Interventions to improve adherence to antenatal and postnatal care regimens among pregnant women in sub-Saharan Africa: A systematic review

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Abstract

Pregnant women in sub-Saharan Africa tend to have low adherence to antenatal (ANC) and postnatal care (PNC) regimens, contributing to high infant and child mortality rates. We conducted a systematic review of the literature to determine the effectiveness of existing interventions to improve adherence to ANC and PNC regimens among pregnant women in sub-Saharan Africa. Full text, peer-reviewed articles, published in English and listed in PubMed or PsycINFO were included. Studies were restricted to randomized controlled trials (RCTs) only and had to assess the intervention's impact on ANC/PNC attendance specifically. Data on the study population, methodology, recruitment, baseline characteristics, treatment arms, study completion rates, primary and secondary outcomes measured, and treatment effects were extracted from 19 studies during full-text screening. Of the 19, five studies met our inclusion criteria. Using the Cochrane risk of bias tool, the risk of systematic error in each included study was also evaluated. Although the risk of bias was unclear or high in some cases, it remained low in most categories across studies. None of the interventions were directly aimed at improving adherence, but two of the five, both behavioral interventions, demonstrated effectiveness in increasing ANC and PNC uptake, respectively. Three home visit interventions had no effect on ANC adherence. Results point to a large gap in the literature on interventions to address ANC/PNC adherence in sub-Saharan Africa.

Keywords: antenatal care; postnatal care; adherence; sub-Saharan Africa; interventions; systematic review

Introduction

The infant mortality rate, defined as the probability of dying before age 1, was 31 deaths per 1,000 live births worldwide in 2016, with 61% occurring in the first 28 days of life (UNIGME, 2017). Despite improvement in the last two decades, the global maternal mortality rate remains at 216 deaths per 100,000 live births (World Health Organization, 2015). These figures are highest in sub-Saharan Africa, where the infant mortality rate is 53 deaths per 1,000 live births; the neonatal mortality rate is 28 deaths per 1,000 live births; and the maternal mortality rate is 547 deaths per 100,000 live births (UNIGME, 2017).

One factor hypothesized to play an important role in accounting for regional disparities in infant and maternal mortality is insufficient antenatal (ANC) and postnatal care (PNC) regimen takeup. Regular contact with a skilled doctor, nurse, or midwife during ANC allows pregnant women to prepare for delivery and receive education on the warning signs of poor maternal or infant health during pregancy and childbirth. In addition, assessment of the mother and baby during PNC is vital to mitigate the risks to maternal and infant morbidity and mortality, which are highest in the days and weeks following childbirth. The World Health Organization (WHO) recommends that pregnant women attend a minimum of four ANC visits with a skilled health provider and seek PNC checkups within 24 hours, and no later than two days, after delivery (World Health Organization, 2014a, 2016). While more than 90% of women in developed regions, such as the Americas and Europe, adhere to the WHO's ANC/PNC recommendations, only 52% in sub-Saharan Africa receive at least four ANC visits (UNICEF, 2016), and only 41% attend a PNC checkup within two days of childbirth (World Health Organization, 2014b). Thus, low adherence to recommended ANC/PNC regimens in sub-Saharan Africa poses a significant risk to infant and maternal mortality.

In light of these low adherence figures and the high returns from attending ANC/PNC visits, it is perhaps surprising that research on interventions to improve adherence is in its infancy. In particular, because mothers are likely to be highly motivated to optimize their children's

outcomes, and ANC/PNC resources are often available even in resource-poor settings, it is possible that behavioral factors are obstacles to adherence. Our aim in the current review is to summarize all randomized controlled trials (RCTs) of behavioral interventions to increase adherence to ANC and PNC regimens among pregnant women in sub-Saharan Africa. We present and assess the results of each individual intervention study within a framework of psychological mechanisms hypothesized to affect adherence. We also examine the risk of bias at the study design level by rating the quality of the intervention studies reviewed. We conclude by making recommendations on how to use this review to inform the development and evaluation of future ANC/PNC adherence interventions.

