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DECENTRALIZED PUBLIC DELIVERY, ACCESSIBILITY, AND UTILIZATION OF MATERNAL HEALTH SERVICE IN GIDA AYANA WOREDA, WESTERN ETHIOPIA.

BY

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DECENTRALIZED PUBLIC DELIVERY, ACCESSIBILITY AND UTILIZATION OF MATERNAL HEALTH SERVICES IN GIDA AYANA *WOREDA*, WESTERN ETHIOPIA

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This is to certify that the thesis prepared by Habtamu Tolera, entitled: ***Decentralized public delivery, accessibility and utilization of maternal health services in Gida Ayana Woreda, western Ethiopia*** and presented in fulfillment of the requirements for the Degree of Doctor of Philosophy in Geography and Environmental Studies (Specialization in Socio-Economic Development Planning and Environment) compiles with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Declaration

I, the undersigned, declare that this thesis is my original work, and all sources used in the dissertation have been duly acknowledged.

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Acronyms and abbreviations

Acronyms

ANC: Antenatal care

AOR: Adjusted Odds Ratio

COR: Crude Odds Ratio

CI: Confidence interval

CRDA: Christian Relief and Development Association

CSA: Central Statistical Agency

DHFs: Decentralized Health Facilities

DEM: Digital Eleveation Model

EWZFEDO: Eastern Wollega Zone Finance and Economic Development Office

EDHS: Ethiopian Demographic Health Survey

FDRE: Federal Democratic Republic of Ethiopia

EPRDF: Ethiopian People Revolutionary Democratic Front

FMoH: Federal Ministry of Health

FH: Facility Heads

FGD: Focus Group Discussion

GAW: Gida Ayana *Woreda*

GIS: Geographic Information System

GPS: Global Positioning System

GP: General Practitioner

HEWs: Health Extension Workers

HIC: High Income Countries.

HSTP: Health Sector Transformation Plan

ICF: International Classification for Functioning

LMIC: Low- and Middle-Income Countries

MMR: Maternal Mortality Rate

MDG5: Millennium Development Goal Five

MNL: Multinomial Logit

OHB: Oromia Health Bureau.

ORS: Oromia Regional State

PM: Policy Makers

PNC: Postnatal Care

QGIS: Quantum Geographic Information System

SA: Spatial Accessibility

SB: Service Board

SD: Standard Deviation

SDG: Sustaianable Development Goal

SPSS: Statistical Package for Social Science

TBA: Traditional Birth Attendant

TV: Television

TGE: Transitional Government of Ethiopia

UAO: Unadjusted Odds Ratio

UNs: United nations

US: United States

USAID: United States Agency for International Development

VIF: Variance Inflation Factor

WHO: *Woreda* Health Officials

WHO: World Health Organization

WB: World Bank

Abbreviations

X^2: Chi-square

N: Number

Km: Kilometer

Km^2: Kilometers Square

±: Plus-Minus sign

$: Dollar sign

Min: Minute

M: Meter

Abstract

***Objective*:** *The specific objectives of this study were to explore the extent of implementation of decentralized public health reform delivery and its effects on local service performance, to examine behavioral factors influencing participants' visits to decentralized healthcare facilities (DHFs) for ANC visits as recommended, to identify delay factors for women's choice of DHFs for child delivery, to identify risk factors for non-utilization of DHFs for PNC and to model the spatial accessibility of DHFs to target households in Gida Ayana Woreda, western Ethiopia.*

Methods: *Qualitative data were collected through IDI (from 29 randomly selected informants) and FGD (with 8 groups from purposively selected community users). Quantitative data on utilization of DHFs were collected from randomly selected 459 eligible women. A total of 459 random households and 7 DHFs were geo-referenced. Software such as Epidata version 3.1, SPSS version 24.0, GIS version 10.3, QGIS version 3.6, etc. were used. Qualitative data were analyzed for themes with the aid of a decentralization framework and OpenCode 4.02.*

Results: *The qualitative data showed mixed results regarding decentralizations. The reform brought some achievements such as improved autonomy over several areas of personnel management, utilization of health care revenue, local resource mobilization, health service board and so forth. On the other hand, decentralization was not able to ensure local community's needs in service programming. Inadequate capacity and capability in planning activities and implementing of facility performance monitoring tools were also some other barriers. Chi-square and multinomial logistic regression analyses were employed to examine the association between a set of behavioral factors and visits to DHFs for ANC as recommended. Visit to DHFs for ANC was influenced by complex sets of predisposing, enabling, perceived pregnancy needs and external environmental factors. Having fewer than 2 children, home visits by HEWS, administrative decentralization unit and high fever were most often explaining visits to DHFs for ANC. Phase I and Phase II delay factors driving women's choices of DHFs for child delivery were studied in a multivariable logistic regression model. Accordingly, most women preferred DHFs to home for child delivery. Their choices were Phase I and Phase II delays factors specific. Phase I delays were socio-cultural factors like literate women and support from local traditional practice. Perceived needs were primarily planning to delivery at health facility, knowledge of complications and home visit by HEWs. Physical accessibility (Phase II delays) included availability of transportation and 'health center' type of DHFs. Regression model indicated that women who lived in outer rural kebeles and 35 years or older were most significantly exposed to risks for non-utilization PNC. Households' SA to the closest DHFs in the form of shortest path walkways, traveling time and Euclidian distance were analyzed by ArcGIS and QGIS. SA modeling has been skewed 'because the mean walking time of rural sample households to closest DHFs (in Tobler's hiking time) was 62.4 min.*

Conclusion: *The study emphasized that, reducing woreda's resource dependency, increasing local decision power over recruitment of local staff, promoting bottom up service planning and monitoring, etc should be given priority in order to enhance the effectiveness of the decentralisation of health services. The study also emphasized that it is important to increase ANC and PNC service utilization by improving on birth size and spacing; improving home visit by HEWs, increasing knowledge and benefits of minimum maternal care visits. Local socio-economic development measures such as targeting poor women/households; health education/promotion and reducing physical distance in rural areas are critical for improving service utilization.*

Chapter 1. _____

General introduction

Chapter 1. General introduction

Background

Countries all over the world have health care systems which are sets of activities and actors whose principal goal is to improve the health and welfare of their citizens and sustain the socio-economic productivity of society (Bossert, 1998; Cassels, 1995; Panda & Thakur, 2016). However, millions of people in low-and middle-income countries (LMIC) experience life threatening and other serious health problems related to maternal or general population episodes (Alkema et al., 2016). Complications of pregnancy and childbirth alone cause more deaths than any other health problems (Thaddeus & Maine, 1994; Chakrabortye tal., 2003) and this remains to be the major developmental and health challenges for most LMICs (Bucagu et al., 2012; Chakraborty et al., 2003).

The situation is worse in LMICs like Ethiopia due to inadequate access to modern health services, underutilization due to delays in accessing the existing service (CRDA, 2004; Tesfaye et al., 2017). Evidence shows that 303,000 women worldwide died from obstetric complications in 2015, that can be largely prevented (Alkema et al., 2016). Over 99% of all maternal deaths occur in LMICs. Among these deaths, the largest proportion (66·3%) occur in sub-Saharan Africa with the highest maternal mortality rate (MMR) of 546 per 100,000 live birth (LB) compared to 16 per 100,000 LB in high income countries (HICs). The progress in limiting these has been slow and sporadic (Lassiet al., 2014). With 410 deaths per 100,000 LB, Ethiopia was one of the countries with the highest MMR worldwide and is one of the countries that accounted for 59% of the global maternal deaths in 2015 (Kassebaum et al, 2016; WHO, 2015). The country has made progress in reducing the MMR (from 871 in 2000 to 673 in 2005; 676 in 2011, and 410 in 2016) but a number of individual, community and health system related factors have impeded quick improvements in maternal health primarily antenatal care (ANC), delivery service and postnatal care (PNC) uptake (CSA & ICF International, 2016; Kassebaum et al., 2016).

Decentralized local service delivery alongside local participation reaches wide-ranging beneficiaries (Heywood & Choi, 2016; WHO, 1978). Decentralization has functioned as the

hub of institution building efforts by governments and development organizations, including health service systems. They adopted and implemented these programs in one form or another in a large number of LMIC (see, for instance, Manor, 1999; Campbell, 2003) to increase the accessibility and utilization of health services (Cassels, 1995). The impetus for fostering the reform came from the perceived inefficiencies associated with centralized development approach to provision of basic services. For instance, critics of centralized provision of services delivery argue that public spending by central governments frequently does not reach the intended communities (Atkinsona et al., 2000; Ahmad et al., 2005; Akin et al., 2016) and the distribution of these resources usually follows a skewed pattern (Faguet, 2004).

The theoretical argument posits that decentralized approaches to development ameliorates the delivery of services (WB, 2001; Gupta et al, 2004). The arguments signify the existence of a potent link between decentralization reform and service delivery utilization (Nathan et al., 2015; Heywood & Choi, 2016). However, the empirical evidence concerning the relationship between decentralization and service delivery to date remains inconclusive at best (Collins, 1994; Bossert et al., 2000; Kritski & Ruffino, 2000). For instance, findings from a number of studies (see, for inistance, Faguet, 2004; Gupta et al., 2004; Garcia, 2008; Nathan et al., 2016) show some positive impacts of decentralization and suggest that decentralized institutional arrangements help facilitate efficient delivery of services and utilization performance. Others (Conyers, 2007; Robinson, 2007) found no positive correlation between decentralization and service delivery. Different sources (Gupta et al., 2004; Akin et al., 2016) confirmed that decentralization may serve to create opportunities for causing improvement in service delivery. Such opportunities are, however, often contingent upon a variety of factors, such as strong political will (Blair, 2000; Semali et al., 2005), adequate local authority, autonomy, resources (CRDA, 2004; Frumence et al., 2014), reliable accountability and community participation, all of which can enhance effective implementation of health reform (Cassels 1995; Brinkerhoff, 2004). Some studies in Ethiopia (Garcia, 2008; RLDS, 2013) also documented that the reform showed a substantial improvements in government responsiveness and hence the provision of basic social services such as health care, roads, water and sanitation.

The utilization of the existing decentralized health services program, especially maternal health care, in LMICs is low due to various factors (Andersen, 1995; Anderson & Newman, 1973; Tesfaye et al, 2017). Utilization is not only facilitated by the effectiveness of decentralized

service health reform (Hartwig et al., 2015; Tanga & Bloom, 2000) but also by demand side utilization indicators and risk factors (Singh, 2016; Haile-Mariam & Kloos, 2005) influencing to seek for decentralized health programs (CRDA, 2004; Singh, 2016). Sources (Filippi et al., 2006; Gabrysch & Campbell, 2009;Thaddeus & Maine, 1994) revealed that the utilization of local health services delivery is the interactive effect of numerous factors, including, health beliefs, knowledge and awareness of illness conditions, health-seeking behavior, socio-economic status, the external environment, and the availability, accessibility, quality and cost of services in local settings. These factors are still not fully addressed although they strongly influence the utilization of decentralized community-based health facilities in LMIC (Ghuman & Singh, 2013; Hartwig et al., 2015; Nathan et al., 2015). High disease risk and poor populations require proximal health services to facilitate access to health services and improve health outcomes (Karra & Fink, 2016). Evidence revealed that reduction in physical distance to households and improvements in health services utilization are associated with reductions in maternal mortality and morbidity (Tesfaye et al., 2017). The health reforms that bring health care services closer to remote communities may be assessed by examining the implementation of decentralized health performance, use and outcomes, highlighting utilization as an important part of the access concept.

In Ethiopia, decentralization of the health services to *woredas* (districts) was adopted in 2002 within the framework of the District Level Decentralization Programme (DLDP) that was charged, among other things, with ensuring that *woredas* have relevant and capable devolved structures of governance to offer care (Gebre-Egzhiabher, 2014; Haile-Mariam & Kloos, 2005). Thus, effects of decentralization of services delivery, proper utilization of existing facilities and positive health outcomes affect health reform programs and maternal outcomes. This research aims to explore the extent of implementation of decentralized health service delivery, accessibility and utilization of maternal services in Gida Ayana *Woreda* (GAW), rural western Ethiopia.

Statement of the problem

Increasing access to public health goods (Akin et al., 2016; Khan, 2013) and achieving Sustainable Development Goal 3 (SDG 3) of reducing MMR to less than 140 deaths per 100, 000 LB at national level by 2030 and universal access to reproductive health are major

developmental challenges for most LMICs (Alkema et al., 2016). The past three decades have seen many LMIC decentralizing their health systems with the expectation that the reforms will improve their citizens' health levels and bring about socioeconomic development (Frumence et al., 2014; Akin et al., 2016). In the early 1990s, a source estimated that at least 80% of the world's nations implemented some form of the reform (Manor, 1999). However, the impacts of decentralization on health systems have rarely been empirically tested in these countries (Akin et al., 2016). The extent of implementation and the performance of health sector reforms remain largely unknown (Jimenez & Smith, 2005; Maharani & Tampubolon, 2014).

Inadequate decentralization and implementation affect the delivery, quality and utilization of health services (Kaur et al., 2012; Kilewo & Frumence, 2015). Health care system decentralization, often implemented with adequate local authority, autonomy and community involvement in service planning and delivery has been acknowledged as a key means of improving the accessibility and utilization of services (Alvarez et al., 2016; Nathanet al., 2015). These structural changes also tend to foster socio-economic development since healthy societies are more productive than unhealthy ones (WB, 1993; Bossert et al., 2000; Wunsch & James, 2014).

In many LMIC, including Ethiopia, the local health system is the key structure for the delivery of basic services (Akin et al., 2016). However, many decentralized health systems are curtailed by various constraints in delivering services to the people. These constraints include weak decision power or autonomy over resources, particularly over funds, and the absence of local accountability, transparency and user voices his or her concerns over bad performance (Purwganingrum et al., 2010; Blair, 2000; Munoz, et al., 2017), corruption, lack of actual participation of citizens in decision-making and shortage of qualified staff (Collins et al., 1994; Moses, 2001). These shortcomings lead to poor service planning and poor management of health resources (Asante et al., 2006; Frumence et al., 2014). The lack of effective implementation and monitoring of decentralized programs often resulted in poor quality of service and delivery of infrastructure in terms of the availability of medicines, equipment, and qualified personnel, especially in rural areas (Collins et al., 2002; Kaur et al., 2012). The performance of many decentralized services deteriorated due to a combination of local financial constraints, shortages of personnel with managerial skills, the loss of the ability to re-deploy personnel between facilities (Collins et al., 2002), and personnel management practices

that prioritized the interests of local or higher-level notables rather than the needs of the local people or facility (Aitken, 2004; Kaur et al., 2012; Munga et al., 2009). These barriers adversely constrain the implementation and the benefits of the reform on local health service delivery, quality of performance and utilization outcomes (Kaur et al., 2012; Singh, 2016).

Furthermore, effective service planning and management of a decentralized health services programs are not enough by themselves if the health service system is not properly utilized by the targeted community users (Hartwig et al., 2015; Regmi et al., 2017) due to complex societal problem. Sources argued that the utilization of services is determined not only by their accessibility but also by demand side factors in the form of individual and community based predisposing, enabling, perceived needs and environmental determinants related to socio-economic, cultural and demographic factors (Anderson et al., 1973; Gabrysch & Campbell, 2009; Khan, 2013). In low economic settings, including Ethiopia, diverse nationalities and local cultural and socioeconomic groups have various behaviors regarding health-seeking, pregnancy, delivery and post-delivery services (Tesfaye et al., 2017). In many societies, pregnancy is considered culturally to be a matter of fate and a natural process that does not warrant extra attention (Furuta & Salway, 2006; Khatri et al., 2018). Physical accessibility factors such as inadequate transportation, distances to facilities, and limited economic accessibility due to inadequate household income, health education, poor awareness of available programs, lack of trust in maternal services and the dominance of the family in decision making often cause major delays in deciding to seek or reach facility (Moyer & Mustafa, 2016; Tesfaye et al., 2017; USAID, 2012). Maternal health requires careful attention as it is intricately linked with local context (Idowu, 2013; Yaya et al., 2018). Poor socio-economic and environmental conditions (Phillips et al., 1998; Tesfaye et al., 2017; Khatri et al., 2018), such as low educational status, income, family size, stressful work environments, and inadequate home visit were risk factors and tend to impede the use of locally available maternal services (Haile-Mariam & Kloos, 2016; Kumie & Kloos, 2006; Tesfaye et al., 2017). It is, then important to empirically investigate both decentralization or delivery and utilization of health services particularly in relation to maternal health.

Post-military regime in Ethiopia was accompanied by decentralization drive aimed at making delivery of the country's failing social services more efficient (Gebre-Egzabhre, 2014). The country has embarked on the reform in the early 1990s and the process of decentralization

started taking shape in the midst 1990s based on the 1993 health policy and the 1995 Federal Constitution for management of health-care institutions and other basic social sectors in nine regions and two city councils (EPRDF, 1995; EPRDF, 1993). In 2002, the country also implemented a radical fiscal, political and administrative decentralization (Gebre-Egzhiabher, 2014) under which the responsibility for delivery of health services was transferred from regional government to *woreda* (district) government (Garcia, 2008; USAID, 2010; Wamai, 2009). The *woreda* health system was the focal points for the operationalization of the health reform because it is the structure that is the closest to communities and where most of the basic services are provided (Haile et al., 2017). In DLDP, *woreda* (district) government had primary hospital at the top of their pyramidal system, followed by health centers, and community health posts at the bottom which are currently the level of entry into the healthcare system primarily for women and under-five (FMoH, 2002).

The issue is then how decentralization reform functions in practice in delivering basic health services (in connection with devolved local decision power, local autonomy, local accountability and community participation), or understand the extent of the implementation of decentralization to subnational local institution and identify the challenges of implementation. Furthermore, in addition to service delivery, it is important to understand health care utilization and identify local variables that influence the same by assessing a set of local variables attributed to behavioral, delay and risk factors of utilization including spatial accessibility of the decentralized health facilities (DHFs) that influence local service delivery and maternal service outcomes.

There is no empirical works on the extent of decentralization of health reform in practice in Ethiopia (Kassa, & Shawel, 2013; Lee, 2015). Previous studies considered only the aggregate provision of social services (Lee, 2015; RLDS, 2013; Pundhir & Boke, 2015) and not the health services. The issue of the actual measuring of spatial accessibility (SA) of DHFs to local community users have also not been documented in Ethiopia; usually in public health studies it has been examined as a perceived binary variable as yes, ‘a factor’ or no, ‘not a factor’ kind of analysis (Okwaraji et al., 2012) which did not actually measure how far or close the users are to the DHFs in the country (Kloos, 1990; Okwaraji et al., 2012). This study seeks to fill this knowledge gap by measuring geographical accessibility to DHFs in our research area. There are also gaps in our knowledge about the effects of a set of behavioral, delay and risk

factors on the utilization or non-utilization of DHFs for ANC, delivery site choice or PNC services using frameworks such as Andersen model, the 'Three-delays model' and others (see for instance, Tesfaye et al., 2017; USAID, 2012; Fisseha et al., 2017; Tarekegn & Lieberman, 2014; Tiruaynet & Muchie, 2019). Furthermore, these studies did not also consider the relationship between the extent of implementation of decentralization reform, accessibility and utilization of maternal health (Haile et al., 2017; Kassa & Shawel, 2013). Thus, there is a need for holistic studies that evaluate the extent of implementation of decentralization of health reform in relation to service utilization. Hence, this study hopes to fill these gaps and seeks to explore the extent of decentralization reform, accessibility and maternal utilization indictors and risk factors through a case study of Gida Ayana *Woreda* (GAW), in rural western Ethiopia.

Objectives of the study

General objective

The general objective of this research was to examine the implementation of decentralized health service delivery, the spatial accessibility (SA) of decentralized health care facilities (DHFs) and the factors influencing the utilization of maternal health service in Gida Ayana *Woreda* (GAW), rural western Ethiopia.

Specific objectives

The specific objectives were:

- To explore local communities', health providers' and policy makers` perception of the extent of implementation of decentralized public health delivery and effects on local service performance,
- To examine behavioral factors influencing women's use of DHFs for ANC visits as recommended,
- To identify delay factors for women's choice of DHFs for delivery service site utilization,
- To examine potential risks for women's non-utilization of DHFs for PNC services,
- To identify the spatial accessibility (SA) of primary healthcare facilities to target households in the study areas.

Research questions

Based on the above specific objectives, the following research questions were addressed during the course of this study:

- How do the local communities, health providers, and policy makers perceive the implementation of decentralization and its impact on local service delivery in connection with local authority, autonomy, local accountability and community participation?
- What factors influence the recommended number of ANC visits and fewer than the recommended number of ANC visits to DHFs?
- What are the determining factors that delay women's choice of DHFs for delivery services utilization?
- What are the key risk factors for non-utilization of DHFs for PNC service?
- What is the level of the spatial accessibility (SA) of decentralized primary healthcare facilities in the study area?

Scope of the study

Decentralization is a very wide multifaceted concept, including the transfer of responsibility for public goods from the national government to subordinate or quasi-independent subnational government organizations and/or the private health service providers. However, the study, focuses on the extent of implementation of public health sector decentralization reform at a *woreda* level (in connection with local authority, local autonomy, local accountability and community participation) and its effects on local health service delivery, accessibility and utilization of maternal health. The geographical scope of the study is confined to GAW local government. With regard to methodological scope, mixed approaches of both qualitative (including FGDs and IDIs) and quantitative (community based cross-sectional survey) study designs were employed. Temporally, the research was conducted from 2015/2016 to 2019/2020.

Rationale

Examining information on how efficiently the decentralized public health sector reform is functioning, in Ethiopia and other developing countries must address complex phenomena of local institutional service delivery management, individual, community and facility-based barriers (Alkema et al., 2016; Pasha et al., 2013; Wamai, 2009). However, our knowledge of the extent of implementation and health impacts of decentralization, accessibility and utilization of health facilities is insufficient to develop programs that can reduce maternal morbidity and mortality in all high-risk populations (Hartwig, 2015). This is the major instigation to conduct this study.

Knowledge about the effects of decentralized health system delivery provision and utilization to improve decision making (Jeremie et al., 2014) is constantly growing. In LMICs including Ethiopia, this has special importance for the government, policy makers and administrators of health services in view of geographic vastness and socio-economic and cultural diversities on one hand, and the ever-growing health needs and population growth on the other (Akin et al., 2016; Bucagu et al., 2012; CRDA, 2004; Garcia & Rajkumar, 2008; Idowu, 2013). Empirical evidence from frontline service delivery agencies, community users, and policy makers about the relationship between decentralization and health services utilization provide valuable knowledge on how the decentralized system of primary health service delivery actually works and contributes a lot to the existing literature (CRDA, 2004; Kassa & Shawel, 2013; Lee, 2015).

This micro-level research has allowed for a deeper insights into actual outcomes in public service delivery at the community level (Akin et al., 2016; Heywood & Choi, 2016). Assessments of health system performance at the national level have only limited value due to the heterogeneity of populations and health systems (Haines & Cassells, 2004; Idowu 2013). More useful information for policymakers has to be obtained from *woreda* (district) and *kebele* (sub-district) levels assessments of health system performance (Tandon, 2005), particularly for a country as diverse as Ethiopia. The findings of this study will enrich the policy dialogue within the country about institutional measures to improve local authority, autonomy, local accountability and participation and their effect on *woreda's* service accessibility and utilization performance (Gupta e al., 2004).

Conceptual framework

Decentralization of health service (adequate local decision-making authority, local autonomy, local accountability and community participation) plays a pivotal role in affecting service delivery and management with the aim of bringing services closer to target populations and grassroot community users. Linking decentralized health service provision and health system performance, highlighting the utilization and quality of services as an important component of the accessibility concept is therefore critical, as we did in our study (see Figure 1.1).

Figure 1.1 provides the conceptual model of the study. The framework depicts the various key input and output variables in the study and their interactions. The left-hand side of the model (boxes) generally describes the extent of implementation of decentralization, determinants and risks of health system performance, and spatial accessibility of DHFs for maternal health service use. The first box in the left-hand side from the top depicts how the actual implementation of decentralized health programs in practice influence local health service provision in line with given local decision-making authority, local autonomy, local accountability, and local community participation (the four dimensions of decentralized service delivery, see for inistance USAID (2009) and Wunsch, (2014). An adequate transfer and effective implementation of decentralized decision-making authority, autonomy, accountability and community participation improve service delivery while inadequate transfer of power, autonomy, accountability and community participation creates a problem and negatively impacts the actual implementation of the reform which negatively affect the quality and the utilization of health system performance.

There are also factors of health system performance that influence the decision of pregnant mothers to utilize or not utilize a DHFs for maternal health care (see also the left-hand side of the model). These factors are behavior factor, delay factors, risk factors and spatial accessibility factors that also positively or negatively impact health service delivery and the utilization in this study. Unlike the behavioral factors, delay factors and spatial accessibility factors, risk factors are factors that negatively impact on women to utilize DHFs for postnatal care. The middle and the right side of the conceptual framework illustrates the impacts. The impacts are expressed in terms of improved quality of decision-making actions, improved quality of skilled health professionals, access or coverage, improved supplies of equipment

and drugs, and improved maternal services utilization outcomes or otherwise, which then influence the overall health reform performance, and maternal health. In addition, service utilization in the form of recommended ANC utilization, utilization of delivery sites, and utilization of PNC service are other forms of impacts which are affected by the different factors influencing utilization.

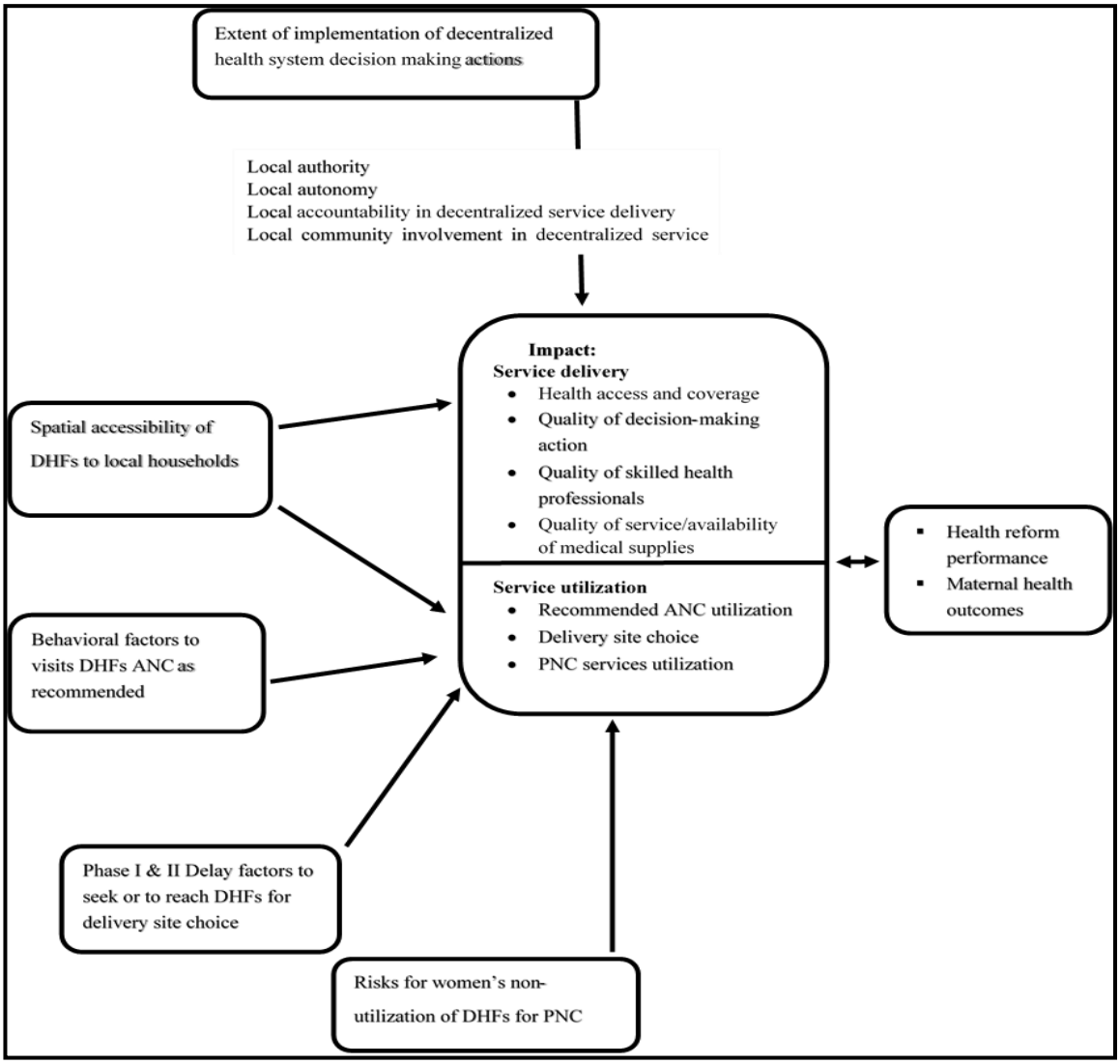

Figure 1.1. A schematic framework showing the extent of implementation of decentralization, geospatial accessibility and other factors impacting local service delivery, utilization, quality and performance.

Dissertation outline

The dissertation contains seven chapters. Chapter one is an introductory part of the dissertation which presented background of the study, statement of the problem, objectives, research questions and rationale of the study among others. Following the introduction, which is presented in chapter one, chapter two deals with public health service delivery in a decentralized system. The chapter explores the extent of implementation of decentralized public health sector reform in practice in the *woreda* nexus vested local authority, local autonomy, local accountability and community participation. In this section, decision powers and functions transferred to GAW local government are identified. Autonomy over different areas of personnel management, fiscal and revenue management, local bidding and procurement, autonomy of service programming and planning and others were scrutinized. Different local accountability holding and verification techniques and forms, problems of local capacity and basic challenges for adequately ensuring local officials and communities' accountability are presented in this part of the dissertation. Finally, the major impacts of the implementation of decentralization reform on local health service delivery, performance and quality of service outcomes are discussed.

The third chapter reports on the proportion of women who received the recommended number of ANC visits, those who failed made fewer ANC visits to DHFs than recommended by World Health organization (WHO) and on women who did not visit DHFs at all. Different health behavior and utilization factors in predisposing, enabling, perceived pregnancy needs, and external environmental conditions are discussed. Major predictors of the outcome variables were also identified and the reasons for not attending DHFs for ANC services at all during the last pregnancy were described. The response variables were also mapped by study sites.

In the fourth chapter the proportion of women who preferred DHFs as their choice for child delivery were tabulated and discussed. Phase I Delay and Phase II Delay factors that determined the choice of the women to give birth at delivery site were examined. Different forms of socio-cultural, perceived benefits and needs factors and physical accessibility factors affecting local women's decision to seek skilled birth care or to travel to delivery sites were also discussed. Predictors of outcome variable were adjusted, tabulated and discussed. The utilization of different health facilities by women for their last childbirth was examined. Lastly,

the chapter also mapped the distribution of the status of women's delivery service utilization across study sites.

In chapter five, major risk factors for women's non-utilization of DHFs for postnatal care are reported in relation to socio-economic, cultural, and demographic factors, reproductive obstetric characteristics, experiences and knowledge about maternal health services. The chapter also mapped the distribution of the status of PNC service utilization across study sites.

Chapter six presents the application of actual measures of SA of DHFs to targeted households using Geographic Information system (GIS) and Quantum Geographic Information System (QGIS) tools. Three travel time scenarios to the closest primary healthcare facilities are examined. These were 1) the shortest path footpath length between the residences of maternal cases and the closest DHFs, 2) walking or traveling time on the shortest path between households and health facilities, and 3) the Euclidian distance between the location of the sample households and the closest health facilities. Estimates of the mean distance of sample households located within 60 minutes (min) travel time from the closest DHFs, and more distant households were discussed. This chapter also mapped walking footpath networks between target households and DHFs in the study area. Chapter seven summarizes the study findings and offers pertinent conclusions and policy implications.

References

Ahmad, J., Devarajan, S., Khemani, S., & Shah, S. 2005. *Decentralization and service delivery. Washington, D. C, USA.*

Aitken, K., & Liisa, R. 2004. Human resources for health decentralization's impact on the health workforce: perspectives of managers, workers and national leaders. *Human Resources for Health* 2: 1–11.

Akin, J., Hutchinson, P., & Strumpf, K. 2016. "Decentralisation and government provision of public goods: The public health sector in Uganda." *The Journal of Development Studies* 41(8): 1417-1443.

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A. A. 2016. Global, regional , and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *Lancet.* 387: 462-74.

Alvarez, F. N., Mart, L., Merida, H R., & Guzman, G. E. 2016. Primary health care research in Bolivia: Systematic review and analysis. *Health Policy & Planning* 31: 114-28.

Andersen, R. M. 1995. Revisiting the behavioral model and access to medical care: Does it matter?" *Journal of Health Social Behaviour* 36: 1-10.

Anderson, R., & Newman, J. F. 1973. Societal and individual determinants of medical care

utilization in the united states. *Milbank Memorial Fund Quarterly.* 81: 95-123.
Asante, A. D., Zwi, A. B., Ho, M. T. 2006. Getting by on credit: How district health managers in Ghana cope with the untimely release of funds. *BMC Health Service Research* 6(105).
Atkinsona, S., Medeirosa R. R., Oliveiraa P. L., & Diasde, A. R. 2000. Going down to the local: Incorporating social organisation and political culture into assessments of decentralised health care. *Social Science & Medicine.* 51: 619-36.
Blair, H. 2000. Participation and accountability at the periphery: Democratic local governance in six countries. *World Development.* 28(1): 21-39.
Blas, E., Limbambala, M. 2001. User-payment, decentralization and health service utilization in Zambia. *Health Policy Planning* 16(Suppl.2): 19-28.
Bossert, T., Beauvais, J., & Bowser, D. 2000. *Decentralization of health systems: preliminary review of four country case studies. Major applied research, technical report. Bethesda, M.D: Partnerships for health reform project, associates Inc.*
Bossert, T. 1998. Analyzing the decentralization of health systems in developing countries: Decision space, innovation and performance. S*ocial Science & Medicine.* 47(10): 1513-27.
Brinkerhoff, D.W. 2004. Accountability and health systems: Toward conceptual clarity. *Health Policy & Planning* 19(6): 371-79.
Bucagu, M., Kagubare, J. M., Basinga, P., Ngabo F., Timmons, B. K., & Angela, C. L. 2012. Impact of health systems strengthening on coverage of maternal health services in Rwanda, 2000-2010: A systematic review. *Reproductive Health Management,* 20(39): 50–61.
Cassels, A. 1995. Health sector reform: Key issues in less developing countries. *Journal of International Development.* 7(3): 329-47.
Central Statistical Agency [CSA] of Ethiopia & ICF International. 2016. *Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, & Rockville, Maryland, USA: CSA & ICF.*
Chakraborty, N., Islam, M. A., Chowdhury, R. I., Bari, W., & Akhter, H. H. 2003. Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International.* 18(4): 327-37.
CRDA [Christian Relief & Development Association]. 2004. *The participation of NGOs/CSOs in the health sector development program of Ethiopia*. Addis Ababa: Ethiopia.
Collins, C. D., & Green, A. T. 1994. Decentralisation and primary health care: Some negative implications in developing countries. *International Jorunal of Health Service* 24: 459-476.
Collins, C. D., Mayeh, O., & Ehsanullah, T. 2002. Decentralization, health care and policy process in the Punjab, Pakistan in the 1990s. *International Journal of Health Planning Management.* 17: 123-46.
Conyers, D. 2007. Decentralization and service delivery: Lessons from sub-Saharan Africa. *IDS bulletin* 38(1): 18-32.
Ethiopian People Revolutionary Democratic Front [EPRDF]. 1995. The Constitution of the 1995. *Proclamation no. 1 (November, 1995)*. Addis Ababa: Ethiopia
Faguet, J. P. 2004. Does decentralization increase government responsiveness to local needs?: Evidence from Bolivia. *Journal of Public Economics.* 88: 867-893.
Fang, P., Ruirong H., & Qiuxia H. 2016. Effects of healthcare reform on health resource allocation and service utilization in 1110 Chinese county hospitals: Data from 2006 to 2012. *International Journal of Health Planning & Management. (2):230-246.*

Federal Ministry of Health [FMoH] of Ethiopia. 2002. *Health Sector Development Program II. 2002/2003-2004/2005. Addis Ababa: Federal Ministry of Health [FMoH][Ethiopia]*.

Filippi, V., Ronsmans, C., Campbell, O. M., Graham, W. J., & Mills, A. 2006. Maternal health in poor countries: the broader context and a call for action. *Lancet.* 368: 1535-1541.

Fisseha, G., Berhane, Y., Worku, A., & Terefe, W. 2017. Distance from health facility and mothers perception of quality related to skilled delivery service utilization in northern Ethiopia. *International Journal of Women's Health*, 9: 749-756.

Frumence, G., Nyamhanga, T., Mwangu, M., & Hurtig, A. K. 2014. The dependency on central government funding of decentralised health systems: Experiences of the challenges and coping strategies in the Kongwa district, Tanzania. *BMC Health Service Research*, 14(39): 1-9.

Furuta, M., & Salway, S. 2006. Women's position within the household as a determinant of maternal health care use in Nepal. *International family planning perspective*: 17-27.

Gabrysch, S., & Campbell, O M. 2009. Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy & Childbirth*, 9: 34.

Garcia, M., & Rajkumar, A. S. 2008. *achieving better service delivery through decentralization in Ethiopia achieving better service delivery through decentralization in Ethiopia.* The World BanK: *Washington, D.C*.

Gebre-Egziabhre, T. 2014. Decentralization and regional and local development: trends and policy implications in Rahmato, D., Ayenew, M., Kefale, A., & Habermann, B, Eds. Reflection on development in Ethiopia: New trends, sustainability and challenges. Addis Ababa: Forum for Social Studies. pp.130-168.

Ghuman, B. S., & Singh, R. 2013. Decentralization and delivery of public services in Asia. *Policy & Society* 32(1): 7-21.

Gupta, M. D., Gauri, V., Stuti, K. 2004. *Decentralized delivery of primary health services in Nigeria survey evidence from the states of Lagos and Kogi, Africa Region Human Development*.

Haile-Mariam, D., & Kloos, H. 2005. Modern health services. In: *Epidemiology and Ecology of Health and Disease in Ethiopia*, Eds., Berhane, Y., Haile-Mariam, D., & Kloos, H. Addis Ababa: Shama Books, 13-28.

Haile, T., Abera, D., & Andualem, Y. 2017. An assessment of decentralized public health service delivery: The case of Afar national regional state. *Inernational Journal of Research in Management, Science & Technology* 13(7): 29-45.

Haines, A., Cassells, A. 2004. Can the millennium development goals be attained? *British Medical Journal.* 329: 394-397.

Hartwig, R., Sparrow, R., Budiyati, S., Yumma, A., Warda, N., Suryahadi, A., & Bedi, A. 2015. Effects of decentralized health care financing on maternal care in Indonesia. Jakarta: Indonesia.

Heywood, P., & Choi, Y. 2016. Health system performance at the district level in Indonesia after decentralization. *BMC International Health & Human Rights.* 10(3): 1-8.

Hutchinson, P. 2002. *Decentralization in Tanzania: The view of district health management teams*. Wahington, D. C: USAID, USA.

Idowu, A. E. 2013. *The socio-cultural context of maternal health in Lagos state, Nigeria: Covenant University, Ota, Ogun State.*

Jeremie, N., Kaseje, D., Olayo, R., & Akinyi, C. 2014. Utilization of community-based health information systems in decision making and health action in Nyalenda, Kisumu County, Kenya. *Universal Journal of Medical Science* 2(4): 37-42.

Jiménez, D., & Peter, C. S. 2005. *Decentralisation of health care and its impact on health outcomes*.

Karra, M., & Fink, G. 2016. Facility distance and child mortality: A multi-country study of health facility access, service utilization, and child health outcomes. *International Journal of Epidemiology*. 1-10.

Kassa, A., & Shawel, Y. 2013. Integrating all stakeholders: health service governance in Addis Ababa. In: Mihyo, P & Chanie, P (Eds.), Thirty years of public sector reforms in africa: Selected country experiences. Kampala: Fountain, 55-131.

Kassebaum, J N., Steiner, C., Murray, C., Lopez, A., & Lozano, R. Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease Study. *Lancet*. 2016; 388:1775-812.

Kaur, M., Prinja, S., Singh, K., & Kumar, R. 2012. Decentralization of health services in india: Barriers and facilitating factors. *Journal of Public Health* 1(1): 94-104.

Khan, S. A. 2013. Decentralization and poverty reduction: A theoretical framework for exploring the linkages. 18(2) 145-172. *International Review of Public Administration* 18(2): 145-72.

Khatri, R. B., Dangi, T. P., Gautam, R., Shrestha, K. N., & Homer, S. E. 2018. Barriers to utilization of childbirth services of a rural birthing center in Nepal: A qualitative study. *PLoS ONE*, 12(5).

Kilewo, E. G., & Frumence, G. 2015. Factors that hinder community participation in developing and implementing comprehensive council health plans in Manyoni district, Tanzania. *Global health action* 8(1).

Kritski, A. L., & Ruffino., N. A. 2000. Health sector reform in Brazil: Impact on Tuberculosis Control. *International Journal of Tuberc & Lung Disease* 4: 622-626.

Lassi, Z. S., Rehana, A S., Jai, K. D., & Zulfiqar., A. B. 2014. Essential interventions for maternal, newborn and child health: background and methodology. *Reproductive Health* 11(Suppl 1): 1-7.

Lee, J. 2015. The process of decentralisation in ethiopia since 1991: Issues on improving efficiency. *Korea Review of International Studies*: 3-16.

Maharani, A., & Tampubolon, G. 2014. Has decentralisation affected child immunisation status in Indonesia?, *Global Health Action* 7(1).

Manor, J. 1999. *The political economy of democratic decentralization. Washington, D.C: The World Bank, USA.*

Moses, G. 2001. *Decentralization, local bureaucracies and service delivery in Uganda. Vol. 115. Discussion paper, Campala: Uganda*.

Munoz, D. C., Amador, P. M., Lamas, L. M., Hernandez, D. M., & Sancho, J. S. 2017. Decentralization of health systems in low and middle income countries: a systematic review. *International Journal of Public Health* 62(2): 219-229.

Nathan, L. M., Shi, Q., Plewniak, K., Zhang, C., Nsabimana, D., Sklar, M.,…Mutimura, E. 2015. Decentralizing maternity services to increase skilled attendance at birth and antenatal care utilization in rural Rwanda: A prospective cohort study. *Maternal Child Health Journal*

19(9): 1949-55.
Okwaraji, Y. B., Cousens, S., Berhane, Y., Mulholland, K., & Edmond, K. 2012. Effect of geographical access to health facilities on child mortality in rural Ethiopia: A community based cross sectional study. *PLoS ONE* 7(3): 1-8.
ORS [Oromia Resgional State]. 2015. *Oromia Regional State, Eastern Wollega Zone Finance And Economic Development Office: Physical and socio economic profile of Gidda Ayana Woreda*. Finfinne: ORS, Ethiopia.
Panda, B., & Harshad, P.T. 2016. Decentralization and health system performance: a focused review of dimensions, difficulties, and derivatives in India. *BMC Health Services Research* 16(Suppl 6): 1-14.
Pundhir, R. K., & Abebe, B. 2015. Assessment of decentralized local governance performance for service delivery in Ethiopia: The case study of Angacha District. *European Academic Research* 3(3).
Purwganingrum, A., Aningrum, F., McDonald, F., Short, D., & Ariani, D. 2010. *Health Governance in the local level: The case of decentralization, planning and accountability in Gunungkidul, NIAS, Indonesia*.
RLDS [Regional & Local Development Studies]. 2013. *Governance and public service delivery: The case of water supply and roads services delivery in Addis Ababa and Hawassa cities. Addis Ababa University: Regional and Local Development Studies (RLDS), Ethiopia*.
Regmi, K., Jennie, N., Paul, A. P., & Alan, G. 2017. Decentralization and district health services in Nepal: Understanding the views of service users and service providers. *Journal of public health devolvepment* 32(3): 406-17.
Robinson, M. 2007. Does decentralization improve equity and efficiency in public service? 30 delivery provision? *IDS bulletin* 38(1): 7-17.
Semali, I. A. J., Marcel, T., & Don, D. S. 2005. Decentralizing EPI services and prospects for increasing coverage: The case of Tanzania. *International Journal of Health Planning & Management*, 2005; 20: 21-39.
Shrestha, G., & Ganga, S. 2011. Statistical analysis of factors affecting utilization of antenatal care in Nepal. *Nepal Journal of Science & Technology* 12: 268-75.
Singh, A. 2016. Supply-side barriers to maternal health care utilization at health sub-centers in India. *PeerJournal.* (11).
Tandon, A. 2005. Measuring efficiency of macro systems: An application to millennium development goal attainment. *Asian Development Review.* 22: 108-1258.
Tang, S., & Bloom, G. 2000. Decentralizing rural health services: A case study in China. *International Journal of Health Planning & Management.* 15: 189-200.
Tarekegn, S., Lieberman, S., & Giedraitis, V. 2014. Determinants of maternal health service utilization in Ethiopia: Analysis of the 2011 Ethiopian Demographic and Health Survey. *BMC Pregnancy & Childbirth* 14(161): 1-13.
Tesfaye, G., Loxton, D., Chojenta, C., Semahegn, A., & Smith, R. 2017. Delayed initiation of antenatal care and associated factors in Ethiopia: A systematic review and meta-analysis. *Reproductive Health* 14(150): 1-17.
Thaddeus, S., & Maine, D. 1994. Too far to walk: Maternal mortaliity in context. *Social Scince & Medicine.* 38(8): 1091-1110.
Tiruaynet, K., & Muchie K. F. 2019. Determinants of utilization of antenatal care services in

Benishangul Gumuz region, western Ethiopia: A study based on Demographic and Health Survey. *BMC Pregnancy & Childbirth* 19(115): 1-5.

WHO [World health organization]. 2015. Trends in maternal mortality. *1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization*.

USAID [United States Agency for International Development]: 2009. *Democratic decentralization programming handbook*. Washington, D. C. USA

USAID [United States Agency for International Development]. 2012. *Cultural barriers to seeking maternal health care in Ethiopia: A Review of the literature*. Washington, D. C: USAID, Addis Ababa, Ethiopia.

USAID [United States Agency for International Development]. 2010. *Health facility governance in the Ethiopian health system.* Washington, D. C: USAID, Addis Ababa, Ethiopia.

Vidler, M., Ramadurg, U., Charantimath, U., Katageri, G., Katadiguddi, C., & Qureshi, R. 2016. Utilization of maternal health care services and their determinants in Karnataka State, India. *Reproductive Health* 13(Supl1).

Wamai, Richard G. 2009. Reviewing Ethiopia's health system. *International Medical Community Reviewing*, 52(4): 279-86.

WB [World Bank]. 1993. *World Development Report: Investing in health.* Oxford University Press, *New York*.

WB [World Bank]. 2001. Decentralization and governance: Does decentralization improve public service delivery?*, no 55, PREMnote*.

WHO [World Health Organization]. 1978. *Primary health care: Report of the international conference on primary health care: Alma-Ata, USSR. Geneva, Switzerland*.

Wunsch, J. 2014. Decentralization: Conceptual and analytical issues. In: *Wunsch, J., & Dickovick, T. Eds., Decntralization in Africa: The paradox of state strength. London: Lynne Rienner.*1-22.

Yaya, S., Ghose, B., Olalekan, A. U., & Agbessi, A. 2018. Why some women fail to give birth at health facilities: A comparative study between Ethiopia and Nigeria.*PLoS ONE* 13(5): 1-11.

Yilmaz S., & Venugopal, V. (2008). Local government discretion and accountability in Ethiopia (Working Paper 08-38). Atlanta: Georgia State University. USA.

Chapter 2. _____

Public health service delivery in a decentralized system: A qualitative study of the perception of health providers and community members in Gida Ayana *woreda*, rural western Ethiopia

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Chapter 2. Public health service delivery in a decentralized system: A qualitative study of the perception of health providers and community members in Gida Gida Ayana *Woreda*, western Ethiopia

Abstract

Background: Some policy makers believe a decentralized health system enhances service delivery by improving authority, autonomy, accountability, and community participation at the local level. An understanding of the extent to which these benefits have been realized and whether there are gaps in service delivery is essential for policy designs and system reinforcing strategies.

Methods: Data were gathered through 29 interviews with service providers and policy-makers and 8 FGDs with residents to capture their opinions and perceptions. Data were analyzed with the aid of guiding thematic framework approach deductively, based on the topic guide, and the conceptual framework, and inductively by subthemes or quotes emerging from the the transcripts with the aid of openCode software version 4.02.

Results and conclusion: The results showed several benefits of the decentralization program that include increased autonomy over staff planning, budgeting, appointments; increased participation in service boards, in cash and in kinds. The findings also revealed several challenges that hinder the effective functioning of decentralization including lack of authority to recruit staff, interference in the appointment, transfer of cases, procurement; limited fiscal autonomy and community accountability in service planning and monitoring. Although the decentralized health program was designed in earnest, critical elements for attaining adequate decentralization are still lacking. The region is still a major player in staff recruitment, resource transfer, and planning/programming. These deficiencies have resulted in inadequate information, nominal service monitoring, and low quality of services outcomes. Better quality of service delivery necessitates financial independence and meaningful service monitoring.

Keywords: Decentralized health service, Ethiopia, Authority, Autonomy, Effects of decentralization.

Introduction

Calls for health system decentralization date back to the Alma Ata Declaration in1978 (Beard & Redmond, 1979) and became more urgent during the 1990s (Mehrotra, 2006). Conceptually, decentralization in the context of health services entails the following: transfer of administrative authority to lower offices accountable to the centre (Rondinelli et al., 1989), transfer of routine managerial authority to semi-autonomous health facility boards reporting to politicians (Mills, 1990), transfer of power and structures for health from the central government to the local government answerable to electorates (Smith, 1997), and shift of public health to private providers (Hutchinson, 1999).

Local authority and autonomy overcome the disadvantages of centralized institutional and spatially distant bureaucracies; minimize costs, increase responsiveness to local needs; improve community involvement; and ensure accountability of local politicians, health managers, planners, and decision makers (Rifkin, 2014; Tang & Bloom, 2000). Several health sector reforms recommend citizen participation to ensure local accountability of health program management for ensuring adequate service delivery, monitoring the allocation and utilization of monies for health services, and developing and monitoring programs that permit them to voice their rights (Molina, 2017).

A number of studies have emphasized the need for local institutional authority, autonomy, participation, and accountability for effective implementation and improvements of health services outcomes (Menon, 2006; Mill, 1990; Murthy & Klugman, 2004). However, evidence drawn from 10 countries indicates that decentralization of public systems, including health systems, has increased only slightly in Africa recently, with few achievements in the areas of autonomy, accountability, and capacity in service delivery (Wunsch, 2014). Many healthcare professionals are concerned that only a few of the policy designs and systems that have been implemented reinforce strategies for health that use authority, autonomy, participation, and accountability as important guidelines for effective health policy programs (Mill, 1990; Murthy & Klugman, 2004). Some studies also report a lack of effort to fully examine this situation even though these aspects are essential for the implementation of decentralized public health services (Kassa & Shawel, 2013; Kwamie et al., 2015).

Prior to 1991, Ethiopia was a centralized country with a unitary form of authoritarian government. Decisions were made at the centre in the absence of formally established sub-national governments accountable to the needs of local communities (Gebre-Egzhiabher, 2014). Decisions on production and distribution of public health services were channelled from the capital, Addis Ababa, without actual authority, autonomy, accountability, or participation at the lower levels (Fiseha, 2007; Kloos, 1998).

With the introduction of decentralization following the downfall of the authoritarian military regime in 1991, the sub-national governments gained status in the country (Gebre-Egzhiabher, 2014). As a result, power was transferred to the regions and *woredas* (district) as part of a broader process of political and economic reform in two waves (Dickovick & Gebre-Egziabher, 2014). The first wave, or regional decentralization, was accomplished in the early 1990s; it divided Ethiopia into nine regional state structures (Federal Democratic Republic of Ethiopia [FDRE], 1995). This devolved considerable power, authority, functions, and resources to the regional governments. The second wave, or *woreda* decentralization, was implemented in 2002. This reform further deepened decision-making power, authority, and resource transfer from the regions to *woredas* governments for service delivery (Dickovick & Gebre-Egziabher, 2014).

Public health service delivery functions were among the key service areas devolved by the program to regional and *woreda* levels (Wamai, 2009). However, the possible effects of decentralized reform on health service delivery were often ignored in decentralization studies in Ethiopia (Kassa & Shawel, 2013). Studies have revealed that inadequate local authority and autonomy over resources, poor accountability, and insufficient local participation have inhibited effective health delivery outcomes (Kassa, 2015; Kassa & Shawel, 2013; Kilewo & Frumence, 2015; Pundhi & Boke, 2015; Regmi et al., 2017). There is a need to explore the details of the *woreda* decentralization to understand the extent to which the decentralization program shaped local healthcare delivery system and outcomes (Kassa & Shawel, 2013; Lee, 2015; Wamai, 2009).

The objective of this study was to explore the views and perceptions of participants regarding whether the decentralized public health system has improved health service delivery and management at the community level in four *kebele* in Gida Ayana *Woreda* (GAW*)*. The study

provides baseline data about the health sector reform implementation and about the health status of the study groups. Moreover, it adds to the existing evidence about some impediments to health service delivery reform and some of the outcomes. Lastly, the results of this study call for policy makers to revisit decentralized health service delivery in order to ensure that local governance structures and health policy practitioners have adequate authority, autonomy, resources, accountability, and popular participation in healthcare reform implementation and management to improve the status and quality of health service delivery.

