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Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review

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Abstract

Introduction: Poor antenatal care (ANC) utilisation in sub-Saharan Africa contributes significantly to the high maternal, perinatal and infant mortality and morbidity in the region. This review aimed to summarise the factors associated with the utilisation of ANC in sub-Saharan Africa.

Methods: This study was a systematic review. Databases including PubMed, OVID, EMBASE, CINAHL, and Web of Science were searched for primary research on factors associated with ANC utilisation following multivariate analysis and published between 2008 and 2018. Search terms used include antenatal, prenatal, maternal health, utilisation, factors, determinants, Africa.

Results: Eighty-seven (87) studies that met the inclusion criteria were fully assessed. Most studies identified high socio-economic status, urban residence, older/increasing age, low parity, being educated and having an educated partner, being employed, being married and Christian religion were predictors of ANC use. Women who were aware of danger signs, the timing and the adequate number of ANC visits, exposed to mass media and who had a good attitude and whose partners had a good attitude towards ANC services were more likely to utilise ANC promptly. Having an unplanned pregnancy, previous pregnancy complications, poor autonomy, lack of husband's support, increased distance to ANC services, and not having health insurance negatively impacted the uptake of ANC visits. Also, health system factors such as the cost of services and attitude of health workers decreased ANC use.

Conclusion: A variety of factors affect ANC utilisation in sub-Saharan Africa. These factors include the social determinants of health, family and inter-spousal/partner dynamics, previous pregnancy experiences, health system factors and policy factors amongst others. Multi-stakeholder intersectoral collaboration and continuous health system strengthening, improved quality of care, community mobilisation and implementation research to improve ANC utilisation are recommended.

Strengths of the study

- This study involved a large number of studies that covered a wide and geographically important sub region of Africa.
- This study accessed several databases and utilized recent publications (≤ 10 years old)
- This review provides evidence on the role of social determinants of health in ANC utilisation and the importance of intersectoral collaboration in improving ANC utilisation

Limitations

- The studies included in this review utilised different study designs such as secondary analysis of national household surveys and cross-sectional surveys.
- Also, there were variations in the measurement of the outcomes with some studies measuring at least one ANC attendance while others measured at least three or four visits.
- Early booking for ANC was also variably defined. This was defined as attendance to ANC at gestation age less than 12, 14, 16 and even 20 weeks. These could have affected deductions and comparability of the studies.

Keywords: Antenatal care, prenatal care, utilization, determinants, sub-Saharan Africa

Introduction

Globally, pregnancy and childbirth are significant events for women and their families even though they represent a period of heightened vulnerability for both women and their unborn babies.[1] Every day, preventable causes related to pregnancy and childbirth lead to the deaths of over 800 women with 99% of these maternal deaths occurring in developing countries. Although by 2015, maternal mortality had decreased by over 40% from the 1990 levels, maternal mortality levels have continued to remain unacceptably high in sub-Saharan Africa (SSA).[2,3] Inadequate access to quality antenatal care (ANC) contributes significantly to these preventable maternal deaths.[4] As part of reproductive health care, ANC presents a unique and life-saving opportunity for health promotion, disease prevention, early diagnosis and treatment of illnesses in pregnancy using evidence-based practices.[5] In 2016, the World Health Organization (WHO) revised its recommended minimum number of ANC visits from 4 to 8 contacts following recent evidence that increased number of contacts between a pregnant woman and a skilled health provider reduced perinatal mortality and improved women's experience of care. Early ANC initiation and receiving the required services is emphasised in the revised guideline.[5] In spite of this, global reports in

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3 2017 showed that only three in five women attended at least four antenatal visits. In regions with
4
5 the highest rates of maternal mortality, such as SSA, only 52% of women received at least four
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7 ANC visits.[6]
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13 ANC not only promotes the health of pregnant women but has also been found to reduce the risk
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15 of adverse pregnancy outcomes, perinatal and infant mortality and morbidity.[7–10] It also
16
17 encourages skilled birth attendance for delivery and postnatal care as women who attend ANC are
18
19 more likely to utilise these services more than the non-attenders.[11–16] Studies have used a
20
21 variety of indicators to assess ANC use. This includes at least one visit, at least four visits, trimester
22
23 timing of ANC visits, services received during ANC visits and care provider type visited.
24
25 However, the quantity of contacts remains commonly used. Recently, indicators to enable the
26
27 progressive realisation of maternal health targets have been proposed especially for developing
28
29 country contexts like countries in SSA.[17]
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38 Various studies have assessed factors affecting ANC utilisation in SSA countries, but none has
39
40 systematically summarised such studies in SSA. A review conducted over ten years old in
41
42 developing countries examined factors affecting the use of ANC however this review only
43
44 contained seven studies from Africa and thus does not include recently published studies from
45
46 SSA.[18] The aim of this review was to systematically identify the factors associated with the
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48 utilisation of ANC in SSA.
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55 **Methods**

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3 The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] checklist
4 for reporting a systematic review or meta-analysis protocol [19], was used to guide the screening
5 and eligibility of the studies. (See supplementary file 1)
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16 **Search strategy**

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19 A systematic review of published quantitative literature was conducted between October 2018 and
20 February 2019 to capture studies published in the last ten years (2008-2018). The databases
21 searched were PubMed, OVID, EMBASE, CINAHL and Web of Science. Other databases
22 searched were Google scholar and African journal online (AJOL). The search terms used include:
23 antenatal, prenatal, maternal health, maternal care, maternal health services, utilisation, factors,
24 determinants, predictors, Africa. The search strategy is provided in supplementary file 2.
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37 **Inclusion and exclusion criteria**

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40 Studies were eligible for inclusion if they were quantitative (primary or secondary data utilised)
41 reporting on factors associated with ANC utilisation following multivariate analysis, conducted in
42 SSA and published between 2008 and 2018. This review excluded articles and studies published
43 before 2008 and written in any language other than English.
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53 **Data extraction**

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3 A data extraction form was developed and reviewed by all reviewers. Data extraction was then
4 carried out independently by two of the reviewers. Discrepancies in data extraction were resolved
5 by discussion and consensus between the two review authors. Mendeley reference manager was
6 used to keep track of references. Data were extracted for each paper using standardised forms with
7 the following domains; the name of first author and year of publication, study location and setting,
8 study design, study subjects and sample size and factors/determinants. Figure 1 shows the article
9 selection and inclusion process.
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23 **Quality appraisal**

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26 Quality assessment of the studies included in this review was carried out by the main reviewer in
27 consultation with the other authors. The Quality Assessment Tool for Observational Cohort and
28 Cross-Sectional Studies was used to assess the quality of the studies. This quality assessment tool
29 has been used in other systematic reviews.[20,21] (See supplementary file 3). The tool consists of
30 fourteen questions assessing different aspects of a study including but not limited to definition of
31 objectives, study population, sampling strategy, sample size and statistical analyses. To appraise
32 a study, each question is scored as Yes (1) or No (0), and others (CD, cannot determine; NA, not
33 applicable and NR, not reported). All the studies included in this review were assessed for quality
34 using the appropriate criteria based on study design. Elements of the criteria which did not apply
35 to a particular study was marked as not applicable.
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49 All the studies fulfilled the quality criteria except for ten studies [7,22–30] that did not report on
50 sample size.
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Patient and public involvement

It was not appropriate or possible to involve patients or the public in this work

Study selection

The search yielded 1548 studies. The initial search identified a total of 1543 articles from the main databases and 5 articles Google scholar. After removal of duplicates, 1481 articles remained. Using title and abstracts, we first screened the identified articles and excluded 1384 articles based on the agreed inclusion criteria with the other three authors. The studies were excluded because they were irrelevant to the study, conducted outside sub-Saharan Africa and were purely descriptive. A total of 97 full text studies were assessed for eligibility and ten articles were further excluded after reading the full text because they did not assess predictors of ANC, were focused on other aspects of maternal health not ANC and were qualitative studies. The four reviewers agreed on the inclusion of 87 studies in the final review.

Results

The 87 studies included were from 24 SSA countries. Twenty-seven studies were from Ethiopia, 16 studies from Nigeria, and six studies from Ghana and Kenya respectively. Most studies used secondary data analyses and cross-sectional surveys (Table 1). These studies assessed the determinants of attending ANC (at least one ANC visit, at least four ANC visits) and determinants of timing of ANC visit(s). The characteristics and summary of findings of the articles included in

1
2
3 the review is presented in tables 3 and 4 (see supplementary file 4). The summary measure utilized
4
5 by various studies was mostly the odds ratio. The findings were presented using the Andersen
6
7 framework for the utilisation of health services.[31] The Andersen framework is a health behaviour
8
9 model used to assess the factors affecting health services utilisation. The model proposes three
10
11 main determinants that influence the use of health services including predisposing, enabling and
12
13 need factors. These represent the pre-illness sociocultural characteristics, access-related factors
14
15 and immediate cause/problems that generate a need for the use of health services, respectively.
16
17 The predisposing factors include age, gender, marital status, family size, social status, education
18
19 and race; enabling factors include family income, health insurance, distance, social relationships,
20
21 service availability, and health facility characteristics (waiting time, availability of health
22
23 providers) and need factors include symptoms or perceived illness.
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29 **Determinants of ANC utilisation**

31 **Predisposing factors**

32 *Maternal age*

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38 Nineteen studies reported the effect of age on ANC attendance. Majority of the studies showed
39
40 that older/increasing age was a predictor of ANC utilisation.[24,27,40,41,32–39] However, in two
41
42 of the studies, women aged less than twenty years were more likely to utilise ANC than their older
43
44 counterparts.[35,42] Two of the studies found that younger age at first pregnancy was a predictor
45
46 of ANC use as women aged less than or equal to twenty years at the time of first pregnancy were
47
48 nearly three times more likely to use ANC services than whose age at first pregnancy was more
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50 than twenty years.[43,44] Younger age was also a predictor of early booking for ANC in some
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3 studies.[44–47] Younger age was associated with the late timing of ANC in one of the studies.[48]
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5 (Table 2)
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8 *Maternal education*

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11 Thirty-two studies examined and reported on the relationship between maternal education and
12
13 ANC utilisation. In all the studies, the lack of formal education and lower educational levels were
14
15 predictors of poor ANC use among women in these studies.[7,13,43,44,49–56,24,57–65,33,35–
16
17 39,41] Educated women were likely to book early for ANC.[45,47,49,63] However, one of the
18
19 studies found that more educated women were less likely to utilise ANC from skilled medical
20
21 providers.[42] (Table 2)
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29 *Husband/partner's education*

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32 Seven studies reported on the influence of husband/partner's education on ANC use. Women
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34 whose husbands/partners had some education were more likely to access ANC services than those
35
36 with less educated husbands/partners.[23,24,39,56,66–68] (Table 2)
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42 *Maternal occupation/employment status*

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46 Twenty studies assessed the impact of occupation/employment status on ANC use. In twelve of
47
48 the studies, women who were employed and those who had a working status were found to be
49
50 more likely to utilise ANC than the unemployed/not
51
52 working.[13,24,69,70,37,39,40,54,55,65,67,68] In another study, there was a higher odds of
53
54 inadequacy in ANC visits among women who engaged in sales/business, agriculture, skilled
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3 manual and other jobs when compared to women who currently do not work.[71] Women who
4
5 were farmers were more likely to use ANC.[50] (Table 2)
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11 Unemployed women were less likely to initiate ANC early in pregnancy.[47,72–74] In another
12
13 study in the rural area, being employed was associated with late ANC presentation.[48] In
14
15 Rwandan communities with higher employment rate among men, women were more likely to have
16
17 received care early in the pregnancy.[75] (Table 2)
18
19
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24 *Husband/partner's occupation*

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27 One of the studies found that women whose husbands were engaged in non-farming occupations
28
29 were more likely to use ANC services.[76] (Table 2)
30
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35 *Maternal religion*

36
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38 Ten studies documented the relationship between religion and ANC use. In five of the studies,
39
40 Christian women were more likely to utilise ANC services compared to non-Christians (traditional
41
42 African religion and Muslims).[14,38,69,70,77] In another of the studies, orthodox Christians
43
44 utilized ANC more than the Protestants and Catholics group.[40] Women who had no religion
45
46 were less likely to attend ANC in 2 studies.[59,62] In two of the studies, Muslim and traditionalists
47
48 and highly religious women were less likely to initiate ANC in the first trimester.[47,73] (Table 2)
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56 *Marital status and family type*

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3 Seventeen of the studies assessed the effect of marital status on ANC use. Twelve studies showed
4 that married women were more likely to utilise ANC than the never married/currently
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7
8 unmarried.[23,25,80,27,32,35,52,63,76,78,79] One of the studies found that never and formerly
9
10 married women were more likely to use skilled ANC attendants.[56] In six of the studies, early
11
12 ANC initiation was significantly associated with being married than being
13
14
15 unmarried.[35,48,73,78,81] Married women were more likely to receive all ANC interventions
16
17 than unmarried women.[82] (Table 2)
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23 *Parity/birth order and household size*

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26 Twenty-two studies reported the relationship between parity/birth order and ANC use. Eleven of
27
28 the studies found that women with high parity or large household sizes had a significant reduction
29
30 in adequacy of ANC visits.[13,22,69,25,33,36,37,39,51,52,63] In other studies, mothers with high
31
32 parity were more likely to utilise ANC.[24,83]
33
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36 In some studies, low parity/null parity was a predictor of early booking while having many children
37
38 leads to delayed ANC initiation.[26,47,65,78,81,84,85] However, one of the studies showed that
39
40 women who had given birth at least once were less likely to seek prenatal care in the first
41
42 trimester.[77] Birth order was associated with ANC attendance in one of the studies.[44] (Table
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45 2)
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51 *Ethnicity/cultural influence*

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3 Seven of the studies showed that within-country ethnic differences influenced the number and
4 timing of ANC visits in different countries.[14,46,52,54,62,70,86] (Table 2)
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11 *Knowledge of pregnancy/exposure to media*

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14 Seven studies reported on the influence of knowledge on ANC use. Awareness of danger signs of
15 pregnancy, timing and recommended number of ANC visits was a predictor of ANC
16 use.[49,74,82,83,85,87,88] (Table 2)
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22 In nine studies, women exposed to mass media were more likely to utilise ANC services and
23 promptly compared to those who were not.[38–40,49,57,66,69,70,89] In another study, women
24 who were aware of places to get skilled providers and listened to radio were more likely to utilize
25 killed antenatal care.[90] (Table 2)
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35 *Attitude and perception towards ANC*

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38 Women and their husbands/partners with a good attitude towards ANC were more likely to utilise
39 them on time.[36,88] Women who perceived that ANC should be initiated in the first trimester
40 were more likely to make four or more visits and book early than those who perceived that ANC
41 should commence in the second and third trimesters.[45,91] Also, those who considered pregnancy
42 a risky event were more likely to utilise ANC.[36] (Table 2)
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53 *The timing of the first ANC visit*

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3 Women who attended ANC in the first trimester were more likely to attend up to four ANC
4 visits.[92] (Table 2)
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11 **Enabling factors**

14 *Household wealth/socioeconomic status*

16
17 Thirty-three studies documented a significant relationship between wealth/socio-economic status
18 and ANC attendance. In most of the studies, women of high socioeconomic status tended to use
19 ANC services more than those in the lower socio-economic/wealth strata.[13,14,58–
20 65,69,70,23,80,82,88,92–96,38,39,44,47,54,56,57] Lower wealth/poor socio-economic status was
21 also associated with late initiation of ANC.[28,46,47,63,74,86] (Table 2)
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29 *Place of residence/geographical location*

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32 Twenty-eight studies reported the role of place of residence (urban/rural) on ANC attendance. In
33 sixteen studies, rural dwellers were reported to be less likely to attend ANC
34 [13,33,71,80,93,95,97,36,40,44,47,50,56,57,67]. Two studies showed that women residing in
35 communities with a government health facility providing ANC services were more likely to have
36 four ANC visits.[30,77] Seventeen studies assessed the role of geographic regions on ANC
37 use.[30,35,66,69,80,82,95,97,38,39,47,55,59,60,62,63] This varied by the different regional and
38 zonal categories within each country. Rural dwellers were more likely to present late for ANC in
39 some of the studies.[48,71,77,89,98] (Table 2)
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54 *Distance from the health facility*

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3 Twelve studies reported the influence of distance from a health facility on ANC use. In seven
4 studies, increased distance to ANC services negatively impacted the uptake of ANC visits.[14,34–
5 36,38,52,76] In one of the studies, women living closer to the dispensary were more likely to have
6 at least one ANC visit however among those women with at least one visit, the number of ANC
7 visits increased as the distance from the dispensary increased.[7] Another study also found that for
8 each 10 km increase in distance from a health facility, the odds of women receiving good quality
9 ANC decreased by a quarter.[99] In one of the studies, having a Women' Health Development
10 Team (WHDT) within a 2 km radius from the nearest health facility increased the likelihood of
11 skilled ANC utilization.[90] Access to health services was associated with increased utilization of
12 ANC services.[40] (Table 2)
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30 *Health insurance/user-fee exemption*

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32 In one of the studies, the mean proportion of women who made at least one ANC visit during
33 pregnancy increased significantly following user fee exemption.[100] Women who did not have
34 health insurance were more likely to underutilise/attend ANC.[23,38,93,101] Women who had
35 any form of health insurance were less likely to delay the initiation of ANC.[81,102] However,
36 women who had insurance were more likely to initiate ANC attendance in the third trimester.[89]
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44 (Table 2)
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50 *Involvement in decision-making/autonomy*

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53 Women who made decisions jointly with their husbands or partners were significantly more likely
54 to have adequate ANC coverage compared with women whose husbands or partners made
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3 decisions alone.[39,54,91] Another study conducted in Eritrea and Ethiopia showed that women
4 who were involved in major household decisions such as large purchases were more likely to use
5 ANC.[67] Women who do not participate in decision making were more likely to use ANC in
6 second trimester relative to the first trimester.[89] (Table 2)
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16 *Husband's/partner's approval and support, social support*

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18 Women who had their husband/partner's approval/permission to attend ANC were more likely to
19 utilise ANC services compared to those without support from their husbands.[43,49,103] Women
20 who did not experience physical intimate partner violence during the year preceding survey were
21 more likely to have four ANC visits.[30] In another study, women who had the father of their child
22 present in their lives were more likely to utilise ANC services.[73] Women who lacked social
23 support were more likely to underutilise ANC services compared to those with social support.[32]
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33 (Table 2)
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36 *Quality/content of ANC services*

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38 Decentralised intrapartum care was independently associated with a 67 % reduced odds of having
39 at least three ANC visits.[104] Cost of services was also associated with decreased ANC use.[35]
40
41 In one of the studies, having an ANC at a private hospital was a predictor of delayed initiation of
42 ANC, but in another, it increased the likelihood of receiving adequate ANC compared to those
43 clients using public healthcare facilities.[53,81] The level of antenatal service provision (measured
44 as the availability of key functions, screening tests, skilled health workers and opening times)
45 affected the quality of ANC received. Utilising ANC at facilities that provide a wide range of ANC
46 services was associated with an increase in the odds of receiving good quality ANC and attending
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3 ANC.[9,99] Visits by health extension workers during pregnancy increased ANC attendance in
4 one of the studies.[105] In one of the studies, women who received advice on ANC from health
5 workers were more likely to attend ANC.[103] (Table 2)
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13 **Need factors**

14 *Pregnancy wantedness and planning*

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17 Women with planned pregnancies were more likely to attend ANC than those with unplanned
18 pregnancies.[23,36,41,43,49,64,83] Conversely, women with mistimed, unwanted/unplanned
19 pregnancies were unlikely to attend ANC or initiate same in the first trimester.
20
21 [11,26,106,35,37,48,73,77,81,85,87] (Table 2)
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32 *Previous/current health and pregnancy experiences*

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35 Pregnancy complications, illnesses and stillbirths in previous pregnancies were found to influence
36 ANC use in four studies negatively.[41,43,84] Women who were HIV positive were more likely
37 to attend ANC early in the pregnancy.[29] Women who had an early initiation of ANC in a
38 previous pregnancy were more likely to book early for ANC in the subsequent pregnancy.[45] One
39 of the studies found that women whose gestational age was at least 27 weeks were more likely to
40 attend ANC.[103] Postponed ANC visit after booking was a predictor of delayed attendance to
41 ANC.[48] Women whose pregnancy was confirmed by missed period rather than urine test were
42 more likely to delay booking ANC visit.[91] (Table 2)
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Discussion

This study reviewed the predictors of ANC utilisation in SSA. Although the studies included in this review utilised different study designs, most were secondary data analyses of national surveys and cross-sectional studies. The contextual differences in study settings and outcome measures used could affect the interpretation and meaning of the results. Some determinants showed similarities and differences within and between countries. The determinants identified include social determinants of health (such as work/employment status, education, income status, health services, access to health services, insurance coverage, social relationships/norms, place of residence) other socio-demographic factors (age, marital status), family and pregnancy characteristics (decision-making, parity, wantedness of pregnancy, previous pregnancy experiences) and health service factors (cost, attitude of health workers).

In all the studies reviewed, high socio-economic/wealth status increased the use of ANC services. This included attending at least one and at least four ANC visits, early initiation of ANC and the receipt of quality ANC package. Poverty is a known deterrent to health care utilisation in SSA and women of low wealth status may be unable to afford the medical and non-medical costs associated with utilising ANC.[107,108] Thus, because of lack of financial access, such women may not attend ANC at all, limit the number of ANC visits or even initiate ANC late in pregnancy. The effect of SES on ANC use is documented in other studies.[18,109–111] Although free/subsidised maternal health services are offered in some African countries, women still pay out of pocket for some direct medical costs such as laboratory investigation and non-medical costs for travel and accommodation. These costs pose barriers to using ANC services by pregnant women.[112,113] Further reflecting the role of the woman's ability to fund ANC on utilisation, women who did not

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2
3 have health insurance were more likely to underutilise/attend ANC. [23,38,93,101] Studies have
4 also shown that women are willing to pay less for insurance compared to men.[114] Thus
5
6 mandatory health insurance for ANC and other maternal health services with subsidies/exemptions
7
8 will improve the use of these services.
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16 Increasing/older maternal age was a predictor of attendance to ANC in most of the studies that
17 assessed its impact. In contrast, mothers with high parity were more likely to utilise ANC in one
18 of the studies.[24] However, this was not the case with the timing of ANC initiation as younger
19 age, and younger age at first pregnancy significantly increased the odds of early initiation of ANC
20 in some of the studies.[43,45–47] This disparity could be as a result of confounding by parity on
21 age as low parity was also associated with early ANC booking and increased number of ANC
22 contacts. [13,22,69,25,33,37,39,51,52,63,67] Lower parity is commoner in younger women who
23 may be newly-weds or adolescents and therefore seek out ANC earlier than their older counterparts
24 due to ignorance/limited knowledge of pregnancy. Likewise, women who have had previous
25 pregnancies may consider themselves ‘experienced’ and used to the routine care offered during
26 ANC and so delay ANC initiation and number of ANC contacts made.[115] Also, decreased use
27 of ANC among high parity women could be because of the less time available for ANC attendance
28 due to the care of children, inadequate resources in the family and negative experiences with ANC
29 from previous pregnancies.[18]
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52 High formal educational attainment for women and their husband/partner increased attendance and
53 timeliness of ANC visits in all except one study. [109,110,116,117] These studies found that higher
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3 education attainment increases the odds of the number and timeliness of ANC visits. Educated
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5 women tend to be more financially independent (employed), and better informed on the
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7 importance of ANC to the mother and baby.[118]
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14 Studies in this review showed that women with a working status were found to be more likely to
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16 attend ANC than the unemployed/not working. Being employed also increased the odds of early
17
18 initiation of ANC. Employment status is closely related to income and educational status as
19
20 educated women tend to be employed and consequently earn income. Beyond being a source of
21
22 funds for sponsoring ANC use, employment can also increase women's exposure and access to
23
24 information on ANC thus further promoting utilisation. In contrast, there was a higher odds of
25
26 inadequate ANC visits among women engaged in sales/ business, agriculture, skilled manual and
27
28 other jobs when compared to women who currently do not work.[71] In one of the studies, women
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30 engaged in farming were more likely to use ANC services than non-farmers.[50] On the other
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32 hand, the farming occupation seemed to exert a different effect on ANC uptake among women
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34 whose husbands were farmers as women whose husbands were engaged in non-farming
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36 occupation were more likely to use ANC services.[76]
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45 Christian women were more likely to utilise ANC compared to Muslims, traditionalists and those
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47 with no religion. Muslim and traditionalists and highly religious women with unspecified religious
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49 affiliation were less likely to initiate ANC in the first trimester.[47,73] This finding suggests that
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51 more emphasis should be placed on the active engagement of religious leaders in promoting the
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3 timely use of ANC services among their followers. There is however need for more research with
4
5 a mixed methods approach to better understand the reasons behind this observation.
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11 Most of the studies showed that marriage conferred a protective effect on ANC utilisation as
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13 married women were not only more likely to attend ANC but also less likely to delay initiation of
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15 ANC visits when compared to their unmarried counterparts. Additionally, being currently married
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17 positively influenced the receipt of ANC.[82] This could be to the psychosocial and financial
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19 support received from their husbands, planning/ desirability of their pregnancy and the societal
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21 acceptability and support of their pregnant state when compared to their unmarried
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23 counterparts.[115] Some studies included in this review show that women who enjoyed support
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25 from their husbands and other social support were more likely to utilise ANC.[32,43,49,73] This
26
27 suggests the need to target unmarried women in programmes that are designed to improve ANC
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29 uptake. In contrast, one of the studies in this review found higher odds of utilising skilled ANC
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31 attendants among currently unmarried women.[56] One possible explanation for this is that
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33 unmarried women are sole decision makers, making them empowered to seek and utilise ANC.
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43 Although different studies reported variations in ANC use based on within-country ethnic, cultural
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45 and geographic differences, these results are context-specific and thus should be interpreted with
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47 caution. They are however useful in the design and implementation of country-level programmes
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49 on ANC. Women who were aware of the danger signs of pregnancy, timing and the recommended
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51 number of ANC visits were more likely to use more ANC services than the ignorant. Exposure to
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53 information on ANC from mass media positively influenced attendance and early timing of the
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3 first ANC visit. This agrees with findings from other studies.[117] Collaboration with the media,
4 given their wider reach, will be useful in disseminating information and improving the knowledge
5 of women and the general public on the importance of ANC. Also, women and their
6 husbands/partners with a good attitude/perception towards ANC were more likely to utilise ANC
7 services on time.[36,88]
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18 In most of the studies, rural residence negatively influenced attendance and timing of the first ANC
19 visit.[48,71,77,89,98] The interplay between peculiar characteristics of rural areas such as sparse
20 distribution of health services, poor educational and employment status of residents and poor
21 access to mass media could explain this. Similar findings have been documented in other
22 studies.[119,120] Likewise, increased travel distance between a woman's place of residence and
23 the health facility providing ANC services was associated with a lower odds of ANC utilisation.
24 Walking or travelling long distances could be difficult for pregnant women in addition to travel-
25 related costs and these may discourage them from utilising ANC services. This negative effect of
26 long distance on the utilisation of ANC and the continuum of maternal health care services has
27 been documented in other studies.[121]
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45 Some studies in this review showed that involvement in decision-making on major household
46 decisions and ANC exerted a positive effect on attaining adequate ANC visits.[39,54][67]
47 Autonomy and involvement in decision-making increase the utilisation of maternal health
48 services.[122] Women whose pregnancies were planned and desired were significantly more likely
49 to utilise ANC services compared to those with unplanned/undesired pregnancies.[23,43,83].
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3 Thus, women should be encouraged to employ family planning methods to secure planned
4 pregnancies and promote ANC use. In one of the studies, delayed initiation of ANC was associated
5 with the receipt of care at a private hospital, while in another study, women who utilised private
6 health facilities for ANC were more likely to receive an adequate ANC service package compared
7 to users of ANC in public healthcare facilities.[53,81] The cost of services, the attitude of health
8 workers, waiting time, visits by health workers and the quality of ANC package available are
9 predictors of ANC utilisation in this review.[9,35,99]
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20 **Conclusion**

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23 Based on this review, a variety of factors affect ANC utilisation in SSA. These factors include the
24 social determinants of health, family and inter-spousal/partner dynamics, previous pregnancy
25 experiences, health system factors and policy factors amongst others. These factors also
26 demonstrate the importance of multi-stakeholder intersectoral collaboration in mitigating poor
27 ANC utilisation in SSA. Thus, ministries of labour/employment, education, rural development,
28 women affairs, finance, community and religious leaders need to collaborate with the ministry of
29 health to achieve universal ANC coverage. Continuous health system strengthening, improved
30 quality of care, community mobilisation and implementation research are recommended to
31 improve ANC coverage.
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INO: Study of conceptualization and design, data extraction, analysis and interpretation of results, manuscript drafting and approval of the final manuscript for publication.

