	X
Rahman et al. 2007 (Pakistan)	25%-ICD10		X	X	X	X	X	X	√	X	X
Rahman et al. 2007 (Pakistan)	24%-ICD10	49.6%-ICD10	5.6%-ICD10	94%-ICD10	X	X	X	X	X	√	X
Rahman et al. 2007 (Pakistan)	25%-ICD10		X	57%-ICD10	X	X	X	√	X	X	X
Rahman et al. 2004(Pakistan)	25%-ICD10		X	X	X	X	X	X	√	X	X
Rahman et al. 2004b (Pakistan)	X	40%-SRQ	X	X	X	X	X	X	X	√	X
Rahman et al. 2003(Pakistan)	25%-ICD10	28%-ICD10	√	X	√	√	X	X	X	X	X
Kalyani et al. 2001 (Pakistan)	X	63.3%-EPDS (@2 wks)	√	X	X	√	X	X	X	X	X
Saikh et al. 2011 (Pakistan)	40%-CES-D		X	X	X	X	X	X	√	X	X
Kazi et al. 2006 (Pakistan)	39.4%-CES-D		X	X	√	X	X	X	√	X	X
Ali et al. 2012 (Pakistan)	16.8%-HADS		X	X	√	X	X	X	X	X	X
Affonso et al. 2000 (9-country sample study, including south America and Asia)**[Taiwan]**	X	60.8%-EPDS	X	X	X	X	X	X	X	X	X
Limlomwingse et al. 2006 (Thailand)	20.5%-EPDS	16.8%-EPDS	X	X	√	√	X	X	X	X	X
Liabsuetrakul et al. 2007 (Thailand)	X	9%-DSM-IV	X	X	X	√	X	X	X	X	X
Fisher et al. 2004	X	33%-EPDS	X	X	X	√	X	X	X	X	X

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
(Vietnam)											
Navpreet et al. 2008 (Asian women in UK)	30.7%-EPDS		X	X	√	X	X	X	X	X	X
Lteif et al. 2005 (Lebanon)	13.9%-BDI				√	X	X	X	X	X	X
South America (N=28)											
DON	9.6%-DSM	3.8%-DSM-IV	2.5%-DSM-IV	12.4%-DSM-IV	√	√	√	√	√	√	√
Galler et al. 1999 (Barbados)	X	16%-ZUNG	X	X	X	X	X	X	X	√	X
Galler et al. 2004 (Barbados)	X		X	X	X	X	X	X	X	√	X
Galler et al. 2004b (Barbados)	X		X	X	X	X	X	X	X	X	X
Galler et al. 2000 (Barbados)	X	19%-ZUNG	X	X	X	√	X	X	X	√	X
Galler et al. 2006 (Barbados)	X		X	X	X	X	X	X	X	√	X
Falceto et al. 2004 (Brazil)	X	37%-DSM-IV	X	X	X	X	X	X	X	√	X
Ferri et al. 2007 (Brazil)	13.6%-CIDI		X	X	X	X	X	X	√	X	X
Pinheiro et al. 2011 (brazil)	X	22.7%-EPDS	12.3%-EPDS	10.4%-EPDS	X	X	X	X	X	√	X
Tannous et al. 2008 (Brazil)	X	20.7%-EPDS	X	X	X	√	X	X	X	X	X
Lovisi et al 2005 (Brazil)	19.1%-CIDI		X	X	√	X	X	X	X	X	X
Moraes et al. 2008 (Brazil)	X	19.1%-HAM-D	X	X	X	√	X	X	X	X	X
Pinheiro et al. 2006 (Brazil)	X	26.3%-BDI	X	X	X	√	X	X	X	X	X
Da-Silva et al. 1998 (Brazil)	X	42.8%-EPDS	X	X	X	X	X	X	X	X	X
Faisal-Cury et al. 2009 (Brazil)	20.2%-CIS-R		X	X	√	X	X	X	X	X	X
Santos et al 2010 (Brazil)	X	17.9%-EPDS	X	X	X	X	X	X	X	√	X
Walters et al. 1998	X	47%-CES-D	X	X	X	X	X	X	X	X	X

Region/studies	Prevalent antenatal depression	Prevalent postnatal depression	Onset PND estimates	Persistence AND estimates	Determinants-AND	Determinants-PND	Determinants-onset PND	Determinants-persistence AND	Consequences-AND	Consequences-PND	Consequences-persistence
(Chile)											
Florenzano et al. 2002 (Chile)	X	50% (2 wks)-EPDS	X	X	X	X	X	X	X	X	X
Risco et al. 2002 (Chile)	X	48%-EPDS	X	X	X	X	X	X	X	X	X
Da-Silva et al. 1998 (Chile)	X	4.6%-CES-D	X	X	X	X	X	X	X	X	X
Jadresic & Araya 1995 (Chile)	X	36.7%-EPDS	X	X	X	X	X	X	X	X	X
Jadresic et al. 1992 (Chile)	X	28.7%-EPDS	X	X	X	X	X	X	X	X	X
Alvarado et al. 1992 (Chile)	X	20.5%-DSM-III-R	X	X	X	X	X	X	X	X	X
Lozoff et al. 1987 (Costa Rica)	X	34%-CES-D	X	X	X	X	X	X	X	X	X
Lozoff et al. 1996 (Costa Rica)	X	46%-CES-D	X	X	X	X	X	X	X	X	X
Affonso et al. 2000 (9-country sample study, including south America and Asia)[Guyana]	X	57%-EPDS	X	X	X	X	X	X	X	X	X
Baker-Henningham et al. 2003(Jamaica)	X		X	X	X	X	X	X	X	√	X
Lara & Le 2009 (Mexico)	36.8%-CES-D		X	X	√	X	X	X	X	X	X
Wolf et al. 2002 (postnatal depression in 3 samples (chile, costa rica)puts prevalence in Latin America between 35-50%	X	35-50%-CES-D	X	X	X	√	X	X	X	X	X

Rahman studies based on the same sample

Outcome Measures Explained:

SSQ-Shona symptom questionnaire

SCID- Structured clinical interview for DSM-IV disorders

GHQ-General health questionnaire

SADS-Schedules for affective disorders and schizo

HADS- Hospital anxiety and depression scale

MINI-Mini international neuro-psychiatric interview

PDT-Pitt depression questionnaire

CES-D: Centre for epidemiological study-depression scale

CIDI: Composite international diagnostic interview

HAM-D: Hamilton depression scale

BDI: Beck's Depression Inventory

ICD-10: International Classification of diseases, 10th edition

SPI: Goldberg's standardized psychiatric interview

Summary:

Outcome	**Number of studies**		
	SSA	ASIA	SOUTH AMERICA
Prevalence AND	11	15	4
Prevalence PND	33	20	20
Onset estimates	6	9	1
persistence	7	6	1
Determinants AND	11	9	3
Determinants PND	20	16	5
Determinants onset	2	1	0
Determinants persistence	2	2	0
Consequences AND	5	7	1
Consequences PND	12	5	8
Consequences persistence	4	0	0

14. Appendix 3: Data Collection Forms

14.1 DON Form

KINTAMPO HEALTH RESEARCH CENTER **OBAAPAVITA/NEWHINTS "DON"** DON (PREGNANCY) FORM	**DON_ PREG Form No.**

FORMNO

BACKGROUND and ID:

1.1 Cluster code: **CLUSTER**

1.2 Woman's ID : **WOMANID**

1.3 Woman's name

1.4 Week group: ....

1.5 Month visit number: **MONTHNO**

1.6 Date of visit: ..... DATEVISIT

1.7 Staff code: ..... FW

2. STATUS:

2.1. Status at time of visit: **STATUS**

1. Present	2. Currently in hospital	3. Temporarily absent
4. Died	5. Moved out	6.Withdrawn
7. False alarm		

NOTE 1: IF NO WITNESS AT TIME OF VISIT, PLEASE STOP THE CONSENTING PROCESS AND RESCHEDULE THE VISIT.

NOTE 2: THIS FORM IS ADMINISTERED AT THE FIRST VISIT THE WOMAN IS SEEN AFTER REPORTING SHE IS PREGNANT. IT SHOULD BE FILLED IN AFTER THE MONTH (PREGNANCY) FORM AND THE PROFILE FORM.

3. INFORMATION AND CONSENT:

EXPLAIN THE OBJECTIVES OF THIS QUESTIONNAIRE TO THE WOMAN BY READING THE STATEMENT DETAILED ON THE INFORMATION SHEET. OBTAIN HER AGREEMENT TO PARTICIPATE BY ASKING HER TO ENDORSE THE DECLARATION BELOW:

Wɔakenkan krataa a ɛkyerɛkyerɛ botae ne dwumadie ahodoɔ a ɛwɔ nhwehwɛmu yi mu
Akyerɛ me. Me nsɛmmisa a me wɔ no nhwehwɛmu yi ho nso, wɔayi ano akyerɛ me.
Na sɛ mepene so sɛ mɛka dwumadie yi ho a, mete nea wɔwhewhɛ sɛ meyɔ nyinaa ase.

Mesane te aseɛ sɛ metumi atwe me ho afiri nhwehwɛmu yi anaa ɛmu nhyehyɛe bi mu berɛ a memma sɛntia meyɛɛ saa.

3.1 Mepene so sɛ mɛka nhwehwɛmu no ho

1. Aane	2. Daabi

WAGREE

.