Methods

Search Strategy and Data Sources

In January 2018, we identified published studies in the electronic databases of PubMed and PsycINFO. RCTs of interventions intended to improve adherence to the recommended number of ANC/PNC visits were sought and selected if they included pregant women in sub-Saharan Africa and reported treatment effects on the primary outcome of interest, ANC/PNC uptake. We did not restrict publication date, but did limit the search to English-language and peer-reviewed articles. The search was further restricted to RCTs conducted only in sub-Saharan Africa to evaluate the causal effect of each intervention on ANC/PNC regimen adherence specific to this population. No further exclusion criteria were applied.

Three blocks of index terms were used to search the PubMed database, and four blocks to search PsycINFO. The first block referred to *interventions* with terms including: “Intervention”, “Program”, and “Training”. To generate a comprehensive list of interventions targeting pregnant women in sub-Saharan Africa, the second block individually listed the names of every country in sub-Saharan Africa, i.e. “Botswana”, “Ethiopia”, “Kenya”, “Nigeria”, etc. The third block referred to *ANC/PNC adherence* with terms including: “Prenatal”, “Postnatal”, “Antenatal”,

"Pregnant", and "Adherence". Due to an inability to restrict the sample to RCTs only in PsychINFO, a fourth block was added to the PsycINFO search strategy related to *RCT design* and included the following terms: "Randomized controlled trial", "Randomized trial", "RCT", and "Randomized". The full systematic review protocol, which includes the entire search strategy, was registered with the international prospective registrar of systematic reviews, PROSPERO, at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=88152 with registration id number CRD42018088152 and is publicly accessible (Esopo et al., 2018).

Study Selection

For the initial search, two reviewers used a software called abstrackr (Wallace et al., 2012) to independently screen abstracts and subsequently accept or reject each study for full text review. Following our Population Intervention Comparison Outcome (PICO) search strategy (Santos et al., 2007), abstracts were rejected if the studies did not have (1) interventions that were geared toward pregnant women in sub-Saharan Africa, (2) at least one quantitative ANC/PNC adherence outcome measure, and (3) an RCT study design. Any disagreements regarding the eligibility of particular studies were resolved through discussion with a third independent reviewer.

Full Text Review and Data Extraction

The same two reviewers independently reviewed the full text of the studies identified in the abstract screening phase and used a standardized, pre-piloted digital spreadsheet to extract data from all included studies. The following data was extracted: publication title and authors; study setting; study population and characteristics at baseline; study design; recruitment procedures; study completion rates; details of the intervention and control conditions, including number of participants assigned to each group; description of outcomes measured and times of measurement; and treatment effects. The extracted data were then used to determine study eligibility for inclusion in the review. Discrepancies between the data extracted and the final determination to include or exclude a particular study were reconciled by the third independent reviewer.

In addition, each included study was assessed for risk of bias at the study design level that could potentially lead to underestimation or overestimation of the true treatment effect (Wood et al., 2008). Using the Cochrane risk of bias tool, we identified and recorded any information that was given about (1) the randomization sequence generation (selection bias); (2) concealment of the treatment allocation sequence (selection bias); (3) blinding of participants and study personnel to treatment allocation (performance bias); (4) blinding of enumerators assessing outcomes and analyzing data to treatment allocation (detection bias); (5) participant exclusions, attrition, and incomplete outcome data (attrition bias); (6) selective outcome reporting (reporting bias); and (7) other sources of bias, such as baseline imbalance, recruitment issues, etc. (Higgins et al., 2011). Qualitative ratings of "high risk", "unclear risk", or "low risk" were given for each of these internal validity indicators within studies. Any disagreements regarding the qualitative ratings of bias within each category were reconciled by the third independent reviewer.

Results

Following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009), Figure 1 illustrates the process for selecting studies that were included in this systematic review. The initial search identified 186 abstracts. After screening these abstracts, 19 studies were accepted for full-text review based on our PICO search strategy. Subsequently, 5 of these studies were still eligible after full text review and data extraction. The other 14 studies were rejected because they did not report treatment effects on ANC or PNC adherence as an outcome of interest.

