Thesis for doctoral degree (Ph.D.) 2011

Utilization of Preventive Maternal and Child Public Health interventions in Sub-Saharan Africa: a Multilevel Analysis of Individual and Small-Area Socio-economic Disadvantage

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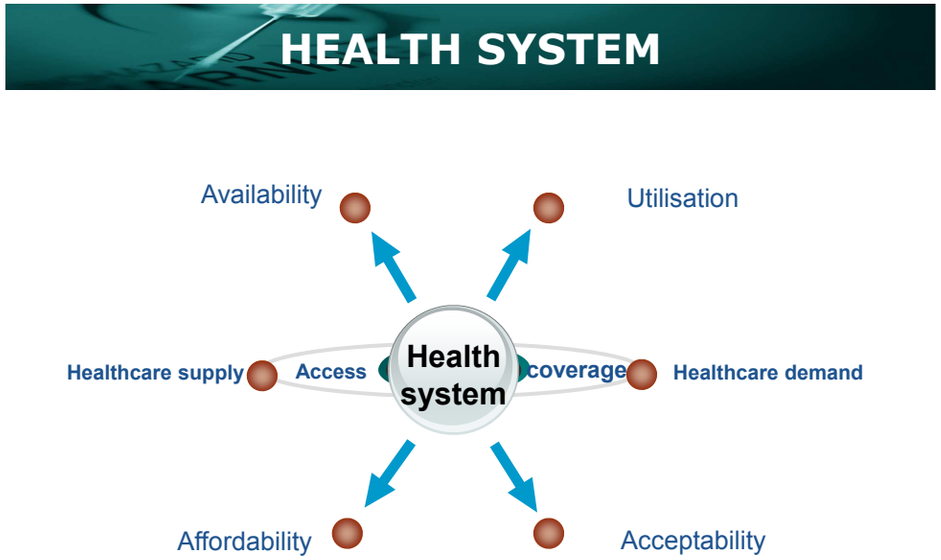

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"…..A world that is not advancing towards the millennium development goals-a world mired in the deprivation of hunger, the prevalence of disease and the despair of poverty-will not be a world at peace"

former UN Secretary General- Kofi Annan 2003

ABSTRACT

Background: Uptake of programmatic maternal and childhood preventive interventions continue to be sub-optimal in sub-Saharan Africa with wide variations within and across the countries. There is evidence suggestive of socioeconomic inequities in access to and coverage of preventive health intervention. In the context of maternal and child health (MCH) in sub-Saharan Africa, women and children among the poor are more disadvantaged in terms of access to life saving preventive interventions. In other words, MCH is likely to show inequities in utilization. While this is true, a distinction between social economic disadvantage at the individual and community level in relation to care utilization is so far under studied in sub-Saharan Africa. Such distinction is important to inform at which level/levels public health policy towards improving care utilization should be directed.

Aims: This thesis examined the influence of individual measures of socio-economic indicators and neighborhood socioeconomic disadvantage on uptake of preventive maternal and childhood health care intervention in sub-Saharan Africa.

Methods: Retrospective analysis was performed using data from several rounds of Demographic and Health Surveys (DHS) conducted during 2003 - 2008 in sub-Saharan Africa. Multilevel-modelling **(studies I& IV**)-and Multilevel discrete choice analytical techniques **(studies II&III)** were applied on various individual indicators of SES such as occupation, education, health insurance coverage and household wealth to understand their association with maternal and child programmatic preventive intervention uptake.
Also, measure of neighbourhood socio-economic disadvantage was estimated based on an index which comprised a percentage of respondents who were unemployed or not working, and living below 20^{th} percentile of the wealth index; those that are resident of rural areas were also computed, and used in the analysis.

Results Uptake of preventive maternal and child healthcare intervention were marked with inequities. Three out of five measure of individual socio-economic status were associated with choice of appropriate treatment for childhood diarrhoea management, while high level of neighbourhood socio-economic disadvantage was associated with choice of in appropriate treatment option (study 1). Access to preventive life saving public health interventions i.e. Vitamin A capsule were associated with higher level of neighbourhood socio-economic disadvantage and four measure of individual socio-economic position. In addition, geographic location also contributed largely to high level of inequities observed (Study II). In study III, community attended antenatal care from physician, high level of neighbourhood socio-economic disadvantage, partner's education; partner's occupation, women's education and occupation were the determinants of socio-economic inequities in obstetrics care utilization. The choice of facility based delivery; either public or private were associated with all the measures of individual level socio-economic status relative to home delivery. However, higher neighbourhood socio-economic disadvantage was only associated with choice of home delivery for child birth but not government health facilities (study IV). No associations were seen between choices of private facilities relative to home delivery.

Conclusion: The results show that among women and children in sub-Saharan Africa, socioeconomic position is an important determinant of access to and uptake of preventive intervention. Specifically, individual measure of socioeconomic position such as education, occupation and in some cases household wealth status contributes to inequities in uptake of preventive intervention. In addition, socioeconomic characteristic of the neighbourhood where women and children live may constitute a major disadvantage. In summary, there is need to acknowledge the relevance of socioeconomic factors both at the individual and community level in developing strategies aimed at scaling up both community and facility based preventive intervention. Specifically more attention should be given to demand side mechanisms aimed at reducing catastrophic spending on access to live saving interventions for the disadvantaged. The findings from these studies may serve as a means to open up the need to targeting preventive health intervention at the economically disadvantaged group at the community level as demand for highly innovative intervention begin to surge.

LIST OF PUBLICATIONS

I. **AREMU, O**., LAWOKO, S. & DALAL, K. 2010. Childhood vitamin A capsule supplementation coverage in Nigeria: a multilevel analysis of geographic and socioeconomic inequities. ScientificWorldJournal, 10**,** 1901-14.

II. **AREMU, O.,** LAWOKO, S., MORADI, T. & DALAL, K. 2011. Socio-economic determinants in selecting childhood diarrhoea treatment options in Sub-Saharan Africa: a multilevel model. Ital J Pediatr, 37**,** 13.

III. **AREMU, O.,** LAWOKO, S. & DALAL, K. 2011. Neighbourhood socioeconomic disadvantage, individual wealth status and patterns of delivery care utilization in Nigeria: a multilevel discrete choice analysis. Int J Womens Health, 3**,** 167-74.

IV. **AREMU, O.,** LAWOKO, S. & DALAL, K. The influence of individual and contextual socioeconomic status on obstetric care utilization in Democratic Republic of the Congo: a population based study.(SUBMITTED)

CONTENTS

LIST OF ABBREVIATIONS

AIDs	Acquired Immune Deficiency Syndrom
CI	Confidence Interval
CHEWs	Community Health Extension Workers
DSF	Demand side Financing
DRC	Democratic Republic of Congo
DHS	Demography and Health Surveys
HIPC	Highly Indebted Poor Country
HIV	Human Immunodeficiency Virus
ICC	Inter-class correlation
LMICs	Low-and-Middle income countries
MDGs	Millennium Development Goals.
OOP	Out-of-Pocket Expenses
ORT	Oral Rehydration Therapy
OR	Odd Ratio
PCA	Principal Component Analysis
PSU	Primary Sampling Units
SE	Standard Error
SES	Socio-economic status
SEP	Socio-economic Position
SSA	Sub-Saharan Africa
WHO	World Health Organization
VAC	Vitamin A Capsule
VAS	Vitamin A supplement

1 INTRODUCTION

High income countries have continued to witness a sustained improvement in human development partly due to remarkable decline in childhood mortality and rare occurrence of maternal deaths. Most childhood deaths in those countries are now related to causes such as injuries, chronic health conditions and congenital abnormalities[1-3]. The situation however, in most low-and-middle income countries (LMICs) and in sub-Saharan Africa (SSA) in particular, has remained static with an estimated 4.4 million children-including 1.2 million newborns-and 265,000 mothers dying yearly[4-6]. This high death toll can be attributed to six main challenges, which includes pregnancy and childbirth complications, newborn illness, childhood infections, malnutrition, poverty and HIV/AIDS [6-9 10 11 12],all of which depict the shameful failure of human development in LMICs as a whole[13]. The year 2000, envisaged renewal of global commitments to improve maternal and child health outcome with the adoption of Millennium Development Goals (MDGs) 4 and 5 for maternal and child health. The MDG 4 aimed at reducing under five mortality by two-thirds, and Goal 5 targets reduction of the maternal mortality ratio by three-quarters and universal access to reproductive health services by the year 2015[5 14].

In keeping with actualizing these ambitious promises, efforts were intensified to achieve universal coverage of several programmatic curative and preventive interventions. Cost-effective interventions with demonstrated effectiveness such as childhood immunization, Vitamin A supplementation, oral rehydration therapy (ORT), Zinc tablet, insecticidal treated nets, Magnesium sulphate, skilled attendance at birth for all deliveries, antenatal care and access to emergency obstetric care were all accorded priorities (see fig 1)[13 15 16]. Despite the existence of these domains of preventive interventions which potentially could halve the over 4.4 million deaths in children aged-five and below and reduced maternal mortality and morbidity in SSA in the last decade; there has not been an appreciable progress[2 17]. Many more women and children are not benefiting from these interventions. Consequently large variations both within and across countries continue to persist[18 5 15 16 19-25]. If this trend is not reversed, it would be improbable for most countries in SSA to meet targets of the two critical goals of MDGs[22].