3.2 Signature/thumbprint **participant:** _____

Signature/thumb print- **Witness**: _____

3.4 Name of witness: _____

Signature of project staff (position): Date:

_____ _____

3.6 Consent obtained?

1. Yes	2. No

CONSENT

STOP IF THE WOMAN DOES NOT CONSENT. DRAW A LINE ACROSS THE REST OF THE FORM

4. PERCEPTIONS OF PREGNANCY:

4.1 Did **YOU** plan to fall pregnant?

1. Yes	2. No	3. Not sure

PL**ANPREG**

Note: If pregnancy terminated before your visit please circle NA for 4.2, 4.3 and 4.4

4.2 Do **YOU** have a preference for a boy or a girl?

1. Girl	2. Boy	3. No preference	4. NA

SEXPREFW

4.3 Does your **PARTNER** have a preference for a boy or a girl?

1. Girl	2. Boy	3. No preference	4. Not Known	5. NA

SEXPREFP

4.4 Are you aware of the sex of your unborn baby(s) through a scan or other means?

1. Yes, Boy(s)	2. Yes, Girl(s)	3. Yes, Boy/Girl (twins)	4. No

PREKNOW

5. WELL-BEING IN PAST 2 WEEKS:

Now I would now like to ask you if you have been bothered by any of the following problems over the last 2 weeks.

5.1 Have you been bothered by little interest or pleasure in doing things?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wanigyeâ anaa wahosâpâ so ate âwo wo nneâma a wo yâ mu anaa?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*

LINT

5.2 Have you been bothered by feeling down, depressed, or hopeless?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wanigyeâ so ate anaa wo werâ aho anaasâ wo ho nni mfasoô?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*

FEELDOWN

5.3 Have you been bothered by trouble falling or staying asleep, or sleeping too much?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wontumi nna anaasâ woda dodo?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*

PSLEEP

5.4 Have you been bothered by feeling tired or having little energy?
Nnawôtwe mmienu a atwam yi mu âha wo sâ âyâ a wote nka sâ wabrâ anaasâ ahoôden a âwô wo mu no sua?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*

FEELTIRED

5.5 Have you been bothered by poor appetite or overeating?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wo kôn nnô aduane anaasâ wodidi boro soô?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*

POORAPPI

5.6 Have you been bothered by feeling bad about yourself or that you are a failure or have let yourself or your family down?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wo ankasa wompâ wo ho, anaasâ wadi nkoguo wô abrabô mu anaasâ wadi woho ne wabusua hwammô?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*	**FEELBAD**

5.7 Have you been bothered with trouble concentrating on things, such as engaging in a conversation or being able to complete your household chores?
Nnawôtwe mmienu a atwam yi mu âha wo sâ wontumi mfa wadwene nsi nneâma so, sâ âbia nkômmôdie mu anaasâ wo tumi yâ wo daada fie nnwuma die?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*	**PROBCONC**

5.8 Have you been bothered by moving or speaking so slowly that other people could have noticed? Or the opposite, which is being so fidgety or restless that you have been moving around a lot more than usual?
Nnawôtwe mmienu a atwam yi mu âha wo sâ nnipa ahunu sâ wahokeka anaa wokasaa yâ brâoo dodo anaasâ wontumi tena faako na wokyinkyini basabasa a anka ânsâ sâ âba saa?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*	**SLOWFIDG**

5.9 Have you been bothered by thoughts that you would be better off dead or thoughts of hurting yourself in some way?
Nnawôtwe mmienu a atwam yi mu ayâ adwendwene ama wo sâ âyâ mpo sâ anka wo wu anaasâ anka wofa kwan bi so di woho dâm?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*	**DEADHURT**

Note: If all questions 5.1 to 5.9 are circled '0', please STOP - draw two parallel lines across rest of questions and go to information at end.

5.10 Have any of these problems made it difficult for you to do your work, take care of things at home, or get along with people?
Ôhaw ahodoô(**spell out problems recorded**) a wo akasâ âha wo yi, ama ayâ den ama wo sâ, wo bâ yâ wo nnwuma, wo bâ hwâ wo fie nnoama so, annasâ wo ne afoforo bâdi nkitaho?

0. No, not at all *Dabi, ɛnnte sa koraa*	1. Yes, some of the time *Aane, etɔ berɛ bia*	2. Yes, most of the time *Aane mprɛɛ pii*	3. Yes, All the time *Aane, berɛ bia.*	**DISABIL**

END OF DON PREGNANCY FORM. CHECK THE FORM, THANK THE WOMAN

14.2 Profile Form

KINTAMPO HEALTH RESEARCH CENTER KIVAP OBAAPAVITA PROJECT PROFILE FORM 270505 ENG	PROFILE Form No.	FORMNO

BACKGROUND and ID:

Cluster code: | | | | | CLUSTER

Woman's ID: | | | | | | | | | | | WOMANID

Woman's name: NAME

Date of visit: …….. | | | | | DATEVISIT

1.5 Staff code: ……. | | FW

1.6. Status at time of visit:

1. Present	2. Currently in hospital	3. Temporarily absent	STATUS
4. Died	5. Moved out	6.Withdrawn	

1.7. Are you filling in this form as :
- a fieldworker visiting a woman you have found to be pregnant (FW)
- or as a member of the IEC team making your random adherence checks (IEC)?.

1. FW	2. IEC	INTTYPE

SOCIO-DEMOGRAPHIC CHARACTERISTICS:

2.1. In what year were you born? [1908 = NK]……. | 1 | 9 | | | YEARBORN

2.2. In what month were you born? [88 = NK]…… | | | MONTHBORN

2.3. Do you know your age? (in years) [88 = NK]…….. | | | AGE

2.4. PLACE THE MOTHER IN ONE OF THE FOLLOWING AGE GROUPS:

1. 15 - 19 years	2. 20 – 29 years	3. 30 – 45 years	4. More than 45 years	AGEGRP

2.5. Highest educational level reached?

1. None	2. Primary school	3. Middle/continuation school, JSS	MEDLEV
4.Technical/commercial/SSS secondary school	5. Post-middle college – teacher training, secretarial	6. Post secondary – nursing, teacher, polytechnic, etc.	
7. University	8. Not known	//////////////////////////////////////	

2.6. Number of years completed at the highest level reached? [88 = NK, 99 = NA, 00 = no education]……. | | | NUMYRS

2.7. Are you currently single, married, or living with a man, or are you widowed, divorced or separated?

1. Married	2. Living together	3. Widowed	MARRIED
4. Divorced	5. Separated	6. Single, unmarried	

2.8. What is your religion?

1.Catholic	2. Protestant	3. Pentecostal	4. Muslim	5. Traditional African	6. Other:	RELIGION

2.9. What ethnic group do you belong to?

				ETHNIC
11. Akan: e.g.Bono, Ashanti, Fanti.etc.	12. Bimoda, Chokosi	13. Dagarti, Frafra, Kusasi	14. Fulani	
15. Ga, Adangbe, Ewe	16. Gonja, Dagomba, Mamprusi	17. Konkomba, Basare	18. Mo	
19. Sisala, Wala	20. Zambraba	21. Banda/Pantra	22. Other:	

2.10. Do you own any land?..... 1. Yes | 2. No — WOWNLAND

2.11. Do you have land on which you farm?

1. Yes, my own	2. Yes, part of family land	3. Yes part of husband's	4. Yes, rented land	5. No	OWNLAND

2.12. What do you grow (on your land)?

1. Food items, mainly for home consumption	2. Food items, mainly for sale on the market	3. Cash crops: tobacco, cashew, cocoa, etc.	9. NA, no farm	CROPS

2.13. Do you have a regular cash income/are you a salaried worker?

				SALARY
1. Yes, professional – teacher, nurse, accounts, administrative	2. Yes, clerical/secretarial	3. Yes, seamstress, hairdresser etc.		
4. Yes, trader/food seller	5. Yes, labourer/domestic worker/farmer	6. Other:	7. No	

SAY NOW YOU ARE GOING TO ASK ABOUT THE 'HOUSEHOLD' AND EXPLAIN WHAT A HOUSEHOLD IS

2.14. Who is the household head?

1. You	2. Your husband	3. Your father	4. Your mother	5. Other:	8. NK	HOUSEHEAD

2.15. In what year was the household head born? [1908 = NK]…… 1 9 ☐☐ — HHYOB

2.16. How old is the household head now (in years)? [88 = NK]…… ☐☐ — HHAGE

2.17. What was the household head's highest educational level reached?

1. None	2. Primary school	3.Middle,continuation school, JSS	4. Technical, commercial, SSS, Secondary school	HHMEDLEV
5. Post-middle college, teacher training, secretarial	6. Post secondary, nursing, teacher, polytechnic	7. University	8. Not known	

2.18. What was the number of years that the household head completed at the highest level reached? [88 = NK, 00 = no education]…… ☐☐ — HHNUMYRS

2.19. Does the household head have a regular cash income or salaried job?

1. Professional – teacher, nurse, accounts, administrator etc.	2. Clerical / secretarial	3. Trader / businessman / driver with own car etc.	4. Employed tradesman, driver without own car, builder, etc.	HHSALARY
5. Farmer/labourer/domestic Worker	6. Other:		7. No	8. NK

2.20. Do members of the household do any farming?..... 1. Yes | 2. No — HHFARMING

2.21. Does anyone in the household own any land?..... 1. Yes | 2. No — HHOWNLAND

2.22. Does anyone in the household own their own farm?.....	1. Yes	2. No	HHOWNFARM

2.23. What do they grow?

1. Food items, mainly for home consumption	2. Food items, mainly for sale on the market	3. Cash crops – tobacco, cashew, cocoa, etc.	9. NA, no farm	HHCROP

2.24. Does anyone in the household own:	Chickens or ducks?.....	1. Yes	2. No	CHICKEN
	Sheep or goats?.....	1. Yes	2. No	SHEEP
	Other animals?.....	1. Yes	2. No	OTHANIM
	Table?.....	1. Yes	2. No	TABLE
	Sleeping mattress?.....	1. Yes	2. No	MATTRESS
	Cupboard, wardrobe, room divider?.....	1. Yes	2. No	DIVIDER
	Mosquito net?.....	1. Yes	2. No	MOSNET
	Sewing machine?.....	1. Yes	2. No	MACHINE
	Bicycle?.....	1. Yes	2. No	BICYCLE
	Radio?.....	1. Yes	2. No	RADIO
	TV?.....	1. Yes	2. No	TV
	Gas or electric cooker?.....	1. Yes	2. No	COOKER
	Fridge or freezer?.....	1. Yes	2. No	FRIDGE
	Motorcycle?.....	1. Yes	2. No	MOTORCYCLE
	Car?.....	1. Yes	2. No	CAR