ICA: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

OBE: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

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3 CJU: Study design, analysis and interpretation of results, manuscript drafting, analysis and
4 interpretation of results, and approval of the final manuscript for publication.
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11 **Key messages**

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14 What is already known?

- 15 • Antenatal care promotes the health of pregnant women and their unborn babies
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- 17 • Antenatal care utilization is still low in sub-Saharan Africa
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23 What are the new findings?

- 24 • Factors affecting ANC use span health and non-health sectors
- 25
- 26 • Dearth of studies investigating the factors affecting having at least eight ANC visits
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32 What do the new findings imply?

- 33 • Health system strengthening is essential to improve ANC coverage
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- 35 • Mitigating poor ANC attendance will require multi-sectoral/intersectoral stakeholder
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Table 1: Summary of articles included in the review by regions

Region	Countries	References	Study design
West Africa	Nigeria=16	[13,30,70,72,80,84,89,97,38,39,42,54,55,58,60,66]	11 SA, 4 cross sectional, 1 mixed methods
	Ghana=6	[22,23,59,82,93,101]	4 SA, 2 cross sectional, SA
	Benin= 2	[64,69]	SA
	Niger =1	[103]	Cross-sectional
	Cameroon= 1	[61]	SA
	Burkina Faso= 3	[14,25,27]	
	DRC= 1	[11]	
South Africa	South Africa= 5	[26,28,34,48,73]	1 SA, 3 cross sectional, 1 mixed method
	Lesotho= 1	[29]	Cross-sectional
East Africa	Rwanda= 3	[32,81,104]	1 SA, 1 cross sectional, 1 cohort
	Malawi= 1	[100]	Natural experiment
	Kenya= 6	[7,24,63,78,79,98]	3 SA, 3 cross sectional,
	Tanzania= 5	[35,86,92,102,106]	2 SA, 3 cross sectional,
	Zambia= 2	[68,99]	2 SA
	Zimbabwe= 1	[77]	1 SA
	Ethiopia= 27	[36,37,51,53,56,57,62,69,74,76,83,85,40,87,88,90,91,95,96,104,105,41,43–46,49,50]	6 SA, 21 cross sectional
Multi-country	n=6	[33,47,52,65,67,75]	6 SA

SA: secondary analysis

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Table 2: Determinants of ANC utilisation in sub-Saharan Africa

Factor	Determinants	West Africa	East Africa	South Africa	Central Africa	Multi-country
Predisposing factors	Household wealth/socio-economic status	[13,14,61,64,70,71,80,82,93,23,38,39,54,55,58–60]	[44,46,92,95,96,47,56,57,62,63,74,86,88]	[28]	[61]	[65]
	Maternal Age	[27,38,39,42]	[24,32,47,35–37,40,41,43,44,46]	[34,48]		[33]
	Maternal Education	[13,38,39,42,54,55,58–60,64]	[7,24,50–53,56,57,62,63,68,35–37,41,43–45,49]		[61]	[33,47,52,65]
	Maternal occupation/ Employment Status	[13,39,54,55,69,70,72]	[24,37,40,50,68,71,74,76]	[48,73]		[47,65,67,75]
	Husband/Partner’s Occupation		[76]			
	Husband/Partner’s Education	[23,39,66]	[24,56,68]			[67]
	Maternal Religion	[14,38,59,69,70]	[40,62,77]	[73]		[47]
	Marital Status and Family type	[23,25,27,80,82]	[32,35,56,63,76,78,79,81]	[48,73]		[52]
	Parity/family and household size	[13,22,25,39,69,84]	[24,36,83,85,37,42,44,51,63,77,78,81]	[26]		[33,47,52,65]
	Ethnicity and cultural Influence	[14,54,70]	[46,62]			[52]

	Residence/Geographical location	[13,30,82,89,93,97,38,39,55,59,60,66,69,80]	[35,36,77,95,98,40,44,50,56,57,62,63,71]	[48]	[33,47,67]
Enabling factors					
Table 2: Determinants of ANC utilisation in sub-Saharan (Continued)					
	Distance from health facilities	[14,38]	[7,34–36,40,76,90,99]		[52]
	Health insurance/user-fee exemption	[23,38,89,93,101]	[81,100,102]		
	Involvement in decision-making/autonomy	[39,54,89]	[91]		[67]
	Husband's/partner's approval and support	[30,103]	[32,43,49]	[73]	
Need Factors					
	Knowledge/Exposure to media	[38,39,66,69,70,82,89]	[40,49,57,74,83,85,87,88,90]		
	Attitude and perception toward ANC		[36,45,88,91]		
	Pregnancy wantedness and planning	[11,23,64]	[35,36,87,106,123,37,41,43,49,77,81,83,85]	[26,48,73]	[11]
	Current/Previous pregnancy and health experiences	[84,103]	[41,43,45,91]	[29,48]	
	Quality/content of services	[82]	[35,53,81,99,104,105]		

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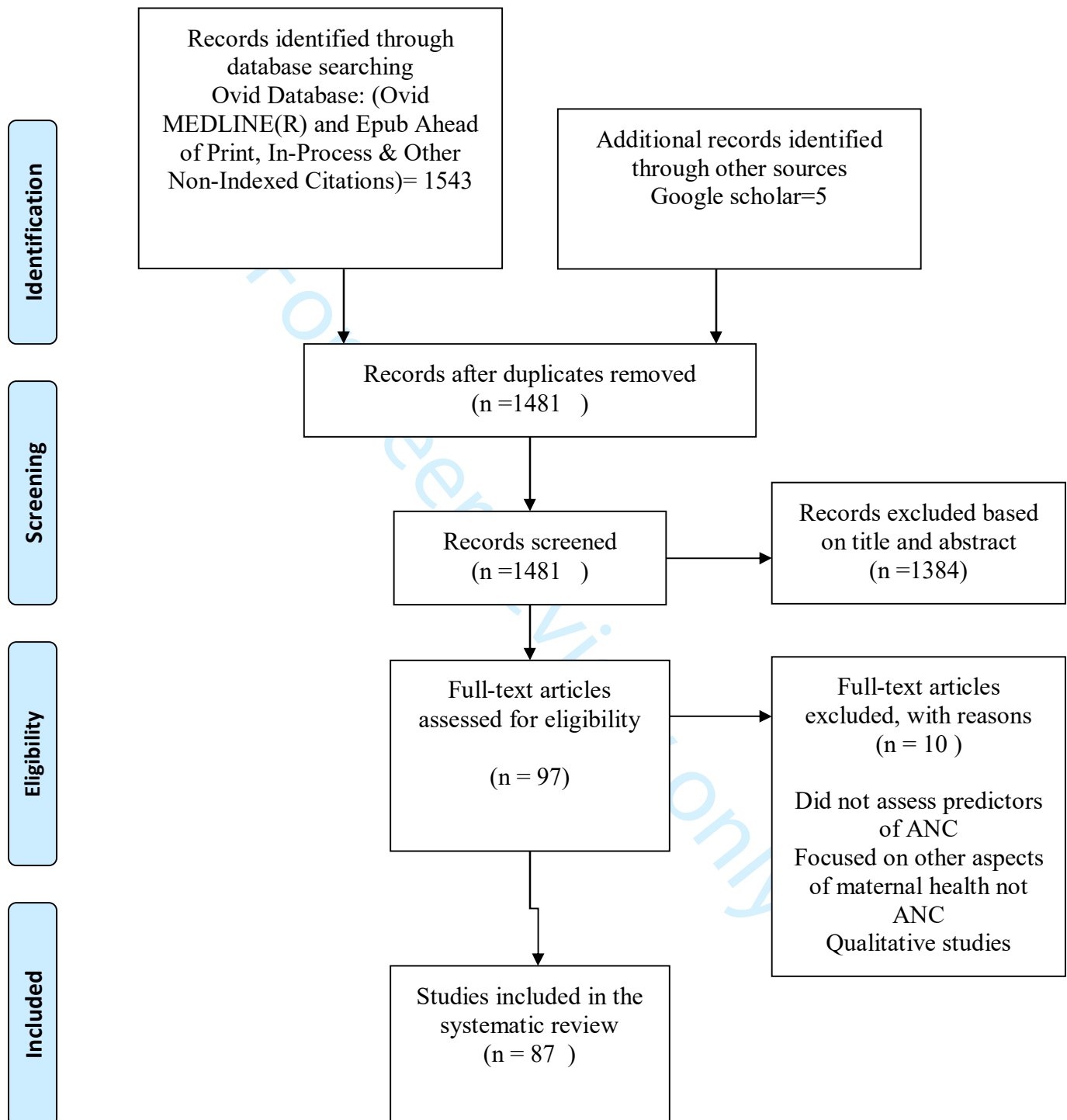


Fig. 1: PRISMA flow chart. The figure presents the publication identification and selection process. It shows the number of records identified, included and excluded, and the reasons for exclusions



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 3 - 4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Not applicable
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Page 5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Page 7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 5-6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 8
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Page 8
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	Not applicable



PRISMA 2009 Checklist

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Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Not applicable
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not applicable
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 7-8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Tables 3,4
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Page 7
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Not applicable
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Not applicable
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Not applicable
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not applicable
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Page 16-22
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Page 22
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 22
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Page 24

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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PRISMA 2009 Checklist

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determinants[All Fields] AND predictors[All Fields] AND factors[All Fields] AND prenatal[All Fields] AND ("prenatal care"[MeSH Terms] OR ("prenatal"[All Fields] AND "care"[All Fields]) OR "prenatal care"[All Fields] OR ("antenatal"[All Fields] AND "care"[All Fields]) OR "antenatal care"[All Fields]) AND ("africa"[MeSH Terms] OR "africa"[All Fields])

OVID MEDLINE

Search Strategy:

Searches Results

1 determinant*.mp. or "Social Determinants of Health"

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3 predict*.mp.

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6 ante-natal.mp.

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10 "Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.

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Additional file 3: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

Criteria	No. of articles		
	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	87		
2. Was the study population clearly specified and defined?	87		
3. Was the participation rate of eligible persons at least 50%?	87		
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	87		
5. Was a sample size justification, power description, or variance and effect estimates provided?	46	8	25
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			87
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			87
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			87
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	87		
10. Was the exposure(s) assessed more than once over time?			87

11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	87		
12. Were the outcome assessors blinded to the exposure status of participants?			87
13. Was loss to follow-up after baseline 20% or less?			87
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	87		

*CD, cannot determine; NA, not applicable; NR, not reported

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Table 3: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Dahiru et al 2013	Nigeria	SA of 2013 NDHS	38,945 women aged 15-49 years	Older age (+), rural residence (-), mother's and husband' level of education (+), working status of the woman (+), rich household (+), health insurance (+), Christian and Muslim religion (+)
Muchie 2017	Ethiopia	SA 2014 DHS	3694 women aged 15-49 years	Lower educational level (-), lower economic conditions (-), higher birth order (-), rural residence (-), available high quality ANC services (+)
Gebre 2018	Ethiopia	SA 2000-2016 Ethiopia DHS	5867 (year 2000), 2279 (year 2016)	Low-economic status (-), illiteracy (-), rural residence (-), no occupation (-), poor access to mass media (-)
Yaya 2018	Benin	Benin DHS	17,794 and 16,599 women in 2006 and 2012 respectively.	Education (+), higher wealth index (+), rural residence (-), employed (+)
Yaya 2017	Ethiopia	SA 2011 Ethiopia DHS	10,896 women	Frequency- older age interval (-), rural residence (+), primigravidity (+), unemployed (+) Timing- Rural residence (-), multiparity (-)
Rurangirwa 2017	Rwanda	Cross-sectional study	921 women	Age >31 years (-), single women (-), poor social support (-)
Akinyemi 2017	Nigeria	SA 2013 NDHS	20,467 women	Low formal education (-), poverty (-) healthcare access problems (-)
Saad–Haddad 2016	Multi-country- Bangladesh, Cambodia, Peru Cameroon, Nepal, Senegal, Uganda.	SA NDHS	7576, 8008, 4818 women, in Cameroon; Senegal and Uganda respectively	Education (+) household wealth(+), gestational age at first visit (-), birth rank (-), preceding birth interval (-)
Ebonwu 2018	South Africa	Cross-sectional study	807 women	Timing- Rural residence (-) Rural areas: Age <20 years (-), married (-), employed (-), unplanned pregnancy (-) Peri-urban areas- booking delays (-),unplanned pregnancy (-), primigravidity (-)
Worku 2016	South Africa	Cross-sectional	272 mothers	Mother's age >20 years (+), increased distance to health facility(+), service satisfaction (+)
Manthalu 2016	Malawi	SA	142 health facilities	Use fee exemption (+)
Fagbamigbe 2017	Nigeria	SA	6,299 females	Low education (-), poverty (-)
Tsegay 2013	Ethiopia	cross-sectional study	1113 women	Married (+), educated (+), proximity of health facility to the village(+), and husband's not a farmer (+)
Babalola 2009	Nigeria	SA	2148 women	Education (+), older age at the birth of last child (+), and approval of family planning (+),urban residence(+), wealthy household (+), large number of clients in PHC (-)
Allegri 2011	Burkina Faso	Cross-sectional study	435 women	Living within 5km from a facility (+), animist religion (-), some ethnicities (-), low household wealth (-)
Abor 2011	Ghana	Ghana DHS	5588 women	Oder age (-), multiple pregnancies (-), education (+),religious affiliation (+), high economic status (+)

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Wilunda 2015	Ethiopia	Cross-sectional study	500 women	High wealth status (+), knowledge of the recommended number of ANC visits (+), attitude towards maternal health care (+), older age (-)
Abosse 2010	Ethiopia	Cross-sectional study	691 women	Older age (+), husband’s positive attitude to ANC (+), small family size (+), no education (-)
Zegeye 2013	Ethiopia	Cross-sectional	446 women	Timing: Mothers with no parity before (+), good knowledge on early ANC (+), planned pregnancy (+)
Gross 2012	Tanzania	Cross sectional	440 pregnant women	Perceived poor quality of care (-), late recognition of pregnancy (-), not being supported by the husband or partner (-), primiparity (+), previous experience of a miscarriage or stillbirth (+)
Akowuah 2018	Ghana	Cross-sectional study	200 pregnant women	Older age (+), large household size (+), employed (+)
Adewuyi 2018	Nigeria	SA of DHS 2013	19652 mothers aged 15 to 49 years old	Rural: maternal non-working status (-), birth interval < 24 months (-), single birth type (-), not listening to radio at all (-), lack of companionship to health facility (-), not getting money for health services (-) Urban: mothers professing Islam (-), those who did not read newspaper at all (-), and those who lacked health insurance (-)
Brown et al 2008	Kenya	Cross-sectional	1,562 perinatal outcomes	Education: secondary education or above (+), Distance: living further than 5 km from a dispensary (-),
Mbuagbaw 2011	Camaeron	DHS	7,557 women	Secondary or higher education (+), greater wealth (+), urban residence (+), parity of 3–4 (+)
Birmeta 2013	Ethiopia	Cross-sectional	422 women	Parity (+), literacy status of women (+), average monthly family income (+), media exposure (+), decision where to give birth (+), perception of distance to health institutions (+)
Tarekegn 2014	Ethiopia	DHS	16,515 women	Women with higher education (+), Women from urban areas (+), autonomous women (+)
Sakeah 2017	Ghana	Cross-sectional	1497 women	Young age (+), least educated (+), poorest women (+) women whose partners were uneducated (+), those with health insurance (+), low socioeconomic status (-)
Ochako 2011	Kenya	SA 2003 KDHS	1675 young women	Timing: rural (-), secondary education (+), higher parity (-), married (+)
Ononokpono 2013	Nigeria	DHS	16,005 women	Living in communities with a high proportion of women who delivered in a health facility (+), Residence in high-poverty communities (-)
Melaku 2014	Ethiopia	Cross-sectional	2361 mothers	Older mothers (+), urban residents (+), higher education (+), farmer mothers (+)
Afulani 2015	Ghana	SA 2007 Ghana Maternal Health Survey	4,868 women	Urban residence (+) and higher SES (+)
Straneo 2016	Tanzania	Cross sectional	464 women	Young age (+) Timing: young age (+)
Ononokpono 2015	Nigeria	SA NDHS 2008	17560 women	Younger women (+), secondary/higher education (+),

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3					Employed (+), Christian women (+), rich households (+), involvement in
4					decision making (+), joint decision (+), Igbo, Yoruba and other minority
5					ethnic groups(+), urban areas (+), educated women (+), exposed to mass
6					media (+)
7	Arthur 2013	Ghana	SA of GDHS 2008	NR	Wealth (+), urban areas (+), mothers with health insurance
8					(+), educational level (+)
9	Tewodros 2009	Ethiopia	Cross-sectional	627 women	Educated (+), less than 60 minute walk to facility (+), husband approval
10					(+), illness in future pregnancies (+), planned pregnancy and illness
11					experienced in past pregnancy (+), age at first pregnancy (+)
12	Gupta 2014	Tanzania	SA of DHS	8,035 women	urban areas (+)
13	Ntambue 2012	Democratic Republic of Congo	Cross-sectional	1762 women	primiparous and grand multiparous (-), unplanned pregnancies (-)
14					
15	Barasa 2015	Kenya	Cross-sectional	306 mothers participated.	Older women (-), primary education (-), parity(+), Unemployed (-), husbands
16					no formal education (+),
17	Mwase 2018	Burkina Faso	Cross-sectional	6601 women	least poor households (+), married (+), living further away (-), multiparous
18					(-), Muslim religion (-),
19	Bobo 2017	Ethiopia	SA of DHS 2014	8070 women	urban area (+), secondary level (+),
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22	Nathey 2018	South Africa	Cross-sectional	411 adult (>18 years old)	Timing: shift workers (+), Patients dependant on public transportation (-),
23				HIV-positive women	partner's support (+), poor women (+)
24	Anchang-Kimbi 2014	Burkina Faso	Cross-sectional	287 parturient women	Only one dose of IPTp (-)
25					
26	Wabiri 2013	South Africa	Cross-sectional	Women aged 15–55 years who had been pregnant in the past two years (n=1113), and women interviewed as the parent of a child born in the past two years (n = 1304)	Poorest (+), rural (-)
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32	Melese et al 2016	Ethiopia	Cross-sectional	Women (15–49 years) who gave birth in one year preceding the study (n=748)	Preference of skilled personnel (+), awareness about places where to get skilled providers (+), listening to radio (+), distance of WHDT within 2km radius from the nearest health facility (+)
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DHS: Demographic health survey, SA: Secondary Analysis FGD: Focal Group Discussion SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants NR: Not Reported IPTp: intermittent preventive treatment during pregnancy *Only results for Cameroon, Senegal, Uganda included in review NR: Not reported (+): increases ANC use (-) reduces ANC use

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Table 4: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Kyei 2012	Zambia	SA 2007 DHS	2405 rural births	Distance(+), level of provision category (+)
Doctor 2011	Nigeria	SA 2008 Nigeria DHS	18,028) women	youngest age cohort(-), rural residence (-), lack of schooling (-), higher parity (-), residence in northern region(-) and poor economic status(-)
Woldemicael 2010	Eritrea, Ethiopia	SA DHS 2007	Currently married women	Women’s autonomy (+)
Alemu 2018	Ethiopia	Cross sectional	400 mothers	Distance (+), Knowledge of timing of ANC(+), No under-five children (+), one under-five child (+), desire for pregnancy (+)
Kibusi 2018	Tanzania	SA 2011/2012 Tanzania HIV/AIDS and malaria indicator survey	4513 women	Having health insurance (+)
Makate 2017	Zimbabwe	SA ZDHS 2005/06 and 2010/11	8907 women (2005/06), 9171 women (2010/11)	Contraceptive prevalence (+), religious composition (+), density of nurses (+), health expenditures per capita (+), availability of government hospitals in communities (+)
Haruna-Ogun Ejeta 2017	Nigeria Ethiopia	NDHS 2013 Cross sectional	20,192 cases 421 pregnant women	Place of residence (+) Ethnic group (-), maternal age equal or more than 25 year old (-), second trimester and third trimester (-) ; higher monthly income (+)
Gulema 2017	Ethiopia	Cross sectional study	Pregnant women	Wrongly perceived ANC initiation schedule (-)
Aliyu 2017	Nigeria	SA NDHS 2013	20, 467 women	maternal education (+), media exposure (+), place of residence (+), having health insurance(+)
Banke-Thomas	Ethiopia	SA Kenya DHS	898 adolescents	Having education (+), religion (+), ethnicity (+), urban residence (+), wealth quintile (+), mass media exposure (+), and geographical region (+)
Kuuire 2017	Nigeria Malawi	SA NDHS 2003, 2008 and 2013 MDHS 2000, 2004 and 2010	Nigeria (39,923 women) and Malawi (28,951 women).	Nigeria: Wealth (+) Malawi: Wealth (-)
Chorongu 2018	Kenya	Cross-sectional comparative study	385 women	Being Muslim (+), Higher education (-),
Aduloju	Nigeria	A cross-sectional study,	530 pregnant women	Occupation (+)
Owili 2016	Kenya	SA KDHS	4005 women	Monogamous setting (+), marriage (+), Older age (+), religion (+), health insurance (+), Exposure to media (+), higher education (+)

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3	Bayou 2016	Ethiopia	Cross sectional	870 women	Higher education (+), ANC in private facility (+)
4	Browne 2016	Ghana	SA GDHS 2008	3022 Women	Being insured (+)
5	Ochako 2016	Kenya	2008-09 Kenya DHS.	4014 women	Wanted pregnancy (+), Urban residence (+), Higher education (+),
6					Older age (+), birth interval less than 25 months (-)
7	Muhwava 2016	South Africa	Cross sectional	363 women from rural sample and 466 women from urban	Urban :Being employed (+), wanted pregnancy
8					Rural site: Being married (+),
9					Religiosity (-)
10	Gudayu 2015	Ethiopia	Cross sectional	390 women	Not aware of right timing of booking (-), not autonomous to use ANC
11					(-), Recognised pregnancy by missing period (-).
12	Oyewale 2015	Nigeria	Cross sectional	384 pregnant women	Older age (-), Higher education (-), Birth order (-), urban residence
13					(+), health insurance coverage (+) and household income (+).
14	Dutamo 2015	Ethiopia	Cross sectional	634 currently married women	Low parity (+), pregnancy intended (+), awareness of danger signs
15					of pregnancy (+), higher education of woman and spouse (+)
16	Nathan 2015	Rwanda	Prospective cohort Study	536 women	Distance (+)
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18	Gill 2015	Lesotho	Cross sectional	728 women	HIV positive (+)
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20	Omer 2014	Nigeria	Cross sectional	7870 women in Bauchi and of	Residence in community with a government health facility (+),
21		(Bauchi and		7759 in Cross River	absence of physical intimate partner violence (+)
22		Cross river)			
23	Manzi 2014	Rwanda	SA 2010 RDHS	6,325 women	Having many children (-), feeling that distance to health facility is a
24					problem (-), unwanted pregnancy (-),ANC at a private hospital
25					(+),being married (+), health insurance (+)
26	Belayneh 2014	Ethiopia	Cross sectional	398 pregnant women	Early timing of ANC: Mothers with younger age (+), formal education
27					(+), previous early ANC visit (+), perceived ANC visit per pregnancy
28					of four and greater (+)
29	Rossier 2014	Kenya,	SA Nairobi DHS,	3,346 and 4,239 births in	Kenya (at least one visit): Less-educated (-), poorer (-), non-Kikuyu
30		Burkina	Ouagadougou DHS	Kenya and Burkina Faso	women (-), women living in the neighbourhood farther from public
31		Faso		respectively	health services (-)
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34					Burkina Faso (at least four visits): poorer households (-), non-
35					educated women (-), women from Polesgo and Nioko tribe (-)
36	Ononokpono 2014	Nigeria	2008 Nigeria DHS	17,476 women	Intimate partner violence (+)
37	Chama-Chiliba 2015	Zambia	SA Zambia DHS	2925 women	Employment (+), low quality ANC (-), multiparity (-), higher
38					education of husband (+),
39	Afework 2014	Ethiopia	Cross-sectional	4949 women	Visit by community health worker (+)
40	Oladokun 2010	Nigeria	Cross-sectional	796 women	Low parity (+), previous stillbirth (+)
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Stephenson 2012	Bangladesh, Egypt, and Rwanda	SA DHS for Bangladesh (2007), Egypt (2008), and Rwanda (2005).	4926, 8036, 5387 women respectively	Rwandan communities with higher employment rate among men (+)
Regassa 2011	Ethiopia	Cross sectional	1094 women	Literacy (+), have exposure to media(+), low parity(+)
Rai 2012	Nigeria	SA NDHS 2008	2434 Women	Women’s education, (+), husband’s Education (+), wealth (+), urban residence (+),Mass media exposure (+)
Exavery 2013	Tanzana	Cross-sectional household survey	3,127 women	Mistimed pregnancy (-),
Worku 2013	Ethiopia	Cross sectional	1668 women who had births in the year preceding the survey	Higher educational of women and their husbands (+), higher wealth Quintiles (+), awareness of risk of pregnancy (+), preference for skilled provider(+), birth order (-), unwanted pregnancy (-)
Yeneneh 2018	Ethiopia	Ethiopian DHS	23,179 women who had a live birth in the five years preceding the survey	Richest wealth quintiles(+), lowest number of birth order(+), urban residence(+), younger age(+) and educated(+)
Dansou 2017	Benin Republic	DHS	9110 mothers who had completed at least a pregnancy within the 5 years preceding the survey	Economically well-off households (+)for richest women (+), educated women(+),and those with desired pregnancies(+)
Assefa 2016	Ethiopia	DHS	7,773 women aged 15-49 years who gave birth during the five-year period preceding the survey	Urban residence (+), older mothers (+), education (+), employment (+), mass media exposure(+), religion (+), access to health services(+)
Ayalew 2017	Ethiopia	Cross sectional	317 women who gave birth 6 months before the study	Older age (+), Education(+), history of stillbirth(+), planned pregnancy(+), service utilization
Begum 2018	Niger	Cross sectional	923 pregnant women	Women with gestational age ≥ 27 weeks (+),Women who reportedly received husbands' advice about attending ANC (+)
Verney 2017	Senegal, Ethiopia, Kenya	Cross sectional	4,575 women	Higher education(+), Higher income (+), formal employment(+), advice from health worker(+), nulliparity(+)

DHS: Demographic health Survey, SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants (+): increases ANC use (-) reduces ANC use

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Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review

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Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review

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Abstract

Objectives: To identify the determinants of antenatal care utilisation in sub-Saharan Africa.