Materials and methods

Study approach

A qualitative case study design was employed in this study in order to allow an in-depth and comprehensive exploration (Yin, 2003) of how decentralization works in practice and affects the delivery of local health service supply at the community level. This qualitative research used a naturalist approach, which tries to understand phenomena in context-specific settings and gives insights of participants' experiences of the world (Frumence et al., 2013; Tong et al., 2018). The qualitative approach was considered suitable because it can elucidate the experiences of those who are directly dealing with the planning and implementation of healthcare reforms as well of community users (Abayneh et al., 2017; Kwamie et al., 2015). Our study focuses on intermediate outcomes of decentralization, such as local authority, autonomy, accountability, and participation, in a case study of Gida Ayana *Woreda*.

Study setting

The study was conducted in Oromia Region, Gida Ayana *Woreda* (GAW), western Ethiopia, about 450 km from Addis Ababa, and 112 km from Nekemte, the capital of Eastern Wollega Zone. GAW lies between latitude of 9º 26' N & 10º 20' N and between longitude of 36º 30' E and 36º 48' E (Figure 2.1). The area of the *woreda* is about 1,502 square km. Administratively, the *woreda* has been organized into 7 urban and 21 rural *kebeles* (the smallest administrative units in Ethiopia). According to the 2013 population projection release and Oromia Regional State, the *woreda* had a total population of 140,484, of which 78.1% were rural residents (Central Statistical Agency of Ethiopia [CSA], 2013). The health care system in the Gida

Ayana *Woreda* is largely based on public health facilities, including 1 woreda hospital,5 health centers and 28 health posts. There were also 8 private drug shops, 3 private drug venders and 1 clinic under NGO ownership (OHB, 2015).

GAW was purposively selected as a typical rural *woreda*. The rationale for undertaking such a study focused on GAW is based on several considerations. First, the *woreda* is one of the *woredas* in Oromia Region which, according to the zonal health sector annual plan assessment report by the Oromia Health Bureau (OHB, 2015), has a low performance at lower level health facilities compared to other *woredas*. Secondly, this *wored*a has been supported by different local NGOs like Oda, Hunde Gudina and other International NGOs, and civil societies during implementation of decentralization process (OHB, 2015). Finally, because of its size and other characteristics (Central Statistical Agency of Ethiopia [CSA], 2013), GAW can provide evidence as to whether decentralization has resulted in improved health services management, delivery and utilization.

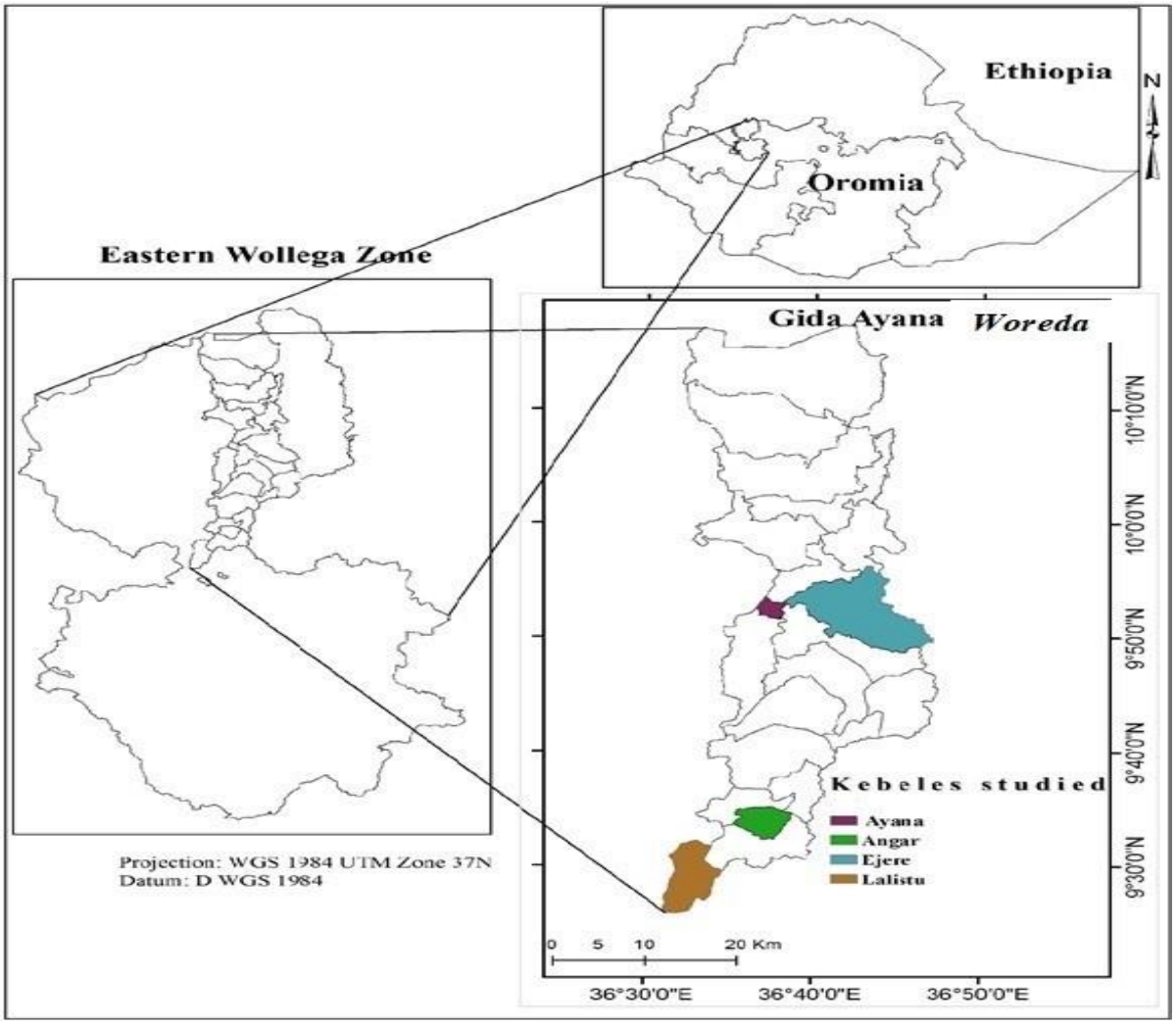

Figure 2.1 Study area (Generated using Arc GIS version 10.3)

Participants

Study participants were categorized into three groups: local service providers, policy makers, and community members. A total of eight focus group discussions (FGD) were held with community participants. The community members were drawn from four randomly selected *kebeles*: Ayana, Ejere, Angar and Lalistu. Male and female community members representing different socioeconomic, sex, and age groups were purposively identified in order to capture their experiences with the health service delivery system and quality in the *woreda*. Women and men participants were placed in separate FGDs.

A total of 29 in-depth interviews (IDIs) (Table 2.1) were conducted with local service providers and higher-level policy makers. Local service providers are people involved in delivering health services at the *woreda* level. They were included in the study because they were experienced in the implementation, management, and delivery of the decentralized healthcare reform (Abayneh et al., 2017). The interviewees consisted of participants from the *woreda* health office (*WHO*) (n = 6), facility heads (FH) (n = 7) from the study *kebeles*, and service board members (SB) (n = 12). Local service providers were chosen purposively based on information from local officials. Policy makers (PM) (n = 4) at both national and regional levels were those involved in policy, planning, and service development. They were also purposively chosen on the basis of their work experience in public health policy making and their knowledge of the subject matter (Tong et al., 2018).

Table 2.1. Demographic characteristics of participants interviewed

Characteristic of participants	*n* (%)
Local service providers	
Woreda health officials	6(20.7)
Facility heads	7(24.1)
Service board members	12(41.4)
Higher level policy makers	4(13.8)
Work experience (years)	
5-10	17(58.6)
11 or more	12(41.4)
Gender	
Male	22(75.9)
Female	7(24.1)
Educational level	
Diploma or certificate	4 (13.8)
First degree	17 (58.6)
Second degree or higher	8 (27.6)

Data collection

In-depth interviews and FGDs were the main data collection methods. In all, 29 face-to-face IDIs and eight FGDs were conducted to gather data. Four FGDs were completed with men community groups and four with women groups. Data were collected between January and June 2017. A topic guide for the interviews and FGDs was developed by the corresponding author on the basis of a literature review (Tong et al., 2018;Yin, 2003). The guide explored participants' experience with and perceptions of the *woreda's* authority, autonomy, accountability, and community participation and awareness in health planning; roles and responsibilities of the *woreda* government in service delivery and management; and effects of the reform on local health care. The questions were piloted with three officials and one FGD to establish face validity (Tong et al., 2018).

Data collection was conducted by two senior staff of a local university who were experienced in data collection and the corresponding author. Each interview was held in the participant's office and all FGDs were conducted at *kebele* halls. An FGD consisted of 8-12 participants. On average, IDIs and FGDs lasted between 60 and 90 minutes and 90 and 120 minutes, respectively. A local language was used in the interview with the local service providers and English language with policy makers. Participants were informed on the objective of the study prior to the interviews. Community participants were approached initially by local administrators.

Ethical issues

Wollega University research ethics board approved the protocol for this study [RNo. WU-99529/2016]. Gida Ayana *Woreda* and respective *kebele* authorities granted their permission to undertake this study in the areas under their jurisdiction. Interviewers also obtained their verbal consent. They were also told to decline the interview at any stage if they wish to do so. To protect the identities and anonymity of participants, only pseudonyms were used in the analysis and presentation of data. Probing was consistently employed during interviews. All interviews and discussions were sound recorded and handwritten field notes were taken.

Data validity and reliability

To ensure reliability, the instrument was pretested in an adjacent *woreda* for clarity and comprehension; after the pertest, some interview questions were reframed. Transcribed data were validated frequently by participants' feedback immediately after each interview and FGD. Important inputs were adjusted where necessary. Emerging themes were carefully compared alongside the data to ensure validity of the data; this enabled us to manage deviant cases in our analysis.

Data analysis

The interviews and FGDs were transcribed verbatim and the transcriptions used for analysis. The audio files and transcripts were crosschecked for accuracy before coding. Overall, the participants were identified by letter and number code. Data were analysed systematically. The researchers read and re-read the transcripts, ensuring a clear understanding of the content of the audio recorded interviews (Tong et al., 2018), and used the thematic framework approach deductively, based on the topic guide, and the conceptual framework, and inductively by subthemes or quotes emerging from the the transcripts with the aid of openCode software version 4.02 (ITS & Division of Epidemiology & Global Health, 2011).

Conceptual framework

Autonomy, authority, accountability, and participation are intermediate results of decentralization, not the end results (United States Agency for International Development [USAID], 2009; Wunsch, 2014). Achieving these results ensures service quality, which can be measured in improved health coverage, quality and availability of medical supplies, and quality of decision and services obtained from skilled providers (Kassa & Shawel, 2013). Our paper investigates whether these intermediate outcomes have been achieved in the study area and whether they have resulted in service improvement (Figure 2.2).

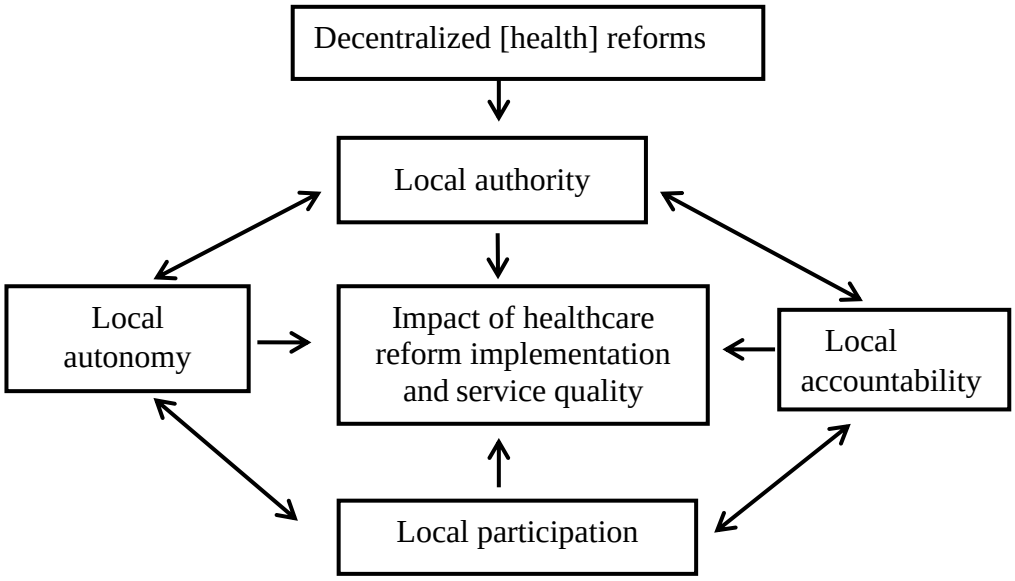

Figure 2.2. Conceptual framework for the study of decentralized healthcare delivery (Adapted from USAID, 2009).

Results

Background characteristics of study participants

The socio-demographic characteristics of the interview participants are shown in Table 2.1. Of the 29 individuals participating in the interviews, 6 (20.7%) worked at the *woreda* health office, 7 (24.1%) were facility heads, 12 (41.4%) were service board members, and 4 (13.8%) were regional and federal level policymakers. The majority (75.9%) were male; 58.6 percent had 5 to 10 years work experience. The four men and four women FGDs each had 8-12 members.

The responses of several of the study participants are cited in this section. The participants are identified by letter and number code. Those designated *W*HO were from the *woreda* health office, those designated SB were service board members, and those designated FH were facility heads. The IDI in the code indicates the information came from an in-depth interview; the FGD denotes information from a focus group discussion.

Authority

The decentralization system in Ethiopia established three constitutionally recognized tiers of government: federal, regional and *woreda*. In the health sector, the Federal Ministry of Health

and the Oromia Region Health Bureaus are policy making and regulatory institutions (Ethiopia Health Sector Development Program [EHSDP], 2006). Zonal Health Departments in Oromia are a conduit between the region and *woredas*; they provide support and channel information to both structures (Oromia Regional State [ORS], 2001).

The regional constitution gives *woreda* governments legal authority to prepare, approve, and implement their own development plans; monitor their implementation; set and collect certain taxes and service fees; and manage local resources (ORS, 2002). They are also charged with accountability for service delivery and engaging local communities (ORS, 2005). Legally, *woreda* health offices are responsible to perform the following functions (ORS, 2014): develop and implement health plans; administer facilities; provide reproductive health, family planning, vaccination, and sanitation services; control communicable diseases and quality of healthcare; promote health education and information and community participation; undertake procurements and implement civil service programs; control resources; monitor and evaluate service performance; manage complaints; and ensure the implementation of policies, proclamations, and directives (ORS, 2013). Health centre and hospital service boards were delegated authority to govern the facilities (ORS, 2005).

The above clearly indicates that the *woreda* government and the *woreda* health office have significant authority under the decentralized system to govern the health system. However, the extent to which the authority bestowed on them is fully exercised is a critical issue because legal authority by itself may not imply full power and ability to discharge responsibilities. The next section, on autonomy, elaborates on this issue by identifying some critical areas of engagement.

Autonomy

In this section we explore Gida Ayana *Woreda*'s administrative and fiscal decision-making autonomy organized around themes that emerged during analysis: (i) personnel management, (ii) fiscal autonomy, (iii) procurements, and (iv) service planning and programming.

Personnel management

Personnel management involves the planning for staff needs; recruitment, hiring, employing, and disciplining/firing of staff; transfers; appointments; and the provision of incentives. This section describes the prevailing practices of the Gida Ayana *Woreda* on these issues.

In terms of planning for local staff needs, most informants from the service board pointed out that the *woreda* has a considerable degree of latitude over planning and budgeting for health staff. The facility head confirmed that planning and budgeting for staff is fully devolved to the *woreda*. In this regard, the reform is fully autonomous and competent. An informant further noted that the sector prepares a recruitment plan to be presented to the *woreda* cabinet. The cabinet approved the plan after scrutinizing the required numbers, the levels of qualification, and the budget for remuneration. Upon approval, the health office directly requests higher offices to either post the recruitment and deploy to the *woreda* or ask the ministry to assign new graduates.

An informant from health office emphasized his appreciation of the autonomy of the *woreda* in planning for staff needs as follows:

Yes, the autonomy was earned since 2002. With this arrangement, the woreda preserved its independence from higher officials which is ultimately done locally. The hospital also plans its personnel need and requests the region to recruit (WHO, *IDI5*).

In response to the question whether the informant from the sector office believed the autonomy improved the decisions of local politicians, the following reply was given:

Yeah, with local autonomies we are able to plan, budget, and satisfy local staff needs (WHO, IDI2).

However, responses to the question of the authority and autonomy for recruiting and hiring of staff for local facilities show mixed results. According to health officials, the recruitment of support staff with diploma and below diploma qualifications is fully devolved to the *woreda*. Thus, the sector office and civil service department post vacancies and recruit and hire for such posts. All technical staff for positions with specific educational requirements and supportive staff for positions requiring an academic degree above the diploma are recruited and employed

at higher levels. Some facility heads approve of the *woreda's* autonomy for the recruitment of non-technical posts:

All right, we are vested with the autonomy of recruiting non-technical staff with diploma and below diploma. We post, recruit, and hire competent candidates. The process is very prompt, and such employees are relatively stable and quick at adapting to our work environment compared to staff hired by higher officials who even disappear after receiving an employment letter or one-month salary (FH, IDI3).

A WHO interviewee declared that the *woreda* has no autonomy to recruit or hire technical staff:

*Yes, we have no avenues open for recruiting these staff, no say about who is selected or not for our technical staff posts. Higher bosses recruit the candidates and lastly deploy to the woreda for the formalization of the employment (*WHO, *IDI5).*

Several local informants had serious concerns over the management of posting and recruiting local technical staff at higher levels, explaining that the practice promotes dependency of local institutions on higher authorities. They were also troubled that a lack of concern among higher officials about hiring skilled staff compromised the quality of local services. A health centre head noted the challenges of hiring inappropriate staff:

Higher politicians often recruit staff without considering our demand. Why? For instance, in 2016, Hangar Health Centre requested community health agents for a rural health post but they hired clinical nurses (*FH, IDI7*).

In terms of disciplining health workers, several informants noted that Gida Ayana has some autonomy in penalizing frontline workers who violate civil service laws. One official described his experience as follows:

The head of Angar Health Centre reported to us in 2016 that five technical staff members were disciplined by withholding one-month salary for repeated absenteeism from work (*WHO, IDI6*).

All facility heads and service boards reported that complaints come from service users were that workers provided inadequate services and these complaints should serve as a basis for

penalizing offenders. Many male FGD participants suggested that several service users do not clearly know their rights due to illiteracy, poor awareness, and lack of capacity that prevents them from exercising their rights. A community representative on a hospital board reflected her experiences as follows:

Users often preferred to tell board members about complaints they faced at the hospital to hold providers accountable due to fear of retribution and so forth. We informally obtained users' complaints and reported them to the head to take measures. For example, a general practitioner was fired from his job in 2016 due to users' complaints (*SB, IDI4*).

An important issue in human resources management has to do with staff transfer and appointments. Many facility heads noted that the *woreda* has some autonomy for making appointments for local positions. Others were concerned about the political patronage and clientelism in the appointment of staff. A medical director observed that officials give priority to certain individuals regardless of their performance and sometimes use their power to appoint their relatives and family members to positions in health centres and hospitals even if they are non-health personnel. One informant was concerned that local patronage was reinforced by staff appointment:

The code of having non-partisan and merit based civil servants is true only on paper. The actual case, however, shows a partisan bias. Members of the local ruling party and those who had links with politicians are often selected. Three staff are usually nominated for a single position and the party then selects a candidate. We are fed up because our exhaustive proposals are like a 'toothless dog' (*SB, IDI11*).

A number of informants noted that the *woreda's* full autonomy over staff transfers within its jurisdiction across facilities, where patronage is also common. Some cited cases in which cabinet members pressured health officials to transfer their relatives from rural posts to facilities in the *woreda* capital. The head of a health post elaborated as follows:

The politicians bring their relatives from rural to urban posts even in other sector offices or deliberately give them political positions which might cause rural facility closure, community mistrust (*FH, IDI7*).

In principle, the *woreda* is responsible for sending and receiving staff to and from other *woredas* through transfers. But *woreda* decisions are sometimes overruled by higher officials, and as a result there have been numerous unplanned transfers out of or into the *woredas* without the discretion of *woreda* health officials.

The provision of an incentive scheme is critical to retaining health workers in rural areas and reducing staff turnover. In this regard, several health centre heads noted that local facilities are currently experiencing high staff turnover due to a lack of established local staff incentive programs. They added that living and working conditions in remote rural *woredas* are not appealing to frontline workers and female workers often marry urban partners in order to leave the *woreda*. A board member of a health centre noted as follows:

Ejere and Lalistu kebeles usually experience high staff turnover because health workers use such settings as a ladder to obtain better jobs in towns (*SB, IDI6*).

Fiscal autonomy

Several health officials noted that health sector finance has relied heavily on regional transfers to the *woreda* council, which accounted for over 85 percent of the *woreda*'s total expenditures. Except for small amounts of capital earmarked for items such as a drug fund, a large proportion of the transfer is spent on staff salaries, over which the *woreda* council has little fiscal latitude. The head of the sector expressed his concern as follows:

*Majority of the council's health budget comes from regional grants. We have also exercised little fiscal autonomy in collecting a small portion of revenue from local resources like land taxes, user charges...within the regional purview. These are low yielding sources and contribute little to the total budget (W*HO*, IDI5).*

All heads of facilities were dissatisfied with budget distribution and mentioned that though the cabinet rhetorically declares health as a priority, this is rarely translated into action. In theory, 15 percent of the total *woreda* budget goes to health, but in fact the sector receives a smaller share. Health officials gave their opinion on whether budget distribution complies with the sector's budget proposals submitted to the council as follows:

*We fail to fill some vacant posts. We often use salaries of staff who died, left their jobs,...to fill our budget gaps (W*HO*, IDI6).*

All facility heads noted that facilities autonomously collect and utilize service fees upon approval by service boards and upon the final deliberations by the councils, which have moderately increased facilities' fiscal autonomy and flexibility in service planning. But setting and improving local tax bases or user fees rates is still subject to the approval of regional councils. Such decision-making process and regulations are imposed in an exercise of top-down authority, in contrast with bottom-up management. The utilization of this revenue is also controlled by extensive rules legislated by the regional government.

Procurements

Several informants from the health centres noted that the *woreda* finance office purchases office and stationery materials through the pull system, following requests from all sectors, including the health office. The informants had some concerns that the finance office obtains bids only from its own procurement committee. There is no space for other sectors, communities, and civil societies to scrutinize the transparency of the bidding and procurement processes. It was very traditional, less inclusive modes of decision-making.

Some informants in a sector office also questioned the quality and types of materials supplied. They further noted that the purchases were not compatible with purchase requisitions and specifications. For example, the purchase of tires for vehicles is often fraudulent. Furthermore, according to these informants, health facilities can purchase drugs and some medical equipment independently of the *woreda* pull system. A service board member also noted that the Oromia Regional Government office sometimes interfered in the drug procurement autonomy of the *woreda*. For instance, in 2016, the regional office retained earmarked drug funds without the knowledge of Gida Ayana *Woreda* officials and failed to send commensurable amounts of drugs. This constrained the fiscal authority and autonomy of the local government.

Service planning and programming

All local health sector informants noted that the *woreda* is not vested with the power of targeting new programs; it can deliver only the services already developed by the region. Regional informants noted that all the health programs implemented in the *woreda* are joint ventures of the national and regional governments. According to policy makers/planners at the federal level, health programs currently offered at the lower primary health level are guided by

centrally determined primary health care packages but are open to regional-level adaptation without requiring further adaptation by the *woredas*. A local board member noted that no forum was even prepared at the local level to inform targeted communities, private sectors, civil societies, and others about the recently introduced programs.

Zones play a significant role in the preparation of the *woreda* health plans. All local informants mentioned that the *woreda* planning team prepares the first draft plan at the zonal level after orientation by higher officials on regional or national plan guidelines, key indicators, regional targets, and a brief orientation on how *woredas* prepare *woreda* health plans based on the template. A health official added:

> *Our plans start at the zone. Every year, local planning teams, including facility heads travel to the zone to produce a draft plan from which we produce our final woreda-based health sector plan (W*HO*, IDI4).*

An informant from the *woreda* health office mentioned that:

> *Though we are interested in preparing woreda health plan on our own, we still lack planning experience and computer skills. We had one planning expert with a diploma but he left us for a better job. Absence of training is a major problem. We also go to the zone to share and agree with zonal targets and to meet regional interests* (*W*HO*, IDI2*).

Accountability

Some of the local accountability dimensions of public health service delivery reported by participants were analysed under the following sub-themes: (i) consultation and community forum, (ii) information access level, (iii) service monitoring, and (iv) auditing and reporting.

Consultation and community forum

Consultation and community forums provide for stakeholder scrutiny of plan activities. Most male FGD participants across *kebeles* mentioned that service boards, health officers, and health facilities approve and submit work and budget plans with no stakeholder scrutiny or feedback on the drafts. A female FGD participant noted the following:

I have lived here for 35 years. No one comes to my kebele [Lalistu] for consultation on the plans. I don't know the officials except a female worker who counselled me how to use maternal packages (*Female FGD1, Lalistu Kebele*).

With regard to forums, male FGD participants noted that although there is a provision to bring together health officials, technical staff, boards, and residents to discuss service accountability, this has not been put into effect. The informant added that failure to conduct a legislated community meeting and report sharing led to local actors neglecting their responsibilities. A service board member from Ejere *Kebele* appreciated the accountability of health extension workers (HEWs) as follows:

What is tangible in my kebele is a pregnant-women meeting held every month by health extension workers and heads of women groups (*SB, IDI9*).

Information access level

The availability of information regarding local health agendas and decisions is critical to ensuring accountability. Several FGD participants mentioned that accessibility to health information has been improved with the deployment of health extension workers (HEWs) and women groups. People living in poor, remote *kebeles* primarily access information through health extension workers and women groups. Many female participants indicated that health extension workers occasionally disseminate posters and provide health information to households. One male participant noted that informal sources of information are *woreda* administration council members; he reported,

We got more information on the health agenda or decisions from our neighbourhood council members than from formal institutions like kebele and health officials (*Male FGD2, Ayana Kebele*).

All community participants appreciated the practice of the *woreda* council in announcing the *woreda* budget by posting it on billboards; this practice increased the accountability of the local government to ordinary residents. Others noted that institutions use various instruments to ensure their fiscal accountability to clients:

Health facilities usually pin their budget and list of service charges on walls and notice boards ... to announce revenue, expenses, new drug names, and user charge-free programs (*Male FGD2, Ejere Kebele*).

Despite the above positive steps for increasing information availability, all informants noted that local channels such as radios and newspapers are lacking, and this constrains initiatives for creating awareness about health agendas among community members.

Service monitoring

One way of ensuring accountability is putting complaint-redressing mechanisms in place and ensuring that clients use them. Several male FGD participants, however, underscored that they lack capacity and are ignorant of their health rights, a situation that limits their ability to monitor services and forward their complaints. They added that clients fear retribution from providers for voicing complaints freely through opinion boxes or feedback booklets placed around each facility ward aimed at promoting downward accountability. Others described evasion by some facility managers of their downward accountability to clients as follows:

Many others including me usually put complaints in the opinion box on the medical ward, for instance, the absence of drugs prescribed for us by a doctor...and frequent referrals to private drug retailers by the hospital pharmacist. But the manager never read our notes submitted to air our complaints (*Male FGD1, Ayana Kebele*).

All informants in the *woreda* mentioned the community score card that enabled citizens to assess health facilities and the survey report card that assessed user satisfaction in 2016; both were available at all facilities. However, these cards are no longer in use due to lack of adequate and skilled human power, financial resources, and training for local staff on how to administer, analyse, report, and design interventions to fill potential gaps.

Reporting and auditing

One board member noted that:

Every quarter, the board, sector office, or regional bureau review plan performance. But the direct involvement of ordinary residents in plan and budget tracking is not yet thinkable to ensure downward accountability (SB, IDI11).

All facility informants described the transmission of activity and budget information from facility actors to the overseeing superior offices in order to ensure upward accountability. They also described quarterly council hearings of reports at which the sector office and hospital manager answered to *woreda* and regional legislators, respectively.

A service board member reported that there is a local auditing system on the utilization of resources. For example, one of the results of an audit exercise in the *woreda* has been an investigation of drug funds embezzled by higher authorities in 2016.

Participation

The nature of public participation in health service delivery is examined by looking at the participatory institutional structure and the forms of participation.

Institutional structure

This analysis found two types of participatory institutional structures in the *woreda*: the service boards and the women team and network. Regarding the boards, health office informants reported that board structures have become popular in the management of health facilities. They added that boards are largely comprised of members appointed by the region from *woreda* or zonal offices; this method of forming boards reduces their legitimacy as the best avenue for public participation. A health centre informant raised concerns over the limited membership of community representatives:

The community has only one representative out of seven board members at the health centre. This is an inadequate voice for the communities (FH, IDI5).

Also, all facility heads were concerned that most board members are officials holding other public positions, which sometimes make them unavailable for board meetings. Thus, the autonomy and the effectiveness of the boards have been negatively affected by the practice of multiple appointments and the centralization of appointments. Some board members were uncertain about their role and relationship with the people to whom they are answerable and were concerned that they had not been updated concerning the dynamics of the health agenda. All policy makers noted that boards have an independent decision-making advantage because most decisions are made at the health-unit level, cutting through bureaucratic rules that delay drug procurement, without necessarily involving the councils or the sector office.

All facility heads noted that women teams of 30 women were grouped into five networks of six members each across the villages. These women structures are inclusive groups that significantly increase women representation and roles in health promotion and mobilization. Several health activities concerning regional policies are done by extension workers with women groups.

Heads of health posts added that women institutions improved service availability to mothers regardless of location or socioeconomic privilege. A health centre head noted that:

Their promotion is cost-effective; the inclusive, village-based structures bridge gaps during staff turnover and improve rural women's trust to use care (FH, IDI3).

Forms of participation

Community participation took two forms: non-cash and cash mobilization of resources. *Woreda* health officers reported that the community has built and owned 21 health posts and many public toilets. The heads of Ejere and Lalistu health posts explained that residents of each *kebele* raised roughly 1,455 $US to build houses for health extension workers (HEWs) in 2015. Another informant mentioned that in 2015, farmers customarily stored 99 quintals of grain and saved 2,103 $US for pregnant women who came to a waiting home for childbirth. Two pregnant waiting homes were built by the community.

Effects of decentralization on *woreda* health service delivery

Improved coverage

Several local informants from a health office listed several improvements made in the coverage of facilities in the *woreda* since health decentralization was effected in Gida Ayana. All facility heads added as follows:

Yes, these days all kebeles have a health post, each serving around 6,000 people, located within reach of the community, in fact in the middle of the kebele (FH, IDI7).

Informants from a service board recalled that there was only a single health centre in Gida Ayana *Woreda* before the reform. However, within a few years of decentralization, the

government expanded services by adding four health centres, 28 health posts, and one primary hospital. A service board member added:

We had only one nurse before the reform. Now, Ayana health centre alone has five nurses (*SB, IDI9*).

Improved quality of local decisions

All policy makers noted that independent decisions over how public resources are employed by service boards at health-unit levels improved local responsiveness through timely purchase of drugs. One health official explained:

*The boards' decision declined local bureaucracies, delayed medical supplies…This improved the quality of service outcomes like safe births, transparency of the utilization of scarce resources (W*HO, *IDI4).*

Improved quality of health professionals

All policy makers noted that in the last centralized regime, the lack of adequate deployment and quality professionals in local facilities had resulted in countless complaints, especially regarding maintaining the quality of maternal care and care for under-fives. However, it has been only in the last 15 years that efforts have been made to find a solution to this problem. Negative attitude of some staff continues to affect the quality of health outcomes as before. A woman commented:

I know, female nurses at health centres are capable enough to handle any maternal complications. But a misbehaved nurse at a delivery ward neglected me when I gave birth to (or Bona), my last child (Female FGD2, Angar Kebele).

Quality and availability of medical supply

A *woreda* office head noted that health centres were relatively better equipped with medical supplies since 2002 due to the empowerment of the health facilities to purchase drugs to improve health outcomes. On the other hand, female FGD members stated that inadequate beds and poor and degraded delivery rooms built of wood and mud in the Angar health centre compromised the quality of childbirth service. These results are consistent with the information obtained from interviews with facility heads and group discussions with male community FGDs. In addition, a woman with a 6-months-old child summarized the problem as follows:

Old and unclean beds in the child delivery room in Angar were risks for both women and the newborns. I used unsafe bed when I gave birth to this child (or Sabanbon) (*Female FGD2, Lalistu Kebele*).

Several community participants from Ejere and Lalistu also had low trust and some dissatisfactions in the health centres because drugs were not consistently available; they ordered drugs from private pharmacies due to their inability to secure them from the health facilities. A service board member added that the embezzlement of drug funds by higher authorities also affected local health outcomes in the study *woreda*.

Discussion

This qualitative study explored the implementation of healthcare reform in the decentralized system of Gida Ayana *Woreda*. Results show that the health reform of 2002, although improving the overall delivery of services, has not yet adequately changed the health sector with regard to authority, autonomy, accountability, participation, and service quality. Although the first four themes are intermediate outputs of the decentralization program of the health sector, they remain critical to the quality of health service delivery throughout all stages of the planning and implementation of the program (Brinkerhoff, 2004). With regard to authority, the sector office has been given considerable responsibility for planning and implementing health services, administering facilities, providing and improving health services and information, controlling resources, procuring materials, and engaging the community. The delivery of services, however, depends on the extent of autonomy the *woreda* enjoys in several areas of engagement that affect service delivery.

Our study showed that Gida Ayana *Woreda* is autonomous in planning and budgeting for staff needs. We also found important areas of autonomy over personnel management whereby the *woreda* can formalize new employment, discipline, fire, transfer internally, appoint, manage, and pay staff under the regional policy. These findings corroborate a study that concluded that decentralization improved local personnel management (Wang et al., 2002). However, administrative authority over recruitment and transfer of technical staff continues to be undertaken by higher authorities, a practice that might open ways for nepotism and clientelism. Budget constraints in recruiting new staff also remain major challenges and affect the

implementation of programs and the quality of local health outcomes. A study carried out elsewhere in Ethiopia reported similar results (Kassa & Shawel, 2013). Our study also found that the *woreda* failed to institute incentive schemes and to address poor working conditions for health staff, a major cause of high turnover, especially in the remote rural areas of Ejere and Lalistu. A similar study linked lack of local incentives schemes, low salaries, and rural infrastructures to high staff turnover (Francoa et al., 2002).

Our analysis indicates that Gida Ayana *Woreda* has very little fiscal capacity and is heavily dependent on fiscal transfer from the regional office. Informants from the *woreda* health office estimated that regional transfers constituted over 85 percent of the *woreda* budget and that the rest was covered by local taxes under the purview of the region. Other officials added that setting or increasing the local tax base and user fees is still subject to the approval of the regional council. The utilization of facility revenue is also controlled by elaborate rules legislated by the regional government. Several studies noted that inadequate funding of local authorities caused poor policy implementation and poor health outcomes (Frumence et al., 2013; Jeppsson & Okuonzi, 2000; Kojo et al., 2011).

Our study revealed that the local bidding and procurement processes lack accountability and transparency. This problem persists because bidding and procurements are conducted by the *woreda* finance office alone, without any representation from or consultation with the concerned sectors, community representatives, and other actors. This caused mismatches between the procurement plan requested and the type and quality of the actual purchase.

Gida Ayana *Woreda* has gained autonomy over the building of health posts, public toilets, maternal waiting homes, and housing for rural workers through community participation. A study in Indonesia noted that the mobilization of community resources and project monitoring by local community improved health outcomes (Purwaningrum et al., 2010).

Our study further revealed that the *woreda* is yet not autonomous over service programming because new programs are developed by higher officials. The targeted communities are not involved in the needs assessment process that would enable them to gear community-level program initiatives to the needs of the community. A study carried out in India found that a low level of knowledge and awareness of the community users about preventive and curative health service packages programming adversely affected health outcomes (Panda & Thakur,

2016). Other study added that limited consultation and lack of users' involvement in the health program development affected service utilization and outcomes (Abayneh et al., 2017). Our study found that prioritizing activities from the bottom up hardly exists in the study area. Plans are heavily scrutinized to satisfy regional indicators conveyed through the zone department in the form of an indicative plan. The various performance indicators of the *woreda* and the region are identical.

Our study found that key actors lacked capacity to perform their planning and budgeting roles at the *woreda* level. Specifically, inadequate technical capacity and inconsistent training hindered effective planning and implementation. These deficiencies have been reported from *woredas* in different parts of Ethiopia (Christian Relief & Development Association [CRDA], 2004; Wamai, 2009). Another study identified lack of capacity of key actors to carry out their planning and budgeting activities at the lower level and consequent impacts on the quality of care and services (Tsofa et al., 2017).

Our study confirms that low community involvement in planning and lack of understanding among providers about the population they serve leads to poor outcomes. These results corroborate those of other studies (Abayneh et al., 2017; Kilewo & Frumence, 2015; Nannyonjo & Okoto, 2013; Regmi et al., 2017). Other studies show that the process of deepening decentralization to *woreda* levels has undermined popular participation by civil society organizations and communities (CRDA, 2004; Wamai, 2009; Kassa & Shawel, 2013).

Furthermore, our analysis shows that general forums and sharing of reports with ordinary citizens are still uncommon. Although primary care units are the first points of contact for patients and are viewed as mechanisms for ensuring social accountability (Collins et al., 2002), this is not the case in Gida Ayana *Woreda,* which still implements social accountability service monitoring tools at the regional level. A similar study noted that the absence of established institutional mechanisms for citizens to assess the accountability of local facilities caused information gaps (Kassa & Shawel, 2013). A study in highly constrained public institutions found cost and inadequate local skill to be serious impediments in utilizing such tools (Yilmaz & Venugopal, 2008). Similarly, although opinion boxes, reports, and auditing records are becoming increasingly used monitoring tools, users' illiteracy; fear of retribution; lack of knowledge on why, how, and where to present complaints; and the failure of facilities to

respond to complaints greatly limit the usefulness of monitoring tools. This is consistent with the findings of Masanyiwa et al. (2013).

Our study showed that decentralization energized community participation through representatives in service boards and women's structures in the forms of both cash and in-kind contributions. There were, however, some limits on participation. For instance, although the revised health policy specified the need for a greater decision space for *woreda* governments. Oromia Region has retained control over board appointments, thus significantly limiting the *woreda's* service management capability. Double-job positions and inadequate training further hindered boards from effective service management. Women's structures are slowly beginning to assist health extension workers by involving communities in health promotion. A study in Indonesia found women groups to be main hubs for communicating health programs to the community (Purwaningrum et al., 2010). But the potential role of women committees in Gida Ayana remains largely unknown because of lack of training, illiteracy, and inadequate support from health officials.

The study also indicates that decentralization improved health service coverage and the quality of health professionals and health services. This finding is consistent with Wamai (2009), who noted that healthcare reform expands primary health coverage universally and increases skilled health manpower which in turn increased both the quantity and quality of health services delivered (Semali et al., 2005). Several studies have reported that maternal, infant, and under-five mortality rates decrease with increasing numbers of skilled personnel (CSA & ICF International, 2017; World Bank, 2004). Our study also found that local facility service boards enhance the quality of local decision-making processes, specifically in the area of drug supply. This agrees with a study by Yang et al. (2017). Our analysis also shows that disrepair of maternal delivery rooms, ill-equipped facilities or poor quality of beds in delivery wards, patient dissatisfaction with care received during child delivery, and providers' behaviour were constraints in improving the quality of child delivery services. Similar studies in Ethiopia and elsewhere have reported that the quality of service outcomes suffers from poor infrastructure and lack of medical supplies and essential drugs, as indicated by patient dissatisfaction with the available care (Brinkerhoff, 2004; CRDA, 2004; Kassa & Shawel, 2013; Molina, 2017; Panda & Thakur, 2016).

Strengths and limitations

This study has a number of limitations. First, the study was confined to Gida Ayana *Woreda* in Ethiopia. Thus, the results of the study may not represent the actual trends in the implementation and effect of decentralized public health reform across Ethiopia. Second, this qualitative study does not provide quantitative results. Despite these limitations, the study gives insights into the process of decentralizing health services in the country by identifying the challenges, opportunities, and achievements of the decentralization reform in a particular *woreda.*

Conclusion and policy implications

Despite the fact that the decentralized public health delivery system promotes community participation in service programming and planning processes, this study found that health sector programming or planning and budgeting traditions were not prioritized based on community needs in Gida Ayana *Woreda*. Though this reform had been designed in earnest, planning failed to involve key actors in the design and implementation of the health programs. Thus, we propose that healthcare reforms include local communities and non-governmental actors towards bottom-up designing, targeting, and preparing health plans and programs (Abayneh et al., 2017; Semali et al., 2005; Tsofa et al., 2017).

The study found unnecessary and counterproductive interventions of higher officials and clientelism in different areas of local personnel management, such as staff transfer, recruitment, and appointment; these interventions had negative impact on healthcare reform implementations and quality of care. Therefore, avoiding such interventions, improving fiscal autonomy, reducing the *woreda*'s resource dependency, and increasing *woreda* decision power through the recruitment of adequate and competent staff with better salaries and incentives for staff retention should be priority areas (Hutchinson, 1999; Sakyi, 2008; Semali et al., 2005).

Moreover, our study shows that quality of care suffers from poor infrastructure and supplies. Hence, improving infrastructure and ensuring adequate pharmaceutical supplies and beds in delivery wards should be prioritized (CRDA, 2004; Wamai, 2009). In addition, use of the balanced scorecard and citizen report card system, advocated for close monitoring of health system strengthening interventions (Panda & Thakur, 2016), should be considered. Employing such service monitoring practices and more inclusive modes of decision-making, together with

holding community forums, increasing the community's access to health information, improving literacy and awareness levels, and appointing service boards, may help to enhance the community's trust about health services. Increasing the *woreda* government's transparency and accountability can improve the quality of healthcare. Several studies have reported that access to health information increased maternal and child health service utilization and improved infant, under-five, and maternal mortality rates (CSA & ICF International, 2017; Jimenez & Smith, 2005).

We recommend that *woredas* be included in future studies of the decentralized healthcare reform in Ethiopia. Including *woredas* will allow researchers to examine wide variation in the decentralized healthcare reform implementation and identify its local impacts among the regions and also within regions.

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References

Abayneh, S., Lempp, H., Alem, A., Alemayehu, D., Eshetu, T., Lund, C.,…Semrau, M. 2017. Service user involvement in mental health system strengthening in a rural African setting: Qualitative study. *BMC Psychiatry*, *17*(187).

Beard, C., & Redmond, S. 1979. Declaration of Alma-Ata. *Lancet*, *313*(8109), 217-24.

Brinkerhoff, W. 2004. Accountability and health systems: Toward conceptual clarity. *Health Policy Planning*, *19*(6): 371-379.

CSA [Central Statistical Agency] of Ethiopia. 2013. *Population projection of Ethiopia for all regions at woreda level from 2014-2017.* Addis Ababa, Ethiopia: Central Statistical Agency [CSA).

CSA [Central Statistical Agency] of Ethiopia & International ICF. 2017. *Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF*.

CRDA [Christian Relief & Development Association]. 2004. *The participation of NGOs/CSOs in the health sector development program of Ethiopia*. Addis Ababa.

Collins, D., Omar, M., & Tarin, E. 2002. Decentralization, health care and policy process in the Punjab, Pakistan in the 1990s. *International Journal of Health Planning &Management*, *17*, 123-146.

Dickovick, T., & Gebre-Egziabher, T. 2014. Ethiopia: Ethnic federalism and centripetal forces. In: Wunch, J., & Dickovick, T., Eds., *Decentralization in Africa: The paradox of state strength*. Boulder, CO: Lynne Rienner, pp.69-89.

FDRE [Federal Democratic Republic of Ethiopia]. 1995. The Constitution of 1995. Proclamation. No. 1/1995. *Negarit Gazeta. Addis Ababa, Ethiopia.*

FMoH [Federal Ministry of Health] of Ethiopia. 2006. *Health Sector Development Programme final evaluation: Addis Ababa: Federal Ministry of Health [FMoH]*, Ethiopia.

Fiseha, A. 2007. Theory versus practice in the implementation of Ethiopia's ethnic federalism. In:, Turton, D., Ed., *Ethnic federalism: The Ethiopian experience in comparative perspective*. Oxford: Jamse Currey. pp. 131-164.

Francoa, M., Bennett, S., & Kanfer, R. 2002. Health sector reform and public sector health worker motivation: A conceptual framework. *Social Science & Mediicine, 54*, 1255-1266.

Frumence, G., Nyamhanga, T., Mwangu, M., & Hurtig, A. K. 2013. Challenges to the implementation of health sector decentralization in Tanzania: Experiences from Kongwa district council. *Global Health Action*, (6):1–11.

Gebre-Egziabher, T. 2014. Decentralization and regional and local development: Trends and policy implications. In: Rahmato, D., Ayenew, M., Kefale, A., & Habermann, B., Eds., *Reflection on development in Ethiopia: New trends, sustainability and challenges.* Addis Ababa: Forum for Social Studies. pp. 130-168

Hutchinson, P. 1999. Progress on decentralization in Uganda in health care: Selected issues. *Nature Science, 1*(3), 343-365.

ITS & Division of Epidemiology & Global Health. 2011. OpenCode 4.0. Department of public health and clinical medicine, Umea University, Sweden. Downloaded on 12th of April, 2016, http://www.phmed.umu.se/enheter/epidemiologi/forskning/open-code/.

Jeppsson, A., & Okuonzi, A. 2000. Vertical or holistic decentralization of the health sector? Experiences from Zambia and Uganda. *International Journal of Health Planning & management, 15*, 273-89.

Jimenez, D., & Smith, P. C. 2005. Decentralisation of health care and its impact on health outcomes. Discussion Papers 05/10, Department of Economics, University of York, USA.

Kassa, A., & Shawel, Y. 2013. Integrating all stakeholders: Health service governance in Addis Ababa. In: Mihyo, P., & Chanies, P., Eds., *Thirty years of public sector reforms in Africa:Selected country experiences*. Kampala: Fountain. pp. 55-131

Kassa, A. 2015. District level decentralization and public service delivery in Ethiopia: Cases from Amhara region *Internnational Journal of African Asian Studies, 10*, 24-39.

Kilewo, G., & Frumence, G. 2015. Factors that hinder community participation in developing and implementing comprehensive council health plans in Manyoni District, Tanzania. *Global Health Action*, (8).

Kloos, H. 1998. Primary healthcare in Ethiopia: From Haile Sellassie to Meles Zenawi. *Northeast African Studies*, 5(1): pp. 83-113.

Kojo, S., Awoonor, K., & Adzei, F. 2011. Barriers to implementing health sector administrative decentralization in Ghana: A study of the Nkwanta District health management team. *Journal of Health Organ Management*, 25: 400–19.

Kwamie, A., Agyepong, A., & Dijk, V. 2015. What governs district manager decision making? A

case study of complex leadership in Dangme. *Health Systems Reform*, *1*(2), 167-177.

Lee, J.S. 2015. The process of decentralisation in Ethiopia since 1991: Issues on improving efficiency. *Korea Review of International Studies*, 3-16.

Masanyiwa, Z., Niehof, T., & Termeer, C. 2013. Institutional arrangements for decentralized water and health services delivery in rural Tanzania: Differences and constraints. *Journal of Social & Political Sciences, 1(4): pp. 77-88*.

Mehrotra, S. 2006. Governance and basic social services: Ensuring accountability in service delivery through deep democratic decentralization. *Journal of Internernational Development, 18*, 263-283.

Menon, S. 2006. Decentralization and health care in the former Yugoslav Republic of Macedonia. *International Journal of Health Planning & Management, 21*(1), 3-21.

Mills, A. 1990. Decentralization concepts and issues: A review. In: Mills, A., Vaughan, P., Smith L., & Tabibzadeh, I., Eds., *Health system decentralization: Concepts, issues and country experiences*. Geneva: World Health Organization. pp. 10-42

Molina, G. 2017. An integrity perspective on the decentralization of the health sector in Colombia. *Qualitative Social Research, 10*(2): 1-21.

Murthy, R., & Klugman, B. 2004. Service accountability and community participation in the context of health sector reforms in Asia: Implications for sexual and and reproductive health services. *Health Policy Planning*, 19(1):78-86.

Nannyonjo, J., & Okot, N. 2013. Efficiency of health service delivery in Uganda. *Journal of African Development*, *15*(1):125-158.

OHB [Oromia Health Bureau]. 2015. *Gida Ayana Woreda: Woreda based health sector plan target and performance report. Finfinne [Addis Ababa]:* Oromia Health Bureau [OHB], Ethiopia.

ORS [Oromia Regional State]. 2001. *The revised constitution of the Oromia regional government of 2001. Proclamation No. 2/2001. Finfinne [Addis Ababa]: Oromia regional Satate [ORS], Ethiopia.*

ORS [Oromia Regional State]. 2002. *District level decentralization program, 2002.* Finfinne [Addis Ababa]. *Oromia regional Satate [ORS], Ethiopia.*

ORS [Oromia Regional State]. 2005. A proclamation to provide health service delivery and administration of Oromia region. Proclamation No. 93/2005. Finfinne [Addis Ababa]. *Megeleta Oromia*, Oromia Regional Satate [ORS], Ethiopia.

ORS [Oromia Regional State]. 2013. A directive of linking health centre and health post of Oromia region. Direstive No. 08/2013. Finfinne [Addis Ababa]. *Oromia regional Satate [ORS], Ethiopia.*

ORS [Oromia Regional State]. 2014. A directive of health delivery and administration of Oromia region. Directive No. 08/2015. Finfinne [Addis Ababa]. *Oromia regional Satate [ORS], Ethiopia.*

Panda, B., &Thakur, P. 2016. Decentralization and health system performance: A focused review of dimensions, difficulties, and derivatives in India. *BMC Health Services Research*, *16*(Suppl 6): 1-14.

Pundhi, R., & Boke, A. 2015. Assessment of decentralized local governance performance for service delivery in Ethiopia : The case study of Angacha District. *European Academic Research, 3*(3): 3607-3635.

Purwaningrum, F., Yoganingrum, A., McDonald, F., Short, D., & Ariani, D. 2010. *Health governance in the local level: The case of decentralization, planning and accountability in Gunungkidul, Indonesia*. Iakarta, Indonesia.

Regmi, K., Naidoo, J., Pilkington, P., & Greer, A. 2017. Decentralization and district health services in Nepal: Understanding the views of service users and service providers. *Journal of Public Health, 32*(3): 406-417.

Rifkin, B. 2014. Examining the links between community participation and health outcomes : A review of the literature. *Health Policy & Planning, 29*: 98-106.

Rondinelli, D., McCullough. J., & Johnson, R. 1989. Analysing decentralization policies in developing countries: A political-economy framework. *Development & Change, 20,* 57-87.

Sakyi, K. 2008. A retrospective content analysis of studies on factors constraining the implementation of health sector reform in Ghana. *International Journal of Health Planning & Management, 23*(1): 259-285.

Semali, I. A., Tanner, M., & De Savigny, D. 2005. Decentralizing EPI services and prospects for increasing coverage: The case of Tanzania. *International Journal of Health Planning & Management, 20*(1): 21-39.

Smith, C. 1997. The decentralization of health care in developing countries: Organizational options. *Public Administration & Development, 17*(4), 399-412.

Tang, S., & Bloom, G 2000. Decentralizing rural health services: A case study in China. *Interntional Journal of Health Planning &Management, 15,* 189-200.

Tong, A., Sainsbury, P., & Craig, J. 2018. Consolidated criteria for reporting qualitative research: A 32-item checklist for interviews and focus groups. *International Journal of Quality Health Care, 19*(6): 349-357.

Tsofa, B., Molyneux, S., Gilson L., & Goodman, C. 2017. How does decentralisation affect health sector planning and financial management? A case study of early effects of devolution in Kilifi county, Kenya. *International Journal for Equity in Health, 16:151.*

USAID [United States Agency for International Development]. 2009. *Democratic decentralization programming handbook*. Washington, D. C.,USA.

Wamai, G. 2009. Reviewing Ethiopia's health system. *JMAJ, 52*(4), 279-286.

Wang, Y., Collins, C., Tang, S., & Martineau, T. 2002. Health systems decentralization and human resources management in low and middle income countries. *Public Administration & Development, 22,* 439-453.

WB [World Bank]. 2004. *Ethiopia: A country status report on health and poverty*. WHO, Geneva. Addis Ababa, Ethiopia.

Wunsch, J. 2014. Decentralization: Conceptual and analytical issues. In: Wunsch, J., Dickovick, T., Eds., *Decntralization in Africa: The paradox of state strength*. London: Lynne Rienner. pp. 1-22.

Yang, C. W., Yan,Y. H., Fang, S. C., Inamdar, S. N., & Lin, H. C. 2017. The association of hospital governance with innovation in Taiwan. *International Journal of Health Planning &Management:* 1–9.

Yilmaz, S., & Venugopal, V. 2008. *Local government discretion and accountability in Ethiopia.* Working Paper (08-38). Atlanta: Georgia State University.

Yin, R. K. 2003. *Case study research: Design and methods*. Thousand Oaks: Sage.

Chapter 3. _____

Using Andersen's behavioral model of health care utilization in a decentralized program to examine the use of antenatal care in rural western Ethiopia

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Chapter 3. Using Andersen's behavioral model of health care utilization in a decentralized program to examine the use of antenatal care in rural western Ethiopia

Abstract

Background: In Ethiopia, most women do not make the minimum number of antenatal care (ANC) visits recommended by WHO. This study modeled predisposing, enabling, need, and external environmental factors in the utilization of decentralized health facilities for ANC services in rural western Ethiopian communities.

