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Service-Level Factors Affecting Completion of AnteNatal Care Attendance in Uganda

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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Lack of universal coverage of proven, low-cost, high-impact interventions—particularly for underserved and rural populations—remains a key reason for the high rates of maternal deaths in Uganda. Antenatal care (ANC) ensures early detection and treatment of pregnancy-related complications. Completion of recommended ANC visits remains suboptimal, particularly for rural women in Uganda. The purpose of this quantitative, cross-sectional study was to assess facility-level factors affecting completion of ANC attendance among women of reproductive age in a rural district in Uganda. The Dutton theory for initial and continued health services utilization was used to analyze the relationship between facility level factors and ANC service utilization. ANC service provision in eight health facilities was assessed using a service level index tool and 378 client ANC records from the eight health facilities were reviewed. The relationship between ANC completion and continued utilization, and facility service level index scores were analysed using logistic regression.   The results demonstrate that the service level index tool is a potential alternative to the ANC module of the service provision assessment tool for reviewing ANC services. Completion of ANC attendance was primarily predicted by better timing of ANC service provision and, to a lesser extent, by availability of medicines and medical supplies. With the exception of timing of ANC service provision, service-level factors do not have predictive value for continued use of ANC services after the initial visit. These findings can be used to improve availability, content, and organization of ANC services with the aim of motivating clients to complete the recommended number of ANC visits.

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Dedication

I would like to dedicate this dissertation to my friends and family. Special mention for my parents, Violet and Nathan Barungi, who introduced me to the value of education and scholarly learning. I also extend special thanks to my sons Jeremy and Gideon who have been a great source of motivation throughout the entire program.

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I would like to express my sincere gratitude to all those people without whom completion of this doctoral dissertation proposal would not have been possible.

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Table of Contents

List of Tables

List of Figures

Part 1: Overview

Introduction

The sustainable development goals (SDGs) adopted by the United Nations

General Assembly in 2015 underpin the importance of advancements in the health of

women as a critical prerequisite for achieving equitable global human development.

Pregnancy and childbirth still pose specific risks to women globally with an estimated

830 women dying daily from pregnancy- or childbirth-related problems (Akema et al.,

2016). Despite accelerated reductions in these deaths over recent years in both developed

and developing countries, the region of sub-Saharan Africa still accounts for over 50% of

the global pregnancy- or childbirth-related deaths (Akema at al., 2016). The World

Health Organization (WHO) emphasizes that maternal deaths are largely preventable

with the underlying driver being a lack of access to adequate care, not only during

childbirth but also during pregnancy (Say et al., 2014).

Antenatal care (ANC) is defined by WHO (2016a, p. 1) as the care provided by

skilled health care professionals to pregnant women and adolescent girls to ensure the

best health conditions for both mother and baby during pregnancy. Evidence from

developing countries indicates that most pregnant women begin ANC attendance late and

do not complete the recommended minimum number of visits (United Nations Children's

Fund [UNICEF], 2016; Zanconato et al., 2006). The global strategy for women's,

children's, and adolescent's health, therefore, prioritizes (a) addressing inequalities in

access to and quality of reproductive, maternal, and newborn health care services; (b)

ensuring universal health coverage for comprehensive reproductive, maternal, and

newborn health care; (c) addressing all causes of maternal mortality, reproductive and maternal morbidities, and related disabilities; (d) strengthening health systems to collect high-quality data in order to respond to the needs and priorities of women and girls; and (e) ensuring accountability in order to improve quality of care and equity (WHO, 2015a).

The lack of universal access to proven, low-cost interventions—particularly for underserved and vulnerable populations—remains a key reason for the persistently high rates of maternal deaths in most affected countries, which include countries located in sub-Saharan Africa and Southeast Asia. For example, while all women in high-income countries complete at least four ANC visits, only 40% of all pregnant women in low-income countries complete the recommended ANC visits (Say et al., 2014). Nonetheless, evidence has consistently shown that provision of ANC services has the potential to reduce maternal and perinatal morbidity and mortality both directly and indirectly through detection and treatment of pregnancy-related complications, identification of women and girls at increased risk of developing complications during labor and delivery, and prevention of prematurity, fetal growth restriction, congenital abnormalities or asphyxia. (Bauserman et al., 2015; Campbell & Graham, 2006; Carolli et al., 2001; European Board & College of Obstetrics and Gynecology [EBCOG], 2015; McDonagh, 1996; Souza et al., 2013).

As the countdown to 2030 progresses for achievement of SDG targets, it is imperative that bottlenecks to achievement in low-income countries are better understood to determine priorities and refocus resources. This study is aimed at adding to the existing body of evidence pertaining to optimal antenatal service utilization in Uganda, a low-

income country in sub-Saharan Africa. The additional evidence generated by this study could potentially be used to inform maternal health program design and funding decisions at health facilities in Uganda and in similar contexts.

Problem Statement

Maternal mortality in Uganda is unacceptably high, with a nationwide maternal mortality ratio of 336 per 100,000 live births, which is above the national target of 211 per 100,000 live births (Uganda Bureau of Statistics & Inner-City Fund [UBOS&ICF], 2017). Most of the maternal mortality in Uganda is caused by largely preventable conditions; according to the Ministry of Health of Uganda (MOH, 2016), drivers of maternal deaths are hemorrhage (42%), obstructed labor (22%), unsafe abortion (11%), pre-/eclampsia (12%), and sepsis (12%). Some maternal deaths are preventable not only through the provision of high-quality delivery care and access to emergency obstetric and neonatal care but in combination with high-quality ANC services (WHO, 2016a).

In Uganda, ANC attendance rate stands at 97.3% for one visit but drops to 59.9% for four or more visits (UBOS&ICF, 2017). Rural regions in the country have rates as low as 58% for four or more visits indicating noncompletion among up to 42% of pregnant women, with the worst-performing region in the country having a rate of 44.5% (UBOS&ICF, 2017). The purpose of this quantitative study was to assess facility-level barriers and facilitators affecting completion of ANC attendance among women of reproductive age in a rural district in Uganda, which could potentially contribute to improved design of patient-centered ANC services in this setting.