Design: Systematic review.

Data sources: Databases searched were PubMed, OVID, EMBASE, CINAHL, and Web of Science.

Eligibility criteria: Primary studies reporting on determinants of ANC utilisation following multivariate analysis, conducted in Sub-Saharan Africa and published in English language between 2008 and 2018.

Data extraction and synthesis: A data extraction form was used to extract the following information: Name of first author, year of publication, study location, study design, study subjects, sample size and determinants. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] checklist for reporting a systematic review or meta-analysis protocol, was used to guide the screening and eligibility of the studies. The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used to assess the quality of the studies while the Andersen framework was used to report findings.

Results: 74 studies that met the inclusion criteria were fully assessed. Most studies identified socio-economic status, urban residence, older/increasing age, low parity, being educated and having an educated partner, being employed, being married and Christian religion as predictors of antenatal care attendance and timeliness. Awareness of danger signs, timing and adequate number of antenatal visits, exposure to mass media and good attitude towards antenatal care utilisation made attendance and initiation of antenatal care in first trimester more likely. Having an unplanned pregnancy, previous pregnancy complications, poor autonomy, lack of husband's support, increased distance to health facility, not having health insurance and high cost of services negatively impacted the overall uptake, timing and frequency of antenatal visits.

Conclusion: A variety of predisposing, enabling and need factors affect antenatal care utilisation in sub-Saharan Africa. Intersectoral collaboration to promote female education and empowerment, improve geographical access and strengthened implementation of antenatal care policies with active community participation are recommended.

Strengths of the study

- This study involved a large number of studies that covered a wide and geographically important sub region of Africa.
- This study accessed several databases and utilized recent publications (≤ 10 years old)
- This review provides evidence on the role of social determinants of health in ANC utilisation and the importance of intersectoral collaboration in improving ANC utilisation

Limitations

- This review excluded publications in French language may limit the representativeness and generalizability of the findings to some settings.

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Keywords: Antenatal care, prenatal care, utilization, determinants, sub-Saharan Africa

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Introduction

Globally, pregnancy and childbirth are significant events for women and their families even though they represent a period of heightened vulnerability for both women and their unborn babies.[1] Every day, preventable causes related to pregnancy and childbirth lead to the deaths of over 800 women with 99% of these maternal deaths occurring in developing countries. Although by 2015, maternal mortality had decreased by over 40% from the 1990 levels, maternal mortality levels have continued to remain unacceptably high in sub-Saharan Africa (SSA).[2,3] Inadequate access to quality antenatal care (ANC) contributes significantly to these preventable maternal deaths.[4] As part of reproductive health care, ANC presents a unique and life-saving opportunity for health promotion, disease prevention, early diagnosis and treatment of illnesses in pregnancy using evidence-based practices.[5] To ensure optimum care, the World Health Organization previously recommended that every pregnant woman should have a minimum of four ANC visits throughout the pregnancy with the first visit occurring in the first trimester of pregnancy.[6,7] However in 2016, WHO revised its recommended minimum number of ANC visits from 4 to 8 contacts following recent evidence that increased number of contacts between a pregnant woman and a skilled health provider reduced perinatal mortality and improved women's experience of care. Early ANC initiation in the first trimester of pregnancy and receiving the required services is emphasised in the revised guideline.[5] In spite of this, global reports in 2017 showed that only three in five women attended at least four antenatal visits. In regions with the highest rates of maternal mortality, such as SSA, only 52% of women received at least four ANC visits.[8]

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3 ANC not only promotes the health of pregnant women but has also been found to reduce the risk
4 of adverse pregnancy outcomes, perinatal and infant mortality and morbidity.[9–12] It also
5 encourages skilled birth attendance for delivery and postnatal care as women who attend ANC are
6 more likely to utilise these services than the non-attenders.[13–18] Studies have used a variety of
7 indicators to assess ANC use. This includes at least one visit, at least four visits, trimester timing
8 of ANC visits, services received during ANC visits and care provider type visited however the
9 quantity of contacts remains commonly used.[19] Recently, indicators to enable the progressive
10 realisation of maternal health targets have been proposed especially for developing country
11 contexts like countries in SSA.[19] The Andersen framework is a behavioural model that describes
12 the social, individual and health system determinants affecting access to health care services.
13 Several studies have employed this model in identifying the factors affecting ANC utilisation.[20–
14 27]

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17 Various studies have assessed factors affecting ANC utilisation in SSA countries,[28–35] but none
18 has systematically summarised such studies in SSA. A review conducted over ten years ago
19 examined factors affecting the use of ANC in developing countries however this review only
20 contained seven studies from Africa and did not include recently published studies from SSA.[36]
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22 The aim of this review was to systematically identify the factors associated with the utilisation of
23 ANC in SSA.
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Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] checklist for reporting a systematic review or meta-analysis protocol [37], was used in screening studies for eligibility. (See supplementary file 1)

Search strategy

A systematic review of published quantitative literature was conducted between October 2018 and April 2019 to capture studies published in the last ten years (2008-2018). The databases searched were PubMed, OVID, EMBASE, CINAHL and Web of Science. Other databases searched were Google scholar and African journal online (AJOL). The search terms used include: antenatal, prenatal, maternal health, maternal care, maternal health services, utilisation, factors, determinants, predictors, Africa. The search strategy and results are provided in supplementary file 2.

Inclusion criteria

Studies were eligible for inclusion if they were quantitative (primary or secondary data utilised) reporting on factors associated with ANC utilisation following multivariate analysis, conducted in SSA and published between 2008 and 2018. Antenatal care utilisation in this review refers to attendance of at least one and at least four ANC visits and booking visit within the first trimester of pregnancy. Various study designs (longitudinal, cohort, case-control, cross sectional and experimental) were eligible for inclusion if they assessed the predictors of ANC utilisation.

Exclusion criteria

This review excluded articles and studies published before 2008 and written in any language other than English. Studies that used measures other than the WHO recommendation for antenatal care were excluded. Review articles, case reports, case studies and simple descriptive studies without regression analyses were excluded. At the level of titles, titles that did not address antenatal care and maternal health/health services utilisation were excluded. At the abstracts stage, studies that did not report factors associated with antenatal care and qualitative studies were excluded. Full text quantitative studies that did not report on the determinants of ANC utilisation after multivariable regression analysis such as studies that assessed the predictors of utilisation skilled birth attendance and post-natal care were excluded. Full text publications that did not employ the WHO definitions for ANC and qualitative were also excluded

Data extraction

A data extraction form was developed and reviewed by all reviewers. Screening of titles and abstracts and the full texts was carried out independently by two of the review authors (INO and ICA). Any disagreements were resolved through discussion and consensus between the two review authors or with the help of the third author (OBE). Mendeley reference manager was used to keep track of references. Data were extracted for each paper using standardised forms with the following domains; the name of first author and year of publication, study location and setting, study design, study subjects and sample size and factors/determinants. Figure 1 shows the article selection and inclusion process.

Quality appraisal

Quality assessment of the studies included in this review was carried out by the main reviewer in consultation with the other authors. The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used to assess the quality of the studies. This quality assessment tool has been used in other systematic reviews.[38,39] (See supplementary file 3). The tool consists of fourteen questions assessing different aspects of a study including but not limited to definition of objectives, study population, sampling strategy, sample size and statistical analyses. To appraise a study, each question is scored as Yes (1) or No (0), and others (CD, cannot determine; NA, not applicable and NR, not reported). All the studies included in this review were assessed for quality using the appropriate criteria based on study design. Elements of the criteria which did not apply to a particular study was marked as not applicable.

All the studies fulfilled the quality criteria except for six studies[9,40–44] that did not report on sample size.

Patient and public involvement

It was not appropriate or possible to involve patients or the public in this work

Results

Study selection

The search yielded 3248 studies. The initial search identified a total of 3243 articles from the main databases and 5 articles Google scholar. After removal of duplicates, 1481 articles remained. Using title and abstracts, we first screened the identified articles and excluded 1384 articles based on the

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3 agreed inclusion criteria with the other three authors. The studies were excluded because they were
4 irrelevant to the study, conducted outside sub-Saharan Africa and were purely descriptive. A total
5 of 97 full text studies were assessed for eligibility and 23 articles were further excluded after
6 reading the full text because they did not assess predictors of ANC, did not use the WHO
7 definitions for ANC, were focused on other aspects of maternal health not specific to ANC and
8 were qualitative studies. The four reviewers agreed on the inclusion of 74 studies in the final
9 review.

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12 The 74 studies included were from 23 SSA countries. East Africa had the highest number of studies
13 included in this review. Countries with the most studies were Ethiopia (24), Nigeria (15), Kenya
14 (5) and Ghana (5). Most studies were cross-sectional surveys and secondary data analyses. (Table
15 1). Table 2 contains the determinants of ANC utilisation classified as overall uptake of ANC (at
16 least one ANC visit), frequency (at least four ANC visits) and initiation of ANC in first trimester.
17 Table 3 contains the summary of the determinants of ANC utilisation by regions in Africa. The
18 characteristics and summary of findings of the articles included in the review are presented in
19 tables 1 and 2 of supplementary file 4. The summary measure utilized by various studies was
20 mostly the odds ratio.

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22
23 The study findings were presented using the Andersen framework for the utilisation of health
24 services.[45] The Andersen framework is a health behaviour model used to assess the factors
25 affecting health services utilisation. The model proposes three main determinants that influence
26 the use of health services including predisposing, enabling and need factors. These represent the
27 pre-illness sociocultural characteristics, access-related factors and immediate cause/problems that
28 generate a need for the use of health services, respectively. The predisposing factors include age,
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3 gender, marital status, family size, social status, education and race; enabling factors include
4 family income, health insurance, distance, social relationships, service availability, and health
5 facility characteristics (waiting time, availability of health providers) and need factors include
6 symptoms or perceived illness. Under each main category (according to the Andersen framework),
7 each determinant of ANC utilisation was presented with studies on its effect on overall uptake of
8 ANC (at least one ANC visit), frequency (at least four ANC visits) and initiation of ANC in first
9 trimester highlighted as applicable.
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23 **Predisposing factors**

24 *Maternal age*

25 *Overall uptake of ANC (at least one ANC visit)*

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29 Seven studies reported the effect of age on at least one ANC visit. Four of the studies showed that
30 older/increasing age was a predictor of ANC utilisation.[46–49] Two of the studies conducted in
31 Ethiopia found that younger age at first pregnancy was a predictor of ANC use as women aged
32 less than or equal to twenty years at the time of first pregnancy were nearly three times more likely
33 to use ANC services than whose age at first pregnancy was more than twenty years.[50,51] Also,
34 in one of the studies, Nigerian women aged less than twenty years were more likely to utilise ANC
35 than their older counterparts.[23] (Table 2)
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51 *Frequency of ANC (at least four ANC visits)*

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3 Nine studies found that maternal age significantly influenced the frequency of ANC visits. Eight
4 of the studies found that older women were more likely to have at least four ANC visits compared
5 to their younger counterparts.[30,34,43,49,52–55] One of the studies found that increasing
6 maternal age was associated with less than four ANC visits in Ethiopia.[33] (Table 2)
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16 *Timing of first antenatal visit (Gestational age <12 weeks)*

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18 Younger maternal age was a predictor of early ANC initiation in two of the studies.[56,57] (Table
19 2)
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27 **Maternal education**

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29 *Overall uptake of ANC (at least one ANC visit)*

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33 In 19 studies, the relationship between maternal education and overall uptake of ANC was
34 reported. The lack of formal education and lower educational levels were predictors of poor ANC
35 use among women in these studies in 18 of the studies.[9,25,60–68,46,47,49–51,53,58,59]
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37 However, one of the studies found that more educated women were less likely to utilise ANC from
38 skilled medical providers.[23] (Table 2)
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48 *Frequency of ANC (at least four ANC visits)*

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51 In 14 studies, maternal education was a predictor of frequency of ANC. In all the studies, the odds
52 of attending at least four ANC visits was more in women who had higher educational
53 levels.[15,24,67,69–71,25,27,29,30,49,53,54,64] (Table 2)
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Timing of first antenatal visit (Gestational age <12 weeks)

Six studies documented the relationship between maternal education and timing of initiating antenatal care. Five studies found that educated women were likely to book early for ANC.[24,56,57,70,72] Only one of the studies found that more educated women were less likely to utilise ANC from skilled medical providers.[23] (Table 2)

Husband/partner's education

Overall uptake of ANC (at least one ANC visit)

Only one study conducted in Ethiopia found that the higher the educational status of the husbands, the more likely the woman will attend at least one ANC visit.[63] (Table 2)

Frequency of ANC (at least four ANC visits)

Six studies reported on the influence of husband/partner's education on ANC use. Women whose husbands/partners had some education were more likely to access ANC services than those with less educated husbands/partners.[22,30,41,63,73,74] (Table 2)

Maternal occupation/employment status

Overall uptake of ANC (at least one ANC visit)

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3 Seven studies documented the impact of occupation/employment status on uptake of ANC. In six
4 of the studies, women who were employed and those who had a working status were found to be
5 more likely to utilise ANC than the unemployed/not working.[47,48,62,67,75,76] Women who
6 were farmers were more likely to use ANC in one of the studies.[59] (Table 2)
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13 *Frequency of ANC (at least four ANC visits)*

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16 Women who were employed were more likely to utilise ANC up to four times compared to their
17 unemployed counterparts in six of the studies.[29,30,73,74,77]. In another study, there was a
18 higher odds of inadequacy in ANC visits among women who engaged in sales/business,
19 agriculture, skilled manual and other jobs when compared to women who currently do not
20 work.[33] (Table 2)
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31 *Timing of first antenatal visit (Gestational age <12 weeks)*

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34 Unemployed women were less likely to initiate ANC early in pregnancy in one study.[57] In
35 another study carried out in Ethiopia, women who were engaged in agricultural occupation were
36 more likely to have delayed initiation of ANC.[33] In Rwandan communities with higher
37 employment rate among men, women were more likely to have received care early in the
38 pregnancy.[76] (Table 2)
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49 *Husband/partner's occupation*

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52 *Overall uptake of ANC (at least one ANC visit)*

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3 One of the studies found that women whose husbands were engaged in non-farming occupations
4 were more likely to use ANC services.[68] (Table 2)
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14 ***Maternal religion***

15 16 17 *Overall uptake of ANC (at least one ANC visit)*

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20 Two studies found that Christian women were more likely to utilise ANC services compared to
21 non-Christians (traditional African religion and Muslims).[75,78] In another study, orthodox
22 Christians utilized ANC more than the Protestants and Catholics group.[48]
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31 *Frequency of ANC (at least four ANC visits)*

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34 In two studies, Christians were more likely to utilise ANC services compared to non-
35 Christians.[54,77] Women who had no religion were less likely to attend ANC in 2 studies.[27,66]
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38 (Table 2)
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44 *Timing of first antenatal visit (Gestational age <12 weeks)*

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47 In one of the studies, women who were Muslims and traditionalists were less likely to initiate
48 ANC in the first trimester.[57] (Table 2)
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55 ***Marital status and family type***

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3 *Overall uptake of ANC (at least one ANC visit)*
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6 Three of the studies assessed the effect of marital status on utilising ANC once in the course of
7 pregnancy. These studies showed that married women were more likely to utilise ANC than the
8 never married/currently unmarried.[79,80] One of the studies employed a composite index
9 (adequate ANC) comprising at least one, four ANC visits, ANC by skilled professional and
10 number of services received.[79] In another of the studies, never and formerly married women
11 were more likely to use skilled ANC attendants.[63] (Table 2)
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23 *Frequency of ANC (at least four ANC visits)*
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26 Three studies found that married women were more likely to make at least 4 ANC contacts than
27 the unmarried during pregnancy.[42,70,79] (Table 2)
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35 *Timing of first antenatal visit (Gestational age <12 weeks)*
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38 In three studies, early ANC initiation was significantly associated with being married than being
39 unmarried.[53,81,82] (Table 2)
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46 *Parity/birth order and household size*
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49 *Overall uptake of ANC (at least one ANC visit)*
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52 Five studies found that women with high parity or large household sizes were less likely to attend
53 at least one ANC visit.[46,47,49,60,61] Women whose pregnancy was for the first time were more
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3 likely to utilise ANC services at least once during their pregnancy.[51] In one other study, mothers
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5 with high parity were more likely to utilise ANC than those with low parity .[83] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 In six of the studies, women with high parity or large household sizes had significant reduction in
15
16 attainment of at least four ANC contacts in the course of pregnancy.[15,30,40,42,70,77] (Table 2)
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22 *Timing of first antenatal visit (Gestational age <12 weeks)*
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25 Five studies reported that low parity/null parity was a predictor of early booking while having
26
27 many children led to delayed ANC initiation.[57,67,81,82,84,85] However, one of the studies
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29 showed that women who had given birth at least once were less likely to seek prenatal care in the
30
31 first trimester.[78] (Table 2)
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38 ***Ethnicity***
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41 *Overall uptake of ANC (at least one ANC visit)*
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44 Three studies showed that within-country ethnic differences influenced attending at least one ANC
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46 visit in different countries.[61,66,75] (Table 2)
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50 *Frequency of ANC (at least four ANC visits)*
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53 One study identified within-country ethnic differences as a predictor of attending at least four ANC
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55 visits.[75] (Table 2)
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6 ***Knowledge of pregnancy/exposure to media***
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9 *Overall uptake of ANC (at least one ANC visit)*
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12 In two studies, awareness of danger signs of pregnancy, timing and recommended number of ANC
13 visits was a predictor of at least one ANC. [58,83] Exposure to mass media was also increased the
14 odds of attending at least one ANC visit.[48,58,75,86] (Table 2)
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23 *Frequency of ANC (at least four ANC visits)*
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26 Five of the studies showed that women exposed to mass media were more likely to utilise ANC
27 services and promptly compared to those who were not.[22,30,54,64,77] (Table 2)
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34 *Timing of first antenatal visit (Gestational age <12 weeks)*
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37 A study conducted in Nigeria found that women who had been exposed to at three media channels
38 (radio, television and newspaper/magazine) were more likely to initiate ANC in the first trimester
39 compared to those who were less exposed to the media.[72] Another study showed that women
40 who lacked information on correct time of booking were more likely to book late for ANC.[87]
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46 (Table 2)
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52 ***Attitude and perception towards ANC***
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55 *Overall uptake of ANC (at least one ANC visit)*
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3 Women who considered pregnancy a risky event were more likely to utilise ANC than those who
4 considered it risk free.[46] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 Women who had a good attitude towards maternal health were twice more likely to attend ANC
15 compared to those with a poor attitude.[32] (Table 2)
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22 *Timing of first antenatal visit (Gestational age <12 weeks)*
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25 Two studies documented that women who perceived that ANC should be initiated in the first
26 trimester were more likely to book early for ANC than those who perceived that ANC should
27 commence in the second and third trimesters.[56,87] (Table 2)
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39 **Enabling factors**
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42 *Household wealth/socioeconomic status*
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45 *Overall uptake of ANC (at least one ANC visit)*
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48 Nine studies showed high socioeconomic level positively influenced attendance of at least one
49 ANC visit. [51,60,63,65–67,71,80,88]
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3 *Frequency of ANC (at least four ANC visits)*
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6 In 14 studies, women of high socioeconomic status attended at least four ANC visits more than
7 those in the lower socio-economic/wealth strata.[15,25,77,89–91,27,29,30,32,41,54,64,69] (Table
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17 *Timing of first antenatal visit (Gestational age <12 weeks)*
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20 Lower wealth/poor socio-economic status was associated with late initiation of ANC in two
21 studies.[57,70] (Table 2)
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28 ***Place of residence/geographical location***
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31 *Overall uptake of ANC (at least one ANC visit)*
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34 Eight studies reported the role of place of residence (urban/rural) on attendance to at least one
35 ANC clinic. In all the studies, rural dwellers were reported to be less likely to attend at least one
36 ANC visit.[15,33,35,59,64,73,90,91]. Living in communities where a government health facility
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was situated increased the odds of attending at least one ANC visit.[78] Three studies reported
increased likelihood of attending at least one ANC visit based on residence in specified
geographical regions/locations within the countries where the studies were conducted.[62,66,80]
(Table 2)

53 *Frequency of ANC (at least four ANC visits)*
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3 In six of the studies, residing in the rural area made attending at least four ANC more likely than
4 residing in the urban area.[46,48,49,51,63,80] One study showed that women residing in
5 communities with a government health facility providing ANC services were more likely to have
6 four ANC visits.[44] (Table 2)
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13 In eight studies, residing in a particular geographic regions increased the likelihood of achieving
14 at least four ANC visits during pregnancy.[22,25,27,30,44,53,54,80] This varied by the different
15 regional and zonal categories within each country. (Table 2)
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23 *Timing of first antenatal visit (Gestational age <12 weeks)*

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26 Rural dwellers were more likely to present late for ANC (in second and third trimesters) in four
27 of the studies included in this review.[33,72,78,92] (Table 2)
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35 *Distance from the health facility*

36 37 *Overall uptake of ANC (at least one ANC visit)*

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40 In three studies, increased distance to ANC services negatively impacted the uptake of at least one
41 ANC visit.[46,61,68] In one study, Kenyan women who lived close to the dispensary were more
42 likely to have at least one ANC visit however among those women with at least one visit, the
43 number of ANC visits increased as the distance from the dispensary increased.[9] Another study
44 also found that for each 10 km increase in distance from a health facility, the odds of a woman
45 receiving different ANC services decreased by a quarter.[93] In one of the studies, having a
46 Women' Health Development Team (WHDT) within a 2 km radius from the nearest health facility
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3 increased the likelihood of at least one skilled ANC utilization.[86] Access to health services was
4 associated with attending at least one ANC visit in another study.[48] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 Women who lived a far distance from a health facility were less likely to attend four or more ANC
15 visits in three of the studies.[34,53,54] (Table 2)
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22 ***Health insurance/user-fee exemption***
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25 *Overall uptake of ANC (at least one ANC visit)*
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28 One of the studies found that women who were insured were more likely to attend at least one
29 ANC visit.[94] In another study, the proportion of women who made at least one ANC visit during
30 pregnancy increased significantly following user fee exemption.[95] (Table 2)
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36 *Frequency of ANC (at least four ANC visits)*
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39 In three studies, women who did not have health insurance were less likely to attend up to 4 ANC
40 visits.[41,54,90] (Table 2)
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47 *Timing of first antenatal visit (Gestational age <12 weeks)*
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50 Women who had any form of health insurance were less likely to delay the initiation of
51 ANC.[81,96] However, another study found that women who had insurance were more likely to
52 initiate ANC attendance in the third trimester.[72] (Table 2)
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Involvement in decision-making/autonomy

Frequency of ANC (at least four ANC visits)

Women who made decisions jointly with their husbands or partners were significantly more likely to have four or more antenatal visits compared with women whose husbands or partners made decisions alone.[29,30,87] Another study conducted in Eritrea and Ethiopia showed that women who were involved in major household decisions such as large purchases were more likely to use ANC at least 4 times.[73] (Table 2)

Timing of first antenatal visit (Gestational age <12 weeks)

Women who do not participate in decision making were more likely to use ANC in the second trimester relative to the first trimester.[72] (Table 2)