Methods: A community-based, cross-sectional study was conducted in Gida Ayana *Woreda* (District) among 454 women. Data were collected through structured questionnaires. Multinomial logistic regression was used to model the association between the explanatory variables and the use of recommended and fewer than recommended visits for ANC with reference to the base model, no ANC visits.

Results: Only 15.2% of women made the recommended minimum number of ANC visits. Women with fewer than 2 children (AOR 10.7; 95% CI 3.0-8.4) were 10.7 times more likely received ANC service as recommended. Women with a delivery of 2 or more (AOR 9.7; 95% CI 3.7-5.2) home visits by health extension workers (HEWS) were 9.7 times more likely receiving minimum ANC services. Involvement in gainful activities had 4 times higher log odds of seeking recommended ANC (AOR 4.0; 95% CI 1.4-11.7). Women who experienced high fever were more likely to obtain the recommended ANC services (AOR 7.1; 95% CI 2.9-7.5). Residents of Ayana *Kebele* decentralization entity were 60% more likely to make the recommended number of visits to ANC (AOR 24.6; 95% CI 4.8-15.2).

Conclusions: Number of children, home visits, gainful activities, monthly income, high fever, and decentralized administrative *kebele* were strongly linked with recommended ANC schedule. The need for a program intervention aimed at meeting WHO recommendations for ANC visits include economizing birth size and spacing; improving home attendance by HEWs, knowledge of pregnancy complications and benefits of minimum ANC visits, local socio-economic development measures targeting poor women/households; further decentralization of health system improving proximity to ANC in rural western Ethiopia.

Introduction

About 303,000 maternal deaths were reported worldwide in 2015. Of these, 99% were in the developing world, making the maternal mortality rate (MMR) in that region 239 per 100,000 live births (LBs), which was 20 times higher than in industrialized countries. Sub-Saharan African women accounted for roughly 66% (201 000) of the global maternal deaths and had the highest MMR, 546 deaths per 100,000 LBs in 2015 (Trends Maternal Mortality [WHO], 2015).

In Ethiopia, 13 017 maternal deaths were reported in 2015 (Kassebaum et al., 2016). The global burden of disease studies of 2013 and 2015 revealed MMR of 497 and 410 per 100,000 LBs, respectively, showing no significant change between the two studies (Kassebaum et al., 2016; Kassebaum et al., 2014). The prevention of maternal mortality is a priority for the World Health Organization; the UN Sustainable Development Goal (SDG) and the Ethiopian government (Alkema et. al, 2016; Federal Ministry of Health [FMoH], 2015). In the SDG period, the target is to reduce the global MMR to less than 70 per 100,000 LBs by 2030 with no country having MMR more than 140 per 100,000 LBs (Alkema et al., 2016). In 2015, the Health Sector Transformation Plan (HSTP) of Ethiopia targets for improving maternal health is to reduce MMR from 420 per 1000,000 LBs in 2015 to 199 per 100,000 in 2020 (FMoH, 2015). Achieving this target by the year 2020 will also enable the country to reach her SDG3's promise of less than 140 MMR per 100,000 LBs in 2030. However, the countrywide 2016 Demographic Health Survey (EDHS) documented a MMR of 412 (Central Statistical Agency [CSA] & ICF International, 2016), far short of the HSTP and SDG3 targets (FMoH, 2015; WHO, 2015). Most maternal deaths (90%) are avoidable with timely interventions (Harvey et al., 2004; Thaddeus & Maine, 1994).

Studies carried out elsewhere have found that simple ANC interventions such as monitoring blood pressure and body weight, giving vaccinations, and providing counseling on pregnancy and danger signs are highly effective preventive measures (Harvey et al., 2004; Koblinsky et al., 2010; Pell et al., 2013; Shrestha & Shrestha, 2011; Singh, Rai et al., 2012). Non-utilization of local ANC programs may help explain the persisting high rates of pregnancy complications in Ethiopia (Koblinsky et al., 2010; USAID, 2012; WB, 2004). Despite the Ethiopian government's efforts to improve maternal health and bring facilities closer to mothers through

decentralization programs implemented in the early 1990s (Tolera et al., 2019; Kassa & Shawel, 2013; FMoH, 2008), a recommended minimum number of ANC utilization remains low (Aregay et al., 2014; Dulla et al., 2017; Tessema et al., 2017). The 2016 EDHS, which covered all the regions of Ethiopia, found that 49.3% of women in the most populous administrative region, Oromia, did not receive ANC, and results were similar for Somali Region (CSA & ICF International, 2016). This statistics suggests a gap in understanding of the impact of multifaceted factors on the utilization of the minimum number of ANC visits, particularly in Oromia Region, where antenatal outcomes are poor compared to national figures (FMoH, 2015). Preventable maternal health risks may be managed with early detection (Bitew et al., 2016; Harvey et al., 2004; Pell,et al., 2013; USAID, 2012; Tesfaye et al., 2017). This study examined antenatal service utilization behavior of women in a remote rural area in western Ethiopia.

Various studies have reported that ANC utilization is driven by factors such as awareness among service users and the wider communities, knowledge of maternal pregnancy and risks, community customs, previous facility use, parity and pregnancy complications, individual attitudes and health-care-seeking behaviors, household income, occupation, decision power, home visit and availability and accessibility of health facilities (Andersen, 1995; Phillips et al., 1998; Tewodros et al., 2009; Tiruaynet & Muchie, 2019; USAID, 2012). However, the determinants of utilization of ANC vary across different geographical locations and contexts, different cultures and beliefs, and socio-economic and demographic settings (Ayele et al., 2014; Dulla et al., 2017; Kumar & Singh, 2015; Pell et al., 2013; Phillips et al., 1998; Singh et al., 2012). There is little information about women's utilization of decentralized health facilities for ANC and underlying factors in Oromo culture which has its own peculiar geographic, socio-economic, and cultural characteristics that may affect the utilization of the minimum number of ANC services. We adapted the behavioral model framework of Andersen (Andersen, 1995) for use of health services to identify the factors potentially facilitate or impede minimum number of antenatal health services seeking behavior at individuals and community levels (Tarekegn et al., 2014; Tesfaye et al., 2017; USAID, 2012).

The model groups and predicts that a series of factors predisposing, enabling, and need and external factors influence the utilization of health services. Predisposing factors are socio-demographics characteristics; enabling factors facilitates individuals to use services such as

availability of resources such as income, access to free services, availability and access to the service; need factors are physical conditions illness or disease conditions that motivate service use (Andersen, 1995). ANC outcomes need to be modeled as functions of these factors (Mugo et al., 2015; Tarekegn S., Lieberman S., 2014; Tesfaye et al., 2017; USAID, 2012). Studies employing the model in Ethiopia have used secondary sources; thus there is a need for studies using primary data (Tarekegn et al., 2014; Tessema et al., 2017; Tiruaynet & Muchie, 2019). Hence, the objective of this study was to investigate the above domains of determinants influencing the use of decentralized health facilities for the recommended number of ANC services with the aim of informing policy makers and practitioners responsible for planning, administering, and delivering maternal health service programs.

Methodology

Study setting

The study was conducted in Gida Ayana *Woreda* (Tolera et al., 2019), Oromia Region, rural western Ethiopia, about 450 km from Addis Ababa, and 112 km from Nekemte, the capital of Eastern Wollega Zone. The area of the *woreda* is about 1,502 square km and organized into 7 urban and 21 rural *kebeles* (the smallest administrative units in Ethiopia). According to the 2013 population projection release and Oromia Regional State, the *woreda* had a total population of 140,484, including 47,040 child-bearing women and 10, 577 women of reproductive age, 15-49 years (CSA, 2013; ORS, 2015). The *woreda* has 1 primary hospital, 5 health centers, and 28 health posts (ORS, 2015). All promotive and preventive health services and basic essential obstetric care are provided in the health center and health posts where as comprehensive essential obstetric care is provided in the primary hospital (FMoH., 2014). There were also 8 private drug shops, 3 private drug venders and 1 clinic under NGO ownership (ORS, 2015).

Study design and period

A community-based, cross-sectional design was conducted in this study, from November 2016 to January 2017.

Sample and recruitment

The sample size was determined using a single population proportion formula. Following a previous study (CSA., 2014), a proportion of 32.7%, a 95% confidence interval (CI) and a margin of error of 5% were used. Two-stage sampling using a simple random sampling technique was employed to select an appropriate representative study population. In the first stage, four representative *kebeles* were randomly selected using the lottery technique. In the four selected *kebeles*, women who reported to have had their last birth during the 5 years prior to the study were identified with the help of female HEWs and women team leaders. In the second stage, eligible women were sampled using Microsoft Office Excel-generated random numbers proportional to the estimated number of women who had given birth in the respective *kebeles* during those 5 years.

Thus, a minimum adequate sample size was determined using the statistical estimation method (Kelsey et al., 1996).

$$n = \frac{\left(\frac{Z\alpha}{2}\right)2*p(1-p)}{W2} \quad \textbf{(1)}$$

Where,

n = the desired sample sizes

$\boldsymbol{Z\alpha/2}$ = standard normal score (95%)

$\boldsymbol{P}$ = prevalence of antenatal care service (33.0%)

$\boldsymbol{W}$ = degree of precision desired (5%)

Where,

Z = 1.96

n = 340

But since the source of the study subject considered below 10,000, we use sample size correction formula. As a result, using correction formula:

$$nc = \frac{ni}{1+(ni-1/N)} = 291 \quad \textbf{(2)}$$

Where

nc = sample size correction

ni = initial sample size

N = total number of source population

nc = 340/1+(340-1/2022=291

Then, multiplied by a design effect of 1.5 (since the selection was conducted in two stages: at *kebele* and household level) = 291*1.5 = 436.58 and addition of 5 % non-response rate would offer the adequate sample size of 459 participants.

Sample size for each kebele can be proportionately calculated using the following formula:

nk = [Ni/N]*n **(3)**

where, nk is sample size for each *kebele*; Ni is population of each *kebele*; N represents total population of each *kebele* and n denotes total sample size.

When two women were living in the same household, recent births were considered in determining whom to interview. Where study mothers were not available during the survey, they were visited again the next day and, if not available then, they were considered to be non-responders. Inclusion criteria of our study were women aged 15-49 years who gave birth to children during the 5 years prior to the survey. Women who reside for 6 months or fewer in study area preceding to data collection were not included.

Outcome

ANC is defined here as at least one visit to a doctor, nurse, midwife, or trained traditional birth attendant during pregnancy (WHO, 2015). The nominal dependent variable of the study was the number of visits to ANC service clinics. ANC users were categorized into three groups

according to the WHO recommendations for ANC visits (WHO, 2003), irrespective of when in the course of the pregnancy the visits occurred; the groups were as follows: the logit or the log-odds of having y = 2 [those who made the recommended 4 or more ANC visits], y = 1 [those who made 1 to 3 ANC visits, fewer than the recommended number]; and y = 0 [no ANC visits]. No ANC visit was a base model for the first two modeled categories.

Explanatory variables

In the present study, based on Andersen's behavioral model of health care utilization theory (Andersen, 1968; Andersen, 1995), age as a three-categorical variable (19 or less, 20-34, 35-48 years), mother's and father's education (college or higher, secondary, primary, no education), marital status (married or other), mother's religion (Christian or Muslim), and decision making regarding use of household resources (husband only, husband/wife, wife only) were examined as predisposing determinant factors of adherence to the recommended number of visits to ANC clinics.

Enabling factors were mother's employment (skilled employee, small business/service, farmer, housewife), husband's employment (skilled employee, merchant, farmer, other), home visits HEWs (more than one, one, none), distance to ANC (under 30 minutes, 30 minutes or more), household income (less than 50 $US, 50 $US or more), and possession of a radio/TV (yes or no).

Need factors were severe headache, vaginal bleeding/gush, swelling of hands/face, high fever, severe pain in the abdomen, high blood pressure, and blurred vision, each classified as a binary variable (yes or no). As external environmental factors, we examined the administrative *kebeles* where the women lived and in which health facilities were decentralized as well as whether the women lived in urban or rural locations. Using these external factors enabled us to explore differences in ANC utilization across space and to consider the available decentralized health facility type (health post, health center, hospital/clinic) as an enabling factor (Figure 3.1).

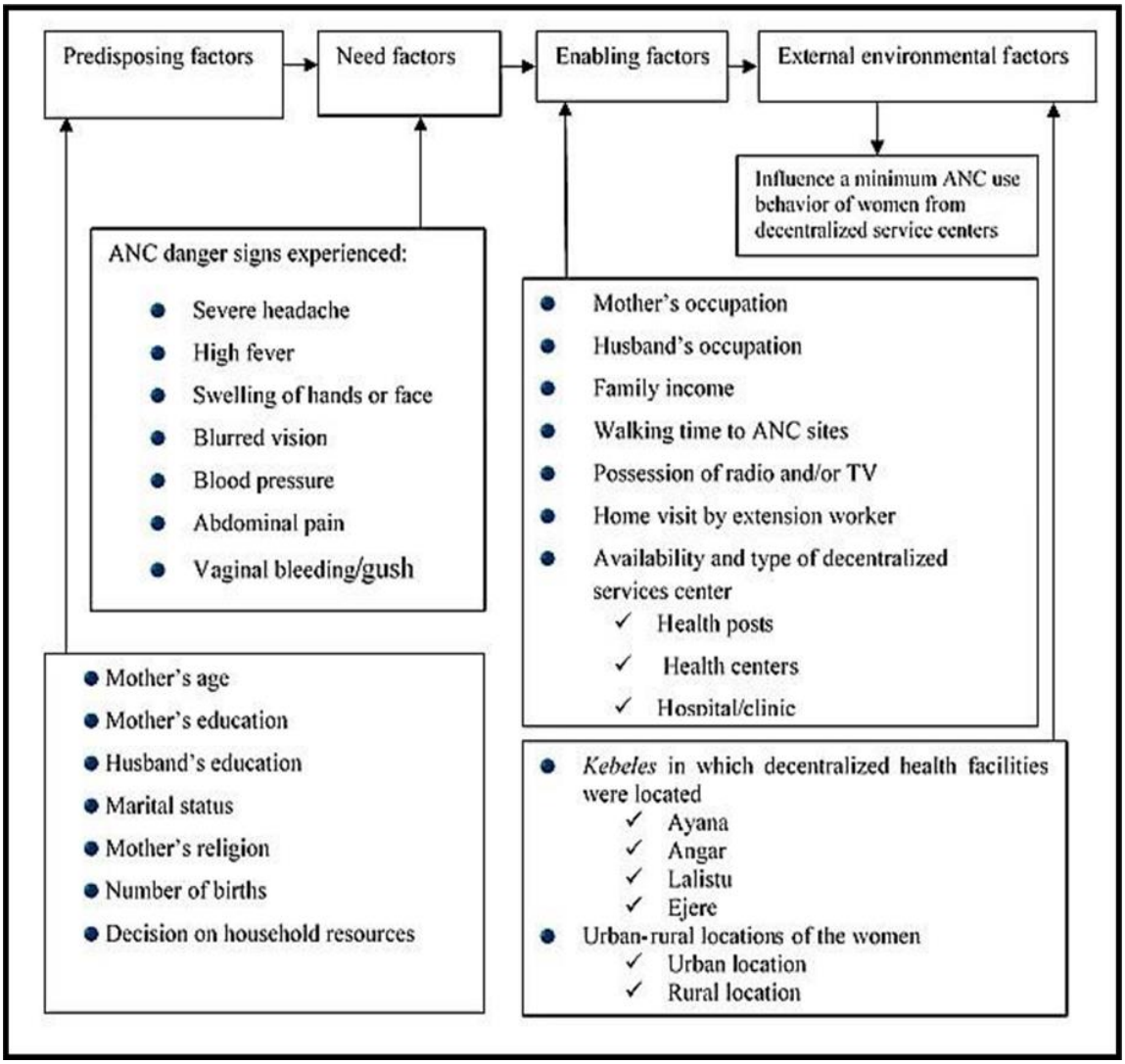

Figure.3.1. Conceptual framework for health-service utilization behavior modified from Andersen's behavioral model (Andersen, 1968 & 1995).

Data collection and quality control

Data were collected using a structured questionnaire. The questionnaire was designed in English and translated to Afan Oromo by staff of the English and Local Language departments of Wollega University. Data collection focused on institutional delivery; place of delivery; status of ANC visits and predisposing, enabling, perceived needs and external environmental factors affecting ANC use. Data were collected by 8 female health workers with BSc degrees or diplomas in health science who had previous experience in data collection in Gida Ayana

Woreda. Data collection was supervised by two supervisors recruited from a local health center and coordinated by the corresponding author. The data collectors and supervisors were trained for two days in data collection techniques and ethics. A pilot study of 10% of the study population was carried out to test the survey instrument in an adjacent *woreda* (or Guto Gida) to ensure reliability, to check for clarity and comprehension. The supervisors and the principal investigator supervised and monitored data collection activities and checked all the complete questionnaires for consistency and missing data daily to address data validity and reliability. Incomplete questionnaires deemed to have problems were returned to the interviewers for completion. A final check was made during data entry through double data entry using EpiData version 3.1 (EpiData; CDC, 2000). The accuracy of data entries was verified using two methods. First, 10% of the questionnaires were randomly selected and checked. Second, frequency distributions, descriptive statistics, and results from cross-tabulations were carefully checked before fitting regression analyses.

Data processing and analysis

We used statistical software SPSS Version 24.0 (SPSS; IBM Corp; USA) for data analysis. Descriptive statistics and cross-tabs were used to determine proportions and the frequency distribution for categorical data. For the normally distributed continuous variables, mean and SD were also used. Different figures and maps were also employed to depict different information. The Variance Inflation Factor (VIF) > 10 indicates redundancy among explanatory variables (Pallant, 2007; Hosmer & Lemeshow, 2000). Our ANC utilization model satisfied this criterion with VIF < 2.0 and Tolerance Value of > 0.10 which indicated that no problem of multicollinearity in the data set. Associations between the number of ANC service visits in the three groups (those receiving the recommended number of ANC visits, those receiving fewer than recommended, and those receiving no ANC) and explanatory variables were calculated by the use of the binomial and multinomial logit (MNL) model.

The associated factors were examined using chi-square test and multivariable logistic regression analysis. All the significant variables in the bivariate analysis ($p < 0.05$) were included in the final multinomial logistic (MNL) regression model because bivariate association between two variables does not necessarily imply a significant causal relationship between them. Therefore, a multivariate approach was applied to determine which factors best

explain and predict health care service use outcome. The final adequacy of the model was detected using different models (Pallant, 2007). The pseudo R-square statistics, Cox & Snell R-Square and the Nagelkerke R-Square values, provide an indication of the amount of variation in the dependent variable explained by the model (from a minimum value of 0 to a maximum of approximately 1). In this study, the two values are 0.505 and 0.583 respectively, suggesting that between 50.5% and 57.3% of the variability is explained by this set of variables (Pallant, 2007).

The developed model was also verified through the standard statistical mean of likelihood ratio test of goodness of fit (Hosmer & Lemeshow, 2000; Pallant, 2007). In this study -2lnLreduced = -909.625 and for the full model, -2lnLfull = -590.645. The likelihood ratio of $\chi 2$ = 318.980, 20 df, p = 0.000) which is highly significant with p-value less than 0.05. This shows that addition of explanatory variables in the model after the intercept term is statistically significant.

Multicollinearity in the MNL model was detected by examining the standard error for the coefficients and our ANC utilization model in this study satisfied this criterion with the values less than 2.0 which demonstrate the absence of multicollinearity in the developed model (Shrestha & Shrestha, 2011). Adjusted odds ratios (AOR) with corresponding 95% CI estimates were used to describe the strength of associations of factors with recommended number of ANC visits and fewer than the recommended number of ANC visits versus no visits. The association of variables was found to be statistically significant at $p < 0.05$.

Ethical consideration

The research protocol was reviewed and approved by Wollega University Research Ethics Approval Committee [Ref/No. WU-99529/H1-3/24/11/2016]. Permission was received from Gida Ayana *Woreda* Health Office. The purpose of the study was explained to all participants and a consent form approved by the Review Board was given to participants. Parents or legal guardians provided consent for all participants under age 18. We emphasized that participation was completely voluntary and that they had the right to withdraw any time during the interview without giving any reason. Confidentiality and anonymity were explained to all participants. We ensured that all participants understood the information given by asking them. The consent form was read aloud for women who could not read or write. Literate women were asked to

read the consent form. A written consent in the form of a signature or a thumbprint was obtained from all of the participants.

Results

Socio-demographic characteristics and nature of home visit

A total of 459 women who had their last birth during the 5 years preceding the survey were enrolled in the study. The response rate was 98.9%. The mean age of mothers was 26.1 (±7.1) years. The mean number of children women gave birth to was 3.11 (±2.0). Nearly half of the mothers reportedly had no formal education. Over one-third of the husbands had completed secondary education and 33.9% completed college/higher education. Forty-nine percent of the respondents were of the Oromo ethnic group, 83.9% were married, and 55.9% were urban. Over half of mothers were Christian. One hundred ninety-eight (43.6%) were housewives and 124 (27.5%) were paid employees. Most husbands (46.7%) were subsistence farmers. Mean walking time it takes pregnant women to reach the nearest health facility was 51.1(±31) minutes, and the mean monthly household income was 47 (±15.1) $US. The majority of participants (56.2%) reported that they did not obtain home visit and support by HEWs (Table 3.1). See also Figure 3.2 which displayed the distribution and status of ANC utilization in the study sites.

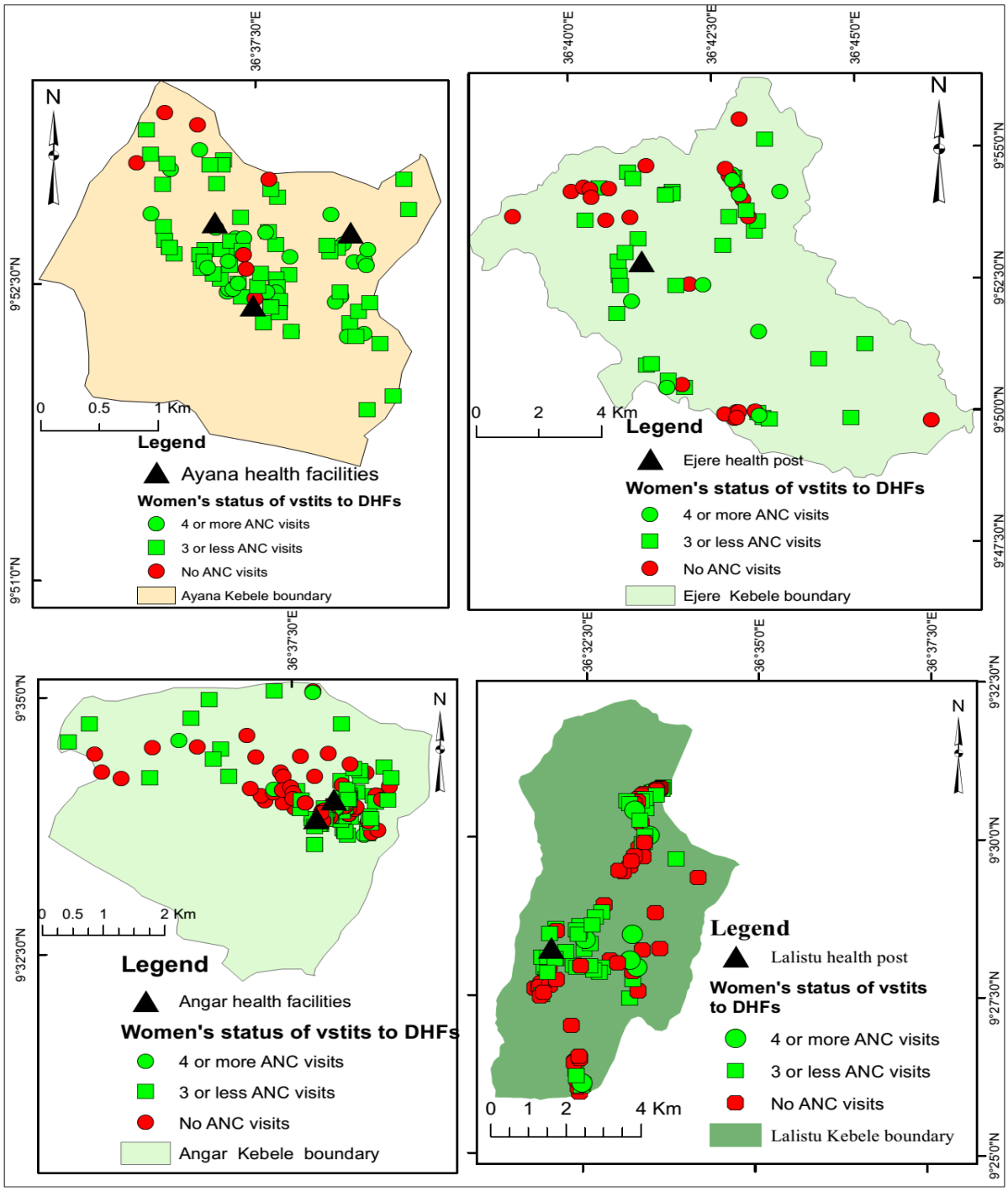

Figure 3.2. Distribution and status of ANC utilization by study sites

Table 3.1. Socio-demographic backgrounds of the study participants (N = 454) and home visits, in Gida Ayana *Woreda*, rural western Ethiopia

Variable	Variable categories	Number	Percentage
[d]Age (in years**)**	19 or less	127	28
	20-34	255	56.1
	35 or more	72	15.9
Education	No formal education	224	49.3
	Primary	81	17.8
	Secondary	73	16.1
	College/higher	76	16.7
Husband's education	No formal education	90	19.8
	Primary	49	10.8
	Secondary	161	35.5
	College/higher	154	33.9
Maternal occupation	Paid employee	124	27.5
	Small business	98	21.6
	Farmer	34	7.3
	Housewife	198	43.6
Husband's occupation	Skilled employee	86	18.9
	Merchant	114	25.1
	[a]Informal activity	42	9.3
	Farmer	212	46.7
Marital status	Married	381	83.9
	[b]Other	73	16.1
Ethnicity	Oromo	222	48.9
	Amhara	144	31.7
	Tigre	88	19.4
Religion	Christian	260	57.3
	Muslim	194	42.7
Urban-rural location of the women	Urban	254	55.9
	Rural	200	44.1
Mean number of births (SD)	3.11(±1.9)		
Mean walking time to ANC clinic in min (SD)	51.1(±30.9)		
Mean monthly family income in $US (SD)	[c]47.0(±15.1)		
Home visit by HEWs	2 times or more	132	29
	One time	67	14.8
	No	255	56.2

*[a]Informal activity: day laborer/weaving/students. [b]Other: single/widowed/divorced. [c]Average exchange rate of 1$US was 27.0 Ethiopian Birr between November 2016 January 2017. [d]Age (in years**)** was the category based on grouping by Ethiopian Demographic Health Survey (2016). SD: Standard Deviation*

ANC service use and decentralized facility attended

The majority (55.1%) of the women obtained ANC from a decentralized health center facility. The women who made the recommended number of visits to ANC constituted 15.2% of the participants while 49.6% made fewer than the recommended number and 35.2% did not seek services. We found that 89.4% and 66.2% of respondents of Ayana and Ejere *Kebeles*, respectively, visited the ANC clinic, and lower proportions did so in Angar and Lalistu *Kebeles.* Of the women who utilized ANC services, 41.5% made their first visit in the second trimester of their pregnancy.

Table 3.2. Utilization of ANC and local health facilities attended, in Gida Ayana *Woreda*, rural western Ethiopia (*N* = 454).

Variable	Variable categories	Number(n)	Percent (%)
ANC visits	Recommended # ANC visits	69	15.2
	Fewer than recommended visits	225	49.6
	No visits	160	35.2
Decentralized health facility visited	Hospital/clinic	25	8.5
	Health center	162	55.1
	Health post	107	36.4
Decentralized administrative *kebele* by ANC visits	Ayana	84	89.4
	Ejere	51	66.2
	Angar	92	57.5
	Lalistu	67	54.5
Timing of 1st ANC visit	First trimester	96	32.6
	Second trimester	122	41.5
	Third or Fourth trimesters	76	25.9

Reason for non-utilization of local health facilities for ANC service

Among those who made no ANC visit, 46.2%, 25.0%, and 11.2% mentioned lack of awareness about the importance of pregnancy care, transportation problems, and long waiting times, respectively, as reasons for not using ANC services (Figure 3.3).

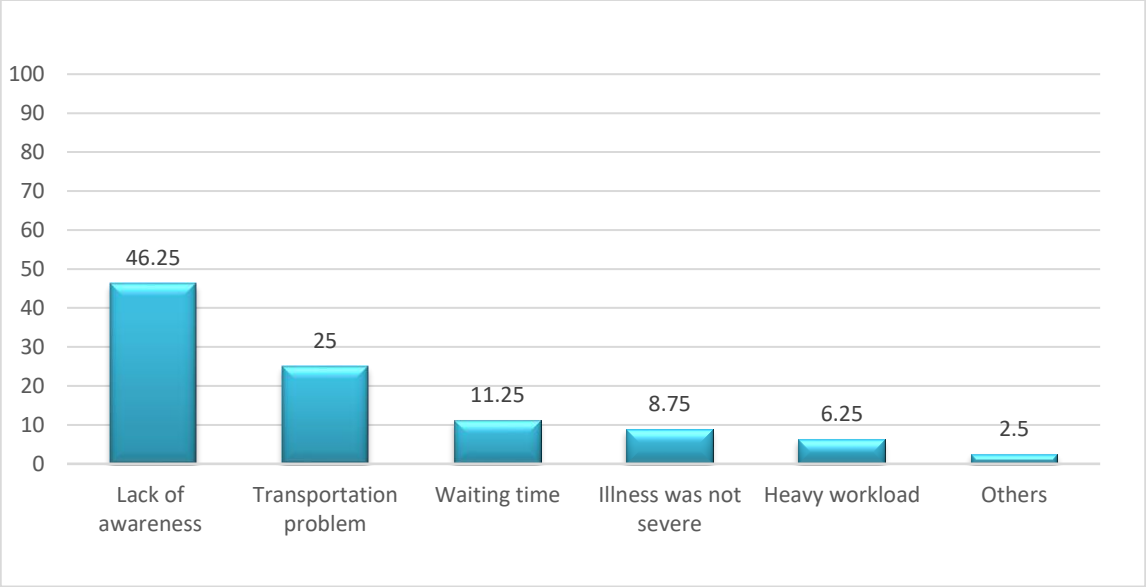

Figure 3.3. Reason for not visiting decentralized local facilities for ANC services among women participants in Gida Ayana Woreda, rural western Ethiopia.

Factors influencing visits to ANC in a decentralized facility

The results of bivariate analyses of number of ANC visits and the independent variables (Table 3.3) showed that walking distance to nearby facility appeared to be positively associated with minimum number of recommended ANC received ($p < 0.05$). Maternal age at last pregnancy, mother's and husband's education, marital status, religion, number of births, decision on family resources, type of decentralized facility, monthly income, occupation, home visit by HEWs, availability of radio/or TV were also significantly associated ($p < 0.01$) with the recommended schedule of ANC visits.

Table 3.3. Bivariate analysis of predisposing and enabling factors by number of ANC visits.

Variable		Status of ANC visits			Number	*p*-value
	Categorical level	Recommended	Fewer than recommended	No visit		
Predisposing factors	[d]Age (in year)					
	19 or less	21.3	53.5	25.2	127	0.002
	20-34	13.7	51	35.3	255	
	35 or more	9.7	37.5	52.8	72	
	Education					
	College or higher	27.6	51.3	21.1	76	0
	Secondary	21.9	50.7	27.4	73	
	Primary	12.3	60.5	27.2	81	
	No formal education	9.8	44.6	45.5	224	
	Husband's education					
	College or higher level	28.9	52.2	18.9	90	0
	Secondary	18.4	57.1	24.5	49	
	Primary	13.7	51.6	34.8	161	
	No formal education	7.8	43.5	48.7	154	
	Marital status					
	Married	12.9	53	34.1	381	0.001
	[a]Other	27.4	31.5	41.1	73	
	Religion					
	Christian	15.8	56.2	28.1	260	0.001
	Muslim	14.4	40.7	44.8	194	
	Number of births					
	Fewer than 2	17.6	59.7	22.7	216	0
	2 to 3	16.1	51	32.9	149	
	4 or more	7.9	22.5	69.7	89	
	Decision on resource use					
	Husband only	19.4	52.5	28.1	139	0.002
	Wife/Husband	11	59.8	29.1	127	
	Wife only	14.9	40.4	44.7	188	
Enabling factors	Decentralized health facility					
	Hospital/clinics	26.2	33.3	40.5	42	0
	Health center	19.4	61.2	19.4	201	
	Health post	9	41.7	49.3	211	

Table 3.3 (Continued)

Variable		Status of ANC visits			Number	*p*-value
	Categorical level	Recommended	Fewer than recommended	No visit		
Enabling factors	Maternal occupation					
	Paid employee	18.5	50.8	30.6	124	0
	Small business/service	16.3	53.1	30.6	98	
	Farmer	32.4	55.9	11.8	34	
	Housewife	9.6	46	44.4	198	
	[c]Monthly income					
	50 $US or more	17.2	53.5	29.3	273	0.004
	Less than 50 $US	12.2	43.6	44.2	181	
	Husband's occupation					
	Skilled employee	26.7	57	16.3	86	0
	Merchant	16.7	53.5	29.8	114	
	[b]Informal activity	14.3	54.8	31	42	
	Farmer	9.9	43.4	46.7	212	
	Visits by HEWs					
	More than one time	22	56.8	21.2	132	0
	One time	23.9	59.7	16.4	67	
	No visit	9.4	43.1	47.5	24	
	Walking time to ANC clinic					
	29 minutes or less	15.2	53.7	31.1	296	0.028
	30 minutes or more	15.2	41.8	43	158	
	Own radio and/or TV					
	Yes	18.5	54.7	26.7	243	0
	No	11.4	43.6	45	211	

[a]Other: single/widowed/divorced. [b]Informal activity: day laborer/weaving/students. [c]Average exchange rate of 1$US was 27.0 Ethiopian Birr between November 2016 January 2017. SD: Standard Deviation. [d]Age (in years) was categorized based on Ethiopian Demographic Health Survey (2016). P-values were from the chi-square test.

The bivariate analyses of number of ANC visits and the independent variables showed that severe headache, vaginal bleeding and rural urban residence appeared to be positively associated with minimum number of recommended ANC received ($p < 0.05$). The results also revealed that high fever, swelling of hands/face, abdominal pain and *kebele* in which decentralized health facilities were located were also significantly associated ($p < 0.01$) with

the recommended schedule of ANC visits (Table 3.4). No statistically significant associations were found for high blood pressure and blurred vision assessed ($p > 0.05$).

Table 3.4. Bivariate analysis of needs and environmental factors by number of ANC visits.

Variable		Status of ANC visits			Number	*p*-value
	Categorical level	Recommended	Fewer than recommended	No visit		
Need factors	Severe headache					
	Yes	12.5	59	28.5	144	0.023
	No	16.5	45.2	38.4	310	
	Vaginal bleed/gush					
	Yes	16.1	59.8	24.1	112	0.015
	No	14.9	46.2	38.9	342	
	Swelling hands/faces					
	Yes	18.1	52.8	29.1	265	0.003
	No	11.1	45	43.9	189	
	High fever					
	Yes	20.2	61.2	18.6	183	0
	No	11.8	41.7	46.5	271	
	Abdominal pain					
	Yes	16.2	52.6	31.2	340	0.007
	No	12.3	40.4	47.4	114	
	High blood pressure					
	Yes	17.8	53.4	28.8	118	0.218
	No	14.3	48.2	37.5	336	
	Blurred vision					
	Yes	13.5	50.6	36	178	0.716
	No	16.3	48.9	34.8	276	
External environmental factors	Administrative *kebele* of the women					
	Ayana	30.9	58.5	10.6	94	0.001
	Ejere	14.3	51.9	33.8	77	
	Lalistu	9.8	44.7	45.5	123	
	Angar	10.6	46.9	42.5	160	
	Urban-rural residence					
	Urban	18.1	51.2	30.7	254	0.02
	Rural	11.5	47.5	41.1	200	

P-values were from the chi-square test.

In the following sections, we present the influence of each determinant factor recommended number of ANC visits and fewer than the recommended ANC visits versus no ANC visits as established through the multinomial regression analysis and shown in Tables 3.5 and 3.6.

Predisposing factors

Holding other variables constant (Table 3.5), Christian women were 3.3 times more likely than Muslims to make 3 or fewer ANC visits than no visits. Nevertheless, identification as Christian was not significantly associated with utilization of the recommended number of ANC visits although the corresponding log odds figure was higher (AOR = 1.6; 95% CI 0.6-3.7, $p > 0.05$).

Women who had fewer than 2 children were 10.7 times and 9.2 times more likely to make the recommended number of ANC visits (AOR= 10.7; 95% CI 3.0-8.4, $p < 0.01$) and fewer than the recommended number (AOR= 9.2; 95% CI 3.6-23.0, $p < 0.01$), respectively, than no visits compared to women who reported 4 children or more. Likewise, women with 2 to 3 children had log odds of 5.5 times and 4.6 times higher of making the recommended number of ANC visits (AOR= 5.5; 95% CI 1.5-2.4, $p < 0.05$) and fewer than the recommended ANC visits (AOR= 4.6; 95% CI 1.8-11.5, $p < 0.01$), respectively, than no visits compared to women who had 4 or more children.

Gendered decision making about resource use by husband (AOR= 1.5; 95% CI 0.6-3.9, $p > 0.05$) and wife/husband (AOR= 1.6; 95% CI 0.6-4.6, $p > 0.05$) influenced women's maternal health service seeking behavior in choosing the recommended number of ANC visits rather than no visits, but the association was not statistically significant. However, when all other factors were held constant, shared decision making (wife/husband) about household resource use was 3.9 times more likely to result in fewer than the recommended ANC clinic visits than no visits compared to wife-only decision making (AOR= 3.9; 95% CI 1.8-8.4, $p < 0.01$).

Enabling factors

When all other determining factors were held constant (Table 3.5), women who operated small businesses had 4.0 times (AOR= 4.0; 95% CI 1.4-11.7, $p < 0.01$). and 2.2 times (AOR= 2.2; 95% CI 1.0-4.8, $p < 0.01$) higher log odds of choosing recommended and fewer than the

recommended number of ANC visits, respectively, than no visits compared to women who identified as housewives.

Women in households with monthly household income of 50 $US or more were nearly 3 times and 2 times more likely to make the recommended (AOR=2.8; 95% CI 1.2-6.2, $p < 0$ 05) and fewer than recommended number of ANC visits (AOR=2.1; 95% CI 1.1-3.8, $p < 0.05$), respectively, than no visits compared to those reporting less than 50 $US in household income. Women who were visited 2 times or more than 2 times by HEWs were 9.7 times and 4.2 times, respectively, more likely to make the recommended (AOR = 9.7; 95% CI 3.7-5.2, $p < 0.01$) and fewer than recommended number of ANC visits (AOR = 4.2; 95% CI 1.9-8.9, $p < 0.01$) than no visits compared to those reporting no visits by HEWs. Likewise, women who were visited one time had higher log odds of making the recommended (AOR = 9.5; 95% CI 2.9-3.7, $p < 0.01$) and fewer than recommended (AOR = 4.8; 95% CI 1.8-13.0, $p < 0.01$) number of ANC visits by 50% and 80%, respectively, than no visits compared to those who were not visited by HEWs.

Walking time strongly influenced the utilization of health facilities, specifically the number of ANC visits, but the relationship was not statistically significant (AOR = 1.7; 95% CI 0.7-4.4, $p > 0.05$). Furthermore, the log odds ratio of receiving fewer than 4 ANC visits versus no visits was 40% higher for women living closer than 30 minutes from the nearest ANC clinics (AOR = 2.4; 95% CI 1.2-5.0, $p < 0.05$). When comparing decentralized health facility types of hospital/clinic (AOR = 1.1; 95% CI 0.2-4.6, $p > 0.05$). and health center (AOR = 2.3; 95% CI 0.9-5.8, $p > 0.05$), no significant association was found with the utilization of the recommended number of ANC visits versus no visits. For women who received services at decentralized front-line health posts, the log odds of making fewer than the recommended number of ANC visits versus no visits to health centers was 20.0% higher (AOR = 2.2; 95% CI 1.1-4.5, $p < 0.05$).

Table 3. 5. Multinomial regression analysis for predisposing and enabling factors influencing number of women's ANC visits, in Gida Ayana *Woreda*, rural western Ethiopia (*N* = 454).

Factor	Variable	Variable categories	Status of ANC visits. Base model: No-visits category			
			Recommended visits		Fewer than recommended visits	
			AOR (95% CI)	*p*-value	AOR (95% CI)	*p-value*
Predisposing factors	Religion	Christian	1.6(0.6-3.7)	0.279	3.3(1.7-6.5)**	0.001
		Muslims	1		1	
	Marital status	Married	0.5(0.1-1.5)	0.253	2.3 (0.9-5.8)	0.06
		[a]Others	1		1	
	No. of children	Fewer than 2	10.7(3.0-8.4)**	0.001	9.2(3.6-23.0)**	0.001
		2 to 3	5.5(1.5-2.4)*	0.01	4.6(1.8-11.5)**	0.001
		4 or more	1		1	
	[d]Age (in year)	19 or less	1.7(0.4-6.5)	0.402	1.0(0.4-2.7)	0.906
		20-34	0.6(0.2-2.3)	0.557	0.9(0.3-2.1)	0.814
		35 or more	1		1	
	Education	College/higher	1.1(0.2-5.1)	0.902	0.7(0.2-2.7)	0.719
		Secondary	0.8(0.2-2.7)	0.743	0.6(0.2-1.7)	0.395
		Primary	1.7(0.5-6.0)	0.373	2.1(0.8-5.1)	0.092
		No education	1		1	
	Husband's education	College/higher	2.4(0.4-12.7)	0.299	0.8(0.2-3.1)	0.771
		Secondary	1.7(0.3-7.7)	0.468	1.3(0.4-4.1)	0.64
		Primary	1.2(0.4-3.9)	0.662	0.9(0.4-2.0)	0.878
		No education	1		1	
	Decision on family resource	Husband	1.5(0.6-3.9)	0.334	1.9(0.9-4.0)	0.075
		Wife/husband	1.6(0.6-4.6)	0.316	3.9(1.8-8.4)**	0.001
		Wife	1		1	
Enabling factors	Employment	Employee	2.1(0.7-5.8)	0.133	1.4(0.6-2.9)	0.365
		Small business	4.0(1.4-11.7)**	0.009	2.2(1.0-4.8)*	0.05
		Farmer	2.3(0.4-13.4)	0.349	1.8(0.3-9.0)	0.424
		Housewife	1			

Table 3. 5. (Continued)

Factor	Variable	Variable categories	Status of ANC visits. Base model: No-visits category			
			Recommended visits		Fewer than recommended visits	
			AOR (95% CI)	*p*-value	AOR (95% CI)	*p-value*
Enabling factor	Husband's employment	Employee	1.5(0.2-8.1)	0.623	2.0(0.5-7.7)	0.291
		Merchant	1.0(0.3-3.1)	0.972	1.5(0.6-3.5)	0.341
		[b]Informal activity	0.8(0.1-4.0)	0.885	1.3(0.4-3.9)	0.603
		Farmer	1		1	
	[c]Monthly income	50 $US or more	2.8(1.2-6.2)*	0.011	2.1(1.1-3.8)*	0.013
		Less than 50 $US	1		1	
	Home visit by HEWs	More than one time	9.7(3.7-5.2)**	0.001	4.2(1.9-8.9)**	0.0001
		One time	9.5(2.9-3.7)**	0.001	4.8(1.8-13.0)**	0.001
		No visit	1		1	
	Walking time to ANC clinic	Less than 30 minutes	1.7(0.7-4.4)	0.226	2.4(1.2-5.0)*	0.013
		30 minutes or more	1		1	
	Possession of radio/or TV	Yes	1.7(0.7-4.1)	0.224	1.7(0.8-3.3)	0.108
		No	1		1	
	Decentralized facilities	Hospital/clinic	1.1(0.2-4.6)	0.889	0.4(0.1-1.6)	0.239
		Health center	2.3(0.9-5.8)	0.08	2.2(1.1-4.5)*	0.019
		Health post	1		1	

*[a]Other: single/widowed/divorced. [b]Informal activity: day laborer/weaving/students. [c]Average exchange rate of 1$US was 27.0 Ethiopian Birr between November 2016 January 2017. SD: Standard Deviation. [d]Age (in years) was categorized based on Ethiopian Demographic Health Survey (2016). TV: Television. 1= Reference category. ** significant at p < 0.01 *significant at p < 0.05*

Need factors

When all other determining factors were held constant, women who reportedly felt severe headaches were found to be 90% (AOR = 2.9; 95% CI 1.1-7.5, $p < 0.05$) and 70% (AOR = 3.7; 95% CI 1.8-7.6, $p < 0.01$) more likely to make the recommended and fewer than recommended number of ANC visits, respectively, than those not reporting headaches. The log odds ratio for making fewer than the recommended number of ANC visits was 20% higher (AOR = 2.2; 95% CI 1.1-4.8, $p < 0.05$) for women who experienced vaginal bleeding/gush compared to those who did not. Likewise, the odds of women who had high fevers were 7.1 and 4.1 times higher for having the recommended (AOR = 7.1; 95% CI 2.9-7.5, $p < 0.01$) and fewer than recommended (AOR = 4.1; 95% CI 1.9-8.5, $p < 0.01$) number of visits to ANC facilities, respectively, than those who felt no fever (Table 3. 6).

External environmental factors

When comparing the utilization of ANC services in the four study *kebeles* in which government decentralized health facilities were located, women of Ayana had higher odds of making the recommended number of visits (AOR = 24.6; 95% CI 4.8-15.2, $p < 0.01$) and fewer than the recommended number (AOR = 8.2; 95% CI 2.1-3.5, $p < 0.01$) than making no visits compared to women of Ejere *Kebele.* Furthermore, when all other factors were held constant, residents of urban settlements were 2.1 times more likely to make the recommended number of ANC service visits (AOR = 2.1; 95% CI 1.1-3.7, $p < 0.01$) compared to rural residents. However, the urban-rural difference did not seem to significantly influence the choice of fewer than the recommended number of ANC service visits in spite of higher log odds (OR= 1.4; 95% CI 0.9-2.1, $p > 0.05$). See Table 3. 6.

Table 3. 6. Multinomial regression analysis for need and external environmental factors influencing number of women's ANC visits, in Gida Ayana *Woreda*, rural western Ethiopia (*N* = 454).

Factor	Variable	Variable categories	Status of ANC visits. Base model: No-visits category			
			Recommended visits		Fewer than recommended visits	
			AOR (95% CI)	*p*-value	AOR (95% CI)	*p-value*
Need factors	Severe headache	Yes	2.9(1.1-7.5)*	0.026	3.7(1.8-7.6)**	0.001
		No	1		1	
	Vaginal bleeding/gush	Yes	1.7(0.6-4.6)	0.239	2.2(1.1-4.8)*	0.036
		No	1		1	
	Swelling of hands/face	Yes	1.2(0.5-2.9)	0.601	0.9(0.5-1.8)	0.99
		No	1		1	
	High fever	Yes	7.1(2.9-7.5)**	0.001	4.1(1.9-8.5)**	0.001
		No	1		1	
	Severe pain in abdomen	Yes	0.8(0.3-2.4)	0.794	1.1(0.5-2.5)	0.676
		No	1		1	
External Environmental factors	*Kebeles* in which decentralized health facilities were located	Ayana	24.6(4.8-15.2)**	0.001	8.2(2.1-3.5)**	0.002
		Angar	2.0(0.3-11.3)	0.398	0.9(0.2-3.3)	0.951
		Lalistu	1.2(0.3-5.1)	0.742	0.8(0.3-2.5)	0.806
		Ejere	1		1	
	Urban-rural residence	Urban	2.1(1.1-3.7)**	0.013	1.4(0.9-2.1)	0.8
		Rural	1		1	

*1= Reference category. ** significant at p < 0.01 *significant at p < 0.05*

Discussion

Although increasing the number of ANC visits has contributed to a drastic reduction in the maternal death rate in low-income countries during the past 30 years, the majority of women

in sub-Saharan Africa, including Ethiopia, still do not make the WHO-recommended 4 ANC visits or more during the pregnancy period (Bitew et al., 2016). This study found that on0ly 15.2% of the 454 participants received the recommended number of ANC visits; 49.6% made fewer than the recommended ANC visits and 35.2% reported no visits for ANC.

Our findings identified a number of predisposing, enabling, need, and environmental factors influencing the choices regarding ANC visits: religion, number of children, woman's occupation, home visit by HEWs, walking time to health facility, monthly income, severe headache, vaginal bleeding/gush, high fever, availability of decentralized ANC facilities, decentralized administrative *kebele*, and urban-vs-rural residence of the women.

After adjusting for all variables, Christian women were found to be 30% more likely to make fewer than the recommended minimum number of ANC visits than no visits compared to Muslim women although religion was not significantly associated with making the recommended number of ANC visits. This finding is consistent with a study in northeastern Ethiopia, where Christians were 2.2 times more likely to make fewer than the recommended number of ANC visits compared to Muslim women (Fenta, 2005). In Nigeria, Christian women were more likely to make the recommended number of ANC visits than fewer than the recommended number than Muslims (Umar, 2017). The higher level of ANC use among women of certain religions could be attributed to theological differences and differences in lifestyle across various beliefs (Singh et al., 2012). In Nepal, Christians and Hindus were 50% and 30%, respectively, more likely to make the recommended and fewer than recommended number of ANC visits versus no visits compared to women of other religions (Shrestha & Shrestha, 2011).

Women experiencing their first pregnancy and those who had 2 or 3 children were 10.7 and 5.0 times more likely to make the recommended minimum number of ANC visits, respectively, than no visits compared to baseline. Recent systematic reviews and meta-analyses reveal that women with first pregnancies are more likely than multiparous women to make the recommended number of ANC visits due to fear of complications with the first birth (Bitew et al., 2016; Tarekegn et al., 2014; Tesfaye et al., 2017). Multiparous women tend to believe there is less risk to current pregnancy due to their previous birthing experiences and their negative perceptions of the environment in local health institutions regarding cleanliness, equipment

quality, and behavior of providers (Ayele et al., 2014; Bitew et al., 2016; Chakraborty et al., 2003; USAID, 2012).

Decision making status on family resources was associated with increased log odds of utilizing minimum antenatal care services among mother. Our results also showed that women who were able to decide with their partners on family resource use had higher log odds of choosing fewer than the recommended number of ANC visits by 90.0%, which implies that housewives with some autonomy in this area were able to make at least some visits to clinics. This suggests that women who were not constrained by a patriarchal structure were better able to utilize ANC services. This finding corroborates a study in northern Ethiopia (Aregay et al., 2014) in which decision making by wives and husbands separately was associated with 45% and 65% lower numbers making the recommended and fewer than recommended number of ANC visits, respectively, compared to couples who made the decision jointly.

Amongst the enabling factors, the odds for utilizing minimum number of ANC clinics increased among mothers who were engaged in non-housewife types of occupations. Our data showed that the log odds ratios associated with gainful small business activities were 4.0 times higher for making the recommended minimum number of ANC visits. The odds ratios corresponding to the other categories of women's occupation were also higher. However, their *p*-values did not demonstrate statistically significant association with ANC service visits. Engaging in skilled employment and small businesses as income sources among mother was associated with increased odds of utilizing recommended minimum number of ANC services which is consistent with those of previous studies in Ethiopia (Bitew et al., 2016; Tewodros et al., 2009). A study in Nigeria (Umar & Bawa, 2015) reported that women who operated small businesses were 6 times more likely to make the recommended number of ANC clinics visits. Similar studies in Nepal and China also corroborate our findings (Zha et al., 2009; Shrestha & Shrestha, 2011).

Furthermore, we found that women in households reporting monthly income of $US 50.00 or more made the recommended minimum number of ANC visits and fewer than recommended visits at a rate 80% and 10% higher than no visits, respectively, compared to those with household incomes of $US 49 or less. Women from high household incomes were more likely to be able to afford health services, and their associated costs, including transportation costs

(Karra., 2016; Titaley et al., 2010). Low household income denoted a major deterrent to mothers to seek prompt care. This variation might be an area of concern for policy makers. A study in Sodo *Woreda* (Bitew et al., 2016) reported that 13% of rural women with higher cash incomes made the ANC visits recommended by WHO. Similar findings were reported in Nigeria, where women in wealthier households were 4.0 times more likely to make the recommended minimum number of ANC visits (Umar, 2016). The differentials were 2.71 times in studies in Afghanistan (Shahram et al., 2015), 8.8 times in Nepal (Shrestha & Shrestha, 2011), and 3.3 times in China (Zha et al., 2009).

Women who were visited 2 or more times by HEWS were 70% and 20% more likely to make the recommended and fewer than recommended number of visits, respectively, than women who were not visited. Women who were visited only once made the recommended minimum ANC visits and fewer than recommended number of visits at a 50% and 80%, respectively, higher rates. A qualitative study in Kafa Zone, southwestern Ethiopia (Jackson, 2016) reported that women preferred to be seen by HEWs who they knew rather than health workers they did not know. Similar oversea findings were reported by several other studies (Ahmed et al., 2010; Azfredrick, 2016; Shahram et al., 2015; Singh et al., 2012). This finding may be important to develop intervention strategies that more strengthened a systematic and regular home visits by health workers which helps women to improve their utilization of a minimum ANC services or more at home or health post with low opportunity costs.