A number of empirical studies have been undertaken to examine factors associated with low uptake of these preventive interventions. Socioeconomic factors including poverty in the region, consistently features as the main reason for disparities in use of the interventions[19 16 20 26 27 28]. Although there have been concerted efforts to improve on the supply-side so as to enable the scaling up and achieve universal coverage, such coverage remains low[19 29 30]. Despite this shortcoming in coverage evidence is not burgeoning on how demand barriers at the community level may prevent uptake of those interventions. The key mechanism to universal coverage lies in reaching the poor and the disadvantaged segment of the communities[31]. Reaching the vulnerable and the most disadvantaged people in the community requires thorough understanding of the characteristics of the neighbourhood. Composition of population around the neighbourhood has been found to be a key determinant of access to care, human health and health outcome; as they shape individual life opportunities [32-34] . This thesis examined both individual and area-level socioeconomic characteristics and their roles in uptake

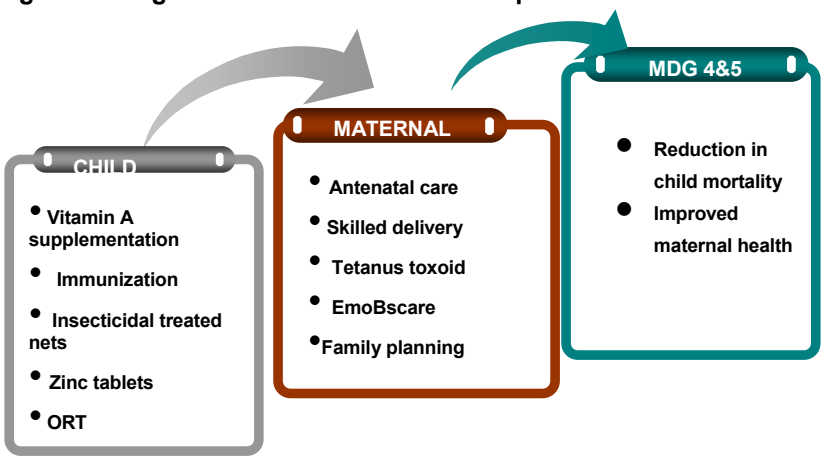
of preventive maternal and child health care interventions in SSA. Knowledge on association of demand side factors such socioeconomic economic status(SES) at more than one levels may give an insight into good evidence which are of relevance for informing policy. The studies forming this thesis are conceptualised by the author. On conceptualisation, the author guided by the supervisory team searched for data sources that could best answer to the research objectives. The demographic and health surveys featured as the best available alternative owing to its special features as being nationally representative, richness of socio-economic data and key indicators of child and marternal health seeking behavior indicators, to mention but a few. A part from the conception of this study, the author carried out data extraction, conducted the statistical analysis, intepreted the findings, wrote the first draft of each paper and reviewed the papers for interllectual content

2 BACKGROUND

There is a general consensus that the bane of health care system in LMICs including SSA is financing. No wonder most countries in SSA are still charging users fees to provide subsidized health and preventive care services[35 36]. Despite this, the health system is still not functioning, as most essential preventive maternal and child health services are still facing a chronic shortage of vital medications and services (e.g. drugs being constantly out of stocks[37]. These scenarios and the commitment to help SSA meet the MDGs for women and children, being the most badly affected[1 38]; have lead to donor agencies and several inter-governmental organizations offering assistance by strengthening of the health system through supply side mechanisms[39 40]. This include improved workforce development through clinical skill trainings, increased geographic coverage, performance-based re-imbursement, provision of essential medications and supply of medical equipments and subsidizing life-saving preventive child interventions among other initiatives [41 42]. Although these have had effect to some extent and improved uptake of some preventive intervention and essential services; they do not address the problem totally [43-45]. The rich continue to benefit more while the poor are becoming impoverished through our-of-pocket (OOP) payment for health services including preventive care [40 46-50]. Demand-side barriers have been shown to be as important as supply factors. Such barriers include the costs of healthcare which may prevent the poor and those that are disadvantaged from obtaining care [28 51-53]. Consistently, it has been shown that poor people in LMICs countries tends to have less access to health services than those that are well-off due to poverty which manifest through lack of money [31]. Moreover, the relationship between poverty and ill-health has been found to be recipricol i.e. poverty causes ill health and ill health sustains poverty[31 48]. This effect accumulates over a life time. In the context of maternal and child health services, and in SSA; women and children from poorer homes are the most vulnerable in terms of unequal access to health services including preventive interventions. A report by the World Health Organization (WHO), showed that access to high quality and subsidized health services can help vulnerable groups out of the poverty trap[54]; but the pervading nature of economic stagnation and weakened health system across SSA has lead to widened socioeconomic disparities in maternal health and health care use. Recently, there has been a change of focus to reducing financial barriers to access through adoption of demand-side mechanisms and improve uptake of preventive maternal and child health services and intervention[40 55]. One such is the Demand-Side-Financing (DSF), an example of which is health vouchers or insurance schemes. DSF is aimed at improving access to health care including preventive care for women and children from poorer households to mitigate cost of care and enhance equity [43 53 56-58 30]. DSF has gained wide popularity in several LMICs including Rwanda, Kenya, and Bangladesh to scaling up of preventive maternal and child health intervention with the hope of maintain acces.[58 59] Several studies have been undertaken to ascertain the efficacy of the DSF in reducing financial burden on women and children from poorer households. In most of these studies it has been acknowledged that DSF like every other innovative interventions is marked with socioeconomic inequities favouring the rich [59 60]. As the interest in the demand side mechanism begins to surge, it is paramount that its inefficiency which relates to socioeconomic disparities is removed. Eliminating socioeconomic disparities in uptake of preventive intervention requires defining the target population and understanding of mechanisms by which it manifest and disconnects the most vulnerable from such interventions. Earlier studies have found association between individual measure of

socioeconomic position such as education, occupation, and household wealth and utilization of maternal and child preventive care [26 61 13 28 45 51 62-66 23 67 68]. Despite these arrays of evidence linking preventive care to individual socioeconomic factors, the role of socioeconomic characteristics of the neighbourhood has been clearly neglected. A couple of studies in SSA have been conducted to understand the influence of community factors on uptake of preventive intervention among women and children [51 52]. Most of these studies have not been able to give insight into effect of economic characteristics of neighbourhoods on uptake of these interventions. Given the fact that most of these interventions are community based, it is probable that economic characteristics of the neighbourhoods' may impede their uptake .Socioeconomic characteristics of neighbourhoods in which people live, it has been shown, may influence their health and access to care for members of such communities[34 69 70] . These influences may manifest sometimes through, concentrated poverty, lack of formal education, joblessness and living in rural areas as neighbourhood socioeconomic disadvantage[71-73]. Studies have shown that individuals living in economic disadvantaged communities are less likely to seek care[74]. In the context of maternal care, inaccess to and inadequate uptake of prenatal care has been closely linked to neighbourhood socio-economic disadvantage [75 76]. In the light of these findings, understanding how neighbourhood socio-economic characteristics -in addition to individual socio-economic status -are linked to the uptake of preventive maternal and child health intervention, is crucial to targeting interventions at those most in need.

Figure 1: Programmatic maternal and child preventive healthcare Intervention



2 THEORETICAL MODELS

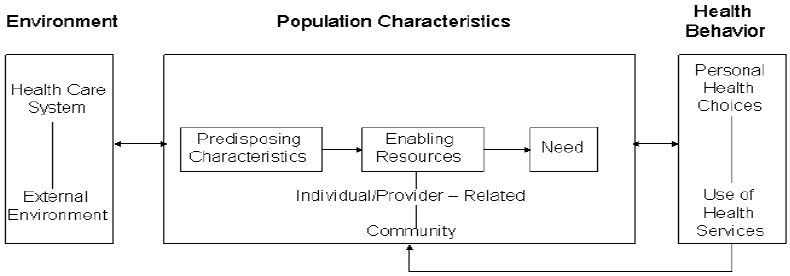
Evidence suggest that the utilization of health services is a complex behavioural phenomenon[77]. The traditional approach to analysing utilization of health services revolve around three core concepts which comprised of;

- Healthcare inequality
- Healthcare need
- Healthcare utilization

This thesis utilized two major conceptual models and one theoretical framework with focus on need to analyse uptake of preventive care intervention among women and children in SSA, described in detail below

2.1 Andersen's health care utilization behavioural model

Figure 2: Andersen's health care utilization behavioural model(R.M. Andersen 1995 [78]



The Andersen's behavioural health model as shown above is based on three factors which include:

2.1.1 Predisposing factors

This basically represents individual personal characteristics which sometimes determine their ability to use healthcare services. These characteristics include age, sex, social status (education, occupation). Differences between individuals with regard to such personal factors are purported to account for variations in their use and choices of health services. The predisposing factor education is in particular linked to the enabling factors.

2.1.2 Enabling factors

This component of the model is very important and sometimes is the most important.
This makes the health service readily available to individuals, irrespective of the predisposing factor, should the enabling factor be lacking - as is often the case in most LMICs where individuals pay out of pocket[28]. In such circumstance, individual may not be able to access or utilizes health services. Attributes such as health insurance coverage, high household wealth or

income, and regular source of care are among other important constituents of enabling factor and have been shown to be relevant even for preventive care use[23] [79]. In the context of the enabling characteristics are the health system factors which are directly linked to characteristics of the community in which individual resides. Examples of such characteristic include the proportion of health care facilities and the percentage of healthcare workers, all in relation to the community population size.

2.1.3 Need factor

This represents the over all perception of illness which could be as a result of the individual's prior knowledge, experiences with healthcare (e.g. as a result of initial visit to health care facility) among others. These factors have been shown to account for differences among individuals in use of healthcare services [80].

2.2 Discrete choice behavioural model

Discrete choice behaviour of individuals traced it roots to random utility theory, which is based on the theory of probabilistic consumer utility. In simple terms, it is used to express individual's preference for particular goods or services based on derived benefits. In the context of maternal/child healthcare seeking therefore, a mothers choice to use or choose care alternatives for herself or her child will be based on her assessment of the benefits derived from each alternative. She is therefore more likely to choose the alternative that will maximise her benefits. For the reader interested in the mathematical detail of this model, a more elaborate description follows.