Background

Carroli et al. (2001) highlighted evidence that ANC has both indirect and direct effects on maternal and perinatal morbidity and mortality reduction. This is attributed to the opportunity to detect and treat pregnancy-related complications during ANC provision as well as the early identification and mitigation of risk factors for complications during labor and delivery (Carroli et al., 2001). The ANC platform is also widely used to prevent, detect, and manage human immunodeficiency virus (HIV) and malaria among pregnant women, thus further expanding its potential to address major indirect causes of maternal morbidity and mortality (Souza et al., 2013; WHO, 2016). Kuhnt and Vollmer (2017) reviewed evidence on the link between ANC services and health outcomes for children from 193 nationally representative studies conducted in 69 middle- and low-income countries. The health outcomes of interest included neonatal and infant mortality, low birth weight, underweight, and stunting. Kuhnt and Vollmer (2017) found statistically significant correlations between higher frequency of ANC attendance of mothers and lower infant and neonatal mortality, as well as lower stunting and underweight rates among their children. The authors concluded that improved access to and utilization of ANC services is an important strategy for addressing short- and long-term mortality and nutritional outcomes of children in middle- and low-income countries (Kuhnt & Vollmer, 2017). Similar findings were reported following a survival analysis on the association between ANC attendance and neonatal mortality in 57 low- and middle-income countries (Doku & Neupane, 2017). Doku and Neupane (2017), found a 55% lower risk of neonatal mortality among women who met WHO recommendations on

timing and frequency of ANC visits, thus concluding that ANC has a protective effect against neonatal mortality.

Current and Emerging ANC Service Delivery Models

ANC remains an essential milestone along the operational continuum of care for mothers and babies that constitutes prepregnancy, pregnancy (intrapartum), childbirth (interpartum) and postnatal (postpartum) phases (Lincetto et al., 2006). The goal of ANC service provision is to ensure adequate preparation for birth and to prevent detect, manage, and mitigate complications of pregnancy in addition to addressing both preexisting conditions and the effects of unhealthy lifestyles that could adversely affect pregnancy outcomes (Lincetto et al., 2006). Goal-oriented ANC delivered through a four-visit model proposed by WHO has until recently been the recommended clinical practice for ANC service delivery. This model consists of 11 essential elements, targets delivery of information and services at four specific timelines of pregnancy: 8–12 weeks, 24–26 weeks, 32 weeks, and 36–38 weeks, using a comprehensive yet focused approach to care (Lincetto et al., 2006).

Emerging evidence on what constitutes a positive pregnancy experience has led to revision of the four-visit model to an eight-contact model approved by WHO in 2016. The rationale for this revision is based on evidence that the four-visit model probably increases perinatal mortality compared with standard ANC with more visits (WHO, 2016a). The 2016 WHO ANC model therefore recommends a minimum of eight ANC contacts per patient. The overall aim of the 2016 WHO ANC model is to promote a patient-centered, respectful, and clinically standardized ANC contact experience for

every woman, delivered by skilled health workers who are supported by a functional

health system (WHO, 2016a). As low-income countries such as Uganda take concrete

steps to ensure full adaptation and implementation of the eight-contact ANC model, there

is an even more urgent need for a deeper understanding of the service level factors that

mediate progression to completion of recommended ANC attendances in rural,

developing country settings with low ANC completion rates (WHO, 2016b).

Trends in ANC Service Utilization

Over the period 2007–2014, a global increase in ANC utilization was registered in

part due to introduction of the focused ANC model by WHO for use in developing

countries (WHO, 2016a). Estimates indicate that over 80% of women worldwide access

ANC with skilled health personnel at least once during pregnancy, but this figure drops to

62% for women who receive at least four antenatal visits (UNICEF, 2017). Low ANC

attendance appears to correlate with high maternal mortality. Sub-Saharan Africa and

South Asia, which together account for 99% of the world's maternal deaths, also record

the lowest ANC attendance rates globally, at 52% and 46%, respectively (UNICEF,

2017).

Factors Affecting Optimal ANC Service Use Among Women

Five major domains have been studied in relation to utilization use of ANC

services: (a) sociodemographic characteristics, (b) sociocultural factors, (c) obstetric

factors, (d) economic factors, and (e) facility factors (Sumera et al., 2018). These can be

further grouped into three key domains: individual level factors, health provider factors,

and health system factors. In high-income countries, evidence points to an association

between sociodemographic and obstetric variables, such as age, education level, marital status, ethnicity, parity, and inadequate ANC utilization (Feigen de-Jong et al., 2011).

In middle- and low-income contexts, the effects of sociodemographic, sociocultural, and economic factors on optimal ANC utilization dominate the literature (Sumera et al., 2018). Studies conducted in India, Bangladesh, and Nepal have demonstrated significant predictive associations between education levels of women, access to media, income, occupation, residence, parity, religion, and frequency of ANC utilization (Kakati et al., 2016; Nausad et al., 2018; Poonam et al., 2016, Shahjahan et al., 2012; Singh & Jha, 2016). Singh and Jha (2016) also found that negative attitudes and behaviors of health workers influenced women's decision to drop out of ANC. A range of studies aimed at understanding factors that affect optimal ANC utilization have also been conducted in sub-Saharan Africa over the past 5 years and add further to the existing body of evidence in middle- and low-income contexts.

Individual, Provider, and System Factors Affecting Utilization of ANC Services in sub-Saharan Africa.

Utilization of health services is influenced by a complex interplay between the attributes of individual users, attributes of health providers, and health system attributes (Dutton,1986). Individual attributes include cultural and sociodemographic factors such as age, education level, geographic residence, marital status, occupational status, and information (Sumera et al., 2018). Health provider attributes include training, specialization, skills, and attitudes; health system attributes include distance to health facilities and costs associated with the services (Levesque et al., 2012).