Husband's/partner's approval and support, social support

Overall uptake of ANC (at least one ANC visit)

Women whose husbands have positive attitude towards ANC were more likely to utilize ANC than women whose husbands had negative attitude towards ANC.[46]

Women who had their husband/partner's approval/permission to attend ANC were more likely to utilise ANC services compared to those without support from their husbands.[50,58,97] (Table 2)

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3 *Frequency of ANC (at least four ANC visits)*
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6 Women who did not experience physical intimate partner violence during the year preceding
7 survey were more likely to have four ANC visits.[44] In another study, women who had the father
8 of their child present in their lives were more likely to utilise ANC services.[98] Women who
9 lacked social support were more likely to underutilise ANC services compared to those with social
10 support.[52] (Table 2)
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21 ***Quality/content of ANC services***
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24 *Overall uptake of ANC (at least one ANC visit)*
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27 In one of the studies, women who received advice on ANC from health workers were more likely
28 to attend ANC a least once in pregnancy.[97] (Table 2)
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35 *Frequency of ANC (at least four ANC visits)*
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38 High cost of services was associated with decreased ANC use.[53] In one of the studies, having
39 an ANC at a private hospital was a predictor of delayed initiation of ANC, but in another, it
40 increased the likelihood of receiving adequate ANC compared to those clients using public health
41 facilities.[24,81] The level of antenatal service provision (measured as the availability of key
42 functions, screening tests, skilled health workers and opening times) affected the quality of ANC
43 received. Utilising ANC at facilities that provide a wide range of ANC services was associated
44 with an increase in the odds of receiving the complete ANC services given in the clinic and
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3 attending ANC.[93] Visits by health extension workers during pregnancy increased ANC
4 attendance in one of the studies.[99] (Table 2)
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11 **Need factors**

12 ***Pregnancy wantedness and planning***

13 *Overall uptake of ANC (at least one ANC visit)*

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20 Nine studies found that women with planned pregnancies were more likely to attend at least one
21 ANC than those with unplanned pregnancies.[46,47,50,55,58,71,83,85,100] (Table 2)
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28 *Frequency of ANC (at least four ANC visits)*

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31 Attending at least four ANC visits was positively influenced by pregnancy planning and
32 wantedness as seen in two studies .[41,55] Conversely, In 6 studies, women with mistimed or
33 unwanted/unplanned pregnancies were unlikely to attend at least four ANC visits.
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38 [13,53,78,81,98,100] (Table 2)
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45 *Timing of first antenatal visit (Gestational age <12 weeks)*

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47 Women with mistimed or unwanted/unplanned pregnancies were more likely to initiate ANC in
48 the second trimester.[81] (Table 2)
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55 ***Previous/current health and pregnancy experiences***

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3 *Overall uptake of ANC (at least one ANC visit)*
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6 Pregnancy complications, illnesses and stillbirths in previous pregnancies were found to reduce
7 the odds of attending at least one ANC visit in 2 studies.[50,55] (Table 2)
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14 *Frequency of ANC (at least four ANC visits)*
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17 Women whose pregnancy was confirmed by missed period rather than urine test were more likely
18 to delay booking ANC visit.[87] Women who attended ANC in the first trimester were more likely
19 to attend up to four ANC visits.[89] (Table 2)
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28 *Timing of first antenatal visit (Gestational age <12 weeks)*
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31 Women who had negative experiences in previous pregnancies were less likely to attend the
32 booking ANC visit in first trimester.[84] Women who had an early initiation of ANC in a previous
33 pregnancy were more likely to book early for ANC in the subsequent pregnancy.[56] (Table 2)
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44 **Discussion**
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47 This study reviewed the predictors of ANC utilisation in SSA. Although the studies included in
48 this review utilised different study designs, most were cross-sectional studies and secondary data
49 analyses of national surveys. The determinants of ANC utilisation identified in this review include
50 predisposing factors (such as age, education, religion, husband/partner's education, maternal
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3 occupation/employment status, husband/partner's occupation, parity), enabling factors (such as
4 income status, place of residence, distance from the health facility, health insurance, involvement
5 in decision making, quality/content of ANC services) and need factors (wantedness of pregnancy,
6 previous pregnancy experiences).
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13 In this review, higher educational attainment for women and their husband/partner was a
14 predisposing factor that increased overall attendance, frequency and timeliness of ANC visits in
15 majority of the studies. These studies found that being educated increases the odds of the number
16 and timeliness of ANC visits. This could be explained as educated women tend to be more
17 financially independent, employed and better informed on the importance of ANC to the mother
18 and baby.[101] Similarly, studies have found that educated women and those with educated
19 partners were more likely to utilize antenatal services and also initiate this within the first trimester
20 of pregnancy.[36,102,103] Poor educational status has been identified as a major cause of health
21 inequality in antenatal care coverage.[104] This finding highlights the need to collaborate with the
22 educational sector to promote both female and male school enrolment and completion.
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40 Studies in this review showed that women with a working status (employed) were found to be
41 more likely to attend at least one and at least four ANC visits than the unemployed/not working.
42 Being employed also increased the odds of early initiation of ANC. Employment status is closely
43 related to income and educational status as educated women tend to be employed and consequently
44 earn income. Beyond being a source of funds for sponsoring ANC use, employment can also
45 increase women's exposure and access to information on ANC thus further promoting utilisation.
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53 Women empowerment programs and provision of employment opportunities sensitive to maternal
54 health considerations should be encouraged in order to promote uptake of ANC services.[105]
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6 As a predisposing factor, the role of high parity in reducing the odds of ANC attendance and
7 initiation could have been because women who have had previous pregnancies may consider
8 themselves 'experienced' and used to the routine care offered during ANC and so delay ANC
9 initiation and number of ANC contacts made.[106] Timely initiation of the first antenatal care visit
10 provides a critical opportunity for health promotion, disease prevention and curative care for
11 women and their unborn children. More efforts are needed to optimize the uptake of first antenatal
12 care visit in the first trimester of pregnancy.[107] Also, decreased use of ANC among high parity
13 women could be due to the less time available for ANC attendance due to the care of children,
14 inadequate resources in the family and negative experiences with ANC from previous
15 pregnancies.[36]

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33 Among the predisposing factors, increasing/older maternal age increased attendance to at least one
34 and four ANC visits in most of the studies that assessed its relationship with ANC utilisation. A
35 few studies however found that younger women attended ANC clinics more than older ones. Also,
36 younger women were more likely to attend the first ANC visit in the first trimester of pregnancy.
37 The higher odds of early trimester booking visits in these studies may have been due to the relative
38 childbearing inexperience (low parity) as they may be newly-weds or adolescents and therefore be
39 more likely to seek out ANC earlier than their older counterparts due to ignorance/limited
40 knowledge of pregnancy. Confounding effect of by parity on age may also have affected the
41 relationship between age and ANC use as low parity was associated with early ANC booking and
42 increased number of ANC contacts in the studies reviewed.[15,30,77,40,42,47,49,60,61,70,73]
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56 Younger women have been found to initiate ANC early in a similar review.[108,109] In contrast,
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3 age was not significantly associated with the utilization of antenatal care in a review of factors
4 affecting ANC in Ethiopia.[103]
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11 Most of the studies showed that being married conferred a protective effect on ANC utilisation as
12 a predisposing factor. Married women were not only more likely to attend ANC but also less likely
13 to delay initiation of ANC visits when compared to their unmarried counterparts. This could be to
14 the psychosocial and financial support received from their husbands, planning/ desirability of their
15 pregnancy and the societal acceptability and support of their pregnant state when compared to their
16 unmarried counterparts.[106] Some studies included in this review showed that women who
17 enjoyed support from their husbands and other social support were more likely to utilise ANC.
18 This suggests and reinforces the importance of including married men in programmes that are
19 designed to improve ANC uptake as male involvement has been proven beneficial to maternal
20 health.[110] However, one of the studies in this review found higher odds of utilising skilled ANC
21 attendants among currently unmarried women.[63] One possible explanation for this is that
22 unmarried women are sole decision makers, making them empowered to seek and utilise ANC.
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43 Our findings suggest that socioeconomic status was one of the enabling factors reported to
44 influence ANC utilisation across many studies as high socioeconomic status increased the uptake
45 of at least one and at least four ANC visits and the early initiation of ANC. Poverty is a known
46 deterrent to health care utilisation in SSA and women of low wealth status may be unable to afford
47 the medical and non-medical costs associated with utilising ANC.[111,112] Thus, because of lack
48 of financial access, such women may not attend ANC at all, limit the number of ANC visits or
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3 even initiate ANC late in pregnancy. The effect of SES on ANC use has been documented in other
4 studies.[36,113–115] Although free/subsidised maternal health services are offered in some
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6 African countries, women still pay out of pocket for some direct medical costs such as laboratory
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8 investigation and non-medical costs for transport. These costs pose financial barriers to using ANC
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10 services by pregnant women.[116,117] Further reflecting the role of the woman's ability to fund
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12 ANC on utilisation, early initiation and attending ANC for at least four times were reduced in
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14 women who did not have health insurance. Women have peculiar maternal-related health needs
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16 (such as pregnancy and childbirth) thus making them utilise health services such as ANC, however
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18 they are often times less willing and able to pay for insurance compared to men because of their
19
20 low income status and financial dependence.[118,119] Consequently, antenatal care and other
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22 maternal health services should be provided free (under mandatory social health insurance) or at
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24 subsidized rates with exemptions in order to improve the utilisation of these services and in turn
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26 reduce maternal morbidity and mortality. This review did not identify cultural/local beliefs as a
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28 determinant of ANC utilisation in contrast with findings from a similar review conducted in
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30 developing countries where women declined from using ANC services due to fear of witchcraft
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32 attacks following blood sample collection for laboratory investigation.[36] It is possible that
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34 women are getting more enlightened and as such not holding on to such beliefs
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46 As part of the enabling factors, rural residence negatively impacted on attendance and timing of
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48 the first ANC visit. The interplay between the peculiar characteristics of rural areas such as sparse
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50 distribution of health services and development, poor educational and employment status of
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52 residents and poor access to mass media could explain this. Similar findings on the effect of rural
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54 residence on ANC use have been documented in other studies.[36,103,108] To improve ANC
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3 utilisation in rural areas, community-wide sensitisation on antenatal care, provision of basic
4 amenities and re-distribution of health services are recommended. Likewise, long travel distance
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6 between a woman's place of residence and the health facility providing ANC services was
7
8 associated with a lower odds of ANC utilisation. Walking or travelling long distances could be
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10 difficult for pregnant women in addition to travel-related costs and these may discourage them
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12 from utilising ANC services. This negative effect of long distance on the utilisation of ANC and
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14 the continuum of maternal health care services has been documented in other studies.[120]
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23 Involvement in decision-making on major household decisions and ANC was one of the enabling
24 factors that exerted a positive effect on attaining adequate and timely ANC visits. Many patriarchal
25 communities exist in SSA in which women lack autonomy and cannot decide to seek ANC without
26 approval from their husbands largely because of financial dependence and cultural norms.[121]
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40 The findings from this review suggest as part of the need factors, women whose pregnancies were
41 planned and desired were significantly more likely to utilise ANC services at least once and at
42 least four times compared to those with unplanned/undesired pregnancies. This agrees with
43 findings from other studies.[36,103] In order to encourage ANC use, more needs to be done to
44 increase uptake of family planning by securing only desired pregnancies.
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Strengths and limitations

This study involved a large number of studies that covered a wide and geographically important sub region of Africa. The review accessed several databases and utilized recent publications (≤ 10 years old). It provides evidence on the variety of determinants across different sectors affecting ANC utilisation and the importance of intersectoral collaboration in improving ANC utilisation.

The contextual differences in study settings and outcome measures used could affect the interpretation and meaning of the results. However, some determinants showed similarities and differences within and between countries. This review excluded publications in French language and this may limit the representativeness and generalizability of the findings to some settings.

Conclusion

Based on this review, a variety of factors affect ANC utilisation in SSA. These factors include the predisposing, enabling and need factors with the poor, uneducated, unmarried, uninsured, rural dwellers, multiparous, poorly knowledgeable, those living far from health facilities and unsupported by their husbands/partners less likely to utilise ANC services. These factors also demonstrate the importance of multi-stakeholder intersectoral collaboration in mitigating poor ANC utilisation in SSA. Thus, ministries of labour/employment, education, rural development, women affairs, finance, community and religious leaders need to collaborate with the ministry of health to achieve universal ANC coverage. Examples would include health-in-all policies, joint stakeholder policy, planning and implementation review meetings, capacity development for policy makers on intersectoral cohabitations secondments and having desk officers represent

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3 related ministries (sectors above) in the ministry of health. An example of the implementation will
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5 be the educational sector encouraging enrolment of in schools while the health sector participates
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7 in curriculum development to include basic information on care in pregnancy (ANC inclusive).
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9 The ministries of works, labour, and employment can lay their part by road construction to improve
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11 access to health facilities especially in rural underdeveloped areas, subsidised transport for
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13 pregnant women, provision regular electricity to enable access to electronic media, provision of
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15 job and empowerment opportunities for women. The finance ministry can partner to provide loans,
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17 grants, conditional cash transfers, and other forms of financial empowerment to women.
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19 Strengthened implementation of antenatal care policies with active community participation are
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21 also recommended.
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ICA: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

OBE: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

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6 CJU: Study design, analysis and interpretation of results, manuscript drafting, analysis and
7 interpretation of results, and approval of the final manuscript for publication.
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11 **Competing interests:** None declared
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14 **Data sharing statement**

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17 All data relevant to the study are included in the article or uploaded as supplementary information
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26 **Figure 1:** Selection and inclusion process for articles included in the review
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Table 1: Summary of articles included in the review by regions

Region	Countries	References	Study design
West Africa	Nigeria=15	[15,22,65,72,75,80,84,23,25,29,30,35,44,54,62]	11 SA, 3 cross sectional, 1 mixed methods
	Ghana=5	[27,40,41,90,94]	3 SA, 2 cross sectional,
	Benin= 2	[71,77]	SA
	Niger =1	[97]	Cross-sectional
	Cameroon= 1	[69]	SA
	Burkina Faso= 2	[42,43]	Cross-sectional
	DRC= 1	[13]	
South Africa	South Africa= 2	[34,98]	1 SA, 1 mixed method
East Africa	Rwanda= 2	[52,81]	1 SA, 1 cross sectional
	Malawi= 1	[95]	Natural experiment
	Kenya=5	[9,70,79,82,92]	3 SA, 2cross sectional,
	Tanzania= 4	[53,89,96,100]	2 SA, 2cross sectional,
	Zambia= 2	[74,93]	2 SA
	Zimbabwe= 1	[78]	1 SA
	Ethiopia= 24	[24,32,59,60,63,64,66,68,77,83,85,86,46,87,88,91,99,47,48,50,51,55,56,58]	6 SA, 18 cross sectional
Multi-country	n=6	[49,57,61,67,73,76]	6 SA

SA: secondary analysis

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Table 2: Determinants of ANC uptake, frequency and timing

Factor	Determinants	At least one ANC visit	At least four ANC visit	Initiation of ANC in first trimester
Predisposing factors	Maternal Age	[23,46–51]	[30,33,34,43,49,52–55]	[56,57]
	Maternal Education	[9,23,59–68,25,46,47,49–51,53,58]	[15,24,67,69–71,25,27,29,30,49,53,54,64]	[23,24,56,57,70,72]
	Maternal occupation/ Employment Status	[47,48,59,62,67,75,76]	[29,30,33,73,74,77].	[33,57,76]
	Husband/Partner’s Occupation	[68]	NA	NA
	Husband/Partner’s Education	[63]	[22,30,41,63,73,74]	NA
	Maternal Religion	[48,75,78]	[27,54,66,77]	[57]
	Marital Status and Family type	[63,79,80]	[42,70,79]	[53,81,82] (
	Parity/family and household size	[46,47,49,51,60,61,83]	[15,30,40,42,70,77]	[57,67,78,81,82,84,85]
	Ethnicity and cultural Influence	[61,66,75]	[75]	NA
	Residence/Geographical location	[15,33,90,91,35,59,62,64,66,73,78,80].	[44,46,48,49,51,63,80]	[33,72,78,92]
Enabling factors	Household wealth/socio-economic status	[51,60,63,65–67,71,80,88]	[15,25,77,89–91,27,29,30,32,41,54,64,69]	[57,70]
	Distance from health facilities	[9,46,48,61,68,86,93]	[34,53,54]	[33,72,78,92]

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3		Health insurance/user-fee exemption	[94,95]	[41,54,90]	[72,81,96]
4		Involvement in decision-making/autonomy	NA	[29,30,73,87]	[72]
5		Husband's/partner's approval and support	[46,50,58,97]	[52,98]	NA
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8					
9	Need Factors				
10		Knowledge/Exposure to media	[48,58,75,83,86]	[22,30,54,64,77]	[72,87]
11		Attitude and perception toward ANC	[46]	[32]	[56,87]
12		Pregnancy wantedness and planning	[46,47,50,55,58,71,83,85,100]	[13,53,78,81,98,100]	[81]
13					
14		Current/Previous pregnancy and health experiences	[50,55,89]	[87]	[56,84]
15		Quality/content of services	[97]	[53,60,81,93]	NA
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Table 3: Determinants of ANC utilisation by regions in sub-Saharan Africa

Factor	Determinants	West Africa	East Africa	South Africa	Central Africa	Multi-country
Predisposing factors	Household wealth/socio-economic status	[15,25,69,71,75,80,90,27,29,30,33,41,54,62,65]	[32,51,57,63,64,66,70,88,89,91]		[69]	[67]
	Maternal Age	[23,30,43,54]	[46–48,50–53,55,57]	[34]		[49]
	Maternal Education	[15,23,25,27,29,30,54,62,65,71]	[9,24,59–61,63,64,66,70,74,46,47,50,51,53,55,56,58]		[69]	[49,57,61,67]
	Maternal occupation/ Employment Status	[15,29,30,62,75,77]	[33,47,48,59,68,74]	[98]		[57,67,73,76]
	Husband/Partner's Occupation		[68]			
	Husband/Partner's Education	[22,30,41]	[63,74]			[73]
	Maternal Religion	[27,54,75,77]	[48,66,78]	[98]		[57]

	Marital Status and Family type	[41–43,80]	[52,53,63,68,70,79,81,82]	[98]	[61]
	Parity/family and household size	[15,30,40,42,77,84]	[23,46,85,47,51,60,70,78,81–83]		[49,57,61,67]
	Ethnicity and cultural Influence	[29,75]	[66]		[61]
	Residence/Geographical location	[15,22,77,80,90,25,27,30,35,44,54,62,72]	[33,46,78,91,92,48,51,53,59,63,64,66,70]		[49,57,73]
Enabling factors					
Table 2: Determinants of ANC utilisation in sub-Saharan (Continued)					
	Distance from health facilities	[54]	[9,34,46,48,53,68,86,93]		[61]
	Health insurance/user-fee exemption	[41,54,72,90,94]	[81,95,96]		
	Involvement in decision-making/autonomy	[29,30,72]	[87]		[73]
	Husband's/partner's approval and support	[44,97]	[50,52,58]	[98]	
Need Factors					
	Knowledge/Exposure to media	[22,30,54,72,75,77]	[32,48,58,64,83,85,86]		
	Attitude and perception toward ANC		[32,46,56,87]		
	Pregnancy wantedness and planning	[13,41,71]	[46,47,100,50,53,55,58,78,81,83,85]	[98]	[13]

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Current/Previous pregnancy and health experiences	[84,97]	[50,55,56,87]
Quality/content of services		[24,53,81,93,99]

For peer review only

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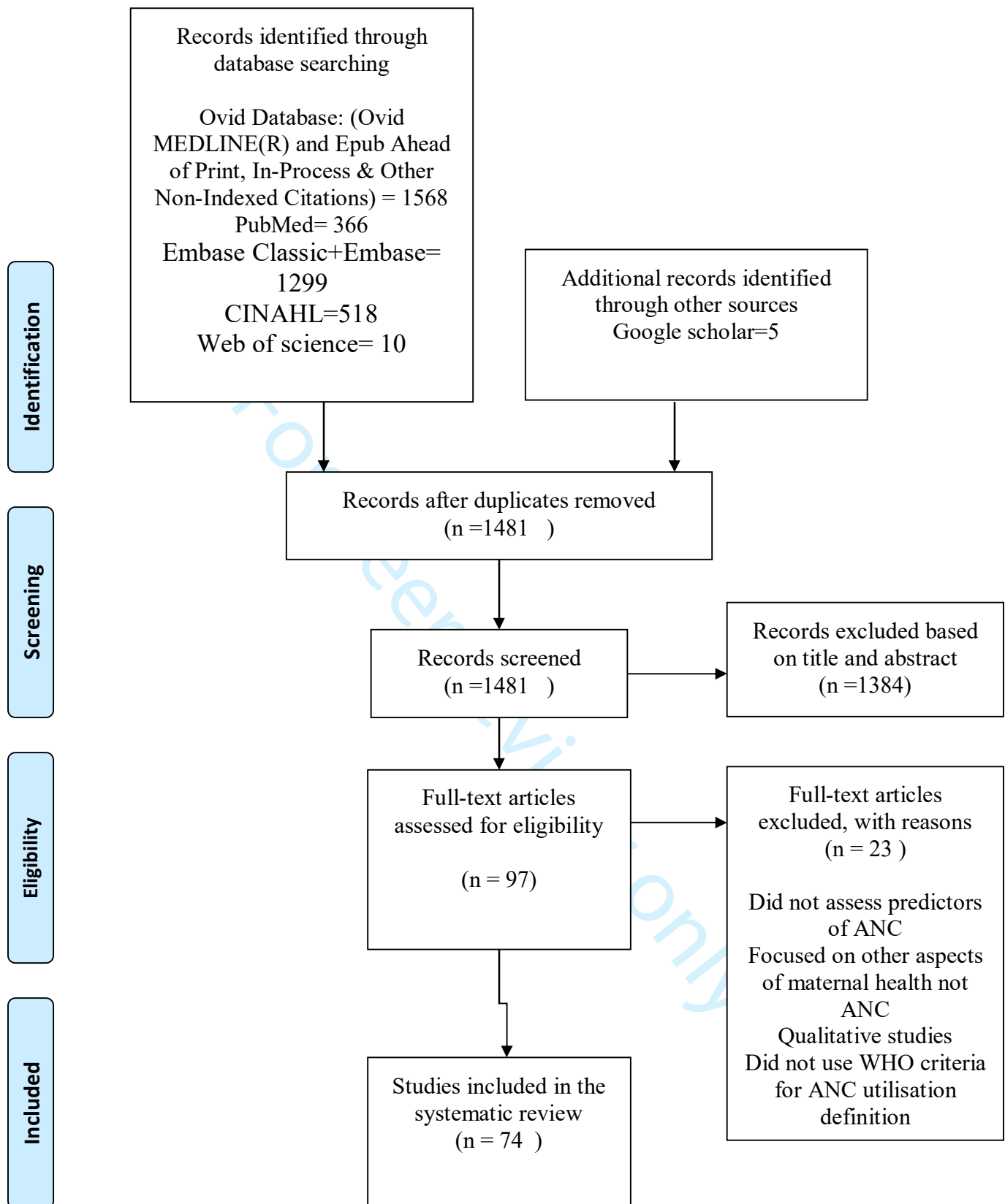


Fig. 1: PRISMA flow chart. The figure presents the publication identification and selection process. It shows the number of records identified, included and excluded, and the reasons for exclusions



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 4- 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Not applicable
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Page 6
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Page 8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 8
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 8
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Page 9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Not applicable



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Not applicable
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not applicable
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 8-9
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Tables 9
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Page 7
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Not applicable
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Not applicable
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Not applicable
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not applicable
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Page 25-30
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Page 30
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 31
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Page 33

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

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3 **SEARCH RESULTS FOR CINAHL. LAST SEARCHED ON 23/04/19**
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5 **TOTAL SEARCH RESULTS = 518**
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#	Query	Limiters/Expanders	Last Run Via	Results
S11	S6 AND S7 AND S8	Limiters - Published Date: 20080101-20181231		
	Search modes - Find all my search termsInterface - EBSCOhost Research Databases			
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			518
S10	S6 AND S7 AND S8	Limiters - Published Date: 19960101-20181231		
	Search modes - Find all my search termsInterface - EBSCOhost Research Databases			
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			575
S9	S6 AND S7 AND S8	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			608
S8	S4 OR S5	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			98,919
S7	S2 OR S3	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			37,921
S6	(MH "Africa South of the Sahara+") OR (MH "Africa, Western+") OR (MH "Africa, Southern+") OR (MH "Africa, Northern+") OR (MH "Africa, Eastern+") OR (MH "Africa, Central+") OR "Africa OR (sub-saharan africa or sub saharan africa or sub sahara) OR sub saharan africa[title]" OR (MH "Africa+") OR (MH "South Africa") OR (MH "Namibia") OR (MH "Benin") OR (MH "Burkina Faso") OR (MH "Cape Verde") OR (MH "Cote d'Ivoire") OR (MH "Gambia") OR (MH "Ghana") OR (MH "Guinea") OR (MH "Guinea-Bissau") OR (MH "Liberia") OR (MH "Mali") OR (MH "Mauritania") OR (MH "Niger") OR (MH "Nigeria") OR (MH "Senegal") OR (MH "Sierra Leone") OR (MH "Togo") OR (MH "Angola") OR (MH "Botswana") OR (MH "Lesotho") OR (MH "Malawi") OR (MH "Mozambique") OR (MH "Swaziland") OR (MH "Zambia") OR (MH "Zimbabwe") OR (MH "Algeria") OR (MH "Egypt") OR (MH "Libya") OR (MH			

1
2
3 "Morocco") OR (MH "Cameroon") OR (MH "Central African Republic") OR (MH "Chad") OR (MH "Congo")
4 OR (MH "Democratic Republic of the Congo") OR (MH "Equatorial Guinea") OR (MH "Gabon") OR (MH
5 "Burundi") OR (MH "Djibouti") OR (MH "Eritrea") OR (MH "Ethiopia") OR (MH "Kenya") OR (MH
6 "Rwanda") OR (MH "Sudan") OR (MH "Somalia") OR (MH "Tanzania") OR (MH "Uganda") Search modes -
7 Find all my search terms Interface - EBSCOhost Research Databases