2.2.1 Consumer Utility

Discrete choice models can be derived from random utility theory [81]. U_{ni} is the utility (or net benefit) that woman ***n*** obtains from choosing alternative ***i***. The behavior of the person is utility-maximizing: person n chooses the alternative that provides the highest utility. The choice of the woman is represented by dummy variables, y_{ni}, (which could be home delivery for each alternative:

$$y_{ni} = \begin{cases} 1, & if\, U_{ni} > U_{nj} \quad \forall j \neq i, \\ 0, & otherwise \end{cases}$$

Examining the choice further, the woman's choice would depend on the particular one that gives the maximum utility (maximum benefit). The utility is a set of individual attributes such as education, household wealth, quality of service. On decomposing the utility obtained by an individual into several parts both known and unknown, thus we have;

$$U_{ni} = \beta z_{ni} + \varepsilon_{ni}$$

Where z_{ni} is a vector of observed variables relating to alternative *i* for woman *n* which depends on attributes of another alternative, x_{ni}, this would result in interaction with attribute of woman, s_n, such that ;

$z_{ni} = z(x_{ni}, s_n)$
for some numerical function *z*, β is a corresponding vector of coefficients of the observed variables (such as education), and ε_{ni} Captures the impact of all unobserved factors that affect the woman's choice. The choice probability is then expressed as;

$$\begin{aligned} P_{ni} &= Prob(\, y_{ni} = 1\,) = Prob(\, U_{ni} > U_{nj}, \quad \forall j \neq i\,) \\ &= Prob(\, \beta z_{ni} + \varepsilon_{ni} > \beta z_{nj} + \varepsilon_{nj},\ \forall\ j \neq i\,) \\ &= Prob(\, \varepsilon_{nj} - \varepsilon_{ni} < \beta z_{ni} - \beta z_{nj},\ \forall\ j \neq i\,) \end{aligned}$$

2.2.2 Tanahashi Model for Health Services coverage [82]

In 1978, Tanahashi [82] proposed a concept which expresses the extent of interaction between the health service and the people for whom it is intended. He distinguished between four different levels of healthcare coverage summarised as follows:

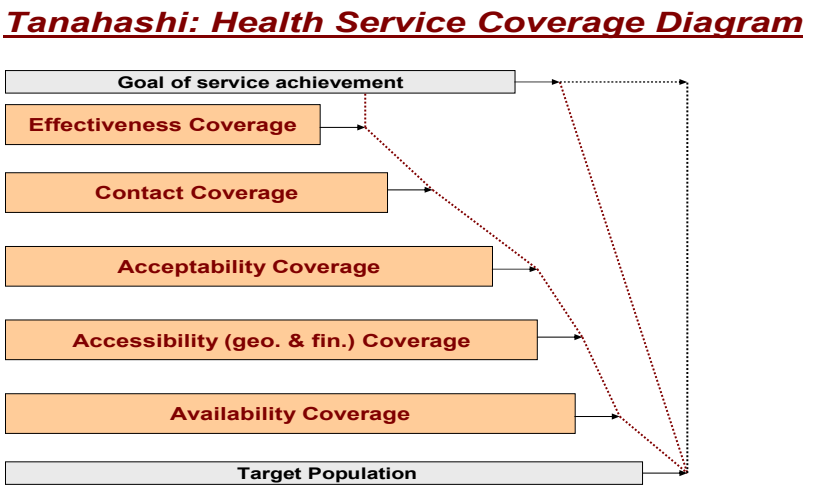
- **Availability coverage:** As the name suggest, it tackles the issue of the health care resources being available and for whom such resources are available.
- **Accessibility-coverage.** This asses how readily accessible the health resources is and for whom it is accessible to. This term is sometimes used to represent physical or financial barriers to access.

- **Acceptability coverage:** Simply ask if the resources or the service is acceptable to the intended population and for which population is the intervention for - This includes social, cultural and perception and financial barriers to using services.

- **Contact coverage**, - are the intended population making contact with the intervention or utilization.

  In the context of the maternal and child healthcare seeking, a number of factors may affect the availability, accessibility, acceptability and contact coverage of health services. A vital objective of this thesis is to understand how underlying socio-economic disadvantage at the individual, household and community level may influence the uptake and choice of health services. Uptake and choice (the main variables in this thesis) can be seen as indicators or proxy to accessibility, acceptability and contact coverage.

Figure 3: Tanahashi Model for Health Services coverage [82]



Source: Tanahashi T. Bulletin of the World Health Organization, 1978, 56 (2)

3 AIMS AND HYPOTHESIS

3.1 GENERAL AIM:

The general aim of this thesis is to examine the extent to which differences in individual socioeconomic status and neighbourhood-level socioeconomic characteristics account for variations in the uptake of preventive health care interventions among women and children under the age of five in SSA.

3.2 SPECIFIC AIM:

The specific aims examined in the thesis are stated as follows;

- To investigate whether Vitamin A supplementation uptake among children in Nigeria is associated with differences in socioeconomic status and geographical location **(study I)**.
- To assess the contribution of individual and neighbourhood socio-economic status to caregiver's treatment choices for managing childhood diarrhoea at household level in SSA **(Study II)**.
- To quantify the effect of household wealth and area-socioeconomic status on the use pattern of delivery care services among women in Nigeria **(Study III)**.

- To examine the influence of individual and contextual socioeconomic status on obstetric care utilization in Democratic Republic of the Congo **(Study IV)**.

3.3 HYPOTHESES

- The main hypothesis of this thesis is that difference in individual-and-neighbourhood-level socioeconomic and geographic location would determine uptake of programmatic preventive maternal and child health care intervention.

4 MATERIAL AND METHODS

4.1 DATA COLLECTION

This thesis is based on the data collected as part of the Demographic and Health Surveys (DHS) conducted during 2003 - 2008 in sub-Saharan Africa. DHS surveys are a series of worldwide population based health and household survey that are normally implemented in most LMICs by ICF Macro International.,[83] with financial support from the US Agency for International Development. The target group for the surveys are women aged 15-49 years and the members of their households. Methods of data collection for the DHS exercise involve a stratified 2-stage cluster sampling techniques. The first stage involves selection of clusters otherwise known as the primary sampling units (PSUs). In the second stage, lists of households are selected from each cluster. Information is then collected using face-to-face interview and in close confidentiality on various sociodemographic and health matters related to the respondent and her households. A more detailed description of the methodology has been abundantly described elsewhere[84]

4.1.1 Data retrieval,

Individual countries pre-coded raw data files were retrieved from the DHS repositories after the acceptance of research proposal submitted by the author. Data cleaning was conducted between January 2009 and May 2009 using the DHS individual recodes data file manuals and sample questionnaire. Data file from DHS were made available in three different structures as flat, rectangular and hierarchical structure. The hierarchical structure of the data set necessitates the type of software packages used in this thesis. Effort was made not to include missing data in the analysis, and where inevitable such were included within the limit permitted for a standard statistical analysis.

4.1.2 Data preparation and management

Preparation of data for analysis proceeded in two stages. All data were cleaned and transferred into STATA Version 11 software package for windows (Stata Corporation, 2008). First, raw data as retrieved from the DHS data repository were recoded, this is necessary so as to make sure that individual respondent is merged with their characteristics as detailed in the field survey recording sheet. In addition, in order to avoid classification ambiguities, variables with wider range of classification which could overlap were recoded by the author using a set of user defined econometrics syntax. For example, in the DHS data set , respondents age range were from 15-49 years this were recoded into three main categories as show below;

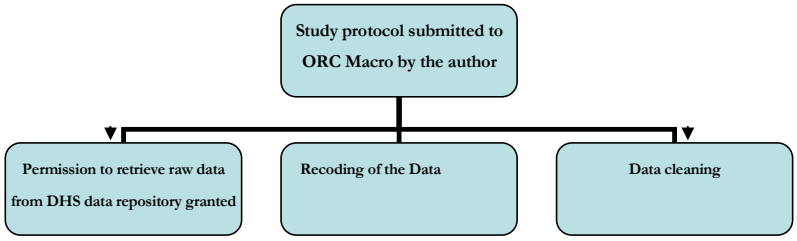
```
------- use "D:\paper 4\New Folder\recode\datasets\DRC.DTA", clear
    * gen respondent age = M012
    *recode M012 (min/24 = 1 "15-24") (25/34 = 2 "25-34 ")(35/max = 0 "35+"),
      gen(respondent age).
```

Educational attainments for the respondent were recorded as “primary, no education, secondary and higher education” This was recoded by the author into three main categories using econometrics syntax detailed below;

```
    *gen respondent education
    *recode M106 (0 =1 "primary") (1 2=2 "secp") (3=0 "no educ") (nonmissing =.),
     gen (respondent education)
```

Also, occupation had been classified into nine categories as not working, technical; management, clerical, sales, agric-self-employed, household & domestic, skilled manual and unskilled manual. This was recoded and classified into three distinct groups as "not working, manual and professional to avoid overlap. Second stage involved a preliminary analysis to estimate associations and compute frequencies between variables of interest. Subsequent and the final analysis were conducted in the modelling software.
The entire process from data acquisition to retrieval, preparation and management is illustrated in Fig .1 below

Figure 1: Data retrieval, preparation and management (from the author)



4.1.1 Study population

The study populations for thesis are women and children who had participated in the survey in Benin, Burkina Faso, Cameroon, Ghana, Kenya, Liberia, Mali, Nigeria, Niger, Senegal, and Tanzania.