Pell et al. (2013) conducted a study on factors affecting the timing and utilization of ANC services in socially and culturally diverse sites located in three countries in sub-Saharan Africa. The authors concluded that while individual factors play a role in the timing and frequency of ANC utilization, health provider and health system factors such as costs of ANC care and interactions with health care workers and flexibility of follow-up ANC appointments for women played a role in ANC service utilization (Pell et al., 2013). A study in Nigeria showed significant associations between health system factors such as distance to ANC services and individual factors such as knowledge about services, age, marital status, education level, and religion and utilization of ANC services but did not find any significant association between individual level factors parity, occupation, and utilization of ANC services (Onasoga et al., 2012). In another study based in Nigeria researchers found significant associations between individual factors such as age, marital status, parity, urban location, and utilization of ANC services (Maduka & Ogu, 2018). Maduka and Ogu (2018), did not find an association between education levels and ANC service utilization among Nigerian women.

In Ethiopia, studies have demonstrated the role of education level, age, occupation, parity, distance to the health facility or urban location, availability of traditional birth attendants, and knowledge of ANC services as significant determinants of ANC service utilization (Getasew et al., 2015; Muluwas et al., 2015; Yaya et al., 2017). In a recent study conducted in peri-urban Ghana, researchers found that age, household size, and occupational status were important individual-level determinants of ANC utilization among respondents (Akowuah et al., 2018). Akowuah et al. (2018), also

found that health system and health provider factors—specifically, distance to ANC facilities, quality of service, and client satisfaction—played a role in ANC utilization rates (Akowuah et al., 2018). Similarly, researchers in South Sudan found that factors that influence utilization of ANC services include health system factors such as distance to health facilities, and costs associated with ANC service,s and individual factors such as decision-making ability of women, and lack of knowledge about ANC services (Wilunda et al., 2017).

In Kenya, parity, education level, place of residence, and pregnancy acceptance determined utilization rates for ANC among women in urban slums (Muindi et al., 2016). In one study conducted in Cameron, researchers did not demonstrate any significant association between individual-level factors such as age, parity, and education level and ANC utilization, but did find that urban location was a significant predictor of number and timing of ANC visits (Halle-Ekane et al., 2014). Fagbamigbe and Idemudia (2015), found evidence that poor, rural women are more likely to be nonusers of ANC services.

Existing literature in low-income countries demonstrates that a range of factors influence utilization of ANC services. The extent of influence varies among different contexts and there is evidence of an interplay between individual-level factors on one hand and health-provider and health-system attributes on the other hand. While individual-level factors dominate the literature, there has been less research conducted that focuses on factors associated with health providers and service provision.

Factors Affecting Utilization of ANC Services in Uganda

ANC coverage in Uganda is near universal that ANC refers to one or more visits during pregnancy, but completion of recommended ANC visits has been persistently low (Benova et al., 2018). The most recent Uganda Demographic and Health Survey (DHS) results showed that the rate of ANC attendance is 97.3% for one visit but only 59.9% for four or more visits (UBOS&ICF, 2017). Individual-level factors, including religion, occupation, level of education, and parity, have been found to influence place of ANC attendance, number of ANC visits. and ANC booking time in Uganda (Kawungezi et al., 2015). Bbaale (2011), found significant associations between individual-level factors, such as regional disparities, religion, access to media, maternal decision-making autonomy, wealth status, timing of pregnancy, birth histories, and birth order and frequency and timing of ANC attendance in Uganda. Bbaale's (2011) findings strengthened the evidence that women in rural areas of Uganda have lower utilization rates of ANC compared to their urban counterparts. Research by Benova et al (2018), in Uganda further revealed that while coverage of ANC and other maternal health services for women in the lowest socioeconomic groups improved between 1991 and 2011, significant disparities in coverage determined by wealth, education, residence, and geographic zone framed this landscape during the same period. Using equity analysis, Benova et al. (2018) recommended expansion of ANC services to reach less-educated, more rural and poor women, a strategy that is best informed by an increased understanding of health service provision factors alongside other factors.

Table 1

Summary of the Literature on Factors Affecting ANC Use

Author/year	Country	Factors assessed	Results
Feign de-Jong, 2011	High income countries	Individual level: age, education, marital status, ethnicity, parity	
Sha & Jha, 2018	Nepal	Individual: education, access to media, income, occupation, residence, parity, religion Health provider: Attitudes	At an individual level, older age, higher parity, higher wealth quintile, urban residence, being married and knowledge about ANC services is significantly associated with higher utilization rates.
Shahjahan et al., 2012	Bangladesh	Individual: education, access to media, income,	
Kakati et al., 2016	India	occupation, residence, parity, religion	At the health provider level, health worker availability, a positive health worker attitude, client satisfaction with information and services provided is associated with higher utilization rates
Poonam et al., 2016	India		
Nausad et al., 2018	Bangladesh		
			At the health system level, longer distances, higher costs and availability of traditional birth attendants are associated with lower rates of ANC service utilization
Pell, 2013	Ghana, Kenya, Malawi	Health system: Cost of care Health provider: Interaction, flexibility of appointments	
Onasoga et al., 2012	Nigeria	Health system: Distance Individual: Knowledge, age, marital status, education level, religion, parity, occupation	
Maduka & Ogu, 2018	Nigeria	Individual: age, marital status, parity, urban location, education	
Getasew et al., 2015	Ethiopia	Individual: Education, age, occupation, parity, knowledge, urban location. Health system: distance, traditional birth attendants	

Author/year	Country	Factors assessed	Results
Akowuah et al., 2018	Ghana	Individual: age, household size, occupation Health system: distance. Health provider: quality of service, and client satisfaction	
Wilunda, 2017	South Sudan	Health system: distance to health facilities, costs of care. Individual factors: decision making ability of women, knowledge.	
Muindi et al., 2016	Kenya	Individual factors: parity, education, place of residence, pregnancy acceptance	
Halle-Ekane et al., 2014	Cameron	Individual factors: age, parity, education level, residence	
Yaya et al., 2017	Ethiopia	Individual: Income, education level, residence, parity	In this study, rural residence was associated with higher utilization levels
Kawungezi et al., 2015	Uganda	Individual: religion, occupation, education, and parity	In Uganda, higher education level, higher parity, having a job/trade, access to media, urban residence and belonging to a higher wealth quintile is associated with higher rates of ANC service utilization.
Bbaale, 2011	Uganda	Individual: region, religion, access to media, maternal decision-making autonomy, wealth status, timing of pregnancy, birth histories, birth order	
Benova et al., 2018	Uganda	Individual: wealth, education, residence and geographic zone	

Facility-Level Factors Affecting ANC Services Utilization

As summarized in Table 1, the evidence for the predictive association between

individual factors and ANC service utilization is strong. However, the evidence on health

provider and health system factors is less coherent except for health worker attitudes,

distance to services, and perceived cost of services (Akouwah et al., 2018; Getaseuw et

al., 2015; Onasoga et al., 2012; Sha & Jha, 2018). Health facilities are an integral part of

the health service delivery system of a country with the potential to influence consumer

behaviors and preferences. Information collected from health facilities is vital for

demonstrating the link between service inputs and type, quantity, and quality of services

eventually accessed by the population (Measure Evaluation, 2008). In addition, facility-

level factors can drive demand for services and, therefore, affect health care utilization

rates (Akowuah, 2018; Kiwanuka et al., 2008; Pell et al., 2013; Sha & Jha; 2018).

