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USE OF ANTENATAL AND SKILLED CARE DURING DELIVERY: A SYSTEMATIC REVIEW AND META-ANALYSIS OF THE EFFECTIVENESS OF INTERVENTIONS IMPLEMENTED IN DEVELOPING COUNTRIES.

BY

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MPH., GEORGIA STATE UNIVERSITY

Thesis Submitted to the Graduate Faculty
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Of the
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MASTER OF PUBLIC HEALTH
ATLANTA, GEORGIA
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APPROVAL PAGE

USE OF ANTENATAL AND SKILLED CARE DURING DELIVERY: A SYSTEMATIC REVIEW AND META-ANALYSIS OF THE EFFECTIVENESS OF INTERVENTIONS IMPLEMENTED IN DEVELOPING COUNTRIES.

BY

CALISTER PETER IMEDA

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April 29, 2013

Dedication

I dedicate this thesis to the Almighty God who gave me all the divine helpers in GSU, good health and peace of mind. I also dedicate this thesis to my son Benjamin for being a good boy and study hard which helped me do my studies without worrying much about him.

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Skills

Language: English, Swahili
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ABSTRACT

Background

Complications due to pregnancy and child bearing are among the leading causes of death and disability among women of child bearing age in developing countries. Maternal Mortality Rate (MMR) is still high in most developing countries even though there is an overall decrease in MMR worldwide. In 2010 MMR in developing countries was 15 times that of developed countries. Skilled antenatal care (ANC) and care during delivery are indispensably important in the reduction of MMR. Interventions to increase use of maternal care have been implemented in different countries however there is a need for a meta-analysis to ascertain the effectiveness of these interventions so as to have evidence for scale up.

Purpose

The objective of this study was to conduct a systematic review and meta-analysis of the effectiveness of interventions implemented in developing countries to improve use of antenatal services and skilled care during delivery.

Methods

Interventions were identified from MEDLINE, PAIS INTERNATIONALA and GLOBAL HEALTH databases. Searches were done between December 2012 and January 2013. No restrictions were put on study date, design, or language of publication. Abstracts reporting results of interventions regarding use of maternal health care in developing countries were examined and data was extracted for meta-analysis. Effect sizes (ES) were calculated as odds ratios. Random effects model was used for meta-analysis.

Main results

A total of 1960 articles were retrieved from Medline and Global Health data bases. Final selection of articles with relevant outcomes and reported data that could be extracted for meta-analysis was 12 articles for delivery care and 13 articles for antenatal care. Articles were published between 1993 to 2012. Results for delivery and antenatal care interventions show that the overall effect size was significant; 2.406 (95% CI 1.847 - 3.135), P-value <=0.001 and 2.548 (95% CI 1.207-5.382), P=0.014 respectively. However heterogeneity between studies was found to be significantly high for both delivery and antenatal care with Q= 285.361, I-square = 96.145 P<=0.001 and Q = 659.426, P<001, I-square=98.635 respectively. Subgroup analysis was performed with moderator variables such as *study design, types of outcomes and region of study.* Results show that there was no evidence of these variables to have contributed to the observed high heterogeneity.

Conclusion

Interventions implemented to improve use of maternal services such as ANC and services during delivery were significantly effective in improving uptake of such services, however heterogeneity between studies was found to be substantially high and subgroup analysis with selected moderator variables did not show the evidence of such variables to have contributed to the observed heterogeneity.

Key words: antenatal, delivery,

CHAPTER I

INTRODUCTION

1.1 Overview

Complications due to pregnancy and child bearing are among the leading causes of death and disability among women of child bearing age in developing countries (WHO, 2012). It is estimated that for every maternal death occurring, there are 20 other women getting disabilities due to pregnancy and childbirth complications (UNFPA, 2010). The fifth Millennium Development Goal (MDG5) aims at improving maternal health with the targets of reducing Maternal Mortality Ratio (MMR) by 75% of 2009 rate by 2015 and achieving universal access to reproductive health services (UN, 2011).

MMR is still high in most developing countries even though there is an overall decrease in MMR worldwide. It is estimated that in 2010 MMR in developing countries was 15 times that of developed countries. Eighty five percent of the global burden of all maternal deaths occurs in Sub-Saharan Africa and Southern Asia. The lifetime risk of maternal death in developing countries is 1/150 whereas that of developed countries is 1/3800 (WHO, UNICEF, UNFPA, World Bank, 2012). During the period 1990 to 2008 Southern Asia made a progress of 53% reduction in MMR while Sub-Saharan Africa made a progress of only 26% reduction (UN, 2011). Most maternal deaths are due to obstetric hemorrhage during delivery or just after delivery, sepsis as well as complications of unsafe abortion. Other causes are indirect causes such as malaria and HIV.

Maternal deaths due to these complications are avoidable by presence and attendance of trained health-care workers before, during and after delivery where a skilled health worker can administer interventions to prevent and manage those complications (UN, 2011). There is

a disparity in attendance to child birth among developing and developed countries. On average, only 65% of child births were attended by skilled personnel in 2009 in developing countries as compared to 99% in developed countries. Sub-Saharan Africa and Asia who bear the biggest burden of maternal deaths had 46% and 50% respectively (UN, 2011).

Skilled health care attendance during pregnancy (antenatal care) is indispensably important because conditions which complicate pregnancy and child birth can be detected and managed. However in developing countries antenatal care is still low; only 51% of pregnant women attend the recommended four visits or more. Sub-Saharan Africa and Southern Asia, the proportion of women who receive the recommended skilled attendance of four visits or more during pregnancy is only 43% and 26% respectively (UN, 2011).

Apart from skilled attendance during pregnancy and at birth, the MDG5 insists on reaching adolescents with the aim of reducing adolescent pregnancies. Childbearing at young age (15-19 years) increases the risks of pregnancy and birth complications which subsequently increases the likelihood of deaths. Again Sub-Saharan African has the highest birth rates among adolescents (122 per 1,000 births) which is high above the average for developing countries (54 per 1,000 births) (UN, 2011).

Another area of concern in the question of improving maternal health is the use of contraceptives and child birth control. Reducing the risk of having unintended or closely spaced pregnancies can be achieved by having access to and use of safe contraception methods which in turn improves maternal and infant health (UN.2011).

1.2 Statement of the problem and Purpose of the study

Use of antenatal care and skilled care during delivery has remained unacceptably low in most developing countries. It is estimated that in 2009 only 51% of pregnant women in developing countries attended the recommend antenatal visits and only 65 % of child births were attended by a skilled personnel. This situation has led into low reduction of maternal mortality. Only three years away from the target, most developing countries have not achieved the goal of reducing maternal mortality by 75% of 2009 rates and having universal access to maternal services. It is estimated that only fifty countries are in progress while 25 countries are either making insufficient progress or are not making any progress and if no accelerated interventions are put in place these countries are likely to miss the MDG5 target (UN, 2011; WHO, UNICEF, UNFPA, World Bank, 2012). Several intervention studies have been implemented in developing countries with the aim of increasing use of maternal services in the areas of ANC and care during delivery but their effectiveness in increasing use of such services is less known. Meta-analysis on these interventions is important so as to ascertain the effectiveness and variations of these studies so as to have a base for scale up.

Goal

The goal of this study is to conduct a systematic review and analysis of the effectiveness of interventions implemented in developing countries to improve the use of antenatal services and skilled care during delivery.

Objectives

1. To conduct a systematic review and analysis on the effectiveness of interventions implemented in developing countries to increase use of antenatal care (ANC) services.
2. To conduct a systematic review and analysis of effectiveness of interventions implemented in developing countries to increase use of skilled care during delivery.

CHAPTER II

LITERATURE RIVIEW

"Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes"(WHO. 2012).

Maternal services are all services given to a woman during pregnancy, during delivery, immediately after giving birth and contraception methods. Being a leading cause of death and disability among women of child bearing age in developing countries, maternal complications could be greatly reduced by increased use of maternal services and reduction of adolescent pregnancy (UNFPA. 2010). This has been shown by examples of developing countries which have significantly reduced maternal mortality. These countries are Egypt, which decreased maternal mortality from 174 to 45 women per 100,000 within the period between 1990 and 2008; Jordan decreased from 150 to 38 women per 100,000 during the same period. These changes occurred due to the large contribution of increased skilled attendance during delivery, increased use of recommended antenatal visits and use of modern contraceptive methods (UNFPA. 2010).
Use of maternal health care services in developing countries varies within and between countries. These differences are due to variations in individual factors, residential location, and economic differences. Individual factors such as age, education of a woman and parity have shown to influence location of delivery where younger women are found to opt for skilled care attendance compared to older women. More educated women tend to seek more skilled care than less educated women. Location of residence has shown to act in favor of urban located women as compared to rural women. Economic differences are also found to favor those in higher social

economic status than those in lower social economic. Women with higher parity tend to use less maternal service compared to women with lower parity probably due to perceived experience. (Say and Raine, 2007). Other factors affecting use of maternal health services are education of the husband, marital status, media exposure, cultural beliefs and history of obstetric complications (Simkhada et al, 2008). Simkhada and others found that availability of services alone does not guarantee use of the service and instead the overall economic, social and political interactions of a woman needs to be explored while considering interventions to increase use of maternal services (Simkhada et al, 2008).

2.1 Antenatal care

Antenatal care services include tetanus immunization, syphilis screening and treatment, malaria prophylaxis, HIV information and testing, nutrition education and management and monitoring of possible complications (Mrisho et al, 2009 and Shah & Say, 2007).Use of antenatal services has been linked to increased use of skilled attendance during delivery. Bloom and others (1999) found that women who used antenatal care are more likely to opt for skilled attendance during delivery and subsequently reduce maternal mortality.

Despite its importance, antenatal care has remained low in most developing countries where on average only 51% of pregnant women attend the recommended four visits or more for pregnant women with no complications. Sub-Saharan Africa and Southern Asia, the proportion of women who receive the recommended skilled attendance of four visits or more during pregnancy is only 43% and 26% respectively (UN, 2011).

Factors affecting use of antenatal clinic services for maternal services in general vary between and within countries. One factor may be a determining factor for using or not using the services in one country while the same factor may not be the case in another country or another region within the country. These factors are availability, accessibility, affordability, characteristics of healthcare services, women's position in the household and society as well as knowledge, attitudes, culture and beliefs (Simkhada et al, 2008).