2.25. Does your household have electricity?.....	1. Yes	2. No	ELECTRIC

2.26. What is the main source of drinking water for members of your household?

11. Piped into dwelling/yard/plot	12. Public tap	13. Handpump / closed bore hole	14. Closed well	15. Open well	WATER
16. Stream / river	17. Lake / dam /pond	18. Water trucks	19.Rain water	20. Other	

2.27. How long does it take for you to go there, get water and come back?

1. Less than 15 minutes	2. 15 minutes- less than 30 minutes	3. 30 minutes – less than 60 minutes	REACH
4. 60 minutes or more	9. NA / drinking water source is in compound		

2.28. What kind of toilet facility does your household have?

1. Flush latrine / WC	2. Ventilated improved pit /VIP /KVIP	3. Other pit latrine	4. Open fields	DEFAEC
5. Defaecate in house, faeces transferred elsewhere / bucket latrine		6. Other:		

2.29. What are the total number of rooms in the household used for sleeping? 88 = NK.....			ROOMS
2.30. What are the total number of people that slept in the household last night? 88 = NK.....			RESIDENT

2.31. Do you own or rent the house you live in, or do you have another type of arrangement, such as "perching"?

1. Sole Ownership	2. Joint Ownership	3. Renting	4. Family/relation's house	OWNHOUSE
5. House provided rent free	6. Perching	7. Other:	8. NK	

MATERIALS USED IN THE CONSTRUCTION OF THE HOUSE [OBSERVE]

2.32. Floor of sleeping room	1. Cement	2. Mud/clay	3. Other:	8. NK	FLOOR
2.33. Roofing	1. Metal/asbestos	2. Thatch/mud	3. Other:		ROOF
2.34. Wall	1. Cement	2. Mud	3. Other:		WALL

2.35. Does the household have a separate room with a roof just for cooking?	1. Yes	2. No	8. NK	KITCHEN
2.36. Does the household have a separate sleeping room for children?	1. Yes	2. No	8. NK	SHARERM
2.37. Does the household have a domestic worker not related to the household head?	1. Yes	2. No	8. NK	DOMESTIC

3. FERTILITY AND OBSTETRIC HISTORY

Now, I would like to ask you some questions about any pregnancies and children that you have had.

3.1 How many male children of your own are living with you right now? [00 = NONE]…… BOYALIV1

3.2 How many male children of your own are living elsewhere? [00 = NONE]…… BOYALIV2

3.3 How many female children of your own are living with you right now? [00 = NONE]…….. GIRLALIV1

3.4 How many female children of your own are living elsewhere? [00 = NONE]…… GIRLALIV2

3.5 Do you have any children who were born alive but died later? How many? [0 = NONE]……. DEADCHN

3.6. Have you ever lost a pregnancy? How many? [0 = NONE] …… ABORT

3.7. Have you ever had a stillbirth? How many? [0 = NONE]..... STILLBIRTH

3.8. Have you ever had an ectopic pregnancy? How many? [0 = NONE]… …… ECTOPIC

3.9. CALCULATE THE TOTAL NUMBER OF PREGNANCIES SHE HAS HAD, THAT IS THE SUM FOR 3.1 – 3.8 [DO NOT INCLUDE THE CURRENT PREGNANCY]……

CHECK THIS NUMBER WITH HER AS FOLLOWS:

3.9.1. I would like to check with you the total number of pregnancies you have had. From what you have told me, you have had a total of [SUM] pregnancies. Is this correct?	1. Yes	2. No	CORRECT

IF THE ANSWER IS NO, REPEAT QUESTIONS 3.1 TO 3.8 UNTIL YOU HAVE AGREEMENT. NOTE THAT THIS NUMBER SHOULD NOT INCLUDE THE CURRENT PREGNANCY IF SHE IS PREGNANT. NOTE ALSO THAT IN OUR DEFINITION TWINS COUNT AS TWO PREGNANCIES AND TRIPLETS AS THREE.

3.10. Have you ever had a Caesarean Section?.....	1. Yes	2. No	CS

3.11. Have you ever had a delivery where the baby had to be pulled out with an instrument?	1. Yes	2. No	VACUUM

3.12. DATE OF BIRTH OF LAST CHILD [THE ONE BEFORE THIS PREGNANCY OR THE ONE BEFORE THE CHILD JUST BORN; 080808 = Not known; 090909 = No child].....		DOBCHILD

3.13. Where did you deliver your last child? [USE FACILITY KEY CODE; 99 = NA, No child or delivered at home]		WHEREDEL

4. HEALTH HISTORY: Now I would like to ask some questions about your health

4.1. How would you describe your state of health in general?....	1. Excellent	2. Good,	3. Poor	HEALTHY

4.2. Have you been admitted to hospital for more than 2 days in the past 12 months?

1. Yes, for illness during pregnancy	2. Yes, for other illness	3. Yes, for accident/injury	4. No	ADMIT

4.3. Has a doctor ever told you if you have any of the following illnesses?

Heart disease or hypertension?.....	1. Yes	2 No	8. NK	HEARTDIS
Varicose veins?.....	1. Yes	2 No	8. NK	VEINS
Kidney disease?.....	1. Yes	2 No	8. NK	KIDNEY
Asthma?.....	1. Yes	2 No	8. NK	ASTHMA
TB?.....	1. Yes	2 No	8. NK	TB
Epilepsy?.....	1. Yes	2 No	8. NK	EPILEPSY
Diabetes?.....	1. Yes	2 No	8. NK	DIABETES
Jaundice or hepatitis……	1. Yes	2 No	8. NK	JAUNDICE
Any other serious illness:	1. Yes	2 No	8. NK	OTHILL

4.4. Do you currently REGULARLY take any medicines for an illness or health condition?	1. Yes	2. No	8. NK	MEDICINE

4.5. Have you ever had any surgical operation on your womb?

1. Yes, C-section	2. Yes, fibroid	3. Yes, D&C	4. Yes, other:	5. No	WOMBOPS

4.6. Have you ever had any other surgical operation?

1. Yes (SPECIFY):	2. No	OTHOPS

END OF PROFILE FORM. CHECK YOUR FORM AND THANK THE RESPONDENT

14.3 Birth Form

KINTAMPO HEALTH RESEARCH CENTER KIVAP OBAAPAVITA PROJECT NEW BIRTH FORM 15052009 ENG	**BIRTH Form No.**	FORMNO

COMPLETE THIS FORM FOR ANY PREGNANCY ENDING AT SIX OR MORE MONTHS WHETHER SHE HAD A LIVE BIRTH OR STILLBIRTH.

1. BACKGROUND and ID:

Cluster code: _____ CLUSTER

1.2 Woman's ID : _____ WOMANID

Woman's name: _____

Date of visit: ……. DATEVISIT

Staff code: ……. FW

2. END OF PREGNANCY

Date of delivery:…….. DATDELIV

How many babies did you have? …….. NUMBABY

Did this pregnancy end early, on time, or late? 1. Early | 2. On time | 3. Late | 8. NK PREMBAB

How many months pregnant were you with this child/children? (88 = NK)……. GESTATE

3. DURING PREGNANCY

How many times did you receive antenatal care from a doctor or nurse during pregnancy?
[00 = NONE] [ASK TO SEE ANTENATAL CARE RECORD, EXCLUDE ILLNESS] ANC

How many tetanus toxoid immunisations did you receive during pregnancy?
[00 = NONE, 88 = NK, ASK TO SEE ANY MEDICAL RECORDS, YELLOW CARD]… TETTOXD

How many tetanus toxoid immunisations had you ever received before this pregnancy?
[00 = NONE, 88 = NK, ASK TO SEE ANY MEDICAL RECORDS, YELLOW CARD] TETTOXB

WAS HAEMOGLOBIN< 10 EVER RECORDED DURING HER ANC ATTENDANCE? [CHECK FROM HER CARD; 8 = NO CARD] 1. Yes | 2. No | 8. NK HAEMOG

During pregnancy did you sleep under a bed net? 1. Never | 2. Sometimes | 3. Always | 8. NK BEDNET

Did a doctor or a nurse ever say you had malaria during pregnancy?.....
. 1. Yes | 2. No | 8. NK MALARIA

Are you currently registered with the new district mutual health insurance 1. Yes | 2. No | 8. NK HEALTHINS

scheme?

Is your baby/babies registered with the new health insurance scheme?

1. Yes	2. No	8. NK	9. NA, stillbirth	BABYINS

Have you had any visits from a CBSV?

3.9	During pregnancy?	0. No (No visits)	1. Yes (1 visit)	2. Yes (2 visits)	3. Yes (3 or more visits)	8. NK	CBSVPREG
3.10	Since delivery?	0. No (No visits)	1. Yes (1 visit)	2. Yes (2 visits)	3. Yes (3 or more visits)	8. NK	CBSVPP

4. LABOUR AND DELIVERY: Now I would like to ask you some questions about the labour and delivery.

Did you deliver in a health facility, on the way, or at home?

1. Clinic/hospital/ Private maternity home	2. At home	3. At the TBA's	4. On the way to the clinic/ hospital/ maternity home	PLACEDEL
5. On the way to the TBA's	6. Multiple births at different places, specify:…		7. Other (specify):	

Was the decision to go to the health facility [ASK IF ANSWER TO Q4.1="1" or "4", OTHERWISE CIRCLE "9. NA"]

Planned during pregnancy?	1.Yes	2. No	9. NA, did not deliver in a facility or on the way to one	PLANNEDHF
Taken because problems occurred in labour/delivery?	1.Yes	2. No	9. NA, did not deliver in a facility or on the way to one	EMERGENCY

Did the waters break before labour or during labour?