Women who visited decentralized health centers type of decentralized healthcare units were 20% more likely to make 3 or fewer ANC visits than those with utilized nearby bottom-line health posts. This finding corroborates those of other studies, which predicted higher log odds for making at least 3 recommended visits to ANC clinics (Azfredrick, 2016; Kloos, 1998). Women were likely to visit health centers that were better equipped and more user friendly than others (Erulkar et al., 2005). But this result was not consistent with the studies in Kaffa Zone, southwestern Ethiopia where majority of study participants reported that they used a minimum number of ANC at the health post rather than the health center because of the physical distance, the cost of health services at health centers or the hospital and because women preferred to be seen by HEWs who they knew rather than health workers they did not know (Jackson, 2016), and in Rwanda, where decentralized health posts were over utilized

compared to health centers because health posts were better supplied with maternal resources and attracted most of the local women (Nathan et al, 2015).

After adjusting for all variables, women were found to be 40% more likely to make fewer than recommended minimum number of ANC visits to health facilities located within walking distance of half an hour than to facilities located at greater distances. Similar extensive studies elsewhere (Alvarez., 2016; Aregay et al., 2014; Tewodros et al., 2009) pointed out that walking distance to the available health facilities and time needed to reach these health facilities influences health-seeking behavior and was associated with the utilization of a minimum number of health services. An extensive study in Ethiopia reported that utilization of health facilities declined with distance from maternal service users homes (Okwaraji et al., 2012).

Severity of pregnancy complication or illness also increased seeking care in health facilities and associated with the utilization of the minimum number of ANC visits (Titaley et al., 2010). Amongst the need factors, our data show that recognizing the severity of illness by danger signs of severe headaches increases the likelihood of utilizing minimum ANC visits and women with severe headaches had 9.0 times higher log odds of making the recommended number of visits for ANC; headaches appeared to motivate mothers to attend the minimum number of ANC clinics, similar to other studies (Arega et al., 2014; Bitew et al., 2016; Chakraborty et al., 2003; Mugo et al., 2015; Qureshi et al., 2016). Furthermore, an increased odd of utilizing minimum ANC services was observed in mothers of high severity of illness by danger signs of high fever. The study found that women reporting high fevers were 7.1 times more likely to make the recommended minimum number of ANC visits. This finding is in line with studies in Hadiya Zone in southern Ethiopia (Abosse et al., 2010), west Bengal in India (Majumder, 2006), and rural Bangladesh (Chakraborty et al., 2003). The reason women with fevers appear motivated to utilize ANC could be that mothers with a history of complications have personal experience that helps them understand the life-threatening condition and makes them inclined to seek preventive maternal care (Bitew et al., 2016).

Log odds of attending recommended minimum number of visits to ANC were 60% among women of Ayana *kebele*, *woreda's* capital than the outer administrative decentralization units in the rural areas. There were geographical variations in the use of ANC among women across *kebeles* of different socio-cultural groups (USAID, 2012) with government-decentralized

health facilities. Another study found wide interregional disparities in ANC use in Ethiopia, with Oromia Region having the lowest use of all regions except Somali (CSA & ICF International, 2016). In India, except for the southern region, as well as in Pakistan, Nigeria, and South Sudan, ANC utilization rates are low (Mugo et al., 2015; Shahram et al., 2015; Umar et al., 2016). Low ANC utilization in these areas may be due to historical, socioeconomic, and cultural conditions across these physical settings and community groups.

The log odds of urban residence of women was significantly associated with adherence to the utilization of minimum number of ANC visits than rural women by 10% higher rate. This finding is consistent with meta-analysis in Ethiopia (Mekonnen et al., 2019). In Nepal, urban women were 7 and 2 times more likely to make the recommended and fewer than recommended number of ANC visits, respectively (Shrestha & Shrestha, 2011). Researchers suggest the reasons for the higher use might be the better quality of care and greater accessibility to professionals in urban areas. Non-significant association between urban residence and fewer than recommended number of ANC visits has been reported elsewhere (Ayele et al., 2014; Umar et al., 2016). Our study had a number of limitations. All data were self-reported by the women participants and were not triangulated with other sources, which may have resulted in bias. The study also did not capture institution-based factors such as health providers' behavior and accessibility and quality of services, all of which influence the health-seeking behavior of women. Moreover, the long recall period may have introduced information bias.

Conclusion

Despite the fact that ANC attendance impacts safe motherhood and reduces maternal deaths, this study found unacceptably low adherence to the recommended number of ANC visits in rural western Ethiopia. Only 15.2% of women studied made the recommended number of visits to ANC clinics, 49.6% made fewer than the recommended number, and 35.2% did not obtain any ANC. The results of this study confirm the importance of several factors in women's making the WHO-recommended number of visits to ANC clinics: number of births, occupation, visits by HEWs, household income, headache, fever, decentralized administrative *kebele*, and urban-rural location. Religion, gendered decisions about resource use, walking

time to ANC services, decentralized health facilities, and vaginal bleeding were significant predictors of fewer than the recommended number of ANC visits.

These results indicate that the study of broadly-based interventions considering the socioeconomic, cultural, demographic, and environmental context of communities may be useful in identifying barriers to ANC utilization and promoting adherence to the recommended number of maternal visits in rural western Ethiopia. Health campaigns conducted through *kebele* and *woreda* health services as well as mass media may promote health-seeking behavior of pregnant women and increase the awareness of communities, religious leaders, and other stakeholders about the recommended number of ANC visits so as to reduce maternal and neonatal mortality. However, policies and programs must extend beyond community awareness of the need for adequate and appropriate maternal care, use of family planning to control birth size and spacing, and address also long-term multi-sectoral development issues. Broadly based interventions need to focus on motorized rural roads, public transport, livelihoods and income generation, and gender equity. Interventions must increase the number and the coverage of home visits by HEWs and upgrade and equip front-line health posts or further extend the decentralization of health centers in rural areas. These actions will ensure that the predisposing, enabling, need, and external environmental factors that promote health-seeking behavior are in place to achieve increased ANC utilization and reduction in maternal deaths.

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References

Abosse, Z., & Woldie, M. O. 2010. Original article factors influencing antenatal care service utilization in Hadiya Zone. *Ethiopian Journal Health Scicence*, *20*(1).

Ahmed, S., Creanga, A. A., Gillespie, D. G., & Tsui, A. O. 2010. Economic status, education and empowerment: Implications for maternal health service utilization in Developing Countries. *PLoS ONE*, *5(*6).

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A., & Gemmill, A. 2016. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN maternal mortalityestimation inter-agency group. *The Lancet*, *387*(10017), 462-474.

Alvarez, F. N., Leys, Mart, H. E. R., & Guzma, G. E. 2016. Primary health care research in Bolivia : Systematic review and analysis. *Health Policy & Planning*, *31*, 114-128.

Andersen, R. A. 1968. Behavioral model of families' use of health services. Chicago: Research Series No. 25, Center for Health Administration Studies, University of Chicago, Chicago.

Andersen, R. M. 1995. Revisiting the behavioral model and access to medical care: does it matter? *Journal of Health & Social Behaviour*, 36:1-10.

Aregay, A., Alemayehu, M., Assefa, H., & Terefe, W. 2014. Factors associated with maternal health care services in Enderta District, Tigray, northern Ethiopia: A cross sectional study. *American Journal of Nursing Science*, *3*(6), 117-125.

Ayele, D. Z., Belayihun, B., Teji, K., & Ayana, D. A. 2014. Factors affecting utilization of maternal health care services in Kombolcha District, Eastern Hararghe Zone, Oromia Regional State, Eastern Ethiopia. *International Scholarly Research Notices*, *2014*.

Azfredrick, E. C. 2016. Using Andersen's model of health service utilization to examine use of services by adolescent girls in south-eastern Nigeria. *International Journal of Adolescence & Youth*, *21*(4), 523-529.

Bitew, T., Charlotte, H., Kebede, E., Medhin, F., & Fekadu, A. 2016. Antenatal depressive symptoms and maternal health care utilisation: A population-based study of pregnant women in Ethiopia. *BMC Pregnancy & Childbirth*, *16*(301), 1-11.

CSA [Central Statistical Agency] of Ethiopia. 2014. *Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa, Ethiopia.*

CSA [Central Statistical Agency] of Ethiopia. 2013. *Central Statistical Agency population projection of Ethiopia for all regions at woreda level from 2014 -2017*.

CSA [Central Statistical Agency] of Ethiopia & ICF International. 2016. *Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, & Rockville, Maryland, USA: CSA & ICF*.

Chakraborty, N., Islam, M. A, Chowdhury, R. I, Bari, W., Akhter, H. H. 2003. Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International*, *18*(4), 327-337.

Dulla, D., Daka, D., & Wakgari, N. 2017. Antenatal care utilization and its associated factors among pregnant women in Boricha District, southern Ethiopia. *Diversity & Equality in Health & Care*, *14*(2), 76-84.

Erulkar, A. S., Onoka, C. J., Phiri, A. 2005. What is youth-friendly? Adolescents' preferences for reproductive health services in Kenya and Zimbabwe. African. *Journal of Reproductive*

Health, 1, 2051-2505.

FMoH [Federal Ministry of Health] of EThiopia. 2008. *HSDP III*: *Ethiopia Health Sector Development Programme (Mid-Term Review)*. Vol.1. Addis Ababa: FMoH.

FMoH [Federal Ministry of Health] of EThiopia. 2014. *Health sector development programme IV: Annual performance report. Addis Ababa: Federal Ministry of Health [FMoH] [Ethiopia]*. Addis Ababa, Ethiopia.

Federal Ministry of Health [FMoH] of Ethiopian. 2015. *Health Sector Transformation Plan.* Vol. 20. *2015/16-2019/20. Addis Ababa: Federal Ministry of Health [FMoH], Ethiopia.*

Fenta, M. 2005. *Assessment of factors affecting utilization of maternal health care services in Ayssaita and Dubti towns, [unpublished masters thesis). Addis Ababa University: Addis Ababa Ethiopia.*

Harvey, S. A., Ayabaca, P., Bucagu, M., Djibrina, S., Edson, W. N., Gbangbade, S.,… Burkhalter, B. R. 2004. Skilled birth attendant competence: An initial assessment in four countries, and implications for the safe motherhood movement. *International Journal of Gynecology & Obstetrics, 87,* 203-210.

Hosmer, D., & Lemeshow, S. 2000. *Applied logistic regression*. 2rd eds. New York: John Wiley & Sons, Inc.

Jackson, R. 2016. Changing the place of birth from home to health facilities in Kafa Zone, Ethiopia. *Journal of Development Effectiveness, 1(22).*

Karra, M., Fink., G., & Canning, D. 2016. Facility distance and child mortality: a multi-country study of health facility access, service utilization, and child health outcomes. *International Journal of Epidemiology*, 1(1).

Kassa, A., & Shawel, Y. 2013. Integrating all stakeholders: Health service governance in Addis Ababa. In: Mihyo, P., & Chanie, P Eds., Thirty years of public sector reforms in Africa: selected country experiences. Kampala: Fountain. pp. 55-131.

Kassebaum, J. N., Steiner, C., Murray, C., Lopez, A., & Lozano, R. 2016. Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease study. *Lancet, 388,* 1775-812.

Kassebaum, N., Villa, A., Coggeshall, M., Shackelford, K., Steiner, C., Heuton, K., & Medina, D. 2014. Global, regional, and national levels and causes of maternal mortality during 1990-2013: A systematic analysis for the Global Burden of Disease study 2013. *The Lancet, 384*, 980-1004.

Kelsey J, Whittemore A, Evans A., & Thompson W. 1996. Methods of Sampling and Estimation of Sample Size. *Methods in Observational Epidemiology*. New York: Oxford University Press.

Kloos, H. 1998. Primary Health Care in Ethiopia: From Haile Sellassie to Meles Zenawi. In *Northeast African Studies*, 5: 83-113.

Koblinsky, M., Tain, F., Gaym, A., Karim, A., Carnell, M., & Tesfaye, S. 2010. Responding to the maternal health care challenge: The Ethiopian health extension program. *Ethiopian Journal of Health Devevelopment, 24*(Specil 1): 105-109.

Kumar, A., & Singh, A. 2015. Explaining the gap in the use of maternal healthcare services between social groups in India. *Journal of Public Health,* 1-11.

Majumder, A. 2006. *Utilisation of health care in north Bengal: A study of health seeking patterns in an interdisciplinary framework, 13*(1): 43-51.

Mekonnen, T., Dune, T., Perz, J., & Ogbo, F. A. 2019. Trends and determinants of antenatal care service use in Ethiopia between 2000 and 2016. *Journal of Environomental. Research & Public Health 2019, 19*(74).

Mugo, N. S., Dibley, M. J., & Agho, K. E. 2015. *Prevalence and risk factors for non-use of antenatal care visits: Analysis of the 2010 South Sudan household survey*. *15*(68), 1-13.

Nathan, L. M., Shi, Q., Plewniak, K., Zhang, C., Nsabimana, D., Sklar, M.,…Mutimura, E. 2015. Decentralizing maternity services to increase skilled attendance at birth and antenatal care utilization in rural Rwanda: A prospective cohort study. *Maternity & Child Health Journal, 19*(9): 1949-1955.

Okwaraji, Y. B., Cousens, S., Berhane, Y., Mulholland, K., & Edmond, K. 2012. Effect of geographical access to health facilities on child mortality in rural Ethiopia: A community based cross sectional study. *PLoS ONE, 7*(3):1-8.

ORS [Oromia Regional State]. 2015. *Oromia Regional State Eastern Wollega Zone Finance And Economic Development Office: Physical and socio-economic profile of Gidda Ayana District*.

Pallant, J. 2007. *Survival Manual: A step by step guide to data analysis using SPSS for windows*. 3rd ed. New York: McGraw Hill Open University Press.

Pell, C., Menaca, A., Were, F., Afrah, N. A., Chatio, S., Taylor, M. L.,… Hame, M. J. 2013. Factors affecting antenatal care attendance: Results from qualitative studies in Ghana , Kenya and Malawi. *PLoS ONE, 8*(1).

Phillips, K. A., Morrison, K. R., Andersen, R., & Aday, L. A. 1998. Understanding the context of healthcare utilization: Assessing environmental and provider related variables in the behavioral model of utilization. *Health Services Research, 33*(3), 571-596.

Qureshi, R., Sheikh, S., Khowaja, A.R., Hoodbhoy, Z., Zaidi, S., Sawchuck, D.,…Vidler, M. 2016. Health care seeking behaviours in pregnancy in rural Sindh , Pakistan : A qualitative study. *Reproductive Health, 13*(34): 75-97.

Shahram, M. S., Hamajima, N., & Reyer, J. A. 2015. Factors affecting maternal healthcare utilization in Afghanistan: Secondary analysis of Afghanistan health survey 2012. *Nagoya Journal of Medical Science, 77*, 595-607.

Shrestha, G., & Shrestha, G. 2011. Statistical analysis of factors affecting utilization of antenatal care in Nepal. *Nepal Journal of Science & Technology, 12*, 268-275.

Singh, P. K., Rai, R. K., Alagarajan, M., & Singh, L. 2012. Determinants of maternity care services utilization among married adolescents in Rural India. *PLoS ONE, 7*(2).

Tarekegn, S., Lieberman, S., & Giedraitis, V. 2014. Determinants of maternal health service utilization in Ethiopia: Analysis of the 2011 Ethiopian Demographic and Health Survey. *Pregnancy & Childbirth, 14*(161), 1-13.

Tesfaye, G., Loxton, D., Chojenta, C., Semahegn, A., & Smith, R. 2017. Delayed initiation of antenatal care and associated factors in Ethiopia: A systematic review and meta-analysis. *Reproductive Health, 14*(150):117.

Tessema, A. G., Laurence, O. C., Melaku, A. Y., Misganaw, A., Woldie, A.S., Hiruye, A.,… Amare, T. A. 2017. Trends and causes of maternal mortality in Ethiopia during 1990-2013: Findings from the global burden of diseases study 2013. *BMC Public Health, 17*(160).

Tewodros, B., Gebre-Mariam, A., & Dibaba, Y. 2009. Affecting antenatal care utilization in Yem Special Woreda , Southwestern Ethiopia. *Ethiopian Journal of Health Science, 19*(1), 45-50.

Thaddeus, S., & Maine, D. 1994. Too long to walk: Maternal mortaliity in context. *Social Science & Medicine, 38*(8): 1091-1110.

Tiruaynet, K., & Muchie, K. F. 2019. Determinants of utilization of antenatal care services in Benishangul Gumuz Region, Western Ethiopia: A study based on demographic and health survey. *BMC Pregnancy & Childbirth, 19*(115):1-5.

Titaley, C. R., Dibley, M. J., & Roberts, C. L. 2010. Factors associated with underutilization of antenatal care services in Indonesia: Results of Indonesia demographic and health survey 2002-2003 and 2007. *Public Health, 10*(485): 1-10.

Tolera, H., Gebre-egziabher, T., & Helmut, K. 2019. Public health service delivery in a decentralized system: a qualitative study of the perception of health providers and community members in Gida Ayana *Woreda*, western Ethiopia. *Global Journal Medical Research, 19*(2), 22-37.

Zhao, Q., Kulane, A.. Goa, Y., & Xu, B. 2009. Reseans for not attending. *BMC Women's Health, 9*(5).

Umar, A. S. 2017. The use of maternalhealth services in Nigeria: Does ethnicity and religious beliefs matter? *Public Health, 6*(6).

Umar, A. S., & Bawa, S. B. 2015. *Antenatal care services Utilization in Yobe State, Nigeria: Examining predictors and barriers. International Journal of MCH & AIDS, 4*(1): 35-46.

Umar, S. A., 2016. Use of maternal health services and pregnancy outcomes in Nigeria. (Unpublished doctoral dissertation). Walden University, Washington, D. C, USA.

USAID [United States Agency for International Development]. 2012. *Cultural barriers to seeking maternal health care in Ethiopia. A review of the literature. Ethiopia. USAID: Washington, D. C.*

WB [World Bank]. 2004. *World Bank country status report on health and poverty in Ethiopia. Washington, D. C. Africa Region Human Development & Ministry of Health Ethiopia. USA.*

WHO [Trends Maternal Mortality]. 2015. *1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization.*

WHO [World Health Organization]. 2015. *Strategies toward ending preventable maternal mortality (EPMM). Geneva: World Health Organisation.*

WHO [World Health Organization]. 2003. *Antenatal care in developing countries-promises, achievements, and missed opportunities: An analysis of trends, levels, and differentials 1990-2001. Geneva: World Health Organization.*

Chapter 4. _____

Utilization of decentralized health facilities and factors influencing women's choice of a delivery site in Gida Ayana *Woreda*, western Ethiopia.

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Chapter 4. Utilization of decentralized health facilities and factors influencing women's choice of a delivery site in Gida Ayana *Woreda*, western Ethiopia.

Abstract

Introduction: Despite the government's efforts to decentralize and expand health institutions to promote facility-based child delivery, home delivery and maternal mortality are still widespread problems in Ethiopia. Most mothers continue to give birth at home. This study aims at identifying the socio-cultural practices, perceived benefit or need, and accessibility factors influencing women's choice of health facilities for delivery services in Gida Ayana *Woreda*, western Ethiopia.

Methods: We conducted a cross-sectional survey to assess women's use of delivery care services in Gida Ayana *Woreda*, from November 2016 to January 2017; 459 women who were selected randomly participated in the study. We evaluated the socio-cultural, perceived benefit or need, and economic and physical accessibility factors in women's choice of delivery care and used adjusted logistic regression analysis to examine significant predictors of delivery site use decisions.

Results: Over half (56.6%) of the women self-reported using institutional delivery care; 80.9% gave birth at a health center. A socio-cultural variable, maternal education, significantly influenced women's choice of health facility for delivery care services (AOR 3.4; 95% CI 2.0-5.9). Mothers' knowledge level of obstetric complications and experience of complications during the last birth were the two perceived benefits or need factors associated with higher odds of receiving delivery care from decentralized local facilities. Utilization of health centers for maternal delivery care was significantly higher than of health posts (AOR 5.0; 95% CI 2.4-10.2). Availability of motorized transportation during labor to nearby delivery site was a significant predictor of institutional delivery.

Conclusion: This study demonstrates the non-utilization of decentralized health facilities for maternal delivery care services in Gida Ayana *Woreda*, which was significantly influenced by socio-cultural, perceived need, and accessibility factors of women during childbirth. This suggests the need for tailored intervention to improve childbirth services use for mothers in this kind of rural settings.

Keywords: Decentralized health services, choice of delivery site, Ethiopia.

Introduction

Childbirth complications remain international public health problems and many thousands of women still die each year from preventable causes before, during, and after giving birth (Abosse et al., 2010; Alkema et al., 2016; Bhandari et al., 2017; Dickson et al., 2018; Kassebaum et al., 2016; Kassebaum et al., 2014). In 2015, such complications resulted in about 275, 000 deaths worldwide, with 99.2% of these occurring in developing countries (Alkema et al., 2016; Kassebaumet al., 2014; Kassebaum et al., 2016). Sub-Saharan Africa shared the highest burden, accounting for almost half (48.3%) of all maternal deaths globally. Maternal mortality in Ethiopia remains high with a ratio of 497 deaths per 100,000 live births (Kassebaumet al., 2014; Tessema et al., 2017; Woldegiorgis et al., 2017). The 2015 MMR estimate of the country was 410 per 100,000 live births compared to 373, 338, and 280 in Rwanda, Kenya, and Uganda, respectively (Kassebaum et al., 2016). The country reported the largest maternal mortality ratio from all causes for total world deaths (Tessema et al., 2017; Woldegiorgis et al., 2017) and did not achieve the goal of driving down maternal deaths to 267 per 100,000 by 2015 (FMoH, 2015). The high maternal death rate was primarily attributed to underutilization of antenatal clinics (Aktar, 2012; Babalola & Fatusi, 2009; Bitew et al., 2016; Regassa, 2011; Simkhada et al., 2007; Teklehaimanot et al., 2007.) and institutional delivery (Abebe et al., 2012; Abera et al., 2011; Dejene & Hailemariam, 2015; Tefera et al., 2012; Tessu et al., 2015; Worku et al., 2013; Worku & Fantahun, 2013).

Several studies indicated that proper follow-up of maternal care can prevent more than 80% of deaths (Ahmed et al., 2010; Harvey et al., 2004; Tessema et al., 2017; Thaddeus & Maine, 1994; Woldegiorgis et al., 2017) and others suggest that increasing access to emergency care around the time of delivery is the most essential intervention for driving down maternal deaths (Borghi et al., 2006; Campbell & Graham, 2006; Filippi et al., 2006; Kebede et al., 2016; Koblinsky et al., 2006; Ronsmans & Graham, 2006; Rosenfield et al., 2007; USAID, 2012). According to Woldegiorgis et al. (2017), only 11.8% of all births were attended by skilled health personnel in Ethiopia, compared to 71.9% in Rwanda and 60.0% in Uganda between 1999 and 2012. Recent surveys noted that skilled birth attendance increased to 28%, far below

the national target of 62% by 2015 and 80% by 2020 (CSA & ICF International, 2016; FMoH, 2010, FMoH, 2015). Only 26.2% and 18.8% of women in Ethiopia and Oromia region give birth to their newborns in health facilities respectively (CSA & ICF International, 2016).

Improving women's health through institutional delivery has become a major health development agenda of the Ethiopian government since the early 1990s. This is clearly indicated in the new health policy of 1993 and the constitution of the 1995, which argue for the provision of basic maternal healthcare services for women through equitable access to services (TGE, 1993) and decentralization of maternal facilities to nine regions (EPRDF, 1995). In 1998, the government provided the free health care initiative for delivery services (FMoH, 1998). In 2002, local decentralization fully empowered *woredas* (districts) governments to manage maternal care through a community-level primary healthcare system: *woreda* (district) hospital, health center and health post (FMoH, 2010). Each peripheral health post is staffed with two female health workers who assist village women to use delivery center (FMoH, 2014; Nathan et al., 2015).

Despite measures to increase the number of women delivering at health facility, underutilization of local primary health facilities reduces the effectiveness of the measures. A knowledge of the factors associated with low institutional delivery is critical for identifying gaps in the existing research, planning interventions, and developing effective policies for addressing the problem (Kaba et al., 2016; Moyer & Mustafa, 2016). Studies have been conducted to address the socio-demographic and facility level determinants of delivery care (Tadele & Lamaro, 2017; Tessema et al., 2017). Several studies also indicated that these components may not be enough for a mother to seek or to reach delivery care (Fisseha et al, 2017; Gabrysch & Campbell, 2009; Tessema et al., 2017; USAID, 2012). It is known that utilization of maternal services is also a function of sets of cultural practices, perceived benefit or need, economic and physical accessibility (Fisseha et al., 2017; Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994). There is however a paucity of evidence on the specific socio-cultural, perceived benefit or need, healthcare availability and accessibility factors to explain the utilization of delivery care in Ethiopia (Fisseha et al., 2017; Tarekegn et al., 2014; Tessema et al., 2017; USAID, 2012).

Moreover, the available studies on factors that influence women's use of health facility are

based on secondary data from the health facility (Tarekegn et al., 2014; USAID, 2012). This study uses primary data to analyze the utilization of decentralized health facilities and the socio-cultural, perceived benefit or need, healthcare availability and accessibility factors associated with women's choice of delivery site (Abera et al., 2011; Kaba et al, 2016; Regassa & Gebi, 2014; Tefera et al., 2012; Worku et al., 2013; Worku & Fantahun, 2013).

Methods

Study design and period

A household-based cross-sectional study was carried out in Gida Ayana *Woreda* to examine utilization of decentralized health facilities for childbirth and factors associated with women's choice of delivery sites.

Study setting

The study was carried out in four *kebeles* (the smallest administrative unit in Ethiopia) of Gida Ayana *Woreda*, Eastern Wollega Zone, Oromia Region, in western Ethiopia. The *woreda* had a total population of about 140,000 in 2017; 78.1% were rural residents (CSA, 2013; OHB, 2015; ORS, 2015). The four *kebeles* studied were Ayana, Ejere, Angar, and Lalistu. The *woreda* is primarily inhabited by the Oromo ethnic group with small numbers of Amhara and Tigre (OHB, 2015; ORS, 2015). The *woreda* has 1 primary hospital, 5 health centers, and 28 health posts. Roads are scarce in the *woreda* and there is no road in the study *kebeles.* People walk, use donkeys, or horses, and motorcycles to travel. As a result, it takes several hours of walking to reach the nearest paved road and motorized transport to public health delivery sites. Stretchers carried by men are used to transport women to the nearest motorway (ORS, 2015).

Study variables

Outcome variable

The outcome variable was health facility use for childbirth service among reproductive women aged 15 to 49 years who gave last birth during the 5 years prior to this study. The variable was coded 1 if the women chose a health institution for delivery of their most recent birth; otherwise, delivery at home was coded 0.

Predictor variables

The explanatory variables were socio-cultural, benefit or need, and accessibility characteristics of women. According to expanded 'three delays model' (Gabrysch & Campbell, 2009), socio-cultural, perceived benefit or need, economic and physical accessibility characteristics affect women's choices of maternal facility for delivery use. These are the main causes of phase I and II delays while phase III delay are factors that affect women in receiving adequate care at the health facility. The phase III delay factors are not considered in this study. Studies further classified the factors as individual and health facility-related factors. The individual factors include the mothers' socio-cultural factors and the perceived benefit or need of facility use. Both factors directly influence mothers' decision to seek care (Phase I delay). Economic and physical accessibility factors are phase II delays that determine whether the woman actually identifies and reaches the health facility (Abera et al., 2011). Perceived accessibility also influences decision-making for delivery (Phase II delays) (Abera et al., 2011).

The socio-cultural factors that affect pregnant women's decision to seek delivery services include maternal age, marital status, ethnicity, religion, traditional beliefs, family composition, women's autonomy, women's and husband's education (Gabrysch & Campbell, 2009; Tarekegn et al., 2014; USAID, 2012). Perceived benefits or needs include maternal information availability, maternal health knowledge, desire of pregnancy, perceived quality of care, antenatal care (ANC) use, previous delivery service use, birth order, and pregnancy complications and other factors related to women's perceptions of the benefit of facility delivery and the need to seek delivery care (Gabrysch & Campbell, 2009). Several studies identified economic accessibility factors as financial capability and opportunity costs which include mother's occupation, husband's occupation and the ability to pay and physical accessibility factors as region, place of residence, distance, availability of transportation services and health facility (Gabrysch & Campbell, 2009; USAID, 2012).

The socio-cultural practice and perceived benefits or needs considered in our study were maternal age, education, autonomy of decision to deliver at health facilities, support of traditional practice of the society for women to deliver at facilities, whether delivery at a health facility is considered to be necessary, plans to deliver at facilities, number of births, ANC clinic visits, knowledge of obstetric complications, presence of complications during earlier and last

births, possession of a radio and/or TV at home, knowledge of free services, home visits by community health agents, and women meetings attendance. Maternal occupation and monthly household income were included as economic factors. Maternal residence, distance to health facilities, availability of motorized transport, and types of decentralized local health facilities for birth were the physical accessibility factors included in the study (Figure. 4.1).

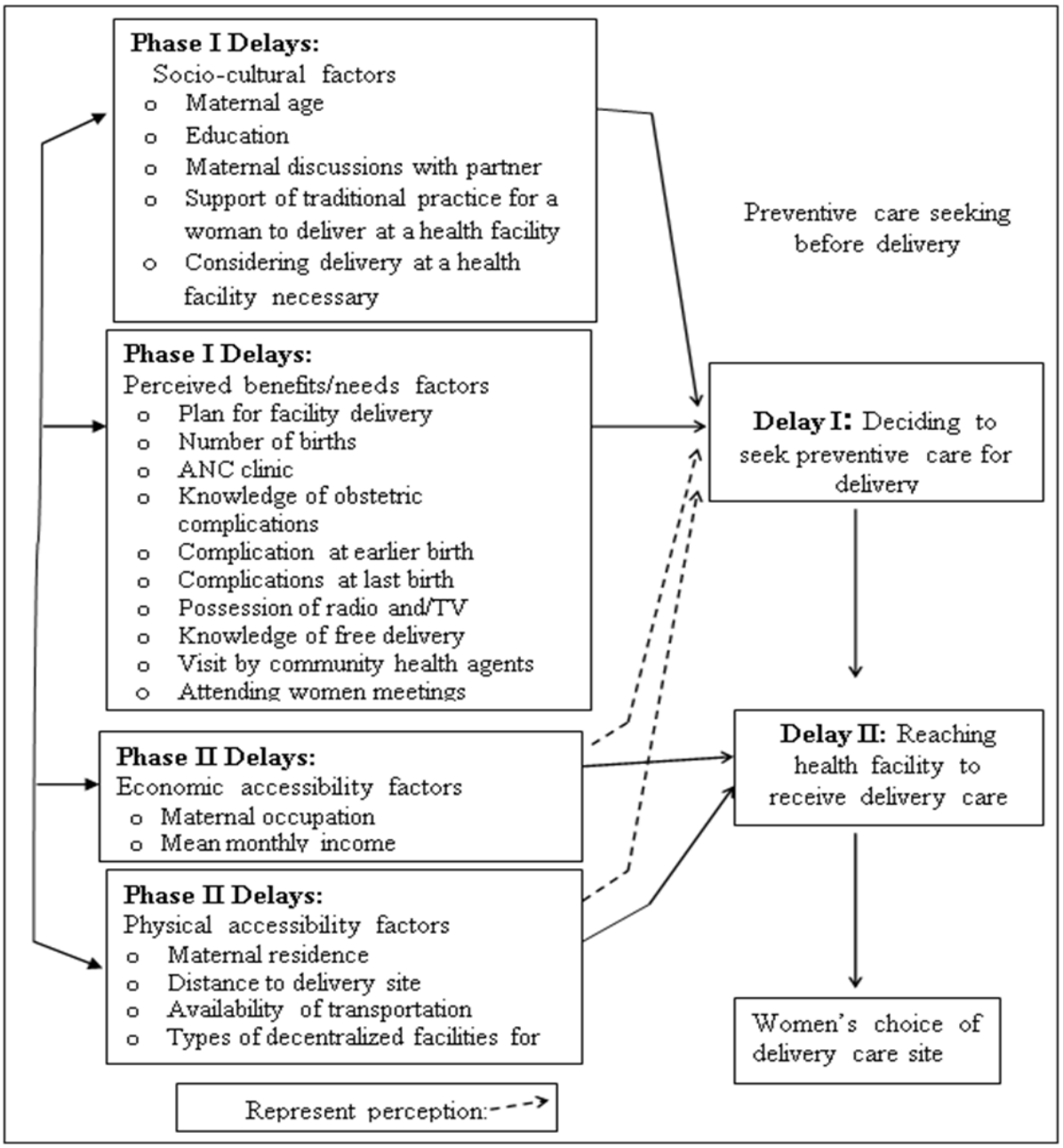

Figure. 4.1. Conceptual delay model of factors influencing women's choice of delivery site. Modified from Gabrysch & Campbell (2009).

Inclusion and exclusion criteria

Women aged 15-49 years living in the study *kebeles* for at least 5 years prior to the survey were included in the study and women with mental illness were excluded.

Operational definitions

Home delivery: giving birth in the mother's home or the home of a neighbor, relative, or member of her extended family.

Institutional delivery: giving birth at a health facility, including a health post, health center, hospital, or private clinic.

Woman's autonomy: Having the ability to decide either by herself or with her husband where to deliver her last child.

Decentralized facilities: health institutions, including health posts, health centers, primary hospitals and private clinics that were established to serve the community in Gida Ayana *Woreda* since the implementation of the national *woreda* decentralization program in 2002.

Home visit: household-based visit made by health extension workers during last birth.

Women meetings: monthly meetings of pregnant women at the health post level.

Study population and sampling

The source population for this study was all women of reproductive age (15 to 49 years) living in Gida Ayana *Woreda*, western Ethiopia and the study subjects were women aged 15 to 49 years who had their last birth during the 5 years preceding the survey. For sample size estimation, we assumed a 95% confidence interval (CI), a margin of error of 5%, a proportion of 33% utilizing public health services (CSA, 2014), and a design effect of 1.5. We used a design effect because we employed the two-stage sampling method.

In the first stage of sampling, the four *kebeles*: Ayana, Angar, Ejere, and Lalistu were randomly selected using the lottery system. At the second stage of sampling, study participants were selected by simple random-number sampling from the respective *kebeles* proportional to their population size. With these considerations, the minimum adequate sample size was computed based on the statistical estimation method (Kelsey et al., 1996). Since the source population was estimated to be less than 10,000, the sample size was corrected. A 5% non-response rate was used to obtain the final sample size of 459. All the selected women gave written consent to participate in the study. Five women wanted to end the interviews early due to personal appointments they had to attend to; they were reported as non-responders.

Data collection and quality control

Data were collected in paper from mothers at households between November 2016 and January 2017 through an interviewer-administered structured questionnaire. A structured questionnaire was adapted from the Demographic Health Survey and other similar works of literature. The questionnaire was initially designed in English, based on the purpose of the study, translated to the local language, Afan Oromo, for the interviews, then translated back to English by experts for consistency. The questionnaire contained socio-cultural, perceived benefit/need, and economic and physical accessibility questions pertaining to maternal service use.

Eight local female interviewers were recruited for data collection. All of them were experienced in data collection, hold bachelor of science degrees or diplomas in health science and could speak the local language. Two nurses experienced in supportive supervision were recruited as supervisors. All interviewers and supervisors were trained for 2 days by the first author on the objectives, instruments, and ethics of the study.

A pilot survey of 10% of the study population was carried out to test the questionnaire. The supervisors and the principal investigator supervised and monitored data collection activities and checked all the completed questionnaires for consistency and missing data daily. Incomplete questionnaires deemed to have problems were returned to the interviewers for completion. A final check was made during data entry through double data entry using EpiData version 3.1 (EpiData; CDC, 2000). The accuracy of data entries was verified using two methods. First, 10% of the questionnaires were randomly selected and checked. Second, frequency distributions, descriptive statistics, and results from cross-tabulations were carefully checked before fitting logistic regressions.

Data processing and analysis

The SPSS Version 24.0 (SPSS; IBM Corp; USA) was used for data processing and analysis. Cross-tabs and descriptive statistics were used to assess the proportions and the frequency distribution for nominal categorical variables. For non-categorical continuous variable, mean and SD were used. Map and figure were also employed to portray different information. Multicollinearity was also examined. Therefore, there is no potential influential observation and no severe co-linearity among predictor variables. Hence, all covariates having a value of variance inflation factor (VIF) of less than 5% were retained in the initial analysis (Pallant,

2007; Woya et al., 2018). The analysis employed logistic regression to study the effect of the independent variables on the dependent variable by controlling confounders.

The final adequacy of the model was detected using Omnibus Test of model co-efficient. The Omnibus Tests of Model Coefficients gives us an overall indication of how well the model performs. For this set of results, we obtained a highly significant value (p = 0.000 which is < 0.05). Therefore, the model (with our set of variables used as predictors) is best fit (Pallant, 2007). Pseudo R-square statistics (The Cox & Snell R-Square and the Nagelkerke R-Square), the Hosmer-Lemeshow Goodness of Fit Test, and standard error for the coefficients were also used to identify the fitness of the final model (Hosmer & Lemeshow, 2000; Pallant, 2007; Shrestha & Shrestha, 2011). The strength of association was assessed using adjusted odds ratios with a 95% confidence interval (CI) at a p-value less than 0.05.

Ethical considerations

The study was approved by the Research Ethics Review Committee (RERC) of Wollega University with a reference letter numbered of WU99529-H1-3-24/11/2016. Permission was received from Gida Ayana *Woreda* Health Office. The purpose of the study was explained to all participants and a consent form approved by the Review Board was given to participants. Parents or legal guardians provided consent for all participants under age 18. We emphasized that participation was completely voluntary and that they had the right to withdraw any time during the interview without giving any reason.

Confidentiality and anonymity were explained to all participants. We ensured that all participants understood the information given by asking them. The consent form was read aloud for women who could not read or write. Literate women were asked to read the consent form. A written consent in the form of a signature or a thumbprint was obtained from all of the participants. None of the participants refused to be interviewed. Five women wanted to end the interviews early due to personal appointments they had to attend to; they were reported as non-responders.

Results

Socio-cultural and demographic backgrounds of women

The mean and standard deviation of mothers' age was 26.1 and 7.1 years, respectively; 56% were in the age group of 20 to 34 years. Almost half of the respondents reported that they were illiterate, 48.9 % were Oromo ethnic group, 57.3% were Christians and the majority of participants were married. Over half of the participants reported that their society supported institutional delivery traditionally, and 88.1% of women considered institutional delivery to be necessary (Table 4.1).

Table 4.1. Socio-cultural and demographic characteristics of study participants, Gida Ayana *Woreda*, western Ethiopia.

Variable	*n(%)*
Maternal mean age (years)	26.1 ± 7.1 SD
Maternal marital status	
Married	381(83.9)
[a]Other	73(16.1)
Maternal ethnicity	
Oromo	222(48.9)
[b]Other	232(51.1)
Maternal religion	
Christian	260(57.3)
Muslim	194(42.7)
Maternal literacy	
Can read and write	230(50.7)
Illiterate	224(49.3)
Support of traditional practice for facility care	
Yes	246(54.2)
No	208(45.8)
Delivery at a health facility is necessary	
Yes	400(88.1)
No	54(11.9)

[a]Other: single/widowed/divorced. [b]*Others include Amhara and Tigre. SD: Standard Deviation.*

Perceived need characteristics and knowledge of women

The mean number of children born to a mother was 3.1 (ranging from 1 to 6) with a standard deviation of 2 (Table 4.2)**.** Almost two-thirds of the participants used ANC services and 41.9% had plans to deliver at local health facilities in the future. More than half of the mothers had reportedly been informed about potential pregnancy, labor, and delivery obstetric complications during the last birth; 56.4% had encountered at least one complication during previous births, and 56.6% reported they had faced at least one delivery complication during the last birth. Thirty-one percent of women attended monthly meetings for pregnant women, 43.8% had been visited by a community health agent, and 52.4% were well informed about the availability of free delivery services through the free care initiative for pregnant women. Of the 197 mothers delivering at home, 51.3% reported they were assisted by a traditional birth attendant.

Table 4.2. Perceived obstetric need characteristics and knowledge of study participants, Gida Ayana *Woreda*, western Ethiopia.

Variable	*n(%)*
ANC visit for the last pregnancy	
Yes	294(64.8)
No	160(35.2)
Plan to deliver at a facility	
Yes	190(41.9)
No	264(58.1)
Knowledge of pregnancy, labor and birth complications	
Yes	241(53.1)
No	213(46.9)

Table 4.2. (Continued)

Variable	n(%)
Complications during the previous birth	
Yes at least one	256(56.4)
No any	198(43.6)
Use of health facilities for the last birth	
Yes	257(56.6)
No	197(43.4)
Assistance during delivery at home (*N*=197)	
TBA	101(51.3)
Relative or neighborhood	92(46.7)
Skilled person	4(2.0)
Attended monthly women meetings	
Yes	142(31.3)
No	312(68.7)
A home visit by the health extension worker	
Yes	199(43.8)
No	255(56.2)
Knowledge of free service for delivery care	
Yes	238(52.4)
No	216(47.6)
Mean number of births	3.1 ± 2SD
Possession of radio and/or TV	
Yes	243(53.5)
No	211(46.5)

ANC: Antenatal care. SD: Standard Deviation. TV: Television. TBA: Traditional birth attendant.

Economic and physical accessibility characteristics of women

Forty-four percent of participants were housewives. The mean monthly income of the mothers' households was 47.0 $US (around 1, 270 Ethiopian Birr) with a standard deviation of 15.1 $US. The mean and standard deviation for walking to the health facilities for delivery care were 51.1 and 32.0 minutes, respectively.

Table 4.3. Economic and physical accessibility characteristics of study participants, Gida Ayana *Woreda*, western Ethiopia.

Variable	*n(%)*
Maternal occupation	
[a]Non-housewife	256(56.4)
Housewife	198(43.6)
Mean monthly household income ($US)	47 ± 15.1SD
Mean walking distance to the delivery site (minutes)	51.1 ± 32SD
Maternal residence	
Urban	254(55.9)
Rural	200(41.1)
Availability of motorized transport	
Easily available	145(31.94)
Difficult	309(68.06)

[a]Non-housewife activities include skilled employment, small business/service, and farming. SD: Standard Deviation. $US: United States Dollars with the exchange value of 27 Ethiopian Birr (Nov. 2016).

Utilization of decentralized health facilities for delivery care

Of the 459 mothers who participated in this study, 98.9% provided valid answers to the questionnaire. Over half of the mothers reportedly had their last child delivered in a health facility; 43.4% delivered at home. In regard to women's choice of child delivery site across decentralized health systems, 80.9% reported that they gave birth at local health centers, 10.5%

at health posts, and 8.6% in the local hospital or in a private clinic. The majority of women in Ayana and Ejere *kebeles* preferred health facilities, and most participants in Lalistu and Angar reportedly gave birth at home (look at Table 4.4). See also Figure 4.2 below which portrayed the delivery service utilization status and distribution of the targeted participants.

Table 4.4. Characteristics of study participants, Gida Ayana *Woreda*, western Ethiopia.

Variable	*n(%)*
Delivery by type of health facility (*N = 257*)	
Hospital or clinic	22(8.6)
Health centers	208(80.9)
Health posts	27(10.5)
Delivery in a health facility by *kebele* (*N* = 257)	
Ayana	77(81.9)
Ejere	46(59.7)
Lalistu	56(45.5)
Angar	78(48.8)

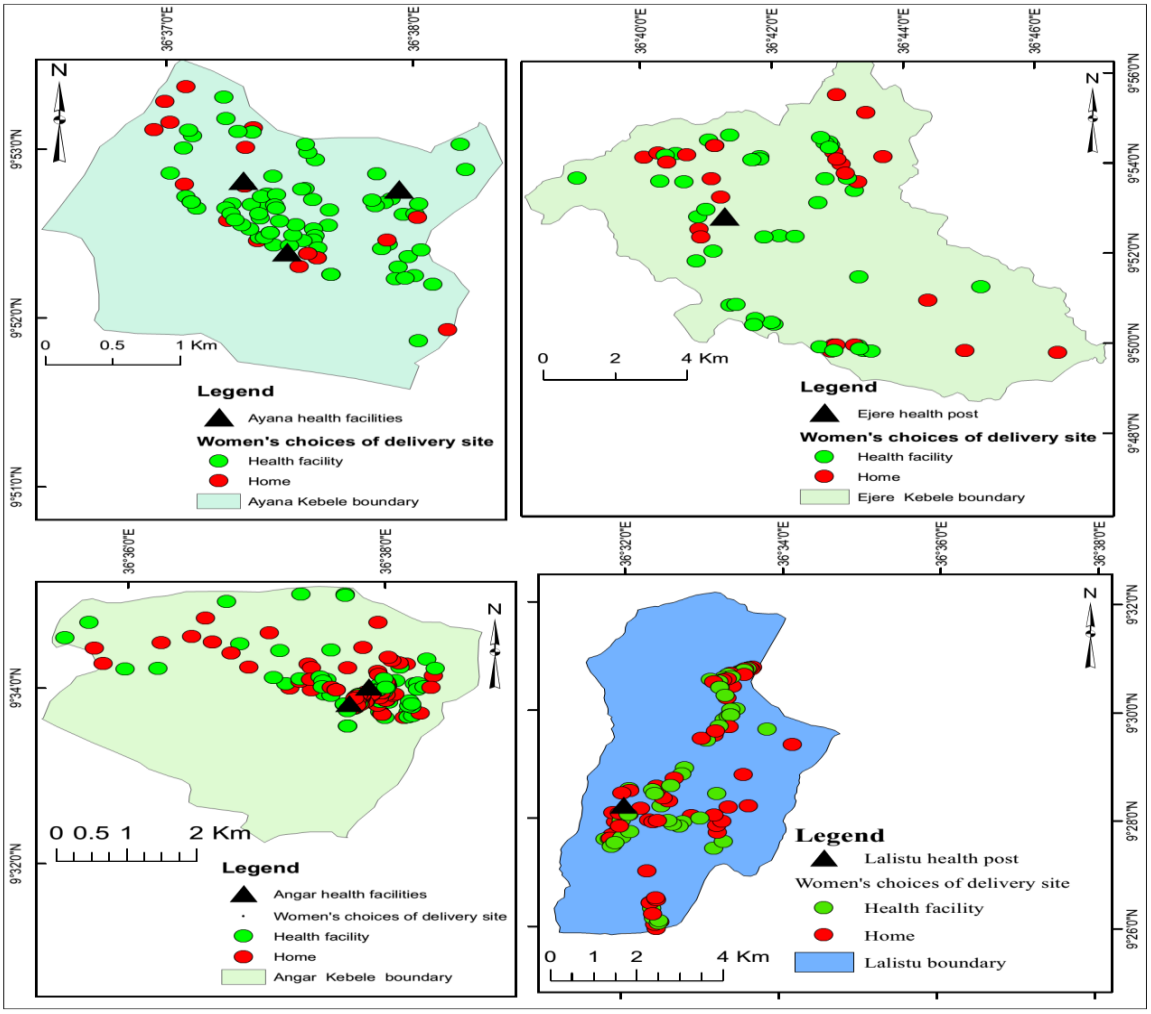

Figure 4.2. Distribution of delivery utilization status by study sites

Factors influencing women's choice of the delivery site

A model adjusted for confounding factors maternal age at delivery, number of births, maternal literacy, support of traditional practice, ANC clinic visit, plan to deliver at a facility, maternal knowledge of pregnancy, labor, and birth complications, complications during last birth, home visit by community health agents, availability of motorized transport during labor and type of health facility for delivery care (see Table 4.5, 4.6 and Table 4.7). The confounding factors were determined using before and after adjustments. Adjusted Odds Ratio (AOR) of socio-cultural, perceived benefit/need, and accessibility factors predicting women's choice of the delivery site were presented as follows:

Socio-cultural factors

After adjustment for confounding factors, the results of the multivariable logistic regression analysis (Table 4.5) showed that literate mothers were 3.4 times more likely to deliver in health facilities (AOR 3.4; 95% CI 2.0-5.9) than illiterate mothers. Women who reported that the traditional practices of the society were positive towards institutional delivery were almost 3 times more likely to give birth at health facilities compared to their counterparts who reported that the tradition of their society did not support delivery at health facilities (AOR 2.9; 95% CI 1.7-4.9).

Table 4.5. Socio-cultural factors influencing women's choice of delivery sites, Gida Ayana *Woreda*, western Ethiopia.

Variable	Delivery site choice			
	Health facility (*N* =257)	Home (*N* =197)	COR(9%CI)	AOR(9%CI)
Maternal age (in years)				
19 or less	82(64.6)	45(35.4)	2.2(1.2-4.1)*	0.9(0.4-2)
20-34	143(56.1)	112(43.9)	1.5(0.9-2.7)	0.9(0.4-1.8)
35 or more	32(44.4)	40(56.6)	1	1
Number of births				
0-1	139(64.4)	77(35.6)	2.1(1.2-3.4)*	0.9(0.4-2.0)
2-3	77(51.7)	72(48.3)	1.2(0.7-2.1)	0.6(0.3-1.4)
4 or more	41(46.1)	48(53.9)	1	1
Maternal literacy				
Can read and write	167(72.6)	63(27.4)	3.9(2.6-5.8)**	3.4(2.0-5.9)**
Illiterate	90(40.2)	134(59.8)	1	1
Autonomy to discuss with husband				
Yes	193(59.0)	134(41.0)	1.4(0.9-2.1)	
No	64(50.4)	63(49.6)	1	
Support of traditional practice				
Yes	167(67.9)	79(32.1)	2.7(1.8-4.0)**	2.9 (1.7-4.9)**
No	90(43.3)	118(56.7)	1	1
Delivery at a health facility is necessary				
Yes	231(57.8)	169(42.2)	1.4(0.8-2.6)	
No	26(48.1)	28(51.9)	1	

*1: reference category. **significant at p < 0.01. * significant at p < 0.05. CI: Confidence Interval. COR: Crude Odds Ratio. AOR: Adjusted Odds Ratio.*

Perceived benefit or need factors

In a multivariate model (Table 4.6), mothers who had plans to deliver in nearby health facilities in case of complications had almost 2 times higher odds of giving birth at health facilities (AOR 1.8; 95% CI 1.1-3.0) than those who had no plans. Participants who knew about obstetric complications related to pregnancy, labor, and delivery were 2.5 times more likely to deliver at facilities (AOR 2.5; 95% CI 1.4-4.2) compared to the reference group, and those who experienced at least 1 complication during the last birth were almost 3 times more likely to give birth at health facilities (AOR 2.9; 95% CI 1.6-5.2) than women who reported no complications. Mothers who were visited by community health agents during pregnancy period were nearly twice as likely to deliver at health facilities than those who were not visited (AOR 1.7; 95% CI 1.1-2.9).

Table 4.6. Perceived pregnancy needs factors influencing women's choice of delivery sites, Gida Ayana *Woreda*, western Ethiopia.

Variable	Delivery site choice			
	Health facility (*N* =257)	Home (*N* =197)	COR(9%CI)	AOR(9%CI)
ANC clinic visit				
Yes	198(67.3)	96(32.7)	3.5(2.3-5.2)**	1.5(0.8-2.7)
No	59(36.9)	101(63.1)	1	1
Plan to deliver at a facility				
Yes	126(66.3)	64(33.7)	1.9(1.3-2.9)**	1.8(1.1-3.0)*
No	131(49.6)	133(50.4)	1	1
Knowledge of pregnancy, labor and birth complications				
Yes	173(71.8)	68(28.2)	3.9(2.6-5.7)**	2.5(1.4-4.2)*
No	84(39.4)	129(60.6)	1	1
Complications during previous births				
At least one	145(56.6)	111(43.4)	1.0(0.6-1.4)	
None	112(56.6)	86(43.4)	1	

Table 4.6 (Continued)

Variable	Delivery site choice			
	Health facility (*N* =257)	Home (*N* =197)	COR(9%CI)	AOR(9%CI)
Complications during the last birth				
At least one	221(63.5)	127(36.5)	3.3(2.1-5.3)**	2.9(1.6-5.2)**
None	36(34.0)	70(66.0)	1	1
Attended monthly women's meetings				
Yes	97(68.3)	45(31.7)	2.0(1.3-3.1)*	1.6(0.9-2.7)
No	160(51.3)	152(48.7)	1	1
A home visit by community health workers				
Yes	139(69.8)	60(30.2)	2.6(1.8-3.9)**	1.7(1.1-2.9)*
No	118(46.3)	137(53.7)	1	1
Knowledge of free service for childbirth				
Yes	141(59.2)	97(40.8)	1.2(0.8-1.8)	
No	116(53.7)	100(46.3)	1	
Possession of radio and/or TV				
Yes	155(63.8)	88(36.2)	1.8(1.2-2.7)*	1.0(0.6-1.7)
No	102(48.3)	109(51.7)	1	1

*1: reference category. **significant at p < 0.01. * significant at p < 0.05. CI: Confidence Interval. COR: Crude Odds Ratio. AOR: Adjusted Odds Ratio. ANC: Antenatal care. TV: Television*

Accessibility factors

In a multivariate analysis (Table 4.7), women who used health centers were 5 times more likely (AOR 5.0; 95% CI 2.4-10.2) than those who used health posts. Our study also found that mothers who reported ease of access to motorized transport in their last birth were nearly twice as likely to deliver their child at a healthcare facility than their counterparts who faced

difficulties in securing motorized transportation to the delivery site (AOR 1.9; 95% CI 1.1-3.3).