Availability and accessibility of antenatal services is associated with the use of the service. Women who live a short distance from the health facility offering antenatal services are more likely to use the service compared to women who live in the settings with no service close to them. Opening time and waiting time to receive services is also associated with use. (Simkhada et al. 2008, Chowdhury et al. 2003, Magadi et al. 2000). Inconsistence has been found between studies regarding place of residence , for example a study done in Ethiopia shows that, women who lived in urban areas were more likely to use antenatal services (Mekonnen & Mekonnen 2003) while another study done in India shows that, women who lived in urban areas were less likely to use antenatal services than the rural residents (Navaneetham & Dharmalington 2002).

Another factor that affects use of antenatal services is affordability. Financial difficulties are found to hinder use of services. Women who could afford transport costs and required laboratory tests are more likely to use the services as compared to those who cannot afford (Simkhada et al.2008).

Characteristic of Health care services also affects use of antenatal care where health insurance coverage may affect positively use of services. Poor quality of care and poor relationship

between care providers has a negative effect on the use of service; this was found to be the case in Zimbabwe (Simkhada et al. 2008).

Women's position in the household is another factor that may affect the decision on use or non-use of services. Women who are more independent are more likely to use services as compared to those who depend entirely on their husbands or other members of the family to decide. Studies done in India and Nepal found that women's autonomy was highly related to use or nonuse of services (Pallikadavath et al. 2004, Matsumura & Gubhaju, 2001). Social support also influences use of care; for example a woman with a mother in-law who does not consider antenatal care as necessary is more likely to be discouraged to attend antenatal clinic (Chowdhury et al. 2004). Husbands' refusal was also found to be a major reason for not seeking care in Nigeria (Adam &Salihu, 2002).

Women's knowledge, attitude, beliefs and culture also affect use of antenatal clinic. Women with higher level of media exposure, family planning knowledge and nutritional knowledge are more likely to use antenatal clinic than their counter parts (Simkhada et al. 2008). Perception concerning the importance of antenatal services also was found to affect use of services in India where pregnancy is regarded as a natural process and care is necessary only when a problem arises (Griffith &Stephenson 2001). The same case was found in South Africa where women did not see the necessity of attending antenatal clinic at early stage if they had no problems in their previous pregnancies, instead they sought service at a late stage of their pregnancy while perception of the risks associated with obstetric complications is associated with increased use of antenatal services (Myer & Harrison, 2003). Perception of the risks associated with obstetric complications is associated with increased use of antenatal services. Fear of witchcraft and fear of testing for HIV were also reasons for not attending antenatal clinic in Zimbabwe (Mathole et

al. 2004). A woman's experience in the previous pregnancy also affects use of antenatal services for the current pregnancy where if a woman experienced fetal loss in the previous pregnancy she is likely to attend clinic earlier than if she had no complications (Matthews et al 2001, Simkhada et al. 2008).

2.2 Delivery care

The International Conference on Population and Development (ICPD) aims at having at least 90% of deliveries (births) attended by skilled health care providers by 2015 as a strategy in reducing maternal mortality (UNFPA, 2008). However, in 2009 about 6 years away to 2015, on average only 65% of child births were attended by skilled personnel in developing countries as compared to 99% in developed countries. Sub-Saharan Africa and Asia who bear the biggest burden of maternal deaths had 46% and 50% respectively of births attended by skilled personnel (UN, 2011).

Factors affecting use of maternal health services can be categorized into groups such as (i) Socio-cultural (ii) Perceptions regarding risks of the condition and benefits of using skilled heath care services (iii) Socioeconomic status and physical accessibility to the health facility (iv) Quality of care. The interaction between these factors is complex since there are different levels that are affected concerning service uptake and more than one factor may interact to affect one level (Thaddeus &Maine, 1994 and Gabrysch & Campbell.2009).

2.2.1 Socio-cultural beliefs

Decision to seek skilled care may be affected by the community's belief on the cause of the problem as defined by the society which does not necessarily agree with biomedical definitions. Societal perception may agree with experts or biomedical definitions on the risk of the condition but not on the causes of the condition; for example supernatural linkage to causes

of the conditions is frequently cited as a reason not to seek skilled care attention. Prolonged labor for example is considered to be associated with infidelity in some cultures thus skilled care is not required but traditional rituals which need to be performed by the woman's husband will help her deliver safely (Kowalewski et al. 2000, Thaddeus and Maine, 1994).

2.2.2 Perceptions regarding risks of the condition and benefits of using skilled heath care services.

Perception of the characteristic of the disease/illness by an individual affects their decision to seek care. Before a person decides to seek care they need to recognize that there is a condition which needs skilled care attention; this is not an exception for obstetric conditions (Thaddeus & Maine.1994). In most societies pregnancy and delivery have been regarded as natural conditions which do not require skilled care unless abnormal conditions or complications occur (Thaddeus & Maine, 1994). Moreover most women in developing countries do not have a broad understanding of danger signs and symptoms which could eventually help them make decision to seek care. A study done in Senegal found that one quarter of the interviewed women cold not mention even one symptom which could be regarded as a danger sign and some women claimed that fever, dizziness and pallor were normal pregnancy signs (Dia et al 1989). Another study done in Benin found that labor pains that last for up to twenty four hours are regarded as normal and do not require skilled care attention (Sargent, 1998).

2.2.3 Socioeconomic status and physical accessibility to the health facility

Distance from the facility, lack of reliable transport and costs associated with transport are barriers to reaching the facility on time. Most rural areas in developing countries do not have reliable roads and most people do not own private care which could take them to the health facility on time. Public transport may not be available during emergencies and if found and hired, it will be more expensive to compensate running costs with only one or a few passengers.

This leads to women walking long distances seeking for care. The journey may take several minutes to hours to reach the facility. This situation discourages women from seeking skilled care unless complications arise, and even if a woman decides to seek care she might not reach the facility on time (Kandeh et al.1997, Thaddeus & Maine. 1994).

2.2.4 Quality of care

Quality of care is found to surpass concerns about physical accessibility or distance to the facility. The decision to seek care can be greatly affected by the quality of care they receive in the facility and the experiences they have had or people close to them. A facility with inadequate trained staff, inadequate drugs and supplies, poor record keeping, poor hygiene, bad attitude of care givers and long waiting time were found to affect the motivation to use skilled care services (Kandeh et al. 1997, Thaddeus & Maine. 1994). Thaddeus and Maine (1994) found that quality of care was a more important factor for decision to seek care as compared to costs of transport as well as costs of services in Nigeria and Ethiopia. A study done in Tajikistan revealed that women prefer to deliver at home although health facilities are accessible and with no cost for services because health facilities are considered to be of low quality and not safe (Say & Raine,2007)

A summary of the interaction between socio-cultural/beliefs/perceptions, economic, physical accessibility and quality of care with the levels of care delivery are presented in figure one below.

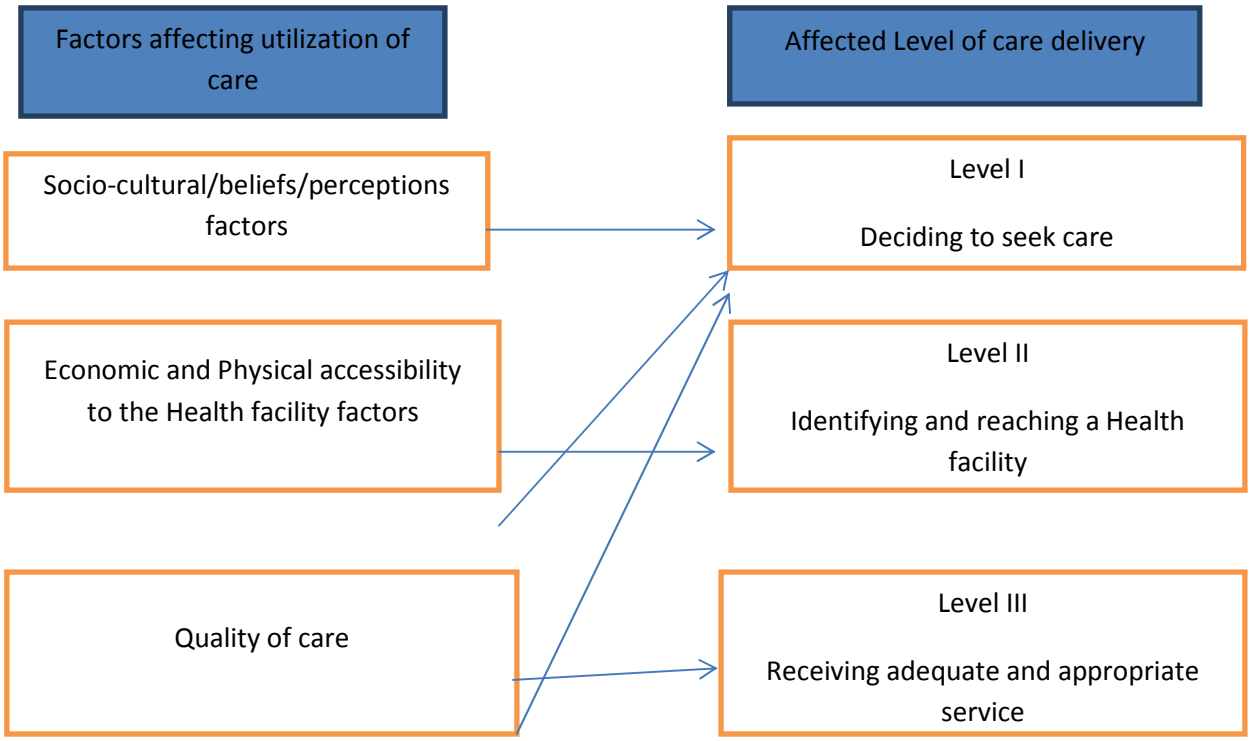

Fig 1: The interaction model between factors and level of care delivery affected (Adopted from Thaddeus &Maine and modified

Summary of literature review

Despite its importance in reducing maternal mortality use of antenatal care and skilled care during delivery has remained unsatisfactorily low in developing countries. WHO recommends four or more antenatal visits for women with no complications but on average only 51% of pregnant women attend the recommended visits. Sub-Saharan Africa and Southern Asia, the proportion of women who receive the recommended skilled attendance of four visits or more during pregnancy is only 43% and 26% respectively (UN, 2011). The International Conference on Population and Development (ICPD) aims at having at least 90% of deliveries (births) attended by skilled health care providers by 2015 as a strategy in reducing maternal mortality (UNFPA, 2008). However, only 65% of child births were attended by skilled personnel in developing countries as compared to 99% in developed countries. Sub-Saharan Africa and Asia

who bear the biggest burden of maternal deaths had 46% and 50% respectively of births attended by skilled personnel (UN, 2011).