Study Design, Intervention Characteristics, and Findings

Table 1 summarizes the study design, intervention characteristics, and findings for each of the five studies included in this review (Ayiasi et al., 2016; Cherniak et al., 2017; Kirkwood et al., 2013; Magoma et al., 2013; Waiswa et al., 2015). Because of the small sample size of publications

included and the differences across studies in interventions and adherence measures, there was little commonality to quantify differences between groups or calculate effect sizes that would allow comparisons of findings across studies. Thus, the results of the studies presented in Table 1 and discussed below, outline whether there were statistically significant differences in adherence to ANC/PNC between the treatment arms being compared within studies.

All of the studies were cluster randomized controlled trials of interventions to improve maternal and infant health that took place within the past five years. Three were conducted in Uganda (Ayiasi et al., 2016; Cherniak et al., 2017; Waiswa et al., 2015), one in Ghana (Kirkwood et al., 2013), and one in Tanzania (Magoma et al., 2013). Although ANC or PNC adherence was measured in each study, the primary outcome of interest varied across studies, with two focusing on delivery in a health facility (Ayiasi et al., 2016; Magoma et al., 2013), one on coverage of key essential newborn care behaviors, such as breastfeeding, thermal care, and cord care (Waiswa et al., 2015), one on neonatal mortality and newborn care behaviors (Kirkwood et al., 2013), and one on ANC attendance explicitly (Cherniak et al., 2017).

Three studies implemented a home visit intervention in which trained community health workers visited the homes of identified pregnant women and provided educational counseling on preventive and promotive care during pregnancy (Ayiasi et al., 2016; Kirkwood et al., 2013; Waiswa et al., 2015). Two of the three included two prenatal and three postnatal home visits (Kirkwood et al., 2013; Waiswa et al., 2015), while the remaining study included two prenatal home visits and one postnatal home visit (Ayiasi et al., 2016). A variety of topics related to preventive and promotive care were covered in the visits. Prenatal visits focused on danger signs in pregnancy, birth preparation, and clean delivery practices promoting the health of the newborn, including hygenic cord care, proper wrapping, early/exclusive breastfeeding, and delayed bathing. Postnatal visits focused on screening for and counseling on maternal and newborn danger signs, as well as encouragement and reinforcement of breastfeeding, skin-to-skin contact, newborn immunization, and prompt care-seeking. In each study, there was no statistically significant difference in ANC attendance between the treatment group that received the home visit

intervention and the standard care control group (see Table 1). Importantly, ANC adherence to the WHO recommendations of four ANC visits during pregnancy remained fairly low across treatment arms in the two studies that measured this particular outcome, with rates of 74% adherence amongst the control and 76% amongst the treatment group in the Kirkwood et al. (2013) study, and rates of 44% adherence amongst the control and 47% amongst the treatment group in the Waiswa et al. (2015) study.

The remaining two studies implement behavioral interventions that utilize planning and incentive schemas, respectively, to promote ANC/PNC uptake among pregnant women. In the Magoma et al. (2013) study, ANC healthcare providers helped pregnant women in the treatment group to develop a birth plan prior to delivery. Developing a birth plan involved discussions on place of delivery, importance of skilled delivery care, transport arrangements, funding, possible blood donors should an emergency occur, birth companions, and home support. As a result, PNC utilization in the first month after delivery was higher amongst the intervention group compared to the standard care control group (62% vs. 32%, respectively; 95% CI 15.4–47.2, $p = 0.0009$). Further, women in the treatment group sought PNC approximately three times sooner than those in the control group (see Table 1).

In the final included study (Cherniak et al., 2017), the treatment group was exposed to advertisement for ANC, and informed about the availability of a portable ultrasound (pOBU), in three separate conditions: 1) word of mouth advertisement of ANC and pOBU; 2) word of mouth advertisement of ANC and pOBU plus radio advertisement of only ANC; and 3) word of mouth advertisement of ANC and pOBU plus radio advertisement of both ANC and pOBU. ANC uptake was significantly higher among those subjected to word of mouth plus radio advertisement of ANC and pOBU compared to the control group that received word of mouth advertisment of ANC only with no mention of pOBU (65% vs. 11%, respectively, rate ratio 5.86, 95% CI 2.6 - 13.0, $p < 0.0001$; see Table 1). There were no differences in rate ratio attending ANC among the three variants of the intervention arm, and when comparing each of the first two intervention variants to the control group.