Table 4.7 Accessibility factors influencing women's choice of delivery sites, Gida Ayana *Woreda*, western Ethiopia.

Variable	Delivery site choice			
	Health facility (*N* =257)	Home (*N* =197)	COR(9%CI)	AOR(9%CI)
Average monthly household income				
50 $US or more	153(56.0)	120(44.0)	0.94(0.6-1.3)	
Less than 50 $US	104(57.5)	77(42.5)	1	
Maternal occupation				
[a]Non-housewife	164(64.1)	92(35.9)	2.0(1.3-2.9)**	1.5(0.9-2.5)
Housewife	93(47.0)	105(53.0)	1	1
Physical accessibility factors				
Maternal residence				
Urban	155(61.0)	99(39.0)	1.5(1.0-2.1)*	0.4(0.2-1.8)
Rural	102(51.0)	98(49.0)	1	1
Walking distance to delivery site in minutes				
Less than 30	174(58.8)	122(41.2)	1.2(0.8-1.9)	
30 or more	83(52.5)	75(47.5)	1	
Availability of motorized transport				
Easily available	100(69.0)	45(31.0)	2.1(1.4-3.2)**	1.9(1.1-3.3)*
Difficult	157(50.8)	152(49.2)	1	1
Type of delivery or decentralized health facility				
Hospital or clinic	22(61.1)	14(38.9)	7.1(3.2-15.7)**	1.3 (0.4-3.7)
Health center	208(77.6)	60(22.4)	15.7(9.5-26)**	5.0 (2.4-10.2)**
Health post	27(18.0)	123(82.0)	1	

*[a]Non-housewife activities include skilled employment, small business/service, and farming. $US: United States Dollars with the exchange value of 27 Ethiopian Birr (Nov. 2016). 1: reference category. **significant at p < 0.01. * significant at p < 0.05. CI: Confidence Interval. COR: Crude Odds Ratio. AOR: Adjusted Odds Ratio.*

Discussion

Although the level of utilization of decentralized maternal childbirth services in Gida Ayana *Woreda* was 56.6%, more than twice as high as the national figure (26.2%), it is still low compared to other developing countries. Results showed that socio-cultural characteristics of maternal literacy and the support of traditional community practice for delivery use; perceived benefit or need factors of plan to deliver at a facility, knowledge of complications during pregnancy, labor and birth, complications during last birth, and home visits by community health agents were significantly associated with women's utilization of maternal health facilities for delivery service. Multivariate analysis indicates that women with physical access to motorized local transportation services during labor and access to the preferred type of health facility were more likely to seek care from health facilities to deliver their last child. However, the study results are inconclusive with respect to the influence of economic accessibility, maternal occupation and household monthly income on the use of maternal delivery care services.

Women who could read and write were more likely to receive institutional delivery care services from skilled providers than those with no education. Women's choice of institutional delivery is strongly influenced by education. This finding is corroborated by other studies (Bhandari et al., 2017; Fisseha et al., 2017; Kebede et al., 2016; Kidanu et al, 2017; Say & Raine, 2007; Singh et al., 2012). The possible explanation for this finding is that educated women may be more aware of pregnancy complications and delivery at home and may know the importance of delivering with the help of a skilled provider.

This study also found that the support of traditional birthing practices of the local community positively influenced the odds of women delivering at health facilities compared to women who reported that the traditions of their communities did not allow them to use institutional delivery services. Cultural beliefs and practices influence their choices of health care providers in the study setting, corroborating the findings of other studies (Aktar, 2012; Gabrysch & Campbell, 2009; Kaba et al., 2016; Moyer & Mustafa, 2016; Thaddeus & Maine, 1994; USAID, 2012).

In developing countries, the use of public health delivery services has been found to be significantly higher among women who had information about the risk factors of pregnancy, labor, and delivery during their last birth (Ahmed et al., 2010; Arba et al., 2016; Dejene, & Hailemariam, 2015; Fisseha et al,, 2017; Gabrysch &Campbell, 2009; Kaba et al., 2016; Karkee et al., 2015; Lassi et al., 2014; Shahram et al., 2015; Tadele, & Lamaro, 2017; Thaddeus & Maine, 1994; Wako & Kassa, 2017). These findings are similar to our results, which show that women who had information about obstetric complications during the last birth were 2.5 times more likely to deliver at health facilities than their counterparts who did not have that information. The strong relationship between education and delivery in public health facilities appears to be linked to knowledge about the risks of delivering at home and the greater safety of skilled delivery care.

Our findings also show that maternal plans to give birth at health facilities exerted a significant influence on women's choice of delivery care services, after controlling for selected covariates. Women who had planned to give birth at health facilities in case of complication were almost 2 times more likely to deliver at a birth center than women who did not have a birth plan. Studies in Asia and Africa have documented that women who saved money and made arrangement for transportation and potential birthing risks were more likely to use public delivery services (Bhandari et al., 2017; Worku et al., 2013; Dejene & Hailemariam, 2015; Harvey et al 2004) pregnant women without delivery plans either used unsafe childbirth methods or gave birth at home (Moyer & Mustafa, 2016; Kaba et al., 2017; Hosmer & Lemeshow, 2000; Karkee et al., 2011; Jayaweera et al., 2018).

Institutional delivery was nearly 3 times more prevalent among women who experienced at least one complication during their last pregnancy, mostly during labor, than among women who did not report any complication. This indicated that mothers were not likely to use skilled delivery services unless they had experienced complications. This could be due to the poor knowledge of potential complications and lack of a birth preparedness plan, cultural influence, or poor counseling during pregnancy (Fisseha et al., 2017; Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994; Wako & Kassa, 2017; Woldegiorgis et al., 2017). Also, in the current study, of the total women who gave the most recent birth to a child in the Gida Ayana *Woreda*, it was only 41.9% who prepared a plan to give birth at a health institution. The majority of women did not plan to use health facility during delivery. This scenario may be

incorporated into health promotion messages aimed at overcoming traditional attitudes of complacency and other forms of aversion to the use of professional delivery services.

The type of health facility significantly predicted the odds of delivery at a facility. Our multivariate analysis showed that the decentralized healthcare system enhanced the uptake of local delivery services. The odds of choosing decentralized health center for delivery than a health post were 5 times higher when other variables were controlled. This finding corroborates studies done in Guji, Wolaita, and Dawaro Zones, Dembecha *Woreda*, and in a countrywide survey in Ethiopia (Arba et al., 2016; Kidanu et al., 2017; Wako & Kassa, 2017; Woldegiorgis et al., 2017), Kenya & Jordan (Ikamari, 2004; Obermeyer & Potter, 1991). However, unlike these studies, in rural Rwanda over 90% of births were recorded in health posts where decentralized delivery care extended effectively to the health posts (Nathan et al., 2015). Decentralization facilitated intensive community health worker education and mobilization, provision of clean newborn clothes at the time of delivery, and financial disincentives for home delivery, thus significantly increasing positive delivery outcomes (Nathan et al., 2015).

The positive relationship between home-based counseling by local health providers and utilization of healthcare services is well documented (Aktar, 2012; Ikamari, 2004; Kaba et al., 2016; Shahram et al., 2015; Singh et al., 2012; Teklehaimanot et al., 2007; Wako & Kassa, 2017). Similarly, home visits by community health agents during last pregnancy were strongly associated with the outcome variable in Gida Ayana. Women who were visited opted for facility delivery care services whereas most women who were not visited preferred to give birth at home. The explanation might be that well-informed women in Gida Ayana are more aware of health risks and obtain delivery at health facilities.

Availability of motorized transport was found to be another major factor in the choice of delivery. Studies carried out elsewhere found higher odds of health facility use by women who have access to better local transport systems or road connections (Fisseha et al., 2017; Gabrysch & Campbell, 2009; Ikamari, 2004; Karkee et al., 2015; Say & Raine, 2007; Singh et al., 2012; Wako & Kassa, 2017, Kloos, 1998). Our multivariate analysis indicated that women having some form of motorized local transport services have higher odds of accessing and using maternal healthcare facilities during the last labor compared to those with difficult access to transport service.

Strengths and limitations

As a strength, this study utilized a relatively large and randomized sample, increasing the power of the study and making the results broadly representative. However, this study has some limitations. Primarily, women might have had difficulties of remembering maternal information from the 5 years preceding our study, causing recall bias. Secondly, of the 'Three delays model', the third delay namely receiving adequate care in the facility is not addressed in the current study. Data on the quality of delivery services and information related to waiting time at the delivery sites were not collected. Health facility-related factors may have prevented some women from utilizing the health services for delivery. We recommend a study of factors influencing the utilization of decentralized health facility after stratified analysis with interaction terms and sampling weights employing small risk factors of delivery care service use in western Ethiopia.

Conclusion and recommendations

Many underlying socio-cultural, perceived benefit or need, and physical accessibility factors were the significant predictors of women's use of health facility. This study found that maternal education influenced women's attitudes toward the use of health facilities for delivery services. Therefore, policymakers need to implement outreach interventions through *kebeles* to encourage women to use services. It is also crucial for health promotion programs to target rural women and communities with different traditional practices and views about the importance of knowledge on potential pregnancy, labor and delivery complications. The ministry of health, local government authorities and health care services, childbirth professionals and community health extension agents can contribute in this regard.

Equally important, is intervention program to raise awareness and community mobilization campaigns to overcoming the deep-seated cultural aversion of using delivery services in public health facilities. In addition, women need to plan to deliver at health facilities to overcome complications and increase their ability to give safe birth. This has to be supported with increasing the accessibility of delivery care clinics either through further decentralization of health centers or by upgrading the frontline health posts into health centers, as well as implementing community-based intervention programs and improving rural transport services and the quality of maternal services.

References

Abebe, F. 2012. Factors associated with home delivery in Bahirdar, Ethiopia: A case control study. *BMC Res Notes, 5*(653).

Abera, M., Gebremariam, A., & Belachew, T. 2011. Predictors of safe delivery serice utilizion in Arsi Zone, southeastern Ethiopia. *Ethiopian Journal of Health Science., 21*(Spesl issue), 95-106.

Abosse, Z., Woldie, M., & Ololo, S. 2010. Factors influencing antenatal care service utilization in Hadiya zone. *Ethiopian Journal of Health Science., 20*(2), 75-82.

Ahmed, S., Creanga, A. A., Gillespie, D. G., & Tsui, A. O. 2010. Economic status, education and empowerment: Implications for maternal health service utilization in Developing Countries. *PLoS One, 5(*16).

Aktar, S. 2012. Health care seeking behavior for safe motherhood: Findings from rural Bangladesh. *Bangladesh E-Journal Society., 9*(2), 57-70.

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A., & Gemmill, A. 2016. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN maternal mortalityestimation inter-agency group. *The Lancet, 387*(10017), 462-474.

Arba, M. A., Darebo, T. D., & Koyira, M. 2016. *Institutional delivery service utilization among women from rural districts of Wolaita and Dawro Zones, southern Ethiopia: a community based cross-sectional study. PLoS ONE, 11(3):* 1-10.

Babalola S., & Fatusi, F. 2009. Determinants of use of maternal health services in Nigeria: Looking beyond individual and household factors. *BMC Pregnancy & Childbirth., 9*(43).

Bhandari, T. R., Kutty, V. R., Sarma, P. S., & Dangal, G. 2017. Safe delivery care practices in western Nepal: Does women's autonomy influence the utilization of skilled care at birth? *PLoS One*, 1-10.

Bitew, T., Hanlon, C., Kebede, E., Medhin, G., & Fekadu, A. 2016. Antenatal depressive symptoms and maternal health care utilisation: A population-based study of pregnant women in Ethiopia. *BMC Pregnancy & Childbirth, 16*(301), 1-11.

Borghi, J., Ensor, T., Somanathan, A., Lissner, C., & Mills, A. 2006. Mobilizing financial resources for maternal health. *Lancet, 368*, 1457-1465.

Campbell, O. M., & Graham, W. J. 2006. Strategies for reducing maternal mortality: getting on with what works. *Lancet, 368*, 1284-1299.

CSA [Central Statistical Agency] of Ethiopia. 2013. *Population projection of Ethiopia for all regions at woreda level from 2014-2017.* Volume 3. *Addis Ababa: Central Statistical Agency [CSA], Ethiopia*.

CSA [Central Statistical Agency] of Ethiopia. 2014. *Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa, Ethiopia.*

CSA [Central Statistical Agency] of Ethiopia & ICF International. 2016. *Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, & Rockville, Maryland, USA: CSA & ICF*.

Dejene, G., & Hailemariam, T. 2015. Utilization of institutional delivery services and associated factors among mothers in semi-pastoralist, southern Ethiopia. *Journal of*

Women's Health Care, *4*(7).

Dickson, K., Darteh, E., Kyereme, A., & Ahinkorah, B. 2018. Determinants of choice of skilled antenatal care service providers in Ghana: analysis of demographic and health survey. *Maternity Health Neonatal & Perinatal Research, 4*(14), 1-8.

EPRDF [Ethiopian People Revolutionary Democratic Front]. 1995. Proclamation No.1 The constitution of the 1995.

FMoH [Federal Ministry of Health] of Ethiopia. 1998. Ethiopia health care financing strategy. *Addis Ababa: Federal Ministry of Health [FMoH], Ethiopia*.

FMoH [Federal Ministry of Health] of Ethiopia. 2010. *Health Sector Development Program IV. 2010/2011-2014/2015. Addis Ababa: Federal Ministry of Health [FMoH], Ethiopia*.

FMoH [Federal Ministry of Health] of Ethiopia. 2014. *Health Sector Development Programme IV: Annual performance report. Addis Ababa: Federal Ministry of Health [FMoH] [Ethiopia]*. Addis Ababa, Ethiopia.

FMoH [Federal Ministry of Health] of Ethiopia. 2015. *Health Sector Transformation Plan (HSTP). 2015/16-2019/20. Addis Ababa: Federal Ministry of Health [FMoH], Ethiopia*.

Filippi, V., Ronsmans, C., Campbell, O. M., Graham, W. J., & Mills, A. 2006. Maternal health in poor countries: the broader context and a call for action. *Lancet, 368*, 1535-1541.

Fisseha, G., Berhane, Y., Worku, A., & Terefe, W. 2017. *Distance from health facility and mothers' perception of quality related to skilled delivery service utilization in northern Ethiopia*. International Journal of Women's Health: 749-756.

Gabrysch, S., & Campbell, O. 2009. Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy & Childbirth, 9*(34), 1-27.

Harvey, S. A., Ayabaca, P., Bucagu, M., Djibrina, S., Edson, W. N., Gbangbade, S., … Burkhalter, B. R. 2004. Skilled birth attendant competence: An initial assessment in four countries, and implications for the safe motherhood movement. *International Journal of Gynecology & Obstetrics, 87*, 203-210.

Hosmer, D., & Lemeshow, S. 2000. *Applied logistic regression*. 2rd eds. New York: John Wiley & Sons, Inc.

Ikamari, L. 2004. Maternal health care in Teso District in Kenya. *African Journal of Health Scince, 11*, 21-32.

Jayaweera, R. T., Ngui, F. M., Hall, K. S., & Gerdts, C. 2018. *Women's experiences with unplanned pregnancy and abortion in Kenya: A qualitative study*. *PLoS ONE* 13(1): 1-13.

Kaba, M., Bulto, T., Tafesse, Z., Lingerh, W., & Ali, I. 2016. Sociocultural determinants of home delivery in Ethiopia: A qualitative study. *International Journal of Women's Health, 8*, 93-102.

Karkee, R., Lee, A. H., & Khanal, V. 2014. *Need factors for utilisation of institutional delivery services in Nepal: an analysis from Nepal Demographic and Health Survey, 2011*. *BMJ Open*, (4).

Kassebaum, N. J., Barber, R. M., Dandona, L., Hay., S. I., Larson., H. J., Lim., S. S., … Lopez., A. D. 2016. Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease study 2015. *The Lancet, 388*(10053), 1775-1812.

Kassebaum, N., Villa, A., Coggeshall, M., Shackelford, K., Steiner, C., Heuton, K., & Medina,

D. 2014. Global, regional, and national levels and causes of maternal mortality during 1990-2013: A systematic analysis for the Global Burden of Disease study 2013. *The Lancet, 384,* 980-1004.

Kebede, A., Hassen K., & Teklehaymanot, A. 2016. Factors associated with institutional delivery service utilization in Ethiopia. *International Journal of Women's Health,* 463-475.

Kelsey, J., Whittemore, A., Evans, A., & Thompson, W. 1996. *Methods of sampling and estimation of sample size. Methods in observational epidemiology.* New York: Oxford University Press.

Kidanu, S., Degu, G., &Turiye, Y. 2017. *Factors influencing institutional delivery service utilization in Dembecha District, northwest Ethiopia: A community based cross sectional study*. *Reproductive Health, 14 (98).*

Kloos, H. 1998. Primary Health Care in Ethiopia: From Haile Sellassie to Meles Zenawi. *Northeast African Studies,* (5): 83-113.

Koblinsky, M., Tain, F., Gaym, A., Karim, A., Carnell, M., & Tesfaye, S. 2006. Going to scale with professional skilled care. *Lancet, 368,* 1377-1386.

Lassi, Z. S., Salam, R. A., Das, J. K., & Bhutta, Z. A. 2014. Essential interventions for maternal, newborn and child health: Background and methodology. *Reproductive Health, 11*(Suppl 1).

Moyer, C., & Mustafa, A. 2016. Drivers and deterrents of facility delivery in sub-Saharan Africa: a systematic review. *Reproductive Health Journal,* (43), 1-15.

Nathan, LM., Shi, Q., Plewniak, K., Zhang, C., Nsabimana D., Sklar, M.,… Mutimura, E. 2015. Decentralizing maternity services to increase skilled attendance at birth and antenatal care utilization in rural Rwanda: A prospective cohort study. *Maternity & Childhealth Journal, 19*(9), 1949-1955.

Obermeyer, C. M., & Potter, J. E. 1991. Maternal health care utilization in Jordan: A study of patterns and determinants. *Studies in Family Planning., 229*(3), 177-187.

OHB [Oromia Health Bureau]. Gida Ayana Woreda based health sector plan performance evaluation report, 2015. Finfinnee: Oromia Health Bureau. Ethiopia; 2015.

ORS [Oromia Resgional State]. 2015. *Oromia Regional State Eastern Wollega Zone Finance And Economic Development Office: Physical and socio economic profile of Gidda Ayana District.*

Regassa, N. 2011. Antenatal and postnatal care service utilization in southern Ethiopia: A population based study. *Africa Health Scince., 11*(3), 390-7.

Regassa, T., & Gebi, A. 2014. Determinants of institutional delivery among childbearing age women in western Ethiopia: unmatched case control study. *PLoS One, 9*(5), 1-7.

Ronsmans, C., & Graham, W. J. 2006. Maternal mortality: Who, when, where, and why. *Lancet, 368,* 1189-1200.

Rosenfield, A., Min, C. J., & Freedman, L. P. 2007. Making motherhood safe in developing countries. *Engl Joural of Medicine, 356,* 1395-1397.

Say, L., & Raine, R. 2007. A systematic review of inequalities in the use of maternal health care in developing countries: Examining the scale of the problem and the importance of context public health reviews. *Public Health Reviews, 85*(10), 812-819.

Shahram, M. S., Hamajima, N., & Reyer, J. A. 2015. *Factors affecting maternal healthcare*

utilization in Afghanistan: Secondary analysis of Afghanistan health survey 2012. 595-607.
Simkhada, B., Teijlingen, E., Porter, M., & Simkhada, P. 2007. Factors affecting the utilization of antenatal care in developing countries: Systematic review of the literature. *Journal of Advanced Nursing.*, *6*(13), 244-60.
Singh, P. K., Rai, R. K., Alagarajan, M., & Singh, L. 2012. *Determinants of maternity care services utilization among married adolescents in rural India*. *7*(2).
Shrestha, G., & Shrestha, G. 2011. Statistical analysis of factors affecting utilization of antenatal care in Nepal. *Nepal Journal of Science & Technology*, *12*, 268-275.
Tadele, N., & Lamaro, T. 2017. *Utilization of institutional delivery service and associated factors in Bench Maji zone, southwest Ethiopia: Community based, cross sectional study*, 1-10.
Tarekegn, S., Lieberman, S., & Giedraitis, V. 2014. Determinants of maternal health service utilization in Ethiopia: Analysis of the 2011 Ethiopian Demographic and Health Survey. *Pregnancy & Childbirth*, *14*(161), 1-13.
Tefera, A., Alemu, F. M., & Woldeyohannes, S. M. 2012. Institutional delivery service utilization and associated factors among mothers who gave birth in the last 9 months in Sekela District, northwest of Ethiopia. *BMC Pregnancy & Childbirth*, *12*(74).
Teklehaimanot, A., Kitaw, Y., Gebre-Yohannes, A., Girma, S., Seyoum, A., Desta, H., & Ye-Ebiyo, Y. 2007. Study of the working conditions of health extension workers in Ethiopia. *Ethiopian Journal of Health Development*, *21*(3), 246-259.
Tessema, G. A., Laurence, C. O., Melaku, Y. A., Misganaw, A., Woldie, S. A., Hiruye, A., …, Zeleke, M. B. 2017. *Trends and causes of maternal mortality in Ethiopia during 1990-2013: Findings from the Global Burden of Diseases study 2013*, 1-8.
Tessu, M., Lamaro, T., & Henok, A. 2015. Prevalence of institutional delivery among mothers in Kometa sub-locality, Mizan-Aman Town, southwestern Ethiopia. *Health Science Journal*, *10*(3), 1-6.
TGE [Transitional Government of Ethiopia]. 1993. *Health policy of the transitional government of Ethiopia*.
Thaddeus, S., & Maine, D. 1994. Too far to walk: maternal mortaliity in context. *Social Scince & Medicine*, *38*(8), 1091-1110.
USAID [United States Agency for International Development]. 2012. *Cultural barriers to seeking maternal health care in Ethiopia: A review of the literature*. Washington, D. C, USA.
Wako, W., & Kassa, D. 2017. *Institutional delivery service utilization and associated factors among women of reproductive age in the mobile pastoral community of the Liban District in Guji Zone, Oromia, southern Ethiopia: A cross sectional study*. BMC Pregnancy & Childbirth, 17(144).
Woldegiorgis, M., Bhowmik, J., & Mekonnen, W. 2017. Trends in reproductive health indicators in Ethiopia: 2000-2014. *International Journal of Healthcare*, *3*(1).
Worku, A., Yalew, A., & Afework, M. 2013. Maternal complications and women's behavior in seeking care from skilled providers in north Gondar, Ethiopia. *PLoS One*, *8*(3).
Worku, A., & Fantahun, M. 2013. Factors affecting utilization of skilled maternal care in northwest Ethiopia: A multilevel analysis. *BMC International Health & Human Rights*, *13*(20).

Chapter 5. _____

Risk factors for women's non-utilization of decentralized primary healthcare facilities for postnatal care in Gida Ayana, rural western Ethiopia.

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Chapter 5. Risk factors for women's non-utilization of decentralized primary healthcare facilities for postnatal care in Gida Ayana, rural western Ethiopia.

Abstract

Objective: Evidence suggests postnatal care (PNC) contributes to reductions in maternal mortality. In Ethiopia, the proportion of women who do not utilize PNC after birth is high and the frequency of postnatal checks falls short of the four visits recommended by WHO. This study examined risk factors associated with non-utilization of decentralized local health facilities, namely health posts, health centers, and a primary hospital, for PNC services in Gida Ayana *Woreda* in rural western Ethiopia.

Methods: In this study, 454 mothers were examined for the following risk factors: *kebele* (the smallest administrative unit in Ethiopia) in which decentralized health facilities were located, postnatal woman's age, antenatal care (ANC) service visit, experience of postnatal complications, knowledge of postnatal complications, knowledge of the recommended number of PNC visits, knowledge of the availability/provision of PNC, and health extension workers' home visits. Bivariate and multivariable logistic regression analyses were applied to identify predictors of non-utilization of decentralized local facilities for PNC services.

Results: Over half (55.7%) of the women did not utilize PNC within 42 days of delivery, and only 10.0% utilized the care considered appropriate according to WHO guidelines. After adjusting for various potential confounding factors, we found the following risks to be strongly associated with non-utilization of decentralized healthcare facilities for PNC services: some outer rural administrative decentralization entities such as Angar, Lalistu, and Ejere *kebeles*; age 35 years or older (AOR = 3.4, 95% CI:1.4-8.3); not receiving ANC during this pregnancy (AOR = 2.0, 95% CI: 1.1-3.7); no experience of any postnatal complications (AOR = 3.3, 95% CI: 1.7-6.4); and no knowledge of at least one postnatal complication (AOR = 2.0, 95% CI: 1.2–3.3). Risk factors highly but less strongly associated with women's non-utilization of PNC services were: no knowledge of the standard number of PNC visits recommended, no knowledge about the availability/provision of services at a local health facility, and no home visit from health extension worker by day 3 post-delivery.

Conclusion: The risk factors for women's non-utilization of decentralized health facilities for PNC identified in this study need to be considered in interventions for enhancing the utilization of the service and reducing maternal and newborn deaths in rural western Ethiopia. Strengthening of PNC services, especially in the more remote *kebeles*, should include upgrading of the referral system and expansion of counseling of women by health extension workers.

Keywords: Postnatal care non-utilization; risk factor; decentralized health facilities; Gida Ayana, rural western Ethiopia.

Introduction

Providing timely access to postnatal care (PNC) is one of the most effective methods of improving maternal health outcomes in less-developed countries (USAID, 2007; WHO, 2013) According to WHO, the postnatal period begins at 1 hour after the delivery of the placenta and continues until 6 weeks after delivery (WHO, 1998; WHO, 2013). PNC is important for maternal wellbeing; it prevents cognitive complications and illness that might result from childbirth (Djellouli et al., 2017; Kikuchi et al., 2018; Somefun & Ibisomi., 2016; Tesfaye et al., 2014). Skilled care during this period can help protect against maternal complications and deaths (Kikuchi et al., 2018; Sines et al., 2007; WHO, 2013). One researcher suggested that 88 to 98% of all pregnancy-related deaths are preventable if postnatal women receive timely and effective PNC (Kunst, 2001).

Non-utilization of PNC hinders initiatives aimed at improving maternal morbidity and mortality because PNC is an essential component of those initiatives (Djellouli et al., 2017; Kikuchi et al., 2018; Sines et al., 2007; Titaley et al., 2009; WHO, 1998; WHO, 2013). A 2015 analysis of maternal mortality documented 303,000 mothers' deaths worldwide due to pregnancy and skilled attendance-related complications (Alkema et al., 2016). More than two thirds of maternal deaths occur as a result of non-utilization of PNC (WHO, 1998; WHO, 2013) and 62% of these deaths happen in the postnatal period (Angore et al., 2018). Over 50% occur on day one (Bhutta et al., 2014; Harvey et al., 2004).

The maternal mortality rate (MMR) of Ethiopia is 410 per 100,000, which is higher than rates in some other low- and middle-income countries (CSA & ICF International, 2016; Kassebaum

et al., 2016). It is far higher than the MMR of the United Kingdom (9 per 100,000), higher than the global average (196 per 100,000), above the Eastern sub-Saharan African average (368 per 100,000), and higher than the MMR of Kenya (338 per 100,1000) (Kassebaum et al., 2016). In low-and middle-income countries, the number of women obtaining PNC examinations is much lower than the number receiving antepartum and intrapartum services (Angore et al., 2018; Sines et al., 2007; Tesfaye et al., 2014). This is the case in Ethiopia, where use of PNC is markedly very sluggish; even in safe motherhood programs PNC utilization in Ethiopia is lower than use of antenatal care (ANC) and skilled health providers at birth (FMoH, 2015; USAID, 2007; WHO, 2013). Only 17% of Ethiopian women receive a PNC check-up. In Oromia, the largest and most populous region and the region in which the present study was conducted, average PNC use was only 9% (CSA & ICF International, 2016). This is the lowest for all regions of Ethiopia.

Research suggests the following are risk factors for women's non-utilization of PNC: availability and accessibility of health facilities; availability of transport and rural road network; maternal literacy, age, and occupation; cultural beliefs; attitude of providers; place and mode of delivery; history of pregnancy; knowledge of pregnancy programs, complications, and PNC services; health promotion; and home visits (Djellouli et al., 2017; Durg et al., 2016; Gu et al., 2018; Hordofa et al., 2015; Somefun & Ibisomi, 2016). The extent to which any of these factors poses risks to women's non-utilization of PNC services varies according to local cultural practices, geographic setting, and various barriers within specific societies (USAID, 2012; Khanal et al., 2014; Titaley et al., 2010).

The effectiveness of the health system in Ethiopia is undermined by non-utilization of existing decentralized healthcare facilities (DHFs) for PNC (CRDA, 2004; Wamai, 2009). Beginning in 2002, the government demonstrated commitment to improving maternal health by offering services close to postnatal women's homes through decentralization at *woreda* and district levels and innovative, community-based approaches (Haile et al., 2017). The reforms increased the number of frontline health workers, including health extension workers (HEWs); extended community-based peripheral health centers and health posts to reduce geographical barriers to reproductive health services; provided free PNC service (Wamai, 2009) and introduced guidelines for PNC, including adoption of the WHO recommendation that women make a minimum of four PNC visits (FMoH, 2006; Haile-Mariam & Kloos , 2005). Since 2004, under

these arrangements, more than 30,000 female HEWs have been trained at the national level and deployed to the frontline health posts at the *kebele* level in *woredas* all over Ethiopia, working as community mobilizers to promote maternal health and greater health in the general population (FMoH, 2010). However, despite these measures, PNC utilization is still far below the standard (Kassa & Shawel, 2013).

Recent national surveys indicate that although Ethiopia's MMR appears to have gone down over the past decade (from 673 in 2011 to 410 in 2016), it is still high compared to some other sub-Saharan countries (CSA & ICF International, 2016; Kassebaum et al., 2016). Low PNC utilization is reflected in the high MMR, which prevented Ethiopia from achieving Millennium Development Goal 5 (FMoH, 2015). Further, per the 2015 Gida Ayana *Woreda*-Based Health Sector Plan Performance Evaluation Report, Gida Ayana *Woreda* had done little to improve PNC to achieve the goal (OHB., 2015). Moreover, studies that have been conducted elsewhere in Ethiopia explicitly examined factors associated with PNC uptake in larger, urban settings of the country, not in rural areas such as Gida Ayana (Limenih et al., 2016; Workineh & Hailu, 2014; Wudineh et al., 2018). Risk factors associated with non-utilization of DHFs for PNC service in Ethiopia have not been well addressed, and the literature says little regarding the reasons women do not seek PNC from DHFs (CRDA, 2004; Kassa & Shawel, 2013).

The circumstances in rural western Ethiopia and the poor documentation of risk factors in non-utilization of PNC have created a gap in the country's ability to improve postnatal outcomes; this study was undertaken to fill this gap. The results from this study will help public health managers, practitioners, and policymakers develop interventions aimed at improving access to PNC services and thus may help reduce maternal morbidity and mortality in rural western Ethiopia.

Methods

Study setting and period

This study was conducted from November 2016 to January 2017 in Gida Ayana *Woreda*, rural western Ethiopia. Gida Ayana *Woreda* is located at 42 km north of Nekemte, the capital of Eastern Wollega Zone, and 440 km from Addis Ababa (Eastern Wollega Zone Finance and Economic Development Office [EWZFEDO]., 2015). The *woreda* has 28 administrative

kebeles. The total population of the *woreda* was estimated at 140,484 in 2013; of this number, 65,556 were females (CSA, 2013). According to the Eastern Wollega Zone Finance and Economic Development Office, 10,577 women of reproductive age (15-49 years) resided in Gida Ayana in 2015 (EWZFEDO, 2015).

Study design and population

A community-based cross-sectional study design was used. The research was conducted with randomly selected mothers who gave birth in the five years preceding the data collection period.

Sample and recruitment

A total sample size was determined using a single proportion formula employing a population estimate of 33.0%, 95% confidence interval (CI), a marginal error of 5%, and a design effect of 1.5 (CSA, 2014). Thus, the minimum adequate sample size was determined using the statistical estimation method (Kelsey et al., 1996). Since the source population was assumed to be less than 10,000, the sample size was corrected. By adding 5% for contingency, the final sample size determination was 459 women.

A two-stage sampling strategy was used to ensure representativeness of the sample. In the first stage of sampling, the four *kebeles* of Ayana, Angar, Ejere, and Lalistu were randomly selected using the lottery technique. In the second stage, households having women who had their last child during the five years prior to the study in the four selected *kebeles* were identified via health extension workers. Then, qualified women from each *kebele* were selected based on the total number of households in each selected *kebele* (proportionate to size) using a Microsoft Office Excel-generated random number. If a household had more than one eligible woman, the mother with the most recent birth was selected. The results reported in this paper are based on data from 454 women with the primary outcome of women's non-utilization of decentralized healthcare facilities for PNC service.

Data collection and quality control

Data were collected from mothers at their homes through an interviewer-guided structured survey questionnaire. The questionnaire elicited data regarding socioeconomic, cultural, and demographic factors; maternal information; and women's knowledge regarding available

health facility services. For data quality control, the questionnaire was translated into the local language, Afan Oromo, and back-translated into English by blind translators to check consistency. A pilot test was conducted outside the study *woreda* (in Guto Gida) with a sample size of 10% of the study population; modifications to the questionnaire were made on the basis of the pilot test results. Data were collected by eight experienced female health professionals recruited from the study community. They were trained for two days on the purpose and content of the survey prior to the actual study period. Data collection was supervised on a daily basis. Every day the completed questionnaires were cross-checked for quality and consistency. Confidentiality and privacy of every woman's information were ensured; no identifiers of the study participants were used.

Dependent variable

The outcome variable of this study was skilled PNC service utilization. The variable was coded y =1 if mothers reported they did not receive PNC from skilled health personnel (midwife, nurse, medical doctor, or health extension worker) at the health facility or elsewhere for their recent birth; otherwise, it was coded y = 0. The non-utilization of PNC category (y =1) was modeled.

Independent variables

In this study, the potential determinants that pose risks for women's non-utilization of DHFs for PNC services (see Table 5. 1) were as follows: rural administrative *kebele* in which DHF was located; postnatal maternal age (in years); postnatal maternal marital status; postnatal woman's literacy; postnatal woman's occupation; average monthly household income; woman's autonomy in making decisions about postnatal service; local community belief that postnatal visit is unnecessary; distance to postpartum service (in minutes); access to motorized transport services; availability/types of decentralized health facilities; number of children; ANC service; knowledge of complications during pregnancy, labor, and delivery; location of last childbirth; method of last child delivery; experience of postnatal complications; knowledge of at least one postnatal complication; knowledge of the recommended number of PNC visits; attending monthly women's meetings; knowledge of availability and provision of PNC at a local facility; health extension worker home visit within three days of delivery; woman's perception of treatment by healthcare providers; and infant illness.

Table 5. 1. Independent risk factors

Variable	Definition of variable	Type of variable
Kebele	The smallest administrative decentralization entity in Ethiopia in which decentralized health systems were located. This item was categorized into four nominal variables: Ayana, Ejere, Lalistu and Angar, the latter three being outer rural decentralization entities considered the exposure variables.	Nominal
Postnatal maternal age	A three-category variable: Less than 20 years old, 20-34 years, and 35 years or higher age groups with the latter two categories considered the exposed. It is generally recognized that older and experienced women are more likely to be non-utilizers of PNC than younger or less experienced women.	Nominal
Postnatal woman's marital status	Maternal marital status was dichotomized into Married and then Single; Divorced or Widowed were brought together in the exposure category.	Nominal
Postnatal woman's literacy	Literacy level was categorized as Literate (able to read and write) or Illiterate (unable to read and write); the latter was the exposure category.	Nominal
Postnatal woman's occupation	Maternal occupation was dichotomized into Non-Housewife activities (e.g., skilled employment, small business/service, farming) brought together in the reference category and Housewife as the exposure category.	Nominal
Mean monthly income	Total household monthly income earned was made into a two-category variable: 50 $USD or higher and Less than 50 $USD as the exposure category.	Nominal
Woman's autonomy of postnatal service decision	Defined as autonomy to make decisions independently and having freedom to go from home for PNC whenever she likes to. The assumption was made that women generally are looked after and follow decisions of the husband/family/elder women in their community. This item was responded to with Self or Others, which combined family members, relatives, neighbors, and traditional birth attendants, as the exposure category.	Nominal

Table 5. 1. (Continued)

Variable	Definition of variable	Type of variable
Local community belief that PNC visit is unnecessary	This categorical variable was measured by the mother's response to the question "Does the local community believe postnatal visits are unnecessary? Responses were dichotomized into No or Yes, with the latter as the exposure variable.	Nominal
Distance to postnatal services	Defined as walking time (in minutes) from home to the closest PNC center. This was made into a two-category variable: Less than 30 min or 30 min or higher, with the latter as the exposure category.	Nominal
Access to motorized transport services	Mothers were asked to label difficulty getting motorized transport service, including ambulance, from their home to nearest facility as Simple/Not simple, with the latter as the exposure categorical variable.	Nominal
Decentralized healthcare facilities visited	Type of decentralized healthcare facilities visited was a three-category variable: primary hospital, health center, and health post, with the latter two considered the exposure variables.	Nominal
Number of children	Defined as the number of children a woman gave birth to which. Classified into three categories: fewer than 2, 2-3, and 4 children or more; the latter two were the exposure variables.	Nominal
ANC service	Assessed from the report of mothers responding that they received ANC service or did not received ANC service, with the latter as the exposure variable	Nominal
Knowledge of complications during pregnancy, labor, and delivery	Self-reported knowledge of complications during pregnancy, labor, and childbirth (e.g., bleeding, fever, prolonged labor, foul vaginal discharge, convulsion, vision problem, head ache) was dichotomized into Yes/No**,** with the latter as the exposure variable. Woman generally do not visit if no problems arise.	Nominal
Location of last childbirth	Place of last childbirth was dichotomized into two categories: health facility or home delivery, with latter considered the exposure variable.	Nominal
Method of last child delivery	A three-category variable: caesarean-section, instruments, and normal vaginal birth, with the latter two as the exposure variables.	Nominal

Table 5. 1. (Continued)

Variable	Definition of variable	Type of variable
Experience of postnatal complications	Self-reported as a three-category variable: 3 or more complications, 2-3 complications, or did not experience any postnatal complications during last birth; the latter two were the exposure variable. The assumption was that women would not visit a health facility if they did not face any complications.	Nominal
Knowledge of at least one postnatal complication	Defined as knowledge of at least one complication that occurred to themselves; yes or no response, with the latter as the exposure category.	Nominal
Knowledge of the recommended number of PNC visits	Response was yes or no, with the latter as the exposure variable.	Nominal
Attending monthly mothers meeting	Response was yes or no, with the latter as the exposure variable.	Nominal
Knowledge of availability/provision of PNC	Response was yes or no, with the latter as the exposure variable.	Nominal
HEW home visit	Visit from an HEW during the first 3 days after delivery was reported as yes or no, with the latter as the exposure variable. HEWs perform home visits to postnatal women, lending support or urging them to seek postnatal services at a health facility if any problem arises.	Nominal
Woman's perception of treatment by healthcare providers	Mothers reported their perception of treatment as Good, Medium, or Not Good; the latter was the exposure category.	Nominal
Severe illness of infant	Assessed as a binary variable and dichotomized into Yes/No, with the latter considered the exposure variable. It is generally recognized that women visit health centers if their infants have any severe problem.	Nominal

Statistical analysis

All the questionnaires were checked manually, coded and entered into EpiData version 3.1, and exported to SPSS Version 24.0 (SPSS; IBM Corp; USA) for analysis. The data were cleaned to check for errors and missed values and any error identified was corrected.

Descriptive statistics were used to calculate the frequency distribution and proportions for categorical variables. Pearson's correlation was used to check multicollinearity among the categorical covariates (Pallant, 2007); the correlation was 0.5, which was less than 0.7. Therefore, there is no potential influential observation and no severe co-linearity among predictor variables. Hence, all variables were retained (Pallant, 2007; Woya et al., 2018).

The bivariate logistic regression model was applied to assess the different risk factors associated with women's non-utilization of DHFs for postnatal care services. The logistic regression model for a binary outcome variable (y = 1 or 0) is defined as follows:

$$\ln(\pi i) = \Pr(Yi = 1) = \beta 0 + \beta 1 xi, \quad \textbf{(1)}$$

where x is the single covariate of the model, βs are the model parameters, and πi is the probability of being not utilized (y = 1) for ith individual. For more than one covariate, the model is defined as follows:

$$\ln(\pi i) = \Pr(Yi = 1) = \beta 0 + \beta 1 x1i + \ldots + \beta k\, xki, \quad \textbf{(2)}$$

where k is the number of covariates and the remaining terms are the same as defined above. The odds ratio can be estimated by exp(βk). Variables with a p-value of < 0.2 were entered into the multivariable model (Bursac et al., 2008; Kirkwood & Sterne, 2003). A p-value of < 0.05 was considered the cutoff point for statistical significance. The degree of association between the dependent variable and the risk factors for non-utilization of DHFs for PNC was assessed using Crude Odds Ratios (COR) and adjusted Odds ratios (AOR) with 95% CI. We used before and after adjustment to ensure a reliable statistical estimate for a potential confounding variable (McNamee, 2003). The Hosmer-Lemeshow test was used to compare and rule out the goodness of fit of the final models (Hosmer & Lemeshow, 2000; Woya et al., 2018).

Ethical considerations

The study was approved by the Wollega University Research Ethics Review Board (WU99529-H1-3/2016), and a formal letter of permission to conduct the research was obtained from the Oromia Regional Health Bureau. All study participants were informed that they had the right to withdraw any time during the interview without giving any reason. Written consent

in the form of a signature or a thumbprint was obtained from all participants or their legal guardians.

Results

Postnatal women's socioeconomic, cultural, and demographic characteristics

A total of 459 mothers were contacted and 454 were included in the study, making the response rate 99.0%. Table 5.2 describes the background characteristics of the participants. The majority of the respondents (56.0%**)** were in the age range of 20-34 years; 84.0% were married. Almost half of the respondents belonged to the Oromo ethnic group and 57% were Christians. Almost half of the women were illiterate. Forty-four percent reported they were housewives or had no paid employment. Forty percent of the mothers reported monthly household income of about 1323 Ethiopian birr or less (equivalent to 49 $US or less) and 34.8% reported they were located 30 or more minutes away from the nearest local health facility. More than half of the mothers reported they considered postnatal visits unnecessary culturally, and 29.5% said their postnatal healthcare decisions were made by others, specifically their family members, relatives, or neighbors.

Table 5.2. Socioeconomic, cultural, and demographic backgrounds of participants (N = 454)

Variable	Frequency (n)	Percent (%)
Postnatal women's age in years		
19 or younger	127	28
20-34	255	56.2
35 or older	72	15.9
Postnatal women's marital status		
Married	381	83.9
Single/divorced/widowed	73	16.1
Postnatal women's ethnicity		
Oromo	222	48.9
Amhara	144	31.7
Tigre	88	19.4
Postnatal women's religion		
Christian	260	57.3
Moslem	194	42.7
Postnatal women's literacy		
Literate	230	50.7
Illiterate	224	49.3
Postnatal women's occupation		
[a]Non-housewife	256	56.4
Housewife	198	43.6
Mean monthly household income		
50 $US or more	273	60.1
Less than 50 $US	181	39.9
Distance to postnatal services		
Less than 30 minutes	296	65.2
30 minutes or more	158	34.8
Access to motorized transport services		
Simple	371	81.7
Not simple	83	18.3
Postnatal women's residence		
Urban	254	56
Rural	200	44.1
Local community believes postnatal visits are unnecessary		
No	46	54.2
Yes	208	45.8
Autonomy of postnatal service decision		
Self	320	70.5
[b]Others	134	29.5

[a]Non-housewife activities include skilled employment, small business/service, and farming. [b]Others include family members, relatives, neighbors, or traditional birth attendants. 1$US: United States Dollars with the exchange value of 27 Ethiopian Birr (Nov. 2016).

Reproductive history and knowledge of maternal health services

The data regarding participants' reproductive and obstetric history and knowledge about maternal health services use are given in Table 5. 3. Almost half (47.6%) of the participants had a first-birth-order child, 65.0% received ANC service at least once from skilled health personnel during the course of their pregnancy, and 56.6% delivered at a local health facility. Fifty-three percent of the women had good knowledge of the obstetric complications associated with pregnancy, delivery, and post-delivery; 48.0% reported they did not experience any postnatal complications; 56.0% had knowledge of at least one postnatal complication; 62.0% knew the standard number of PNC visits; and 68.7% reported they never attended a monthly pregnant-women's meeting in their *kebele.* About three-fourths of the respondents reported they knew of the availability/provision of PNC services at a local health facility. Two hundred sixty-four (58.0%) of the postnatal women reported they were not visited by HEWs during the first three days after delivery. Furthermore, look at Figure 5.1. below depicted PNC utilization status and distribution by study areas.

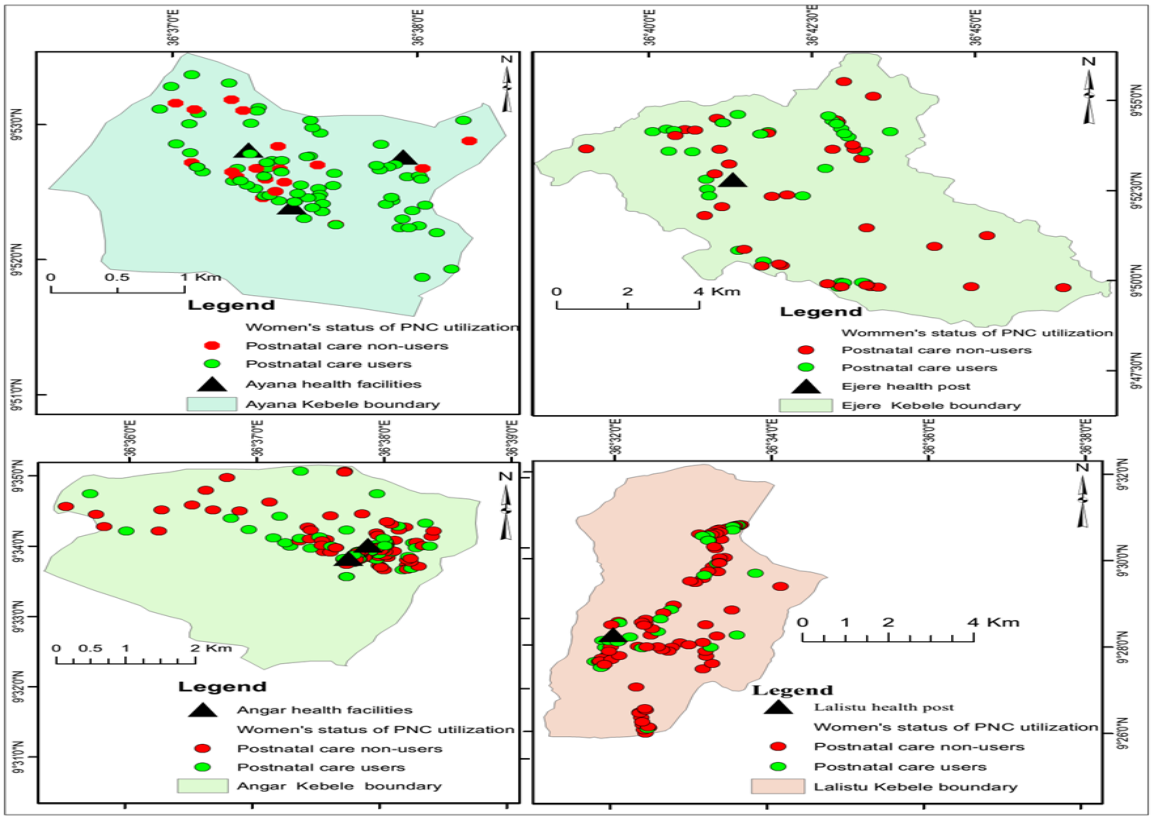

Figure 5.1 Postnatal care (PNC) utilization status and distribution by study sites.

Table 5. 3. Reproductive characteristics and knowledge of maternal healthcare services of participants (N = 454)

Variable	Frequency (n)	Percent (%)
Number of children born		
Fewer than 2	216	47.6
2-3	149	32.8
4 or more	89	19.6
ANC service		
Received	294	64.9
Not received	160	35.2
Location of last childbirth		
Health institution	257	56.6
Home	197	43.4
Knowledge of pregnancy, labor, and delivery complications		
Yes	241	53.1
No	213	46.2
Method of last child delivery		
Caesarean	39	8.6
Using instruments	61	13.4
Normal vaginal delivery	354	79.0
Experience of postnatal complications		
3 or more	101	22.3
1-2	134	29.5
No complications	219	48.2
Knowledge of at least one postnatal complication		
Yes	254	55.9
No	200	44.1
Knowledge of the recommended number of PNC visits		
Yes	280	61.7
No	174	38.3
Knowledge of the availability/provision of PNC		
Yes	335	73.8
No	119	26.2
Attended monthly women meetings		
Yes	142	31.3
No	312	68.7
HEWs home visit during the first 3 days after delivery		
Yes	190	41.9
No	264	58.2

Table 5.3. (Continued)

Variable	Frequency (*n*)	Percent (%)
Perception of treatment by healthcare providers		
Good	105	23.1
Medium	233	51.3
Not Good	116	25.6
Severe infant illness during postnatal period		
Yes	246	54.2
No	208	45.8

Service utilization by DHF type and *kebele*

The proportion of women who did not use any PNC services was 55.7%, and the proportion of those who had at least one PNC visit was 44.3%. Ninety percent of the women made fewer than four PNC visits; only 10.0% made the recommended number of four PNC visits during the postnatal period (Table 5. 4). Among the total PNC attendants, 9.5% received postnatal services from a hospital/clinic, 55.0% from a health center, and 35.3% from a health post. Smaller proportions of women in Ejere (17%) and Angar (16%) *kebeles* utilized postnatal services at health facilities than in Ayana (37%) and Lalistu (29.5%) *kebeles*.

Table 5. 4. Participants' utilization of postnatal services by *kebele* and number of visits (*N* = 454).

Variable	Frequency (*n*)	Percentage (%)
PNC use by *kebele* with a decentralized primary healthcare facility		
Ayana	75	37.3
Ejere	34	16.9
Angar	32	15.9
Lalistu	60	29.9
Number of visits for postnatal care		
1	119	59.2
2	38	18.9
3	24	11.9
4 or more	20	10.0
No visit	253	55.7

Among the 201 PNC attendants, 9.5% received postnatal services from a hospital/clinic, 55.0% from a health center, and 35.3% from a health post (Figure 5. 2).

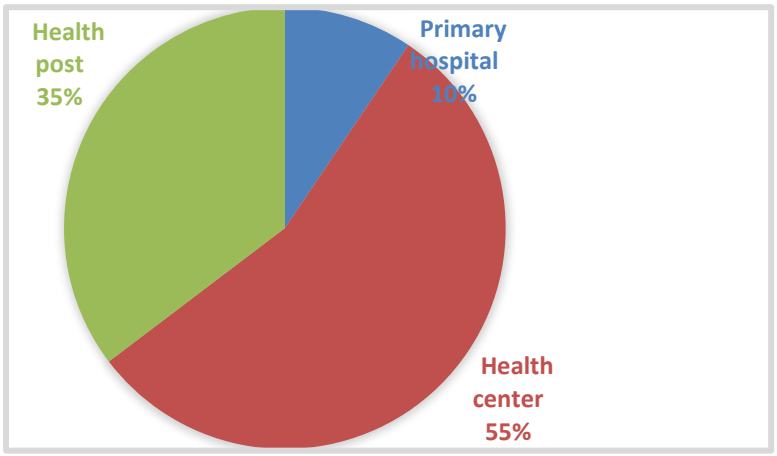

Figure.5. 2. Distribution of PNC utilization by decentralized maternal health facilities visited (*n* = 201).

Risk factors for women's non-utilization of DHFs for PNC

Table 5. 5 and Table 5.6 shows the unadjusted and adjusted odds ratios for the risk factors associated with non-utilization of DHFs for PNC visits. The adjusted logistic regression analysis showed that eight risk factors were significantly associated with non-utilization of DHFs for PNC services: location of DHFs in outer rural *kebeles*, older age, no ANC visit, no experience of postnatal complications, no knowledge of postnatal complications, no knowledge of availability and provision of postnatal care at a local facility, lack of knowledge of recommended number of PNC visits, and no home visits by HEWs to lend support to postnatal women. The odds of not utilizing postnatal care were significantly lower in Ayana than in the other three *kebeles*. The postnatal women who lived in outer rural areas in which DHFs were located, specifically Angar (AOR = 12.4; 95% CI: 5.1, 30.2), Laistu (AOR = 12.0; 95% CI: 4.9, 28.9), and Ejere (AOR = 7.8; 95% CI: 3.2, 18.9), were more likely not to utilize PNC services compared to women in Ayana *Kebele*. Among the other socio-demographic determinant risk factors, maternal age was significantly associated with non-utilization of PNC. Women age 20–34 years (AOR = 2.1; 95% CI: 1.1, 3.6) and 35 years or older (AOR = 3.4; 95% CI: 1.4, 8.3) tended not to utilize PNC visits during their postnatal course compared

to younger women (age 15-19 years). Non-utilization of PNC services was significantly higher among women who did not receive antenatal care during this pregnancy (AOR = 2.0; 95% CI: 1.1, 3.7). See Table 5.5.

Table 5. 5. Socio-economic and demographic risk factors for women's non-utilization of DHFs for PNC services in Gida Ayana *Woreda*, rural western Ethiopia (*N* = 454).