Factors affecting use of antenatal care and skilled care during delivery can be divided into socio-economic factors, physical accessibility of the health facilities, socio-cultural factors and quality of care available in the health facilities. To address this situation there is a need for evidence based interventions to accelerate use of services so as to reduce the existing higher rates of maternal mortality in developing countries. Several interventions to increase use of maternal services have been implemented in developing countries. However the evidence of effectiveness of these interventions is not known as there has been none or little evidence through systematic review and meta- analysis to ascertain the effectiveness of these studies.

This study will add knowledge on which interventions are effective in increasing use of antenatal care and skilled care during delivery. It will also add knowledge on the variations of effectiveness between different strategies and study designs used in different intervention studies.

CHAPTER III

METHODOLOGY

3.1 Search Strategy

Systematic review was done in ***Medline***, ***PAIS International Global Health*** using search terms pairing the aspects of intervention and services, with delivery or natal, antenatal or prenatal and use or utilization. Below is a full list of search terms as they were paired during electronic search.

1. Intervention AND delivery AND services AND use
2. Intervention AND delivery AND services AND Utilization
3. Intervention AND antenatal AND services AND use
4. Intervention AND antenatal AND services AND utilization
5. Intervention AND prenatal AND services AND use
6. Intervention AND prenatal AND services AND Utilization

3.2 Types of Outcome/dependent variables

Primary outcome variables for this study are attendance to antenatal care services, and institutionalized care during delivery or attendance to skilled care during delivery**.**

3.3 Initial selection criteria

Intervention studies or evaluation of intervention studies which were done to increase use of maternal services in general were included for further screening. Restriction was done on studies done in developing countries only. There was no restriction on the year of publication or year of study. Only articles from peer reviewed journals were included in this study. There was no restriction on the language of publication although no articles published in other languages were retrieved by the search terms used.

3.4 Criteria for quality assessment

Quality of selected studies with outcomes of interest was done by considering the following criteria.

- Was the purpose stated clearly?
- Was relevant background literature reviewed?
- Was the sample described in detail
- Was there randomization of selection of participants
- Were results reported in terms of statistical significance?
- Were the conclusions appropriate considering study methods and results

3.5 Data collection.

One author did screening of retrieved articles. Searches were done in December 2012, January and February 2013. Titles and abstracts were screened to include only interventions studies or evaluation of interventions implemented to increase use of maternal services. Articles with available full articles were retrieved and selected for further analysis. Further analysis examined specifically reporting of variables of interest such as use of antenatal and delivery care.

3.6 Data entry and analysis

Data extracted from the articles was then recorded on Excel 2010 for further analysis. Extracted data included Data analysis was performed by using Comprehensive Meta-analysis software (CMA version 2). Analysis was performed with random effects model due to the fact that studies were conducted at different countries, researchers, study designs and different strategies. Data extracted and recorded on excel for further analysis were;

- Authors
- Year of publication
- Number of participants
- Country of study
- Study design
- Outcomes
- Type of intervention
- Data on the effect of the intervention (odds ratios or data from which odds ratios could be calculated)

CHAPTER IV

RESULTS

4.1 General search results

A total of 1960 articles were retrieved from Medline Global Health and PAIS International databases using a combination of search terms as listed below.

Table1 Summary of search terms by database and number of articles

Database	Search terms	Number of articles found
Medline	Intervention AND delivery AND services AND use	465
	Intervention AND delivery AND services AND Utilization	181
	Intervention AND antenatal AND services AND use	68
	Intervention AND antenatal AND services AND utilization	35
	Intervention AND prenatal AND services AND use	112
	Intervention AND prenatal AND services AND Utilization	66
Global Health	Intervention AND delivery AND services AND use	490
	Intervention AND delivery AND services AND Utilization	161
	Intervention AND antenatal AND services AND use	137
	Intervention AND antenatal AND services AND utilization	61
	Intervention AND prenatal AND services AND use	80
	Intervention AND prenatal AND services AND Utilization	33
PAIS International	Intervention AND delivery AND services AND use	38
	Intervention AND delivery AND services AND Utilization	10
	Intervention AND antenatal AND services AND use	8
	Intervention AND antenatal AND services AND utilization	5
	Intervention AND prenatal AND services AND use	5
	Intervention AND prenatal AND services AND Utilization	5

Additional searches with search terms “Intervention AND natal AND services AND use” As well as “Intervention AND natal AND services AND utilization” did not yield any additional results. Searches with the same terms in the Web of Knowledge database did not yield any results.

A total number of articles with relevant initial selection criteria were 22 articles of which three articles reported delivery without ANC, three article reported ANC only and 16 articles reported both ANC and delivery services.

Final selection of articles with relevant outcomes and reported data that could be extracted for meta-analysis excluded 6 articles which resulted in 16 articles.

Table 2 below summarizes the selected articles with authors, study country, and reported outcomes of interest.

Table 2: Summary of selected article authors, country of study, study design and reported outcomes of interest.

Article Number	**Author**	**Country**	**Study design**	**Reported outcomes of interest**
1	Bhutta et al, (2008)	Pakistan	Independent comparison groups	ANC, Delivery
2	Brazier et al, (2009)	Burkina Faso	Independent comparison groups	Delivery
3	Gennaro et al, (2002)	Uganda	pre-post comparison	ANC. Delivery
4	Hodgins et al, 2010	Nepal	Pre-Post comparison	ANC, Delivery
5	Hounton et al, (2008)	Burkina Faso	Independent comparison groups	Delivery
6	Liu et al, (2010)	China	Independent comparison groups	ANC, Delivery
7	Midhet &Becker (2010)	Pakistan	independent Comparison groups	ANC, Delivery,
8	Msyomboza et al, (2009)	Malawi	Independent comparison groups	ANC
9	Mullany et al, (2007)	Nepal	Independent comparison groups	ANC, Delivery
10	Mullany et al (2010)	Burma	pre-post comparison,	ANC, Delivery
11	Mushi et al, (2010)	Tanzania	pre-post comparison,	ANC, Delivery
12	Nguyen et al, (2012)	Bangladesh	Independent comparison groups	ANC, Delivery
13	Penfold et al, (2007)	Ghana	Pre-Post comparison	Delivery
14	Shah et al, (1993)	Multi-country*	Independent comparison groups	ANC
15	Turan et al, (2011)	Eritrea	independent comparison	ANC, Delivery
16	Zhou et al, (2012)	China	Pre-post comparison	ANC, Delivery

Multi-country*= Egypt, Senegal, Zambia

Table 3 Quality assessment

Author	Purpose clearly stated	relevant background and literature reviewed	sample size described	randomization of participants	results reported in statistical significance	conclusion appropriate as per results	study design
Bhutta et al, (2008)	yes	yes	yes	no	yes	yes	comparison groups
Brazier et al, (2009)	yes	yes	yes	no	yes	yes	comparison groups
Gennaro et al, (2002)	yes	yes	yes	no	yes	yes	pre-post comparison
Hodgins et al, 2010	yes	yes	yes	no	yes	yes	pre-post comparison
Hounton et al, (2008)	yes	yes	yes	no	yes	yes	comparison groups
Liu et al, (2010)	yes	yes	yes	yes	yes	yes	comparison groups
Midhet &Becker (2010)	yes	yes	yes	yes	yes	yes	comparison groups
Msyomboza et al,(2009)	yes	yes	yes	no	yes	yes	comparison groups
Mullany et al, (2007)	yes	yes	yes	yes	yes	yes	comparison groups
Mullany et al (2010)	es	yes	yes	no	yes	yes	pre-post comparison
Mushi et al, (2010)	es	yes	yes	no	yes	yes	pre-post comparison
Nguyen et al, (2012)	es	yes	yes	no	yes	yes	comparison groups
Penfold et al, (2007)	es	yes	yes	yes	yes	yes	pre-post comparison
Shah et al, (1993)	es	yes	yes	no	yes	yes	comparison groups
Turan et al, (2011)	yes	yes	yes	no	yes	yes	comparison groups
Zhou et al, (2012)	es	yes	yes	no	yes	yes	pre-post comparison

4.2 Delivery care services

4.2.1 General information extracted on delivery services

A total of 14 articles from the final selection were found to have reported delivery care services as the outcome of interest. However 2 articles (Liu eta al, 2010 and Mullany et al. 2010) were excluded in the analysis on the basis of reported data which was either incomplete or reported in the format that could not be extracted for inclusion in Meta-analysis. This resulted into 12 articles from 12 studies which were included for meta-analysis.

Interventions to increase uptake of delivery services were found to fall in one of the four groups;

(i) **Education, sensitization and counseling**: These interventions targeted to bridge the gap on socio-cultural factors as well as perceptions regarding risks of the condition and benefits of using skilled heath care services

(ii) **Fee exemption or cost reduction through voucher programs**: These programs aimed at reducing a burden on the costs of services and/or costs of transport to the facility

(iii) **Combination of quality of improvement and community sensitization:** Targeted to bridge the gap on quality of care, socio-cultural factors as well as perceptions regarding use of skilled care.

(iv) Combination of fee exemption and community sensitization and/counseling: These programs aimed at reducing the burden of costs of care and transport to the facility as well as social-cultural factors and perceptions regarding use of skilled care.

Table 4: Summary of author by type of intervention and targeted factor

Author and year of publication	Type of intervention and targeted factor that determine use of delivery service
Bhutta et al, (2008)	Education, sensitization and/or counseling(social-cultural factors, perceptions)
Brazier et al, (2009)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Gennaro et al, (2002)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Hodgins et al, (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Hounton et al, (2008)	Quality improvement, community sensitization
Midhet &Becker (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Mullany et al (2007)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Mushi et al, (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Nguyen et al, (2012)	Fee exemption, cost reduction or voucher program (socioeconomic factors)
Penfold et al, (2007)	Fee exemption, cost reduction or voucher program
Turan et al, (2011)	Education, sensitization and/or counseling(social-cultural factors, perceptions)
Zhou et al, (2012)	Fee exemption &community sensitization (Both economic and socio-cultural factors

4. 2.2 Data presentation and Meta-analysis

Table 4 summarizes extracted data from the articles as was reported or was calculated from the reported data. The number of women who used skilled care delivery combines those who had institutionalized care delivery and those delivered at home with an assistance of a skilled attendant.