Although studies have been conducted on facility-level factors in the context of ANC

service provision, such as ANC service availability, ANC content, and organization of

ANC services, few of these studies provide insights into the relationships, if any, between

these factors and utilization rates of ANC services (Benova et al., 2018; Bucher et al.,

2015; Halle-Ekane et al., 2014; MOH, 2013).

Approaches for Assessing ANC Services Provision at Facility Level

Generation of health service delivery data in middle- and low-income countries is

largely based on health facility surveys and routine monitoring data from national health

management information systems. Health facility surveys typically focus on the domains

of access, availability, patient-centered care, and organization and management (Primary

Health Care Performance Initiative [PHCPI], 2015). Three tools have predominantly been

used for health facility surveys in these settings: the World Bank Service Delivery

Indicators tool, the WHO Service Availability and Readiness Assessment (SARA) tool,

and the WHO Service Provision Assessment (SPA) tool (PHCPI, 2015). Of these, the

SARA and the SPA tools have been useful in monitoring some aspects of maternal health

service provision. According to Sheffel et al. (2018), use of the SARA tool to assess

service provision generates data for the indicators comprising the WHO quality of care framework but only to a limited extent. There is consensus that the main limitation of this tool remains the overwhelming focus on service inputs to the detriment of actual provision of care and experience of care indicators, both of which influence quality of care in synergy with service inputs (PHCPI, 2015; Sheffel et al., 2018).

The WHO SPA tool can be used to generate data on service inputs such as financial, human resource, medicines, equipment, and health infrastructure, capturing all the core indicators already reflected in the SARA tool (DHS, n.d.). In addition, the SPA tool includes a module on provision of care broken down into three subdomains: (a) evidence-based practices for routine care and management of complications, (b) actionable information systems and functional referral systems for assessment of ANC and family planning services, (c) and a module on experience of care (Sheffel et al., 2018). According to DHS (n.d.), information on provision and experience of care for ANC and family planning services using the SPA tool is collected using observations, exit interviews, and provider interviews. Researchers point out that some of the limitations of the SPA tool include the high costs needed to collect information using this tool, time needed to complete the assessment, and the need for technical assistance when administering the tool in a survey (Fort, 2014). Nickerson et al. (2015), conducted a systematic review of health facility assessment tools used in middle- and low-income countries and found that inconsistency of methodology as well as the exclusion of essential elements of service provision present obstacles to comparability of findings within and across countries and over time. Specifically, Nickerson et al. (2015),

highlighted the limitations of service provision modules which provided an incomplete picture of a health facility's ability to delivery defined health service packages. These limitations could potentially constrain use of the tool at subnational level for purposes of collecting evidence to inform planning and programming.

For health managers at facilities and subnational levels, the health management information system (HMIS) represents the most accessible data for decision making and for assessment of service provision (Dwivedi et al., 2014). Primary data collection tools in the HMIS through which service data are generated are the patient registers, client records, and periodic summaries. The current national HMIS in Uganda is anchored on the web-enabled District Health Information System 2. Using this system, district health offices country-wide are expected to collect and summarize health information from 214 health subdistricts and more than 4,000 health facilities and submit reports to the central level (MOH, 2014). The information is stored electronically and transmitted as a district data set to the national level (MOH, 2012). Review reports, dashboards, and feedback reports are generated at the national level and disseminated to relevant stakeholders (MOH, 2012). Although the national e-health policy provides for electronic medical records, these have not been rolled out across the country (MOH, 2013). In a study conducted across 13 countries to assess maternal and newborn health content in the HMIS, Dwivedi et al. (2014) found that, for Uganda, information in the integrated antenatal registers tracked ANC first and fourth visits, thus generating data on enrollment into ANC and ANC dropout rates.

Figure 1

Model of the Factors Affecting Health Care Use
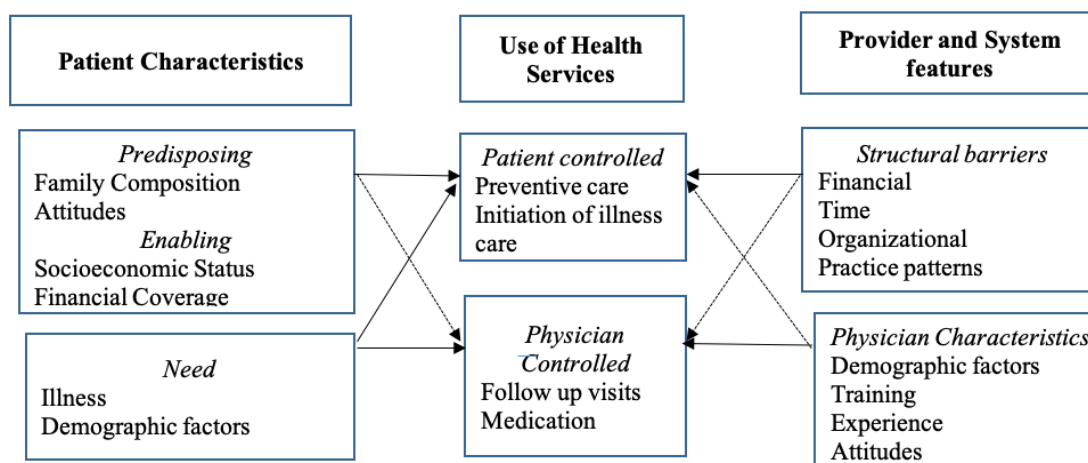
Note. Solid arrows denote expected major relationships, while dashed arrows denote less important relationships (Dutton, 1986).