1. Before labour started	2. During labour or delivery	8. Don't know	WATERBRK

How much time before you started labour did the waters break?
[ASK IF ANSWER TO Q4.4="1" or OTHERWISE CIRCLE "9. NA"]

1. Less than 4 hours	2. 4 to 23 hours	3. 24 hours or more	8. Don't know	9. NA, broke during labour	TIMEBRK

Did the person assisting with delivery wash their hands before or during the delivery?

1. Yes, with soap	2. Yes, with water only	3. No	8. NK	9. NA, nobody assisted with delivery	WASHHANDS

On what surface did you deliver? **PROMPT**

1. Indoors, uncovered floor	2. Indoors, floor covered with plastic sheet/mat/cloths/rags	3. Outdoors, inside of the compound	DELSURF
4. Outdoor outside of the compound	5. Other (specify)	8. NK	

Did you have a Caesarean Section	1. Yes	2. No	8. NK	CS
Did you know you were going to have a CS before you went into labour?	1. Yes	2. No	9. NA, no CS	KNOWCS

Now, I would like to ask about SERIOUS problems you may have experienced during labour or soon after delivery.

Did you experience:

Surgery to repair or remove the womb?	1. Yes	2. No	8. NK	SURGERY
Tear in the vagina	1. Yes	2. No	8. NK	VAGTEAR
Heavy bleeding from vagina during labour, delivery or after delivery?	1. Yes	2. No	8. NK	DBLEED
Convulsions during labour, delivery or after delivery?	1. Yes	2. No	8. NK	DCONVUL
Loss of consciousness during labour, delivery or after delivery?	1. Yes	2. No	8. NK	LOSSCONC
Did somebody have to remove the placenta from inside the uterus?	1. Yes	2. No	8. NK	RETPLAC
Were you given an IV drip?	1. Yes	2. No	8. NK	IVDRIP
Were you given a blood transfusion?	1. Yes	2. No	8. NK	BLOODTR
The umbilical cord coming out before the baby?	1. Yes	2. No	8. NK	PROLAPSE
Dark green fluid in the birth fluids?	1. Yes	2. No	8. NK	MECONIUM

5. PROBLEMS SINCE THE BIRTH: Now I'd like to ask about problems you may have experienced since the birth.

Have you experienced any of the following?

Large clots and heavy bleeding from the vagina	1. Yes	2. No	8. NK	PPCLOT
Offensive or foul smelling vaginal discharge	1. Yes	2. No	8. NK	PPDISCHARG
Hot body	1. Yes	2. No	8. NK	PPFEVER
Leaking urine or faeces	1. Yes	2. No	8. NK	PPLEAK
Breast infection: swollen, painful, "pompo", discharge, etc.	1. Yes	2. No	8. NK	PPMASTITIS
Any other serious problem I have not mentioned [SPECIFY]	1. Yes	2. No	8. NK	PPOTHPROB

.....

SAY THAT YOU WILL NOW LIKE TO ASK SOME QUESTIONS ABOUT THE BABY (BABIES).

6. FIRST BABY C **1** CHILD1ID

6.1 Where was this baby born?

1. Clinic/hospital	2. Private maternity home	3. At home/TBA	4. On the way to the clinic/ hospital /TBA	B1PLACEBIR

6.2 IF THE ANSWER TO 6.1 IS 1 OR 2, STATE WHERE. [USE CODE FROM FACILITY KEY] | | | B1HOSPITAL

6.3 Was this baby born via a normal delivery through the vagina?

1.Normally, through the vagina	2. Baby was pulled with an instrument	3. By caesarean section	4. Other. Specify.	B1TYPDELIV

6.4 Who delivered this baby?

1. Doctor	2. Midwife	3. TBA	4.Other person/relative	5. Delivered myself	8. Don't know	B1WHODELIV

6.5 Was the baby born alive ie. did it cry or move or breathe after birth?

1. Yes	2. No

B1ALIVE

6.6 Is the baby still alive?

1. Yes	2. No, died within an hour of birth	3. No, died first day	4. No, died after 1 day	9. NA, stillbirth

B1STATUS

6.7 If the baby died, how many days old was it when it died? (99= Still alive OR Stillbirth)

B1AGEDIED

6.8 Is/was the baby a male or female?.....

1. Male	2. Female	8. NK

B1SEX

6.9 Which part of the baby came out first?

1. Head	2. Feet/bottom	4. Hand/arm	5. Other . SPECIFY	8. NK

B1POSN

6.10 Does the baby have any congenital abnormality? [EXAMINE AND SPECIFY]:

1. Yes	2. No	8. NK	9. NA, baby dead

B1ANOMALY

6.11 How big was the baby when he/she was born? [PROMPT]

1. Very tiny	2. Smaller than average	3. Average size
4. Larger than most babies	5. Very big baby	8. Don't know

B1SIZE

ASK TO SEE ANY HEALTH OR FAMILY CARDS FOR THE BABY.

6.12 Weighing Card/Discharge Slip

1. Seen	2. Not seen

B1HLTHCARD

6.13 Family Card

1. Seen	2. Not seen

B1FAMCARD

RECORD BIRTHWEIGHTS FROM CARDS (IN KILOGRAMS; 888 = NO RECORD)

6.14 FROM HEALTH CARD/DISCHARGE SLIP: | | . | | |

B1BIRTHWT

FROM FAMILY CARD:
6.15 BIRTHWEIGHT | | . | | |

B1BIRWTFC

6.16 COLOUR CODING OF WEIGHT

1. Red (<1.5Kg)	2. Yellow (1.5-2.49Kg)	3. Green (2.5+Kg)	9. NA, No card

B1LBWCODE

IF RESPONSE TO Q6.6 IS "9" (STILL BIRTH) OR "2" (BABY DIED WITHIN AN HOUR OF BIRTH) PLEASE DRAW A DOUBLE LINE THROUGH THE REST OF THE QUESTIONS FOR THIS BABY, AND GO TO SECTION 7.

What was used to cut the umbilical cord?

1. Clinic/hospital instrument (scissors, razorblade, knife, etc)	2. New razorblade/knife (not from clinic/hospital)	
3. Old razorblade/knife (not from clinic/hospital)	4. Other:	8. NK

B1CORDCUT

What was used to tie the cord?

1. New thread	2. Used thread	3. Other:	8. NK

B1TIECORD

Since birth, what has been applied to the baby's umbilical cord stump?

1. Nothing. Left it alone	2. Hospital clinic medicine	3. Shea butter	4. Leaves or herbs	5. Palm oil

B1CORDMED

6. Ground nut oil	7. Other:	8. NK

Was the baby dried after delivery?	1. Yes, Before cord tied	2. Yes, After cord tied, Before placenta delivered	3. Yes, After placenta delivered	4. No, Not dried after birth	8. NK	B1DRIED
Was the baby wrapped after delivery?	1. Yes, Before cord tied	2. Yes, After cord tied, Before placenta delivered	3. Yes, After placenta delivered	4. No, Not wrapped	8. NK	B1WRAPPED

6.22 How soon after birth was the baby first put to the mother's breast?

1. Immediately	2. Within an hour of birth	3. After 1 hour but within first 12 hours		4. Between 12 & 24 hours	B1BFSTART
5. Day 2	6. Day 3	7. Day 4 or after	8. NK	9. NA, mother did not breastfeed baby	

6.23 IF Q6.22 WAS "1", "2' OR "3" CIRCLE "99/NA", OTHERWISE ASK:
Why was the baby not put to the mother's breast in the first 12 hours after birth?

11. Mother ill / weak	12. Child ill / weak	13. Child died	B1DAY1REAS
14. Nipple / breast problem	15. Not enough milk	16. Mother working	
17. Child refused	19. Did not want to give colostrum	20. Mother died	
18. Other	99. NA, mother did breastfeed baby in first 12hrs		

In the first 24 hours after birth, Was the baby offered anything else: [PROMPT]:

Breastmilk from another woman?	1. Yes	2. No	8. NK	B1DAYWET
Other milk [PROMPT for: cow's milk, tinned milk, infant formula, Lactogen, SMA]?	1. Yes	2. No	8. NK	B1DAYOTH
Other fluids [PROMPT for: water, tea, traditional medicines]?	1. Yes	2. No	8. NK	B1DAYFLUID
Any foods [PROMPT for: any solid foods, gruels, porridge, bread, rice, cerelac, nutrimix]?	1. Yes	2. No	8. NK	B1DAYSOLID

Did you give colostrum to this baby?.....	1. Yes	2. No	8. NK	B1COLOSTRU

How soon after delivery was the baby bathed?

1. Less than 1 hour	2. 1-6 hours	3. after 6 hours but less than 24 hours	4. after 24 hours	8. NK	B1FIRSBATH

Was the water heated?	1. Yes	2. No	8. NK	B1HOTWATER
Was the baby well in the first 24 hours after birth?.....	1. Yes	2. No	8. NK	B1DAYWELL

Have you heard of SKIN-to-SKIN Contact between the mother and her baby as a way to take care of the new baby?	1. Yes	2. No	8. NK	B1HEARDSSC

6.33 A. Was the baby placed in SKIN-to-SKIN contact in the first 24 hours after delivery?

1. Not at all	2. A little (up to 2 hours total)	3. Moderate amount (between 2 to 5 hours total)	4. A lot (more than 5 but less than 12 hours)	5. Most of the time (day & night, more than 12 hours)	B1SKTOSKIN

6.33 B. IF Q6.33 A, was "1. Not at all" then circle "9/NA". IF Q6.33 A. was "2", "3" , "4" or "5" then ask:
How soon after delivery was the baby placed SKIN-to-SKIN for the first time?.