Table 5 Summary of extracted data by author

Author and year of publication	Intervention			Control		
	skilled delivery	Non-skilled delivery	Total	skilled delivery	Non-skilled delivery	Total
Bhutta et al, (2008)	121	274	395	48	327	375
Brazier et al, (2009)	873	686	1559	710	1263	1973
Gennaro et al, (2002)	18	84	102	16	90	106
Hodgins et al, (2010)	489	1234	1723	412	1304	1716
Hounton et al, (2008)	10610	12743	23353	14363	30274	44637
Midhet &Becker (2010)	42	216	703	39	983	1022
Mullany et al (2007)	120	13	133	106	22	128
Mushi et al, (2010)	263	249	512	88	170	258
Nguyen et al, (2012)	703	401	1104	299	805	1104
Penfold et al, (2007)	1004	723	1727	632	666	1298
Turan et al, (2011)	58	66	124	31	173	204
Zhou et al, (2012)	540	82	622	234	301	535

Meta-analysis for delivery care data

Meta-analysis was performed using a random effects model on the 12 final selected studies. Random effects model was chosen by considering the fact that these studies were implemented in different areas, with different strategies and study designs therefore it was assumed that there will be multiple true effect sizes for this studies. The overall effect size for the 12 studies was found to be 2.406 (95% CI 1.847 to 3.135) and P-value <=0.001. The effect sizes ranged from 1.205 to 8.471. Figure one below represents a forest plot for the random effects model

Random Effects Weights

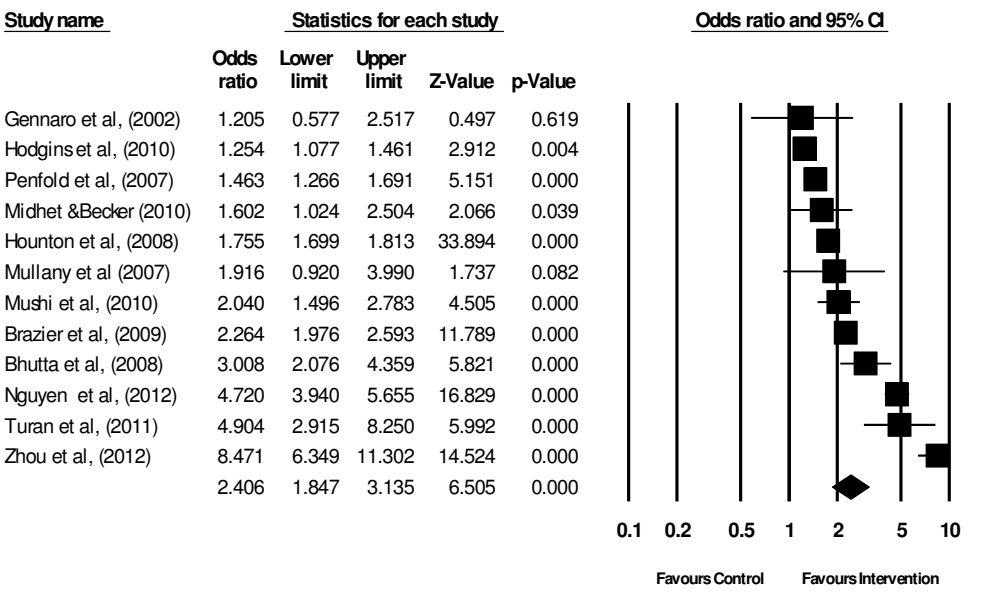

Fig 2: Forest plot for the effect sizes and overall effect size.

Heterogeneity

Heterogeneity for the effect sizes of 12 studies on use of delivery care services was found to be significantly high with Q=285.361

Degree of freedom (df) = 11

P<0.001, I-square = 96.145

Publication Bias:

Assessment of publication bias was done using a combination of funnel plot and Duval and Tweedie's Trim and fill method. Analysis was done with random effects/random effects option and It was found that overall there was no evidence of publication bias.

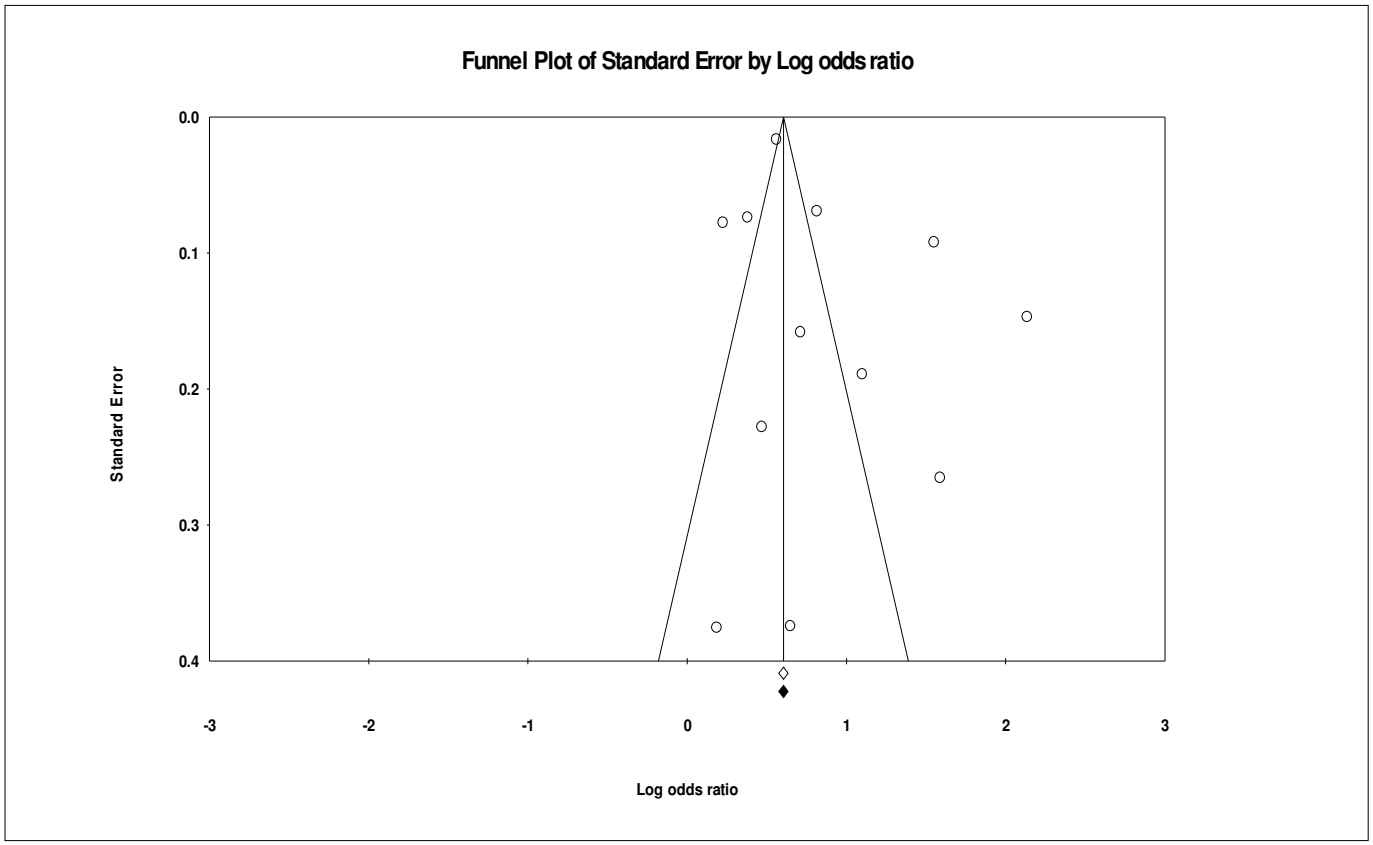

Fig: 3 Funnel plot of standard error by log risk ratios.

Subgroup analysis

Having a significantly high heterogeneity, subgroup analysis was performed to check if moderator variables could explain part or all of the observed heterogeneity. The moderator variables were *targeted outcome, study design* and *region of study*. Analysis on type of

intervention used to increase use of delivery care was not performed due to the fact that some groups did not have enough studies to perform a meaningful subgroup analysis.

(a) **Subgroup analysis with "*outcome*" as a moderator variable**.

Nine studies implemented their interventions with the aim of improving both ANC and Delivery care while 3 studies implemented their interventions with the aim of increasing delivery care only. The two groups were analyzed where the effect sized for the those implemented interventions with the aim of improving both ANC and delivery were found to have slightly higher but not significantly different effect size from those targeted only delivery care.

ANC and delivery interventions had effect size of 2.704 (95% CI 1.944 -3.762), P<=0.001, while that of delivery only had the effect size of 1.798 (95% CI 1.06-3.025), P=0.027.

The Q statistic for the difference between the two groups was found to be 1.686 with df=1 and P=0.194

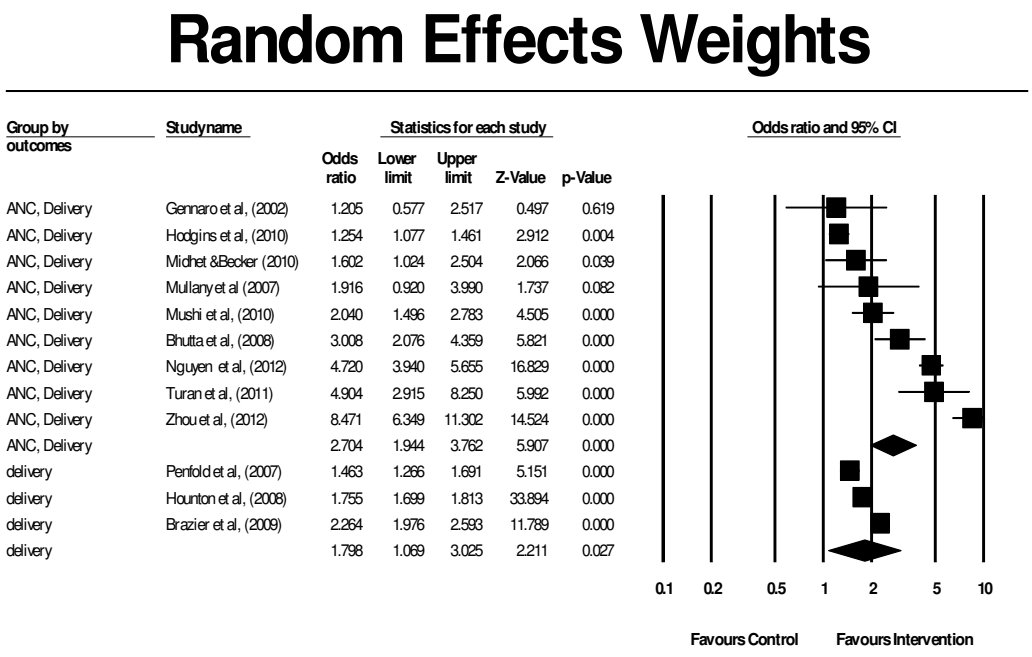

Fig 4: Forest plot for the random effects weights for the subgroups of "outcomes" as a moderator variable.