The overarching theoretical framework for this study is based on the Dutton (1986) framework for understanding health services utilization, which is illustrated in Figure 1 above. The Dutton framework suggests that health services' utilization is a product of characteristics of service users and provider and system attributes (Levesque et al., 2012). Building on Andersen's behavioral model of health care utilization and aligning well with the organizational approach to health service utilization described by Anderson, Dutton postulated that the role of providers and system factors have been overlooked in previous attempts to understand the factors affecting service utilization (Andersen & Newman, 1973; Anderson, 1973, Dutton, 1986). Although initially applied in a developed country setting, the model considers various health service settings and their interaction with poor populations, which makes it applicable to a developing

country setting. Dutton postulated that the interaction between individual characteristics, health provider characteristics, and health system attributes influences patterns of initial and continued service utilization for a given condition or need. Dutton (1986), further postulated that first contact is initiated by the service user and is controlled by individual characteristics and health system attributes. However, according to this service utilization model, subsequent contacts are controlled by health provider characteristics, implying that health provider training and actions could influence continued utilization of a specified service (Dutton, 1986).

Scholars have highlighted the limited applicability of the Andersen-Newman framework for health service utilization and the Dutton model in low-income countries, arguing that these frameworks were designed with more advanced health systems in mind (Buor, 2004). Travassos and Martins (2004), however, argued that existing service utilization frameworks are relevant for developing countries when appropriately adapted to capture the unique characteristics of the context where each study is based.

In this study, an adapted Dutton framework was used for service utilization to examine factors affecting completion and noncompletion of recommended ANC attendances by women in rural Uganda. Utilization of ANC services measured by ANC attendance rates for completers and non-completers was the dependent variable. The independent variables included service-level barriers and facilitators such as ANC service availability, ANC service content, and ANC service organization.

Figure 2

Conceptual Framework
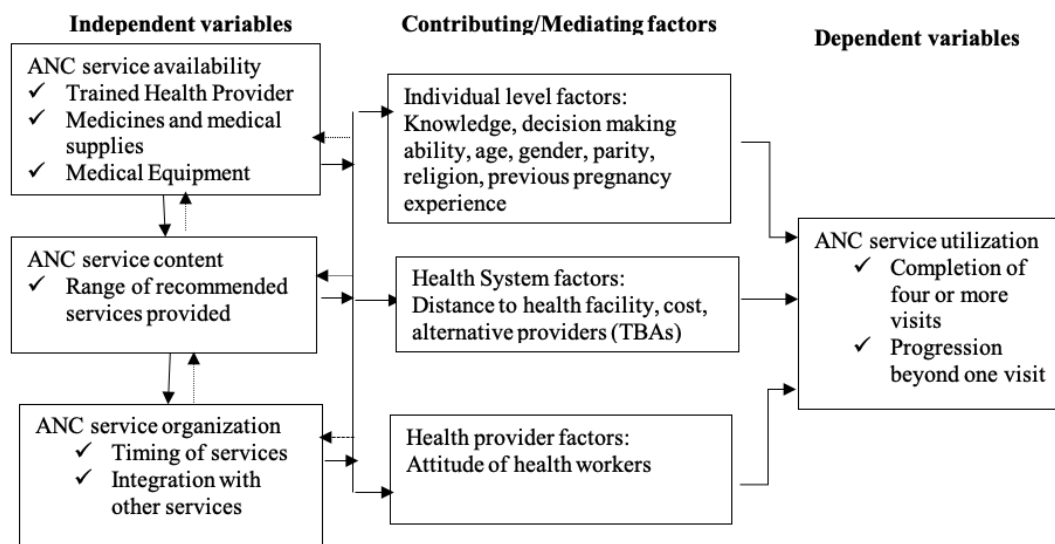
Gap in the Literature

There is limited evidence on service-level factors mediating actual completion of four or more ANC visits and progression to completion of recommended visits once ANC attendance is initiated.

Overview of the Manuscripts

This study was conducted using a three-manuscript approach with each study generating insights for the subsequent study.

Manuscript 1

The first manuscript was used to address the problem of measurement of ANC service provision. The two aspects of ANC service delivery most commonly studied are content and quality. However, studies on ANC service delivery have not used an

approach to measurement the key aspects of service availability, content, and organization, with the aim of generating an integrated service delivery index (PHCPI, 2015; Sheffel et al., 2018).

The research question for this manuscript was: To what extent is the service level index (SLI) tool for measurement of ANC service provision accurate and reliable compared to the SPA tool?

A cross-sectional, quantitative study was conducted to establish the accuracy and reliability of the SLI tool in comparison with the ANC module from the SPA tool, the latter being a standardized health facility assessment tool that captures elements in the provision of care and experience of care domains for ANC services (Measure Evaluation, 2008; Sheffel et al., 2018).

To determine the level of agreement between the SLI tool and the SPA tool, the results from the SLI measurement for each health facility in a sample of eight health facilities were compared to the results obtained by using the DHS SPA tool. Bland-Altman analysis was used to determine the statistical significance of differences between measurements obtained using the SLI tool and those obtained using the SPA tool (Altman & Bland, 1983; Bland & Altman, 1999).

Manuscript 2

There is limited understanding of the interaction between key service-level factors and utilization of ANC services in Uganda (Bbaale, 2011; Benova et al., 2018; Conrad et al., 2012; Kawungezi et al., 2015). The second study was aimed at determining the

relationship, if any, between ANC service availability, service content and service organization, and completion of four or more ANC visits.

This was a quantitative study involving investigation of the possible relationship between completion rates of users of ANC services, which was the dependent variable and a set of independent variables: provider availability, services hours, range of services, and level of service integration. Deductive techniques that are core to quantitative research were used to test the null hypothesis that there is no statistically significant relationship between provider availability, service hours, range of services, the level of service integration, and ANC completion (Creswell, 2009).