Variable	Postnatal care service		UOR(95% CI)	AOR(95% CI)[a]
	Non-users *n*(%)	Users *n*(%)		
Kebele in which decentralized health facilities were located				
Ayana	19(20.2)	75(79.8)	1	
Ejere	43(55.8)	34(44.2)	4.9(2.5-9.8)	7.8(3.2-18.9)**
Lalistu	91(74.0)	32(26.0)	11.2(5.8-21.3)	12.0(4.9-28.9)**
Angar	100(62.5)	60(37.5)	6.5(3.6-11.9)	12.4(5.1-30.2)**
Postnatal women's age (in years)				
Less than 20	56(44.1)	71(55.9)	1	1
20-34	149(58.4)	106(41.6)	1.7(1.1-2.7)*	2.1 (1.1-3.6)*
35 or higher	48(66.7)	24(33.3)	2.5(1.3-4.6)*	3.4 (1.4-8.3)*
Postnatal maternal marital status				
Married	214(56.2)	167(43.8)	1	
Single/divorced/widowed	39(53.4)	34(46.6)	0.8(0.5-1.4)	
Postnatal women's literacy				
Literate	111(48.3)	119(51.7)	1	1
Illiterate	142(63.4)	82(36.6)	1.8(1.2-2.7)*	1.3(0.7-2.2)
Postnatal women's occupation				
[b]Non-housewife	130(50.8)	126(49.2)	1	1
Housewife	123(62.1)	75(37.9)	1.5(1.1-2.3)*	1.0(0.6-1.7)
Mean monthly household income				
50 $US or more	141(141)	132(48.4)	1	1
Less than 50 $US	112(61.9)	69(38.1)	1.5(1.1-2.2)*	1.4(0.8-2.3)
Autonomy of postnatal service decision				
Self	174(54.4)	146(45.6)	1	1
[c]Others	79(59.0)	55(41.0)	1.2(0.8-1.8)***	1.1(0.6-1.9)

Table 5.5. (Continued)

Variable	Postnatal care service		UOR(95% CI)	AOR(95% CI)[a]
	Non-users *n*(%)	Users *n*(%)		
Local community's cultural beliefs that PNC is unnecessary				
No	152(61.8)	94(38.2)	1	1
Yes	101(48.6)	107(51.4)	0.5(0.4-0.8)	0.8(0.4-1.3)
Distance to postnatal services				
Less than 30 minutes	154(52.0)	142(48.0)	1	1
30 or more minutes	99(62.7)	59(37.3)	1.5(1.1-2.2)*****	1.2(0.6-2.2)
Access to motorized transport services				
Simple	210(56.6)	161(43.4)	1	
Not simple	43(51.8)	40(48.2)	1.2(0.7-1.9)	
Availability/type of decentralized healthcare facilities visited				
Primary hospital	17(47.2)	19(52.8)	1	
Health center	96(46.4)	111(53.6)	0.5(0.2-1.1)	
Health post	140(66.4)	71(33.6)	0.4(0.2-1.0)	

[a]*Adjusted risk of the following independent variables: administrative kebeles in which decentralized facilities were located, postnatal woman's age at her last birthday (years), postnatal woman's literacy, postnatal woman's occupation, mean monthly household income ($USD), autonomy of postnatal service decision, and local community's cultural beliefs, distance to postnatal service (minutes)*

[b]*Non-housewife activities include skilled employment, small business/service, and farming.* [c]*Others includes family members, relatives, neighbors, or traditional birth attendants. $US: United States Dollars with the exchange value of 27 Ethiopian Birr (Nov. 2016). 1: indicates the reference variable. *p < 0.05; **p < 0.001; ***p ≤ 0.3. UOR: unadjusted odds ratio. AOR: adjusted odds ratio.*

Among the reproductive history and knowledge of maternal service-related determinant risk factors, women who did not experience any postnatal complications (AOR = 3.3, 95% CI: 1.7-6.4) were more likely to not utilize PNC services than their counterparts who had experienced at least one complication (Table 5.6). No knowledge of postnatal complications (AOR = 2.0; 95% CI:1.2, 3.3**)**, no knowledge of the recommended number of PNC visits

(AOR = 2.7; 95% CI: 1.5-4.7**)**, no knowledge of the availability/provision of PNC services in a local facility (AOR = 3.2, 95% CI: 1.7-5.9), and no home visits by an HEW (AOR = 2.5; 95% CI:1.5-4.2) were also significantly associated with non-utilization of PNC

Table 5.6. Reproductive history and knowledge of maternal health services related risk factors for non-utilization of DHFs for PNC, rural western Ethiopia (*N* = 454).

Variable	Postnatal care service		UOR(95% CI)	AOR(95% CI)[a]
	Non-users *n*(%)	Users *n*(%)		
Number of children woman had				
Fewer than 2	128(59.3)	88(40.7)	1	1
2-3	71(47.7)	78(52.3)	0.6(0.4-0.9)	0.7(0.3-1.2)
4 or more	54(60.7)	35(39.3)	1.0(0.6-1.7)	0.8(0.3-1.6)
ANC service				
Received	143(48.6)	151(51.4)	1	1
Not received	110(68.8)	50(31.2)	2.3(1.5-3.4)**	2.0(1.1-3.7)*
Knowledge of complications during pregnancy, labor, and delivery				
Yes	133(55.2)	108(44.8)	1	
No	120(56.3)	93(43.7)	1.0(0.7-1.5)	
Location of last childbirth				
Health institution	134(52.1)	123(47.9)	1	1
Home	119(60.4)	78(39.6)	1.4(0.9-2.0)***	0.5(0.2-1.9)
Method of last child delivery				
Caesarean-section	15(38.5)	24(61.5)	1	1
Instruments	28(45.9)	33(54.1)	1.3(0.5-3.0)	1.9(0.6-6.2)
Normal vaginal birth	210(59.3)	144(40.7)	2.3(1.1-4.6)*	2.6(0.9-7.6)
Experience of postnatal complications				
3 or more complications	53(52.5)	48(47.5)	1	1
1-2 complications	50(37.3)	84(62.7)	0.5(0.3-0.9)*	0.7(0.4-1.5)
No complications	150(68.5)	69(31.5)	1.9(1.2-3.1)*	3.3(1.7-6.4)**
Knowledge of at least one postnatal complication				
Yes	121(47.6)	133(52.4)	1	1
No	132(66.0)	68(34.0)	2.1(1.4-3.1)**	2.0(1.2-3.3)*

Table 5.5. (Continued)

Variable	Postnatal care service		UOR(95% CI)	AOR(95% CI)[a]
	Non-users *n*(%)	Users *n*(%)		
Knowledge of the recommended number of PNC visits				
Yes	133(47.5)	147(52.5)	1	1
No	120(69.0)	54((31.0)	2.4(1.6-3.6)**	2.7(1.5-4.7)**
Attending monthly women meeting				
Yes	72(50.7)	70(49.3)	1	1
No	181(58.0)	131(42.0)	1.3(0.9-2.0)***	0.9(0.5-1.5)
Knowledge of the availability/provision of PNC services				
Yes	157(46.9)	178(53.1)	1	1
No	96(80.7)	23(19.3)	4.7(2.8-7.8)**	3.2(1.7-5.9)**
HEW home visit during the first 3 days after delivery				
Yes	82(43.2)	108(56.8)	1	1
No	171(64.8)	93(35.2)	2.4(1.6-3.5)**	2.5(1.5-4.2)**
Women's perception of treatment by healthcare providers				
Good	65(61.9)	40(38.1)	1	
Medium	122(52.4)	111(47.6)	0.6(0.4-1.1)	
Not Good	66(56.9)	50(43.1)	0.8(0.4-1.3)	
Severe illness of infant during postnatal period				
Yes	138(56.1)	108(43.9)	1	
No	115(55.3)	93(44.7)	0.9(0.6-1.4)	

[a]*Adjusted risk of the following independent variables: number of children, ANC service, attending monthly mothers' meeting, knowledge of the availability/provision of postnatal service, HEW home visit, knowledge of at least one postnatal complication, knowledge of recommended number of postnatal visits, experience of postnatal complications, location of last childbirth, method of last child delivery. 1: indicates the reference variable. *p < 0.05; **p < 0.001; ***p ≤ 0.3. UOR: unadjusted odds ratio. AOR: adjusted odds ratio.*

Goodness of fit of the model

The -2log likelihood statistic was 623.409. The statistic for the model that had only an intercept was -2LLo = 426.175. The inclusion of the parameters reduced the -2log likelihood statistic

by 218.258, which is reflected in the model chi-square for the Omnibus Test and the *P*-value less than 0.05. Hence, an Omnibus Test showed the fit is adequate. This means that at least one of the predictors is significantly related to the response variable. Pseudo R-square statistics, the Cox & Snell R-Square and the Nagelkerke R-Square, ranges from 38.3% to 51.1%, indicating the explanatory variable was useful in predicting women's non-utilization of PNC in the study area. The Hosmer-Lemeshow goodness of fit test statistic was not significant in this study, $p = 0.806 > 0.05$, suggesting that the model fits the data well. Multicollinearity in the final model was detected by examining the standard error for the coefficients. Standard errors larger than 2.0 indicate problems of multicollinearity among the independent variables (Shrestha & Shrestha, 2011). In this study the values were less than 2.0, demonstrating the absence of multicollinearity in the developed model.

Discussion

This study investigated women's non-utilization of DHFs for PNC services in a rural area in western Ethiopia. In Gida Ayana *Woreda*, the main factors that pose risks for non-utilization of PNC services at the micro level were the remote rural administrative *kebeles* in which decentralized health facilities were located, older age, absence of visits to ANC service, absence of postnatal complications, lack of knowledge of postnatal complications, lack of knowledge of the standard number of PNC visits recommended, lack of knowledge of the availability and provision of PNC services at local health facilities, and failure of HEWs to make home visits within three days of delivery. In the study area, 55.7% of the study population did not receive postnatal care services.

Recent studies in other countries found variations in the geographical location of the homes of mothers to be a potential and actual risk factor in non-utilization of maternal health services (Somefun & Ibisomi, 2016; Titaley et al., 2009) a finding corroborated by our study. Our study also demonstrated that significant variations in the utilization of postnatal care services across *kebeles* in which decentralized primary healthcare facilities were located persisted after adjusting for covariates. Rural study populations in the outer *kebeles*, namely Ejere, Lalistu, and Angar administrative areas, remained highly disadvantaged with higher odds of not utilizing PNC services compared to women in Ayana *Kebele*. Several studies suggested that

non-utilization of PNC services, especially among rural women, may be attributed to the lack of these services or difficulty accessing them due to poor infrastructure in some rural locations (Somefun & Ibisomi, 2016; USAID, 2007).

Another significant finding concerns the age of study participants in rural western Ethiopia. Our study revealed that non-utilization of maternal PNC services was 2.1 and 3.4 times higher among women aged 20-34 years and 35 years or older, respectively, compared with postnatal women aged 19 years or younger. Studies in rural Indonesia, rural Nigeria, and rural South Sudan reported that age affects maternal healthcare utilization behavior of reproductive-age women (Somefun & Ibisomi, 2016; Mugo et al., 2015;Titaley et al., 2009). A study conducted elsewere noted that age of postnatal mothers at childbirth significantly affected non-utilization of postnatal care services (Somefun & Ibisomi, 2016). Several studies in rural areas of low- and middle-income countries reported that older and experienced postnatal mothers used post-delivery services less frequently than mothers who were younger at the birth of their children (Bhutta et al., 2014; Sines et al., 2007; Titaley et al., 2009; Titaley et al., 2010).

In rural western Ethiopia, non-utilization of PNC services was significantly associated with non-utilization of ANC clinics during the pregnancy of the mother's last birth. Our study found the odds of non-utilization of PNC services were higher among women who had never visited health facilities for ANC services than among those who had, corroborating the findings of other studies (Gu et al., 2018; Harvey et al., 2004; Kikuchi et al., 2018; Limenih et al., 2016; Somefun & Ibisomi, 2016). Similarly, recent demographic health surveys across African countries indicate that rural postnatal residents who were ANC non-users had higher odds of not receiving postnatal services (Djellouli et al., 2017).

Furthermore, our study revealed that women who had experienced postnatal complications after their last birth were much more likely to visit a reproductive health facility for PNC services than those who had not encountered any complications. Several other studies reported that non-utilization of PNC services was significantly higher among mothers who did not face any postnatal complications (Abebo & Tesfaye, 2018; Angore et al., 2018; Somefun & Ibisomi, 2016). Studies carried out elsewhere found that absence of postnatal complications cannot protect against either actual or potential postnatal morbidity and maternal deaths (Abebo & Tesfaye, 2018; Angore et al., 2018; Gu et al., 2018; Limenih et al., 2016).

In rural western Ethiopia, non-utilization of postnatal care services was consistently higher among mothers who had no knowledge of at least one postnatal-related complication than among their counterparts who knew about post-delivery complications. Mothers who were not aware of at least one maternal complication that can occur during the postnatal period were 2.0 times less likely to use postnatal care services than mothers who were aware of the potential for complications. This finding is consistent with those of other studies (Khanal et al., 2014; Mohan et al., 2015; Mugo et al., 2015; Sacks, 2016; USAID, 2007, USAID, 2015).

We also found non-utilization of PNC services higher among women who reportedly were not aware of the recommended number of PNC visits. Mothers who did not know the recommended number of PNC visits were 2.7 times less likely to utilize PNC services than mothers who knew this information. This may be explained by the role of knowledge in increasing awareness of basic health services and health risks, leading to improved health-seeking behavior. This finding is in agreement with results from various developing countries (Bhutta et al, 2014; Gu et al., 2018; Harvey et al., 2004; Mann, 2013; Mohan et al., 2015) and from other studies in rural Ethiopia (Abebo & Tesfaye, 2018; Amare et al., 2018; Angore et al., 2018).

The multivariable logistic regression analysis showed that lack of awareness of the availability/provision of PNC services in a local facility was a major factor in the women's non-utilization of postnatal care service. Woman who had no information about their local health facilities missed the opportunity to be informed about types, benefits, and availability of PNC services. The provision of services alone, without the communication of that provision, especially among rural residents, did not improve PNC services-seeking behavior of the study participants. This result corroborates the results of several other similar studies (Abebo & Tesfaye, 2018; Angore et al., 2018; Kikuchi et al., 2018).

The absence of home visits and counseling in remote rural *kebeles* to urge mothers to obtain PNC from decentralized health facilities was another significant factor in non-utilization of these services. The odds of not receiving postnatal care were 2.5 times higher among women who were not visited by a health extension worker than among women who were visited within three days of delivery. This result is consistent with research in three rural districts of Indonesia that found that the lack of visits by facility providers led to rural women's non-utilization of

postnatal care (Titaley et al., 2010). The odds of receiving post-delivery care in India were 1.4 times higher among women visited by skilled professionals than among mothers who were not visited (Singh et al., 2012) low knowledge and inadequate visits or counseling sessions at home for postnatal mothers were risk factors in non-utilization of PNC services. Similar studies in rural India and Indonesia found home visits by health personnel to be essential not only for utilization of maternal healthcare services among rural populations (Singh et al., 2012; Titaley et al., 2010) but also for quality postnatal care content (Alexandrou et al., 2018; Amare et al., 2018; Sacks, 2016).

The cross-sectional design of this study measured exposure and outcome simultaneously. The determination of causal relationships between the proposed predictors and the outcomes of interest would have been strengthened with longitudinal information. Moreover, the long recall period may have introduced information bias. The confidence intervals were, however, too wide to consider administrative decentralization entity in particular as an important predictor of non-utilization of DHFs for PNC in this case. Hence, a larger sample size may prove helpful in subsequent studies. Despite its limitations, this study sheds light on overlooked risk factors associated with non-utilization of a decentralized healthcare service system for postnatal care.

Conclusion

This study demonstrates that the utilization of PNC in Gida Ayana *Woreda* is still low. The identified risk factors for non-utilization need to be considered by health planners and administrators in expanding the maternal healthcare program in Gida Ayana and in other *woredas* in western Ethiopia. Improvements must include the strengthening of PNC and ANC services, especially in outlying *kebeles*, to bolster their referral capacity and ensure HEWs provide women with adequate counseling during home visits after delivery about the need for and the availability of postnatal care. Further spatial and temporal studies are required to examine distance and time barriers to ANC and PNC accessibility and utilization at the household level.

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References

Abebo T. A., & Tesfaye, D. J. 2018. Postnatal care utilization and associated factors among women of reproductive age group in Halaba Kulito town, southern Ethiopia. *Arch Public Health, 79*(9):1-17.

Alexandrou, F., Sakellari, E., Kourakos, M., & Sapountzi, K. D. 2018. Health visitors' perceptions on their role to assess and manage postpartum depression cases in the community. *Health Social Care Community*, 1–6.

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A., Gemmill, A., … Say, L. 2016. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *Lancet*, (*387):*462-74.

Amare, Y., Scheelbeek, P., Schellenberg, J., Berhanu, D., & Hill, Z. 2018. Early postnatal home visits: A qualitative study of barriers and facilitators to achieving high coverage. *BMC Public Health, 18*(1074).

Angore, B. N., Tufa, E. G., & Bisetegen, F. S. 2018. Determinants of postnatal care utilization in urban community among women in Debre Birhan town, northern Shewa, Ethiopia. *Journal of Health, Population & Nutrition*, *37*(10).

Bhutta, Z. A., Das, J. K., Bahl, R., Lawn, J. E., Salam, R. A., & Paul, V. K. 2014. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet*.

Bursac, Z., Gauss, C.H., Williams, D. K., & Hosmer, D. W. 2008. Purposeful selection of variables in logistic regression. *Source Code Biology Medicine., 3*(17).

CSA [Central Statistical Agency] of Ethiopia. 2013. *Population projection of Ethiopia for all regions at woreda level from 2014-2017. Addis Ababa: CSA, Ethiopia*.

CSA [Central Statistical Agency] of Ethiopia. 2014. *Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa: CSA, Ethiopia.*

CSA [Central Statistical Agency] & ICF International. 2016. *Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF*.

CRDA [Christian Relief & Development Association]. 2004. *The participation of NGOs/CSOs in the health sector development program of Ethiopia*. Addis Ababa: CARD, Ethiopia.

Dhakal, S., Chapman, G. N., Simkhada, P. P., Van, E. R., Stephens, T. J., & Raja, A. E. 2007. Utilization of postnatal care among rural women in Nepal. *BMC Pregnancy & Childbirth.*, *7*(19).

Djellouli, N., Mann, S., Nambiar, B., Meireles, P., Miranda, D., Barros, H., … Colbourn, T. 2017. Improving postpartum care delivery and uptake by implementing context-specific interventions in four countries in Africa: A realist evaluation of the missed opportunities in maternal and infant health project. *BMJ Global Health,* (*2)*.

Durg, U., Charantimath, U., Katageri, G., Karadiguddi, C., Sawchuck, D., Qureshi, R., … Derman, R. 2016. Utilization of maternal health care services and their determinants in Karnataka state, India. *Reproductive Health*, *13*(Suppl 1).

EWZFEDO [Eastern Wollega Zone Finance and Economic Development Office]. 2015. *Physical and socio economic profile of Gidda Ayana Woreda*. Nekemte: Ethiopia.

FMoH [Federal Ministry of Health]. 2015. *Federal Ministry of Health of Ethiopia, Partnership for Paternal, Newborn and Child Health, WHO, World Bank, Alliance for Health Policy and Systems Research and participants in the Ethiopia multistakeholder policy review. Addis Ababa: FMoH, Ethiopia.*

FMoH [Federal Ministry of Health]. 2006. *Postnatal care: Blended module for the health extension programme*. *Addis Ababa: FMoH, Ethiopia.*

FMoH [Federal Ministry of Health] of Ethiopia. 2010. *Health Sector Development Program IV. 2010/2011-2014/2015. Addis Ababa: Federal Ministry of Health [FMoH] ,Ethiopia*.

[FMoH] Federal Ministry of Health of Ethiopian. 2015. *Health Sector Transformation Plan. 2015/16-2019/20.* Vol. 20. *Addis Ababa: Federal Ministry of Health [FMoH], Ethiopia.*

Gu, H., You, H., Yan, Z., Yang, N., Kou, Y., Sun, J., … Zhang, N. 2018. Determinants of the utilization of postpartum family visits: Evidence from rural areas of eastern China. *PLoS ONE, 13*(3), 1-12.

Haile-Mariam, D., & Kloos, H. 2005. Modern heealth services. In: Berhane, Y., Haile Mariam., D., & Kloos, H. Eds., *Epidemiology and ecology of health and disease in Ethiopia*. pp. 13-28. Addis Ababa: Shama Books.

Haile, T., Abera, D., & Andualem, Y. 2017. An assessment of decentralized public health service delivery: the case of Afar National Regional State. *International Journal of Research in Management, Science & Technology*, *13*(7), 29-45.

Harvey, S. A., Ayabaca, P., Bucagu, M., Djibrina, S., Edson, W. N., Gbangbade, S., … Burkhalter, B. R. 2004. Skilled birth attendant competence: An initial assessment in four countries, and implications for the safe motherhood movement. *International Journal of Gynecology & Obstetrics*, *87*, 203-210.

Hordofa, M. A., Almaw, S. S., Berhanu, M. G., & Lemiso, H. B. 2015. *Postnatal care service utilization and associated factors among women in Dembecha District , northwest Ethiopia*. *3*(5), 686-692.

Hosmer, D., & Lemeshow. S. 2000. *Applied logistic regression*. 2nd ed. New York: John Wiley & Sons, Inc.

Kassa, A., & Shawel, Y. 2013. *Integrating all stakeholders: Health service governance in Addis Ababa. In: Mihyo, P., & Chanie, P. Eds., Thirty years of public sector reforms in Africa: Selected country experiences. Kampala: Fountain.*

Kassebaum, J. N., Steiner, C., Murray, C., Lopez, A., & Lozano, R. 2016. Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease study. *Lancet*, 388:1775-812

Kelsey, J., Whittemore, A., Evans, A., & Thompson, W. 1996. *Methods of sampling and estimation of sample size. Methods in observational epidemiology.* New York: Oxford University Press.

Khanal, V., Adhikari, M., Karkee, R., & Gavidia, T. 2014. Factors associated with the

utilisation of postnatal care services among the mothers of Nepal: Analysis of Nepal Demographic and Health Survey 2011. *BMC Women's Health, 14*(1), 1-13.

Kikuchi, K., Yasuoka, J., Nanishi, K., Ahmed, A., Nohara, Y., Nishikitani, M.,… Yokota, F. 2018. Postnatal care could be the key to improving the continuum of care in maternal and child health in Ratanakiri, Cambodia. *PLoS One*, 13(*5)*.

Kirkwood, B. R., & Sterne., J. A. 2003. Medical statistics: Chapter 29: Regression modelling. In: Kirkwood, B. R., Sterne, J. A. C, Eds. In *Essential medical statistics. 2nd ed. Hoboken: Blackwell Science*.

Kumie, A., & Kloos, H. (2005). Occupational health and industrial pollution. In: *The epidemiology and ecology of health and disease in Ethiopia*. Berhane, Y., Haile Mariam D and Kloos, H., Eds., pp. 171-195, Addis Ababa: Shama Books.

Kunst, A.E., & Houweling, T. 2001. *A global picture of poor-rich differences in the utilization of delivery care in safe motherhood strategies. A review of the evidence: ITG Press, Belgium,(17): 297-315.*

Limenih, M. A., Endale, Z. M., & Dachew, B. A. 2016. Postnatal care service utilization and associated factors among women who gave birth in the last 12 months prior to the study in Debre Markos town, northwestern Ethiopia: A community-based cross-sectional study. *International Journal of Reproductive Medicine*.

Mann, S. 2013. *Cross-country analysis of maternal, newborn and child health policies in Burkina Faso, Kenya, Malawi and Mozambique. London: University College London*.

McNamee., R. 2003. Confounding and confounders. *Occupation & Environment Medicine*, *60*(3), 222-234.

Mohan, D., Gupta, S., LeFevre, A., Bazant, E., Killewo, J., & Baqui, H. A. 2015. Determinants of postnatal care use at health facilities in rural Tanzania: Multilevel analysis of a household survey. *BMC Pregnancy & Childbirth*, *15*(282).

Mugo, N. S., Dibley, M. J., & Agho, K. E. 2015. Prevalence and risk factors for non-use of antenatal care visits: Analysis of the 2010 south Sudan household survey. *BMC Pregnancy & Childbirth*, *15*(68):1-21.

OHB [Oromia Health Bureau]. 2015. *Gida Ayana Woreda based health sector plan performance evaluation report, 2015. Finfinne [Addis Ababa]: Oromia Health Bureau. Ethiopia*.

Pallant, J. n.d. *Survival manual a step by step guide to data analysis using SPSS for Windows*.

Sacks, E., Langlois, É.V. 2016. Postnatal care: Increasing coverage, equity, and quality. *Lancet Global Health*, (*4*).

Sines, B. E., Syed, U., Wall, S., & Worley, H. 2007. Postnatal care: A critical opportunity to save mothers and newborns. *Population Reference Bureau*, 1-8.

Singh, P. K., Rai, R. K., Alagarajan, M., & Singh, L. 2012. Determinants of maternity care services utilization among married adolescents in rural India. *PLoS One*, (*7*).

Somefun, O. D., & Ibisomi, L. 2016. Determinants of postnatal care non-utilization among women in Nigeria. *BMC Research Notes*, *9*(21), 1-11.

Tesfaye, S., Barry, D., Gobezayehu, G. A., Frew, H. A., Stover, E. K., &Tessema, H. 2014. Improving coverage of postnatal care in rural Ethiopia using a community-based, collaborative quality improvement approach. *Journal of Midwifery & Women's Health*,

59(55): 55-64.

Titaley, C. R., Dibley, M. J., & Roberts, C. L. 2009. Factors associated with non-utilisation of postnatal care services in Indonesia. *Journal of Epidemiology & Community Health*, *63*(10): 827-831.

Titaley, C. R., Hunter, C. L., Heywood, P., & Dibley, M. J. 2010. Why don't some women attend antenatal and postnatal care services?: A qualitative study of community members' perspectives in Garut, Sukabumi and Ciamis districts of west Java province, Indonesia. *Pregnancy & Childbirth*, *10*(61):1-12.

USAID [United States Agency for International Development]. 2007. *Reproductive, maternal and child services in health Networks: Baseline assessment of reproductive, maternal and child health services in project NOVA supported networks*.

USAID [United States Agency for International Development]. 2012. *Cultural barriers to seeking maternal health care in Ethiopia: A review of the literature*. Washington D. C: USAID; Addis Ababa, Ethiopia.

USAID [United States Agency for International Development]. 2015. *Ending preventable maternal mortality: USAID maternal health vision for action evidence for strategic approaches*. Washington DC: USAID; Addis Ababa, Ethiopia.

Wamai, R. G. 2009. Reviewing Ethiopia's health system. *International Medical Community Reviewing*, *52*(4), 279-286.

Workineh, Y. G., & Hailu, D. A. 2014. Factors affecting utilization of postnatal care service in Jabitena district, Amhara region, Ethiopia. *Science Journal of Public Health*, *2*(3), 169-176.

WHO [World Health Organization].1998. *WHO safe motherhood: Postpartum care of the mother and newborn a practical guide. WHO: Geneva*.

WHO [World Health Organization]. 2013. *WHO recommendations on postnatal care of the mother and newborn*. *WHO: Geneva*.

Woya, A. A., Tekile, A. K., & Mitiku, A. A. 2018. Women's empowerment on contraceptive use among married women in Amhara Region, Ethiopia. *Journal of Health & Environmental Sciences*, *5*(1).

Wudineh, K. G., Nigusie, A. A., Gesese, S. S., & Tesu, A. A. 2018. Postnatal care service utilization and associated factors among women who gave birth in Debretabour town , northwest Ethiopia: A community- based cross-sectional study. *BMC Pregnancy & Childbirth*, *18*(508), 1-9.

Chapter 6. _____

Spatial accessibility of primary healthcare facilities in Gida Ayana *Woreda*, rural western Ethiopia: GIS Based Modeling

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Chapter 6. Spatial accessibility of primary healthcare facilities in Gida Ayana *Woreda*, rural western Ethiopia: GIS Based Modeling

Abstract

Background: Access to healthcare services has an essential role in promoting health coverage and quality of life. Knowing where distribution of health facilities and how much of the population is covered by the existing healthcare network is important information that can be determined with Geographical Information Systems (GIS) and Quantum Geographical Information Systems (QGIS) tools and used in effective healthcare planning. The aim of this chapter is to measure the spatial accessibility (SA) of households to existing DHFs, and to estimate the number of persons served by the health network in selected *kebeles* in Gida Ayana *Woreda.*

Methods: The study population was 459 households in two urban and two rural *kebeles* were randomly selected from the 28 *kebeles* in Gida Ayana *Woreda* and studied for accessibility to health care service utilization. All seven existing primary health facilities located in these randomly selected four *kebeles* were purposively selected in this study. All household samples and health facilities were geopositioned to record the x-y coordinates using the Garmin® H72 Global Positioning System (GPS) handheld device. All footpaths were systematically digitized. The shortest path identification was done using Network analysis extension in the ArcGIS software Version 10.3. The walking time on footpaths to nearest health facility was measured using Tobler's Hiking Function plugin of the Quantum Geographic Information System (QGIS) software Version 3.6. A 12.5 m resolution Digital Elevation Model (DEM) dataset was also downloaded to obtain slope information in the travel time calculation. The Euclidian distance was measured using the Near function of the ArcGIS software.

Results: The findings from this study highlight accessibility problems in the walking scenario, in which 44.0 % of households in rural areas were considered to be underserved (> 60 minutes). All households in Ayana and Angar towns, by contrast, had greatest coverage of primary health care centers. Furthermore, the mean walking time to the closest DHFs in rural areas was 62.4 minutes with average Euclidian and footpath distances of 3183.45m, and 4294.1m,

respectively. For the urban households, the mean walking time was 11.44 minutes, and the footpath length and Euclidian distances were 835.4 m and 597.2m, respectively.

Conclusions: This study determined travel distance and time from the residences of maternal women to the nearest health facilities in in four *kebeles* in Gida Ayana *Woreda*. The majority of these women are living in the more rural areas in the walking scenario. The mapped outputs may have policy implications and can be used for future decision-making processes and analyses. Policies and programs that improve access in the more remote areas through, for example, further extending decentralization of health services through the construction of additional primary care facilities or reducing travel times through increased access to motorized transport, may result in substantial increases in the coverage rates of healthcare services.

Keywords: Spatial accessibility, decentralization, service area, Ayana, geographic information system, Ethiopia

Introduction

WHO defines universal access regardless of where the people live or work (WHO, 1978) towards the goal of health for all (WHO, 1981). Equally, universal coverage (UN, 2012) is a pillar issue of sustainable development and global security. Therefore, public health goods should be equally available and accessible (Campbell et al., 2013). Several studies in LMICs, including Ethiopia, identified the strong relationship between distance to health facilities, service utilization and mortality and morbidity outcomes (Karra et al., 2016; Nesbitt et al., 2014). It has also been investigated that in public health service delivery of LMIC countries, there is a direct relationship between the distance households travel to get service and the reduction of illness and suffering (Nesbitt et al., 2014; Danjuma, 2015; Karra et al., 2016). Patients incline to use the existing facilities more if they are located closer to them than otherwise (Levesque & Harris, 2013; Mizen, 2015).

The results of reviews and a meta-analysis across 21 LMICs further confirm the empirical relationship between facility distance and health service utilization (Karra et al., 2016; Nesbitt et al., 2014; Vadrevu & Kanjilal, 2016). These studies reported that reducing physical travel distance to primary health facilities increased service utilization among local households and,

more significantly, improved maternal and neonatal health outcome. Physical distance has significant impacts on the utilization of health facilities in rural areas in Africa (Penchansky, 1981; Stock, 1983).

Various geo-spatial studies employed a number of advanced methodological approaches, including gravity techniques, to measure actual waking and travel time distances between patients and the nearest public health institutions, (Luis & Cabral, 2016; Langford, 2006). However, the most common models used to measure distance in accessibility studies are still the travel time along road networks and Euclidean measurements (Luis & Cabral, 2016). Euclidean distance examines the distance between places based on straight-line distance (ESRI, 2016), which does not consider physical barriers like water bodies, mountains, and land use patterns to movements (Boscoe, 2013; Noor et al, 2010). The travel distance along road networks is the most appropriate estimation of physical travel path to reach the destination service center (Kadobera et al., 2012).

When travel time and walking distance along road networks are used, accessibility tends to be greater in areas that have a higher density of good road infrastructural links and health services (Mwasi, 2010; Kloos et al., 1990). The WHO recommends the use of travel time models rather than distance to examine the effect of SA on healthcare services utilization (Huerta & Kallestal, 2012). This type of accessibility measurement takes into account the type of roads and the means of transport (Huerta & Kallestal, 2012). One study considers 30 minutes walking time to be a convenient distance for people to travel to medical care (Roovali & Kiivet, 2006), and other investigators categorize people travelling more than 45 minutes to live in underserved areas, although most studies set 1 hour as an adequate standard cut-off point, which agrees with the opinion of ambulance drivers (Kara, 2013). World Bank (2001) also suggests a 1-hour cut-off point for reasonable spatial access. These measures assume that people always use the nearest health services, with little regard for patients' actual use patterns (Gething et al., 2004; Guagliardo, 2004).

This study focuses on primary health care. It is argued that a lack of health facilities close to people is a major obstacle to reaching health facilities and can inhibit access (Graham et al., 2010). Long travel times over great distances can prevent patients from visiting healthcare facilities (Awoyemi & Obayelu, 2011).

The issue of distance and time barriers to healthcare services have not been well documented in Ethiopia; usually, distance has been examined as a nominal binary variable as yes, a factor or no, not a factor kind of analysis (Okwaraji et al., 2012), and there are no accessibility maps showing how far or close the communities are to the health facilities in the country. Moreover, there has been few systematic attempts to analyze the effects of distance barriers to healthcare in Ethiopia (Kloos, 1990). This study seeks to fill this knowledge gap by measuring geographical accessibility to DHFs in Gida Ayana *Woreda*, Ethiopia. We calculate the spatial coverage of the existing primary health care facility network using three scenarios: walking time, shortest path footpath length and Euclidean distances. We also estimate the number of people lying within and outside 60 minutes travel time from pubic primary health services system to understand the degree of accessibility of the households to the health network.

Having adequate insight on SA to healthcare services in a given area allows decision makers to understand the impacts of opening, closing, or modifying the services offered by existing facilities (Delamater et al., 2012). The use of Geographic Information System (GIS) and Quantum Geographic Information System (QGIS) in public health has grown rapidly due to the availability of various information technologies and softwares and is currently being considered useful in the identification and control of health problems in different geographical areas and communities (Fradelos et al., 2014). A considerable number of studies investigated measures of access to healthcare services as a result of the availability of GIS and QGIS in health organizations and the increasing availability of spatially disaggregate data (Higgs., 2004).

Methods and Materials

Study design and period

A household-based cross-sectional study was carried out in Gida Ayana *Woreda* (District) to determine the distance between the residences of maternal cases and the nearest health care services. The data were collected from November 2016 to January 2017.

Setting

The study was conducted in Gida Ayana *Woreda*, western Ethiopia. Gida Ayana *Woreda* consists of seven urban and 21 rural *kebeles*, the smallest administrative unit in Ethiopia. The population in this *woreda* is currently more than 140,000, mostly of the Oromo ethnic group (CSA, 2013; ORS, 2015). The main economic activities of the people are subsistence farming and trading. Livestock also are commonly kept in the *woreda* (ORS, 2015). There are few roads in this part of western Ethiopia. Off-road motorized transport is not viable in most areas due to poor intervention of local governments and because of the difficult terrain (CSA, 2013; ORS, 2015). The main form of travel is walking and people live in distant, mostly mountainous regions characterized by a poor road network. The *woreda* health care system comprises 1 primary hospital, 5 health center and 28 health posts and one satellite in each *kebele* (ORS, 2015). The health system offers basic care such as promotive, preventive and curative services (FMoH, 2015).

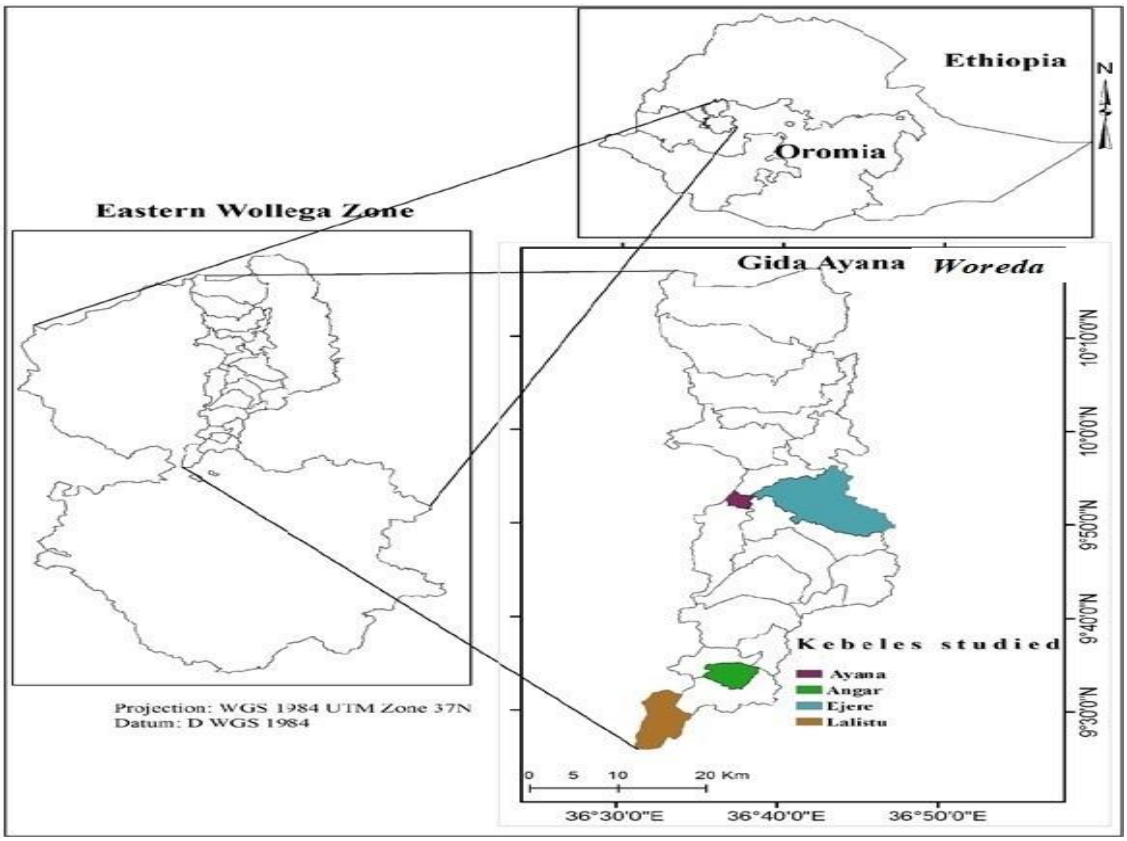

Figure 6. 1. Gida Ayana *Woreda*

Study population and sampling

The study population was 459 households randomly selected and studied by the researchers for women's maternal health care service utilization in four *kebeles*, namely Ayana, Angar, Ejere and Lalistu (see Figure 6.1 above). Seven primary health facilities found in the study *kebeles* were also purposively considered in this spatial accessibility analysis.

Data collection.

The locational points (x-y coordinates) of the 459 households in 2 urban and 2 rural *kebeles* were recorded using Geographical Positioning System (GPS) by experienced technicians. The Garmin® H72 GPS handheld device was used to collect all the geo-referenced data. The locations of 7 primary health care units (1 primary hospital, 2 health centers and 4 health posts) were also recorded on GPS devices by the same data collectors. See the detailed methodologies of data collection and analyses in the next section.

Use of the distance estimation approach

Among the many types of distance estimation techniques, the actual distance approach was preferred to estimate the geographical accessibility of the sample households for health care facilities. This was done in consideration of the traveling pattern of the sample population and the accessibility of transportation means as determined by a preliminary field survey.

During preliminary observations, walking was found to be the most commonly used means of transportation in the study area. The reason for this varies for the rural and urban area sample households. In the rural areas, walking is the most common means of transportation as paved roads rarely exists in the villages and most of the homesteads are far from the existing roads. In areas where there are some paved roads, transportation services are rarely available, which force individuals to travel on foot. In the urban areas, walking is the most preferred transportation means despite the availability of a well-connected road network in all the urban spaces because few households own a personal vehicle or can afford to pay for motorized transport. Public transportation is restricted to the main highway crossing the towns but is relatively seldom used. The health facilities in the urban areas were estimated to be accessible for the majority of residents in less than a 30-minute walking time (Tolera et al., 2020).

It is for these reasons that walking is the most common means of transportation in both the urban and rural areas. The decision to use the walking distance approach of accessibility measurement method is arising from this reason. Following this, an attempt was made to understand the walking pattern of individuals in the study area while moving from place to place. Both in the urban and rural areas, individuals traveling habit is patterned by a network of walking paths. In the urban areas, walking is through the formal roads paved by the municipality offices, and for this study it is assumed that the urban residents use the shortest roads to reach to the closest health facility from their homes. In the rural areas, it is assumed that individuals travel on paved footpaths rather than on unpaved paths (covered with different land cover classes), although this may be necessary because not all households are connected to paved paths.

From these observations, the following assumptions were made and employed in the process of geographical accessibility measurement:

- ✓ Walking is the most commonly used means of transportation in the study area and individuals travel on foot to go to health facilities.
- ✓ Individuals follow mostly paved footpaths rather than walking randomly through the landscape.
- ✓ Individuals know and employ the shortest foot path while traveling to the closest health facility.
- ✓ Individuals choose to use the closest health facility to obtain health services because multiple viable options are rarely available for most of the households.

GIS data base construction process

Once all the required preliminary information was gathered in the aforementioned ways, we tried to construct a GIS data base that shows the individual movement patterns in the study area and to identify the specific foot path each target household travels to reach to the closest health facility. The approach of data base construction varied for the urban and rural areas as traveling paths appear to be different in the two places. In the urban areas, all the paved roads were digitized from the Google Earth platform, the pattern of which could easily be recognized.

In the rural areas, footpath tracking was done through a combination of different data collection approaches. During the household survey, the data collectors were asked to travel only on the paved footpaths while going to the households so that they could track the footpath line they

travelled using the GPS they were equipped with. They also recorded their footpath tracks whenever they moved across the villages for activities other than data collection. In addition, attempts were made to track all visible footpaths using a field-based mapping process by sketching the recognizable footpaths on the top of a printed google earth image of the study area. The field mapping task was done through traveling on foot and covered most parts of the study area.

Following this, the footpath network of the rural areas was digitized on the google earth software using a combination of the footpath dataset and the field-based sketch map. Other footpaths that were untracked by the data collectors were incorporated from the google earth images as recognized through visual image interpretation. The final product of this analysis is a footpath dataset that the individual households use in their movements. Once the road networks were digitized; the next step was to identify the footpath individuals chose. It is assumed that individuals know the shortest path and prefer to travel on the shortest paths to the closest health station. The shortest path identification process was done using the closest facility option of the Network Analysis Extension in the ArcGIS software, considering the health service location as 'facilities' and the household locations as 'incidents'. This analysis yields the shortest path line dataset of all the target households and the footpath distance (in meters) that they are expected to travel for accessing the closest health facilities.

Next, the duration of travel to the closest health facility was measured using Tobler's Hiking Function plugin of the QGIS software: This function determines travel time as a function of slope steepness considering travel time as a reciprocal of slope steepness (Tobler, 1993). A 12.5 m resolution DEM dataset (downloaded from https://search.asf.alaska.edu/) was used as an input data source to derive slope information in the travel time calculation. The Tobler's Hiking Function yields a closer estimation to the actual value than a constant traveling speed measurement technique (Kondo & Seino, 2008).

In addition to the shortest footpath length and Tobler traveling time, Euclidian distances between the location of the sample households and the closest health facilities were measured using the Near function of the ArcGIS software so that it could be used as an additional accessibility measure.

Table 6.1. Sources and data capturing techniques

Data types	Data sources/ analysis techniques
Geographic location of households and health facilities	GPS survey during the household survey
Main road lines across the villages	Google earth platform
Footpaths in the villages	GPS track of the data collectors during the household survey Field sketch map Google earth platform
Digital Elevation data	Downloaded from (https://search.asf.alaska.edu/)
Shortest footpath length (between households and health facilities)	ArcGIS Network analysis tool
Travel time across the shortest path	Tobler's Hiking Function plugin of the QGIS software
Euclidian distance (between households and the nearest health facilities)	ArcGIS 'Near' function

Results and discussions

Descriptive statistics of walking time and distance

A total of 459 household were georeferenced in the spatial assessment of households accessing the closest health facility. However, the response rate was 98.4% due to the missing of x-y coordinates for 7 households as a result of GPS utilization errors among data collectors during field recording. Of the total geo-positioned households, more than half (56.2%) were urban households while the remaining proportion (43.8%) were rural households. More than half (56.1%) of rural households lived within 1-hour walking travel time from the health facilities and 43.9 % of them lived more than 1 hour away from the closest facilities, living within the underserved region (> 60 minutes). See Table 6. 4 and Figures 6.3. A and 6.3. B. Likewise, all

of the urban households lived within 1-hour walking travel time and none lived more than 1 hour away from closest health facilities (Table 6.3, Figures 6.2. A and 6.2. B).

Mean walking time, footpath length and Euclidian distance

The result of the spatial analysis shows that the average walking time of rural households for accessing the closest health facility is about 62.4 minutes, with the average Euclidian and footpath distance of 3183.45 minutes, and 4294.1m, respectively. For the urban households, the average walking time was11.44 minutes, and the footpath length and Euclidian distances were 835.39m and 597.2 minutes, respectively. See Table 6. 2 below.

Table 6. 2. Descriptive statistics of geographical accessibility of the sample households to health facilities

Location	Mean Footpath Length (m)[b]	Mean walking time (min)[a]	Mean Euclidian distance (min)
Rural	4294.14	62.42	3183.45
Urban	835.39	11.44	597.29

[a]*minutes*, [b]*meters*

Traveling distance to the closest health facility in urban area

The highest proportion of the urban households (54%) travel an average distance ranging between 5 and 15 minutes. The frequency decreases as travel time increases and there are only 2% of the households travelling for more than 45 minutes (Table 6. 3 and Figure 6.2. A & B). In this analysis we used 60 minutes as the maximum travel time or a threshold to distinguish between served and underserved areas (Bagheri et al., 2005; Huerta & Kallestal, 2012). Accordingly, all sample households in Ayana and Angar urban *kebeles* lie within the served region. Households in Ayana Town have easy access to three types of health care units: primary hospital, health center and health post (Figure 6.2. B) while households from Angar Town have access to at least two types of primary health care facilities, namely a health center and health post (Figure 6.2. A). Overall, the analysis concluded that there were no households within the underserved region (> 60 minutes) in urban *kebeles* in our research area.

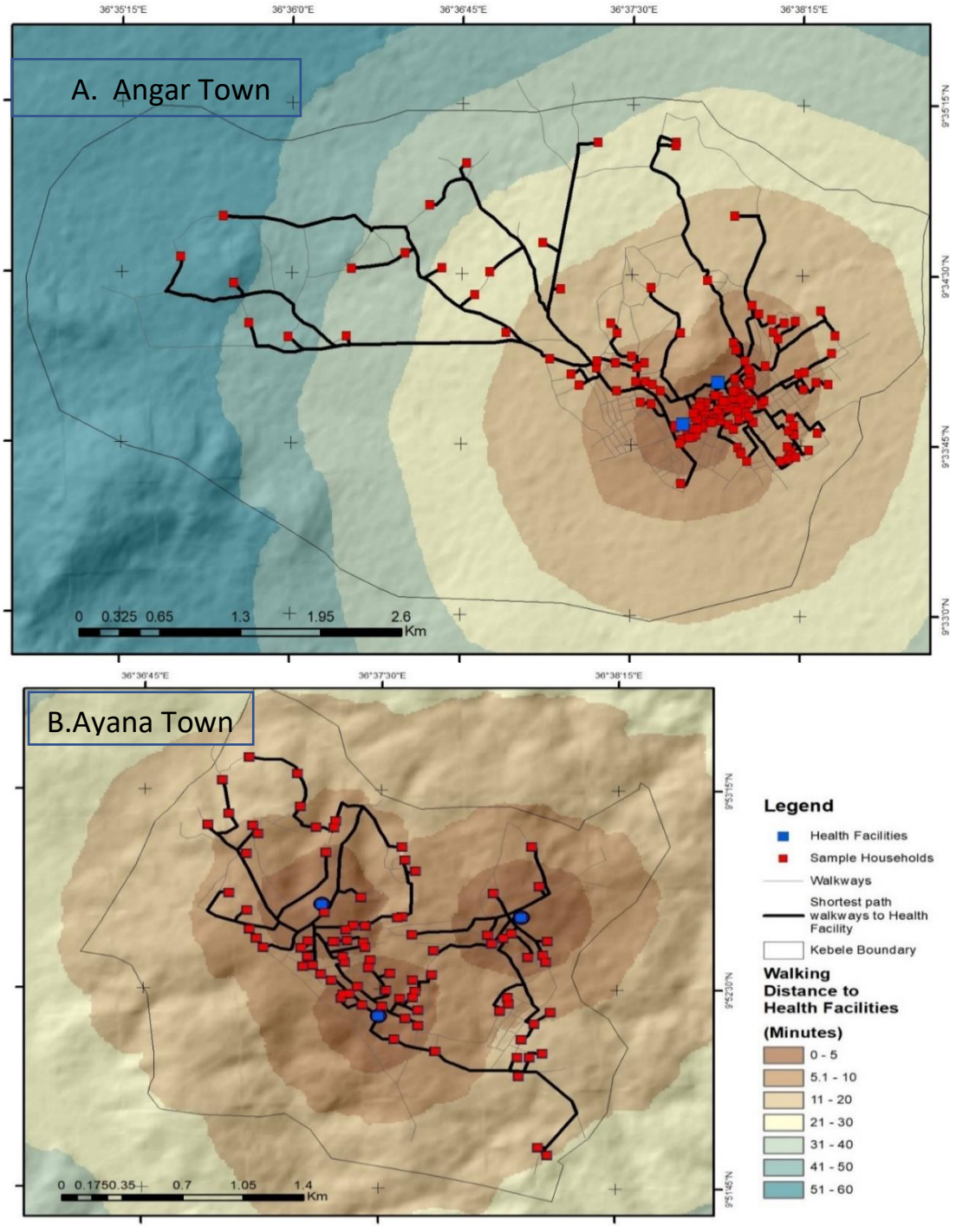

Figure 6.2 A and B. Walking distance of the urban area sample households to the closest health facility (distance in Tobler's hiking time).

Table 6.3. Frequency of the urban area sample households by traveling distance to reach the closest health facility (*N*=254)

Traveling Time (min)[a]	Number (*n*)	Percent (%)
<5	61	24
5-15	136	54
15-25	36	14
25-35	7	3
35-45	8	3
>45	6	2
Total	254	100.00

[a]*minutes*

Traveling distance to reach to the closest health facility in rural areas

The majority of the rural area sample households (51%) fall in the travel time ranging between30 to 90 minutes; with the relatively highest proportion (28%) living between 30 to 60 minutes. The number of households decreases with the increase in travel time; households traveling for more than 90 minutes form only 20%. (see Table 6. 4, see also Figure 6. 3. A and B below).

The result revealed that 56.1% of the households in Lalistu and Ejere rural areas lie within the served area or 60 minutes travel time while 43.9% of the households lie in the underserved area or inhabit areas with more than 60 minutes travel time from the nearest health facility (Figure 6. 3). Our findings corroborate studies conducted in Mozambique (Luis & Cabral, 2016) and New Zealand (Bagheri et al., 2005), where areas within 60 min travel to health centers were considered well served. Other geospatial studies also concluded that that household population should have access to a health facility within one hour of walking (Huerta & Kallestal, 2012). People pay both financially and emotionally to visit a primary health care service centers (Karra & Gunther, 2016; Luis & Cabral, 2016).