(b) Subgroup analysis for "*study design*" as a moderator variable

Seven studies implemented their interventions with unmatched comparison groups while five studies used pre-post comparison studies. Unmatched comparison groups' studies had a slightly higher but not significantly different overall effect size as compared to those with pre-post design studies.

Unmatched comparison groups effect size was 2.632 (95% CI 1.750 -3.958), P<=0.001 while pre-post design studies had the effect size of 2.120 (95% CI 1.314 -3.421), P=0.002.

The Q statistic for the difference between the two groups was 0.454, df= 1 and P=0.501

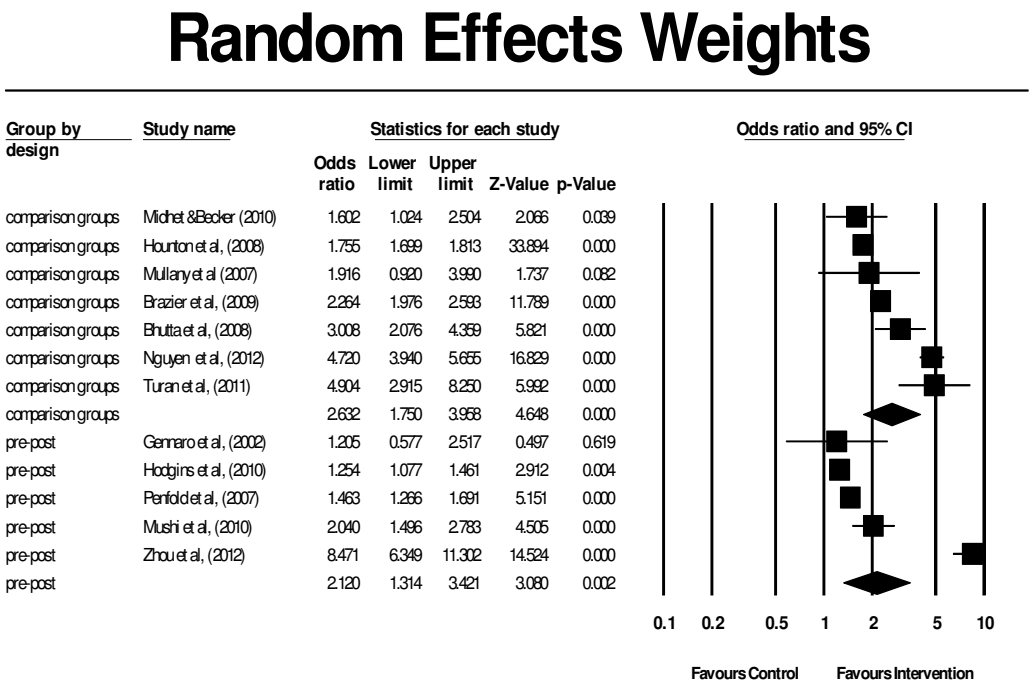

Fig 5: Forest plot for the random effects weights for the subgroups of "study design" as a moderator variable.

(a) Subgroup analysis for " region " as a moderator variable

Six studies were implemented in Africa and six studies were implemented in Asia. Subgroup analysis with region as a moderator variable showed that studies implemented in Asia had slightly higher but not significant effect size as compared to those implemented in Africa. Intervention studies implemented in Asia had overall effect size 2.812 (95% CI 1.393 – 5.675) while those implemented in Africa had the overall effect size of 1.961 (95%CI 1.620 – 2.375), Q statistic =0.943, P= 0.332.

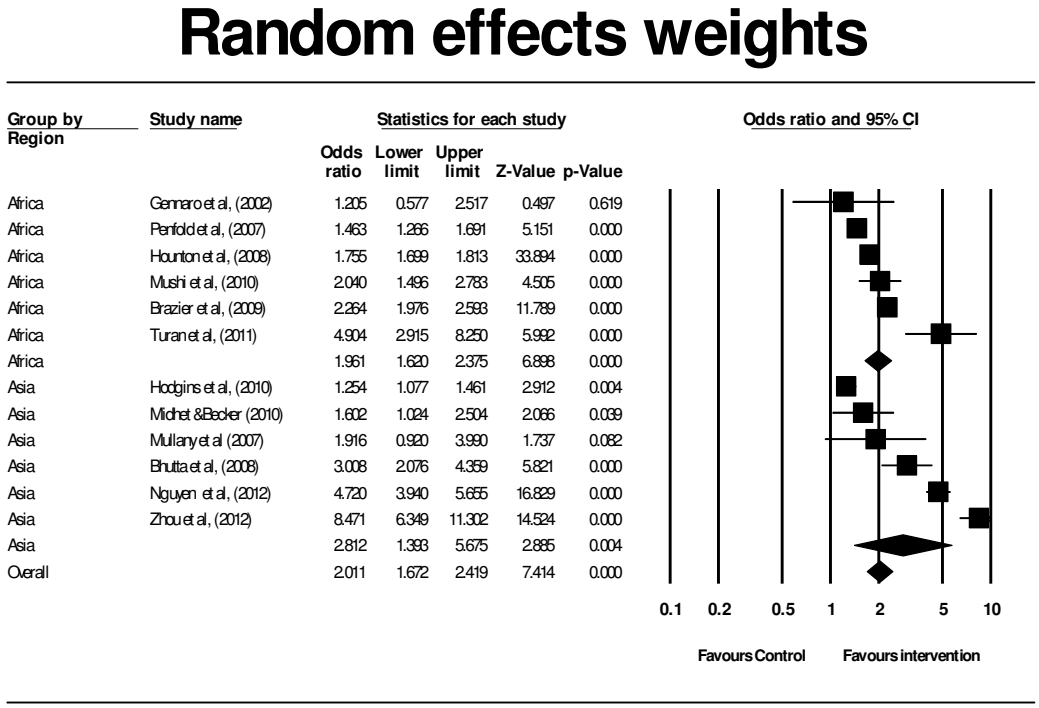

Fig 6: Forest plot for subgroup analysis with "region " as a moderator variable

4.3 Antenatal care services

4.3.1 General information from ANC studies

A total of 13 articles were found to have reported use of ANC services as the outcome of interest. Interventions to increase uptake of ANC services were found to fall in one of the four groups of type of intervention applied.

(v) **Education, sensitization and counseling**. These interventions targeted to bridge the gap on Socio-cultural factors as well as perceptions regarding risks of the condition and benefits of using skilled heath care services

(vi) **Fee exemption or cost reduction through voucher programs**; These programs aimed at reducing a burden on the costs of services and/or costs of transport to the facility

(vii) **A combination of Education, sensitization, counseling and fee exemption or cost reduction through voucher programs.**

(viii) **Combination of quality of improvement and fee exemption or cost reduction;** these programs targeted to bridge the gap on quality of care as well socioeconomic factors.

Table 6 gives a summary of selected studies with strategies used to increase use of antenatal care and a targeted factor that determine uptake of care.

Table 6 Summary of authors and type of intervention with a targeted factor

Author	Type of intervention and targeted factor that determine
Bhutta et al, (2008)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Gennaro et al, (2002)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Hodgins et al, 2010	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Liu et al, (2010)	subsidize for delivery costs, quality of care improvement(Both economic and Quality of care)
Midhet &Becker (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Msyomboza et al, 2009)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Mullany et al (2007)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Mullany et al (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Mushi et al, (2010)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Nguyen et al, (2012)	Fee exemption, cost reduction or voucher program (socioeconomic factors)
Shah et al, 1993	Home Based Maternal Records (HBMR) (social-cultural factors, perceptions)
Turan et al, (2011)	Education, sensitization and/or counseling (social-cultural factors, perceptions)
Zhou et al, (2012)	Fee exemption &community sensitization (Both economic and socio-cultural factors

4.3.2 Data presentation and meta-analysis.

The World Health Organization (WHO) guideline on the recommended number of ANC visits is greater than or equal to four visits, therefore data for ANC was extracted from articles that reported use of ANC >=4, However it was also found that most articles reported uptake of ANC

as “ANY” number of visits for ANC (That is to say any ANC visits >=1) or both. It was found that three articles reported data for both ANC visits >=1 and ANC visits >=4. Three articles reported ANC visits>= 4 only and seven articles reported ANC visits >= 1 only. Table 7 gives a summary of the selected articles and the number of visits reported.

Table 7 summaries of authors and reported number of visits

Author	ANC>=4 visits	**ANC<1visits**
Bhutta et al, (2008)	**No**	**yes**
Gennaro et al, (2002)	**No**	**yes**
Hodgins et al, 2010	**No**	**yes**
Liu et al, (2010)	**No**	**yes**
Midhet &Becker (2010)	**yes**	**No**
Msyomboza et al, 2009)	**No**	**yes**
Mullany et al (2007)	**yes**	**yes**
Mullany et al (2010)	**yes**	**No**
Mushi et al, (2010)	**yes**	**No**
Nguyen et al, (2012)	**No**	**yes**
Shah et al, 1993	**No**	**yes**
Turan et al, (2011)	**yes**	**yes**
Zhou et al, (2012)	**yes**	**yes**

Table 8 gives a summary of data on ANC>= 1 from ten articles reported data for ANC>=1 or both ANC>=1 and ANC>=4.

Table 8: Data for intervention and control groups on ANC>=1

Study name	Intervention			Control					
	ANC >=1	No ANC visits	Total	ANC>=1	No ANC visit	Total	Strategy	Study design	outcomes
Bhutta et al, (2008)	313	82	395	247	128	375	A*	comparison groups	ANC,Delivery
Gennaro et al, (2002)	88	7	95	94	6	100	A*	pre-post	ANC,Delivery
Hodgins et al, 2010	1554	186	1740	1336	404	1740	A*	pre-post	ANC,Delivery
Liu et al, (2010)	2991	52	3043	6629	108	6737	BC*	comparison groups	ANC
Msyomboza et al, 2009)	586	302	888	831	64	895	A*		ANC
Mullany et al (2010)	1099	432	1531	885	1367	2252	A*	pre-post	ANC,Delivery
Nguyen et al, (2012)	1011	93	1104	835	269	1104	B*	comparison groups	ANC,Delivery
Shah et al, (1993)	936	216	1152	472	993	1465	A*	comparison groups	ANC
Turan et al, (2011)	128	1	129	226	23	249	A*	comparison groups	ANC,Delivery
Zhou et al, (2012)	615	7	622	433	121	554	AB*	pre-post	ANC,Delivery

A*=Education, sensitization and/or counseling (social-cultural factors, perceptions), B*= Fee exemption, cost reduction or voucher program (socioeconomic factors), AB*= Fee exemption &community sensitization (Both economic and socio-cultural factors, BC=subsidize for delivery costs, quality of care improvement (Both economic and Quality of care)

Meta-analysis results for ANC visits >=1

Meta-analysis was performed using random effects weights for ten studies which reported ANC>=1 as the outcome variable. Articles which reported both ANC>=1 and ANC>=4, data for ANC>=1 was taken for this analysis.