4.1.2 Level-one data

The DHS surveys questionnaire is of three types and are listed below;

- Household questionnaire
- Women's questionnaire
- Child's questionnaire.

Information on sociodemographic and socioeconomic characteristics (described in detail in section on "measures") of women and children including members of their households' collected using DHS survey questionnaire constitute the level-one data of the analysis in this thesis.

The response rate for the surveys used in this thesis was 98%. DHS survey uses a standard core questionnaire which is similar across all the countries. This unique feature makes it easier for findings to be generalized and allows pooling of data across countries while accounting for effects of complex survey design.

4.1.3 Level-two data

This is referred to as community level data. According to DHS, communities were classified based on sharing the same PSU. PSU classification in DHS is usually based on administrative areas otherwise known as census tracts. The use of census tracts makes differentiation between rural and urban areas to be straight forward. For example, an average of 50 households within a village is equivalent to a PSU. This methodology has been used to classify communities in all the surveys. For the purpose of this thesis, as is often the case for studies with focus on population health, level 2 data had been operationalized to refer to both neighborhood and community.

4.1.4 Ethical consideration

The survey instrument used in the data collection received approval from the National Ethics Committee of the ORC Macro in the US and the Ethics committee in the respective country. All the participants gave their consent. To safeguard the interest of the respondents, face-face interviews were conducted in close confident.

4.3 MESURES

4.3.1 Outcome variables

Study 1 - Vitamin A supplementation status: this was measured (*yes/*no), as marked on the vaccination cards for children aged 12-month and above presented to the DHS interviewers by the mother. A Binary recode was assigned to the supplementation status;"0" if No, otherwise it is yes, in which case is coded "1"

Study 2-Choice of treatments for managing childhood diarrhoea: ascertained by the responses of the caregiver of a child who have had episode of diarrhoea 2 weeks before the survey. The caregivers ware asked were care was sought to manage the diarrhoea episode. Responses to this question was coded as follows; "0" for self-treatment/no treatment, "1" for medical centre, "2" for pharmacy,"3" for home care, "4" for the choice of traditional medicine

Study 3-Choice of place of delivery of the most recent live birth classified as follows: Government hospital, made up of healthcare facility maintained by government both at local and national level; Private-any birth that took place at a private clinic owned by a private entity including non-governmental or religious organizations and home, - for child birth that took place at the respondents home.

Study 4 - Obstetrics care utilization: responses to the question "did you give birth under the supervision of a health personnel for your last birth "If the response was yes it is coded"1" otherwise"0", meaning that the respondent did not gave birth in a health care facility neither was the birth assisted by a qualified health care personnel. The other question was in relation to antenatal care; women were asked if they had antenatal check-up the last time they were pregnant. This response was coded as binary "1 or 0" if the response is yes, it is coded 1 or 0 if no

4.4 EXPLANATORY VARIABLES

The selections of explanatory variables were based on findings from the literature. In consonance with the research objectives and given the effects of the outcome variables at more than one level; where study participants are nested within households, which are in turn nested within communities, two levels of explanatory variables were considered. These were individual-level variables and community-level explanatory variables.

4.4.1 Individual-level explanatory variables:

These included various demographic, socioeconomic and ethnic characteristics of the child, mother and the father described below.

- **Child demographic characteristics**: Sex group as male or female, child's age (in months) grouped as 12– 23, 24–35, 36–47, 47+ months;
- **Mother's demographic and socioeconomic characteristics**:

Age (in years) categorised as 15–24, 25–34, 35+ years; parity grouped as (between 1-3 and 4+) socioeconomic characteristics include education grouped as no education, primary, secondary, and higher; occupation grouped not working, manual, professional

- **Father's demographic and socioeconomic characteristics** include: Level of educational attainment education grouped as no education, primary, secondary, and higher; occupation grouped as not working, manual, and professional

4.4.2 Household socioeconomic variables:

These includes overall household wealth status and possession of health insurance by the respondents. Possession of health insurance was grouped as yes/no irrespective of the forms of health insurance whether employment based or personal. In most countries in sub-Saharan Africa, as the case in other LMICs, paucity of appropriate data on household expenditure has been an age long problem. To overcome this problem and for policy purpose, researchers have adopted a methodology for constructing wealth index based on a set of household assets, known as principal component analysis(PCA) [85] [86] [87]. This surrogate measure of household economic status, represents a better ways of quantifying wealth status based on ownership of durable items such as type of toilet facilitates, possession of mobile phone, motor care, bicycle, type of fuel used for cooking, source of drinking water. Households were assigned coefficient scores based on their possessions of the aforementioned items. The final scores were then used to group households and their members into wealth quintiles as poorest, poor, middle, richer and richest.

4.4.3 Community-level explanatory variables

Four sets of community level variables were considered as follows: Programmatic preventive care (physician-provided community antenatal care categorised as low and high), Region of residence categorized as: North Central, North East, North, West, South East, South West, South South, Place of residence was categorised as rural and urban, Neighbourhood socioeconomic disadvantage index was developed using PCA. This comprised four variables: proportion of respondents living in rural areas, proportion of respondents who were unemployed, proportion of respondents living below the poverty level (below the 20% quintile), and proportion of respondents with no education. The scores generated from the continuous index have a mean value of 0 and standard deviation of 1. The index allows for the

categorization of neighbourhoods into both least disadvantaged and most disadvantaged based on socio-economic characteristics. Increasing scores are an indication of increasing neighbourhood disadvantage (i.e. a neighbourhood is most disadvantaged, if the scores is high).

5 STATISTICAL ANALYSIS

Data analysis was performed using both STATA 11 and MLwiN 2.20 statistical software packages to account for the hierarchical nature of the data. Choice of analytical strategy for this thesis was driven by theoretical model as well as the nature of the survey data. The fact that one respondent was selected from each household implies that the lowest level of analysis was the respondent or household. Thus, it is possible to explore variability of the outcome variable at each level of analysis. That is, at both the respondent or household level and the community level. In the context of preventive care, propensity of women from different households but with similar characteristics to utilize or choose a provider will depend on their discretion as determined by the economic ability of the household. Understanding of association between shared characteristics of individuals and that of the administrative area or household they belong requires the use of appropriate methodology[88]. This is necessary, in order to control for correlation between individuals within a defined enumeration area. Estimation of such relationship over the years has been problematic.

However, the recent advancement in statistical techniques and the interest in exploring both "micro" and "macro" level attributes as led to the use of multilevel analysis [88 89]. Multilevel analysis which incorporates the use of regression models at more than one level of hierarchy is a powerful and technically robust statistical technique with numerous strengths [88 90-98]. Multilevel analysis allows for estimation of outcome variables at more than one level i.e. those that are due to context and composition and had been applied in many fields [99-101 88 102]. For a classical multilevel model, the probability that an event occur for a binary response outcome variable is specified as shown below.

$$\pi_{ijk}: y_{ijk} \sim \text{Bernoulli}(1, \pi_{ijk})$$

The equation could be interpreted as the probability of a child *i* residing in community *j* in region *k* having received a dose of VAS *y*. The probability is a function of a set of predictor variables such as mother's education, region of residence, and household wealth. The general two-level multilevel model is expressed as follows;

$$\text{log it}\left(\pi_{ijk}\right) = \log\left(\frac{\pi_{ijk}}{1-\pi_{ijk}}\right) = \beta_0 + \boldsymbol{X}_{ijk} + \boldsymbol{u}_{0jk} + \boldsymbol{v}_{0k}$$

The right-hand side of the expression consists of fixed parts *Xijk and* β_0, which are estimating the vectors attributable to the explanatory coefficients at both individual and community levels, respectively. The last two vectors, *u*0jk and *v0k,* are the random effects and denote unobserved factors at either the child or household and community level, respectively. The fixed part of the expression, estimates the association between the outcome

variable i.e the likelihood of a child receiving VAC supplement and various explanatory variables such as mothers education and occupation. These are normally expressed as odds ratio (OR) at their 95% confidence intervals (95% CIs). Unlike the fixed part, the random part, measures the variation of the outcome variable at the highest level of hierarchy (community). This variation is sometimes expressed as variance partition coefficient or interclass correlation (VPC or ICC) and proportional change in variance (PCV)[90]. ICC is the measure of clustering of the outcome variable at level-one (woman or child) and level-two (community). The ICC is expressed mathematically as follows;

$$\rho = \frac{\tau}{\tau + \pi^2/3}$$

$\boldsymbol{\tau}$, in the expression represent estimated the variances between communities. ICC estimates is interpreted as follows; a high value indicates high clustering of the outcome variable i.e. Vitamin A supplementation uptake in the community, while a low value indicates a low clustering of the outcome variable within the community. Sometimes, outcome variable in multilevel data do involves polytomous responses; such is the case of choice of place of delivery. This special case of multilevel model incorporates discrete choice modelling approach governed by utility. For any choice made by the respondent, there is a special utility attached to it; the utility could be cost or other measure of socioeconomic status such as household wealth. Using a logit link function, the multilevel discrete choice model[103] is expressed as;

$$\log\left(\frac{\pi_{ij}^{(s)}}{\pi_{ij}^{(t)}}\right) = \beta_{0j}^{(s)} + \beta_{1j}^{(s)} x_{1ij} + \beta_{2j}^{(s)} x_{2ij}.$$

In multilevel discrete choice modelling one of the outcome variables is taken as the reference, category and a set of *t*- 1 logistic regressions estimated for the remaining categories. Taking home delivery as the reference category for the choice of place of delivery; in the multilevel discrete choice model expressed above, subscript ***s*** represents the estimated intercept for home and for both government and private hospital deliveries. The probability of delivery at either government or private hospital ***i***, for a pregnant woman ***j*** $\boldsymbol{\pi_{ij}}$ is given by $\boldsymbol{\pi_{ij}}$, while $\boldsymbol{\beta_{0j}^{(s)}}$ is a parameter associated with the fixed part of the model. In general, for every 1-unit increase in ***X*** (a set of predictor variables such as woman's educational attainment or and occupation) there is a corresponding effect on the probability of choosing category ***s*** (i.e. private or government) relative to the reference The variability in the choice of place of delivery at individual women level, i.e. the random effect is measured by ICC [90] and expressed as shown below;

$$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma^2} \times 100$$

5.1 Specific analytical methodologies for each study

All models in each study were built sequentially using different statistical methods listed below.