1. Before the cord tied	2. After the cord tied, before the placenta delivered	3. After the placenta delivered, within the first hour after birth.	4. After one hour after delivery	8. NK	9. NA, baby was not put SKIN-to-SKIN at all.	B1IMMSKIN

IF BABY HAS DIED PLEASE DRAW A DOUBLE LINE THROUGH THE REST OF THE QUESTIONS FOR THIS BABY, AND GO TO SECTION 7.

SAY THAT YOU WILL NOW ASK SOME QUESTIONS ABOUT THE LAST 24 HOURS

How many times did you bath your baby during the day yesterday? 88= NK		B1BATHE
How many times did you breastfeed your baby during the day yesterday? 88= NK		B1BFDAY
How many times did you breastfeed your baby during the night? 88= NK		B1BFNIGHT

Did the baby sleep under a bednet last night?	1. Yes	2. No	8. NK	B1BEDNET

In the last 24 hours, was the baby offered anything else: [PROMPT]:

Breastmilk from another woman?	1. Yes	2. No	8. NK	B1CURRWET
Other milk [PROMPT for: cow's milk, tinned milk, infant formula, Lactogen, SMA]?	1. Yes	2. No	8. NK	B1CURROTH
Other fluids [PROMPT for: water, tea, traditional medicines]?	1. Yes	2. No	8. NK	B1CURFLUID
Any foods [PROMPT for: any solid foods, gruels, porridge, bread, rice, cerelac, nutrimix]?	1. Yes	2. No	8. NK	B1CURSOLID

SAY THAT YOU WILL NOW ASK SOME QUESTIONS ABOUT WHETHER THE BABY HAS BEEN WELL

Since birth, has the baby had any illness that you thought was serious or severe	1. Yes	2 No	B1ILLNESS

IF ANSWER IS NO, DRAW A DOUBLE LINE THROUGH THE REST OF THE SECTION, AND GO TO SECTION 7.

What illness/illnesses did the baby have?

Weak, abnormal crying, or no crying	1. Yes	2. No	8. NK	9. NA	B1ABNCRY
Unresponsive/Lethargic	1. Yes	2. No	8. NK	9. NA	B1UNRESP
Too weak to feed or stopped feeding	1. Yes	2. No	8. NK	9. NA	B1WEAK
Difficulty breathing	1. Yes	2. No	8. NK	9. NA	B1DIFFBR
Fast breathing	1. Yes	2. No	8. NK	9. NA	B1FASTBR
Very hot body	1. Yes	2. No	8. NK	9. NA	B1HOTBODY
Very cold body	1. Yes	2. No	8. NK	9. NA	B1COLDBODY

Convulsions/shocks	1. Yes	2. No	8. NK	9. NA	B1CONVULS
Jaundice	1. Yes	2. No	8. NK	9. NA	B1JAUNDICE
Vomits all feeds	1. Yes	2. No	8. NK	9. NA	B1VOMIT
Asram	1. Yes	2. No	8. NK	9. NA	B1ASRAM
Puni	1. Yes	2. No	8. NK	9. NA	B1PUNI
Other serious illness, please specify:	1. Yes	2. No	8. NK	9. NA	B1OTHERILL

Was care sought outside the home for this illness/illnesses?	1. Yes	2 No	8. NK	9.NA	B1CARESEE
Who was consulted?					
Traditional healer?	1. Yes	2. No	8. NK	9.NA	B1TRADHEAL
Druggist?	1. Yes	2 No	8. NK	9.NA	B1DRUGGIST
CBSV?	1. Yes	2 No	8. NK	9.NA	B1CBSVCARE
Doctor/nurse at a clinic?	1. Yes	2 No	8. NK	9.NA	B1CLINCARE
Doctor/nurse at a hospital?	1. Yes	2 No	8. NK	9.NA	B1HOSPCARE

Was he/she admitted to the hospital?.....	1. Yes	2. No	9. NA	B1ADMITTED

Where was he/she admitted? [ENTER CODE FROM FACILITY KEY] ["88"=Not known, "99"=Not applicable]		B1PLADM

Did anyone advise you to take the baby to the clinic or hospital during this illness/ illnesses?

Family member?	1. Yes	2 No	8. NK	9.NA	B1FAMREFER
Traditional healer?	1. Yes	2. No	8. NK	9.NA	B1THREFER
Druggist?	1. Yes	2 No	8. NK	9.NA	B1DRGREFER
CBSV?	1. Yes	2 No	8. NK	9.NA	B1CBSVREF
TBA?	1. Yes	2 No	8. NK	9.NA	B1TBAREFER

IF ONLY ONE BABY END FORM HERE, DRAW A DOUBLE LINE THROUGH THE REST OF THE FORM, THANK THE RESPONDENT, AND CHECK YOUR FORM.

<u>NOTE</u>: THIS FORM IS ADMINISTERED TO EACH BABY IN THE EVENT OF A MULTIPLE BIRTH

14.4 Process Evaluation Form

KINTAMPO HEALTH RESEARCH CENTER **KIVAP NEWHINTS PROJECT** PROCESS EVALUATION FORM ENG 17032009	**PROCESS EVALUATION Form No.**	FORMNO

BACKGROUND and ID:

Cluster code:…… CLUSTER

1.2 Woman's ID:…….. WOMANID

Woman's name……

Date of visit: ……. DATEVISIT

Staff code: ……. FW

Status of mother at time of visit:

1. Present	2. Currently in hospital	3. Temporarily absent (for another reason)	STATUS
4. Died	5. Moved out	6.Withdrawn	

Date of mother's death
[DRAW A LINE THROUGH IF NOT APPLICABLE] DATEDIED

STOP IF THE MOTHER IS NOT PRESENT.
DRAW A LINE ACROSS THE REST OF THE FORM IF STATUS = 2, 4, 5, or 6.
RESCHEDULE VISIT LATER IN DAY OR WEEK IF MOTHER IS TEMPORARILY ABSENT

STATUS OF THE BABY

2.1 Is the baby (babies) still alive?.....	1. All Alive	2.Baby(ies) died	BSTATUS

IF ANY BABY DIED, DRAW DOUBLE LINE THROUGH REST OF FORM, END INTERVIEW

CBSV VISITS
READ OUT: *I would like to ask you some questions about visits that CBSVs have been making.*

Did you have any visits from a CBSV in which he discussed about your pregnancy, delivery and newborn baby?	1. Yes	2. No	VISITANY

If Not , Why not? [PROMPT]

CBSV did not visit me	1. Yes	2. No	8. NK	9. NA	VISNOCBSV
I did not have time for these visits	1. Yes	2. No	8. NK	9. NA	VISNOTIME
I did not like/trust CBSV	1. Yes	2. No	8. NK	9. NA	VISNOTRUST
I did not think the visits were useful	1. Yes	2. No	8. NK	9. NA	VISNOUSEF

Other, specify: _____	1. Yes	2. No	8. NK	9. NA	VISNOOTHER

IF ANSWER TO 3.1= "2, NO CBSV VISITS RECEIVED", END INTERVIEW HERE, DRAW DOUBLE LINE THROUGH REST OF FORM

Did the CBSV give you a card like this during any of the visits to keep home? [**SHOW EXAMPLE OF NEWHINTS FAMILY CARD**]	1. Yes	2. No	8. NK	CARDFAMILY
IF yes: Can you show me the card	1. Card presented	2. Card not presented	9. NA	CARDFAMSHW

IF A FAMILY CARD IS PRESENTED, USE IT ALSO TO COMPLETE SECTION 8 AT THE END OF THE INTERVIEW

CBSV VISITS DURING PREGNANCY

READ OUT: *I would like to ask you about any visits the CBSV made **DURING PREGNANCY**.*

Did you have visits from a CBSV **during your pregnancy**	1. Yes	2. No	VISPREGANY

If "No", why not?				VISPREGNOY
The CBSV did not know that I was pregnant	The CBSV knew about my pregnancy but didn't visit me	I was too busy to receive any visits	I delivered before CBSV could make a visit	
I Moved-In just before or after delivery	Other, specify: _____	8. NK.	9. NA, had visits	

How did the CBSV know about your pregnancy? [**PROMPT**]						KNOWPREG
1. I/my family informed the CBSV	2. CBSV asked me/my family	3. The Obaapa fieldworker informed the CBSV	4. Other source of information, Specify: _____	8. NK	9.NA, CBSV didn't know	

How old was your pregnancy when the CBSV came the first time to discuss the pregnancy or planning for the birth? [**WRITE IN MONTHS. 88= NK, 99=NA, no visits received in pregnancy**].			VISPRGFRST
How old was your pregnancy when the CBSV came the last time before delivery to discuss the pregnancy or planning for the birth? [**WRITE IN MONTHS. 00= NO SECOND VISIT in pregnancy, 88= NK, 99=NA, no visits received in pregnancy**].			VISPRGLAST

CBSV VISITS AFTER DELIVERY

READ OUT: *Now I would like to ask you about any visits the CBSV made **AFTER DELIVERY**.*

Did you have any visits from a CBSV **after delivery to assess the baby**	1. Yes	2. No	VISDELANY

If "No", why not?					
	The CBSV did not know that I had delivered	The CBSV knew about my delivery but didn't visit me	I was too busy to receive any visits	I moved just after delivery	VISDELNOY
	Other, specify: _____		8. NK.	9. NA, had visits	

How did the CBSV know about your delivery? [**PROMPT**]						
	1. I/my family informed the CBSV	2. CBSV asked me/my family	3. The Obaapa fieldworker informed the CBSV	4. Other source of information, Specify: _____	8. NK	9.NA, CBSV didn't know	KNOWDEL

IF ANSWER TO 5.1= "2, NO CBSV VISITS AFTER DELIVERY", DRAW DOUBLE LINE THROUGH REST OF SECTION 5 AND 6 AND CONTINUE WITH SECTION 7