Results from a random effects model shows that the overall effect size is 2.548 (95%CI 1.207-5.382), P=0.014. The overall effect size ranged from 0.149 to 24.552. Fig 7 below shows a forest plot for the random effect weights on the 10 studies.

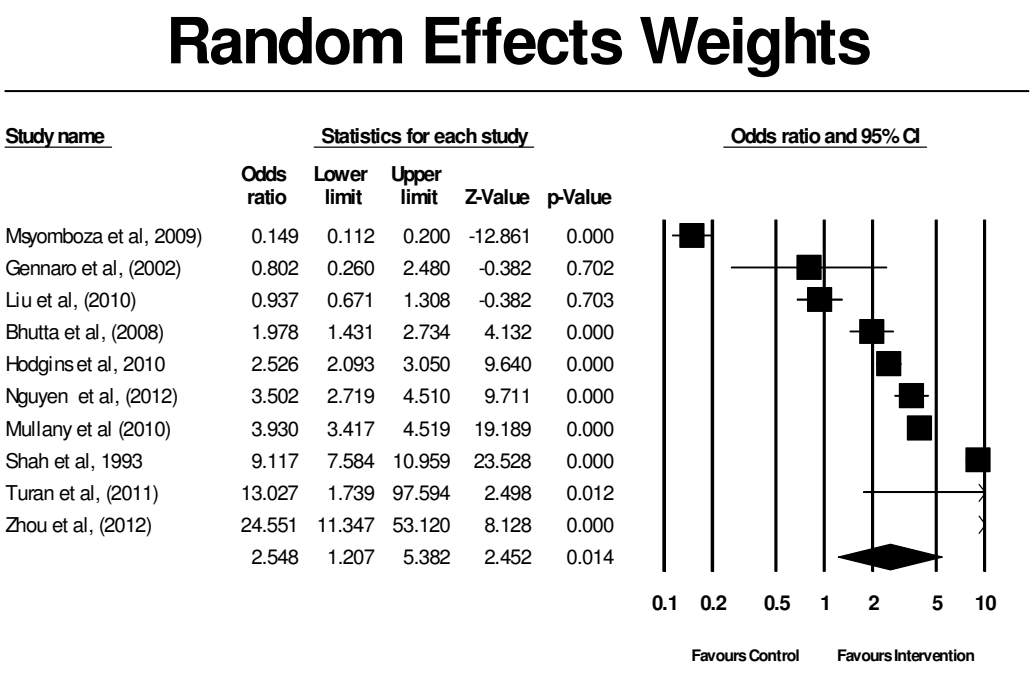

Fig 7: Forest plot for random effects weights on ANC>=1

Heterogeneity

Heterogeneity was found to be substantially high with Q statistic = 659.426, degree of freedom (df) = 9, P<001 and I-square=98.635.

Publication bias

Assessment of publication bias was done using Duval and Tweedie's Trim and fill method. It was found that overall there was some evidence of publication bias. Adjusting the effect size by publication bias resulted to one study trimmed and the overall effect size reduced slightly from the observed effect size of 2.548 (95% CI 1.207 -5.38) to an adjusted effects size of 1.9971 (95%CI 0.9578-4.1638). Fig 8 below shows the funnel plot of standard error by log odds ratios for the 10 studies and their observed and adjusted effect sizes.

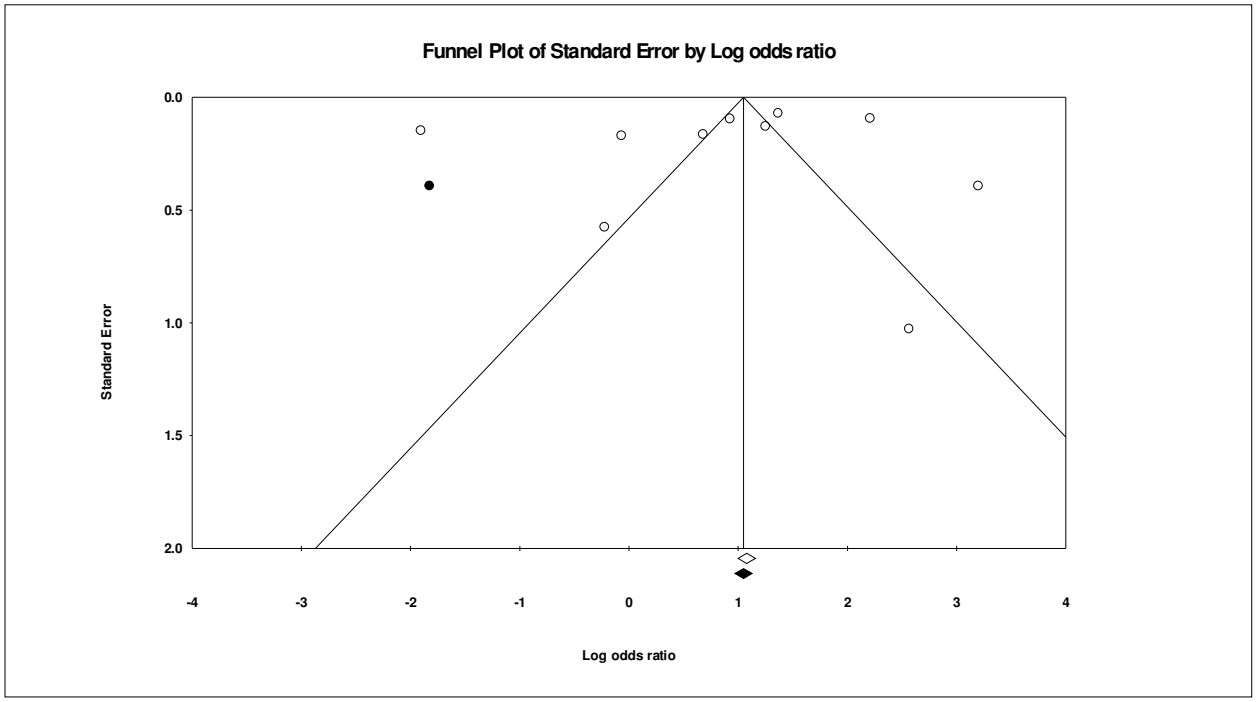

Fig 8: Funnel plot of standard error by log odds ratios

Subgroup analysis

Having a substantially high heterogeneity, subgroup analysis was performed to check if moderator variables could explain part or all of the heterogeneity. The moderator variables were targeted outcome, study design used and region of study. Strategy used was excluded in subgroup analysis due to the fact that some groups did not have enough number of studies to have a meaningful subgroup analysis.

(a) **Subgroup analysis with "*outcomes*" as moderator variable**

Three studies implemented their studies to increase use of ANC only as the variable of interest while seven studies implemented their interventions with the aim of increasing use of both ANC and delivery care. Results from subgroup analysis on the outcome of interest variable show that the effect size on the use of ANC services for studies that aimed at increasing uptake of both ANC and delivery care was slightly but not significantly higher than those aimed at increasing ANC only.

Effect size for ANC only= 1.091 (95% CI 0.254 - 4.679)

Effect size for ANC and delivery interventions= 3.839 (95%CI 1.416 - 10.404)

Q statistic for the difference between the two groups was 1.92 with degree of freedom (df) =1 and P=0.162. Figure seven below is a forest plot for region as a moderator variable

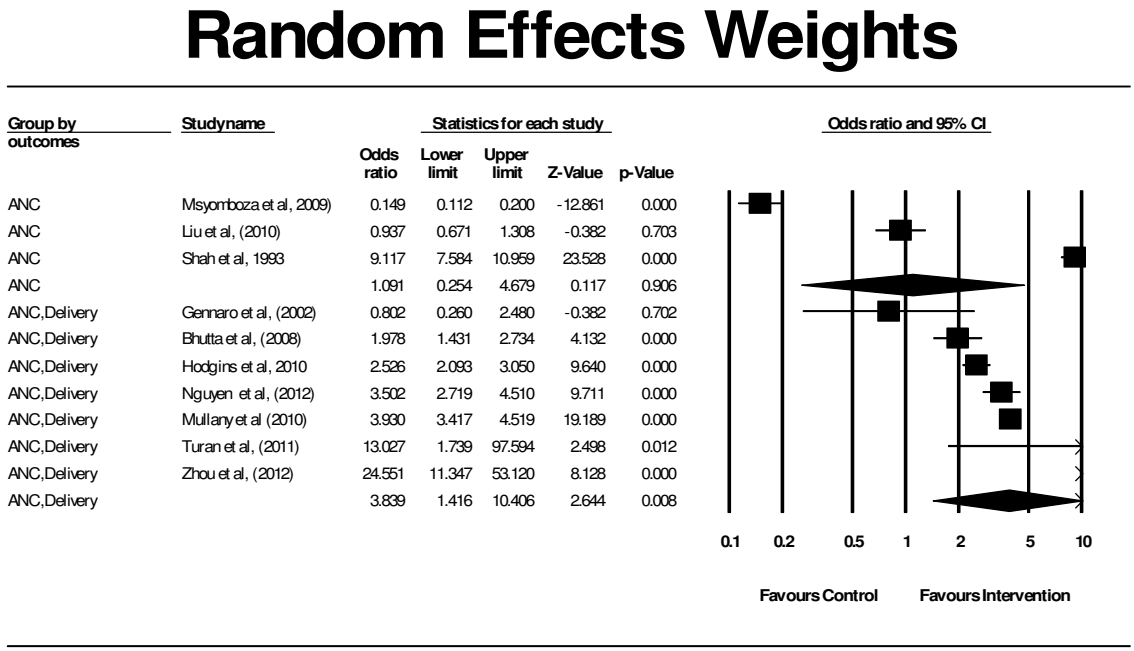

Fig 9: Forest plot for subgroup analysis with "outcomes" as a moderator variable

(b) **Subgroup analysis with "*study design*" as a moderator variable**

Four studies designed the interventions as pre-post designs while six studies did comparison groups design. Results from subgroup analysis for study design as a moderator variable show that studies with pre-post design had slightly higher but not significant overall effect size as compared to those with comparison groups. Overall effect size for pre-post interventions = 3.837 (95% CI 1.023 - 14.383) and that of comparison groups interventions =1.965 (95% CI 0.664 - 5.816).