8
9
10 Search Screen - Advanced Search

11
12 Database - CINAHL Plus with Full Text 70,341

13 S5 (MH "Health Services Accessibility") OR "usage OR access" Search modes - Find all my
14 search terms Interface - EBSCOhost Research Databases

15
16 Search Screen - Advanced Search

17
18 Database - CINAHL Plus with Full Text 74,113

19
20 S4 (MH "Drug Utilization") OR (MH "Health Resource Utilization") OR (MH "Bed Occupancy") OR
21 (MH "Resource Utilization Group") OR "(Equipment AND Supplies Utilization) OR Drug Utilization OR (
22 Procedures AND Techniques Utilization) OR (Facilities AND Services Utilization.) OR utilization" OR (MH
23 "Utilization Review") Search modes - Find all my search terms Interface - EBSCOhost Research
24 Databases

25
26 Search Screen - Advanced Search

27
28 Database - CINAHL Plus with Full Text 28,228

29
30 S3 (MH "Maternal Health Services") OR (MH "Maternal-Child Health") OR "maternal health OR
31 Maternal Health Services OR Maternal Health OR Pregnancy" Search modes - Find all my search terms
32 Interface - EBSCOhost Research Databases

33
34 Search Screen - Advanced Search

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36 Database - CINAHL Plus with Full Text 10,586

37
38 S2 (MH "Prenatal Care") OR (MH "Pregnancy in Adolescence") OR (MH "Pregnancy Tests,
39 Immunologic") OR "Prenatal Care OR antenatal OR Pregnancy" OR (MH "Ultrasonography, Prenatal") OR
40 (MH "Gender Specific Care") OR (MH "Pregnancy Care (Saba CCC)") Search modes - Find all my
41 search terms Interface - EBSCOhost Research Databases

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43 Search Screen - Advanced Search

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45 Database - CINAHL Plus with Full Text 28,499

46
47 S1 "determinant OR Social Determinants of Health OR factor* OR predict*" OR (MH "Social
48 Determinants of Health") Search modes - Find all my search terms Interface - EBSCOhost Research
49 Databases

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51 Search Screen - Advanced Search

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53 Database - CINAHL Plus with Full Text 3,992

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5 **SEARCH RESULTS FOR EMBASE. LAST SEARCHED ON 23/04/19**
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9 **TOTAL SEARCH RESULTS = 1299**
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#	Searches	Results
1	determinant*.mp. or "Social Determinants of Health"/	279285
2	factor*.mp.	5433149
3	predict*.mp.	2049535
4	Prenatal Care/ or antenatal.mp. or Pregnancy/	747759
5	ante natal.mp.	957
6	ante-natal.mp.	957
7	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	719423
8	or/1-3	6997886
9	or/4-7	757867
10	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	369706
11	utilisation.mp.	34492
12	usage.mp.	126891
13	access.mp.	454816
14	or/10-13	936915
15	"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or "sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or	286700

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3	ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/	
4	or senegal/ or sierra leone/ or togo/	
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7	16 8 and 9 and 14 and 15	1681
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9	17 determinant*.mp. or "Social Determinants of Health"/	279285
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11	18 factor*.mp.	5433149
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13	19 predict*.mp.	2049535
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15	20 Prenatal Care/ or antenatal.mp. or Pregnancy/	747759
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17	21 ante natal.mp.	957
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19	22 ante-natal.mp.	957
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21	23 maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	719423
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23	24 or/17-19	6997886
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25	25 or/20-23	757867
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28	26 "Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques	
29	Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	369706
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35	29 access.mp.	454816
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37	30 or/26-29	936915
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40	"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or	
41	chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or	
42	"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or	
43	ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or	
44	31 uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or	286700
45	mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or	
46	africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or	
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23	44	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.
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37		chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or
38		"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or
39		ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or
40	49	uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or
41		286700
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5 1122 birth outcomes in Minnesota. *J Immigr Minor Health* [Internet]. Apr 2011 13(2):224-231. In:
6 Embase Available from
7 [http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=362102](http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=362102796)
8 796
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11 Rwenge M.J., Tchamgoue-Nguemaleu H.B. [Social factors associated with the use of
12 1123 obstetrical health care services among Cameroonian teenagers]. [in French] *Afr J Reprod Health*
13 [Internet]. Sep 2011 15(3):81-92. In: Embase Available from
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SEARCH STRATEGY FOR OVID MEDLINE(R). LAST SEARCHED= 23/04/19

SEARCH RESULTS= 1568

#	Searches	Results
1	determinant*.mp. or "Social Determinants of Health"/	202245
2	factor*.mp.	4926645
3	predict*.mp.	1287587
4	Prenatal Care/ or antenatal.mp. or Pregnancy/	854680
5	ante natal.mp.	421
6	ante-natal.mp.	421
7	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	853071
8	or/1-3	5831393
9	or/4-7	859617
10	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	171310
11	utilisation.mp.	17533
12	usage.mp.	73333
13	access.mp.	239255
14	or/10-13	483498

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or senegal/ or sierra leone/ or togo/

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24 **SEARCH FINDINGS FOR WEB OF SCIENCE**

25 **SEARCH RESULTS= 10. DATE LAST SEARCHED= 23/4/19**
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41 Title: Mothers treatment seeking intention for neonatal danger signs in northwest Ethiopia: A structural
42 equation modeling
43

44 Author(s): Bogale, TN (Bogale, Tariku Nigatu); Worku, AG (Worku, Abebaw Gebeyehu); Yalew, AW
45 (Yalew, Alemayehu Worku); Bikis, GA (Bikis, Gashaw Andargie);
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49 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209959 DOI:
50 10.1371/journal.pone.0209959 Published: DEC 31 2018
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52 Accession Number: WOS:000454627200117
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54 PubMed ID: 30596745
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56 ISSN: 1932-6203
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5 Title: Estimating levels of HIV testing coverage and use in prevention of mother-to-child transmission
6 among women of reproductive age in Zambia
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8 Author(s): Muyunda, B (Muyunda, Brian); Mee, P (Mee, Paul); Todd, J (Todd, Jim); Musonda, P
9 (Musonda, Patrick); Michelo, C (Michelo, Charles)
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11 Source: ARCHIVES OF PUBLIC HEALTH Volume: 76 Article Number: 80 DOI: 10.1186/s13690-018-0325-
12 x Published: DEC 29 2018
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14 Accession Number: WOS:000454558300001
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16 PubMed ID: 30619607
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18 ISSN: 0778-7367
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20 eISSN: 2049-3258
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22 Record 3 of 10
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24 Title: Bypassing health facilities in rural Mozambique: spatial, institutional, and individual determinants
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26 Author(s): Yao, J (Yao, Jing); Agadjanian, V (Agadjanian, Victor)
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28 Source: BMC HEALTH SERVICES RESEARCH Volume: 18 Article Number: 1006 DOI: 10.1186/s12913-
29 018-3834-y Published: DEC 29 2018
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31 Accession Number: WOS:000454562700012
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33 PubMed ID: 30594198
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35 ISSN: 1472-6963
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37 Record 4 of 10
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39 Title: Acceptability of option B plus among HIV positive women receiving antenatal and postnatal care
40 services in selected health centre's in Lusaka
41

42 Author(s): Chanda, BC (Chanda, Bridget Chomba); Likwa, RN (Likwa, Rosemary Ndongyo); Zgambo, J
43 (Zgambo, Jessy); Tembo, L (Tembo, Louis); Jacobs, C (Jacobs,
44

45 Choolwe)
46

47 Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 510 DOI: 10.1186/s12884-
48 018-2142-1 Published: DEC 29 2018
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50 Accession Number: WOS:000454579200002
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52 PubMed ID: 30594161
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55 true&displayUsageInfo=true&viewType=summary&product=WOS&mark_id=WOS&colName=WOS&sear
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7 ISSN: 1471-2393

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9 Record 5 of 10

10 Title: HIV incidence among pregnant and postpartum women in a high prevalence setting

11 Author(s): Machekano, R (Machekano, Rhoderick); Tiam, A (Tiam, Appolinaire); Kassaye, S (Kassaye,
12 Seble); Tukei, V (Tukei, Vincent); Gill, M (Gill, Michelle); Mohai, F

13 (Mohai, Florence); Nchepe, M (Nchepe, Masepeli); Mokone, M (Mokone, Majoalane); Barasa, J (Barasa,
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15 Mosilinyane); Guay, L (Guay, Laura)

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17 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209782 DOI:
18 10.1371/journal.pone.0209782 Published: DEC 28 2018

19 Accession Number: WOS:000454621900041

20 PubMed ID: 30592749

21 ISSN: 1932-6203

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23 Record 6 of 10

24 Title: Knowledge on birth preparedness and complication readiness among expecting couples in rural
25 Tanzania: Differences by sex cross-sectional study

26 Author(s): Moshi, FV (Moshi, Fabiola V.); Ernest, A (Ernest, Alex); Fabian, F (Fabian, Flora); Kibusi, SM
27 (Kibusi, Stephen M.)

28 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209070 DOI:
29 10.1371/journal.pone.0209070 Published: DEC 28 2018

30 Accession Number: WOS:000454621900014

31 PubMed ID: 30592725

32 ISSN: 1932-6203

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34 Record 7 of 10

35 Title: Spontaneous haemorrhagic stroke complicating severe pre-eclampsia in pregnancy: a case report
36 in a resource-limited setting in Cameroon

37 Author(s): Tolefac, PN (Tolefac, Paul Nkemtendong); Awungafac, NS (Awungafac, Nkemnji Standley);
38 Minkande, JZ (Minkande, Jacqueline Ze)

39 Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 506 DOI: 10.1186/s12884-
40 018-2157-7 Published: DEC 27 2018

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3 Accession Number: WOS:000454408800002
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5 PubMed ID: 30587133
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10 Tolefac, Paul Nkemtendong 0000-0001-5165-7887
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12 ISSN: 1471-2393
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14 Record 8 of 10
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16 Title: Postnatal care service utilization and associated factors among women who gave birth in
17 Debretabour town, North West Ethiopia: a community- based crosssectional
18
19 study
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21 Author(s): Wudineh, KG (Wudineh, Kihinetu Gelaye); Nigusie, AA (Nigusie, Azezu Asres); Gesese, SS
22 (Gesese, Shumiye Shiferaw); Tesu, AA (Tesu, Azimeraw Arega);
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24 Beyene, FY (Beyene, Fentahun Yenealem)
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32 Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 508 DOI: 10.1186/s12884-
33 018-2138-x Published: DEC 27 2018
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35 Accession Number: WOS:000454578900002
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37 PubMed ID: 30591039
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43 Title: Factors associated with institutional delivery: Findings from a cross-sectional study in Mara and
44 Kagera regions in Tanzania
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46 Author(s): Bishanga, DR (Bishanga, Dunstan R.); Drake, M (Drake, Mary); Kim, YM (Kim, Young-Mi);
47 Mwanamsangu, AH (Mwanamsangu, Amasha H.); Makuwani, AM
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49 (Makuwani, Ahmad M.); Zougrana, J (Zougrana, Jeremie); Lemwayi, R (Lemwayi, Ruth); Rijken, MJ
50 (Rijken, Marcus J.); Stekelenburg, J (Stekelenburg, Jelle)
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52 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209672 DOI:
53 10.1371/journal.pone.0209672 Published: DEC 26 2018
54

55 Accession Number: WOS:000454416400083
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ISSN: 1932-6203

Record 10 of 10

Title: Application of Core Processes for Understanding Multiple Concurrent Sexual Partnerships Among Adolescents in Uganda

Author(s): Nalukwago, J (Nalukwago, Judith); Alaii, J (Alaii, Jane); Van den Borne, B (Van den Borne, Bart); Bukuluki, PM (Bukuluki, Paul Mukisa); Crutzen, R (Crutzen, Rik)

Source: FRONTIERS IN PUBLIC HEALTH Volume: 6 Article Number: 371 DOI: 10.3389/fpubh.2018.00371 Published: DEC 21 2018

Accession Number: WOS:000454437200001

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ISSN: 2296-2565

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Additional file 3: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

Criteria	No. of articles		
	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	74		
2. Was the study population clearly specified and defined?	74		
3. Was the participation rate of eligible persons at least 50%?	74		
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	74		
5. Was a sample size justification, power description, or variance and effect estimates provided?	43	6	25
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			74
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			74
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			74
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	74		
10. Was the exposure(s) assessed more than once over time?			74
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	74		
12. Were the outcome assessors blinded to the exposure status of participants?			74
13. Was loss to follow-up after baseline 20% or less?			74
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	74		

*CD, cannot determine; NA, not applicable; NR, not reported

Table 1: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Dahiru et al 2013	Nigeria	SA of 2013 NDHS	38,945 women aged 15-49 years	Older age (+), rural residence (-), mother's and husband' level of education (+), working status of the woman (+), rich household (+), health insurance (+), Christian and Muslim religion (+)
Muchie 2017	Ethiopia	SA 2014 DHS	3694 women aged 15-49 years	Lower educational level (-), lower economic conditions (-), higher birth order (-), rural residence (-), available high quality ANC services (+)
Gebre 2018	Ethiopia	SA 2000-2016 Ethiopia DHS	5867 (year 2000), 2279 (year 2016)	Low-economic status (-), illiteracy (-), rural residence (-), no occupation (-), poor access to mass media (-)
Yaya 2018	Benin	Benin DHS	17,794 and 16,599 women in 2006 and 2012 respectively.	Education (+), higher wealth index (+), rural residence (-), employed (+)
Yaya 2017	Ethiopia	SA 2011 Ethiopia DHS	10,896 women	Frequency- older age interval (-), rural residence (+), primigravidity (+), unemployed (+) Timing- Rural residence (-), multiparity (-)
Rurangirwa 2017	Rwanda	Cross-sectional study	921 women	Age >31 years (-), single women (-), poor social support (-)
Akinyemi 2017	Nigeria	SA 2013 NDHS	20,467 women	Low formal education (-), poverty (-) healthcare access problems (-)
Saad-Haddad 2016	Multi-country- Bangladesh, Cambodia, Peru Cameroon, Nepal, Senegal, Uganda.	SA NDHS	7576, 8008, 4818 women, in Cameroon; Senegal and Uganda respectively	Education (+) household wealth(+), gestational age at first visit (-), birth rank (-), preceding birth interval (-)
Worku 2016	South Africa	Cross-sectional	272 mothers	Mother's age>20 years (+), increased distance to health facility(+), service satisfaction (+)
Manthalu 2016	Malawi	SA	142 health facilities	Use fee exemption (+)
Fagbamigbe 2017	Nigeria	SA	6,299 females	Low education (-), poverty (-)
Tsegay 2013	Ethiopia	cross-sectional study	1113 women	Married (+), educated (+), proximity of health facility to the village(+), and husband's not a farmer (+)
Babalola 2009	Nigeria	SA	2148 women	Education (+), older age at the birth of last child (+), and approval of family planning (+), urban residence(+), wealthy household (+), large number of clients in PHC (-)
Abor 2011	Ghana	Ghana DHS	5588 women	Oder age (-), multiple pregnancies (-), education (+), religious affiliation (+), high economic status (+)
Wilunda 2015	Ethiopia	Cross-sectional study	500 women	High wealth status (+), knowledge of the recommended number of ANC visits (+), attitude towards maternal health care (+), older age (-)
Abosse 2010	Ethiopia	Cross-sectional study	691 women	Older age (+), husband's positive attitude to ANC (+), small family size (+), no education (-)
Zegeye 2013	Ethiopia	Cross-sectional	446 women	Timing: Mothers with no parity before (+), good knowledge on early ANC (+), planned pregnancy (+)

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3	Akowuah 2018	Ghana	Cross-sectional study	200 pregnant women	Older age (+), large household size (+), employed (+)
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5	Adewuyi 2018	Nigeria	SA of DHS 2013	19652 mothers aged 15 to 49 years old	Rural: maternal non-working status (-), birth interval < 24 months (-), single birth type (-), not listening to radio at all (-), lack of companionship to health facility (-), not getting money for health services (-)
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8					Urban: mothers professing Islam (-), those who did not read newspaper at all (-), and those who lacked health insurance (-)
9					
10	Brown et al 2008	Kenya	Cross-sectional	1,562 perinatal outcomes	Education: secondary education or above (+),
11					Distance: living further than 5 km from a dispensary (-),
12	Mbuagbaw 2011	Cameroon	DHS	7,557 women	Secondary or higher education (+), greater wealth (+), urban residence (+), parity of 3–4 (+)
13					
14	Birmeta 2013	Ethiopia	Cross-sectional	422 women	Parity (+), literacy status of women (+), average monthly family income (+), media exposure (+), decision where to give birth (+), perception of distance to health institutions (+)
15					
16	Tarekegn 2014	Ethiopia	DHS	16,515 women	Women with higher education (+), Women from urban areas (+), autonomous women (+)
17					
18	Sakeah 2017	Ghana	Cross-sectional	1497 women	Young age (+), least educated (+), poorest women (+) women whose partners were uneducated (+), those with health insurance (+), low socioeconomic status (-)
19					
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21	Ochako 2011	Kenya	SA 2003 KDHS	1675 young women	Timing: rural (-), secondary education (+), higher parity (-), married (+)
22					
23	Ononokpono 2013	Nigeria	DHS	16,005 women	Living in communities with a high proportion of women who delivered in a health facility (+), Residence in high-poverty communities (-)
24					
25	Melaku 2014	Ethiopia	Cross-sectional	2361 mothers	Older mothers (+), urban residents (+), higher education (+), farmer mothers (+)
26					
27	Straneo 2016	Tanzania	Cross sectional	464 women	Young age (+)
28					Timing: young age (+)
29	Ononokpono 2015	Nigeria	SA NDHS 2008	17560 women	Younger women (+), secondary/higher education (+),
30					Employed (+), Christian women (+), rich households (+), involvement in decision making (+), joint decision (+), Igbo, Yoruba and other minority ethnic groups (+), urban areas (+), educated women (+), exposed to mass media (+)
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34	Arthur 2013	Ghana	SA of GDHS 2008	NR	Wealth (+), urban areas (+), mothers with health insurance (+), educational level (+)
35					
36	Tewodros 2009	Ethiopia	Cross-sectional	627 women	Educated (+), less than 60 minute walk to facility (+), husband approval (+), illness in future pregnancies (+), planned pregnancy and illness experienced in past pregnancy (+), age at first pregnancy (+)
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39	Gupta 2014	Tanzania	SA of DHS	8,035 women	urban areas (+)
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Ntambue 2012	Democratic Republic of Congo	Cross-sectional	1762 women	primiparous and grand multiparous (-), unplanned pregnancies (-)
Mwase 2018	Burkina Faso	Cross-sectional	6601 women	least poor households (+), married (+), living further away (-), multiparous (-), Muslim religion (-),
Bobo 2017	Ethiopia	SA of DHS 2014	8070 women	urban area (+), secondary level (+),
Anchang-Kimbi 2014	Burkina Faso	Cross-sectional	287 parturient women	Only one dose of IPTp (-)
Melese et al 2016	Ethiopia	Cross-sectional	Women (15-49 years) who gave birth in one year preceding the study (n=748)	Preference of skilled personnel (+), awareness about places where to get skilled providers (+), listening to radio (+), distance of WHDT within 2km radius from the nearest health facility (+)

DHS: Demographic health survey, SA: Secondary Analysis FGD: Focal Group Discussion SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants NR: Not Reported IPTp: intermittent preventive treatment during pregnancy *Only results for Cameroon, Senegal, Uganda included in review NR: Not reported (+): increases ANC use (-) reduces ANC use

Table 2: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Kyei 2012	Zambia	SA 2007 DHS	2405 rural births	Distance(+), level of provision category (+)
Doctor 2011	Nigeria	SA 2008 Nigeria DHS	18,028) women	youngest age cohort(-), rural residence (-), lack of schooling (-), higher parity (-), residence in northern region(-) and poor economic status(-)
Woldemicael 2010	Eritrea, Ethiopia	SA DHS 2007	Currently married women	Women’s autonomy (+)
Kibusi 2018	Tanzania	SA 2011/2012 Tanzania HIV/AIDS and malaria indicator survey	4513 women	Having health insurance (+)
Makate 2017	Zimbabwe	SA ZDHS 2005/06 and 2010/11	8907 women (2005/06), 9171 women (2010/11)	Contraceptive prevalence (+), religious composition (+), density of nurses (+), health expenditures per capita (+), availability of government hospitals in communities (+)
Haruna-Ogun	Nigeria	NDHS 2013	20,192 cases	Place of residence (+)
Aliyu 2017	Nigeria	SA NDHS 2013	20, 467 women	maternal education (+), media exposure (+), place of residence (+), having health insurance(+)

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3	Banke-Thomas	Ethiopia	SA Kenya DHS	898 adolescents	Having education (+), religion (+), ethnicity (+), urban residence (+),
4					wealth quintile (+),
5					mass media exposure (+), and geographical region (+)
6	Kuuire 2017	Nigeria	SA NDHS 2003, 2008	Nigeria (39,923 women) and	Nigeria: Wealth (+)
7		Malawi	and 2013	Malawi (28,951 women).	Malawi: Wealth (-)
8			MDHS 2000, 2004 and		
9			2010		
10	Chorongo 2018	Kenya	Cross-sectional	385 women	Being Muslim (+), Higher education (-),
11			comparative study		
12	Owili 2016	Kenya	SA KDHS	4005 women	Monogamous setting (+), marriage (+), Older age (+), religion (+),
13					health insurance (+), Exposure to media (+), higher education (+)
14	Bayou 2016	Ethiopia	Cross sectional	870 women	Higher education (+), ANC in private facility (+)
15	Browne 2016	Ghana	SA GDHS 2008	3022 Women	Being insured (+)
16	Ochako 2016	Kenya	2008-09 Kenya DHS.	4014 women	Wanted pregnancy (+), Urban residence (+), Higher education (+),
17					Older age (+), birth interval less than 25 months (-)
18	Muhwava 2016	South Africa	Cross sectional	363 women from rural sample	Urban :Being employed (+), wanted pregnancy
19				and 466 women from urban	Rural site: Being married (+),
20					Religiosity (-)
21	Gudayu 2015	Ethiopia	Cross sectional	390 women	Not aware of right timing of booking (-), not autonomous to use ANC
22					(-), Recognised pregnancy by missing period (-).
23	Oyewale 2015	Nigeria	Cross sectional	384 pregnant women	Older age (-), Higher education (-), Birth order (-), urban residence
24					(+), health insurance coverage (+) and household income (+).
25	Dutamo 2015	Ethiopia	Cross sectional	634 currently married women	Low parity (+), pregnancy intended (+), awareness of danger signs
26					of pregnancy (+), higher education of woman and spouse (+)
27	Omer 2014	Nigeria	Cross sectional	7870 women in Bauchi and of	Residence in community with a government health facility (+),
28		(Bauchi and		7759 in Cross River	absence of physical intimate partner violence (+)
29		Cross river)			
30	Manzi 2014	Rwanda	SA 2010 RDHS	6,325 women	Having many children (-), feeling that distance to health facility is a
31					problem (-), unwanted pregnancy (-),ANC at a private hospital
32					(+),being married (+), health insurance (+)
33	Belayneh 2014	Ethiopia	Cross sectional	398 pregnant women	Early timing of ANC: Mothers with younger age (+), formal education
34					(+), previous early ANC visit (+), perceived ANC visit per pregnancy
35					of four and greater (+)
36	Rossier 2014	Kenya,	SA Nairobi DHS,	3,346 and 4,239 births in	Kenya (at least one visit): Less-educated (-), poorer (-), non-Kikuyu
37		Burkina	Ouagadougou DHS	Kenya and Burkina Faso	women (-), women living in the neighbourhood farther from public
38		Faso		respectively	health services (-)
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					Burkina Faso (at least four visits): poorer households (-), non-educated women (-), women from Polesgo and Nioko tribe (-)
Ononokpono 2014	Nigeria	2008 Nigeria DHS	17,476 women		Intimate partner violence (+)
Chama-Chiliba 2015	Zambia	SA Zambia DHS	2925 women		Employment (+), low quality ANC (-), multiparity (-), higher education of husband (+),
Afework 2014	Ethiopia	Cross-sectional	4949 women		Visit by community health worker (+)
Oladokun 2010	Nigeria	Cross-sectional	796 women		Low parity (+), previous stillbirth (+)
Stephenson 2012	Bangladesh, Egypt, and Rwanda	SA DHS for Bangladesh (2007), Egypt (2008), and Rwanda (2005).	4926, 8036, 5387 women respectively		Rwandan communities with higher employment rate among men (+)
Regassa 2011	Ethiopia	Cross sectional	1094 women		Literacy (+), have exposure to media(+), low parity(+)
Rai 2012	Nigeria	SA NDHS 2008	2434 Women		Women's education, (+), husband's Education (+), wealth (+), urban residence (+),Mass media exposure (+)
Exavery 2013	Tanzana	Cross-sectional household survey	3,127 women		Mistimed pregnancy (-),
Worku 2013	Ethiopia	Cross sectional	1668 women who had births in the year preceding the survey		Higher educational of women and their husbands (+), higher wealth Quintiles (+), awareness of risk of pregnancy (+), preference for skilled provider(+), birth order (-), unwanted pregnancy (-)
Yeneneh 2018	Ethiopia	Ethiopian DHS	23,179 women who had a live birth in the five years preceding the survey		Richest wealth quintiles(+), lowest number of birth order(+), urban residence(+), younger age(+), and educated(+)
Dansou 2017	Benin Republic	DHS	9110 mothers who had completed at least a pregnancy within the 5 years preceding the survey		Economically well-off households (+)for richest women (+), educated women(+),and those with desired pregnancies(+)
Assefa 2016	Ethiopia	DHS	7,773 women aged 15-49 years who gave birth during the five-year period preceding the survey		Urban residence (+), older mothers (+), education (+), employment (+), mass media exposure(+), religion (+), access to health services(+)
Ayalew 2017	Ethiopia	Cross sectional	317 women who gave birth 6 months before the study		Older age (+), Education(+), history of stillbirth(+), planned pregnancy(+), service utilization
Begum 2018	Niger	Cross sectional	923 pregnant women		Women with gestational age ≥ 27 weeks (+),Women who reportedly received husbands' advice about attending ANC (+)

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3 Verney 2017 Senegal, Cross sectional 4,575 women Higher education(+), Higher income (+), formal employment(+),
4 Ethiopia, advice from health worker(+), nulliparity(+)
5 Kenya

6 DHS: Demographic health Survey, SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants (+): increases
7 ANC use (-) reduces ANC use
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Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review

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Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review

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Abstract

Objectives: To identify the determinants of antenatal care utilisation in sub-Saharan Africa.