Thus, overall, two of the five studies (Cherniak et al., 2017; Magoma et al., 2013) included in this review demonstrate the effectiveness of behavioral interventions to increase ANC/PNC attendance. The remaining three studies, which implement a home visit intervention, do not seem to have an impact on adherence to recommended ANC regimens (Ayiasi et al., 2016; Kirkwood et al., 2013; Waiswa et al., 2015).

Risk of Bias

Table 2 summarizes the results from the Cochrane risk of bias assessment. Each of the included studies received "low risk" ratings on indicators of selection bias by using random sequence generation. Specifically, three of the five studies invited an independent epidemiologist or statistician to allocate participants to the treatment arms in a 1:1 ratio, using computer-generated restricted randomization (Kirkwood et al., 2013; Magoma et al., 2013; Waiswa et al., 2015); one study utilized a simple random number program in Microsoft Excel to randomly select and assign sub-counties to the treatment arms (Cherniak et al., 2017); and one study randomly allocated health centers, villages, and village health teams to the treatment arms by writing the names of each on small pieces of paper, folding them, and then asking two independent people not associated with the study to randomly pick folded papers from the pool Ayiasi et al. (2016). Based on these methodologies, concealment of each treatment allocation sequence was judged to be "low risk" across studies.

In the performance bias and detection bias domains, each study was assessed for its blinding protocol and the extent to which ANC/PNC adherence was likely to be influenced by the chosen protocol. When evaluating blinding of participants and personnel to treatment allocation, Cherniak et al. (2017) was the only study rated as "low risk" since the researchers intentionally masked the presence of pOBU when initial consent was obtained in the control arm. Three studies did not mention or utilize a procedure to blind participants and study personnel to treatment allocation and, thus, were judged to be of "unclear risk" (Ayiasi et al., 2016; Kirkwood et al., 2013; Waiswa et al., 2015). Magoma et al. (2013) was considered to be "high risk" because

the study did not allow blinding of birth plan providers or pregnant women who participated in the study to the treatment allocation. Further, when evaluating blinding of outcome assessors from knowledge of which intervention a participant received, all studies received "unclear risk" ratings due to lack of information provided.

Attrition bias was evaluated in each study based on the extent of missing data from each group, the reasons provided, and the type of analysis conducted. According to these criteria, all studies were judged to be "low risk" in this category. Three of the five studies reported no participants were lost at follow up or excluded from the analysis (Cherniak et al., 2017; Magoma et al., 2013; Waiswa et al., 2015); although the two remaining studies have some attrition, both provide final sample sizes in each treatment arm compared with the total number originally randomized alongside reasons for the missing data that do not appear to differ between treatment arms (Ayiasi et al., 2016; Kirkwood et al., 2013). Intention-to-treat analysis was used in four out of five studies (Ayiasi et al., 2016; Kirkwood et al., 2013; Magoma et al., 2013; Waiswa et al., 2015), further mitigating any risks associated with attrition bias.

To examine reporting bias, each protocol was checked for discrepancies between outcomes of interest study authors said they would measure and those they report on. Four of the five studies pre-specified their outcomes of interest in previously registered trial protocols (Ayiasi et al., 2016; Cherniak et al., 2017; Kirkwood et al., 2013; Waiswa et al., 2015). Three of these reported intervention effects on all pre-specified outcomes and, thus, were determined to be "low risk" (Ayiasi et al., 2016; Cherniak et al., 2017; Kirkwood et al., 2013). Waiswa et al. (2015) was rated as "high risk" in this category due to the presence of pre-specified intermediate outcomes that appear to be excluded in the published paper. Although a pre-specified protocol for the Magoma et al. (2013) study was not found, the study was judged to be "low risk" given that all expected outcomes of interest are included.

Finally, each study was examined for other sources of bias. We primarily focused on baseline imbalances between treatment arms within each study. Relevant demographic variables were

comparable across treatment arms in four out of five of the studies (Cherniak et al., 2017; Kirkwood et al., 2013; Magoma et al., 2013; Waiswa et al., 2015), resulting in a "low risk" rating. Although treatment arms were comparable for religion, level of education, outcome of previous pregnancy, and gestation age at recruitment in the Ayiasi et al. (2016) study, baseline imbalances in age of the mother, ethnicity, sources of income, parity, and number of antenatal consultations in previous pregnancy led to a rating of "unclear risk".