- Study I- multilevel modelling
- Study II- Mixed effect multilevel multinomial modeling(multilevel discrete choice modelling)
- Study III- Multilevel discrete choice model
- Study IV- Multilevel modelling

6 RESULTS

6.1 Study I: Childhood Vitamin A Capsule Supplementation Coverage in Nigeria: a Multilevel Analysis of Geographic and Socioeconomic Inequities

Reason for the study: Vitamin A supplementation (VAS) is the most powerful community based programmatic childhood intervention and holds the promise for reducing childhood mortality towards MDG 4. Being a community based intervention; it is of policy relevance to examine how the target populations for the intervention are being reached. Examining Vitamin A supplementation coverage for equity among children in a country with a high rate of childhood deaths and pediatrics blindness in SSA is much needed.

Findings: As seen from multilevel model result in table below**,** VAS coverage among children in Nigeria is marked with inequity. The results showed that antecedent factors such as maternal occupation, geographic location and household wealth status were associated with receipt of VAC supplement. For the first time, the result indicates that economic development of the community where these children resides is a factor for being covered by the intervention. Specifically, it was revealed that children from economic disadvantaged neighbourhoods were less likely to receive the supplements. These findings reverberates the importance of accessibility and affordability in relation to uptake of community directed evidenced based intervention.

Key message: Inequalities as a result of differences in individual and neighbourhoods' socioeconomic characteristics in addition to geographic locations are closely associated with Vitamin A supplement uptake among children in Nigeria.

Table 1: Multilevel logistic regression modelling of factors associated with Vitamin-A Capsule supplement uptake among Nigerian children, NDHS 2008.

	Model 1 [a]	Model 2[b]	Model 3[C]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Variables			
Fixed effects			
child's age in months			
12-23(ref)		1.00	1.00
24-35		0.80(0.71-0.89)***	0.80(0.71-089)***
36-47		1.17(1.02-1.33)**	1.17(1.02-1.33)**
48+		1.06(0.97-1.25)	1.09(0.96-1.24)
Child sex			
Male (ref)		1.00	1.00
Female		0.96(0.89-1.05)	0.96(0.89-1.05)
Mother's age (years)			
35+ (ref)		1.00	1.00
15-24		0.80(0.70-0.90)**	0.81(0.72-0.92)**
25-34		0.92(0.84-1.02)	0.93(0.84-1.03)
Mother's education			
No education (ref)		1.00	1.00
Primary		0.44(0.34-0.60)***	0.47(0.36-0.61)***
Secondary &Higher		0.69(0.54-0.89)***	0.70(0.55-0.89)**
Father's education			
No education (ref)		1.00	1.00
Primary		0.77(0.64-0.92)**	0.72(0.65-0.92)**
Secondary &Higher		0.90(0.77-1.06)	0.87(0.74-1.03)
Mother's occupation			
Not working (ref)		1.00	1.00
Manual		1.34(1.20-1.50)***	1.30(1.17-1.44)***
Professional		1.29(1.12-1.50)***	1.27(1.10-1.47)**
Father's occupation			
Not working (ref)		1.00	1.00
Manual		0.84(0.71-0.99)*	0.84(0.71-1.00)*
Professional		0.93(0.78-1.11)	0.91(0.76-1.09)
Wealth index			
Poorest(ref)		1.00	1.00
Poorer		1.19(1.04—1.37)*	1.11(0.96-1.27)
Middle		1.59 (1.35-1.86)***	1.37(1.16-1.62)***
Richer		1.82(1.51-2.20)***	1.45(1.21-1.82)***
Richest		2.37(1.88-2.90)***	1.86(1.45-2.38)***

		OR (95% CI)	OR (95% CI)
Variables			
Community-level variables			
North Central (ref)			1.00
North East			0.87(0.63-1.19)
North west			0.45(0.34-0.61)***
South east			0.58(0.36-0.92)**
South west			1.01(0.70-1.47)
South South			1.66(1.17-2.35)***
Residence			
Rural (ref)			1.00
Urban			1.21(0.87-1.67)
Community economic status Neighborhood socioeconomic Disadvantage index			0.76(0.65-0.89)**
Random effects			
Intercept	0.18(0.16-0.21)***	0.30(0.22-0.41)***	0.34(0.21-0.53)***
Community-level variance (SE)	1.41(0.05)***	1.19(0.04)***	1.13(0.04)***
VPC (%)	30	26.5	25.5
Explained variation PCV (%)	reference	15.6	19.9
Model fit statistics			
DIC (-2log likelihood	16,914	16,524	16,444

Abbreviations: OR – Odds ratio, CI – Confidence interval, SE – Standard error,
DIC – Deviance information criterion *p < .05, **p < .01, and ***p < .001, ref-reference category
VPC –Variance Partition Coefficient, PCV- Proportional Change in Variance

[a] Model 1 is null model with no exposure variable.

[b] Model 2 is adjusted for child's characteristics(age, sex),mothers and fathers characteristics(education, occupation, and wealth index

[c] Model 3 sequentially adjusted for community socioeconomic disadvantage, place of residence, and region in addition to all the included variables in Model 2.

6.2 Study II: Socio-economic determinants in selecting childhood diarrhea treatment options in Sub-Saharan Africa: a multilevel model.

Reason for the study: Childhood diarrhea is a disease of poverty which kills more than 2 million children annually in most LMICs. Integrated Management of childhood illness advocate prompt and appropriate use of simple, cheap and highly effective intervention which as been in existence for more than 20-years for diarrhoea management ; yet the disease continue to contribute immensely to childhood mortality and morbidity in SSA. Therefore, this study was conducted to examine the effect of economic ability of caregiver and her household in relation to type of care that was sought to manage childhood diarrhoea.

Findings: As shown in table 2; educational attainment of both the caregiver and the father of the child, were associated with choice of medical centre, pharmacies and home care as compared to no treatment. In contrast, partners' occupation was negatively associated with selection of medical centre and home care for managing diarrhea. In addition, living in less economic disadvantaged neighbourhoods was significantly associated with selection of both medical centre and pharmacy stores and medicine vendors.

Key message: While choice of place to seek care is discretionary, educational attainments and degree of economic development of the communities where each caregiver resides are highly important in choices for childhood diarrhoea treatment.

Table 2: Multilevel-multinomial model estimates of treatment options by caregivers' socio- economic characteristics with no treatment as reference.

Variables	Medical centers'	Pharmacy/Vendors	Home care	Traditional
	OR 95 % CI	OR 95% CI	OR 95% CI	OR 95 % CI
Fixed effects				
Caregivers age				
35+ (ref)	1 -	1.	1.	1 -
25-34	0.92 (0.82,1.02)	-	0.92 (0.78 -1.06)	0.94(0.74,1.13)
15-24	0.86 (0.74,0.98)*	0.90 (0.75 ,1.10)	0.80 (0.65,0.95)**	1.03(0.84,1.23)
Caregiver's education		0.92 (0.74 ,1.09)		
None (ref)	1 -	1 -	1 -	1 -
Primary	1.19 (1.08,1.30)*	1.01 (0.83,1.17)	1.26 (1.11,1.41)***	0.88 (0.61,1.10)
Secondary/Higher	1.47 (1.31,1.63)***	1.01 (0.92,1.29)	1.72 (1.50,1.94)***	0.76 (0.37,1.15)
Partner's education				
None (ref)	1 -	1 -	1	1 -
Primary	1.57 (1.46,1.68)***	1.50 (1.34,1.66)***	1.23 (1.08,1.38)**	1.10 (0.93,1.35)
Secondary/Higher	2.48 (2.35,2.61)***	2.00 (1.78,2.21)***	1.29 (1.10,1.48)**	1.60 (1.34,1.86)
Caregiver's occupation				
None (ref)	1 -	1 -	1	1.
Manual	1.16 (1.01,1.26)***	0.97(0.83,1.11)	1.12 (0.98,1.25)	1.18 (0.99,1.36)
Professional	0.98 (0.83,1.13)	1.28 (1.08,1.48) **	1.05 (0.87,1.26)	1.22 (0.97,1.47)
Partner's occupation				
None (ref)	1 -	1 -	1 -	1 -
Manual	1.08 (0.89,1.27)	1.04 (0.74,1.34)	0.84 (0.59,1.09)	0.99 (0.68,1.41)
Professional	0.77 (0.57,0.96)*	0.75 (0.44,1.06)	0.75(0.50,1.01)*	1.08 (0.66,1.50)
Household wealth				
Poorest(ref)	1 -	1 -	1 -	1 -
Poorer	1.04 (0.91,1.16)	0.86 (0.73,1.02)*	1.18 (1.00,1.33)*	1.07(0.87,1.27)
Middle	1.12 (0.99,1.25)	0.58 (0.39,0.77)***	1.14 (1.24, 1.58)***	0.93 (0.71,1.15)
Richer	1.10 (0.96,1.24)	0.45 (0.23,0.67)***	1.19 (1.00,1.39)	0.64 (0.37,0.91)
Richest	0.92 (0.74,1.10)	0.21(0.10,0.52) ***	1.16 (0.93,1.36)	0.68 (0.33,1.03)
Place of residence				
Urban (ref)	1 -	1 -	1 -	1 -
Rural	0.70 (0.86,1.10)***	0.44(0.26,0.62)***	0.82 (0.66,0.98)**	1.02(0.91,1.26)
Neighbourhoods socio-economic disadvantage				
High(ref)		1 -	1 -	1 -
Low	1 -	1.56(1.39,1.73)***	1.02 (0.88,1.16)	1.13(0.68,1.32)
Random effects	1.17(1.06,1.28)**			
Community multinomial Variance(SE)	1.17(0.03)***	1.50(0.06)**	1.31(0.04)***	1.49(0.08)***
Intracluster correlation (ICC) *(%)*	26.2	31.3	28.4	31.1

Abbreviations: OR, odds ratio; CI, confidence intervals; SE, standard error; ICC, intracluster correlation. *p < 0.05, **p < 0.01, ***p < 0.001.