Design: Systematic review.

Data sources: Databases searched were PubMed, OVID, EMBASE, CINAHL, and Web of Science.

Eligibility criteria: Primary studies reporting on determinants of ANC utilisation following multivariate analysis, conducted in Sub-Saharan Africa and published in English language between 2008 and 2018.

Data extraction and synthesis: A data extraction form was used to extract the following information: Name of first author, year of publication, study location, study design, study subjects, sample size and determinants. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] checklist for reporting a systematic review or meta-analysis protocol, was used to guide the screening and eligibility of the studies. The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used to assess the quality of the studies while the Andersen framework was used to report findings.

Results: 74 studies that met the inclusion criteria were fully assessed. Most studies identified socio-economic status, urban residence, older/increasing age, low parity, being educated and having an educated partner, being employed, being married and Christian religion as predictors of antenatal care attendance and timeliness. Awareness of danger signs, timing and adequate number of antenatal visits, exposure to mass media and good attitude towards antenatal care utilisation made attendance and initiation of antenatal care in first trimester more likely. Having an unplanned pregnancy, previous pregnancy complications, poor autonomy, lack of husband's support, increased distance to health facility, not having health insurance and high cost of services negatively impacted the overall uptake, timing and frequency of antenatal visits.

Conclusion: A variety of predisposing, enabling and need factors affect antenatal care utilisation in sub-Saharan Africa. Intersectoral collaboration to promote female education and empowerment, improve geographical access and strengthened implementation of antenatal care policies with active community participation are recommended.

Strengths of the study

- This study involved a large number of studies that covered a wide and geographically important sub region of Africa.
- This study accessed several databases and utilized recent publications (≤ 10 years old)
- This review provides evidence on the role of social determinants of health in ANC utilisation and the importance of intersectoral collaboration in improving ANC utilisation

Limitations

- This review excluded publications in French language may limit the representativeness and generalizability of the findings to some settings.

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Keywords: Antenatal care, prenatal care, utilization, determinants, sub-Saharan Africa

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Introduction

Globally, pregnancy and childbirth are significant events for women and their families even though they represent a period of heightened vulnerability for both women and their unborn babies.[1] Every day, preventable causes related to pregnancy and childbirth lead to the deaths of over 800 women with 99% of these maternal deaths occurring in low and lower middle income countries. Although by 2015, maternal mortality had decreased by over 40% from the 1990 levels, maternal mortality levels have continued to remain unacceptably high in sub-Saharan Africa (SSA).[2,3] Inadequate access to quality antenatal care (ANC) contributes significantly to these preventable maternal deaths.[4]

As part of reproductive health care, ANC presents a unique and life-saving opportunity for health promotion, disease prevention, early diagnosis and treatment of illnesses in pregnancy using evidence-based practices.[5] To ensure optimum care, the World Health Organization previously recommended that every pregnant woman should have a minimum of four ANC visits throughout the pregnancy with the first visit occurring in the first trimester of pregnancy.[6,7] However in 2016, WHO revised its recommended minimum number of ANC visits from 4 to 8 contacts following recent evidence that increased number of contacts between a pregnant woman and a skilled health provider reduced perinatal mortality and improved women's experience of care. Early ANC initiation in the first trimester of pregnancy and receiving the required services is emphasised in the revised guideline.[5] In spite of this, global reports in 2017 showed that only three in five women attended at least four antenatal visits. In regions with the highest rates of maternal mortality, such as SSA, only 52% of women received at least four ANC visits.[8]

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6 ANC not only promotes the health of pregnant women but has also been found to reduce the risk
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8 of adverse pregnancy outcomes, perinatal and infant mortality and morbidity.[9–12] It also
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10 encourages skilled birth attendance for delivery and postnatal care as women who attend ANC are
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12 more likely to utilise these services than the non-attenders.[13–18] Studies have used a variety of
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14 indicators to assess ANC use. This includes at least one visit, at least four visits, trimester timing
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16 of ANC visits, services received during ANC visits and care provider type visited however the
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18 quantity of contacts remains commonly used.[19] Recently, indicators to enable the progressive
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20 realisation of maternal health targets have been proposed especially for developing country
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22 contexts like countries in SSA.[19] The Andersen framework is a behavioural model that describes
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24 the social, individual and health system determinants affecting access to health care services.
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26 Several studies have employed this model in identifying the factors affecting ANC utilisation.[20–
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35 Various studies have assessed factors affecting ANC utilisation in SSA countries,[28–35] but none
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37 has systematically summarised such studies in SSA. A review conducted over ten years ago
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39 examined factors affecting the use of ANC in developing countries however this review only
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41 contained seven studies from Africa and did not include recently published studies from SSA.[36]
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44 The aim of this review was to systematically identify the factors associated with the utilisation of
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46 ANC in SSA.
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Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] checklist for reporting a systematic review or meta-analysis protocol [37], was used in screening studies for eligibility. (See supplementary file 1)

Search strategy

A systematic review of published quantitative literature was conducted between October 2018 and April 2019 to capture studies published in the last ten years (2008-2018). The databases searched were PubMed, OVID, EMBASE, CINAHL and Web of Science. Other databases searched were Google scholar and African journal online (AJOL). The search terms used include: antenatal, prenatal, maternal health, maternal care, maternal health services, utilisation, factors, determinants, predictors, Africa. The search strategy and results are provided in supplementary file 2.

Inclusion criteria

Studies were eligible for inclusion if they were quantitative (primary or secondary data utilised) reporting on factors associated with ANC utilisation following multivariate analysis, conducted in SSA and published between 2008 and 2018. Antenatal care utilisation in this review refers to attendance of at least one and at least four ANC visits and booking visit within the first trimester of pregnancy. Various study designs (longitudinal, cohort, case-control, cross sectional and experimental) were eligible for inclusion if they assessed the predictors of ANC utilisation.

Exclusion criteria

This review excluded articles and studies published before 2008 and written in any language other than English. Studies that used measures other than the WHO recommendation for antenatal care were excluded. Review articles, case reports, case studies and simple descriptive studies without regression analyses were excluded. At the level of titles, titles that did not address antenatal care and maternal health/health services utilisation were excluded. At the abstracts stage, studies that did not report factors associated with antenatal care and qualitative studies were excluded. Full text quantitative studies that did not report on the determinants of ANC utilisation after multivariable regression analysis such as studies that assessed the predictors of utilisation skilled birth attendance and post-natal care were excluded. Full text publications that did not employ the WHO definitions for ANC and qualitative were also excluded

Data extraction

A data extraction form was developed and reviewed by all reviewers. Screening of titles and abstracts and the full texts was carried out independently by two of the review authors (INO and ICA). Any disagreements were resolved through discussion and consensus between the two review authors or with the help of the third author (OBE). Mendeley reference manager was used to keep track of references. Data were extracted for each paper using standardised forms with the following domains; the name of first author and year of publication, study location and setting, study design, study subjects and sample size and factors/determinants. Figure 1 shows the article selection and inclusion process.

Quality appraisal

Quality assessment of the studies included in this review was carried out by the main reviewer in consultation with the other authors. The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used to assess the quality of the studies. This quality assessment tool has been used in other systematic reviews.[38,39] (See supplementary file 3). The tool consists of fourteen questions assessing different aspects of a study including but not limited to definition of objectives, study population, sampling strategy, sample size and statistical analyses. To appraise a study, each question is scored as Yes (1) or No (0), and others (CD, cannot determine; NA, not applicable and NR, not reported). All the studies included in this review were assessed for quality using the appropriate criteria based on study design. Elements of the criteria which did not apply to a particular study was marked as not applicable.

All the studies fulfilled the quality criteria except for six studies[9,40–44] that did not report on sample size.

Patient and public involvement

It was not appropriate or possible to involve patients or the public in this work

Results

Study selection

The search yielded 3248 studies. The initial search identified a total of 3243 articles from the main databases and 5 articles Google scholar. After removal of duplicates, 1481 articles remained. Using

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3 title and abstracts, we first screened the identified articles and excluded 1384 articles based on the
4 agreed inclusion criteria with the other three authors. The studies were excluded because they were
5 irrelevant to the study, conducted outside sub-Saharan Africa and were purely descriptive. A total
6 of 97 full text studies were assessed for eligibility and 23 articles were further excluded after
7 reading the full text because they did not assess predictors of ANC, did not use the WHO
8 definitions for ANC, were focused on other aspects of maternal health not specific to ANC and
9 were qualitative studies. The four reviewers agreed on the inclusion of 74 studies in the final
10 review.
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22 The 74 studies included were from 23 SSA countries. East Africa had the highest number of studies
23 included in this review. Countries with the most studies were Ethiopia (24), Nigeria (15), Kenya
24 (5) and Ghana (5). Most studies were cross-sectional surveys and secondary data analyses. (Table
25 1). Table 2 contains the determinants of ANC utilisation classified as overall uptake of ANC (at
26 least one ANC visit), frequency (at least four ANC visits) and initiation of ANC in first trimester.
27 Table 3 contains the summary of the determinants of ANC utilisation by regions in Africa. The
28 characteristics and summary of findings of the articles included in the review are presented in
29 tables 1 and 2 of supplementary file 4. The summary measure utilized by various studies was
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3 generate a need for the use of health services, respectively. The predisposing factors include age,
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5 gender, marital status, family size, social status, education and race; enabling factors include
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7 family income, health insurance, distance, social relationships, service availability, and health
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9 facility characteristics (waiting time, availability of health providers) and need factors include
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11 symptoms or perceived illness. Under each main category (according to the Andersen framework),
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13 each determinant of ANC utilisation was presented with studies on its effect on overall uptake of
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15 ANC (at least one ANC visit), frequency (at least four ANC visits) and initiation of ANC in first
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17 trimester highlighted as applicable.
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25 **Predisposing factors**

26 *Maternal age*

27 *Overall uptake of ANC (at least one ANC visit)*

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34 Seven studies reported the effect of age on at least one ANC visit. Four of the studies showed that
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36 older/increasing age was a predictor of ANC utilisation.[46–49] Two of the studies conducted in
37
38 Ethiopia found that younger age at first pregnancy was a predictor of ANC use as women aged
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40 less than or equal to twenty years at the time of first pregnancy were nearly three times more likely
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42 to use ANC services than whose age at first pregnancy was more than twenty years.[50,51] Also,
43
44 in one of the studies, Nigerian women aged less than twenty years were more likely to utilise ANC
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46 than their older counterparts.[23] (Table 2)
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54 *Frequency of ANC (at least four ANC visits)*

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3 Nine studies found that maternal age significantly influenced the frequency of ANC visits. Eight
4 of the studies found that older women were more likely to have at least four ANC visits compared
5 to their younger counterparts.[30,34,43,49,52–55] One of the studies found that increasing
6 maternal age was associated with less than four ANC visits in Ethiopia.[33] (Table 2)
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16 *Timing of first antenatal visit (Gestational age <12 weeks)*

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18 Younger maternal age was a predictor of early ANC initiation in two of the studies.[56,57] (Table
19 2)
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27 **Maternal education**

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29 *Overall uptake of ANC (at least one ANC visit)*

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33 In 19 studies, the relationship between maternal education and overall uptake of ANC was
34 reported. The lack of formal education and lower educational levels were predictors of poor ANC
35 use among women in these studies in 19 of the studies.[9,25,46,47,49–51,53,58,59,60–68]
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37 However, one of the studies found that more educated women were less likely to utilise ANC from
38 skilled medical providers.[23] (Table 2)
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48 *Frequency of ANC (at least four ANC visits)*

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51 In 14 studies, maternal education was a predictor of frequency of ANC. In all the studies, the odds
52 of attending at least four ANC visits was more in women who had higher educational
53 levels.[15,24,25,27,29,30,49,53,54,64,67,69–71] (Table 2)
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Timing of first antenatal visit (Gestational age <12 weeks)

Six studies documented the relationship between maternal education and timing of initiating antenatal care. Five studies found that educated women were likely to book early for ANC.[24,56,57,70,72] Only one of the studies found that more educated women were less likely to utilise ANC from skilled medical providers.[23] (Table 2)

Husband/partner's education

Overall uptake of ANC (at least one ANC visit)

Only one study conducted in Ethiopia found that the higher the educational status of the husbands, the more likely the woman will attend at least one ANC visit.[63] (Table 2)

Frequency of ANC (at least four ANC visits)

Six studies reported on the influence of husband/partner's education on ANC use. Women whose husbands/partners had some education were more likely to access ANC services than those with less educated husbands/partners.[22,30,41,63,73,74] (Table 2)

Maternal occupation/employment status

Overall uptake of ANC (at least one ANC visit)

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3 Seven studies documented the impact of occupation/employment status on uptake of ANC. In six
4 of the studies, women who were employed and those who had a working status were found to be
5 more likely to utilise ANC than the unemployed/not working.[47,48,62,67,75,76] Women who
6 were farmers were more likely to use ANC in one of the studies.[59] (Table 2)
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12 *Frequency of ANC (at least four ANC visits)*

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16 Women who were employed were more likely to utilise ANC up to four times compared to their
17 unemployed counterparts in six of the studies.[29,30,73,74,77]. In another study, there was a
18 higher odds of inadequacy in ANC visits among women who engaged in sales/business,
19 agriculture, skilled manual and other jobs when compared to women who currently do not
20 work.[33] (Table 2)
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31 *Timing of first antenatal visit (Gestational age <12 weeks)*

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34 Unemployed women were less likely to initiate ANC early in pregnancy in one study.[57] In
35 another study carried out in Ethiopia, women who were engaged in agricultural occupation were
36 more likely to have delayed initiation of ANC.[33] In Rwandan communities with higher
37 employment rate among men, women were more likely to have received care early in the
38 pregnancy.[76] (Table 2)
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49 *Husband/partner's occupation*

50 51 52 *Overall uptake of ANC (at least one ANC visit)* 53 54 55 56 57

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3 One of the studies found that women whose husbands were engaged in non-farming occupations
4 were more likely to use ANC services.[68] (Table 2)
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14 ***Maternal religion***

15 16 17 *Overall uptake of ANC (at least one ANC visit)*

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20 Two studies found that Christian women were more likely to utilise ANC services compared to
21 non-Christians (traditional African religion and Muslims).[75,78] In another study, orthodox
22 Christians utilized ANC more than the Protestants and Catholics group.[48]
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31 *Frequency of ANC (at least four ANC visits)*

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34 In two studies, Christians were more likely to utilise ANC services compared to non-
35 Christians.[54,77] Women who had no religion were less likely to attend ANC in 2 studies.[27,66]
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38 (Table 2)
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44 *Timing of first antenatal visit (Gestational age <12 weeks)*

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47 In one of the studies, women who were Muslims and traditionalists were less likely to initiate
48 ANC in the first trimester.[57] (Table 2)
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55 ***Marital status and family type***

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3 *Overall uptake of ANC (at least one ANC visit)*
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6 Three of the studies assessed the effect of marital status on utilising ANC once in the course of
7 pregnancy. These studies showed that married women were more likely to utilise ANC than the
8 never married/currently unmarried.[79,80] One of the studies employed a composite index
9 (adequate ANC) comprising at least one, four ANC visits, ANC by skilled professional and
10 number of services received.[79] In another of the studies, never and formerly married women
11 were more likely to use skilled ANC attendants.[63] (Table 2)
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23 *Frequency of ANC (at least four ANC visits)*
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26 Three studies found that married women were more likely to make at least 4 ANC contacts than
27 the unmarried during pregnancy.[42,70,79] (Table 2)
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35 *Timing of first antenatal visit (Gestational age <12 weeks)*
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38 In three studies, early ANC initiation was significantly associated with being married than being
39 unmarried.[53,81,82] (Table 2)
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46 *Parity/birth order and household size*
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49 *Overall uptake of ANC (at least one ANC visit)*
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52 Five studies found that women with high parity or large household sizes were less likely to attend
53 at least one ANC visit.[46,47,49,60,61] Women whose pregnancy was for the first time were more
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3 likely to utilise ANC services at least once during their pregnancy.[51] In one other study, mothers
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5 with high parity were more likely to utilise ANC than those with low parity .[83] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 In six of the studies, women with high parity or large household sizes had significant reduction in
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16 attainment of at least four ANC contacts in the course of pregnancy.[15,30,40,42,70,77] (Table 2)
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22 *Timing of first antenatal visit (Gestational age <12 weeks)*
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25 Five studies reported that low parity/null parity was a predictor of early booking while having
26
27 many children led to delayed ANC initiation.[57,67,81,82,84,85] However, one of the studies
28
29 showed that women who had given birth at least once were less likely to seek prenatal care in the
30
31 first trimester.[78] (Table 2)
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38 ***Ethnicity***
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41 *Overall uptake of ANC (at least one ANC visit)*
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44 Three studies showed that within-country ethnic differences influenced attending at least one ANC
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46 visit in different countries.[61,66,75] (Table 2)
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50 *Frequency of ANC (at least four ANC visits)*
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53 One study identified within-country ethnic differences as a predictor of attending at least four ANC
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55 visits.[75] (Table 2)
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Knowledge of pregnancy/exposure to media

Overall uptake of ANC (at least one ANC visit)

In two studies, awareness of danger signs of pregnancy, timing and recommended number of ANC visits was a predictor of at least one ANC. [58,83] Exposure to mass media was also increased the odds of attending at least one ANC visit.[48,58,75,86] (Table 2)

Frequency of ANC (at least four ANC visits)

Five of the studies showed that women exposed to mass media were more likely to utilise ANC services and promptly compared to those who were not.[22,30,54,64,77] (Table 2)

Timing of first antenatal visit (Gestational age <12 weeks)

A study conducted in Nigeria found that women who had been exposed to at three media channels (radio, television and newspaper/magazine) were more likely to initiate ANC in the first trimester compared to those who were less exposed to the media.[72] Another study showed that women who lacked information on correct time of booking were more likely to book late for ANC.[87] (Table 2)

Attitude and perception towards ANC

Overall uptake of ANC (at least one ANC visit)

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3 Women who considered pregnancy a risky event were more likely to utilise ANC than those who
4 considered it risk free.[46] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 Women who had a good attitude towards maternal health were twice more likely to attend ANC
15 compared to those with a poor attitude.[32] (Table 2)
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22 *Timing of first antenatal visit (Gestational age <12 weeks)*
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25 Two studies documented that women who perceived that ANC should be initiated in the first
26 trimester were more likely to book early for ANC than those who perceived that ANC should
27 commence in the second and third trimesters.[56,87] (Table 2)
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39 **Enabling factors**
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42 *Household wealth/socioeconomic status*
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45 *Overall uptake of ANC (at least one ANC visit)*
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48 Nine studies showed high socioeconomic level positively influenced attendance of at least one
49 ANC visit. [51,60,63,65–67,71,80,88]
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3 *Frequency of ANC (at least four ANC visits)*
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6 In 14 studies, women of high socioeconomic status attended at least four ANC visits more than
7 those in the lower socio-economic/wealth strata.[15,25,27,29,30,32,41,54,64,69,77,89–91] (Table
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17 *Timing of first antenatal visit (Gestational age <12 weeks)*
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20 Lower wealth/poor socio-economic status was associated with late initiation of ANC in two
21 studies.[57,70] (Table 2)
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28 ***Place of residence/geographical location***
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31 *Overall uptake of ANC (at least one ANC visit)*
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34 Eight studies reported the role of place of residence (urban/rural) on attendance to at least one
35 ANC clinic. In all the studies, rural dwellers were reported to be less likely to attend at least one
36 ANC visit.[15,33,35,59,64,73,90,91]. Living in communities where a government health facility
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was situated increased the odds of attending at least one ANC visit.[78] Three studies reported
increased likelihood of attending at least one ANC visit based on residence in specified
geographical regions/locations within the countries where the studies were conducted.[62,66,80]
(Table 2)

53 *Frequency of ANC (at least four ANC visits)*
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3 In six of the studies, residing in the rural area made attending at least four ANC more likely than
4 residing in the urban area.[46,48,49,51,63,80] One study showed that women residing in
5 communities with a government health facility providing ANC services were more likely to have
6 four ANC visits.[44] (Table 2)
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13 In eight studies, residing in a particular geographic regions increased the likelihood of achieving
14 at least four ANC visits during pregnancy.[22,25,27,30,44,53,54,80] This varied by the different
15 regional and zonal categories within each country. (Table 2)
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23 *Timing of first antenatal visit (Gestational age <12 weeks)*

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26 Rural dwellers were more likely to present late for ANC (in second and third trimesters) in four
27 of the studies included in this review.[33,72,78,92] (Table 2)
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35 *Distance from the health facility*

36 37 *Overall uptake of ANC (at least one ANC visit)*

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40 In three studies, increased distance to ANC services negatively impacted the uptake of at least one
41 ANC visit.[46,61,68] In one study, Kenyan women who lived close to the dispensary were more
42 likely to have at least one ANC visit however among those women with at least one visit, the
43 number of ANC visits increased as the distance from the dispensary increased.[9] Another study
44 also found that for each 10 km increase in distance from a health facility, the odds of a woman
45 receiving different ANC services decreased by a quarter.[93] In one of the studies, having a
46 Women' Health Development Team (WHDT) within a 2 km radius from the nearest health facility
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3 increased the likelihood of at least one skilled ANC utilization.[86] Access to health services was
4 associated with attending at least one ANC visit in another study.[48] (Table 2)
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11 *Frequency of ANC (at least four ANC visits)*
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14 Women who lived a far distance from a health facility were less likely to attend four or more ANC
15 visits in three of the studies.[34,53,54] (Table 2)
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22 ***Health insurance/user-fee exemption***
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25 *Overall uptake of ANC (at least one ANC visit)*
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28 One of the studies found that women who were insured were more likely to attend at least one
29 ANC visit.[94] In another study, the proportion of women who made at least one ANC visit during
30 pregnancy increased significantly following user fee exemption.[95] (Table 2)
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36 *Frequency of ANC (at least four ANC visits)*
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39 In three studies, women who did not have health insurance were less likely to attend up to 4 ANC
40 visits.[41,54,90] (Table 2)
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47 *Timing of first antenatal visit (Gestational age <12 weeks)*
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50 Women who had any form of health insurance were less likely to delay the initiation of
51 ANC.[81,96] However, another study found that women who had insurance were more likely to
52 initiate ANC attendance in the third trimester.[72] (Table 2)
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Involvement in decision-making/autonomy

Frequency of ANC (at least four ANC visits)

Women who made decisions jointly with their husbands or partners were significantly more likely to have four or more antenatal visits compared with women whose husbands or partners made decisions alone.[29,30,87] Another study conducted in Eritrea and Ethiopia showed that women who were involved in major household decisions such as large purchases were more likely to use ANC at least 4 times.[73] (Table 2)

Timing of first antenatal visit (Gestational age <12 weeks)

Women who do not participate in decision making were more likely to use ANC in the second trimester relative to the first trimester.[72] (Table 2)

Husband's/partner's approval and support, social support

Overall uptake of ANC (at least one ANC visit)

Women whose husbands have positive attitude towards ANC were more likely to utilize ANC than women whose husbands had negative attitude towards ANC.[46]

Women who had their husband/partner's approval/permission to attend ANC were more likely to utilise ANC services compared to those without support from their husbands.[50,58,97] (Table 2)

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2
3 *Frequency of ANC (at least four ANC visits)*
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6 Women who did not experience physical intimate partner violence during the year preceding
7 survey were more likely to have four ANC visits.[44] In another study, women who had the father
8 of their child present in their lives were more likely to utilise ANC services.[98] Women who
9 lacked social support were more likely to underutilise ANC services compared to those with social
10 support.[52] (Table 2)
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21 ***Quality/content of ANC services***
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24 *Overall uptake of ANC (at least one ANC visit)*
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27 In one of the studies, women who received advice on ANC from health workers were more likely
28 to attend ANC a least once in pregnancy.[97] (Table 2)
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35 *Frequency of ANC (at least four ANC visits)*
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38 High cost of services was associated with decreased ANC use.[53] In one of the studies, having
39 an ANC at a private hospital was a predictor of delayed initiation of ANC, but in another, it
40 increased the likelihood of receiving adequate ANC compared to those clients using public health
41 facilities.[24,81] The level of antenatal service provision (measured as the availability of key
42 functions, screening tests, skilled health workers and opening times) affected the quality of ANC
43 received. Utilising ANC at facilities that provide a wide range of ANC services was associated
44 with an increase in the odds of receiving the complete ANC services given in the clinic and
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3 attending ANC.[93] Visits by health extension workers during pregnancy increased ANC
4 attendance in one of the studies.[99] (Table 2)
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11 **Need factors**

12 ***Pregnancy wantedness and planning***

13 *Overall uptake of ANC (at least one ANC visit)*

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20 Nine studies found that women with planned pregnancies were more likely to attend at least one
21 ANC than those with unplanned pregnancies.[46,47,50,55,58,71,83,85,100] (Table 2)
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28 *Frequency of ANC (at least four ANC visits)*

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31 Attending at least four ANC visits was positively influenced by pregnancy planning and
32 wantedness as seen in two studies .[41,55] Conversely, In 6 studies, women with mistimed or
33 unwanted/unplanned pregnancies were unlikely to attend at least four ANC visits.
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38 [13,53,78,81,98,100] (Table 2)
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44 *Timing of first antenatal visit (Gestational age <12 weeks)*

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47 Women with mistimed or unwanted/unplanned pregnancies were more likely to initiate ANC in
48 the second trimester.[81] (Table 2)
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55 ***Previous/current health and pregnancy experiences***