VISIT SCHEDULE AFTER DELIVERY:

How soon after delivery did the CBSV make the first visit?					
	1. Within the first hour	2. After 1 hour but within three hours	3. More than 3 hours but less than 6 hours	4. More than 6 hours after delivery but within a day	VISDELDAY
	5. on the 2nd day	6. On the 3rd day	7. After 3rd day	8. NK	

CODE NUMBER OF DAYS OF FIRST VISIT AFTER DELIVERY: [ ][ ] VISDEL1
IF ANSWER TO 5.3 WAS 1-4 ENTER 01,
IF ANSWER WAS 5 ENTER 02,
IF ANSWER WAS 6 ENTER 03,
IF ANSWER WAS 7 ASK HOW MANY DAYS AFTER DELIVERY.
(88=NK)

FOR QUESTION D to 0 USE "88" IF VISIT WAS MADE BUT DAYS SINCE DELIVERY OR PREVIOUS VISIT ARE NOT KNOWN; USE "99" IF NO VISIT WAS MADE

How many days later did the CBSV make the next (second) visit? [ ][ ] VISDEL2

How many days later did the CBSV make the next (third) visit?. [ ][ ] VISDEL3

How many days later did the CBSV make the next (fourth) visit? [ ][ ] VISDEL4

How many days later did the CBSV make the next (fifth) visit? [ ][ ] VISDEL5

How many days later did the CBSV make the next (sixth) visit? [ ][ ] VISDEL6

How many days later did the CBSV make the next (seventh) visit? [ ][ ] VISDEL7

READ OUT: *Now I would like to ask you some questions* ***about what the CBSV did:***

Did the CBSV weigh the baby on the first visit after delivery?……	1. Yes	2. No	8. NK	WEIGHTDAY1
Did the CBSV weigh the baby on any other visit?	1. Yes	2. No	8. NK	WEIGHTOTH

Did the CBSV tell you anything about the weight of your baby?	1.Yes	2. No	8. NK	9. NA, Not weighed	WEIGHTTELL

If yes, what did the CBSV tell you?	1. The baby was small or very small	2. The baby's weight was okay	3. Other, specify _____	9. NA: Not weighed	WEIGHTINFO

Did the CBSV take the baby's temperature?	1. Yes, on all visits	2. Yes, on some visits	3No, not at all	8. NK	CHKTEMP
Did the CSBV count the baby's breaths?	1. Yes, on all visits	2. Yes, on some visits	3No, not at all	8. NK	CHKBREATH

REFERRALS

At any of the visits, After the CBSV checked your baby, did they tell you that you needed to take your baby to get treatment at a health facility?	1. Yes	2. No		REFCBSV
If Yes, what was the reason for this?	1. Baby sick	2. Baby very small	8. NK	9. NA	REFWHY

IF NO REFERRAL, DRAW DOUBLE LINE THROUGH REST OF SECTION 6 AND CONTINUE WITH SECTION 7

Did the CBSV give you a referral slip like this? **[SHOW EXAMPLE OF REFERRAL SLIP]**	1. Yes	2. No	8. NK	REFSLIP
If yes, can you show it to me?	1. Referral slip shown	2. Referral slip not shown		REFSLIPSHW

IF A REFERRAL SLIP IS PRESENTED, USE IT ALSO TO COMPLETE SECTION 9 AT THE END OF THE INTERVIEW

Did the CBSV discuss any of the following ways of caring for your baby on the way to the facility?:

Keeping the baby skin to skin……...	1. Yes	2. No	8.NK	REFDISSSC
Keeping the baby well wrapped (if skin to skin not done)	1. Yes	2. No	8.NK	REFDISWRAP
Breastfeeding continuously ……..	1. Yes	2. No	8.NK	REFDISBF

Did you take the baby to the facility?.....	1. Yes	2. No	REFTAKE

If "No", why not?

CIRCLE ALL THOSE MENTIONED. DO NOT PROMPT

Financial constraints	1. Mentioned	2. Not Mentioned	9. NA	REFNOFINAN
Transport constraints	1. Mentioned	2. Not Mentioned	9. NA	REFNOTRANS
Husband did not allow	1. Mentioned	2. Not Mentioned	9. NA	REFNOALLOW
Husband not at home	1. Mentioned	2. Not Mentioned	9. NA	REFNOHUSBA
Waiting to see if baby improved	1. Mentioned	2. Not Mentioned	9. NA	REFNOWAIT
Used herbal or home treatment/ visited trad. healer first	1. Mentioned	2. Not Mentioned	9. NA	REFNOHERB
Thought baby was okay	1. Mentioned	2. Not Mentioned	9. NA	REFNOOKAY
Other, specify: _____	1. Mentioned	2. Not Mentioned	9. NA	REFNOOTHER

IF THEY DID NOT TAKE THE BABY, DRAW DOUBLE LINE THROUGH REST OF SECTION 6 AND CONTINUE WITH SECTION 7

How soon were you able to take the baby to the facility?				
	1. Within 1 hour	2. After 1 hour but within 3 hours	3. More than 3 hrs but within a day	REFWHEN
	4. Next day	5. Two (2) or more days later	8. NK	

If you did not take the baby to the facility on the same day , why not?

CIRCLE ALL THOSE MENTIONED. DO NOT PROMPT

Financial constraints	1. Mentioned	2. Not Mentioned	9. NA	REFDLFINAN
Transport constraints	1. Mentioned	2. Not Mentioned	9. NA	REFDLTRANS
Husband did not allow	1. Mentioned	2. Not Mentioned	9. NA	REFDLALLOW
Husband not at home	1. Mentioned	2. Not Mentioned	9. NA	REFDLHUSBA
Waiting to see if baby improved	1. Mentioned	2. Not Mentioned	9. NA	REFDLWAIT
Used herbal or home treatment/ visited trad. healer first	1. Mentioned	2. Not Mentioned	9. NA	REFDLHERB
Other, specify: _____	1. Mentioned	2. Not Mentioned	9. NA	REFDLOTHER

FOR THE FOLLOWING QUESTION EXPLORE HOW MANY FACILITIES THE MOTHER TOOK THE BABY TO FOLLOWING THE REFERRAL BY THE CBSV (Either because she chose to consult more than one or because she was referred on)

To how many facilities in total did you end up taking your baby to after the CBSV told you to?	1. One	2. Two	3. Three	4. More than three	9. NA	REFFACNR

Ask the following questions 0 **to 6.12 only for the <u>FIRST</u> facility they took the baby to:**

To which facility did you take your baby **FIRST**?...

Facility Name= _____

WRITE FACILITY CODE **FIRST** FACILITY: | | | REF1CODE

How did you get to this (first) facility?
[RECORD MAIN WAY ONLY]

1. Walked	2. Bicycle	3. Motorbike	4. Tro-Tro / Bus	REF1TRANS
5. Taxi	6. Private car	7. Other, specify: _____		

Did you do any of the following on the way to the **FIRST** facility?

Keeping the baby skin to skin……	1. Yes	2. No	REF1SSC
Keeping the baby well wrapped (if skin to skin not done)…	1. Yes	2. No	REF1WRAP
Breastfeeding continuously ……..	1. Yes	2. No	REF1BF

In this (first) facility, how quickly were you seen by a health worker?

1. Less than 30 minutes	2. More than 30 minutes but less than 1 hour	3.More than 1 hour but less than 3 hours	4. More than 3 hours	REF1WAIT

Was your baby admitted in this (first) facility you went to?

1. Yes, admitted	2. NO, referred to another facility	3. Treated at facility and sent home	REF1ADMIT
4 Sent home with treatment to give	5. Sent home, no treatment		

Did you go to a second facility? And why?

1. Yes, because the baby was referred	2. Yes, not referred but went on our own initiative	3. No	REF2TAKE

IF ONLY ONE FACILITY WAS VISITED , DRAW DOUBLE LINE THROUGH QUESTIONS 0 **to 6.25**

Ask the following questions 0 **to** 0 **only for the <u>SECOND</u> facility they took the baby to:**

What was the name of this (second) facility?

Facility Name=

WRITE FACILITY CODE **SECOND** FACILITY: | | | REF2CODE

Did you go straight away to this (second) facility

1. Yes	2. No, went home first	3. No, other	REF2STRAIT

How did you get to this (second) facility?
[RECORD MAIN WAY ONLY]

1. Walked	2. Bicycle	3. Motorbike	4. Tro-Tro / Bus	REF2TRANS

5. Taxi	6. Private car	7. Other, specify: _____

In this (second) facility, how quickly were you seen by a health worker?

1. Less than 30 minutes	2. More than 30 minutes but less than 1 hour	3.More than 1 hour but less than 3 hours	4. More than 3 hours	REF2WAIT

Was your baby admitted in this (second) facility you went to?

1. Yes, admitted	2. NO, referred to another facility	3. Treated at facility and sent home	REF2ADMIT
4 Sent home with treatment to give	5. Sent home, no treatment		

Did you go to a third facility? And why?

1. Yes, because the baby was referred	2. Yes, not referred but went on our own initiative	3 No	REF3TAKE

IF ONLY TWO FACILITIES WERE VISITED , DRAW DOUBLE LINE THROUGH QUESTIONS 0 **to** 0
Ask the following questions 0 **to** 0 **only for the <u>THIRD</u> facility they took the baby to:**

What was the name of this (third) facility??

Facility Name= _____

WRITE FACILITY CODE **THIRD** FACILITY: REF3CODE

Did you go straight away to this (third) facility

1. Yes	2. No, went home first	3. No, other	REF3STRAIT

How did you get to this (third) facility?
[RECORD MAIN WAY ONLY]

1. Walked	2. Bicycle	3. Motorbike	4. Tro-Tro / Bus	REF3TRANS
5. Taxi	6. Private car	7. Other, specify: _____		

In this (third) facility, how quickly were you seen by a health worker?