Overall, risk of bias was low in most categories across studies. All five studies received "low risk" ratings in random sequence generation (selection bias), treatment allocation concealment (selection bias), and incomplete outcome data (attrition bias). All five studies also received "unclear risk" ratings in the blinding of outcome assessment (detection bias). Four out of five studies received "low risk" ratings in selective reporting (reporting bias), with one study deemed to be "high risk". Sources of other bias were "low risk" in four out of five studies, with one study judged to have "unclear risk". The greatest variation across studies was in blinding of participants and personnel (performance bias), with one study rated as "low risk", three as "unclear risk", and one as "high risk".

Discussion

Given high rates of infant and maternal mortality in sub-Saharan Africa, the purpose of this systematic review was to examine the availability of effective behavioral interventions to increase adherence to ANC and PNC regimens among pregnant women. Of the five studies reviewed, two demonstrated effectiveness in increasing ANC or PNC uptake (Cherniak et al., 2017; Magoma et al., 2013); both studies implemented behavioral interventions using incentives and planning, respectively. Three community health worker home visit interventions had no effect on ANC adherence (Ayiasi et al., 2016; Kirkwood et al., 2013; Waiswa et al., 2015). Risk of bias in these five studies was also assessed by rating each study on random sequence generation; treatment allocation concealment; blinding of participants, personnel, and outcome assessors; incomplete

outcome data; selective reporting; and other sources of bias. Risk of bias was low in most categories across studies, particularly in random sequence generation, treatment allocation concealment, incomplete outcome data, selective reporting, and other sources of bias, with the greatest concerns in the blinding of outcome participants, personnel, and outcome assessors. Although the evidence convened here does not appear to be systematically biased, the paucity of studies identified in this review reveals a gap in evidence-based interventions to increase ANC/PNC adherence in sub-Saharan Africa.

We speculate that Cherniak et al. (2017) and Magoma et al. (2013) find effects of their interventions on ANC and PNC uptake, respectively, because of the behavioral nature of these interventions, tapping potential mothers' high motivation to adhere to ANC/PNC regimens in the first place alongside executive control functions, such as memory, planning, and task monitoring, that are vital to adherence (Brock et al., 2011). Cherniak et al. (2017) show that using the radio to advertise the availability of a portable ultrasound (pOBU) during ANC significantly increases ANC uptake. Although the effect can be explained as a simple incentive effect because of the free provision of pOBU, it is also possible that the pOBU acts as a salient reminder to attend ANC in this low-income context, where fewer tasks have built-in reminders. Indeed, Mullainathan and Shafir (2013) have documented the effects of "scarcity", a cognitive form of stress induced in contexts of limited resources that produces characteristic flaws in executive function, such as persistent tradeoff thinking. In line with this view, reminders have been linked to greater medical regimen adherence in developing contexts (Lester et al., 2010). Further, Magoma et al. (2013) find that the introduction and promotion of birth plans by care providers during ANC significantly increases PNC utilization, suggesting that the engagement of executive control through the act of planning ahead for the delivery of the baby can impact adherence to PNC regimens. This finding is consistent with research on implementation intentions, demonstrating that the realization of a goal is more likely to be achieved by forming a plan that describes the when, where, and how of goal striving in advance (Gollwitzer and Sheeran, 2006; Milkman et al., 2011).

The three studies that do not find effects on ANC adherence implement a home visit intervention, where community health workers educate pregnant women on danger signs in pregnancy, birth preparation, and clean, newborn health-promoting delivery practices, including hygenic cord care, proper wrapping, early/exclusive breastfeeding, and delayed bathing; and screen for and counsel on maternal and newborn danger signs, breastfeeding, skin-to-skin contact, newborn immunization, and prompt care-seeking. Since women are receiving two ANC visits at their homes, the lack of a perceived need to attend external ANC might account for this result, despite the fact that the WHO recommends that pregnant women attend at least four ANC visits prior to delivery. Still, these studies may have underestimated the treatment effects given that the measures of adherence relied on self-report, a method that is known to overestimate adherence (Gordis, 1979; Haynes et al., 1980; Stephenson et al., 1993) and could potentially undermine any true differences between groups. Further, while Ayiasi et al. (2016) and Kirkwood et al. (2013) find that approximately 75% of the sample adhere to at least three ANC visits, suggesting that ANC adherence is relatively high overall, Waiswa et al. (2015) report that less than half of the sample adhere to the WHO recommendations, thus highlighting the need for further studies on interventions to improve ANC adherence directly.