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3 *Overall uptake of ANC (at least one ANC visit)*
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6 Pregnancy complications, illnesses and stillbirths in previous pregnancies were found to reduce
7 the odds of attending at least one ANC visit in 2 studies.[50,55] (Table 2)
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14 *Frequency of ANC (at least four ANC visits)*
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17 Women whose pregnancy was confirmed by missed period rather than urine test were more likely
18 to delay booking ANC visit.[87] Women who attended ANC in the first trimester were more likely
19 to attend up to four ANC visits.[89] (Table 2)
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28 *Timing of first antenatal visit (Gestational age <12 weeks)*
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31 Women who had negative experiences in previous pregnancies were less likely to attend the
32 booking ANC visit in first trimester.[84] Women who had an early initiation of ANC in a previous
33 pregnancy were more likely to book early for ANC in the subsequent pregnancy.[56] (Table 2)
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44 **Discussion**
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47 This study reviewed the predictors of ANC utilisation in SSA. Although the studies included in
48 this review utilised different study designs, most were cross-sectional studies and secondary data
49 analyses of national surveys. The determinants of ANC utilisation identified in this review include
50 predisposing factors (such as age, education, religion, husband/partner's education, maternal
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3 occupation/employment status, husband/partner's occupation, parity), enabling factors (such as
4 income status, place of residence, distance from the health facility, health insurance, involvement
5 in decision making, quality/content of ANC services) and need factors (wantedness of pregnancy,
6 previous pregnancy experiences).
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13 In this review, higher educational attainment for women and their husband/partner was a
14 predisposing factor that increased overall attendance, frequency and timeliness of ANC visits in
15 majority of the studies. These studies found that being educated increases the odds of the number
16 and timeliness of ANC visits. This could be explained as educated women tend to be more
17 financially independent, employed and better informed on the importance of ANC to the mother
18 and baby.[101] Similarly, studies have found that educated women and those with educated
19 partners were more likely to utilize antenatal services and also initiate this within the first trimester
20 of pregnancy.[36,102,103] Poor educational status has been identified as a major cause of health
21 inequality in antenatal care coverage.[104] This finding highlights the need to collaborate with the
22 educational sector to promote both female and male school enrolment and completion.
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40 Studies in this review showed that women with a working status (employed) were found to be
41 more likely to attend at least one and at least four ANC visits than the unemployed/not working.
42 Being employed also increased the odds of early initiation of ANC. Employment status is closely
43 related to income and educational status as educated women tend to be employed and consequently
44 earn income. Beyond being a source of funds for sponsoring ANC use, employment can also
45 increase women's exposure and access to information on ANC thus further promoting utilisation.
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53 Women empowerment programs and provision of employment opportunities sensitive to maternal
54 health considerations should be encouraged in order to promote uptake of ANC services.[105]
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6 As a predisposing factor, the role of high parity in reducing the odds of ANC attendance and
7 initiation could have been because women who have had previous pregnancies may consider
8 themselves 'experienced' and used to the routine care offered during ANC and so delay ANC
9 initiation and number of ANC contacts made.[106] Timely initiation of the first antenatal care visit
10 provides a critical opportunity for health promotion, disease prevention and curative care for
11 women and their unborn children. More efforts are needed to optimize the uptake of first antenatal
12 care visit in the first trimester of pregnancy.[107] Also, decreased use of ANC among high parity
13 women could be due to the less time available for ANC attendance due to the care of children,
14 inadequate resources in the family and negative experiences with ANC from previous
15 pregnancies.[36]
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33 Among the predisposing factors, increasing/older maternal age increased attendance to at least one
34 and four ANC visits in most of the studies that assessed its relationship with ANC utilisation. A
35 few studies however found that younger women attended ANC clinics more than older ones. Also,
36 younger women were more likely to attend the first ANC visit in the first trimester of pregnancy.
37 The higher odds of early trimester booking visits in these studies may have been due to the relative
38 childbearing inexperience (low parity) as they may be newly-weds or adolescents and therefore be
39 more likely to seek out ANC earlier than their older counterparts due to ignorance/limited
40 knowledge of pregnancy. Confounding effect of by parity on age may also have affected the
41 relationship between age and ANC use as low parity was associated with early ANC booking and
42 increased number of ANC contacts in the studies reviewed.[15,30,40,42,47,49,60,61,70,73,77]
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56 Younger women have been found to initiate ANC early in a similar review.[108,109] In contrast,
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3 age was not significantly associated with the utilization of antenatal care in a review of factors
4 affecting ANC in Ethiopia.[103]
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11 Most of the studies showed that being married conferred a protective effect on ANC utilisation as
12 a predisposing factor. Married women were not only more likely to attend ANC but also less likely
13 to delay initiation of ANC visits when compared to their unmarried counterparts. This could be to
14 the psychosocial and financial support received from their husbands, planning/ desirability of their
15 pregnancy and the societal acceptability and support of their pregnant state when compared to their
16 unmarried counterparts.[106] Some studies included in this review showed that women who
17 enjoyed support from their husbands and other social support were more likely to utilise ANC.
18 This suggests and reinforces the importance of including married men in programmes that are
19 designed to improve ANC uptake as male involvement has been proven beneficial to maternal
20 health.[110] However, one of the studies in this review found higher odds of utilising skilled ANC
21 attendants among currently unmarried women.[63] One possible explanation for this is that
22 unmarried women are sole decision makers, making them empowered to seek and utilise ANC.
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43 Our findings suggest that socioeconomic status was one of the enabling factors reported to
44 influence ANC utilisation across many studies as high socioeconomic status increased the uptake
45 of at least one and at least four ANC visits and the early initiation of ANC. Poverty is a known
46 deterrent to health care utilisation in SSA and women of low wealth status may be unable to afford
47 the medical and non-medical costs associated with utilising ANC.[111,112] Thus, because of lack
48 of financial access, such women may not attend ANC at all, limit the number of ANC visits or
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3 even initiate ANC late in pregnancy. The effect of SES on ANC use has been documented in other
4 studies.[36,113–115] Although free/subsidised maternal health services are offered in some
5
6 African countries, women still pay out of pocket for some direct medical costs such as laboratory
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8 investigation and non-medical costs for transport. These costs pose financial barriers to using ANC
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10 services by pregnant women.[116,117] Further reflecting the role of the woman's ability to fund
11
12 ANC on utilisation, early initiation and attending ANC for at least four times were reduced in
13
14 women who did not have health insurance. Women have peculiar maternal-related health needs
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16 (such as pregnancy and childbirth) thus making them utilise health services such as ANC, however
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18 they are often times less willing and able to pay for insurance compared to men because of their
19
20 low income status and financial dependence.[118,119] Consequently, antenatal care and other
21
22 maternal health services should be provided free (under mandatory social health insurance) or at
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24 subsidized rates with exemptions in order to improve the utilisation of these services and in turn
25
26 reduce maternal morbidity and mortality. This review did not identify cultural/local beliefs as a
27
28 determinant of ANC utilisation in contrast with findings from a similar review conducted in
29
30 developing countries where women declined from using ANC services due to fear of witchcraft
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32 attacks following blood sample collection for laboratory investigation.[36] It is possible that
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34 women are getting more enlightened and as such not holding on to such beliefs
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46 As part of the enabling factors, rural residence negatively impacted on attendance and timing of
47
48 the first ANC visit. The interplay between the peculiar characteristics of rural areas such as sparse
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50 distribution of health services and development, poor educational and employment status of
51
52 residents and poor access to mass media could explain this. Similar findings on the effect of rural
53
54 residence on ANC use have been documented in other studies.[36,103,108] To improve ANC
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3 utilisation in rural areas, community-wide sensitisation on antenatal care, provision of basic
4 amenities and re-distribution of health services are recommended. Likewise, long travel distance
5
6 between a woman's place of residence and the health facility providing ANC services was
7
8 associated with a lower odds of ANC utilisation. Walking or travelling long distances could be
9
10 difficult for pregnant women in addition to travel-related costs and these may discourage them
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12 from utilising ANC services. This negative effect of long distance on the utilisation of ANC and
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14 the continuum of maternal health care services has been documented in other studies.[120]
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23 Involvement in decision-making on major household decisions and ANC was one of the enabling
24
25 factors that exerted a positive effect on attaining adequate and timely ANC visits. Many patriarchal
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27 communities exist in SSA in which women lack autonomy and cannot decide to seek ANC without
28
29 approval from their husbands largely because of financial dependence and cultural norms.[121]
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32 Autonomy and involvement of women in decision-making have been found to increase the
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34 utilisation of maternal health services.[103,109,122]
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41 The findings from this review suggest as part of the need factors, women whose pregnancies were
42
43 planned and desired were significantly more likely to utilise ANC services at least once and at
44
45 least four times compared to those with unplanned/undesired pregnancies. This agrees with
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47 findings from other studies.[36,103] In order to encourage ANC use, more needs to be done to
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49 increase uptake of family planning by securing only desired pregnancies.
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Strengths and limitations

This study involved a large number of studies that covered a wide and geographically important sub region of Africa. The review accessed several databases and utilized recent publications (≤ 10 years old). It provides evidence on the variety of determinants across different sectors affecting ANC utilisation and the importance of intersectoral collaboration in improving ANC utilisation.

The contextual differences in study settings and outcome measures used could affect the interpretation and meaning of the results. However, some determinants showed similarities and differences within and between countries. This review excluded publications in French language and this may limit the representativeness and generalizability of the findings to some settings.

Conclusion

Based on this review, a variety of factors affect ANC utilisation in SSA. These factors include the predisposing, enabling and need factors with the poor, uneducated, unmarried, uninsured, rural dwellers, multiparous, poorly knowledgeable, those living far from health facilities and unsupported by their husbands/partners less likely to utilise ANC services. These factors also demonstrate the importance of multi-stakeholder intersectoral collaboration in mitigating poor ANC utilisation in SSA. Thus, ministries of labour/employment, education, rural development, women affairs, finance, community and religious leaders need to collaborate with the ministry of health to achieve universal ANC coverage. Examples would include health-in-all policies, joint stakeholder policy, planning and implementation review meetings, capacity development for policy makers on intersectoral cohabitations secondments and having desk officers represent

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3 related ministries (sectors above) in the ministry of health. An example of the implementation will
4
5 be the educational sector encouraging enrolment of in schools while the health sector participates
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7 in curriculum development to include basic information on care in pregnancy (ANC inclusive).
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10 The ministries of works, labour, and employment can lay their part by road construction to improve
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12 access to health facilities especially in rural underdeveloped areas, subsidised transport for
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14 pregnant women, provision regular electricity to enable access to electronic media, provision of
15
16 job and empowerment opportunities for women. The finance ministry can partner to provide loans,
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18 grants, conditional cash transfers, and other forms of financial empowerment to women.
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20 Strengthened implementation of antenatal care policies with active community participation are
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22 also recommended.
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Authors' contributions:

INO: Study of conceptualization and design, data extraction, analysis and interpretation of results, manuscript drafting and approval of the final manuscript for publication.

ICA: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

OBE: Study design, data extraction, manuscript drafting and approval of the final manuscript for publication

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6 CJU: Study design, analysis and interpretation of results, manuscript drafting, analysis and
7 interpretation of results, and approval of the final manuscript for publication.
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11 **Competing interests:** None declared
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14 **Data sharing statement**

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17 All data relevant to the study are included in the article or uploaded as supplementary information
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26 **Figure 1:** Selection and inclusion process for articles included in the review
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Table 1: Summary of articles included in the review by regions

Region	Countries	References	Study design
West Africa	Nigeria=15	[15,22,23,25,29,30,35,44,54,62,65,72,75,80,84]	11 SA, 3 cross sectional, 1 mixed methods
	Ghana=5	[27,40,41,90,94]	3 SA, 2 cross sectional, SA
	Benin= 2	[71,77]	SA
	Niger =1	[97]	Cross-sectional
	Cameroon= 1	[69]	SA
	Burkina Faso= 2	[42,43]	Cross-sectional
	DRC= 1	[13]	
South Africa	South Africa= 2	[34,98]	1 SA, 1 mixed method
East Africa	Rwanda= 2	[52,81]	1 SA, 1 cross sectional
	Malawi= 1	[95]	Natural experiment
	Kenya=5	[9,70,79,82,92]	3 SA, 2cross sectional,
	Tanzania= 4	[53,89,96,100]	2 SA, 2cross sectional,
	Zambia= 2	[74,93]	2 SA
	Zimbabwe= 1	[78]	1 SA
	Ethiopia= 24	[24,32,46–48,50,51,55,56,58–60,63,64,66,68,77,83,85–88,91,99]	6 SA, 18 cross sectional
Multi-country	n=6	[49,57,61,67,73,76]	6 SA

SA: secondary analysis

Table 2: Determinants of ANC uptake, frequency and timing

Factor	Determinants	At least one ANC visit	At least four ANC visit	Initiation of ANC in first trimester
Predisposing factors	Maternal Age	[23,46–51]	[30,33,34,43,49,52–55]	[56,57]
	Maternal Education	[9,23,25,46,47,49–51,53,58–68]	[15,24,25,27,29,30,49,53,54,64,67,69–71]	[23,24,56,57,70,72]
	Maternal occupation/ Employment Status	[47,48,59,62,67,75,76]	[29,30,33,73,74,77].	[33,57,76]
	Husband/Partner's Occupation	[68]	NA	NA
	Husband/Partner's Education	[63]	[22,30,41,63,73,74]	NA
	Maternal Religion	[48,75,78]	[27,54,66,77]	[57]
	Marital Status and Family type	[63,79,80]	[42,70,79]	[53,81,82] (
	Parity/family and household size	[46,47,49,51,60,61,83]	[15,30,40,42,70,77]	[57,67,78,81,82,84,85]
	Ethnicity and cultural Influence	[61,66,75]	[75]	NA
	Residence/Geographical location	[15,33,35,59,62,64,66,73,78,80,90,91].	[44,46,48,49,51,63,80]	[33,72,78,92]
Enabling factors	Household wealth/socio-economic status	[51,60,63,65–67,71,80,88]	[15,25,27,29,30,32,41,54,64,69,77,89–91]	[57,70]
	Distance from health facilities	[9,46,48,61,68,86,93]	[34,53,54]	[33,72,78,92]

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Need Factors

Health insurance/user-fee exemption	[94,95]	[41,54,90]	[72,81,96]
Involvement in decision-making/autonomy	NA	[29,30,73,87]	[72]
Husband's/partner's approval and support	[46,50,58,97]	[52,98]	NA
Knowledge/Exposure to media	[48,58,75,83,86]	[22,30,54,64,77]	[72,87]
Attitude and perception toward ANC	[46]	[32]	[56,87]
Pregnancy wantedness and planning	[46,47,50,55,58,71,83,85,100]	[13,53,78,81,98,100]	[81]
Current/Previous pregnancy and health experiences	[50,55,89]	[87]	[56,84]
Quality/content of services	[97]	[53,60,81,93]	NA

Table 3: Determinants of ANC utilisation by regions in sub-Saharan Africa

Factor	Determinants	West Africa	East Africa	South Africa	Central Africa	Multi-country
Predisposing factors	Household wealth/socio-economic status	[15,25,27,29,30,33,41,54,62,65,69,71,75,80,90]	[32,51,57,63,64,66,70,88,89,91]		[69]	[67]
	Maternal Age	[23,30,43,54]	[46–48,50–53,55,57]	[34]		[49]
	Maternal Education	[15,23,25,27,29,30,54,62,65,71]	[9,24,46,47,50,51,53,55,56,58–61,63,64,66,70,74]		[69]	[49,57,61,67]
	Maternal occupation/ Employment Status	[15,29,30,62,75,77]	[33,47,48,59,68,74]	[98]		[57,67,73,76]
	Husband/Partner's Occupation		[68]			
	Husband/Partner's Education	[22,30,41]	[63,74]			[73]
	Maternal Religion	[27,54,75,77]	[48,66,78]	[98]		[57]

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Marital Status and Family type	[41–43,80]	[52,53,63,68,70,79,81,82]	[98]	[61]
Parity/family and household size	[15,30,40,42,77,84]	[23,46,47,51,60,70,78,81–83,85]		[49,57,61,67]
Ethnicity and cultural Influence	[29,75]	[66]		[61]
Residence/Geographical location	[15,22,25,27,30,35,44,54,62,72,77,80,90]	[33,46,48,51,53,59,63,64,66,70,78,91,92]		[49,57,73]

Enabling factors

Table 2: Determinants of ANC utilisation in sub-Saharan (Continued)

Distance from health facilities	[54]	[9,34,46,48,53,68,86,93]		[61]
Health insurance/user-fee exemption	[41,54,72,90,94]	[81,95,96]		
Involvement in decision-making/autonomy	[29,30,72]	[87]		[73]
Husband’s/partner’s approval and support	[44,97]	[50,52,58]	[98]	

Need Factors

Knowledge/Exposure to media	[22,30,54,72,75,77]	[32,48,58,64,83,85,86]		
Attitude and perception toward ANC		[32,46,56,87]		
Pregnancy wantedness and planning	[13,41,71]	[46,47,50,53,55,58,78,81,83,85,100]	[98]	[13]

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3 Current/Previous [84,97] [50,55,56,87]
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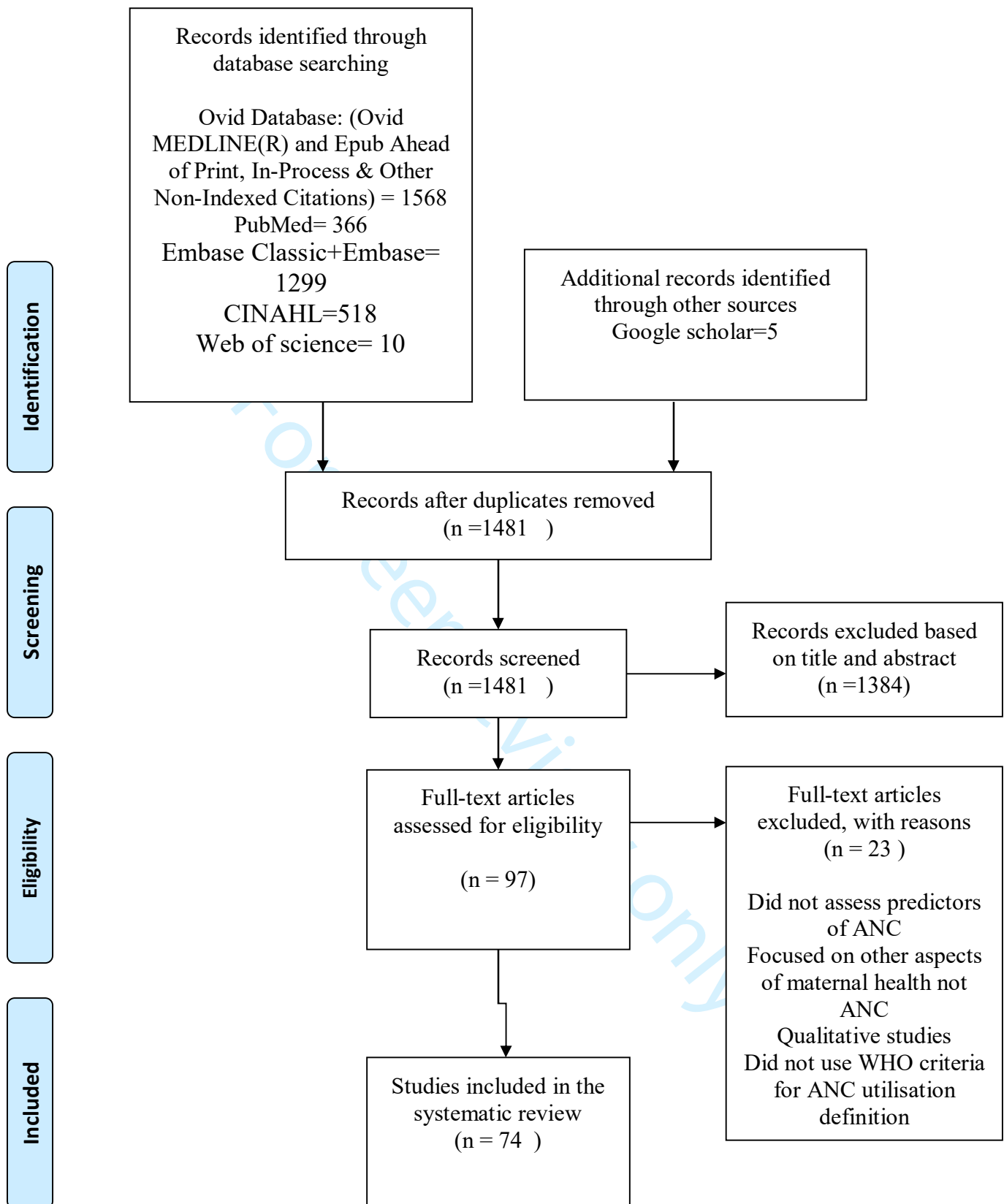


Fig. 1: PRISMA flow chart. The figure presents the publication identification and selection process. It shows the number of records identified, included and excluded, and the reasons for exclusions



PRISMA 2009 Checklist

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Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 4- 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Not applicable
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Page 6
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Page 8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 8
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 8
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Page 9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Not applicable



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Not applicable
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not applicable
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 8-9
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Tables 9
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Page 7
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Not applicable
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Not applicable
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Not applicable
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not applicable
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Page 25-30
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Page 30
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 31
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Page 33

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

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3 **SEARCH RESULTS FOR CINAHL. LAST SEARCHED ON 23/04/19**
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5 **TOTAL SEARCH RESULTS = 518**
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#	Query	Limiters/Expanders	Last Run Via	Results
S11	S6 AND S7 AND S8	Limiters - Published Date: 20080101-20181231		
	Search modes - Find all my search termsInterface - EBSCOhost Research Databases			
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			518
S10	S6 AND S7 AND S8	Limiters - Published Date: 19960101-20181231		
	Search modes - Find all my search termsInterface - EBSCOhost Research Databases			
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			575
S9	S6 AND S7 AND S8	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			608
S8	S4 OR S5	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			98,919
S7	S2 OR S3	Search modes - Find all my search termsInterface - EBSCOhost Research Databases		
	Search Screen - Advanced Search			
	Database - CINAHL Plus with Full Text			37,921
S6	(MH "Africa South of the Sahara+") OR (MH "Africa, Western+") OR (MH "Africa, Southern+") OR (MH "Africa, Northern+") OR (MH "Africa, Eastern+") OR (MH "Africa, Central+") OR "Africa OR (sub-saharan africa or sub saharan africa or sub sahara) OR sub saharan africa[title]" OR (MH "Africa+") OR (MH "South Africa") OR (MH "Namibia") OR (MH "Benin") OR (MH "Burkina Faso") OR (MH "Cape Verde") OR (MH "Cote d'Ivoire") OR (MH "Gambia") OR (MH "Ghana") OR (MH "Guinea") OR (MH "Guinea-Bissau") OR (MH "Liberia") OR (MH "Mali") OR (MH "Mauritania") OR (MH "Niger") OR (MH "Nigeria") OR (MH "Senegal") OR (MH "Sierra Leone") OR (MH "Togo") OR (MH "Angola") OR (MH "Botswana") OR (MH "Lesotho") OR (MH "Malawi") OR (MH "Mozambique") OR (MH "Swaziland") OR (MH "Zambia") OR (MH "Zimbabwe") OR (MH "Algeria") OR (MH "Egypt") OR (MH "Libya") OR (MH			

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3 "Morocco") OR (MH "Cameroon") OR (MH "Central African Republic") OR (MH "Chad") OR (MH "Congo")
4 OR (MH "Democratic Republic of the Congo") OR (MH "Equatorial Guinea") OR (MH "Gabon") OR (MH
5 "Burundi") OR (MH "Djibouti") OR (MH "Eritrea") OR (MH "Ethiopia") OR (MH "Kenya") OR (MH
6 "Rwanda") OR (MH "Sudan") OR (MH "Somalia") OR (MH "Tanzania") OR (MH "Uganda") Search modes -
7 Find all my search terms Interface - EBSCOhost Research Databases

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10 Search Screen - Advanced Search

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12 Database - CINAHL Plus with Full Text 70,341

13 S5 (MH "Health Services Accessibility") OR "usage OR access" Search modes - Find all my
14 search terms Interface - EBSCOhost Research Databases

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16 Search Screen - Advanced Search

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18 Database - CINAHL Plus with Full Text 74,113

19
20 S4 (MH "Drug Utilization") OR (MH "Health Resource Utilization") OR (MH "Bed Occupancy") OR
21 (MH "Resource Utilization Group") OR "(Equipment AND Supplies Utilization) OR Drug Utilization OR (
22 Procedures AND Techniques Utilization) OR (Facilities AND Services Utilization.) OR utilization" OR (MH
23 "Utilization Review") Search modes - Find all my search terms Interface - EBSCOhost Research
24 Databases

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26 Search Screen - Advanced Search

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28 Database - CINAHL Plus with Full Text 28,228

29
30 S3 (MH "Maternal Health Services") OR (MH "Maternal-Child Health") OR "maternal health OR
31 Maternal Health Services OR Maternal Health OR Pregnancy" Search modes - Find all my search terms
32 Interface - EBSCOhost Research Databases

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34 Search Screen - Advanced Search

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36 Database - CINAHL Plus with Full Text 10,586

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38 S2 (MH "Prenatal Care") OR (MH "Pregnancy in Adolescence") OR (MH "Pregnancy Tests,
39 Immunologic") OR "Prenatal Care OR antenatal OR Pregnancy" OR (MH "Ultrasonography, Prenatal") OR
40 (MH "Gender Specific Care") OR (MH "Pregnancy Care (Saba CCC)") Search modes - Find all my
41 search terms Interface - EBSCOhost Research Databases

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47 S1 "determinant OR Social Determinants of Health OR factor* OR predict*" OR (MH "Social
48 Determinants of Health") Search modes - Find all my search terms Interface - EBSCOhost Research
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51 Search Screen - Advanced Search

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53 Database - CINAHL Plus with Full Text 3,992

SEARCH RESULTS FOR EMBASE. LAST SEARCHED ON 23/04/19

TOTAL SEARCH RESULTS = 1299

#	Searches	Results
1	determinant*.mp. or "Social Determinants of Health"/	279285
2	factor*.mp.	5433149
3	predict*.mp.	2049535
4	Prenatal Care/ or antenatal.mp. or Pregnancy/	747759
5	ante natal.mp.	957
6	ante-natal.mp.	957
7	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	719423
8	or/1-3	6997886
9	or/4-7	757867
10	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	369706
11	utilisation.mp.	34492
12	usage.mp.	126891
13	access.mp.	454816
14	or/10-13	936915
15	"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or "sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or	286700