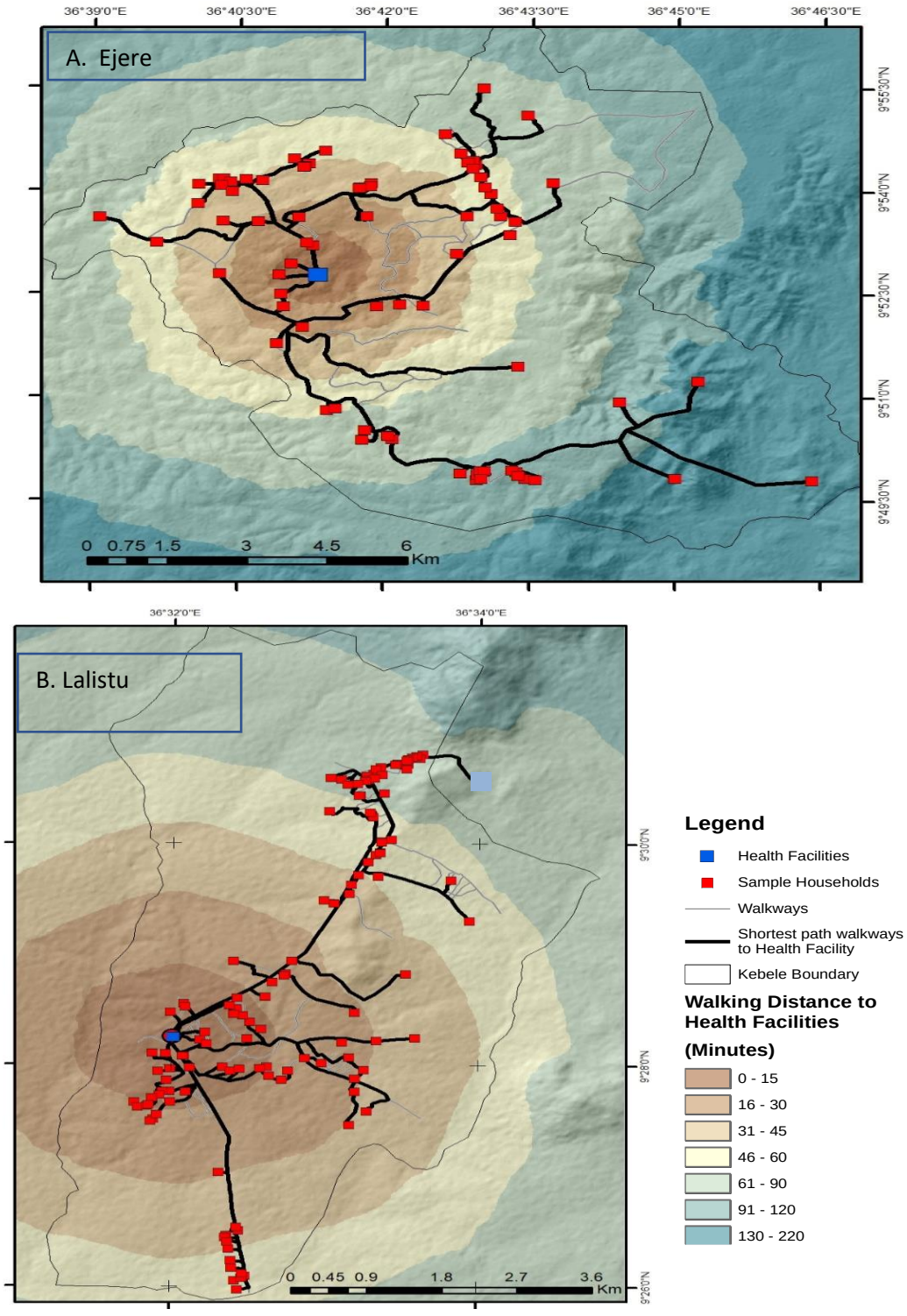

Figure 6.3 A and B. Walking distance of the rural area sample households to the closest health facility (distance in Tobler's hiking time)

Table 6.4. Frequency of the rural area sample households by traveling distance to reach the closest health facility (*N*=198)

Traveling time (min)[a]	Number (*n*)	Percent (*%*)
0-30	56	28
30-60	55	28
60-90	46	23
90-120	22	11
120-150	10	5
>150	9	5
Total	198	100.00

[a]*minutes.*

Conclusion

Walking time and distances have emerged as key measures of SA, in the last decade particularly in relation to primary health care access in developing countries. This study measured the travel times of households to the nearest health facility in Gida Ayana *Woreda* using waking time and Euclidean distance scenarios and provided new insights about the accessibility of health care services in Ethiopia.

The results of this research show that in terms of geographical accessibility, walking is the most problematic and worrying scenario for maternal cases because nearly about half (44.0%) of the rural households in Gida Ayana *Woreda* were within the underserved region and need to walk for more than 60 minutes to reach the closest health facility. It was found that the mean walking time of rural households for accessing the closest health facility was about 62.4 minutes. This will reduce health care utilization and increase undesirable health outcomes especially for mothers and children. Policies that reduce travel distances and travel times through further extending health facilities and other infrastructures in rural areas are likely to increase the utilization of health services and reduce morbidity and mortality, especially the morbidity and mortality of mothers and under five-year-old children.

References

Awoyemi, T.T., Obayelu, O.A., & Opaluwa., H. I. 2011. Effect of distance on utilization of health care services in Nigeria rural Kogi state. *Hum Ecology.;35(1):1-9.*

Bagheri, N., Benwell, G. L., & Holt, A. 2005. *Measuring spatial accessibility to primary health care. Dunedin: Otago University, New Zealand*.

Boscoe, F.P. E. 2013. *Geographic health data: Fundamental techniques for analysis. Wallingford: CABI.*

Campbell, J., Buchan, J., Cometto, G., David, B., Dussault, G., Fogstad, H.,…Fronteira, I. 2013. Human resources for health and universal health coverage: Fostering equity and effective coverage. *Bulletin of World Health Organorganization., 91*(11).

CSA [Central Statistical Agency] of Ethiopia. 2013. *Central Statistical Agency Population Projection of Ethiopia for all regions at woreda level from 2014-2017*.

Inarigu, D. 2015. Locational analysis of healthcare facilities in Keffi local government area of Nasarawa state, Nigeria. (unpublished masters thesis). Ahmadu Bello University, Zaria, Nnigeria

Delamater, P. L., Messina, J. P., Shortridge, A.M., Grady, S. C. 2012. Measuring geographic access to health care: raster and network-based methods. *Int J Health Geogr., 11*(1), 15.

ESRI [Environmental Systems Research Institute]. 2016. Documentation/ArcGIS for Desktop" 2016.

FMoH [Federal Ministry of Health] of Ethiopian. 2015. *Health Sector Transformation Plan I. 2015/16-2019/20.* Vol. 20. *Addis Ababa: Federal Ministry of Health [FMoH] [Ethiopia]*.

Fradelos, E., Papathanasiou, I., Mitsi, D., Tsaras, K., Kleisiaris, C., Kourkouta, L. 2014. Health based Geographic Information Systems (GIS) and their Applications. A*cta Information Medical.* 22(6):402.

Gatrell, T. 2009. GIS and public health. *Economic Geography., 79*(3), 341-342.

Gething, P. W., Noor, A. M., Zurovac, D., Atkinson, P. M., Hay, S. I., Nixon, M. S., & Snow, R. W. 2004. Empirical modelling of government health service use by children with fevers in Kenya. *Acta Tropica.; 9:* 227-237.

Graham, J. E., Fisher, S. R., Berges, I. M., Kuo, Y. F., Ostir, G. V. 2010. Walking Speed threshold for classifying walking independence in hospitalized older adults. *Physical Therphy., 90*(11): 1591-1597.

Guagliardo, M. F. 2004. Spatial accessibility of primary care: concepts, methods and challenges. *International Journal of Health Geography., 3*(3), 1-14.

Higgs, G. 2004. A literature review of the use of GIS-Based measures of access to health care services. *Health Serv Outcomes & Research Methodology., 5*, 119-139.

Huerta, M.U., & Kallestal, C. C. 2012. Geographical accessibility and spatial coverage modeling of the primary health care network in the western province of Rwanda. *International Journal of Health Geogrography., 11*(1).

Kadobera, D., Benn, S., Masanja, H., Mathew, A., & Waiswa, P. 2012. The effect of distance to formal health facility on childhood mortality in rural Tanzania. Global Health Action; 5.

Kara, F., & Egresi, I. 2013. Accessibility to health care institutions: A case study by using GIS.

International Journal of Science & Knowledge., 3(4): 16-27.
Karra, M., Fink, G., & Canning, D. 2016. Facility distance and child mortality : a multi- country study of health facility access, service utilization, and child health outcomes. *International Journal of Epidemiology,* 1(1):1-10.
Kloos, H. 1990. Utilization of selected hospitals, health centers and health statiuos in central, southern and western Ethiopia. *Social Science and Medicine,* 31, 104-114.
Kondo, Y., & Seino, Y. 2008. *GPS-aided walking experiments and data-driven travel cost modeling on the historical road of Nakasendo-Kisoji: Central Highland Japan, Tokyo, Japan*.
Langford, M., & Higgs, G. 2006. Measuring potential access to primary healthcare services: The influence of alternative spatial representations of population. *Professional Geography, 58*(3), 294-306.
Levesque, J. F, Harris, M. F., & Russell, G. 2013. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *International Journal of Equity & Health*, *12*(1):18.
Luis, A., & Cabral, P. 2016. Geographic accessibility to primary healthcare centers in Mozambique. *International Journal for Equity in Health*, 15 (173): 1-13.
Mizen, A., Fry, R., Grinnell, D., & Rodgers, S. E. 2015. Quantifying the error associated with alternative GIS-based Techniques to measure access to health care services. *AIMS Public Health;, 2*(4).
Mwasi, B. N. 2010. Factors affecting access to rural health services: A case study of Baringo area of Kenya using GIS. Addis Ababa: Addis Ababa university, OSSREA, Ethiopia.
Nesbitt, R. C., Gabrysch, S., Laub, A., Soremekun, S., Manu, A., Kirkwood, B. R., … Grundy, C. 2014. Methods to measure potential spatial access to delivery care in low- and middle-income countries: A case study in rural Ghana. International Journal of Health Geographics, 13:25: 1-13.
Okwaraji, Y. B., Cousens, S., Berhane, Y., Mulholland, K., & Edmond, K. 2012. Effect of geographical access to health facilities on child mortality in rural Ethiopia: A Community based cross sectional study. *PLoS ONE*, *7*(3), 1-8.
ORS [Oromia Resgional State]. 2015. Oromia Regional State Eastern Wollega Zone Finance And Economic Development Office: Physical and socio economic profile of Gidda Ayana district. Finfinne (Addis Ababa): ORS, Ethiopia
Penchansky, T., & Thomas, J. W. 1981. The concept of access: Definition and relationship to consumer satisfaction. *Medical Care*, 19(2), 127-140.
Roovali, L., & Kiivet, R. A. 2006. Geographical variations in hospital use in Estonia. *Health Place*, 12(2), 195-202.
Stock, R. 1983. Distance and the utilization of health facilities in rural Nigeria. 17(9), 563-70.
Tobler, W. 1993. Three Presentations on Geographical. National Center for Geographic Information and Analysis.
Tolera, H., Gebre-egziabher, T., & Kloos, H. 2020. Using Andersen's behavioral model of health care utilization in a decentralized program to examine the use of antenatal care in rural western Ethiopia. *PLoS ONE, 15*(1), 1-18.
UNs [United Nations]. 2012. General Assembly. Sixty seventh session A/67/L.36. United

Nations., 12, 63051.
Vadrevu, L., & Kanjilal, B. 2016. Measuring spatial equity and access to maternal health services using enhanced two step floating catchment area method (E2SFCA): A case study of the Indian Sundarbans. *International Journal for Equity in Health*, 15:87: 1-12.
WHO [World Health Organization]: 1981. Health for All by the Year, Genev.

WB [World Bank]. 2001. *World Development Indicators*.

WHO [World Health Organization]. 1978. Primary health care: report of the international

Chapter 7. _____

Summary, contribution of the research to knowledge, conclusion and implications for policy and future studies

Chapter 7. Summary, contribution of the research to knowledge, conclusion and implications for policy and future studies

Introduction

The main objective of this study was to investigate the state of implementation of decentralization of public health services, accessibility to households and utilization of maternal services by analyzing information on perception of service providers and community users and geographical factors in Gida Ayana *Woreda.* The following sections present the summary of the main findings and the conclusion, including the contribution of the study to the literature on maternal health care and implications for future inquiry.

Summary of main findings

The first research question raised was related to the extent of the implementation of decentralized public health and its effect on local health service delivery in Gida Ayana *Woreda*. The findings show multiple benefits of decentralization programs, including increased autonomy over determining staff needs, appointments, transfers, disciplining and firing; local procurement; local community participation in the form of health service board (SB), women teams and networks, and resource contributions in cash and in kind. Results show that decentralization has enabled local health facility managers the autonomy to collect and utilize service fees and user charges. The reform also made the *woreda* fully autonomous for posting and hiring support staff. The program improved the coverage of service delivery in the *woreda* by increasing the number of facilities and deploying adequate and better qualified health professionals. Informants in IDIs and FGDs reported that decentralization further improved the quality of local health services delivery by establishing a fully autonomous service board (SB) at the periphery which reduced local bureaucracies and the time required for making decisions in some areas, especially in reducing problems of drug supply in the *woreda*.

However, the study also identified several deficiencies that hinder the effective functioning of the decentralized health system. Significant decision-making power, in the areas of posting

and recruiting of all technical health staff of all categories, autonomy of local service programming and planning, performance monitoring, assignment and appointment of SB members; setting or improving local tax and service fee and revenue sources including health facility's user charges and service fee rates for attaining adequate decentralization were lacking. Other impediments included local and higher-level politicians' interference in drug funds, in recruitment, transfer of health workers; widespread patronage and clientelism in appointments and transfer cases; as well as in bidding and procurement. Low quality of services outcomes in the form of maltreatment of service users, ordering patients to purchase prescribed drugs from private vendors by hospital pharmacists, rundown delivery wards and poor quality of beds/delivery tables in some facilities were also widespread in the *woreda*.

The second main research question was to identify the major health behavior factors in the utilization of decentralized program for a minimum number of ANC visits as recommended. Of the total women investigated, nearly two-thirds (64.8%) of them stated that they made at least one visit to ANC clinic during pregnancy to their last child. Out of this, only 15.2% of women made the recommended minimum number of ANC visits while the majority (49.6%) received fewer than the recommended number of visits. The remaining proportion (35.2%) did not visit maternal health centers at all. In Ayana and Ejere, 89.4% and 66.2% of the sample respondents visited ANC services, respectively. The proportions were 57.5% in the rural areas of Angar and 54.5% in Lalistu.

Women who were not using ANC clinics, cited lack of awareness about the importance of pregnancy care (46.2%) and transportation problems (25.0%). The majority (55.1%) of the women obtained ANC from health centers. Women's frequency of visits to DHFs for ANC visits was affected by predisposing, enabling, perceived need and external environmental factors. The multinomial logistic regression analysis in this study found associations between the explanatory variables and the number of recommended numbers of ANC visits and fewer than recommended visits compared to the base model, no ANC visits. The model identified predisposing factors (religion, number of children born to a woman, decision on family resource), enabling factors (women's employment, estimated monthly family income, frequency of home visits by HEWs, walking time to ANC clinic, decentralized healthcare facility type), perceived need factors (severe headache, vaginal bleeding/gush, high fever) and

external environmental factors (*kebeles* in which decentralized health facilities were located and urban-rural residence) were significant predictors of ANC utilization.

The third research question was regarding the utilization of decentralized health facilities and factors influencing women's choice of DHFs for delivery. The proportion of women choosing institutional child delivery sites was 56.6% while the prevalence of home delivery choice was 43.4%. With regard to women's choice of child delivery site across types of decentralized health facilities, 80.9% had their last birth at a local health center, 10.5% at a health post, and 8.6% in the local primary hospital/clinic. The majority of women in Ayana (81.9%) and Ejere (59.7%) study sites chose health facilities while about half of the participants in Lalistu (45.5%) and Angar areas (48.8%) reportedly preferred home arguing that skilled providers are not available in health facilities. The findings indicated that Phase I delay and Phase II delay factors for institutional child delivery site choice are important determinants of promoting or discouraging women's preference to utilize DHFs for child delivery and safe motherhood.

The multiple logistic regression analyses estimated indicators and effect sizes of the predictors on institutional child delivery care service use choices. Accordingly, Phase I delays in the form of socio-cultural factors (literacy, support of traditional practice) and the perceived pregnancy benefit or need factors (plan to deliver at a facility; knowledge of pregnancy, labor and birth complications; complications during the last birth; a home visit by HEWs) and Phase II delays in the form of physical accessibility factor (availability of motorized transport including facility ambulance) were key potential predictors explaining mothers' choice of DHFs for delivery services for their last birth. However, the study results are inconclusive with respect to the influence of economic accessibility (maternal occupation and household monthly income status) on women's choices.

The fourth research question was set out to identify risk factors for women's non-utilization of decentralized primary healthcare services for PNC in Gida Ayana. The results of the study revealed a non-utilization rate of 55.7%. Similarly, the prevalence of women who made at least one PNC visit was 44.3% with 90.0% of these making fewer than the recommended PNC visits during the postnatal period after their last birth. Among the total PNC attendants, 9.5% attended the services at the local primary hospital, 55.0% at a health center, and 35.3% at a health post. The multivariate regression results indicated that in the *kebeles* in which

decentralized health facilities were located, postnatal women's age, ANC service during pregnancy period, experience of postnatal complications, knowledge of at least one postnatal complication, knowledge of the recommended number of PNC visits, knowledge of the availability/provision of PNC services and HEW home visit during the first 3 days after delivery were the potential risk factors for women's non-utilization of DHFs for PNC.

The fifth research question measured the spatial accessibility of decentralized primary healthcare institutions using walking time and distance variables. The findings highlighted accessibility problems, especially in the walking scenario, in which 44.0 % of households in rural areas lived in the underserved area (> 60 minutes). In this scenario, all households in Ayana and Angar towns had the greatest coverage of primary health care centers. The mean walking time to the closest DHFs in the rural areas was 62.4 minutes, with average Euclidian and footpath distances of 3183.45m, and 4294.1m, respectively. For the urban households, the mean walking time was 11.44 minutes, and the footpath length and Euclidian distances were 835.39m and 597.2m, respectively.

Reflection on the link between the research results and the literature

Article I. *Public health service delivery in a decentralized system: A qualitative study of the perception of health providers and community members in Gida Ayana Woreda, Western Ethiopia.* This article is a case study aimed primarily at empirically exploring how decentralization of public health system reform is working in practice in relation to local authority, autonomy, accountability and community participation to improve the management and quality of health service provision at the community level. The extent to which the reform is implemented and affected the provision of *woreda's* health service performance was investigated based on the study of the perception of practitioners and local communities. Major benefits and a number of challenges which undermine the delivery of health services and affect the adequate functioning of the reform were identified. The analysis also depicts some impacts of the program on quality of local service delivery and outcomes. Studies were conducted on public health service delivery in developing countries (Akin et al, 2016; Bossert, 1998). Nonetheless, none of these studies have systematically investigated the extent of implementation and the effects of decentralization reform on public health delivery at the

community level in relation to the four dimension of decentralization framework (USAID, 2009; Wunsch, 2014).

Findings showed that there are evidence of decentralization benefits such as increased local autonomy in staff needs planning; posting vacancies, recruiting, and hiring of non-technical support staff with the diploma or below categories; making appointments for local positions, transferring, firing/disciplining; autonomy of collecting and utilizing service fees and users charge; autonomy of procurement; greater autonomy of in time and quality decision-making by local SBs, community representation in SBs. The findings also identified deficiencies attributed to inadequate implementation of decentralization which include higher level politicians interference in drug funds management, transfer, and recruitment; lack of authorities and autonomy to recruit all technical staff, widespread patronage and clientelism in making local appointment and transfer; procurement problems; limited decision-making autonomy over setting and improving local revenue resources bases including users' charges and service fee rates; lack of community responsibility in service programming and planning, performance monitoring. Unrepaired and unclean delivery wards and misbehaving care users had impacts on receiving adequate and quality care in the study *woreda*.

Previous researches (Collins et al., 2002; Moghadam et al., 2017; Munga et al., 2009) revealed that local governments with full administrative authority and autonomy over different areas of personnel management: staff need plan, transfer, disciplining, appointment and local incentives to retain staff in remote areas are evidences of effective policy implementation which positively affect local service performance and outcomes. These are corroborated in our research since the decentralization, Gida Ayana *Woreda* was able to achieve authority and autonomy in personnel management.

Studies indicated that effective implementation of decentralization policy in local health service delivery increased the efficiency of allocation and utilization of limited local budget and effective utilization of health service charges and users fees (Alvarez et al., 2016; Seshadri et al., 2018; Singh, 2016; Tang & Bloom, 2000; Varatharajan &Thankappan, 2004; Vidler et al, 2016). The results of this study support these propositions since local health facilities reported that they have effectively and efficiently utilized the scarce resources allocated by the *woreda* government council. On the other hand, our findings were inconsistent with the

literature cited above because we observed the presence of limited fiscal capacity and insufficient budget or funding of local authorities. This could be attributed to poor resource allocation and poor efficiency of local health program implementation compared to the need to perform devolved tasks and other outreach activities. The finding of our study also showed some improvements in the autonomy of local health institutions over effective utilization of healthcare revenues, especially for local drug supply in the *woreda*, which was also consistent with similar studies conducted elsewhere (Collin et al., 2002; Tang & Bloom, 2000).

In studies done in Indonesia (Purwaningrum et al., 2010) and Bolivia (Alvarez et al., 2016), scholars reported that decentralization increased community participation in the mobilization local resources, community representation in SBs and women organization which in turn improved health outcomes. These findings confirm our results in which decentralization energized community empowerment through representatives in SBs, women's network teams or structures and participation in the forms of both in cash or in-kind contributions for building several health posts, public toilets, maternal waiting homes and housing for HEWs in the *woreda*.

Decentralization studies in Kerela, India (Varatharajan & Thankappan, 2004), Kifili, Kenya (Tsofa et al., 2017) and China (Tang & Bloom, 2000) indicated that the implementation of devolution created an opportunity for local level plan prioritization at village and block levels and community involvement in district health sector planning and budgeting drawn up from below. These achievements were identified as a deficiency in *woreda* health action planning in Gida Ayana *Woreda*, *whereby* local activity planning process was first drafted at zone health department and then finalized at *woreda* council or sector office level undermining the direct participation of ordinary local community in their needs prioritization in service programming and planning.

A literature on decentralized health service shows that in devolution frontline health service providers become recruits of local council (Tang & Bloom, 2000). In delegation health staff can become recruits of semi-autonomous SBs (Sah et al., 2013; Varatharajan & Thankappan, 2004). These findings are not consistent with our findings in both cases where the Oromia Region is still retaining the posting and recruiting of all technical staff and non-technical first-degree or more qualification under devolution. Our study observed that lack of such autonomy

becomes a challenge to the *woreda* hindering the effective functioning of the decentralization reform.

In terms of the challenges of decentralization, studies in developing countries (Meng et al., 2004; Singh, 2016; Tsofa et al., 2017; Varatharajan &, Thankappan, 2004) revealed that lack of adequate administrative capacity and fiscal autonomies impede effective implementation of local decentralization activities. These findings were corroborated by our findings where the *woreda* faced inadequate funding and showed heavy dependency on regional transfer, lack skilled human power resources and face inadequate training for local staff. These hindered local officials from undertaking *woreda* performance evaluation or monitoring action plans which resulted in poor policy implementation and poor health outcomes.

In addition Akin et tal. (201), Kaur et al.(2012), and Singh (2016) indicated that shortage of equipment such as labor or examination table in local institutions, force patients to purchase essential drugs from non-public institutions, offending users. In addition, poor maintenance of health facility and leakage of drug fund are potential challenges for attaining successful decentralization in health services. These problems were reported in Gida Ayana *Woreda* and affect negatively the delivery of quality of health care.

Article II. *Using Andersen's behavioral model of health care utilization in a decentralized program to examine the use of antenatal care in rural western Ethiopia.* This article examines the status of the utilization of DHFs for maternal ANC health service in our study site. The article primarily identified health seeking behavioral factors affecting the utilization of a minimum standard of WHO recommendations to ANC visits compared to no ANC visits as a base model. The proportions of ANC visits among women by local decentralized health care facilities attended were also examined. Finally, the reasons for not attending DHFs for ANC services at all during the last pregnancy were as well identified. Results showed that various individual and community level maternal health seeking and utilization behaviors attributed to predisposing, enabling, perceived pregnancy needs and external environmental characteristics are determinants of DHFs usage for full ANC visits as scheduled, in our research area.

The results of this study indicated that the proportion of the eligible women who made the recommended 4 or more number of ANC visits, fewer than the recommended number of ANC visits, and who underwent no ANC visits were 15.2%, 49.6% and 35.2%, respectively. Our

study conforms the results of previous researches conducted elsewhere by Karkee et al., (2014) and Shrestha & Shrestha, (2011) on ANC utilization whereby, for insistence, the recommended number of ANC visits were reported to be low at 19.7% and 29.0%, respectively. Lack of awareness about the importance of pregnancy care was the major reason for ANC non-utilization.

The log odds of utilizing ANC as recommended was attributed to the functions of four domains 1288, fire 43, 4, of behavioral characteristics featuring the predisposing (number of children born to a woman), the enabling (women's employment, estimated monthly family income, frequency of home visits by HEWs), the perceived pregnancy needs (severe headache, high fever) and the external environmental factors (*kebeles* in which decentralized health facilities were located and location of residence) in our research area in Gida Ayana *Woreda*. These were consistent with the results of studies conducted in different LMICs. For instance, studies by Karkee et al. (2015) and Mugo et al. (2015) examined the use of recommended number of ANC is the functions of multiple forms of predisposing (educational level, age at birth), enabling (family resources), perceived pregnancy needs (complication, having knowledge of ANC service, pregnancy wanted) and external environmental factors (residential location and region). Predisposing factors were identified as individual's demographic, social structure, and belief characteristics explaining the benefits of ANC visits (Phillips et al., 1998). The enabling factors were personal and community resources which were identified as a means to use health service like income, accessibility, and availability of health services (Andersen, 1995; Andersen & Newman, 1973). Others (Chakraborty et al., 2003; Vidler, et al., 2016) revealed that perceived need factors (pain, symptoms of illnesses, duration and severity of pregnancy complications) explain the utilization of ANC visits. Empirical sources elsewhere (Chakraborty et al., 2003; Mugo et al., 2015; Titaley et al., 2009) also found a significant association between external environmental factor in the form of administrative areas and utilization of ANC as recommended.

Article III. *Utilization of decentralized health facilities and factors influencing women's choice of a delivery site in Gida Ayana Woreda, western Ethiopia.* The article examines the status of utilization of decentralized local health care facilities for child delivery service in our research areas. The analysis identified determinant factors of women's choice of DHFs for

skilled delivery service utilization, which are the main causes of Phase I and II delays. The findings in this research depicted sociocultural and perceived benefits/needs, and physical accessibility as Phase I and Phase II delay factors, respectively influencing women's choices of DHFs for skilled delivery service site during their last pregnancy in our study *woreda*.

The study found that Phase I delays in the form of socio-cultural factors (literacy, support of traditional practice) and the perceived pregnancy benefit or need factors (plan to deliver at a facility; knowledge of pregnancy, labor and birth complications; complications during the last birth; a home visit by HEWs) and Phase II delays in the form of physical accessibility factor (availability of motorized transport including facility ambulance) were the key potential predictors explaining mothers' choice of DHFs for delivery service utilization for their last pregnancy. The findings of this research conform with a literature review on determinants of delivery use conducted by Gabrysch et al. (2009), and those of empirical studies conducted elsewhere in Ethiopia (Simkhada et al., 2007; Tarekegn et al., 2014) which reported a similar findings, where mothers' local sociocultural practices (religion, maternal educational status) and perceived benefit/need factors (information available, health knowledge, pregnancy, complications during pregnancy, delivery) were directly associated with women's choice to seek delivery centers (Phase I delay). Empirical evidences by (Dickson et al., 2018; Fisseha et al., 2017; Thaddeus & Maine, 1994) also identified a physical accessibility factor (availability of road network and mode of transportation) were influencing woman's decision to reach delivery care (Phase II delay). Economic accessibility to DHFs did not show significant effect to increase the likelihood of attending institutional delivery site after adjustment of Phase I and Phase II delay variables in the study area which was also consistent with the finding reported in Tigray, northern Ethiopia (Fisseha et al., 2017).

Article IV. *Risk factors for women's non-utilization of decentralized primary healthcare facilities for PNC in rural woreda in western Ethiopia.* This article examined the pattern of postnatal health care non-utilization. The article aimed at identifying the barriers that must be addressed to raise levels of utilization with the ultimate goal of improving visit to decentralized local health facilities for PNC services. This study further contributes to the literature by providing many community and health system perspectives. Available works gave priority to

factors associated with PNC utilization and no research has been made on the topic of risk factors for women's non-utilization of DHFs for PNC service after delivery in Ethiopia.

Empirical works (Adedokun & Uthman, 2019; Amare et al., 2018; Mugo et al., 2015; Somefun & Ibisomi, 2016; Titaley et al., 2010; Titaley et al., 2009; USAID, 2012) indicated that PNC was reportedly rare and not well utilized. The service was mainly visited for the sake of newborn care than for the maternal health. Studies elsewhere (Pasha et al., 2013; Thaddeus & Maine, 1994; Vidler et al., 2016) revealed suboptimal levels of utilization are considered to contribute to poor maternal health performance. The findings of these studies are in line with our finding in our research area where a large proportion of postnatal women (55.7%) did not visit DHFs for PNC services due to a number of risk factors explaining women's non-utilization of PNC after delivery.

Article V. *Spatial accessibility to primary healthcare facilities in Gida Ayana Woreda, rural western Ethiopia: GIS-Based Modeling.* In this study we aimed at measuring the spatial accessibility of households to the existing primary healthcare facilities. The study measured the spatial coverage of the existing primary health care facility network to households using three scenarios: walking time, shortest path footpath length and Euclidean distances between households and health facilities.

Studies (Bagheri et al., 2005; Kadobera et al., 2012; Roovali, 2006) revealed that spatial accessibility to primary healthcare facilities remains limited in a MLICs. Walking distance or travel time almost marginalized all of the households (Bagheri et al., 2005; Okwaraji et al. 2012). The majority in a resource-poor country who often travelled for more than 1 hours far from their home to receive routine health service were in underserved areas (WB, 2001; Huerta & Kallestal, 2012; Luis & Cabral, 2016). These studies reported a similar finding with our study where 44.0 % of households in rural areas (Figure 6.3. A and B) were found out to be in an underserved area (> 60 minutes). Furthermore, the mean walking time to the closest DHFs in these rural areas was also 62.42 minutes (Table 6.2).

There is a dearth of data in LMICs regarding distance to DHFs. It is also unclear whether distance is associated with worse health outcomes. It is argued that a lack of DHFs in closest proximity to local households is a major obstacle to reaching health centers and can obstruct accessibility to service utilization (Graham et al., 2010). Long travel times induced a morbid

members of the local household in remote areas not to follow up the tedious outpatient services care from DHFs (Awoyemi & Obayelu, 2011). Empirical sources on walking distance and time as positive or negative factors to DHFs service utilization has not been well documented in Ethiopia; usually, distance has been examined as a categorical self-reported opinion based factor (Okwaraji et al., 2012), and there are no accessibility maps showing how far or close the communities are to the health facilities in the country.

Conclusion

Health performance and health outcomes particularly for maternal health depends on supply and demand factor. On the supply side, this study has examined the implementation of decentralized health services in Gida Ayana woreda. On the basis of the empirical findings it can be concluded that decentralization is an important institutional reform in health service delivery which can establish authority, autonomy, accountability and resources for service provision. This improves health outcomes particularly maternal health in a rural setting.

This study has also demonstrated that though decentralization has beneficial effects, its effectiveness can be enhanced if local authorities are fully empowered. Other studies also conform that decentralized local authority in health service supply in LMICs meets a number of challenges that influence the performance and utilization outcomes of health system delivery (Heywood et al., 2016), and the quality and efficiency of services (Conteh, 2016; Dwicaksono & Fox, 2018). In our study, we found that local entities were plagued with inadequate resource, lack of full autonomy over some decisions, and shortage of skill and administrative capacity. The decentralization challenge has also put a strong limit on *woreda* local authorities who were very ambitious to exercise their autonomy over planning, implementing, and executing the decentralized tasks (Asante et al., 2006; Gebre-Egzhiabher, 2014; Seshadri et al., 2016; Singh, 2016). The above conclusion that decentralization is beneficiary thus has to be qualified with the need to empower local entities in terms of resources, full decision-making power, skills and capacity.

Though decentralization is important to improve the supply of health service, mothers need to be supported by identifying the influencing demand factors for better utilization since the utilization of pregnancy healthcare services was related to complex behavioral phenomena.

Given, the great cultural diversity, beliefs and practices attributed to the population of LMICs, these interacting complex factors are peculiar to a specific culture affecting the health seeking behavior of pregnant women in that society (Thaddeus & Maine, 1994; Gabrysch & Campbell, 2009). This study examined the determinant factors that attributed to the four characteristics of behavioral domains (predisposing, enabling, perceived pregnancy needs/benefits, and external environmental factors) which motivate or deter the utilization of the recommended number of ANC services. The multinomial regression analyses revealed that the utilization of the recommended number of ANC visits to DHFs were explained by a predisposing factor in the form of woman's birth size/spacing; a multiple of enabling factors such as women's financial access to maternal health services, status of family income, and constant home visit counseling obtained from skilled service providers during the last pregnancy; perceived need factor (or physical illness conditions like high fever and severe headache that motivated pregnant women to attend ANC service as per of physicians' recommendations); external environmental factors including administrative decentralization unit and being urban residents. These imply that the decentralization of health services needs to be accompanied by also addressing all these factors that influence demand.

This research has shown that women's choices of DHFs for skilled childbirth services utilization during child delivery is often found to be effective intervention program in attaining significant improvement in maternal health outcomes. The choice of where to give childbirth in LMICs involves a complex sociocultural and perceived benefit/need delay factors (Phase I delay) and economic and physical accessibility delay factors (Phase II delay). In line with this, the 'Three delays model' (Gabrysch & Campbell, 2009) argued that the effects of the three phase delays on pregnant women's effective utilization of DHFs for skilled delivery services, as measured by the set of delay factors such as the first phase delay factors that influence women's decision making choices to seek skilled delivery service sites, the second phase delay factors that affect women's choice in reaching the DHFs for delivery service use while the third delays impact women's choice of receiving adequate/appropriate services in the health facility, which were not indeed considered in this study. Our study examined why service developers and providers continue to fall short in answering the question of why health facilities are under-utilized by pregnant women during the previous five years prior to this study in rural western Ethiopia. The findings of this study identified a number of predictors related to phases I delay

and phase II delay factors that explain women's decision choices for the utilization of skilled delivery services site in rural western Ethiopia.

It is well known that several studies support the notion that SA to household impacts probability of contact with DHFs for utilization services. Examining georeferenced data provides a promising opportunity to link health facility location data with household data using a Geographic Information System (GIS) and Quantum Geographic Information System (QGIS). This helps to explore the influence of distance decay to delivery services on service use. The findings of this study revealed the effect of SA on actual healthcare delivery which were manifested in the form of healthcare service utilization in spatial and interpersonal disparity in health service coverage across study site catchments and sample households, which were also consistent with other studies (Guagliardo, 2004; Karra et al., 2016). Increasing distance to health facility was found to be associated with decreased improvements in universal health access to their respective general population by LMICs (Gabrysch & Campbell, 2009).

Overall, this study concludes that while effective design, transfer and implementation of decentralized mode of service provision is essential, utilization of services (ANC and PNC) and choice of child delivery institution is a complex decision influenced by several factors that include cultural, financial, health extension, physical illness and geographical factors.

Policy implication

The policy implications of the results help local implementers and policy makers to become more insightful in program interventions.

- The study found out that there are challenges or barriers in adequately implementing decentralized health sector reform in rural western Ethiopia. In particular, at *woreda* level there was limited direct consultation and involvement of local community in the health policy implementation. Consequently, an effective community participation strategy intervention is needed. In this regard effective implementation of decentralized local authority, autonomy, accountability and community participation in public health policy, however, require more bottom up participatory service delivery approaches and local and higher government officials' political will and commitment. In addition, a

standardized local facility performance monitoring and evaluation approaches is needed in order to improve the *woreda* health system service delivery.

- The study revealed that visiting DHFs increased the utilization of ANC among investigated participants. This increased early disease detection. Reducing maternal complications and mortality rate to 140 per 100,000 LB in developing countries by the year 2030 is one of the goals of global health initiative that should be possible by making women to use DHFs for ANC visits as recommended by WHO. Our results showed that various predisposing, enabling, perceived needs and environmental factors significantly explained optimal number of ANC service visits. Therefore, intervention efforts to improve ANC utilization in Ethiopia needs policy makers and planners targeting the predictors attributed to the four behavioral components identified in our research.
- This study examined different predictors in the forms of Phase I and Phase II delay factors associated with women's choice of DHFs for delivery services. The results should provide insights to policy makers about potential public health strategies to increase the choices and the uptake of *woreda* level DHFs for child delivery. Finding of this study shows that although the level of utilization of DHFs for childbirths in the study area was 56.6%, more than twice as high as the national figure [26.2%] (CSA & ICF International, 2016), it is still low compared to other MLICs. It should need local practitioners' and maternal health policymakers' paying attentions to Phase I and Phase II delay factors related to sociocultural, perceived benefits/needs, and physical accessibility determinants identified in this study. Furthermore, improving the maternal health service and increasing the number of deliveries attended by skilled personnel (from 28% in 2016 to 80%) by 2020 is a strategy in the health sector plan of Ethiopia which requires much attention to local delay factors to meet the national target (FMoH, 2015). Facility infrastructure, in our research area and similar settings in rural western Ethiopia, should also be enhanced to include upgrading referral system, maintenance of rundown delivery wards, and finally to ensure a consistent quality of delivery care service in health centers. Improved cleanliness of the local delivery centers and behavior of skilled providers need policy measures (Tolera et al., 2019).
- Uptake of postnatal maternity care services was attributed to local government, local implementers and service program planners and increased health information,

knowledge, availability of maternity services, and home visits and counseling by front line providers after delivery. Community-based initiatives should be enhanced to encourage optimum utilization of PNC and to provide the community with information regarding the importance of facility-based lifesaving care postnatal service.

- Moreover, there has been no systematic attempt to analyze the effects of the distance barriers to primary healthcare units in Ethiopia. Our study filled this knowledge gap by measuring geographical accessibility to DHFs in Gida Ayana *Woreda*, Ethiopia. The majority of rural Gida Ayana *Woreda* are located in underserved areas in the walking scenario. The mapped outputs may have policy implications and can be used for future decision-making processes and analysis. Policies and programmes that improve access in more remote areas through, for example, further extending decentralization of health facilities or reducing travel times through increased access to transport, are likely to yield substantial increases in the health utilization coverage rates.

Implication for future studies

This study has added important information on maternal health to the implementation of the public health decentralization program, accessibility to DHFs and determinants of their utilization in Gida Ayana *Woreda*. In this regard, future research may provide more insights into the dynamics of implementing the decentralization program and to increase utilization of the maternal health services. Hence, the following points which were not adequately addressed in this study need further investigations:

- Our study was confined to Gida Ayana *Woreda* in Ethiopia. The result of the study may not be applied to Oromia and other regions due to heterogeneity within the region and among regions. We recommend that future studies should include *woredas* in different socioeconomic and cultural communities in other urban and rural areas to examine different experiences, opportunities and challenges in decentralized healthcare reform and access/utilization of maternal health services.
- The cross-sectional design of this survey measured exposure and outcome simultaneously. In the future, utilization studies of DHFs, causal relationships between the proposed predictors and the outcomes of interest can be addressed using longitudinal information. Moreover, the

long recall period may have introduced information bias in maternal utilization. Thus, short recall period may avoid information bias for future studies.

- Future studies should also focus on health system inputs such as availability of essential infrastructures such as water, telephones, toilets, and electricity, health facility based study of quality of services delivery including availability of essential supplies and equipment like obstetric drugs, weighing scales, labor/ examination table, and other medical inputs that can possibly influence the utilization of maternal health care services delivery in rural Ethiopia.
- In our study with delay models, we have not addressed the third delay model, namely receiving adequate and quality care in the facility. Future study can then address this issue.
- This study has examined the effects of decentralization and utilization of health services in public institution. Future studies should examine the same issue for private health services and the mix of both private and public sectors.

Reference

Adedokun, S. T., & Uthman, O. A. 2019. Women who have not utilized health Service for Delivery in Nigeria: who are they and where do they live? *BMC Pregnancy & Childbirth*, *6*, 1-14.

Akin, J., Hutchinson, P., & Strumpf, K. 2016. Decentralisation and government provision of public goods: The public health sector in Uganda. *The Journal of Development Studies* 41(8): 1417-1443.

Alvarez, F. N., Mart, L., Merida, H R., & Guzman, G. E. 2016. Primary health care research in Bolivia: Systematic review and analysis. *Health Policy & Planning.*, 31, 114-28.

Amare, Y., Scheelbeek, P., Schellenberg, J., Berhanu, D., & Hill, Z. 2018. Early postnatal home visits: A qualitative study of barriers and facilitators to achieving high coverage. *BMC Public Health.*, *18*(1074).

Andersen, R. M. 1995. Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health Socience & Behaviour.*, *36*, 1-10.

Anderson, R., & Newman J. F. 1973. Societal and individual determinants of medical care utilization in the united states. *Milbank Memorial Fundation Quarterly.*, *81*, 95-123.

Asante, A. D., Zwi, A. B., Ho, M. T. 2006. Getting by on credit: How district health managers in Ghana cope with the untimely release of funds. *BMC Health Service Research* 6(105).

Awoyemi, T.T., Obayelu, O.A., & Opaluwa., H. I. 2011. Effect of distance on utilization of health care services in Nigeria rural Kogi state. *Human Ecology., 35(1):1-9.*

Bagheri, N., Benwell, G. L., & Holt, A. 2005. *Measuring spatial accessibility to primary health care. Dunedin: Otago University, New Zealand.*

Bossert, T. 1998. Analyzing the decentralization of health systems in developing countries: decision space, innovation and performance. *Social Science & Medicene.*, *47*(10), 1513-1527.

Bucagu, M., Kagubare, J. M., Basinga, P., Ngabo, F., Timmons, B. K., & Angela, C. L. 2012.

Impact of health systems strengthening on coverage of maternal health services in Rwanda, 2000-2010: A systematic review. *RHM*, *20*(39), 50-61.

CSA [Central Statistical Agency] of Ethiopia & ICF International. 2016. *Ethiopia Demographic and Health Survey 2016. Addis Ababa: Ethiopia, and Rockville, Maryland, USA: CSA & ICF*.

Chakraborty, N., Islam, M. A., Chowdhury, R. I., Bari, W., & Akhter, H. H. 2003. Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International* 18(4): 327-37.

Collins, C., Omar, M., & Tarin, E. 2002. Decentralization, health care and policy process in the Punjab, Pakistan in the 1990s. *International Journal of Health Planning & Management.*, *17*, 123-146.

Collins, C. D., & Green, A. 1994. Decentralisation and primary health care: Some negative implications in developing countries. International Journal of Health Service., *24*, 459-476.

Conteh, F. M. 2016. The promise and reality of decentralization: A critical appraisal of Sierra Leone's primary health care system. *Critical African Studies*, *13(92)*, 0-20.

Dickson, K., Darteh, E., Kyereme, A., Ahinkorah, B. 2018. Determinants of choice of skilled antenatal care service providers in Ghana: Analysis of Demographic and Health Survey. *Matern Health Neonatal & Perinatal Research;* 4(14): 1-8.

Dwicaksono, A., & Fox, A. M. 2018. Does decentralization improve health system performance and outcomes in low-and middle-income countries? A systematic review of evidence from quantitative studies. *The Milbank Quarterly*, *96*(2), 323-368.

FMoH [Federal Ministry of Health] of Ethiopian. 2015. *Health Sector Transformation Plan I. 2015/16-2019/20. Addis Ababa: Federal Ministry of Health [FMoH] [Ethiopia]*.

Fisseha, G., Berhane, Y., Worku, A., Terefe, W. 2017. Distance from health facility and mothers' perception of quality related to skilled delivery service utilization in northern Ethiopia. *International Journal of Women's Health*., 9, 749-756.

Frumence, G., Tumaini, N., Mughwira, M., & Hurtig A. 2014. The dependency on central government funding of decentralised health systems: Experiences of the challenges and coping strategies in the Kongwa District, Tanzania. *BMC Health Services Research*, *14*(39), 1-9.

Gabrysch, S., & Campbell, O. M. R. 2009. Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy & Childbirth*, *9*, 34.

Gebre-Egziabhre, T. 2014. Decentralization and regional and local development: trends and policy implications in Rahmato, D., Ayenew, M., Kefale, A., & Habermann, B, Eds. Reflection on development in Ethiopia: New trends, sustainability and challenges. Addis Ababa: Forum for Social Studies. pp.130-168.

Graham, J. E., Fisher, S. R., Berges, I. M., Kuo, Y. F., Ostir, G. V. 2010. Walking Speed threshold for classifying walking independence in hospitalized older adults. *Physical Therphy.*, *90*(11): 1591-1597.

Guagliardo, M. F. 2004. Spatial accessibility of primary care: Concepts, methods and challenges. *International Journal of Health Geography.*, *3*(3), 1-14.

Heywood, P., & Choi, Y. 2016. Health system performance at the district level in Indonesia after decentralization. *BMC International Health & Human Rights*, *10*(3), 1-8.

Huerta, M.U., & Kallestal, C. C. 2012. Geographical accessibility and spatial coverage modeling of the primary health care network in the western province of Rwanda. *International Journal of Health Geogrography.*, *11*(1).

Kadobera, D., Benn, S., Masanja, H., Mathew, A., & Waiswa, P. 2012. The effect of distance to formal health facility on childhood mortality in rural Tanzania. *Global Health Action.*, 5.

Karkee, R., Lee, A. H., & Khanal, V. 2015. Need factors for utilisation of institutional delivery services in Nepal: An analysis from Nepal Demographic and Health Survey. *BMJ Open*.,4.

Karra, M., Fink, G., & Canning, D. 2016. Facility distance and child mortality : a multi- country study of health facility access, service utilization, and child health outcomes. *International Journal of Epidemiology*, 1(1):1-10.

Kaur, M., Prinja, S., Pravin. K S., & Rajesh, K. 2012. Decentralization of health services in India: Barriers and facilitating factors. *Journal of Public Health*, *1*(1), 94-104.

Lufunyo, H. S., & Pallangyo, W. A. 2017. Institutional characteristics and its effect on public health service delivery under decentralization in local government authorities in Tanzania: *Noble International Journal of Business & Management Research*, *1*(1), 31-48.

Luis, A., & Cabral, P. 2016. Geographic accessibility to primary healthcare centers in Mozambique. *International Journal for Equity in Health*, 1-13.

Masanyiwa, Z., Niehof, A., & Termeer, C. 2012. Institutional arrangements for decentralized water and health services delivery in rural Tanzania: Differences and constraints. *Basic Research Journal of Social & Political Sciences.*, *1*(4), 77-88.

Meng, Q., Li, R., Cheng, G., & Blas, E. 2004. Provision and financial burden of TB services in a financially decentralized system: a case study from Shandong, China. *International Journal of Health Planning & Management.*, *19*, 45-62.

Moghadam, M. N., Amiresmaili, M., Sadeghi. V., Zeinalzadeh A. H., Tupchi, M., & Parva. S. 2017. A qualitative study on human resources for primary health care in Iran. *International Journal of Health Planning & Management*, 1-11.

Mugo, N. S., Dibley, M. J., & Agho, K. E. 2015. Prevalence and risk factors for non-use of antenatal care visits: Analysis of the 2010 south Sudan household survey. *BMC Pregnancy & Childbirth*, *15*(68), 1-21.

Munga, M. A., Songstad, N. G., Blystad, A., & Maestad, O. 2009. International Health and The decentralisation-centralisation dilemma: Recruitment and distribution of health workers in remote districts of Tanzania. *BMC International Health & Human Rights*, *9*(9), 1-11.

Munoz, D. C., Amador, P. M., Lamas, L M., Hernandez, D. M., & Sancho, J. S. 2017. Decentralization of health systems in low and middle income countries: A systematic review. *International Journal of Public Health*, *62*(2), 219-229.

Okwaraji, Y. B., Cousens, S., Berhane, Y., Mulholland, K., & Edmond, K. 2012. Effect of geographical access to health facilities on child mortality in rural Ethiopia*:* A community based cross sectional study. *PLoS One*., *7*(3), 1-8.

Pashal, O., McClure, E. M., Wright, L. L., Saleem, S., Goudar, S.S., Chomba, E., Patel, A. 2013. A combined community-and facility-based approach to improve pregnancy outcomes in low-resource settings: A Global Network cluster randomized trial. *BMC Medicine*, *11*(1), 1-12.

Phillips, K. A., Morrison, K. R., Andersen, R., & Aday, L. A. 1998. Understanding the context of healthcare utilization: Assessing environmental and provider-related variables in the behavioral model of utilization. *Health Services Research*, *33*(3), 571-596.

Roovali, L., Kiivet, R. A. 2006. Geographical variations in hospital use in Estonia. *Health Place* 12(2): 195-202.

Sah, P. K., Raut, A.V., Maliye, C. H., Gupta, S. S., Mehendale, A. M., & Garg, B. S. 2013. Performance of village health, nutrition and sanitation committee: a qualitative study from rural Wardha, Maharashtra. *The Health Agenda*: 2320-3749.

Seshadri, S. R., Parab, S., Kotte, S., Latha, N., & Subbiah, K. 2016. Decentralization and decision space in the health sector*:* A case study from Karnataka, *India*. *Health Policy & Planning*, 31,

171-181.
Shrestha, G., & Shrestha, G. 2011. Statistical analysis of factors affecting utilization of antenatal care in Nepal. *Journal of Science & Technology, 12*, 268-275.
Simkhada, B., Teijlingen, E., Porter, M., & Simkhada, P. 2007. Factors affecting the utilization of antenatal care in developing countries: Systematic review of the literature. *Journal of Advanced Nursuring., 6*(13), 244-60.
Singh, A. 2016. Supply-side barriers to maternal health care utilization at health sub-centers in India. *PeerJ*, 11.
Somefun, O. D., & Ibisomi, L. 2016. Determinants of postnatal care non-utilization among women in Nigeria. *BMC Research Notes, 9*(21), 1-11.
Tang, S., & Bloom, G. 2000. Decentralizing rural health services: a case study in China. *International Journal of Health Planning & management., 15*, 189-200.
Tarekegn, S., Lieberman, S., & Giedraitis, V. 2014. Determinants of maternal health service utilization in Ethiopia: Analysis of the 2011 Ethiopian Demographic and Health Survey. *Pregnancy & Childbirth, 14*(161), 1-13.
Thaddeus, S., & Maine, D. 1994. Too long to walk: Maternal mortaliity in context. *Social Sciences & Medicine., 38*(8), 1091-1110.
Titaley, C. R., Dibley, M. J., & Roberts, C. L. 2009. Factors associated with non-utilisation of postnatal care services in Indonesia. *Journal of Epidemiology & Community Health, 63*(10), 827-831.
Tolera, H., Gebre-Egziabher, T., & Helmut, K. (2019). Public health service delivery in a decentralized system: A qualitative study of the perception of health providers and community members in Gida Ayana *Woreda*, western Ethiopia. *Global Journal of Medical Research, 19*(2), 22-37.
Tsofa, B., Molyneux, S., Lucy, G., & Goodman, C. 2017. How does decentralisation affect health sector planning and financial management? a case study of early effects of devolution in Kilifi County, Kenya. *International Journal for Equity in Health, 16*(151).
USAID [United States Agency for International Development]: 2009. *Democratic decentralization programming handbook*. Washington, D. C: USA.
Varatharajan, D., Thankappan, R., Jayapalan, S. 2004. Assessing the performance of primaryhealth centres under decentralized assessing the performance of primary health centres under decentralized government in Kerala, *India*. *Health Policy & Planning* 19(1).
Vidler, M., Ramadurg, U., Charantimath, U., Katageri, G., Katadiguddi, C., & Qureshi, R. 2016. Utilization of maternal health care services and their determinants in Karnataka State, India. *Reproductive Health, 13*(Supl1).
WB [World Bank]. 2001. *World Development Indicators*.
Wunsch, J. S. 2014. Decentralization: Conceptual and analytical issues. In: Wunsch, J., & Dickovick, T., Eds., *Decntralization in Africa: The paradox of state strength*,. London: Lynne Rienner. pp. 1-22.

Ap**pendices**

Appendex 1. Guide for in-depth interviews

Dear interviewee,

You have been purposively chosen for this interview. The purpose of this IDI is to understand the extent of implementation of public health sector decentralization reform in practices and its effects on local service delivery in Gida Ayana Woreda local government. We need your detail understanding on how public health decentralization is working in practice in the woreda connection with local authorities, local autonomy, local mechanisms you will use for ensuring local accountability and community participation. Your genuine responses are extremely valuable for the success of this study, and will be kept in complete confidentiality and anonymity.

A. Backgrounds characteristics of participants

1. Name of the interviewee: ---------- Code----------
2. Age: ----------
3. Sex: ----------
4. Educational level: ----------
5. Work experience: ----------
6. Your current position: ----------

B. Local authority:

What administrative, fiscal, and political functions and responsibilities are legally given for the Gida Ayana *woreda* government to manage and deliver health service for local community?

C. Local autonomy:

1. What management functions do local government is currently practicing in a decentralized public healthcare service provision at the community level? Do *Woreda* local government is autonomous over all areas of personnel management?
2. If ***'Yes'***, to what extent your office is autonomous over human resource decisions such as planning and budgeting staff needs, recruitment, hiring and employing technical and non-technical staffs, disciplining and firing if they are mishandling their duties/clients, transferring, promoting, appointing, and like that? Please, describe each in detail.
3. If **'*No'*,** why?
4. Are there restrictions on your recruitment and hiring of health worker, competent and trained personnel, due to regional level or centrally set human resource budget ceilings, legislative controls, budget problems, etc.?