6.3 Study III: Neighbourhoods socio-economic disadvantage, individual wealth status and patterns of delivery care utilization in Nigeria: a multilevel discrete choice analysis.

Reason for the study: Despite her enormous wealth and abundance of skilled man- power in the health sector; Nigeria the most populous country in sub-Saharan Africa is a leading contributor to the total global maternal deaths. The same country is beset with high infant mortality rates. Exploring the use pattern of delivery care in particular, might give a better understanding of how the demand side factors contribute to the ever increasing maternal deaths in the country.

Findings: Health insurance coverage, education, occupation, community SES and household wealth were the major factors determining the use of private and public health care facilities for child birth. Home delivery is a common practice in Nigeria and cut across both urban and rural areas.

Key message: Low socio-economic status including wide spread poverty informed the pattern of delivery setting among women of reproductive age in Nigeria.

Table 3 Multilevel discrete choice analysis of neighborhood and individual socio-economic determinants of place of delivery based on 2008 NDHS presented as odds ratios at 95% CI

Variables	Government (Home)		Private (Home)	
Fixed effect				
Age (years)				
35+	1		1	
25-34	0.80	(0.69-0.91)***	0.77	(0.62- 0.91)***
15-24	0.81	(0.66-0.98)**	0.75	(0.55-0.95)**
Parity				
1-3	1		1	
4+	0.81	(0.70-0.92)***	0.77	(0.63-0.91)***
Education level				
No education	1		1	
Primary	1.39	(1.25-1.53)***	1.81	(1.61 -2.01)***
Secondary &Higher	2.43	(2.28-2.58)***	3.38	(3.16 -3.59***
Partner's education level				
No education	1		1	
Primary	1.26	(1.11-1.42)**	1.39	(1.18 -1.60)***
Secondary &Higher	1.41	(1.28-1.57)***	1.50	(1.28 -1.72)***
Health Insurance				
No	1		1	
Yes	1.72	(1.39-2.05)***	2.00	(1.65 -2.35)***
Woman's occupation				
Not working	1		1	
Manual	1.00	(0.89-1.13)	0.97	(0.97-1.14)***
Professional	1.23	(1.11-1.35)***	1.16	(1.00-1.32)***
Wealth index				
Poorest	1		1	
Poorer	1.29	(1.11-1.47)**	1.11	(0.96-1.27)
Middle	1.65	(1.45-1.88)**	1.37	(1.16-1.62)***
Richer	2.88	(2.66-3.10)***	1.45	(1.21-1.82)***
Richest	4.45	(4.22-4.70)***	1.86	(1.45-2.38)***
Neighbourhood-level				
Region of residence				
North Central	1		1	
North east	0.55	(0.31-0.79)***	0.10	(-0.32-0.53)
North west	0.31	(0.10-0.56)***	0.10	(-0.37-0.58)
South east	0.79	(0.50-1.08)	2.08	(1.70-2.45)***
South west	0.50	(0.25-0.75)***	0.47	(0.14-0.80)**
South South	1.41	(1.16-1.65)**	1.79	(1.48-2.10)***
Place of residence				
Urban	1		1	
Rural	0.94	(0.74-1.14)	0.68	(0.41-0.95)
Community-level Variables				
Community antenatal				
Low	1		1	
High	2.90	(2.68-3.11)***	3.01	(2.64-3.37)***
Economic disadvantage				
Low				
High	1		1	
	0.63	(0.42-0.82)***	1.21	(0.87-1.67)
Random effect				
Intercept	0.30	(0.22-0.41)***	0.34	(0.21-0.53)***
Community-level variance (SE)				
	1.80	(0.05)***	1.13	(0.04)***
ICC (%)	35.2		25.5	

Abbreviations: SE; standard error; ICC, intracluster correlation; CI; confidence interval $p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

6.4 Study IV: The influence of individual and contextual socio-economic status on obstetric care utilization in Democratic Republic of Congo: a population based study.

Reason for the study: Democratic Republic of the Congo is at the stage of rebuilding her health system which had been severely affected as a result of prolonged effect of armed conflict and internal war. The fear of loss of life and insecurity have resulted in human displacement, and caused the country to loose most of her medical personnel to neighboring countries. As a result, the entire health system had been crippled due to chronic lack of man power. This inadequacy of the supply side of the health system is highly understandable. However, the fact that economic activities were paralyzed during the conflict period gave an indication that some key enabling factors from the demand side would be affected. This study was conducted using the first nationally representative sample to examine the influence of SEP and economic disadvantage on obstetrics care utilization among women in the country.

Findings: There was variability in obstetrics care utilization among women of child bearing age in Democratic Republic of the Congo. Utilization of antenatal care and delivery care were pro-rich, that is, women that are from rich households, those that are working, and those with high level of education and had educated husband were more likely to utilise obstetric care when contrasted with poor, unemployed and less educated peers respectively.

Key message: Individual and contextual socio-economic status plays an important role in obstetric care uptake in Democratic Republic of the Congo.

Table 4. Multilevel model estimates of individual socio-economic, demographic and contextual socio-economic correlates of obstetric care utilization presented as odds ratios and Standard errors.

	Model 1 [a]	Model 2[b]	Model 3[C]	Model 1 [a]	Model 2[b]	Model 3[C]
Variables	**OR (SE)**	**OR (SE)**	**OR (SE)**	**OR (SE)**	**OR (SE)**	**OR (SE)**
Measure of association						
Women's age in years						
35+(ref)		1.00	1.00		1.00	1.00
15-34		1.42(0.16)***	1.40(0.16)*		2.15(0.12)	1.08(0.12)
25-34		1.47(0.12)**	1.45(0.12)***		1.03(0.09)	1.04(0.09)
Parity						
4+(ref)		1.00	1.00		1.00	1.00
1-3		0.88(0.12)	0.87(0.13)*		1.23(0.10)**	1.24(0.21)**
Women's education						
No education(ref)		1.00	1.00		1.00	1.00
Primary		0.77(1.09)	0.74(1.09)		1.04(1.10)*	0.68(1.10)
Secondary & Higher		1.39(1.10)	1.35(1.10)		1.04(1.10)*	1.11(1.10)*
Partner's education						
No education (ref)		1.00	1.00		1.00	1.00
Primary		0.85(0.39)	0.85(0.39)		0.56(0.31)	0.57(0.31)
Secondary &Higher		0.93(0.36)	0.94(0.36)		0.62(0.29)	0.62(0.29)
Women's occupation						
Not working (ref)		1.00	1.00		1.00	1.00
Manual		1.21(0.14)*	1.34(0.14)*		0.64(0.10)***	0.68(0.10)***
Professional		1.52(0.18)**	1.55(0.18)**		0.93(0.31)	0.93(0.13)
Partner's occupation						
Not working (ref)		1.00	1.00		1.00	1.00
Manual		0.73(0.16)*	0.74(0.16)		0.81(0.1)*	0.82(0.10)*
Professional		0.97(0.19)	0.94(0.19)		1.12(0.12)	1.08(0.12)*
Wealth index						
Poorest(ref)		1.00	1.00		1.00	1.00
Poorer		0.98(0.12)	0.93 (0.12)		1.06(0.09)	1.04(0.09)
Middle		1.13 (0.19)	1.04(0.14)		1.25 (0.11)**	1.20(0.10)
Richer		1.13(0.19)*	1.13(0.20)		1.99(0.14)***	1.77(0.14)***
Richest		1.38(0.36)	1.08(0.38)		5.47(0.45)***	4.21(0.41)***
Place of residence			1.00			
Rural(ref)			0.96(0.27)			1.00
Urban						1.24(0.21)**
Community economic status						
Socioeconomic disadvantage			0.54(0.23)***			0.52(0.29)***
Measure of variation						
Community level variance(SE)	1.19(0.10)***	1.09(0.10)***	1.07(0.09)***	1.98(0.11)***	1.74(0.10) ***	1.68(0.10)**
VPC (%)	26.4	25.	24.5	37.6	35	33.8
Explained variation PCV (%)	Reference:	8.4	10.1	Reference:	12.1	15.1
Model fit statistics						
DIC (-2log likelihood)	3,700	,3628	3,619	6,345	6,173	6,157

7 DICUSSIONS

7.1 Main findings

This thesis examined the uptake of programmatic live saving preventive maternal and child public health interventions in SSA taking into account individual ,contextual and health system factor as well as geographic characteristics of women and children and documents that differential in uptake is related both to individual and neigbhbourhood socio-economic factors.