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3	ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/	
4	or senegal/ or sierra leone/ or togo/	
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7	16 8 and 9 and 14 and 15	1681
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9	17 determinant*.mp. or "Social Determinants of Health"/	279285
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11	18 factor*.mp.	5433149
12		
13	19 predict*.mp.	2049535
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15	20 Prenatal Care/ or antenatal.mp. or Pregnancy/	747759
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17	21 ante natal.mp.	957
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19	22 ante-natal.mp.	957
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21	23 maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	719423
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23	24 or/17-19	6997886
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25	25 or/20-23	757867
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28	26 "Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques	
29	Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	369706
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31	27 utilisation.mp.	34492
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35	29 access.mp.	454816
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37	30 or/26-29	936915
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40	"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or	
41	chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or	
42	"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or	
43	ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or	
44	31 uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or	286700
45	mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or	
46	africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or	
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11	38	Prenatal Care/ or antenatal.mp. or Pregnancy/
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13	39	ante natal.mp.
14		957
15	40	ante-natal.mp.
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17	41	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/
18		719423
19	42	or/35-37
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21	43	or/38-41
22		757867
23	44	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.
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37		"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or
38		chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or
39		"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or
40		ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or
41	49	uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or
42		mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or
43		africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or
44		ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/
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- 1102 Blom A., Cloete M., Hendricks N., Joubert B., Roux S., Barnard R., Snell C., Marais A.-S., Seedat S., Gossage J.P., Blankenship J., May P.A. High risk pregnant women and case management: Efficacy of prevention in a community with the highest fetal alcohol syndrome prevalence in the world. *Alcohol. Clin. Exp. Res.* [Internet]. June 2012 36(SUPPL. 1):213A. In: Embase Available from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed13&NEWS=N&AN=70790586>
- 1103 Exavery A. Relationship between contraceptive failure and contraceptive discontinuation among 15 - 49 year-old non-nulligravid women in rural Tanzania. *Eur. J. Contracept. Reprod. Health Care* [Internet]. June 2012 17(SUPPL. 1):S73-S74. In: Embase Available from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed13&NEWS=N&AN=70747972>
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- 1105 Shija A.E., Msovela J., Mboera L.E.G. Maternal health in fifty years of Tanzania independence: Challenges and opportunities of reducing maternal mortality. *Tanzan. J. Health Res.* [Internet]. 2011 13(5 SUPPL.ISS):1-15. In: Embase Available from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=364585607>
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SEARCH STRATEGY FOR OVID MEDLINE(R). LAST SEARCHED= 23/04/19

SEARCH RESULTS= 1568

#	Searches	Results
1	determinant*.mp. or "Social Determinants of Health"/	202245
2	factor*.mp.	4926645
3	predict*.mp.	1287587
4	Prenatal Care/ or antenatal.mp. or Pregnancy/	854680
5	ante natal.mp.	421
6	ante-natal.mp.	421
7	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/	853071
8	or/1-3	5831393
9	or/4-7	859617
10	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.	171310
11	utilisation.mp.	17533
12	usage.mp.	73333
13	access.mp.	239255
14	or/10-13	483498

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4		"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or
5		chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or
6		"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or
7		ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or
8	15	uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or 195777
9		mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or
10		africa, western/ or benin/ or burkina faso/ or cabo verde/ or cote d'ivoire/ or gambia/ or
11		ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/
12		or senegal/ or sierra leone/ or togo/
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23	20	Prenatal Care/ or antenatal.mp. or Pregnancy/ 854680
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25	21	ante natal.mp. 421
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29	23	maternal health.mp. or Maternal Health Services/ or Maternal Health/ or Pregnancy/ 853071
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31	24	or/17-19 5831393
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35	26	"Equipment and Supplies Utilization"/ or Drug Utilization/ or "Procedures and Techniques 171310
36		Utilization"/ or "Facilities and Services Utilization"/ or utilization.mp.
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38	27	utilisation.mp. 17533
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48		"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or
49		chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or
50		"sao tome and principe"/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or
51	31	ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or 195777
52		uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or
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24 **SEARCH FINDINGS FOR WEB OF SCIENCE**

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41 Title: Mothers treatment seeking intention for neonatal danger signs in northwest Ethiopia: A structural
42 equation modeling
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44 Author(s): Bogale, TN (Bogale, Tariku Nigatu); Worku, AG (Worku, Abebaw Gebeyehu); Yalew, AW
45 (Yalew, Alemayehu Worku); Bikis, GA (Bikis, Gashaw Andargie);
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49 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209959 DOI:
50 10.1371/journal.pone.0209959 Published: DEC 31 2018
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52 Accession Number: WOS:000454627200117
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Record 2 of 10

Title: Estimating levels of HIV testing coverage and use in prevention of mother-to-child transmission among women of reproductive age in Zambia

Author(s): Muyunda, B (Muyunda, Brian); Mee, P (Mee, Paul); Todd, J (Todd, Jim); Musonda, P (Musonda, Patrick); Michelo, C (Michelo, Charles)

Source: ARCHIVES OF PUBLIC HEALTH Volume: 76 Article Number: 80 DOI: 10.1186/s13690-018-0325-x Published: DEC 29 2018

Accession Number: WOS:000454558300001

PubMed ID: 30619607

ISSN: 0778-7367

eISSN: 2049-3258

Record 3 of 10

Title: Bypassing health facilities in rural Mozambique: spatial, institutional, and individual determinants

Author(s): Yao, J (Yao, Jing); Agadjanian, V (Agadjanian, Victor)

Source: BMC HEALTH SERVICES RESEARCH Volume: 18 Article Number: 1006 DOI: 10.1186/s12913-018-3834-y Published: DEC 29 2018

Accession Number: WOS:000454562700012

PubMed ID: 30594198

ISSN: 1472-6963

Record 4 of 10

Title: Acceptability of option B plus among HIV positive women receiving antenatal and postnatal care services in selected health centre's in Lusaka

Author(s): Chanda, BC (Chanda, Bridget Chomba); Likwa, RN (Likwa, Rosemary Ndongyo); Zgambo, J (Zgambo, Jessy); Tembo, L (Tembo, Louis); Jacobs, C (Jacobs,

Choolwe)

Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 510 DOI: 10.1186/s12884-018-2142-1 Published: DEC 29 2018

Accession Number: WOS:000454579200002

PubMed ID: 30594161

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4 7/19/2019 Web of Science [v.5.32] - WOS Export Transfer Service

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7 ISSN: 1471-2393

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9 Record 5 of 10

10 Title: HIV incidence among pregnant and postpartum women in a high prevalence setting

11 Author(s): Machekano, R (Machekano, Rhoderick); Tiam, A (Tiam, Appolinaire); Kassaye, S (Kassaye,
12 Seble); Tukei, V (Tukei, Vincent); Gill, M (Gill, Michelle); Mohai, F

13 (Mohai, Florence); Nchepe, M (Nchepe, Masepeli); Mokone, M (Mokone, Majoalane); Barasa, J (Barasa,
14 Janet); Mohale, S (Mohale, Sesomo); Letsie, M (Letsie,

15 Mosilinyane); Guay, L (Guay, Laura)

16
17 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209782 DOI:
18 10.1371/journal.pone.0209782 Published: DEC 28 2018

19 Accession Number: WOS:000454621900041

20 PubMed ID: 30592749

21 ISSN: 1932-6203

22
23 Record 6 of 10

24 Title: Knowledge on birth preparedness and complication readiness among expecting couples in rural
25 Tanzania: Differences by sex cross-sectional study

26 Author(s): Moshi, FV (Moshi, Fabiola V.); Ernest, A (Ernest, Alex); Fabian, F (Fabian, Flora); Kibusi, SM
27 (Kibusi, Stephen M.)

28 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209070 DOI:
29 10.1371/journal.pone.0209070 Published: DEC 28 2018

30 Accession Number: WOS:000454621900014

31 PubMed ID: 30592725

32 ISSN: 1932-6203

33
34 Record 7 of 10

35 Title: Spontaneous haemorrhagic stroke complicating severe pre-eclampsia in pregnancy: a case report
36 in a resource-limited setting in Cameroon

37 Author(s): Tolefac, PN (Tolefac, Paul Nkemtendong); Awungafac, NS (Awungafac, Nkemnji Standley);
38 Minkande, JZ (Minkande, Jacqueline Ze)

39 Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 506 DOI: 10.1186/s12884-
40 018-2157-7 Published: DEC 27 2018

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3 Accession Number: WOS:000454408800002

4
5 PubMed ID: 30587133

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7 Author Identifiers:

8
9 Author Web of Science ResearcherID ORCID Number

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11 Tolefac, Paul Nkemtendong 0000-0001-5165-7887

12
13 ISSN: 1471-2393

14
15 Record 8 of 10

16
17 Title: Postnatal care service utilization and associated factors among women who gave birth in
18 Debretabour town, North West Ethiopia: a community- based crosssectional
19 study

20
21 Author(s): Wudineh, KG (Wudineh, Kihinetu Gelaye); Nigusie, AA (Nigusie, Azezu Asres); Gesese, SS
22 (Gesese, Shumiye Shiferaw); Tesu, AA (Tesu, Azimeraw Arega);

23
24 Beyene, FY (Beyene, Fentahun Yenealem)

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27 true&displayUsageInfo=true&viewType=summary&product=WOS&mark_id=WOS&colName=WOS&sear
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32 Source: BMC PREGNANCY AND CHILDBIRTH Volume: 18 Article Number: 508 DOI: 10.1186/s12884-
33 018-2138-x Published: DEC 27 2018

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35 Accession Number: WOS:000454578900002

36
37 PubMed ID: 30591039

38
39 ISSN: 1471-2393

40
41 Record 9 of 10

42
43 Title: Factors associated with institutional delivery: Findings from a cross-sectional study in Mara and
44 Kagera regions in Tanzania

45
46 Author(s): Bishanga, DR (Bishanga, Dunstan R.); Drake, M (Drake, Mary); Kim, YM (Kim, Young-Mi);
47 Mwanamsangu, AH (Mwanamsangu, Amasha H.); Makuwani, AM

48
49 (Makuwani, Ahmad M.); Zougrana, J (Zougrana, Jeremie); Lemwayi, R (Lemwayi, Ruth); Rijken, MJ
50 (Rijken, Marcus J.); Stekelenburg, J (Stekelenburg, Jelle)

51
52 Source: PLOS ONE Volume: 13 Issue: 12 Article Number: e0209672 DOI:
53 10.1371/journal.pone.0209672 Published: DEC 26 2018

54
55 Accession Number: WOS:000454416400083

PubMed ID: 30586467

Author Identifiers:

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ISSN: 1932-6203

Record 10 of 10

Title: Application of Core Processes for Understanding Multiple Concurrent Sexual Partnerships Among Adolescents in Uganda

Author(s): Nalukwago, J (Nalukwago, Judith); Alaii, J (Alaii, Jane); Van den Borne, B (Van den Borne, Bart); Bukuluki, PM (Bukuluki, Paul Mukisa); Crutzen, R

(Crutzen, Rik)

Source: FRONTIERS IN PUBLIC HEALTH Volume: 6 Article Number: 371 DOI: 10.3389/fpubh.2018.00371 Published: DEC 21 2018

Accession Number: WOS:000454437200001

PubMed ID: 30622938

ISSN: 2296-2565

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Additional file 3: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

Criteria	No. of articles		
	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	74		
2. Was the study population clearly specified and defined?	74		
3. Was the participation rate of eligible persons at least 50%?	74		
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	74		
5. Was a sample size justification, power description, or variance and effect estimates provided?	43	6	25
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			74
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			74
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			74
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	74		
10. Was the exposure(s) assessed more than once over time?			74
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	74		
12. Were the outcome assessors blinded to the exposure status of participants?			74
13. Was loss to follow-up after baseline 20% or less?			74
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	74		

*CD, cannot determine; NA, not applicable; NR, not reported

Table 1: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Dahiru et al 2013	Nigeria	SA of 2013 NDHS	38,945 women aged 15-49 years	Older age (+), rural residence (-), mother's and husband' level of education (+), working status of the woman (+), rich household (+), health insurance (+), Christian and Muslim religion (+)
Muchie 2017	Ethiopia	SA 2014 DHS	3694 women aged 15-49 years	Lower educational level (-), lower economic conditions (-), higher birth order (-), rural residence (-), available high quality ANC services (+)
Gebre 2018	Ethiopia	SA 2000-2016 Ethiopia DHS	5867 (year 2000), 2279 (year 2016)	Low-economic status (-), illiteracy (-), rural residence (-), no occupation (-), poor access to mass media (-)
Yaya 2018	Benin	Benin DHS	17,794 and 16,599 women in 2006 and 2012 respectively.	Education (+), higher wealth index (+), rural residence (-), employed (+)
Yaya 2017	Ethiopia	SA 2011 Ethiopia DHS	10,896 women	Frequency- older age interval (-), rural residence (+), primigravidity (+), unemployed (+) Timing- Rural residence (-), multiparity (-)
Rurangirwa 2017	Rwanda	Cross-sectional study	921 women	Age >31 years (-), single women (-), poor social support (-)
Akinyemi 2017	Nigeria	SA 2013 NDHS	20,467 women	Low formal education (-), poverty (-) healthcare access problems (-)
Saad-Haddad 2016	Multi-country- Bangladesh, Cambodia, Peru Cameroon, Nepal, Senegal, Uganda.	SA NDHS	7576, 8008, 4818 women, in Cameroon; Senegal and Uganda respectively	Education (+) household wealth(+), gestational age at first visit (-), birth rank (-), preceding birth interval (-)
Worku 2016	South Africa	Cross-sectional	272 mothers	Mother's age>20 years (+), increased distance to health facility(+), service satisfaction (+)
Manthalu 2016	Malawi	SA	142 health facilities	Use fee exemption (+)
Fagbamigbe 2017	Nigeria	SA	6,299 females	Low education (-), poverty (-)
Tsegay 2013	Ethiopia	cross-sectional study	1113 women	Married (+), educated (+), proximity of health facility to the village(+), and husband's not a farmer (+)
Babalola 2009	Nigeria	SA	2148 women	Education (+), older age at the birth of last child (+), and approval of family planning (+), urban residence(+), wealthy household (+), large number of clients in PHC (-)
Abor 2011	Ghana	Ghana DHS	5588 women	Oder age (-), multiple pregnancies (-), education (+), religious affiliation (+), high economic status (+)
Wilunda 2015	Ethiopia	Cross-sectional study	500 women	High wealth status (+), knowledge of the recommended number of ANC visits (+), attitude towards maternal health care (+), older age (-)
Abosse 2010	Ethiopia	Cross-sectional study	691 women	Older age (+), husband's positive attitude to ANC (+), small family size (+), no education (-)
Zegeye 2013	Ethiopia	Cross-sectional	446 women	Timing: Mothers with no parity before (+), good knowledge on early ANC (+), planned pregnancy (+)

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Akowuah 2018	Ghana	Cross-sectional study	200 pregnant women	Older age (+), large household size (+), employed (+)
Adewuyi 2018	Nigeria	SA of DHS 2013	19652 mothers aged 15 to 49 years old	Rural: maternal non-working status (-), birth interval < 24 months (-), single birth type (-), not listening to radio at all (-), lack of companionship to health facility (-), not getting money for health services (-) Urban: mothers professing Islam (-), those who did not read newspaper at all (-), and those who lacked health insurance (-)
Brown et al 2008	Kenya	Cross-sectional	1,562 perinatal outcomes	Education: secondary education or above (+), Distance: living further than 5 km from a dispensary (-), Secondary or higher education (+), greater wealth (+), urban residence (+), parity of 3–4 (+)
Mbuagbaw 2011	Cameroon	DHS	7,557 women	Parity (+), literacy status of women (+), average monthly family income (+), media exposure (+), decision where to give birth (+), perception of distance to health institutions (+)
Birmeta 2013	Ethiopia	Cross-sectional	422 women	Women with higher education (+), Women from urban areas (+), autonomous women (+)
Tarekegn 2014	Ethiopia	DHS	16,515 women	Young age (+), least educated (+), poorest women (+) women whose partners were uneducated (+), those with health insurance (+), low socioeconomic status (-)
Sakeah 2017	Ghana	Cross-sectional	1497 women	Timing: rural (-), secondary education (+), higher parity (-), married (+)
Ochako 2011	Kenya	SA 2003 KDHS	1675 young women	Living in communities with a high proportion of women who delivered in a health facility (+), Residence in high-poverty communities (-)
Ononokpono 2013	Nigeria	DHS	16,005 women	Older mothers (+), urban residents (+), higher education (+), farmer mothers (+)
Melaku 2014	Ethiopia	Cross-sectional	2361 mothers	Young age (+) Timing: young age (+)
Straneo 2016	Tanzania	Cross sectional	464 women	Younger women (+), secondary/higher education (+), Employed (+), Christian women (+), rich households (+), involvement in decision making (+), joint decision (+), Igbo, Yoruba and other minority ethnic groups (+), urban areas (+), educated women (+), exposed to mass media (+)
Ononokpono 2015	Nigeria	SA NDHS 2008	17560 women	Wealth (+), urban areas (+), mothers with health insurance (+), educational level (+)
Arthur 2013	Ghana	SA of GDHS 2008	NR	Educated (+), less than 60 minute walk to facility (+), husband approval (+), illness in future pregnancies (+), planned pregnancy and illness experienced in past pregnancy (+), age at first pregnancy (+)
Tewodros 2009	Ethiopia	Cross-sectional	627 women	urban areas (+)
Gupta 2014	Tanzania	SA of DHS	8,035 women	

Ntambue 2012	Democratic Republic of Congo	Cross-sectional	1762 women	primiparous and grand multiparous (-), unplanned pregnancies (-)
Mwase 2018	Burkina Faso	Cross-sectional	6601 women	least poor households (+), married (+), living further away (-), multiparous (-), Muslim religion (-),
Bobo 2017	Ethiopia	SA of DHS 2014	8070 women	urban area (+), secondary level (+),
Anchang-Kimbi 2014	Burkina Faso	Cross-sectional	287 parturient women	Only one dose of IPTp (-)
Melese et al 2016	Ethiopia	Cross-sectional	Women (15-49 years) who gave birth in one year preceding the study (n=748)	Preference of skilled personnel (+), awareness about places where to get skilled providers (+), listening to radio (+), distance of WHDT within 2km radius from the nearest health facility (+)

DHS: Demographic health survey, SA: Secondary Analysis FGD: Focal Group Discussion SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants NR: Not Reported IPTp: intermittent preventive treatment during pregnancy *Only results for Cameroon, Senegal, Uganda included in review NR: Not reported (+): increases ANC use (-) reduces ANC use

Table 2: Articles included in the review

Author	Location	Study Design	Sample Size/Population	Summary of findings
Kyei 2012	Zambia	SA 2007 DHS	2405 rural births	Distance(+), level of provision category (+)
Doctor 2011	Nigeria	SA 2008 Nigeria DHS	18,028) women	youngest age cohort(-), rural residence (-), lack of schooling (-), higher parity (-), residence in northern region(-) and poor economic status(-)
Woldemicael 2010	Eritrea, Ethiopia	SA DHS 2007	Currently married women	Women's autonomy (+)
Kibusi 2018	Tanzania	SA 2011/2012 Tanzania HIV/AIDS and malaria indicator survey	4513 women	Having health insurance (+)
Makate 2017	Zimbabwe	SA ZDHS 2005/06 and 2010/11	8907 women (2005/06), 9171 women (2010/11)	Contraceptive prevalence (+), religious composition (+), density of nurses (+), health expenditures per capita (+), availability of government hospitals in communities (+)
Haruna-Ogun	Nigeria	NDHS 2013	20,192 cases	Place of residence (+)
Aliyu 2017	Nigeria	SA NDHS 2013	20,467 women	maternal education (+), media exposure (+), place of residence (+), having health insurance(+)

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3	Banke-Thomas	Ethiopia	SA Kenya DHS	898 adolescents	Having education (+), religion (+), ethnicity (+), urban residence (+),
4					wealth quintile (+),
5					mass media exposure (+), and geographical region (+)
6	Kuuire 2017	Nigeria	SA NDHS 2003, 2008	Nigeria (39,923 women) and	Nigeria: Wealth (+)
7		Malawi	and 2013	Malawi (28,951 women).	Malawi: Wealth (-)
8			MDHS 2000, 2004 and		
9			2010		
10	Chorongo 2018	Kenya	Cross-sectional	385 women	Being Muslim (+), Higher education (-),
11			comparative study		
12	Owili 2016	Kenya	SA KDHS	4005 women	Monogamous setting (+), marriage (+), Older age (+), religion (+),
13					health insurance (+), Exposure to media (+), higher education (+)
14	Bayou 2016	Ethiopia	Cross sectional	870 women	Higher education (+), ANC in private facility (+)
15	Browne 2016	Ghana	SA GDHS 2008	3022 Women	Being insured (+)
16	Ochako 2016	Kenya	2008-09 Kenya DHS.	4014 women	Wanted pregnancy (+), Urban residence (+), Higher education (+),
17					Older age (+), birth interval less than 25 months (-)
18	Muhwava 2016	South Africa	Cross sectional	363 women from rural sample	Urban :Being employed (+), wanted pregnancy
19				and 466 women from urban	Rural site: Being married (+),
20					Religiosity (-)
21	Gudayu 2015	Ethiopia	Cross sectional	390 women	Not aware of right timing of booking (-), not autonomous to use ANC
22					(-), Recognised pregnancy by missing period (-).
23	Oyewale 2015	Nigeria	Cross sectional	384 pregnant women	Older age (-), Higher education (-), Birth order (-), urban residence
24					(+), health insurance coverage (+) and household income (+).
25	Dutamo 2015	Ethiopia	Cross sectional	634 currently married women	Low parity (+), pregnancy intended (+), awareness of danger signs
26					of pregnancy (+), higher education of woman and spouse (+)
27	Omer 2014	Nigeria	Cross sectional	7870 women in Bauchi and of	Residence in community with a government health facility (+),
28		(Bauchi and		7759 in Cross River	absence of physical intimate partner violence (+)
29		Cross river)			
30	Manzi 2014	Rwanda	SA 2010 RDHS	6,325 women	Having many children (-), feeling that distance to health facility is a
31					problem (-), unwanted pregnancy (-),ANC at a private hospital
32					(+),being married (+), health insurance (+)
33	Belayneh 2014	Ethiopia	Cross sectional	398 pregnant women	Early timing of ANC: Mothers with younger age (+), formal education
34					(+), previous early ANC visit (+), perceived ANC visit per pregnancy
35					of four and greater (+)
36	Rossier 2014	Kenya,	SA Nairobi DHS,	3,346 and 4,239 births in	Kenya (at least one visit): Less-educated (-), poorer (-), non-Kikuyu
37		Burkina	Ouagadougou DHS	Kenya and Burkina Faso	women (-), women living in the neighbourhood farther from public
38		Faso		respectively	health services (-)
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3					Burkina Faso (at least four visits): poorer households (-), non-
4					educated women (-), women from Polesgo and Nioko tribe (-)
5	Ononokpono 2014	Nigeria	2008 Nigeria DHS	17,476 women	Intimate partner violence (+)
6	Chama-Chiliba 2015	Zambia	SA Zambia DHS	2925 women	Employment (+), low quality ANC (-), multiparity (-), higher
7					education of husband (+),
8	Afework 2014	Ethiopia	Cross-sectional	4949 women	Visit by community health worker (+)
9	Oladokun 2010	Nigeria	Cross-sectional	796 women	Low parity (+), previous stillbirth (+)
10	Stephenson 2012	Bangladesh, Egypt, and Rwanda	SA DHS for Bangladesh (2007), Egypt (2008), and Rwanda (2005).	4926, 8036, 5387 women respectively	Rwandan communities with higher employment rate among men (+)
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14	Regassa 2011	Ethiopia	Cross sectional	1094 women	Literacy (+), have exposure to media(+), low parity(+)
15	Rai 2012	Nigeria	SA NDHS 2008	2434 Women	Women's education, (+), husband's
16					Education (+), wealth (+), urban residence (+), Mass media exposure
17					(+)
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19	Exavery 2013	Tanzana	Cross-sectional household survey	3,127 women	Mistimed pregnancy (-),
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21	Worku 2013	Ethiopia	Cross sectional	1668 women who had births in the year preceding the survey	Higher educational of women and their husbands (+), higher wealth
22					Quintiles (+), awareness of risk of pregnancy (+), preference for
23					skilled provider(+), birth order (-), unwanted pregnancy (-)
24	Yeneneh 2018	Ethiopia	Ethiopian DHS	23,179 women who had a live birth in the five years preceding the survey	Richest wealth quintiles(+), lowest number of
25					birth order(+), urban residence(+), younger age(+), and educated(+)
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28	Dansou 2017	Benin Republic	DHS	9110 mothers who had completed at least a pregnancy within the 5 years preceding the survey	Economically well-off households (+)for richest women (+),
29					educated women(+),and those with desired pregnancies(+)
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32	Assefa 2016	Ethiopia	DHS	7,773 women aged 15-49 years who gave birth during the five-year period preceding the survey	Urban residence (+), older mothers (+), education (+), employment
33					(+), mass media exposure(+), religion (+), access to health
34					services(+)
35					
36	Ayalew 2017	Ethiopia	Cross sectional	317 women who gave birth 6 months before the study	Older age (+), Education(+), history of stillbirth(+), planned
37					pregnancy(+), service utilization
38	Begum 2018	Niger	Cross sectional	923 pregnant women	Women with gestational age ≥ 27 weeks (+), Women who reportedly
39					received husbands' advice about
40					attending ANC (+)
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Verney 2017	Senegal, Ethiopia, Kenya	Cross sectional	4,575 women	Higher education(+), Higher income (+), formal employment(+), advice from health worker(+), nulliparity(+)
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DHS: Demographic health Survey, SA: Secondary Analysis, IDI: In-depth interview, ANC: Antenatal care, TBAs: Traditional birth attendants (+): increases
ANC use (-) reduces ANC use

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