Like other qualitative reviews of interventions studies, this systematic review has its limitations. The gold standard for reviewing intervention effectiveness is with a meta-analysis that calculates a pooled effect size from RCTs. In this review, the interventions and adherence measures were too heterogeneous to combine in a meta-analysis. Instead, we present (1) simple summary data for each intervention group and (2) effect estimates and confidence intervals for each study, following PRISMA guidelines (Moher et al., 2009). Thus, although each individual trial utilizing a home visit intervention was powered to detect an effect on ANC adherence with no effect found, it is impossible to draw pooled conclusions from the current review.

The present study raises several questions for future research. There appear to be very few interventions that aim to directly improve ANC/PNC adherence in sub-Saharan Africa, despite high rates of infant and maternal mortality that persist in this region. Access to free ANC/PNC in

developing contexts is only effective in reducing infant and maternal mortality when mothers attend these clinics, yet ANC attendance was the primary outcome of interest in only one out of five included studies. Interventions drawing upon the executive function literature and the promising results of the behavioral interventions reviewed here are urgently needed to address these gaps.

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Figure 1: PRISMA Flow Diagram

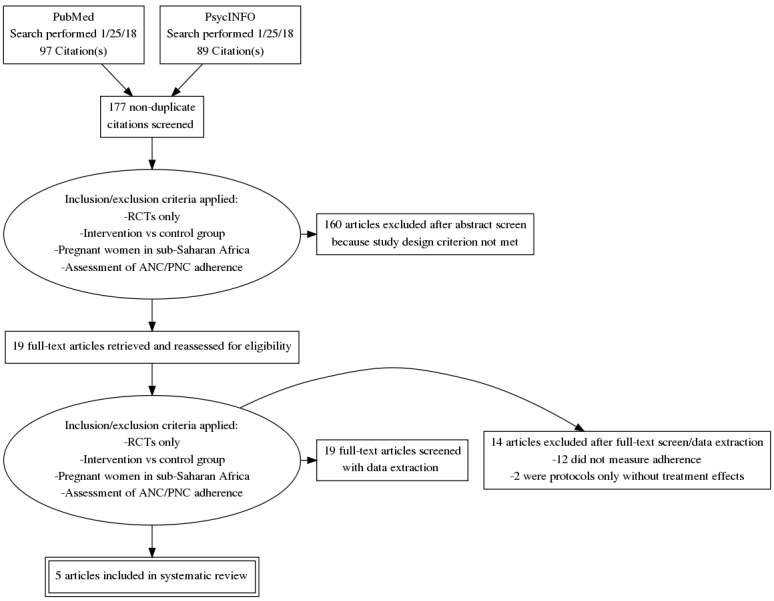

Table 1: Summary of Included Studies and Intervention Effects on ANC/PNC Adherence