Logistic regression was used to analyze the data; 378 client records drawn from a sample of eight health facilities were reviewed. The independent variables were ANC service availability, service content, and service organization. Each of these was coded as ordinal variables using the actual values from the SLI scores of the health facilities. The dependent variable was completion of ANC attendance and was coded with two categories of pregnant women: those who completed four visits and those who did not complete four visits. The relationship between the ANC completion rates of clients sampled from records at the health facilities and facility scores on service-level factors of interest were analyzed. Listwise deletion was used to handle missing data. Using this approach, any cases with missing data were excluded and the remaining data were analyzed. Sensitivity analysis was conducted to determine the robustness of the results to the deviations from the missing at random assumption (Kang, 2013). The multiple R-

statistic was used to determine the strength of the relationship between the independent variables and the dependent variable (Heiman, 2011).

Manuscript 3

There is limited understanding of the mediating influence of key service-level factors on progression from the first ANC visit through to four or more ANC visits (Saad-Haddad et al., 2016). This study was aimed at answering the research question: How do ANC SLI scores predict progression to ANC completion among women at first, second, and third ANC visits?

This was a quantitative study involving investigation of the predictive relationship between progression to ANC completion at the first, second, and third visits by users of ANC services, which was the dependent variable, and facility scores on the SLI.

Logistic regression was used to analyze the data; 378 client records drawn from a sample of eight health facilities were reviewed. The independent variable was ANC service provision categorized as an ordinal variable at different levels based on an SLI score. The dependent variables were the four groups of service users categorized based on number of visits completed and coded as a nominal variable. Listwise deletion was used to handle missing data. Using this approach, any cases with missing data were excluded and the remaining data were analyzed. Sensitivity analysis was conducted to determine the robustness of the results to the deviations from the missing at random assumption (Kang, 2013).

Significance of the Study

Sundin and Willner (2007) postulated that the inequitable distribution of material resources and social capital account for the poor health outcomes observed in populations. The authors argued that social change is inherently about reshaping the deployment and distribution of resources to effect positive change in the health and welfare of people, particularly the most vulnerable (Sundin & Willner, 2007). The results of this study provide new, emergent information relating to ANC service utilization in a developing country setting. The additional evidence generated by this study could potentially be used to inform maternal health program designs and funding decisions at health facilities in Uganda and in similar contexts. A deeper understanding of the service-level factors that are potential structural barriers or facilitators to ANC services use would enable equitable targeting of resources to address identified barriers and to scale up identified enabling factors. This would potentially translate into increased allocative efficiency and reduced resource wastage. Resultant ANC services that are more patient-centered should increase client motivation to participate in ANC services, thus contributing to improved health outcomes and decreased maternal mortality at the community level and, ultimately, national level.

Summary

Uganda's maternal mortality ratio is still high despite recent improvements. ANC provision is a proven low cost and high impact intervention with both direct and indirect effects on reduction in both maternal and newborn mortality. The purpose of this study was to assess facility-level factors affecting completion of ANC attendance among

women of reproductive age in a rural district in Uganda. The study is supported by

Dutton's theoretical framework for service utilization, which proposes a role for service

delivery factors in initial and continued utilization of health services. Evidence for the

relationship between individual-level and some health-system and provider-level

characteristics and ANC service utilization are strong. However, studies on facility-level

factors have not addressed the relationship between these factors and completion of

recommended ANC attendances. The subsequent sections of this document outline three

proposed research studies aimed at generating additional evidence for the relationship, if

any, between ANC service availability, ANC service content, ANC service organization,

and completion and progression to four or more ANC visits in a rural setting.

Part 2: Manuscripts

Level of Agreement of the Service Level Index Tool With the Standard Service

Provision Assessment Tool for Measurement of Antenatal Care Service Provision

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Outlet for Manuscript

The target journal for this manuscript is the Reproductive Health Journal. URL: https://reproductive-health-journal.biomedcentral.com/. All articles submitted to this journal must include a Plain English Summary of not more than 250 words in addition to the abstract. References should be prepared strictly according to the Vancouver style (Reproductive Health Journal, 2019a). The selection of this journal is based on being a peer-reviewed, open access journal that aims at providing a platform for research on a wide array of reproductive health issues including social and gender issues, sexual health, country and population specific issues, assessment of service provision, education and training and broader aspects of gynecological and obstetrical topics related to reproductive health (Reproductive Health Journal, 2019b). In addition, the journal has a favorable policy on researchers based in low- and middle-income countries who are encouraged to make submissions and are eligible for waivers of the article processing fee as a mechanism of ensuring a global outlook for the journal (Reproductive Health Journal, 2019c).

Abstract

Low-income countries depend on health facility surveys and routine health monitoring data for service delivery assessments. Previous studies on antenatal care (ANC) service delivery have not used measurement parameters that accurately and cost-effectively capture aspects of ANC service availability, content, and organization in an integrated manner. The aim of this study was to assess the level of agreement of the Service Level Index (SLI) tool for measurement of ANC service provision with the standard Service Provision Assessment (SPA) tool. The SLI tool integrates different subdomains inherent in the process of ANC service provision at the health-facility level by using selected, key elements of these subdomains as proxy measures to minimize complexities pertaining to time and effort needed to assess service delivery. In this study, the level of agreement of the SLI tool in comparison with the antenatal care module from the SPA tool was investigated. To assess this, the results from the SLI measurement for each health facility were compared to the results obtained by using the SPA tool. Bland-Altman analysis was used to determine the statistical significance of differences between measurements obtained using the SLI tool and those obtained using the SPA tool. The mean difference ($d\bar{P}$), and standard deviation (*SD*), were estimated as 0.1 and 0.507, respectively. LOA between the two tools (–1.19 to 1.46) indicates that for 95% of observations, scoring of ANC service provision made by the SLI tool was between 1.19% less and 1.46 % more than a score made by the reference SPA tool. The results demonstrated that the SLI tool is a potential alternative to the ANC module of the SPA tool for reviewing ANC services at the microlevel.