The Q statistic for the difference between the two groups was 0.588, degree of freedom (df) = 1 and P=0.443.

Forest plot below shows a summary statistics and overall effects sizes for the subgroups on random effects weights performed on 10 studies.

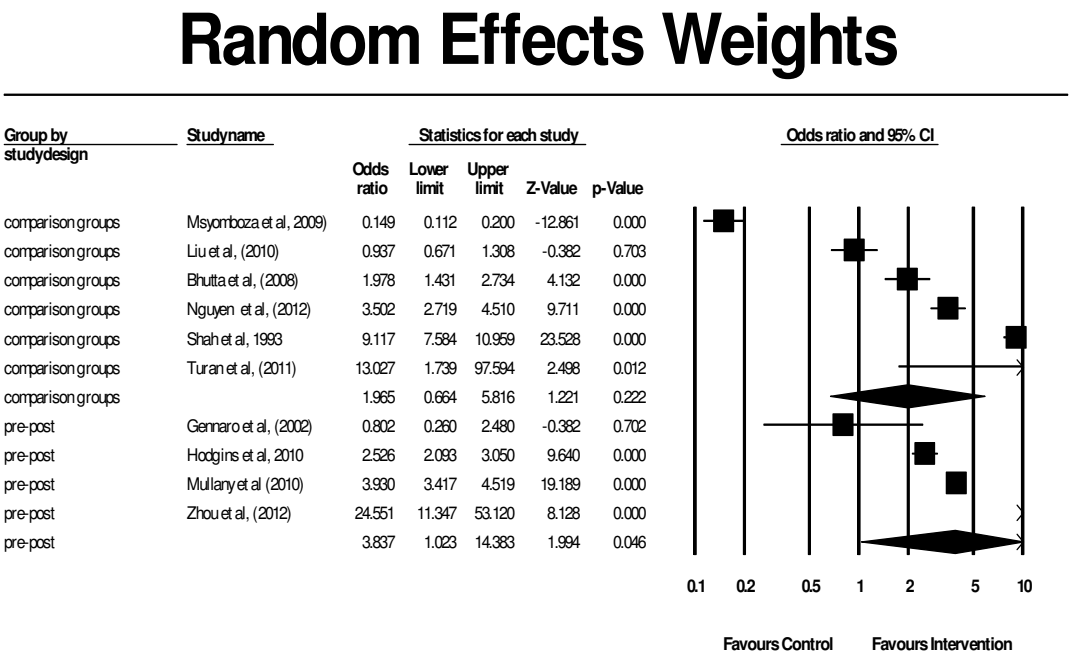

Fig 10: Forest plot for subgroup analysis with "study design" as a moderator variable

(c) Subgroup analysis with *region of study* as a moderator variable

Four studies were implemented in Africa and six studies were implemented in Asia. Subgroup analysis with region of study as a moderator variable shows that studies implemented in Asia had slightly but not significant higher effect size as compared to those implemented in Africa. Q= 0.129 df =1 and P= 0.719. Figure 11 below is a forest plot for region as a moderator variable.

Random effects weights

Group by REGION	Studyname	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Africa	Msyamboza et al, 2009)	0.149	0.112	0.200	-12.861	0.000
Africa	Gennaro et al, (2002)	0.802	0.260	2.480	-0.382	0.702
Africa	Shah et al, 1993	9.117	7.584	10.959	23.528	0.000
Africa	Turan et al, (2011)	13.027	1.739	97.594	2.498	0.012
Africa		1.851	0.114	30.134	0.432	0.665
Asia	Liu et al, (2010)	0.937	0.671	1.308	-0.382	0.703
Asia	Bhutta et al, (2008)	1.978	1.431	2.734	4.132	0.000
Asia	Hodgins et al, 2010	2.526	2.093	3.050	9.640	0.000
Asia	Nguyen et al, (2012)	3.502	2.719	4.510	9.711	0.000
Asia	Mullany et al (2010)	3.930	3.417	4.519	19.189	0.000
Asia	Zhou et al, (2012)	24.551	11.347	53.120	8.128	0.000
Asia		3.109	1.953	4.949	4.782	0.000
Overall		3.066	1.938	4.850	4.788	0.000

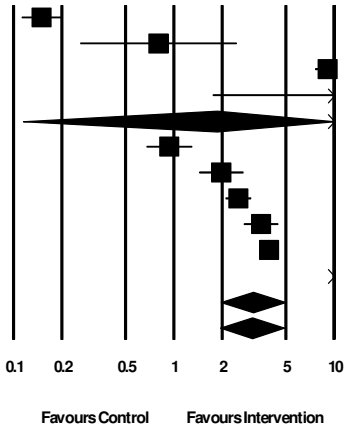

Fig 11: Forest plot for subgroup analysis with "region " as a moderator variable

Analysis for ANC visits >=4

Six studies reported data for ANC visits >=4 which is a WHO guideline for the number of ANC visits for women with no complications and do not need extra care. Table 9 below summarizes data on ANC visits>=4 for the six studies.

Table 9 A summary of data for ANC visits >=4

Study name	Intervention			Control					
	ANC >=4	ANC<4	Total	ANC>=4	ANC<4	Total	Strategy	Study design	outcomes
Midhet &Becker (2010)	107	303	410	111	511	622	A*	comparison groups	ANC, Delivery
Mullany et al (2010)	527	1004	1531	376	1876	2252	A*	pre-post	ANC, Delivery
Mullany et al (2007)	114	19	133	112	16	128	A*	comparison groups	ANC, Delivery
Mushi et al, (2010)	37	35	72	27	37	64	A*	pre-post	ANC, Delivery
Turan et al, (2011)	101	28	129	117	132	249	A*	comparison groups	ANC, Delivery
Zhou et al, (2012)	435	180	615	98	335	433	AB*	pre-post	ANC, Delivery

A*=used one or a combination of education, sensitization and/or counseling (social-cultural factors, perceptions), AB*= Fee exemption &community sensitization (Both economic and socio-cultural factors.

Meta-analysis results for ANC>= 4

Meta- analysis for the six studies on ANC>= 4 was performed using random effects model. Results from a meta-analysis shows that the overall effect size for the 6 studies was 2.476 (95% CI 1. 398 - 4.384), p=0.002. The effect sizes ranges from 0.857 to 8.261. Forest plot below (Figure 12) summarizes the statistics for each study and the overall effect size under random effects weights.

Heterogeneity

A substantial amount of heterogeneity was observed between studies where a Q statistic was 85.037, df= 5 and P<0.001, I-square= 94.12

Random effects weights

[Study name]	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Mullany et al (2007)	0.857	0.420	1.751	-0.423	0.672
Mushi et al, (2010)	1.449	0.735	2.854	1.071	0.284
Midhet &Becker (2010)	1.626	1.203	2.197	3.162	0.002
Mullany et al (2010)	2.619	2.248	3.052	12.341	0.000
Turan et al, (2011)	4.070	2.501	6.623	5.649	0.000
Zhou et al, (2012)	8.261	6.217	10.978	14.556	0.000
	2.476	1.398	4.384	3.110	0.002

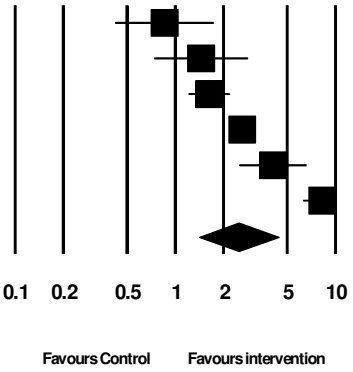

Fig 12: Forest plot for subgroup analysis with "region " as a moderator variable

Publication bias

Assessment of publication bias was done using a combination of funnel plot and Duval and Tweedie's trim and fill method. It was found that there was no evidence of publication bias for this group of studies. Figure 13 below shows a funnel plot of standard error by log odds ratio for ANC>=4 interventions