1st Author, publication date, country	Study Population	Study Design	Intervention Strategy	Measurement of ANC/PNC adherence	Results	Interpretation
Ayiasi, 2016, Uganda	Pregnant women (Masindi & Kiryandongo districts)	Cluster RCT	Treatment (n=627): in addition to routine educational messages in ANC clinic, received village health teams (VHTs) making home visits to provide educational messages for maternal/newborn care & each VHT had mobile phone handset capable of making unlimited phone consultation w/ health workers; VHTs made 2 ANC & 1 PNC home visit. Control (n=758): received group education routinely offered in health centers, but did not receive VHT home visits or mobile phones.	ANC attendance was measured through self-report where attending three or more ANC visits was categorized as adequate & the rest were grouped as inadequate	85% of the intervention group made 3+ antenatal visits, compared to 71% of the control, adjusted odds ratio 1.82 (95% CI 0.65-5.09, p=0.26)	Home visit intervention has no effect on recommended ANC attendance
Cherniak, 2017, Uganda	Pregnant women (Kabale district)	Cluster RCT	Treatment (n=100): word of mouth ANC advertisement carried out by local community leaders who announced free ANC at community gatherings, plus advertisement for availability of portable ultrasound (pOBU), further divided into word of mouth of pOBU & ANC (n=16), radio advertisement of only ANC & word of mouth of ANC & pOBU (n=7), or word of mouth + radio of both ANC & pOBU (n=75). Control (n=59): word of mouth advertisment of ANC only with no mention of pOBU.	ANC uptake rate calculated using # of women attending ANC as the numerator & number of women attending first ANC in 2013-2014 through government-run clinics as the denominator	Rate of ANC attendance was 65.1% per 1000 pregnant women where pOBU advertised by radio & word of mouth vs. 11.1% in control communities (rate ratio 5.86, 95% CI 2.6-13.0, p<.0001)	Advertising pOBU by radio messaging significantly increases ANC uptake as compared to word of mouth advertisement of ANC only
Kirkwood, 2013, Ghana	Pregnant women (Brong Ahafo region)	Cluster RCT	Treatment (n=9174): integrated intervention training community based surveillance volunteers (CBSVs) to identify pregnant women in their community, undertake 2 home visits during pregnancy & 3 visits after birth on days 1, 3, & 7 in addition to standard care provided. CBSVs also were responsible to weigh the newborn & check them for danger signs after birth. Control (n=9435): routine maternal/child health care available, which consisted of antenatal clinics, access to free facility delivery, post-partum checkups, infant welfare clinics, & routine CBSV activities for outreach.	Attendance to four or more ANC visits was measured via self-report following birth	76% treatment & 73.7% control attended 4 or more ANC visits (2.3% incr.), relative risk 1.02 (95% CI 0.96-1.09, p=0.52)	Home visit intervention has no effect on recommended ANC attendance
Magoma, 2013, Tanzania	Pregnant women (Ngorongoro district, Arusha region)	Cluster RCT	Treatment (n=404): introduction & promotion of birth plans by care providers during ANC to prepare women & families for birth. Discussions on place of delivery, importance of skilled delivery care, transport arrangements, funding, possible blood donors, birth companions, & home support. Control (n=501): Standard care without birth plan	PNC attendance within 1 month of delivery was determined from self-reports & cross-checked using health records	PNC utilization within 1 month: 62.1% in treatment & 32.1% in control, adjusted absolute difference 31.3% (95% CI 15.4-47.2, p=.0009); days to initial PNC (mean +- SD) treat 6.6 +-1.7 vs. control 20.9+-4.4, p=.0001	Introduction & promotion of birth plans during ANC care seems to increase PNC utilization in the first month after delivery
Waiswa, 2015, Uganda	Pregnant women (Iganga & Mayuge districts)	Cluster RCT	Treatment (n=894): 5 home visits by community health workers (CHWs), 2 during pregnancy & 3 in the 1st week after birth (day 1, 3, & 7) to offer preventative & promotive care/counseling with extra visits for sick & small newborns to assess & refer plus improved facilities Control (n=893): standard care overseen by district health team in addition to the improved facilities	Data on attendance to one or more ANC visits and to four or more ANC visits were collected via self-report	99.2% intervention & 98.9% control attended at least one ANC visit, p=0.44); 47% intervention & 43.6% control attended 4 or more ANC visits, p=.165	Home visit intervention has no effect on recommended ANC attendance

Table 2: Risk of Bias Within Studies

1st Author, publication date, country	Random sequence generation (selection bias)	Treatment allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other sources of bias
Ayiasi, 2016, Uganda	Low risk	Low risk	Unclear risk	Unclear risk	Low risk	Low risk	Unclear risk
Cherniak, 2017, Uganda	Low risk	Low risk	Low risk	Unclear risk	Low risk	Low risk	Low risk
Kirkwood, 2013, Ghana	Low risk	Low risk	Unclear risk	Unclear risk	Low risk	Low risk	Low risk
Magoma, 2013, Tanzania	Low risk	Low risk	High risk	Unclear risk	Low risk	Low risk	Low risk
Waiswa, 2015, Uganda	Low risk	Low risk	Unclear risk	Unclear risk	Low risk	High risk	Low risk