Background

Efforts to measure delivery of evidence-based, high-impact interventions targeting reductions in maternal mortality have centered around measurement of the coverage of specific health services and health interventions. Generation of health service delivery data in middle- and low-income countries typically depends on health facility surveys and routine monitoring data from national health management information systems (Measure Evaluation, 2004). From the service provision perspective, the two aspects of antenatal care (ANC) service delivery most commonly studied by health care scholars are content and quality. However, researchers conducting studies on ANC service delivery have not used an approach to measurement that captures key aspects of service availability, content, and organization with the aim of generating an integrated ANC service delivery index.

The capacity to provide health services that are responsive to the needs of the target population is an important aspect of accessibility of health services (Donabedian, 1973). As defined by both Donabedian (1973) and Dutton (1978), this widens the scope of health care accessibility to include how services and health resources enable or constrain target populations from using them. Service provision measurements are important for ensuring that health managers have a good understanding of where the gaps and weaknesses are, but these measurements need to be done using validated methods so that any resultant data are considered credible by all stakeholders, including policy makers (Paxton, 2006). Service provision data collected at the health-facility level have the advantage of being more detailed and also more relevant to the local level context.

This is important for guiding evidence-based decision making by local health managers. This study involved the development and assessment of a Service Level Index (SLI) tool to potentially enable rapid, accurate assessment of service provision at the health-facility level with minimal loss of rigor and validity.

The theoretical framework for this study was based on the World Health Organization (WHO, 2016c) conceptual quality of care framework for maternal and newborn health (Figure 3). According to the WHO (2016c), this framework emphasizes the processes that occur inside health facilities as they relate to individual- and facility-level outcomes. Two main subdomains are the focus of the facility-level process domain of the framework, namely provision of care and experience of care (WHO, 2016c). The framework recognizes the cross-cutting importance of availability of competent, motivated human resources and of the physical resources that are prerequisites for good quality of care in health facilities that, in turn, affects utilization of these services (WHO, 2016c). The study drew upon key aspects within the provision of care subdomain and the cross-cutting elements of the WHO quality of care framework to assess ANC service provision levels of participating health facilities using an SLI score.

Aim of the Study

This study aimed to contribute to service-level provision assessments for maternal health care. The study involved evaluating the level of agreement of a novel SLI tool in comparison with a standard Service Provision Assessment (SPA) tool. The novel SLI tool integrates different subdomains inherent in the process of service provision at the health-

facility level by using selected key elements of these subdomains as proxy measures to minimize complexities pertaining to time and effort needed to administer the tool.

Study Significance

Limitations of existing tools for measurement of ANC service provision include focus on service inputs with limited measurement of actual provision of care and high costs, time, and technical assistance requirements to administer the tools (Fort, 2014; PHCPI, 2015; Sheffel et al., 2018). In addition, Nickerson et al. (2015) highlighted the limitations of service provision modules provide incomplete picture of the ability of health facilities to deliver defined health service packages. There is need for generation of data at national, subnational, and facility levels using rapid, cost-effective approaches for data collection and interpretation.

Research Question and Hypotheses

The study was framed around the following research question and hypotheses:

RQ: What is the level of agreement of the SLI (SLI) tool for measurement of ANC service provision with the standard SPA tool?

H_0: There is no significant level of agreement between the SLI tool and the standard SPA tool.

H_A: There is a significant level of agreement between the SLI tool and the standard SPA tool.

Figure 3

World Health Organization Quality of Care Framework for Maternal and Newborn Health
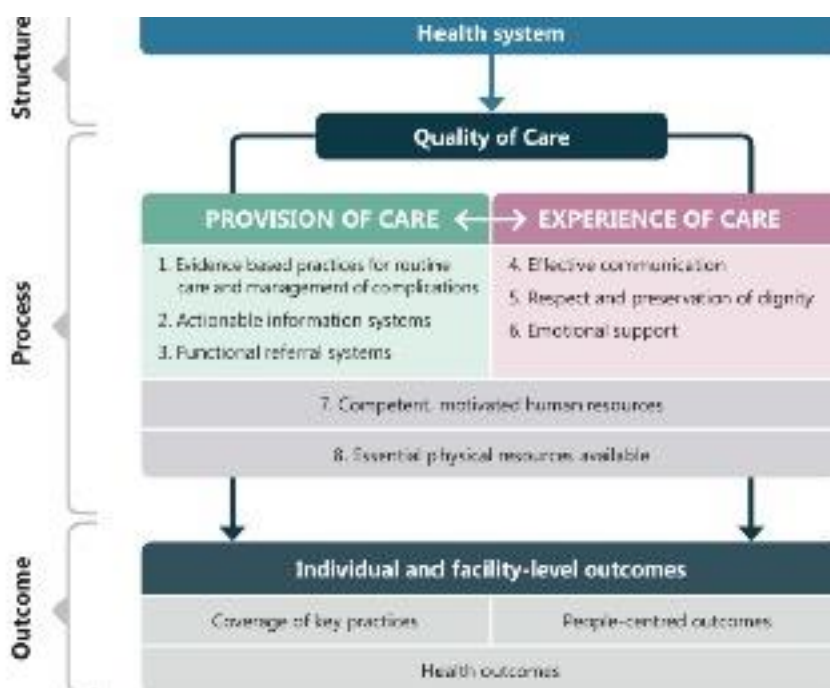
Summary of the Existing Literature

A review of the literature for tools related to SPAs in the field of maternal health in low- and middle-income countries revealed that generation of health service delivery data are largely based on health facility surveys and routine monitoring data from national health management information systems. Health facility surveys typically focus on the domains of access, availability, patient-centered care, and organization and management (Primary Health Care Performance Initiative [PHCPI], 2015). Three tools have predominantly been used for health facility surveys in these settings: the World Bank Service Delivery Indicators tool, the WHO Service Availability and Readiness Assessment (SARA) tool, and the WHO SPA tool (PHCPI, 2015). Of these, the SARA

and the SPA tools have specifically been useful in monitoring some aspects of maternal health service provision. According to Sheffel et al. (2018), use of the SARA tool to assess service provision generates data for the indicators comprising the WHO quality of care framework but only to a limited extent. There is consensus that the main limitation of this tool remains the overwhelming focus on service inputs to the detriment of actual provision of care and experience of care indicators, both of which influence quality of care in synergy with service inputs (PHCPI, 2015; Sheffel et al., 2018).