1. Less than 30 minutes	2. More than 30 minutes but less than 1 hour	3.More than 1 hour but less than 3 hours	4. More than 3 hours	REF3WAIT

Was your baby admitted in this (third) facility you went to?

1. Yes, admitted	2. NO, referred to another facility	3. Treated at facility and sent home	REF3ADMIT
4 Sent home with treatment to give	5. Sent home, no treatment		

GENERAL QUESTIONS ABOUT THE VISITS

READ OUT: *Now, I would like to ask you some general questions about all the visits that you received from the CBSV, both in pregnancy and after delivery.*

Apart from you and the CBSV, who participated in the visits? **[PROMPT]**

Mother or mother-in-law……	1. Yes	2. No	VISPRESMOT

Husband/father of the baby……	1. Yes	2. No	VISPRESHUS
Sister/sister in law……..	1. Yes	2. No	VISPRESSIS
TBA……	1. Yes	2. No	VISPRESTBA
Other. Specify: _____	1. Yes	2. No	VISPRESOTH

Was your CBSV male or female?.....	1. Male	2. Female		CBSVSEX
Did the gender of the CBSV matter to you?	1. Yes	2. No		CBSVSEXMAT
Did the CBSV have the same ethnicity as you?..	1. Yes	2. No	8.NK	CBSVETHNIC
If 7.4= "2, No" : Did it matter to you that the CBSV had a different ethnicity?.....	1. Yes	2. No	9. NA: CBSV same ethnicity	CBSVETHMAT

IF 7.5= "1, Yes", can you explain why? **[WRITE IN CAPITALS**] : CBSVETHWHY

_____

_____

_____

_____

_____

If you become pregnant again, would you like the CBSV to come and visit you again	1.Yes	2. No	8. NK	CBSVFUTURE
Would you recommend the CBSV visits to other women in the community? …….	1.Yes	2. No	8. NK	CBSVRECOM

IF FAMILY CARD WAS PRESENTED EARLIER EXPLAIN THAT YOU WOULD NOW LIKE TO COPY INFORMATION FROM THE CARD

OTHERWISE DRAW DOUBLE LINE THROUGH SECTION 8 AND GO TO SECTION 9

CBSV Name: (WRITE "BLANK" IF NAME NOT FILLED) _____

CBSV ID **[TO BE ENTERED BY NEWHINTS TEAM]**							CBSVID

COPY FROM APPOINTMENTS TABLE ON "NEWHINTS FAMILY CARD"
USE "77 77 77" IF "DAY OF DELIVERY" IS WRITTEN
USE "99 99 99" IF DATES LEFT BLANK
Date of next visit

Date of next visit: 1 …….							CARDVIS1
Date of next visit: 2 …….							CARDVIS2
Date of next visit: 3 …….							CARDVIS3
Date of next visit :4 …….							CARDVIS4

Date of next visit :5 …….

Date of next visit :6 …….

Date of next visit :7 …….

Date of next visit :8 …….

Date of next visit :9 …….

Date of delivery: ……

						CARDVIS5
						CARDVIS6
						CARDVIS7
						CARDVIS8
						CARDVIS9
						CARDATEDEL

First visit after delivery on (circle)	1. Day of delivery	2. 1 day after delivery	3. 2 or more days after delivery	9. Not Filled	CARDELVIS1

BIRTH WEIGHT: COPY INFO FROM CARD.
IF COLOUR IS LEFT BLANK USE "9", NOT FILLED"
IF WEIGHT IS LEFT BLANK, USE "9.9"

circle box for colour code

Baby 1 ___	1. R	2. Y	3. G	9, Not Filled	Weight in kg		.	Kg	WEIGHTCOL1 WEIGHTKG1
Baby 2 ___	1. R	2. Y	3. G	9, Not Filled	Weight in kg		.	Kg	WEIGHTCOL2 WEIGHTKG2
Baby 3 ___	1. R	2. Y	3. G	9, Not Filled	Weight in kg		.	Kg	WEIGHTCOL3 WEIGHTKG3

IF "REFERRALS" SECTION ON FAMILY CARD IS LEFT <u>COMPLETELY</u> BLANK:
DRAW DOUBLE LINE ACROSS 8.6 AND 8.7

DATE REFERRED : COPY INFO FROM CARD. USE "99 99 99 " IF LEFT BLANK

Date referred : …….							CARDATREF1
Date referred : …….							CARDATREF2
Date referred : …….							CARDATREF3

REASON REFERRED : **COPY INFO FROM CARD. USE "9, NA or Not Filled" IF LEFT BLANK**

Reason referred : ……	1. Very small	2. Sick	9. NA, or Not Filled	CARWHYREF1
Reason referred : ……	1. Very small	2. Sick	9. NA, or Not Filled	CARWHYREF2
Reason referred : ……	1. Very small	2. Sick	9. NA, or Not Filled	CARWHYREF3

IF REFERRAL SLIP WAS PRESENTED EARLIER , EXPLAIN THAT YOU WOULD NOW LIKE TO COPY INFORMATION FROM THE REFERRAL SLIP
OTHERWISE DRAW DOUBLE LINE THROUGH SECTION 9, THANK THE MOTHER, END INTERVIEW

COPY FROM REFERRAL SLIP:

Age of baby (in days)							REFSLPAGE
Date referred : …….							REFSLPDATE
Seen at facilty by	1. Filled			2. Not filled			REFSEENFAC
Date (seen) …….							REFSEENDTE

THANK THE MOTHER AND END THE INTERVIEW

14.5 Postpartum Form

KINTAMPO HEALTH RESEARCH CENTRE KIVAP OBAAPAVITA PROJECT POSTPARTUM FORM 301003 ENG	POSTPART Form No.	FORMNO

1. BACKGROUND and ID:

1.1. Cluster code:………………………………………………………………………. CLUSTER

1.2. Woman's name

1.3. Woman's ID :…………………….. WOMANID

1.4. Date of visit: ………………………………………….……… DATEVISIT

1.5. Staff code: …………………………………………..……….……………………………. FW

2. STATUS:

2.1. Status at time of visit:

1. Present	2. Currently in hospital	3. Temporarily absent	STATUS
4. Died	5. Moved out	6.Withdrawn	

IF STATUS = "3", "5" OR "6" DRAW A DOUBLE LINE THROUGH THE REST OF THE FORM. IF STATUS = "2" OR "4" FIND ANOTHER PERSON TO ANSWER THE QUESTIONS FOR THE STUDY WOMAN IF POSSIBLE.

3. MATERNAL POSTPARTUM MORBIDITY:
Since my last visit to you 4 weeks ago have you had:

3.1. Heavy bleeding?………………………………………………….……….	1. Yes	2. No	PPBLEED
3.2. Bleeding with large clots?…………………………………….….	1. Yes	2. No	PPCLOTS
3.3.Convulsions like in children?..	1. Yes	2. No	PPCONVUL
3.4. Hot body?……………………………….…………………….……	1. Yes	2. No	PPFEVER
3.5. 'Fainting'………………………………………………………....	1. Yes	2. No	PPFAINT
3.6. Jaundice (not fever alone)……………..................................... .	1. Yes	2. No	PPJAUNDICE
3.7. Foul smelling vaginal discharge?..	1. Yes	2. No	PPDISCHARGE
3.8. Chest pain or pain in the ribs?..	1. Yes	2. No	PPCHEST
3.9. Any other serious problem that I have not mentioned [SPECIFY]:	1. Yes	2. No	PPOTHPROB

3.10. Did you seek care at a clinic or hospital or consult a traditional healer for any of the problems you have told me about?..	1. Yes	2. No	PPILL

3.11. How long were you in labour before the baby was born (that is from the start of regular or painful contractions)?

1. Less than 4 hrs	2. 4 to 11 hrs	3. 12 to 23 hrs	4. 24 hours or more	8.NK	9. NA, CS	TIMELAB

3.12. Did you think this was too long?.....

1. Yes, too long	2. No,normal duration	8. Cannot tell	TIMENORM

3.13. How much did your delivery cost you? IN CEDIS
0000000 = DID NOT PAY; 8888888 = DON'T KNOW

							AMTPAID

3.14. At what time of the day was the baby born?

1. 5am-7am	2. 8am-12pm	3. 1pm-4pm	4. 5pm-8pm	5. 9pm-1am	6. 2am-4am	TIMEDAY

3.15. Are you having any problems with breastfeeding?.....

1. Yes	2. No	BFEEDPROB

3.16. What problem?

1. No/not enough milk	2. Cracked/painful nipples	3. Breast infection: swollen, "pompo", painful, discharge, etc.	TYPEBFPROB
4. Other:		9. NA, no problem, or baby dead	

3.17 Has the baby had the BCG/TB immunisation? DEMONSTRATE WHERE IMMUNISATION IS INJECTED INTO ARM

1. Yes	2. No	8. NK	9. NA, Stillbirth	BCG

NOW ASK THE WOMAN FOR HER PINK ANTENATAL/POSTNATAL CARE CARD.