7.1.1 Study I: Childhood Vitamin A Capsule Supplementation Coverage in Nigeria: a Multilevel Analysis of Geographic and Socio-economic inequities

In line with the Tanahashi model of health service coverage[82], uptake of Vitamin A supplements (VAS) was found to be marked with inequities. At the individual level, our findings are in consonance with those of many others that have examined factors associated with VAS uptake among children in most LMICs. Regarding the effects of individual socioeconomic status, in line with expectation, socio-economic gradient was observed in uptake favouring children from richer households. Specifically, the findings shows that with all other factors such as age , sex and education being accounted for; children of mothers belonging to the richest household on the wealth index are more likely to receive vitamin A supplements compared to their peer from poorer households. This gradient decreases, as wealth index decreased. The association is not new and has been reported by several others [104 105]. This association between VAS and household wealth is not linear among children in Tanzania, as no difference was observed based on household wealth gradient.[106] In this study, maternal occupation is a stronger predictor of VAS uptake. The multilevel modeling analysis shows that children born to mothers who were professionals and those whose mothers are into manual work are more likely to receive VAS. While this is an expected finding, it is in contrast to a study from another low income country[105]. Higher uptake of VAS has been well associated with parental socioeconomic factors most especially maternal education [107], the present study however, reported a counterintuitive findings. The results shows that children born to mothers with higher level of education and had father that are highly educated were less likely to receive vitamin A supplements compare to those whose mother and fathers were not educated. This finding is not strange as such has been reported for childhood immunization in the study setting. The reason for this could be related to the delivery platform i.e. VAS is a community based intervention now being delivered along with childhood immunization [108]. Another reason from the findings could be related to the statistical homogeneity; as reported in the literature, the effect of maternal education does disappears when modelled together with that of the father[109]. Place of residence e.g. rural or urban in uptake of preventive health care intervention is another important issue examined in this thesis, though, the findings shows no association between uptake of VAS and place of residence. This is contradictory to some findings [110] but in line with others (Masanja et al., 2006). This study documents a positive association between level of economic development of the neighbourhoods and the receipt of VAS supplements using multilevel methodology. Specifically the finding shows that children living in highly socioeconomically disadvantaged communities were less likely than their peers residing in less socioeconomically disadvantaged communities to receive VAS. This represents the first effort, in the application

of multilevel model technique to VAS coverage analysis and the first to document area level variation in uptake of VAS. Results of multilevel model provided evidence of geographic variations in uptake of VAS by children across all the six region of Nigeria. The result shows that children from the North Western geographical region were less likely to receive VAS. This, is in agreement with a result from Guinea[111], another western African country where geographic location has contributed substantively to VAS uptake.

The finding from this study like in every other study examining equity in coverage of preventive intervention has shown once again that effective intervention are not always fully exploited. In addition it also reveals the persistence pro rich inequity in coverage. There are several findings from this study that are of policy relevance and have much implication for the attainment of MDG 4 for reduction of childhood mortality by two-third before 2015. First, the fact that many children from poorer households are not being reached by this intervention calls for review of policies towards distribution of VAS. A review of delivery platform for VAS distribution has been shown to impact positively on number of children being covered in Tanzania[106]. Adoption of such innovation may help to increase the scaling up of VAS and allow more children to be covered by this high cost- effective intervention in Nigeria. Another important fact that emerged from this study is in relation to the effect of climatic condition and deforestation which is typical of the North Western part of the country, and has made the region to be unsuitable for fruits and vegetable s that are rich in vitamin A to be grown. This finding is of policy relevance given the fact that the North Western region has the highest rate of vitamin A deficiency (VAD) in the country. In addition, the region is less economically endowed and with little rainfall. As a result the children and their households continue to rely on legumes'. The problem need to be looked into if the country is to meet the MDGs 1and 7 both which focused explicitly on eradication of extreme poverty and hunger and reversing the loss of environmental resources through environmental sustainability.[14].

7.1.2 Study II: Socio-economic determinants in selecting childhood diarrhea treatment options in Sub-Saharan Africa: a multilevel model.

This study represent the first effort to analyse quantitatively, the association between individual and contextual socio-economic position and choice of treatment setting for childhood diarrhoea at household level in SSA using mixed effect multilevel multinomial modelling technique. Based on nationally representative cross-sectional data from eleven countries in SSA, this thesis has confirmed that choice of treatment setting for childhood diarrhoea varies based on socio-economic status. First, the result shows that, treatment choices for childhood diarrhoea at household level in SSA depend on both individual and neighbourhood measures of SEP. Choice of medical centre for managing case of childhood diarrhoea was highly associated with educational attainments of both the father and the mother (caregiver) of the child.. Highly educated caregivers had a higher likelihood of patronizing medical centre for managing childhood diarrhoea. While this finding is in the right direction, it is in contrast to a study conducted in another low income country with high incidence of childhood diarrhoea[112]. This finding however, is compatible with those of several others [113-115]

that have documents maternal education attainment as a predictor of utilizing medical centre for managing childhood diarrhea episode. Partner's education was shown to be associated with choice of medical centre, this finding is in line with what had been reported earlier [115 116]. The association of partner's education with choice of medical centre gave an indication of the protective role of father's education[117]. In most countries in SSA, fathers are the decision maker and has the final say being the head of the household and sometimes decides where care is sought [118]. Hence, it is not a surprise to see that, caregiver's partner's education is associated with patronage of pharmacy store and medicine vendors and sometimes engage in self- care for treating diarrhea.

However, the influence of wealth status on caregiver's preference for private and public medical centres when managing childhood illness is not noticeable. Although it was shown that, care givers from poorer households relative to those from poorest household engaged in home care as an alternative option for managing childhood diarrhoea. This finding has been reported elsewhere; that households sometimes do engage in self-medication to curtail high cost of treatment in medical centre [119 120]. Similarly, the result lends support to findings from other studies and documents caregivers' occupation, as an important factor influencing choice of treatment [115 121 122]. This study goes further to document that, being a manual worker is closely associated with choice of medical centre, while being a professional occupation is associated with patronage of pharmacy store or medicine vendors. Although it has been documented elsewhere [123 124],that geographic location, is another form of disparities and sometimes could prevent access to utilization of care[125]; this thesis shows that, though statistically not significant, living in rural area, is associated with likelihood of patronizing traditional healers. This finding may not be too surprising as many countries in SSA are highly pluralistic. The mixed effect multilevel multinomial regression models shows that, with all other factors being held constant, living in highly socio-economically disadvantaged neighbourhood is associated with less likelihood of patronizing medical centre, pharmacy or vendors. Though choice is discretionary, several other factors at the caregivers' neighbourhood may directly impact on their individual personal choices.

7.1.3 Study III: Neighbourhoods socio-economic disadvantage, individual wealth status and patterns of delivery care utilization in Nigeria: a multilevel discrete Choice analysis.

Findings from this thesis based on multilevel discrete choice analysis present crucial and rare evidence on the association between individual-and-neighbourhoods socio-economic characteristics and pattern of choice of place of delivery.

The finding in this thesis would be the very first attempt in Nigeria, the study setting and SSA as whole to jointly utilized multilevel discrete choice model to examine association between individual-and-neighbourhoods socio-economic characteristics and pattern of choice of place of delivery. Findings showed positive associations with household wealth status education, and occupation, and the use of private and government health facilities for child birth. This association is in support of earlier findings from previous studies in Nigeria [66 126 127-129], and from other part of the world [68 126]. Multilevel modeling analysis revealed that women in professional occupation and those with higher level of education were more likely to use both than to using home for child birth. This finding is expected given the fact that educational

attainment and occupation are sources of economic resources which empowers women to take charge of their own health and facilitate easy access to quality maternal care. This thesis together with previous work [64], document the role of partner's education on the use of both private and government health facilities against home for child birth. In particular the result shows that, women having partners with higher level of education tend to use either of the facilities than giving birth at home.

Lack of adequate health insurance mechanism coupled with huge out-of-pocket expenses has long been recognized as a major challenge to healthcare financing in Nigeria [130] . This study shows that only those women who had health insurance were able to use either of private or government health facilities for child birth while those without engaged in home delivery. This finding is not new, and is consistent with those of others. [63 131] Possession of health insurance is an indication of economic ability, and according to various health benefits packages across SSA would be instrumental to improving access to maternal health care utilization. [56]. The analysis also revealed that living in neighbourhood where antenatal attendance is higher favors the patronage of both government and private health facilities for child birth. The probable reason for this finding might be related to the intensified health awareness campaign which tends to reaffirm the importance of preventive maternal health care services utilization around the communities. Demographic characteristics such as parity and maternal age at birth are well known to influence choice of delivery place and improve access to maternal healthcare in addition to economic ability[132]. In this study the result shows that, women of younger age at birth compared to those of older age were less likely to using both the government and private health facilities for child birth. This findings is in consonance with those of many others in sub-Saharan Africa and in other developing region of the world [51 68 133], In most of these studies reason for the use of health care facilities for child birth among older women were mixed when compared to result of a study conducted in some selected countries in sub-Saharan Africa [67]. McTavish and colleagues, in their study which looked at the effect of national female literacy and individual socio-economic position on maternal health care use in SSA, reported that both younger and older mothers had a similar risk of less likelihood of access to maternal health care. The main antecedent factors for this finding could be related to factors such as culture, belief, ethnicity, and associating with a traditional group [116 134].

7.1.4 Study IV: The influence of individual and contextual socioeconomic status on obstetric care utilization in Democratic Republic of Congo: a population based study.