5. Is there also any intervention/nepotism on the above indicated health personnel resource management decision actions, etc. from local or higher-level officials?
6. Are there problems to recruit and retain adequate and competent and trained health personnel in your *woreda*? If yes, Why? Please, describe each in detail.
7. Describe in detail the extent of district government/ health manager autonomy over local based incentive schedules to attract new staff or reduce turnover, and other health personnel management related functions?
8. Does the local government have an autonomy over local financial resources?
9. How does the origin of its funding or its powers affect their autonomy or accountability?
    - Can the council raise revenues locally?
    - Is it dependent on grants and funding from outside agents?
10. What is the extent of the autonomy of local government over different local resource bases and is the local government [*woreda*] responsible to legislate, levy, and collect taxes or diversify revenue resources through various income generating activities using such as different tax sources, cost recovery, transfer, *etc*.?
11. How budget is assigned to your *woreda/sector*? Who has the autonomy for budgeting? and allocating of resources to cost centers within the domain assigned to local government? The *woreda* itself, zone, region, or line ministry?
12. On what basis and budgetary allocation practices is funds or own revenue resources assigned to local sectors like health in your *woreda*?
13. Who defines the formula? Do you prepare budget/expenditure proposal ahead of it or not?
14. Do you think budget allocated is enough and suit to your budget and expenditure proposals, you prepared or submitted? For operating expenses of government agency [health personnel] and for use on social infrastructure and service delivery (health facilities). If not, why, and how do you fill the gaps?
15. Who is appointed and granted autonomy over setting hospital/health center user fee and service charge rates, collect, and redistribute this resource to the facility's cost centers? How?

16. Does the *woreda* have full autonomy over decision-making actions like procurement and distribution [to facilities] of drugs and other supplies and to what extent? How? On your own, or through pool system by the *woreda* or by the region? and Who approved it? Was it participatory and transparent enough?
17. If '***Yes'***, does a decision and the supply meet the demand/ preference of local facility and community?
18. If ***'No',*** why? and mention some of the constraints, deficits or abuses with regard to procurement processes or quality of purchases?
19. What autonomy does the *woreda* has in service planning and programming processes? How, with whom and where planning and budgeting processes, and service programming start and end in your *woreda*? Are there indicative guidelines for planning and budgeting? Who approves *woreda* plans? What are your challenges in planning? Who developed a new health program? and how and with whom?
20. Do planning and budgeting process is bottom-up so that local priorities are taken into consideration in seeking input resources? at what levels?
21. What are critical capacity gaps in *woreda* health service planning and programming? Please tell me it in detail

D. Issues about accountability and participation

22. To whom is the local institution accountable with respect to the exercise of the transferred powers?
23. What types of local accountability techniques are adopted to manage decentralized functions? How these are expressed?
24. How do the frontline health institutions engage the beneficiaries of health services in decision-making to be accountable to their local customers and stakeholders?
25. Is there community participation in managing decentralized healthcare service in your *woreda*? At what level?
26. Do you notice improvement in community participation in your *woreda and how*? What types of structures and forms of community participation mechanisms are there? How is this expressed? Do the ordinary people participate in service targeting, programming, planning, and implementation of a decentralized public health reforms? Please tell me it in detail.

27. Who defines and approve facility board and committee size, members, composition and the range of granted autonomy and accountability activities, etc? Tell me in a detail again some of the benefits and defects of local health service boards?
28. What are the observed improvements or effects of decentralization on *woreda* health service delivery in terms of local health coverage, quality of service delivery, utilization, and like that? Please tell me it in detail

.....**thank you once again**.....

Appendix 2**.** FGD Guidelines for local communities

1. Community participation in service programming and planning, implementation, monitoring and evaluation of local health system performance
2. General meeting and community and stakeholder's consultation
3. Forms and structures of participation. How these are expressed?
4. Access to health information and local facility's accountability holding mechanisms in place
5. Effects of decentralization reform on local health service delivery, management, coverage, service quality and utilization outcomes

Thank you!

Appendix 3**.** Survey Questionnaire

- Name of the *Kebele*: _____
- Questionnaire Identification Number: ___

Dear respondents! *I am _____ professional and now I am collecting data on utilization of DHFs for maternal care service. You were selected to be one of the participants in the study by chance. The study will be conducted through interview. Your name and other personal identifiers will not be recorded on data collection format and the information that you give us will be kept confidential and will also be used for this study purpose alone. A code number will identify every participant and no names will be used. If a report of the result is published, only summarized information of the total group will appear.*

Instruction: For the questions that have alternatives, encircle to the response of the mother and write appropriate response (s) on the space provided for questions for which alternatives are not given.

Thank you in advance for your cooperation!

A: Questions regarding ANC service visits to DHFs

A1. Predisposing health service seeking behavior of pregnant women and ANC visits

S/N	Questions	Response option	Remark
10	Women's age at last pregnancy	Age in complete years [_____]	
11	What is your marital status?	Single----------0 Married ----------1 Divorced----------2 Widowed----------3 Others [specify] ----------99	
12	What is your religion?	Protestant----------0 Orthodox----------1 Muslim----------2 Catholic----------3 Other [Specify] ----------99	
13	What is your ethnicity?	Oromo----------0 Amhara ----------1 Tigire----------2 Other [Specify]----------99	
14	The number of children was /were born to a woman?	Number [_____]	
15	Pregnant women's educational status?	Cannot read and write ----------0 Able to read and write ----------1 Primary school [1-8] ----------2 Secondary school [10-12] ----------3 College diploma or higher ----------4	
16	Husband's educational status?	Cannot read and write ----------0 Able to read and write ----------1 Primary school [1-8] ----------2	

		Secondary school [10-12] ----------3 College diploma or higher ----------4	
17	Decision on family resources for visiting ANC clinics	Husband alone----------1 Wife/Husband----------2 Wife alone----------3	

A2. Enabling behavioral characteristic and ANC service visits.

S/N	Question	Response	Remark
18	What is maternal occupation during last pregnancy?	Housewife----------0 Government Employed. ----------1 Small business/service----------2 Farmer----------3 If other [specify]----------99	
19	What is your husband's occupation during last pregnancy?	Farmer----------1 Merchant----------2 public employee/private employee------3 If other [specify]----------99	
20	Estimated household monthly income?	In Ethiopian birr: [_____]	
21	Estimated walking time to nearby decentralized healthcare facilities for minimum number of ANC visits?	In minutes: [_____]	
22	Frequency of home visits by HEWs during the last pregnancy period	No of visits made: [_____]	
23	Presence of functional radio and /or TV	Yes----------0 No----------1	
24	Location of maternal residence?	Urban----------0 Rural----------1	
25	Maternal *Kebele*	Write name your *kebele* [_____]	
26	How did you judge the availability of motorized transport service during your last labor?	Easily available ----------0 Difficult----------1	
27	Decentralized health facility available nearby your home during last birth?	Hospital or clinic----------0 Health center----------1 Health post----------2 If other [specify]---------- ----------99	
28	Place of delivery for last pregnancy?	Hospital or clinic----------0 Health center----------1 Health post----------2 Home----------3	

A3. Perceived maternal danger sign or complication characteristics and ANC visits.

S/N	Question	Response	Remark
30	Have you faced severe headache during your last pregnancy?	Yes----------0 No----------1	
31	Have you faced vaginal bleeding/gush during your last pregnancy?	Yes----------0 No----------1	
32	Have you faced swelling of hands/face during your last pregnancy?	Yes----------0 No----------1	
33	Have you faced severe high fever during your last pregnancy?	Yes----------0 No----------1	

34	Have you faced severe sever abdominal pain during your last pregnancy?	Yes----------0 No----------1	
35	Have you faced blood pressure during your last pregnancy?	Yes----------0 No----------1	
36	Have you faced blurred vision during your last pregnancy?	Yes----------0 No----------1	

A4. External environmental characteristic and ANC services.

S/N	Question	Response	Remark
37	Decentralized administrative entity of woman during her last pregnancy?	Ayana----------1 Ejere----------2 Angar----------3 Lalistu----------4	
38	Woman's residential location during last pregnancy?	Urban----------0 Rural----------1	

A5. Characteristics of ANC utilization and local health facilities attended

S/N	Question	Response	Remark
39	Number of visit(s) ANC woman have made to clinics during last pregnancy?	No visit----------1 One visit----------2 Two visit ----------3 Three visit ----------4 Four visit ----------5 Five visit ----------6 Six visit or mor----------7	
40	Decentralized healthcare facility types a woman visited to obtain a minimum ANC during her last pregnancy?	Hospital/clinic----------1 Health center----------2 Health post----------3	
41	Decentralized administrative *kebele* by ANC visits	Ayana----------1 Ejere----------2 Angar----------3 Lalistu----------4 No visit ----------5	
42	Timing of 1st ANC visit?	1st trimester----------1 2nd trimester----------2 3rd or 4th trimesters----------3 4th or more trimesters----------4 No visit----------5	

A6. Reasons for woman's non-utilization of local health facilities for ANC service

S/N	Question	Response	Remark
43	Lack of awareness	Yes----------1 No----------2	
44	Transportation problem	Yes----------1 No----------2	
45	Waiting time	Yes----------1 No----------2	
46	Illness was not severe	Yes----------1 No----------2	
47	Heavy workload	Yes----------1 No----------2	
48	Others	Yes----------1 No----------2	

B: Questions designed on delays and women's choices for delivery sites

B1. Socio-cultural and demographic characteristics.

S/N	Questions	Response option	Remark
101	Age of mother at last birth	Age in complete years [_____]	
102	What is your marital status?	Single----------0 Married ----------1 Divorced----------2 Widowed----------3 Others [specify] ----------99	
103	What is your religion?	Protestant----------0 Orthodox----------1 Muslim----------2 Catholic----------3 Other [Specify] ----------99	
104	What is your ethnicity?	Oromo----------0 Amhara ----------1 Tigire----------2 Other [Specify]----------99	
105	The number of children a woman gave birth to?	Number [_____]	
106	Maternal education	Cannot read and write ----------0 Able to read and write ----------1 Primary school [1-8] ----------2 Secondary school [10-12] ----------3 College diploma and above ----------4	
107	Did you have the right to discuss with your husband or partner to fix the delivery site for the last birth?	Yes----------0 No----------1	
108	Support of traditional practice to use local health facility for delivery care during last pregnancy	Yes----------0 No----------1	

109	Considered delivery at a health facility to be necessary	Yes----------0 No----------1	

B2. Women's perceived obstetric history and knowledge of maternal health care

S/N	Questions	Response	Remark
201	Where did you give birth to your last child?	Health institution----------0 Home----------1 If other [specify]----------99	
202	Did you have Antenatal visits to health facility during your last delivery?	Yes----------0 No----------1 If other [specify]----------99	
203	Did you have birth plans to deliver at a facility in case of complication during last birth?	Yes----------0 No----------1 If other [specify]--------- ----------99	
204	Have you had a knowledge of pregnancy, labor, and birth complication during last birth?	Yes----------0 No----------1	
205	Have you had any health problems during previous pregnancy	Yes, at least one ----------0 No, without any complication--------1	
206	Have you faced any health problems during last birth?	Yes, at least one ----------0 No, without any complication--------1	
207	Do you attend monthly a held pregnant women's meeting during your last pregnancy?	Yes----------0 No----------1	
208	Do the community health workers offer you home counseling during last birth?	Yes----------0 No----------1	
209	Do you have the knowledge of free service for childbirth during last pregnancy?	Yes----------0 No----------1	
210	Use of health facilities for the last birth	Yes----------0 No----------1	
211	Assistance during delivery at home	TBA Relative or neighbor Skilled person	
212	Do you have radio/TV in your home?	Yes----------0 No----------1	

B3. Women's economic and physical accessibility characteristics to use health facilities

S/N	Question	Response	Remark
301	Estimated household monthly income?	in Ethiopian Birr: [_____]	
302	What is maternal occupation during last birth?	Housewife----------0 Government Employed. ----------1 Small business/service----------2 Farmer----------3 If other [specify]----------99	
303	Location of maternal residence?	Urban----------0 Rural----------1	
304	Maternal *Kebele*	Write name your *kebele* [_____]	
304	Estimated walking distance to closest delivery site?	In hours: [_____]	
305	How did you judge the availability of motorized transport service during your last labor?	Easily available ----------0 Difficult----------1	
306	Decentralized health facility available nearby your home during last birth?	Hospital or clinic----------0 Health center----------1 Health post----------2	

		If other [specify]---------- ----------99	
307	Place of delivery for last pregnancy?	Hospital or clinic----------0 Health center----------1 Health post----------2 Home----------3	

C: Risk characteristics and utilization of DHFs for PNC use

S/N	Questions	Response option	Remark
C1. Socio-cultural and demographic characteristics			
401	Postnatal woman's age at last birth	Age in complete years [_____]	
402	Postnatal woman's marital status	Single----------0 Married ----------1 Divorced----------2 Widowed----------3 Other [specify] ----------99	
403	Postnatal woman's ethnicity	Oromo----------0 Amhara ----------1 Tigre----------2 Other [Specify]----------99	
404	Postnatal woman's religion	Protestant----------0 Orthodox----------1 Muslim----------2 Catholic----------3 Other [Specify] ----------99	
405	Postnatal woman's literacy level	Cannot read and write ----------0 Able to read and write ----------1 Primary school [1-8] ----------2 Secondary school [10-12] ----------3 College diploma and above ----------4	
406	Estimated average household monthly income	in Ethiopian Birr: [_____]	
407	What is postnatal woman's occupation during last birth?	Housewife----------0 Government Employed. ----------1 Small business/service----------2 Farmer----------3 If other [specify]----------99	
408	What is your husband's usual working status?	Farmer----------1 Merchant----------2 public employee/private employee-----3 If other [specify]----------99	
409	How long did it take for you to get from your home to the closest facility on foot?	In hours/minutes: [_____]	
410	How did you judge the availability of motorized transport service during your last labor?	Simple ----------0 Not simple----------1	
411	Location of postnatal woman's residence?	Urban----------0 Rural----------1	
412	Does the local community believe that postnatal visits are unnecessary?	Yes----------0 No----------1	
C2. Obstetric history and knowledge level on maternal health services			
501	Who do have the autonomy to make decision to go from home for PNC services whenever you like to?	Self----------1 Husband----------2 With partner ----------3 If other [specify]---------- ----------99	

502	Total number of children a postnatal woman gave birth to?	Number [_____]	
503	Do you have maternal visits to decentralized health facilities (DHFs) for ANC during your last delivery?	Yes----------0 No----------1 If other [specify]----------99	
504	Where did you give birth to your last child?	Health institution----------0 Home----------1 If other [specify]----------99	
505	Have you had a knowledge of pregnancy, labor, and birth complications during last birth?	Yes----------0 No----------1	
506	Mode of delivery during your last delivery?	Caesareans section----------1 With support of medical instrument----2 Normal/ vaginal delivery----------3 If other [specify]----------99	
507	Maternal exposure to postnatal complications during her last birth?	3 or more----------1 1-2 ----------2 No any----------3	
508	Do you have the knowledge of at least one postnatal complication after delivery to your last child?	Yes----------0 No----------1	
509	During your most recent delivery, were you informed at least about one possible postnatal complication a mother may face after childbirth?	Yes----------0 No----------1	
510	During your most recent delivery, did you know the definition and number of PNC visits recommended by WHO to a postnatal woman?	Yes----------0 No----------1	
511	Do you attend a monthly held pregnant women's meetings during your last pregnancy?	Yes----------0 No----------1	
512	During your most recent delivery, were you visited by health extension workers [at your home] during the first 3 days after delivery?	Yes----------0 No----------1	
513	During your most recent delivery, did have an aware of the availability/provision of PNC services in decentralized health facilities available at your kebeles? levels?	Yes----------0 No----------1	
C3. PNC service use by type of local facility center			
601	Postnatal woman's *kebele* (sub-district) or administrative decentralization entity in which the mother resides during last birth?	Name [_____]	
602	Did you have postnatal visits to decentralized healthcare facilities (DHFs) in your localities during your last delivery?	Yes----------0 No----------1	
603	How many facility-based PNC visits did you attend from DHFs for your most recent birth?	Number [_____]	

604	Time of check-up from a health professional after delivery and within 6 weeks postpartum	during the first 24 hours----------1 on the third days----------2 on the seventh days----------3 on the fourteenth days----------4 On the forty-second days----------5 No PNC visit----------6 If other [specify]---------- ---------99	
605	The type of decentralized health facilities you visited for postnatal care during your delivery to your last child?	hospital----------1 Health center----------2 Health post----------3 Private Clinic----------4 No PNC----------5 If other [specify]----------99	
606	Decentralized health facility available nearby your home during last birth?	Hospital ----------0 Health center----------1 Health post----------2 If other [specify]----------99	
607	Perception of quality of local service treatment by health care providers	Good----------1	
		Medium----------2	
		Not Good----------3	
608	Infant illness during postnatal period		
		Yes----------0	
		No----------1	

Appendix 4. Geo-referenced household GPS point data recording sample format used during field survey.

Household	X-coordinate	Y-coordinate
1		
2		
3		
4		
5		
6		
7		
8		
9		
10 . . . 459		

Appendix 5. Geo-referenced DHFs GPS point data recording sample format used during field survey.

Sr/no	Facility type	X-coordinate	Y-coordinate
1	Ayana health post		
2	Ayana health center		
3	Ejere health post		
4	Gida Ayana *woreda* hospital		
5	Angar health post		
6	Angar health center		
7	Lalistu health post		

Appendix 6**.** Georeferenced households X-Y spatial point data corresponding to their Respective *kebeles*, residence and maternal care utilization statuses

Sr.no	X-cordinate	Y-coordinate	Kebele	residential location	ANC status	Delivery site	PNC-status
1	243497.8	10933843	Ejere	Rural	Yes	Health facility	PNC Non-User
2	249130	1093528	Ejere	Rural	Yes	Health facility	PNC users
3	244290.9	1095409	Ejere	Rural	No	Home	PNC users
4	250138	1094028	Ejere	Rural	Yes	Health facility	PNC Non-User
5	249495	1087458	Ejere	Rural	No	Home	PNC users
6	248057	1092173	Ejere	Rural	No	Health facility	PNC Non-User
7	247632	1092113	Ejere	Rural	Yes	Health facility	PNC Non-User
8	244737.5	1094416	Ejere	Rural	Yes	Health facility	PNC users
9	247910	1088561	Ejere	Rural	Yes	Health facility	PNC Non-User
10	250408	1087485	Ejere	Rural	Yes	Health facility	PNC Non-User
11	249523	1087601	Ejere	Rural	4 or more	Health facility	PNC Non-User
12	247828	1088645	Ejere	Rural	No	Health facility	PNC Non-User
13	247830	10886402	Ejere	Rural	Yes	Health facility	PNC Users
14	249567	1087697	Ejere	Rural	No	Home	PNC Users
15	249189	1087626	Ejere	Rural	No	Health facility	PNC Non-User
16	249641	1087696	Ejere	Rural	No	Home	PNC Users
17	250245	1087670	Ejere	Rural	Yes	Health facility	PNC Users
18	250610	1087453	Ejere	Rural	Yes	Health facility	PNC Non-User
19	250160	1087714	Ejere	Rural	No	Home	PNC Users
20	250283	1087566	Ejere	Rural	4 or more	Health facility	PNC Non-User
21	249575	1095579	Ejere	Rural	No	Home	PNC Users
22	249576	1087487	Ejere	Rural	No	Health facility	PNC Non-User
23	247392	1088793	Ejere	Rural	Yes	Health facility	PNC Users
24	249481	1095906	Ejere	Rural	Yes	Health facility	PNC Non-User
25	249771	1095128	Ejere	Rural	No	Home	PNC Users
26	249325	1094521	Ejere	Rural	Yes	Health facility	PNC Non-User
27	247451.8	109534.3	Ejere	Rural	No	Home	PNC Users
28	245182.5	1095531	Ejere	Rural	Yes	Health facility	PNC Non-User
29	244684.4	1095557	Ejere	Rural	No	Home	PNC Users
30	246093.7	1096091	Ejere	Rural	Yes	Health facility	PNC Non-User
31	24624.64	1094421	Ejere	Rural	No	Home	PNC Non-User
32	246258.8	1095864	Ejere	Rural	4 or more	Health facility	PNC Non-User
33	246675.2	1096299	Ejere	Rural	No	Health facility	PNC Users
34	245484.9	1095500	Ejere	Rural	No	Home	PNC Non-User
35	244764.8	109555	Ejere	Rural	Yes	Home	PNC Non-User
36	247348	1088542	Ejere	Rural	4 or more	Health facility	PNC Non-User

37	245399.9	1094395	Ejere	Rural	No	Health facility	PNC Users
38	245752	1091133	Ejere	Rural	Yes	Health facility	PNC Non-User
39	246692	1089334	Ejere	Rural	Yes	Health facility	PNC Users
40	246853	1089375	Ejere	Rural	Yes	Health facility	PNC Non-User
41	248494	1092136	Ejere	Rural	4 or more	Health facility	PNC Users
42	247518.9	1095418	Ejere	Rural	Yes	Health facility	PNC Users
43	244887.1	1095473	Ejere	Rural	No	Health facility	PNC Users
44	24471.3	1095372	Ejere	Rural	No	Health facility	PNC Non-User
45	247318	1095299	Ejere	Rural	Yes	Home	PNC Users
46	247517.9	1095334	Ejere	Rural	Yes	Health facility	PNC Non-User
47	245822.2	1092464	Ejere	Rural	Yes	Home	PNC Users
48	247303	1095290	Ejere	Rural	Yes	Health facility	PNC Users
49	246426.4	1093753	Ejere	Rural	Yes	Home	PNC Non-User
50	246258.8	1095864	Ejere	Rural	Yes	Home	PNC Users
51	242429.3	1094532	Ejere	Rural	No	Health facility	PNC Non-User
52	249663	1095314	Ejere	Rural	4 or more	Home	PNC Users
53	250231	1094380	Ejere	Rural	Yes	Home	PNC Users
54	244921.4	1095204	Ejere	Rural	No	Home	PNC Non-User
55	248912	109673	Ejere	Rural	Yes	Home	PNC Non-User
56	249433	1096014	Ejere	Rural	4 or more	Health facility	PNC Non-User
57	249333	1095963	Ejere	Rural	No	Health facility	PNC Users
58	249209	1096212	Ejere	Rural	No	Health facility	PNC Users
59	249441	1095804	Ejere	Rural	4 or more	Health facility	PNC Users
60	249949	1094528	Ejere	Rural	No	Health facility	PNC Non-User
61	249884	1094739	Ejere	Rural	Yes	Home	PNC Non-User
62	244271.5	109489.1	Ejere	Rural	No	Home	PNC Users
63	24467.8	1093011	Ejere	Rural	No	Home	PNC Non-User
64	246164.4	1094517	Ejere	Rural	No	Home	PNC Non-User
65	246306.6	109383.6	Ejere	Rural	Yes	Health facility	PNC Users
66	246224.2	1091559	Ejere	Rural	4 or more	Health facility	PNC Non-User
67	245870.7	1092123	Ejere	Rural	Yes	Home	PNC Users
68	245787.1	1092970	Ejere	Rural	Yes	Health facility	PNC Users
69	246020.9	1093265	Ejere	Rural	Yes	Health facility	PNC Non-User
70	253218.7	1087492	Ejere	Rural	Yes	Home	PNC Non-User
71	253663.3	1090085	Ejere	Rural	Yes	Health facility	PNC Non-User
72	255791.1	1087418	Ejere	Rural	No	Home	PNC Non-User
73	250275.9	1090498	Ejere	Rural	4 or more	Health facility	PNC Non-User
74	252191.9	1089546	Ejere	Rural	Yes	Home	PNC Non-User
75	250466.4	1097231	Ejere	Rural	Yes	Home	PNC Non-User
76	250942.8	1095421	Ejere	Rural	4 or more	Home	PNC Users
77	249651.3	1097961	Ejere	Rural	No	Home	PNC Non-User

78	239758.2	1093338	Ayana	urban	Yes	Health facility	PNC Users
79	240370.4	1092166	Ayana	urban	Yes	Health facility	PNC Users
80	240349.8	1092040	Ayana	urban	4 or more	Health facility	PNC Users
81	240737.7	1091482	Ayana	urban	Yes	Home	PNC Users
82	240627.3	1091977	Ayana	urban	Yes	Health facility	PNC Users
83	240491.5	1092070	Ayana	urban	4 or more	Health facility	PNC Users
84	240419.5	1092043	Ayana	urban	Yes	Health facility	PNC Users
85	240519.8	1091362	Ayana	urban	Yes	Health facility	PNC Users
86	240446	1092275	Ayana	urban	Yes	Health facility	PNC Users
87	240540.5	1092354	Ayana	urban	Yes	Health facility	PNC Users
88	240315.3	1092905	Ayana	urban	4 or more	Health facility	PNC Users
89	240266.3	1092870	Ayana	urban	Yes	Health facility	PNC Users
90	240201.6	1092833	Ayana	urban	Yes	Health facility	PNC Users
91	240407.6	1092740	Ayana	urban	4 or more	Health facility	PNC Users
92	240175.7	1092895	Ayana	urban	Yes	Health facility	PNC Users
93	240296.8	1092414	Ayana	urban	4 or more	Health facility	PNC Users
94	240248.5	1092364	Ayana	urban	4 or more	Health facility	PNC Users
95	239698.6	1093414	Ayana	urban	Yes	Health facility	PNC Users
96	239738.2	1092898	Ayana	urban	Yes	Health facility	PNC Non-User
97	239862.7	1092785	Ayana	urban	4 or more	Health facility	PNC Users
98	239852.4	1092617	Ayana	urban	Yes	Health facility	PNC Users
99	239743.3	1092581	Ayana	urban	Yes	Health facility	PNC Users
100	239754.8	1092502	Ayana	urban	Yes	Health facility	PNC Users
101	239741.7	1092460	Ayana	urban	4 or more	Health facility	PNC Users
102	239772.4	1092373	Ayana	urban	Yes	Health facility	PNC Users
103	239633.7	1092169	Ayana	urban	Yes	Home	PNC Users
104	239564	1092397	Ayana	urban	4 or more	Health facility	PNC Users
105	239421.1	1092536	Ayana	urban	Yes	Health facility	PNC Users
106	239289.7	1092850	Ayana	urban	Yes	Health facility	PNC Users
107	239361	1092856	Ayana	urban	Yes	Health facility	PNC Users
108	239326.4	1092455	Ayana	urban	4 or more	Home	PNC Non-User
109	239698.1	1092314	Ayana	urban	Yes	Health facility	PNC Users
110	239770.9	1092265	Ayana	urban	Yes	Health facility	PNC Users
111	239338.6	1092482	Ayana	urban	4 or more	Health facility	PNC Users
112	239448.4	1092408	Ayana	urban	Yes	Health facility	PNC Users
113	239135.3	1092852	Ayana	urban	Yes	Health facility	PNC Users
114	239269.9	1092579	Ayana	urban	Yes	Health facility	PNC Users
115	239209.4	1092624	Ayana	urban	Yes	Health facility	PNC Users
116	239375.9	1092485	Ayana	urban	4 or more	Health facility	PNC Users
117	239280.7	1092850	Ayana	urban	Yes	Health facility	PNC Non-User
118	240210.1	1093183	Ayana	urban	4 or more	Health facility	PNC Users

119	238795.7	1094132	Ayana	urban	No	Home	PNC Users
120	239680	1093021	Ayana	urban	Yes	Health facility	PNC Users
121	239654	1093014	Ayana	urban	4 or more	Health facility	PNC Users
122	240829.7	1093507	Ayana	urban	Yes	Health facility	PNC Users
123	238640.3	1093973	Ayana	urban	Yes	Home	PNC Users
124	239442	1093156	Ayana	urban	Yes	Health facility	PNC Non-User
125	239682.1	1093507	Ayana	urban	No	Health facility	PNC Users
126	239076.8	1094019	Ayana	urban	No	Health facility	PNC Users
127	239231	1093053	Ayana	urban	4 or more	Home	PNC Users
128	239093.4	1093788	Ayana	urban	4 or more	Health facility	PNC Non-User
129	238877	1092809	Ayana	urban	Yes	Health facility	PNC Users
130	238783	1093068	Ayana	urban	Yes	Home	PNC Users
131	240872.7	1093229	Ayana	urban	Yes	Health facility	PNC Non-User
132	238779	1093462	Ayana	urban	Yes	Health facility	PNC Users
133	238846	1093602	Ayana	urban	4 or more	Health facility	PNC Users
134	238816	1093657	Ayana	urban	Yes	Health facility	PNC Non-User
135	238679	1093189	Ayana	urban	4 or more	Health facility	PNC Users
136	238795	1092936	Ayana	urban	Yes	Health facility	PNC Non-User
137	238836	1092873	Ayana	urban	Yes	Health facility	PNC Users
138	239106	1092677	Ayana	urban	Yes	Home	PNC Users
139	239397	1092961	Ayana	urban	4 or more	Health facility	PNC Users
140	238558	1093665	Ayana	urban	No	Home	PNC Users
141	239297	1093687	Ayana	urban	Yes	Home	PNC Users
142	239286	1093641	Ayana	urban	Yes	Health facility	PNC Users
143	238677	1093742	Ayana	urban	Yes	Home	PNC Non-User
144	239240	1093468	Ayana	urban	Yes	Home	PNC Users
145	239182	1093644	Ayana	urban	Yes	Health facility	PNC Non-User
146	239356	1092932	Ayana	urban	Yes	Health facility	PNC Users
147	239870.7	1092087	Ayana	urban	4 or more	Health facility	PNC Non-User
148	240495.1	1092751	Ayana	urban	4 or more	Health facility	PNC Users
149	240523	1092850	Ayana	urban	4 or more	Health facility	PNC Non-User
150	240512.5	1092707	Ayana	urban	4 or more	Home	PNC Users
151	240290.2	1092458	Ayana	urban	Yes	Home	PNC Users
152	238836	1092873	Ayana	urban	Yes	Health facility	PNC Users
153	239666.8	1092454	Ayana	urban	4 or more	Health facility	PNC Users
154	239094.4	1092806	Ayana	urban	Yes	Health facility	PNC Non-User
155	239131.1	1092746	Ayana	urban	Yes	Health facility	PNC Non-User
156	239161.8	1092684	Ayana	urban	4 or more	Health facility	PNC Users
157	239770.9	1092265	Ayana	urban	Yes	Home	PNC Users
158	23942497	1092721	Ayana	urban	Yes	Health facility	PNC Non-User
159	239467.9	1092958	Ayana	urban	4 or more	Health facility	PNC Users

160	239454.6	1092843	Ayana	urban	Yes	Health facility	PNC Non-User
161	239698.1	1092314	Ayana	urban	Yes	Home	PNC Users
162	239564	1092397	Ayana	urban	No	Health facility	PNC Users
163	239466.5	1.09E+08	Ayana	urban	4 or more	Home	PNC Users
164	239586.6	1092511	Ayana	urban	Yes	Health facility	PNC Users
165	239611.7	1092627	Ayana	urban	Yes	Health facility	PNC Users
166	239487.7	1092667	Ayana	urban	No	Health facility	PNC Non-User
167	239466.2	1092808	Ayana	urban	No	Health facility	PNC Users
168	239346.8	1092704	Ayana	urban	Yes	Health facility	PNC Non-User
169	239337.5	1092747	Ayana	urban	4 or more	Health facility	PNC Users
170	239421.1	1092536	Ayana	urban	4 or more	Health facility	PNC Non-User
171	239872	1092084	Ayana	urban	Yes	Health facility	PNC Users
172	230298.2	13632.62	Lalistu	Rural	No	Home	PNC Non-User
173	229911.4	10489.49	Lalistu	Rural	4 or more	Home	PNC Users
174	229773	1047360	Lalistu	Rural	Yes	Home	PNC Non-User
175	230600.9	1049122	Lalistu	Rural	No	Health facility	PNC Non-User
176	230754	1047506	Lalistu	Rural	No	Home	PNC Non-User
177	230558	1047298	Lalistu	Rural	Yes	Health facility	PNC Non-User
178	229866	1047297	Lalistu	Rural	Yes	Home	PNC Users
179	230476	1047145	Lalistu	Rural	Yes	Health facility	PNC Non-User
180	230328	1047215	Lalistu	Rural	Yes	Health facility	PNC Non-User
181	230222	1047340	Lalistu	Rural	Yes	Health facility	PNC Non-User
182	232173.3	1052557	Lalistu	Rural	Yes	Home	PNC Non-User
183	232142.3	1052498	Lalistu	Rural	Yes	Home	PNC Non-User
184	231587.9	102242.9	Lalistu	Rural	Yes	Home	PNC Users
185	231713.7	1051914	Lalistu	Rural	Yes	Home	PNC Non-User
186	231999.2	105240.5	Lalistu	Rural	Yes	Health facility	PNC Non-User
187	232075.6	1052491	Lalistu	Rural	No	Home	PNC Users
188	231876.9	1052406	Lalistu	Rural	Yes	Health facility	PNC Non-User
189	231580	1051516	Lalistu	Rural	No	Home	PNC Non-User
190	23174060	1051621	Lalistu	Rural	Yes	Home	PNC Non-User
191	231851.7	1052391	Lalistu	Rural	4 or more	Health facility	PNC Non-User
192	3633.6	1052543	Lalistu	Rural	Yes	Health facility	PNC Non-User
193	232103	1052532	Lalistu	Rural	No	Home	PNC Users
194	232049	1052512	Lalistu	Rural	No	Health facility	PNC Non-User
195	232000	1052487	Lalistu	Rural	No	Home	PNC Non-User
196	231983	1052456	Lalistu	Rural	No	Health facility	PNC Users
197	231667	1052355	Lalistu	Rural	No	Home	PNC Non-User
198	231613	1052318	Lalistu	Rural	No	Health facility	PNC Non-User
199	231611	1047793	Lalistu	Rural	No	Home	PNC Non-User
200	231507	1052212	Lalistu	Rural	No	Health facility	PNC Non-User

201	231964.4	1048897	Lalistu	Rural	No	Home	PNC Non-User
202	231523	1050773	Lalistu	Rural	No	Health facility	PNC Non-User
203	231614	1050888	Lalistu	Rural	Yes	Health facility	PNC Users
204	231528	1052139	Lalistu	Rural	No	Home	PNC Non-User
205	231795	1051145	Lalistu	Rural	4 or more	Health facility	PNC Non-User
206	232514.8	1050464	Lalistu	Rural	Yes	Health facility	PNC Users
207	233097.1	1049919	Lalistu	Rural	No	Home	PNC Non-User
208	231985	1052318	Lalistu	Rural	Yes	Home	PNC Users
209	231684	1052222	Lalistu	Rural	Yes	Health facility	PNC Non-User
210	231595	1052163	Lalistu	Rural	Yes	Home	PNC Non-User
211	231485	1052128	Lalistu	Rural	No	Home	PNC Non-User
212	231394	1052074	Lalistu	Rural	No	Health facility	PNC Users
213	2311072	1052178	Lalistu	Rural	No	Home	PNC Non-User
214	231203	1052147	Lalistu	Rural	Yes	Health facility	PNC Non-User
215	231276	1052063	Lalistu	Rural	Yes	Home	PNC Users
216	231425	1051877	Lalistu	Rural	No	Health facility	PNC Non-User
217	231410	1051877	Lalistu	Rural	4 or more	Health facility	PNC Users
218	231546	1051597	Lalistu	Rural	Yes	Health facility	PNC Non-User
219	231679	1051116	Lalistu	Rural	Yes	Health facility	PNC Non-User
220	2316680	10511012	Lalistu	Rural	No	Home	PNC Users
221	231664	1050932	Lalistu	Rural	Yes	Home	PNC Non-User
222	231663.2	1050926	Lalistu	Rural	No	Health facility	PNC Non-User
223	231633.5	1050530	Lalistu	Rural	No	Home	PNC Non-User
224	229002	1047299	Lalistu	Rural	Yes	Home	PNC Users
225	229315.2	1047553	Lalistu	Rural	Yes	Home	PNC Non-User
226	231290	1050244	Lalistu	Rural	No	Home	PNC Non-User
227	231106	1050081	Lalistu	Rural	No	Health facility	PNC Non-User
228	230993	1050131	Lalistu	Rural	No	Home	PNC Non-User
229	231405	1050551	Lalistu	Rural	No	Health facility	PNC Non-User
230	228936	1047597	Lalistu	Rural	Yes	Home	PNC Users
231	231319	1050396	Lalistu	Rural	No	Home	PNC Users
232	229507.6	10478200	Lalistu	Rural	Yes	Health facility	PNC Non-User
233	229581.9	1047750	Lalistu	Rural	Yes	Home	PNC Users
234	230063.7	1047828	Lalistu	Rural	Yes	Health facility	PNC Non-User
235	229562.8	104794.2	Lalistu	Rural	Yes	Health facility	PNC Non-User
236	230231.3	1047994	Lalistu	Rural	Yes	Home	PNC Users
237	230104.4	1048114	Lalistu	Rural	4 or more	Home	PNC Non-User
238	230017.4	108217.1	Lalistu	Rural	Yes	Home	PNC Users
239	229943.7	1048338	Lalistu	Rural	Yes	Home	PNC Non-User
240	229141	1047336	Lalistu	Rural	No	Health facility	PNC Non-User
241	229094	1047585	Lalistu	Rural	Yes	Home	PNC Users

242	229314	1048419	Lalistu	Rural	Yes	Health facility	PNC Non-User
243	229330	1048366	Lalistu	Rural	No	Home	PNC Users
244	229951	1048512	Lalistu	Rural	Yes	Home	PNC Non-User
245	230533	1048919	Lalistu	Rural	Yes	Health facility	PNC Users
246	230367	1048775	Lalistu	Rural	Yes	Home	PNC Non-User
247	229855	1048384	Lalistu	Rural	Yes	Health facility	PNC Non-User
248	230510	104884.6	Lalistu	Rural	4 or more	Home	PNC Non-User
249	229911	1048248	Lalistu	Rural	Yes	Health facility	PNC Non-User
250	230286	1048527	Lalistu	Rural	Yes	Health facility	PNC Users
251	229150	1048277	Lalistu	Rural	Yes	Home	PNC Non-User
252	229976	1047328	Lalistu	Rural	No	Home	PNC Non-User
253	229297.1	1047546	Lalistu	Rural	Yes	Health facility	PNC Users
254	229376.4	1.05E+08	Lalistu	Rural	No	Home	PNC Non-User
255	232077.8	1047835	Lalistu	Rural	No	Home	PNC Users
256	231280.8	1046389	Lalistu	Rural	Yes	Health facility	PNC Non-User
257	231497.6	1046615	Lalistu	Rural	No	Health facility	PNC Non-User
258	231355.7	1046939	Lalistu	Rural	Yes	Home	PNC Non-User
259	231350.7	1047159	Lalistu	Rural	No	Home	PNC Non-User
260	231464.1	1047301	Lalistu	Rural	4 or more	Home	PNC Users
261	231287.8	1047513	Lalistu	Rural	4 or more	Home	PNC Non-User
262	231198.6	10477616	Lalistu	Rural	4 or more	Home	PNC Users
263	230954.8	1047417	Lalistu	Rural	No	Health facility	PNC Non-User
264	229131	1046962	Lalistu	Rural	No	Health facility	PNC Non-User
265	229054	1046959	Lalistu	Rural	Yes	Health facility	PNC Users
266	229016	1046903	Lalistu	Rural	No	Home	PNC Non-User
267	228929	1046847	Lalistu	Rural	No	Home	PNC Non-User
268	2287715	1046781	Lalistu	Rural	Yes	Home	PNC Non-User
269	228758	1046697	Lalistu	Rural	No	Health facility	PNC Users
270	228862	1046714	Lalistu	Rural	No	Health facility	PNC Non-User
271	228880	1046729	Lalistu	Rural	No	Home	PNC Non-User
272	229145	1046781	Lalistu	Rural	No	Health facility	PNC Non-User
273	228939	1046498	Lalistu	Rural	Yes	Health facility	PNC Non-User
274	229327	1046955	Lalistu	Rural	No	Health facility	PNC Non-User
275	228905	1046460	Lalistu	Rural	No	Health facility	PNC Users
276	229099	1047140	Lalistu	Rural	Yes	Home	PNC Non-User
277	231350.4	1048262	Lalistu	Rural	4 or more	Health facility	PNC Non-User
278	229940	1043651	Lalistu	Rural	No	Home	PNC Non-User
279	228986	1046571	Lalistu	Rural	No	Health facility	PNC Non-User
280	229909	1043803	Lalistu	Rural	No	Home	PNC Non-User
281	229878	1044010	Lalistu	Rural	No	Health facility	PNC Non-User
282	229842	1044328	Lalistu	Rural	Yes	Health facility	PNC Non-User

283	229813	1044555	Lalistu	Rural	No	Health facility	PNC Non-User
284	229802	1044520	Lalistu	Rural	No	Home	PNC Non-User
285	229825	10444.45	Lalistu	Rural	No	Home	PNC Non-User
286	230031	1043877	Lalistu	Rural	Yes	Home	PNC Non-User
287	229995	1043846	Lalistu	Rural	Yes	Health facility	PNC Users
288	230004	1043920	Lalistu	Rural	4 or more	Health facility	PNC Non-User
289	229726	1045611	Lalistu	Rural	No	Home	PNC Non-User
290	229862	1044141	Lalistu	Rural	Yes	Home	PNC Non-User
291	229954	1044629	Lalistu	Rural	No	Home	PNC Non-User
292	229932	1044695	Lalistu	Rural	No	Home	PNC Non-User
293	239704	1057628	Lalistu	Rural	Yes	Health facility	PNC Non-User
294	239704	1057628	Lalistu	Rural	4 or more	Home	PNC Users
295	239704	1057628	Angar	Urban	Yes	Health facility	PNC Non-User
296	239704	1057628	Angar	Urban	Yes	Health facility	PNC Users
297	240578.4	105847.7	Angar	Urban	4 or more	Home	PNC Non-User
298	240597	105887.6	Angar	Urban	Yes	Health facility	PNC Non-User
299	240659.1	1058518	Angar	Urban	Yes	Health facility	PNC Users
300	240704.2	1058529	Angar	Urban	No	Health facility	PNC Non-User
301	240696	1058391	Angar	Urban	Yes	Health facility	PNC Users
302	240924.9	1058682	Angar	Urban	No	Home	PNC Non-User
303	240797	1058444	Angar	Urban	No	Health facility	PNC Non-User
304	240897	1058431	Angar	Urban	Yes	Home	PNC Users
305	240165	1057921	Angar	Urban	Yes	Health facility	PNC Non-User
306	236017.3	1059805	Angar	Urban	Yes	Health facility	PNC Users
307	240239	1057807	Angar	Urban	Yes	Health facility	PNC Non-User
308	240189	1057883	Angar	Urban	Yes	Home	PNC Users
309	240195	1057869	Angar	Urban	Yes	Home	PNC Non-User
310	240289	1058125	Angar	Urban	Yes	Health facility	PNC Non-User
311	240566	1057923	Angar	Urban	Yes	Health facility	PNC Non-User
312	240509	1057807	Angar	Urban	4 or more	Home	PNC Users
313	240571	1057823	Angar	Urban	Yes	Health facility	PNC Non-User
314	240636	1057841	Angar	Urban	No	Health facility	PNC Users
315	240738	1057898	Angar	Urban	No	Home	PNC Non-User
316	240619	1058021	Angar	Urban	Yes	Health facility	PNC Non-User
317	240490	105805	Angar	Urban	No	Home	PNC Users
318	240575	1058055	Angar	Urban	No	Health facility	PNC Non-User
319	236747.6	1959990	Angar	Urban	Yes	Health facility	PNC Users
320	237049.2	1059376	Angar	Urban	No	Home	PNC Non-User
321	240588	1058158	Angar	Urban	Yes	Health facility	PNC Users
322	240618	1058095	Angar	Urban	Yes	Health facility	PNC Non-User
323	240092	1058104	Angar	Urban	No	Health facility	PNC Non-User

324	240134	1058070	Angar	Urban	Yes	Home	PNC Users
325	240173	1058146	Angar	Urban	Yes	Health facility	PNC Non-User
326	240276.7	1058306	Angar	Urban	4 or more	Health facility	PNC Non-User
327	240183.8	1058245	Angar	Urban	Yes	Home	PNC Users
328	240210.1	1058267	Angar	Urban	No	Home	PNC Non-User
329	237980.5	1060234	Angar	Urban	Yes	Health facility	PNC Non-User
330	238165.7	1059350	Angar	Urban	Yes	Health facility	PNC Non-User
331	238737.2	1059207	Angar	Urban	No	Health facility	PNC Users
332	239467.5	1059218	Angar	Urban	No	Health facility	PNC Non-User
333	239705.6	1058853	Angar	Urban	No	Home	PNC Users
334	239922.6	1059276	Angar	Urban	No	Home	PNC Non-User
335	239673.9	1060398	Angar	Urban	No	Health facility	PNC Non-User
336	240139.6	1059800	Angar	Urban	Yes	Home	PNC Users
337	239038.9	1060398	Angar	Urban	Yes	Health facility	PNC Users
338	239668.6	1060371	Angar	Urban	4 or more	Health facility	PNC Non-User
339	240390.4	1058578	Angar	Urban	Yes	Health facility	PNC Non-User
340	2400234	1058204	Angar	Urban	No	Health facility	PNC Non-User
341	24004.65	1058238	Angar	Urban	No	Home	PNC Non-User
342	240081.1	1058238	Angar	Urban	Yes	Health facility	PNC Non-User
343	240050.7	1058300	Angar	Urban	Yes	Health facility	PNC Users
344	240100.8	1058297	Angar	Urban	Yes	Health facility	PNC Non-User
345	240131.6	1058320	Angar	Urban	4 or more	Health facility	PNC Users
346	240194.3	1058366	Angar	Urban	Yes	Health facility	PNC Users
347	24011018	1058180	Angar	Urban	Yes	Home	PNC Non-User
348	240836.3	1059025	Angar	Urban	Yes	Health facility	PNC Users
349	240951.1	1058829	Angar	Urban	Yes	Health facility	PNC Non-User
350	240276.7	1058470	Angar	Urban	Yes	Home	PNC Users
351	237680.2	1059892	Angar	Urban	Yes	Home	PNC Non-User
352	240253	1058173	Angar	Urban	No	Health facility	PNC Users
353	240253	1058173	Angar	Urban	No	Home	PNC Non-User
354	240253	1058173	Angar	Urban	No	Home	PNC Users
355	240253	1058173	Angar	Urban	No	Home	PNC Non-User
356	240355	1058269	Angar	Urban	No	Home	PNC Users
357	240379	1058298	Angar	Urban	No	Home	PNC Non-User
358	240254	1058279	Angar	Urban	No	Home	PNC Non-User
359	240136	1058242	Angar	Urban	Yes	Health facility	PNC Non-User
360	240632.2	105894.3	Angar	Urban	4 or more	Home	PNC Non-User
361	240160	1058220	Angar	Urban	Yes	Home	PNC Users
362	235673.4	1059472	Angar	Urban	Yes	Health facility	PNC Non-User
363	240263	1058460	Angar	Urban	No	Home	PNC Non-User
364	240254	1058553	Angar	Urban	No	Home	PNC Non-User

365	236100.7	1059257	Angar	Urban	No	Home	PNC Non-User
366	236219.7	1058936	Angar	Urban	No	Home	PNC Non-User
367	236537.2	1058821	Angar	Urban	No	Health facility	PNC Users
368	237005.5	1058829	Angar	Urban	Yes	Health facility	PNC Non-User
369	237481.8	1059503	Angar	Urban	4 or more	Home	PNC Non-User
370	237779.4	1059380	Angar	Urban	No	Home	PNC Non-User
371	240205	1058321	Angar	Urban	Yes	Health facility	PNC Non-User
372	240266	1058522	Angar	Urban	Yes	Home	PNC Non-User
373	240218	1058335	Angar	Urban	4 or more	Health facility	PNC Users
374	240261	1058428	Angar	Urban	Yes	Health facility	PNC Non-User
375	240254	1058553	Angar	Urban	No	Home	PNC Users
376	240188	1058315	Angar	Urban	No	Home	PNC Non-User
377	240132	1058773	Angar	Urban	Yes	Home	PNC Non-User
378	240142	1058478	Angar	Urban	Yes	Health facility	PNC Users
379	240149	1058710	Angar	Urban	No	Home	PNC Non-User
380	240150	1058400	Angar	Urban	Yes	Health facility	PNC Non-User
381	240227	1058623	Angar	Urban	Yes	Health facility	PNC Users
382	240542.9	1058927	Angar	Urban	No	Home	PNC Non-User
383	240451	1058855	Angar	Urban	Yes	Health facility	PNC Non-User
384	240437.5	1058956	Angar	Urban	Yes	Home	PNC Users
385	240337.7	1059003	Angar	Urban	Yes	Home	PNC Non-User
386	240280.8	1059072	Angar	Urban	No	Home	PNC Non-User
387	240141	1058370	Angar	Urban	4 or more	Health facility	PNC Users
388	240129	1058374	Angar	Urban	Yes	Health facility	PNC Non-User
389	240013	1058333	Angar	Urban	Yes	Health facility	PNC Non-User
390	238045.4	1059162	Angar	Urban	Yes	Home	PNC Users
391	240037	1058299	Angar	Urban	Yes	Health facility	PNC Non-User
392	239979	1058342	Angar	Urban	No	Home	PNC Non-User
393	239933.1	1058149	Angar	Urban	Yes	Health facility	PNC Users
394	239958.9	1058150	Angar	Urban	4 or more	Home	PNC Non-User
395	239954.3	1058148	Angar	Urban	No	Home	PNC Non-User
396	239954.3	1058148	Angar	Urban	No	Home	PNC Non-User
397	239972.5	1058186	Angar	Urban	Yes	Home	PNC Non-User
398	239964.9	1058147	Angar	Urban	Yes	Health facility	PNC Users
399	240004.5	1058227	Angar	Urban	No	Home	PNC Non-User
400	240044.3	1058269	Angar	Urban	4 or more	Home	PNC Non-User
401	240046.5	1058295	Angar	Urban	4 or more	Home	PNC Users
402	239946.3	1058131	Angar	Urban	No	Home	PNC Non-User
403	240250.7	1058440	Angar	Urban	Yes	Health facility	PNC Users
404	239953.8	1058127	Angar	Urban	No	Home	PNC Non-User
405	239891	1058195	Angar	Urban	Yes	Home	PNC Users

406	239899	1058212	Angar	Urban	No	Home	PNC Non-User
407	239906	1058255	Angar	Urban	No	Home	PNC Non-User
408	239906	1058255	Angar	Urban	Yes	Home	PNC Users
409	239911	1058283	Angar	Urban	No	Home	PNC Non-User
410	239874	1058289	Angar	Urban	4 or more	Home	PNC Non-User
411	239857	1058286	Angar	Urban	Yes	Health facility	PNC Users
412	239829	1058235	Angar	Urban	No	Home	PNC Users
413	239860	1058251	Angar	Urban	No	Home	PNC Non-User
414	239820	1058160	Angar	Urban	No	Home	PNC Non-User
415	239847	1058125	Angar	Urban	Yes	Health facility	PNC Users
416	239863	1058109	Angar	Urban	Yes	Home	PNC Non-User
417	239803	1058002	Angar	Urban	Yes	Health facility	PNC Non-User
418	239828	1058023	Angar	Urban	No	Home	PNC Non-User
419	239658	1058079	Angar	Urban	No	Health facility	PNC Non-User
420	239887	1058076	Angar	Urban	No	Home	PNC Non-User
421	239869	1058090	Angar	Urban	Yes	Health facility	PNC Users
422	239764	1058046	Angar	Urban	Yes	Home	PNC Non-User
423	239755	1058059	Angar	Urban	Yes	Health facility	PNC Users
424	239659	1058095	Angar	Urban	Yes	Health facility	PNC Users
425	239715	1057983	Angar	Urban	4 or more	Health facility	PNC Non-User
426	239800	1058073	Angar	Urban	Yes	Home	PNC Non-User
427	239773	1057998	Angar	Urban	Yes	Home	PNC Users
428	239838	1058146	Angar	Urban	Yes	Home	PNC Users
429	238886	1058426	Angar	Urban	No	Home	PNC Users
430	238823	1058515	Angar	Urban	No	Health facility	PNC Users
431	238648	1058641	Angar	Urban	No	Health facility	PNC Users
432	239142	1058929	Angar	Urban	No	Home	PNC Non-User
433	239191	1058850	Angar	Urban	No	Home	PNC Non-User
434	239410	1058607	Angar	Urban	Yes	Health facility	PNC Non-User
435	239420	1058454	Angar	Urban	No	Home	PNC Users
436	239378	1058288	Angar	Urban	No	Health facility	PNC Non-User
437	238295.4	1058856	Angar	Urban	Yes	Home	PNC Users
438	239469	1058273	Angar	Urban	Yes	Health facility	PNC Non-User
439	239701.3	1057952	Angar	Urban	Yes	Health facility	PNC Non-User
440	239837.9	1058068	Angar	Urban	No	Home	PNC Non-User
441	239187	1058380	Angar	Urban	No	Home	PNC Users
442	239024.3	1058566	Angar	Urban	No	Home	PNC Non-User
443	239029.5	1058623	Angar	Urban	4 or more	Health facility	PNC Users
444	239176.8	1058609	Angar	Urban	No	Home	PNC Non-User
445	239310.5	1058662	Angar	Urban	No	Health facility	PNC Users
446	238593	1059587	Angar	Urban	No	Home	PNC Non-User

447	239350.1	1058569	Angar	Urban	No	Health facility	PNC Non-User
448	239343.8	1058453	Angar	Urban	No	Health facility	PNC Non-User
449	239478.6	1058431	Angar	Urban	Yes	Home	PNC Users
450	239543.5	1058383	Angar	Urban	No	Health facility	PNC Users
451	239543.5	1058383	Angar	Urban	No	Home	PNC Non-User
452	239806.8	1058197	Angar	Urban	No	Home	PNC Users

Appendix 7. Georeferenced DHFs X-Y coordinate spatial data recorded during field survey

Sr/no	Facility type	X-coordinate	Y-coordinate
1	Ayana health post	239541.8	1092332
2	Ayana health center	239217.6	1093108
3	Ejere health post	246522.5	1092978
4	Gida Ayana hospital	240372.9	1093013
5	Angar health post	239724.2	1058110
6	Angar health center	240005.5	1058452
7	Lalistu health post	229183.6	1047869