3.18. Is there a record of the woman having received vitamin A after delivery on the card?.....

1. Yes	2. No	8. No card	MEGADOSE

END OF POSTPARTUM FORM. CHECK YOUR FORM AND THANK THE RESPONDENT

14.6 Infant Form

KINTAMPO HEALTH RESEARCH CENTER KIVAP OBAAPAVITA PROJECT INFANT FORM 120209	INFANT Form No.	FORMNO

1. BACKGROUND and ID:

1.1. Cluster code: CLUSTER

1.2. Woman's ID : WOMANID

1.3 Woman's name

1.4. Infant ID number: C INFANTID

1.5. Infant visit number: …….. INFVISIT

Date of visit: …….. DATEVISIT

1.7. Staff code: ……. FW

2. STATUS:

Status at time of visit: ISTATUS

1. Present	2. Currently in hospital	3. Temporarily absent (for another reason)
4. Died	5. Moved out	6.Withdrawn

Date of death [DRAW A LINE THROUGH IF NOT APPLICABLE] IDATEDIED

IF THE ANSWER TO 2.1 IS "2. Currently in hospital" OR "3. Temporarily absent", CONTINUE WITH SECTIONS 3 AND 4 ONLY IF THE MOTHER OR USUAL CARER OF THE INFANT IS PRESENT. OTHERWISE, END INTERVIEW AND DRAW A LINE ACROSS THE REST OF THE FORM. IF THE BABY IS DEAD, END INTERVIEW. DRAW A LINE ACROSS THE REST OF THE FORM

MORBIDITY:

In the past month did [name child] have a serious illness for which you took him/her to a clinic, hospital, or traditional healer because he/she was ill? 1. Yes 2. No ISEEKCARE

Was he/she admitted? 1. Yes 2. No 9. NA, not been ill IADMITTED

Where was he/she admitted? [ENTER CODE FROM FACILITY KEY] …… HOSPITAL

SAY THAT YOU WILL NOW ASK SOME MORE QUESTIONS ABOUT THE LAST 24 HOURS

In the last 24 hours was this baby put to the mother's breast?.....	1. Yes	2. No	8. NK	CURRBF

In the last 24 hours, why was the baby not put to the mother's breast?
IF Q4.1. WAS "1/YES" CIRCLE "99/NA"

11. Mother ill / weak	12. Child ill / weak	13. Child died	CURRREAS
14. Nipple / breast problem	15. Not enough milk	16. Mother working	
17. Child refused	18. Child reached weaning age	19. Mother became pregnant or delivered another child	
20. Mother started using contraception	21. Other:	99. NA, mother did breastfeed baby in the last 24 hours	

In the last 24 hours was the baby offered anything else?: [PROMPT] breastmilk from another woman?……	1. Yes	2 No	8. NK	CURRWET
other milk: [PROMPT for]: cow's milk, tinned milk, infant formula, Lactogen, SMA?…….……..…..	1. Yes	2 No	8. NK	CURROTH
other fluids: [PROMPT for]: water, tea traditional medicine…	1. Yes	2 No	8. NK	CURRFLUID
any foods: [PROMPT for]: any solid foods, gruels, porridge, bread, rice, cerelac, nutrimix?.....	1. Yes	2 No	8. NK	CURRSOLID
In the last 24 hours has the baby been well?.....	1. Yes	2 No	8. NK	CURRWELL
In the last 24 hours has the baby been able to suckle or feed in a normal way?.....	1. Yes	2 No	8. NK	CURRSUCK
Did the baby sleep under a bednet last night?	1. Yes	2 No	8. NK	IBEDNET

IMMUNIZATIONS

Since the baby was born, did you take the baby to a health facility for immunizations and or weighing	1. Yes	2. No	PNCEVER
Can I see the Child Health Records card for this baby?	1. Card produced	2. Card not produced	CHRCARD

IF CARD IS NOT PRODUCED DRAW DOUBLE LINE THROUGH REST OF FORM, END INTERVIEW

OPEN THE CARD TO THE 'VITAMIN A SUPPLEMENTATION' PAGE (PAGE 2). COPY THE DATES AND DOSAGES FOR **ALL** VITAMIN A DOSES THAT HAVE BEEN RECEIVED (I.E. WHERE BOXES FOR THE DATE AND DOSE ARE FILLED IN), WHETHER THEY OCCURRED IN THE PREVIOUS MONTH OR NOT. USE "88 88 88" and "888" IF DATE AND / OR DOSE ARE LEFT BLANK.

Vitamin A 1	DATE							DOSE				0	0	0	IU	VADATE1 VADOSE1
Vitamin A 2	DATE							DOSE				0	0	0	IU	VADATE2 VADOSE2
Vitamin A 3	DATE							DOSE				0	0	0	IU	VADATE3 VADOSE3

Vitamin A 4 DATE | | | | | | | DOSE | | | | 0 | 0 | 0 | IU VADATE4 VADOSE4

OPEN THEN CARD TO THE 'IMMUNISATIONS' PAGE (PAGE 3). COPY THE DATES FOR **ALL** VACCINATIONS THAT HAVE BEEN RECEIVED (I.E. WHERE BOXES FOR THE DATE, PLACE GIVEN, ETC. ARE FILLED IN), WHETHER THEY OCCURRED IN THE PREVIOUS MONTH OR NOT. USE "88 88 88" IF DATE IS LEFT BLANK.

TUBERCULOSIS (BCG)

At Birth DATE | | | | | | | BCGDATE

POLIOMELITUS (OPV) (BIRTH)

At Birth DATE | | | | | | | OPVBDATE

1st (6 weeks) DATE | | | | | | | OPV1DATE

2nd (10 weeks) DATE | | | | | | | OPV2DATE

3rd (14 weeks) DATE | | | | | | | OPV3DATE

DIPHTERIAL/PERTUSSIS/HEPATITIS B /HAEMOPHILUS INFLUENZAE B

1 st (6 weeks) DATE | | | | | | | DPTHH1DATE

2nd (10 weeks) DATE | | | | | | | DPTHH2DATE

3rd (14 weeks) DATE | | | | | | | DPTHH3DATE

MEASLES (9 months) DATE | | | | | | | MEASLSDATE

YELLOW FEVER (9 months) DATE | | | | | | | YFEVRDATE

END OF INFANT FORM. THANK THE RESPONDENT AND CHECK YOUR FORM

14.7 Month Pregnancy Form

KINTAMPO HEALTH RESEARCH CENTER **KIVAP OBAAPAVITA PROJECT** **MONTH (PREGNANCY) FORM**	**MONTH (PREGNANCY) Form No.**	FORMNO

BACKGROUND and ID:

1.1 Cluster code: | CLUSTER

1.2 Woman's ID : | WOMANID

1.3 Woman's name

1.4 Week group: | 1.5 Month visit number: | MONTHNO

1.6 Pregnancy visit number: …….. | PREGVISIT

Date of visit: …….. | DATEVISIT

1.8 Staff code: …… | FW

2. EVENTS:

Status at time of visit:

1. Present	2. Currently in hospital	3. Temporarily absent (for another reason)	STATUS
4. Died	5. Moved out	6.Withdrawn	

2.2 Date of death [DRAW A LINE THROUGH IF NOT APPLICABLE] | DATEDIED

STOP IF THE WOMAN IS NOT PRESENT. DRAW A LINE ACROSS THE REST OF THE FORM. IF THE WOMAN
IS DEAD COMPLETE QUESTIONS 3.1 TO 3.3. IF THE ANSWER IS "1" "2" "3" OR "4" FILL IN A BIRTH FORM

3. PREGNANCY:

3.1 Are you still pregnant? …… | 1. Yes | 2. No | PREGNANT

IF THE ANSWER is 2, **No**, ASK HOW THE PREGNANCY ENDED

3.2 What happened?

1. "wawo" (term live birth)	2. "wawo atwene" (term stillbirth)	3. "wasane awoe" (live birth, but died)	4. "wapon ba" (premature, lost the baby)	ENDPREG
5. ectopic	6. "apon"/"asei" (lost before 6mo)	7. False alarm	9. NA, still pregnant	

3.3 Date pregnancy ended [09/09/09 IF STILL PREGNANT] | DATDELIV

IF SHE GAVE BIRTH, ie. “1”, “2”, “3”,OR “4”, COMPLETE THIS FORM, THEN FILL IN A BIRTH FORM.

4. GENERAL MORBIDITY:

Now I want to ask you about any illnesses you’ve had since my last visit.

4.1 Have you been ill? ……..…….			1. Yes	2. No	ILL
4.2 Was the illness severe enough for you to seek care outside the home, that is, go to a doctor, clinic or traditional healer?	1. Yes	2. No	9. NA, not ill		HOWILL
4.3 Were you admitted to the clinic or hospital? ……	1. Yes	2. No	9. NA, not ill		ADMITTED
4.4 Where were you admitted? [ENTER CODE FROM FACILITY KEY] ……					HOSPITAL

END OF MONTH PREGNANCY FORM. CHECK YOUR FORM. AND THANK HER FOR HER TIME.

14.8 Month Standard Form

KINTAMPO HEALTH RESEARCH CENTER **KIVAP OBAAPAVITA PROJECT** **MONTH (STANDARD) FORM**	**MONTH (STANDARD) Form No.**	FORMNO

BACKGROUND and ID:

1.1 Cluster code: CLUSTER

1.2 Woman's ID: WOMANID

1.3 Woman's name

1.4 Week group: 1.5 Month visit number: MONTHNO

1.6 Date of visit: …….. **DATEVISIT**

1.7 Staff code …… FW

2. EVENTS:

Status at time of visit: STATUS

1. Present	2. Currently in hospital	3. Temporarily absent (for another reason)
4. Died	5. Moved out	6.Withdrawn

2.2 Date of death [DRAW A LINE THROUGH IF NOT APPLICABLE] **DATEDIED**

STOP IF THE WOMAN IS NOT PRESENT. DRAW A LINE ACROSS THE REST OF THE FORM

2.3 Are you pregnant? …… 1. Yes 2. No PREGNANT

3. MORBIDITY:

3.1 In the past month, since my last visit, have you been ill? …… 1. Yes 2. No ILL

3.2 Was the illness severe enough for you to seek care outside the home, that is, go to a doctor, clinic or traditional healer? 1. Yes 2. No 9. NA, not ill HOWILL

3.3 Were you admitted to the clinic or hospital? …… 1. Yes 2. No 9. Not applicable ADMITTED

3.4 Where were you admitted? [ENTER CODE FROM FACILITY KEY] …….. HOSPITAL

END OF MONTH FORM. . CHECK YOUR FORM. AND THANK HER FOR HER TIME.