The findings documents both individual and contextual socio-economic factors are important for uptake of both antenatal and delivery care among women in Congo democratic republic. As the country is at a stage of recovery and implementation of several health policies, information from this thesis may serve as guidance to policy makers and health planners. This thesis is the first population based study in the study setting to confirm using nationally representative data that, residence in highly socio-economic disadvantaged neighbourhood is associated with the less likelihood of using antenatal and delivery care. The result shows that after controlling for all other individual bio-demographic and socio-economic characteristics, women from richer households were more likely to have delivered their child at health care facility. This finding reverberates what had been reported in other studies [66 135]. The study documents that women's occupation is associated with the use of antenatal care services and that partners occupation favours use of health facility for child birth. These findings are consistent with those of many others [68 127-129]. This study also compliments other studies [67 136 137], to document the positive effects of women's education on utilization of health facility for child birth. Another important finding from this study is the effect of living in urban area on the utilization of facility- based delivery services. This is in line with a result of an earlier study [68].

7.1.5 STUDY LIMITATIONS

The finding from studies included in this thesis is not without limitations and should be noted. First, this study used an indirect measure of household wealth status. The DHS do not collect information on personal income, as it is rather difficult to obtain such in developing country settings such as SSA. Hence, the use of asset based index as a proxy for household wealth has become the most widely used methodology, had been found to be reliable[138]. Second, other proximate and contextual-level determinant such as social norm and beliefs which are known to be important for uptake of preventive maternal and child health intervention and were not included in the model is another potential limitation. Third, like many other multilevel studies the use of community as proxy for administratively defined boundaries might generate biases. The cross-sectional nature of the data set used in this thesis is acknowledged as such design does not permit for estimation of reverse causation. For instance, it is possible that caregivers after the failure of initial treatment for managing childhood diarrhoea may seek care elsewhere. The data used in the analysis is also prone to information bias, which might introduce recall bias. This is due to the fact that the respondents were asked about which type of care was sought.

7.1.6 STUDY STRENGHTS

Despite these limitations, studies included in this thesis have numerous strengths. First, the studies are based on the most recent nationally representative population-based survey sample. Second, the DHS surveys are similar in design with similar variables which are comparable across settings; therefore the findings could be generalized to other developing countries settings. Third, the studies are unique in its use of multilevel-modeling technique, which takes into consideration the nested structure of the data thus allowing for the clustering effect of the outcome variable to be examined [93], which is an important fact that have been ignored by previous studies. Fourth, area-level socio-economic characteristics have been shown to be more complementary than are individual-level measure of socio-economic[139], hence the author use of this approach in those studies is justified.

7.2 POLICY IMPLICATION AND RECOMMENDATIONS

This thesis provides insight into how SES is related to uptake of programmatic lifesaving preventive maternal and child health care interventions in SSA; from both the individual and neighbourhood socio-economic perspectives. This study as shown that economic characteristic of the neighbourhood's in addition to the well-known effect of individual SES were the main reason for the underutilisation of the preventive interventions. As a result those in actual needs are not been covered by those interventions. This finding is innovative and gave assertion to what has long been known about poor people being confined to a particular section of the community which depicts their standards of living characterised by lack of access to economic resources. Characteristics of the neighbourhoods are important, and sometimes can affect individual health outcome and behaviour [140 141]. This is also evidenced by the choice of home delivery among women in urban areas of Nigeria. Hence, it is worth discussing several issues that are of relevance and would require policies for their implementation. It is worrisome that Nigeria despite having an average density of 35 doctors and 86 nurses per 100,000 population which is well above the sub-Saharan average of 15 doctors and 72 nurses per 100,000 [142 143], still has majority of her urban women population engaging in home delivery. As a first step, to achieve equity and effective coverage, mechanisms that seek to improve on the scaling up of and uptake of programmatic interventions in LMICs should consider neighbourhood effects on both urban and rural areas. To reduce practice of home delivery if it not eliminated totally, and encourage utilization of proven programmatic interventions; Nigerian government should encourage younger doctors to serve in the less economic endowed part of the country with good financial incentives and adequate job security. A culture of home deliveries is highly prevalent in many SSA countries [144] and it is well known that such deeply in-rooted cultural practices are sometime difficult to change in the short term. However, if deemed inevitable, home deliveries should be assisted by qualified personal. This could provide a gradual process of making the population into accepting professional help. Young doctors/midwives could assist in such a process by being available for home deliveries, and raising awareness of the dangers of professional absenteeism during such practices. In relation to socio-economic disadvantage, providing professional assistance in home deliveries would bring the service right to the front door of the women, thus cutting down on cost incurred (e.g. transport). As long as the population remain poor, this could be a feasible short-term innovation

that government could finance and adopt to enhance access to qualified care for mother and child. In relation to this, the population could benefit from increasing the number of health facilities in the community. Indeed, the current thesis has indicated that the proportion of healthcare services in relation to population size is an important factor in healthcare seeking. Such intervention thus is likely to bring the service closer to those in need, thereby reducing cost incurred, beneficial for financially disadvantaged majority.

To further improve on the uptake of preventive and curative interventions, there is an urgent need to revisit the use of community health extension workers (CHEWs), The role of CHEWs in delivering community based preventive and curative healthcare services has long been recognised[145-147]. CHEWs were shown to have made substantive contributions toward strengthening immunization services in rural India [148]. Also in several countries in SSA, CHEWs have contributed to HIV/AIDS prevention and treatment and delivery care services [149] [150]. Much could be achieved using the services of this category of healthcare assistance through capacity building.

As it is now well known that health systems in LMICs face multi-level constraints from micro level at the household and community level to health system to macro public policy and environmental level of the region[151]; with the year 2015 fast approaching, it is paramount that countries in SSA intensified effort and capitalise on what works. The problem of underutilization of health services in SSA and other Low-and-Middle income regions of the world which has been traced in part to the introduction of users' fees [35] is amenable. Arguably, users' fee has imposed unnecessary hardship on the disadvantaged section of the community through catastrophic payment and out-of- pocket expenses when seeking care [152-155]. Even for those interventions that are free, the poor still have to pay a token and in some cases cover some distance to obtain such mainly due to geographic in accessibility. This untold hardship coupled with ease of accessibility as made them to seek solace and reliance on traditional and unregulated providers[53]. During the introduction of user fees in several other part of the world such as Nepal and, Kenya [156] [157] , it was shown that the poor were severely affected. For instance the abolition of user's fees in Uganda leads to improve uptake of preventive services among the poor[155]. This singular incidence corroborates the facts that users fees has always been to the detriment of the poor[40] . However, there are also goods sides to users' fees, empirically it has been shown that users' fees could strengthen health system and yield positive results through effective stewardship and proper implementation[158]. A good example of proper implementation of users fees and its corresponding positive effect is seen in Cambodia [159], where the fees were fixed below the unofficial rate. This encourages the uptake of preventive care services by women and children and discouraged the health providers from charging unregulated fees. In the same vein, introduction of users fees for services such as reproductive and preventive maternal health of which demand is currently in sufficient [40] [160], might not be tenable in most countries. Based on association of each domains of SEP on the utilization of preventive maternal and child services as seen in this thesis; there are several demand side mechanism that could be adopted to increase the demands for the services and benefits the poorer section of the society without hardship. Demand side mechanisms such as sliding user fees, fee exemption and waiver programs, vouchers and health cards for the poor, and health equity funds, If properly implemented based on individual country circumstance could save the continent from perennial deaths of women and children. While some strategies are working, there are some other fee waiver schemes that failed to meet the need of the poor[161]. In practice, for demand side to function effectively, a portion of supply side mechanism must be adopted. Ghana is a good example of a country where debt relief funds from Highly Indebted Poor Country (HIPC) had been used judiciously to institute a universal fee exemptions program for

maternal care, which was well received[162]. Nepal is another country where such funds had been used to impact on health and well-being of it citizenry[160]. The only difference is that Nepalese approach is targeted at the impoverished part of the country. Countries in SSA that has benefited from such program should emulate these exemplary countries and channel the fund to good course such as this. A conditional cash transfer is another program that has been found to be effective in increasing the uptake of preventive services in several LMICs[163]. Adoption of such could serve as a means to reverse less uptake of preventive intervention and help improve health seeking behaviour.

Countries in SSA should as a matter of urgency makes sure they study different demand side mechanism to health financing and adopt the one that suit their situation. Where users' fees can not be abolished totally, countries should at least in principle make sure the poor and the marginalized have a better way of accessing care without much hardship. The need and support from donor agencies in implementing some of these financing mechanisms is highly inevitable in SSA.

8 FURTHER RESEARCH

As countries countinue to experiment with several demand side mechanisms, future research should aim at examining the effect of other factors both at individual and neighbourhood level apart from SES on uptake of these interventions. Specifically, attention should be paid to patronage of private and public health facilitites for preventive services. Sustainability of these new innovation should also be looked into.

8 CONCLUSIONS

This thesis has established the fact that there were socio-economic inequities both at individual-and-neighborhood level in coverage of programmatic life saving interventions among women and children in sub-Saharan Africa. Specifically, sub studies show that:

- High socio-economic status indicated by caregiver's occupation and household's wealth status, being from South South and South Western geographic regions and living in less economic disadvantaged neighbourhood were associated with Vitamin A supplement uptake among children in Nigeria.

- Caregivers educational attainment, father's educational attainment, and caregivers occupation, were strong predictor of selecting medical centre, pharmacies and home care for managing childhood diarrheoa episode; while living in less economic disadvantaged neighbourhood were associated with selecting medical centre and pharmacy stores .

- Household wealth status, women's occupation, partner's educational attainment, and health insurance coverage were associated with use of private and government health facilities for child birth. And that higher birth order, young maternal age and living in highly economic disadvantaged neighborhood were associated with home delivery.

- Women's occupation and household wealth status were predictor of antenatal care uptake, while household wealth status, women's education, partner's education were associated with based delivery. Living in less economic disadvantaged neighbourhoods was associated with antennal care uptake and facility based delivery as compared to home delivery.

Thus polices that would seek to improve on uptake of these intervention should address, the population as a whole and take into consideration the effects of their social environment.

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