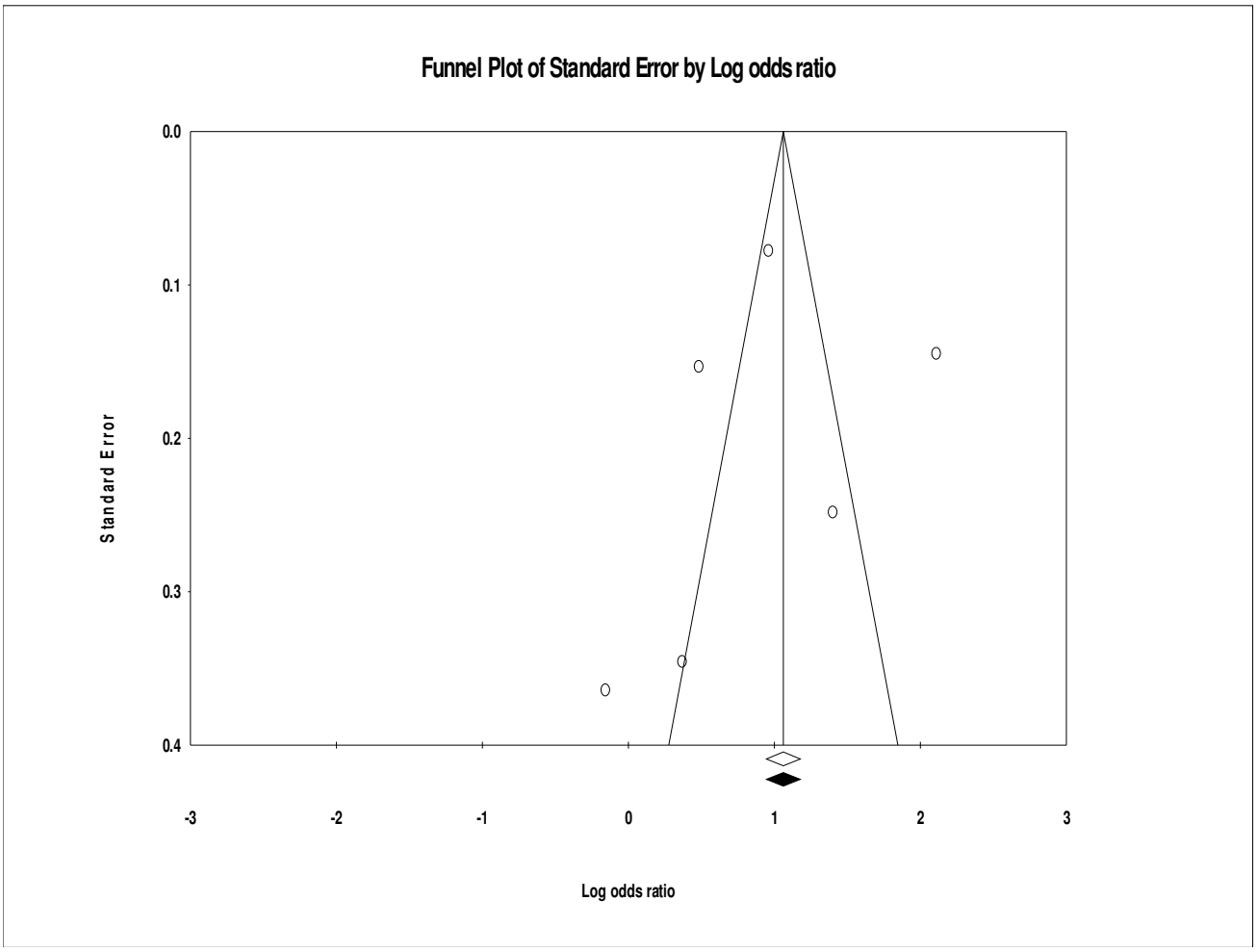

Fig 13 Funnel plot of standard error by log odds ratio for ANC>=4 interventions

Subgroup analysis

Due to heterogeneity being substantially high, subgroup analysis was performed to check if a moderator variable could explain part or all the existing heterogeneity. For this group of studies only “study design” was taken and analyzed as a moderator variable. Due to the fact that all articles reported ANC and delivery services as their outcomes of interest; “outcomes” was excluded as moderator variable. The same case is for “strategies” where only one study applied strategies targeted to reduce the effect of both economic and social-cultural factors which affect use of maternal care.

Subgroup analysis with study design as a moderator variable was performed where three studies applied pre-post intervention studies while three studies applied comparison groups’ intervention studies. Results show that pre-post intervention studies had slightly higher effect size as compared to studies with comparison groups.

Pre-post studies had effect size was 3.277(95%CI 1.377 - 7.797) P=0.007 while for comparison group studies effect size was 1. 826 (95%CI 0.754 - 4.425), P=0.182. The Q statistic for the difference between the two groups was 0.855, df= 1 and P=0.355.

Figure 14 below summarizes the effect sizes for the random effect weights and statistics for each group.

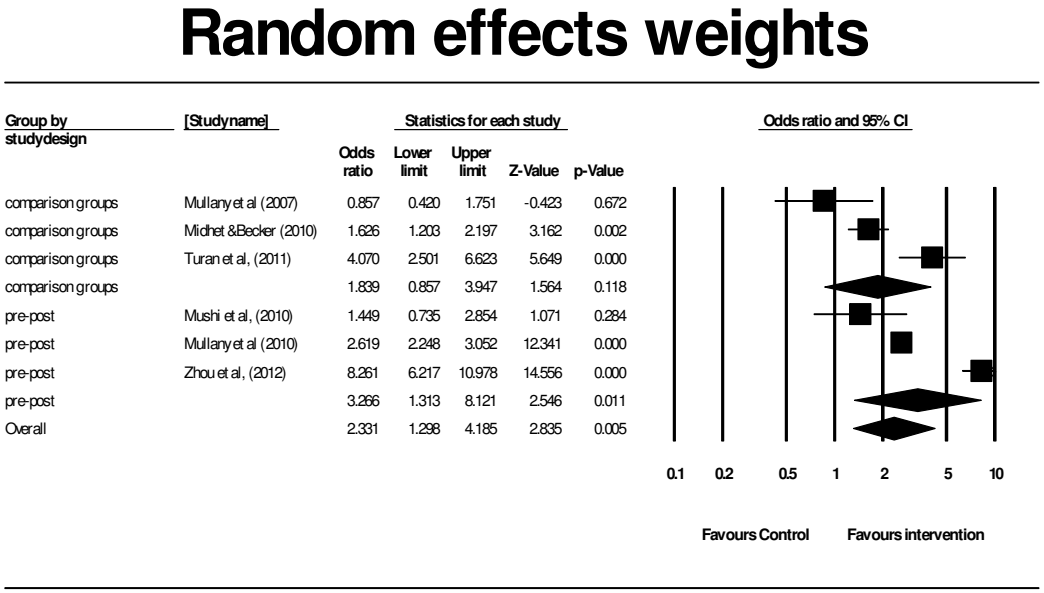

Fig 14: Forest plot for subgroup analysis with "region " as a moderator variable

4.4 Discussion of results

Delivery care

A total of 12 articles which reported delivery as one of the outcomes of interest were used for meta-analysis of which three studies reported studies which were implemented with the aim of increasing delivery only while nine articles reported both delivery and ANC. Results from meta-analysis shows that studies done to improve use of both ANC and delivery care services had a slightly but not significant higher effect size for the use of delivery care services. This is in consistence with literature which shows that use of ANC increases use of delivery care services (Bloom et al, 1999)

It was also found that studies employed one or a combination of types of intervention such (a) education, sensitization and counseling (b) Fee exemption or cost reduction through voucher programs (c) Quality improvement and community sensitization (d) fee exemption and community sensitization/counseling. These interventions aimed at one or more among the factors known to affect use of maternal services in developing countries. These factors are socio-cultural beliefs, perceptions regarding risks of the condition and beliefs of using skilled care services, socioeconomic status and physical accessibility as well as quality of care (Kowaleski et al. 2000, Thaddeus & Maine, 1994. Griffith &Stephenson 2001, Kandeh et al. 1997,Say& Raine, 2007). It was also found that seven studies employed unmatched comparison groups while 5 studies used pre-post comparison design.

Findings from Meta-analysis shows that; overall effect size for delivery care articles was 2.406 (95%CI 1.847 to 3.135) P<0.001. However heterogeneity between studies was found to be substantially high with Q statistic 285.361, degree of freedom (df) =11 and P<0.001. Publication bias assessment revealed that there was no evidence of publication bias.

Having substantially high heterogeneity subgroup analysis was done on moderator variables to check if they could explain part or all of the existing heterogeneity among studies. Moderator variables assessed were *"outcome*s" (delivery only or delivery and ANC), "*study design*" (pre-post comparison design or control groups comparison design) and a "*region of study*. Results from subgroup analysis shows that there was no significant difference in the effect sizes of the subgroups with "*outcomes"* as a moderator variable which indicates that although studies with both delivery and ANC had slightly higher overall effect size, the difference was not significant therefore the types of "*outcomes*" targeted did not contribute to the existing heterogeneity. The same case is for study design which shows that studies with pre-post design had slightly higher effect size than those with comparison groups, the difference was not significant which also indicated that differences in study design did not contribute to the existing heterogeneity. Subgroup analysis with "region" as a moderator variable resulted into the same trend where there was no significant difference between effect sizes for the subgroups. Subgroup analysis with for "type of intervention" as a moderator variable could not be performed due to the fact that some of the groups did not have enough studies for a meaningful analysis.

Antenatal Care (ANC)

A total of 13 studies on ANC were found and meet criteria for inclusion in meta-analysis of which three studies aimed at improving ANC services use while ten studies were implemented with the aim of improving both ANC and Delivery care. It was further found that although WHO recommends four or greater number of ANC visits, some of the articles (seven articles) did not report results for ANC>=4 instead they reported results for any number of ANC visits >=1. The three articles which reported results for ANC>=4 also reported results for ANC >=1 and therefore they were included in both analysis for ANC>=1 and for ANC>=4.

ANC Visits >=1 visits

Ten articles were included in the analysis for this category where the overall effect size was found to be 2.548 with 95%CI (1.207-5.382), P=0.014. The overall effect size ranged from 0.149 to 24.552. However Heterogeneity was substantially high which led to subgroup analysis on moderator variable such as “outcomes”, “study design and region of study”.

Analysis for outcome as a moderator variable indicated that studies which aimed at increasing uptake of both ANC and delivery care had slightly higher but not significant effect size (P=0.162). This indicates that differences in the outcomes of interest did not contribute to the observed heterogeneity. The same case was observed for “study design” as a moderator variable where studies with pre-post design had a slightly higher effect size as compared to studies with comparison group design. However the difference was not significant (P=0.443) which indicates that the differences in study design did not contribute to the observed heterogeneity.

ANC visits >=4

Six articles were included in the analysis for this category where the overall effect size was 2.476 (95% CI 1. 398 -4.384), p=0.002. Heterogeneity was found to be substantially high therefore subgroup analysis was performed on study design to find out where the differences in study designs accounted for the existing heterogeneity. All studies reported ANC and delivery as the outcomes of interest therefore there were no groups for analysis with outcomes as a moderator variable. The same case is for strategies where some groups had only one article therefore there subgroup analysis were not performed.

Results from subgroup analysis with study design shows that studies with pre-post design had slightly but not significant higher overall effect size as compared to those with comparison groups design (P=0.355).

Overall it can be concluded that interventions to increase use of maternal care (ANC and delivery care) resulted into a significant increase in the uptake of services. However there is a substantially high heterogeneity between studies and the evidence of moderator variables to have accounted for the variability could not be found probably due to lack of sufficient statistical power resulted from a small number of studies in the subgroups.

CHAPTER V

Conclusion and recommendations

5.1 Conclusion

Results of this analysis shows that intervention studies implemented to increase use of maternal services increased use of such services significantly. However there was a significant heterogeneity between studies and subgroup analysis with moderator variables could not show evidence of such variables to have contributed to the observed heterogeneity. Lack of evidence of moderator variables to have contributed to the variation between studies could be due to low statistical power resulted from a small number of studies and lack of enough studies in some of the subgroups which could not allow rigorous analysis.

5.2 Limitations of study

A systematic review for this study was conducted by only one person; this might have lead into bias in the identification and selection of studies to be included in the analysis.

5.3 Authors recommendations

Following results of this study, I recommend interventions to increase use of maternal services to be implemented more so as to increase use of services and subsequently reduce maternal deaths in developing countries. A combination of strategies could be used to increase use of maternal services because use of maternal services is a complex phenomenon which is affected by multiple factors.

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