The WHO SPA tool can be used to generate data on service inputs such as financial, human resource, medicines, equipment, and health infrastructure, capturing all the core indicators already reflected in the SARA tool (DHS, n.d.; WHO, 2015b). In addition, the SPA tool includes a module on provision of care broken down into three subdomains: evidence-based practices for routine care and management of complications, actionable information systems, and functional referral systems for assessment of ANC, and family planning services, and a module on experience of care (Sheffel et al., 2018). According to DHS (n.d), information on provision and experience of care for ANC and family planning services using the SPA tool is collected using observations, exit interviews, and provider interviews. Researchers point out that some of the limitations of the SPA tool include the high costs needed to collect information using this tool, time needed to complete the assessment, and the need for technical assistance when administering the tool in a survey (Fort, 2014). Nickerson et al (2015), conducted a systematic review of health facility assessment tools used in middle- and low-income countries. The authors found that inconsistency of methodology as well as the exclusion

of essential elements of service provision presents obstacles to comparability of findings within and across countries, and over time. Specifically, Nickerson (2015), highlighted the limitations of service provision modules which provided an incomplete picture of a health facility's ability to delivery defined health service packages. These limitations could potentially constrain use of the tool at subnational level for purposes of collecting evidence to inform planning and programming.

For health managers at facility and subnational levels, the health management information systems represent the most accessible data for decision making and for assessment of service provision (Dwivedi et al., 2014). Primary data collection tools in the HMIS through which service data are generated are the patient registers, client records and periodic summaries. The current national health management information system in Uganda is anchored on the web-enabled district health information system 2. Using this system, 112 district health offices country-wide are expected to collect and summarize health information from 214 health sub-districts and more than 4,000 health facilities and submit reports to the central level (Uganda Ministry of Health [MOH], 2014). The information is stored electronically and transmitted as a district dataset to the national level (MOH, 2012). Review reports, dashboards and feedback reports are generated at national level and disseminated to relevant stakeholders (MOH, 2012). Although the national e-health policy provides for electronic medical records these have not been rolled out across the country (MOH, 2013a). In a study conducted across 13 countries to assess maternal and newborn health content in the HMIS, Dwivedi et al. (2014), found that for Uganda, information in the integrated antenatal registers tracked

ANC first and fourth visits thus generating data on enrollment into ANC and ANC dropout rates.

Gap in the Literature

From the literature review, it can be deduced that standard, validated tools for health SPA exist, however simpler tools suitable for facility level assessments in low- and middle-income countries have not been widely disseminated or rigorously compared to these standard tools as a means of increasing their use and acceptability at these levels of service delivery.

Methods

Study Design and Setting

This was a cross-sectional, quantitative study to establish the level of agreement of the SLI tool in comparison with the ANC module from the SPA tool, the latter being a standardized health facility assessment tool that captures elements in the provision of care and experience of care domains for ANC services (Measure Evaluation, 2008; Sheffel et al., 2018).

The setting for the study was a Private Not for Profit (PNFP) health facility in Iganga, District, Uganda.

Characteristics of Study Participants

The study involved investigation of ANC service provision at a health facility in Eastern Uganda. Health workers interviewed included clinical health facility staff directly involved in management of the health facility.

Variables and Data Sources

Data sources included structured interviews with health facility managers.

Instrumentation and Measures

Facility assessment scores on the service level factors of interest were obtained using both the SLI tool and the SPA tool. The SPA methodology uses validated tools to collect information about the availability of different facility-based health services and the level of readiness of health facilities to deliver these services (DHS, n.d.). Service availability and readiness are assessed when using the Service Provision tools in the following four areas (DHS, n.d.):

i.   The availability of different health services,

ii.   The extent to which facilities are prepared to provide different health services,

iii.   The extent to which the service delivery process follows accepted standards of care,

iv.   The level of satisfaction that clients and health providers have with the service delivery environment.

The SPA involves the use of an inventory questionnaire to collect information on availability of health services at the time of the visit. Observation protocols for ANC, family planning, and child health are used to observe client-provider consultations. Client exit interviews are used to interview clients leaving the facility and health worker interviews are used to assess provider training, experience, and perceptions about

working conditions. The SPA focuses on 10 health service domains outlined in Table 2

(DHS, n.d.)

Table 2

Major Health Service Domains Assessed by the Service Provision Assessment Instruments

1	Infrastructure, resources, and systems	6	Sexually Transmitted Diseases
2	Child Health	7	Malaria
3	Maternal and newborn health	8	Tuberculosis
4	Family Planning	9	Basic Surgery
5	HIV/AIDS	10	Non-communicable diseases

This study involved administration of the ANC module of the SPA inventory

questionnaire which also included process alignment to standards of care. Client and

health provider satisfaction modules of the standard SPA were not included in the

assessment for purposes of this study.

The SLI tool was developed and administered in this health facility alongside the

ANC module of the SPA tool to enable collection of information on ANC service

availability, ANC service content, and ANC service organization. The indicators included

in the SLI tool are listed in Table 3.

Table 3

Key Parameters of ANC Service Provision in the Service Level Index Tool

ANC service availability	Availability of trained health provider
	Availability of medicines and medical supplies
	Availability of medical equipment
ANC service content	Range of recommended services provided
ANC service organization	Timing of services
	Integration with other services

Statistical Analysis

To determine the level of agreement between the SLI tool and the SPA ANC module, the results from the SLI measurement for the health facility were compared to the results obtained by using the MEASURE/DHS SPA tool. Bland-Altman analysis was used to determine the statistical significance of differences between measurements obtained using the SLI tool and those obtained using the SPA tool (Altman & Bland, 1983; Bland & Altman, 1999). The analysis focused on comparison of the paired measurements in the selected health facility using the two data instruments. 30 assessment parameters were found to overlap between the two tools of which 12 were under the service availability component, 17 were under the service content component, and 1 was under the service organization component.

All plots for the Bland-Altman method comparisons were graphed using SPSS version 27.0. Correlation between the scores from the SPA tool and those from the SLI tool was determined using regression. A plot of the differences between the tools was done according to method described by J. M. Bland and D. G. Altman (1). Values are presented as means and standard deviations (SD). Regression analysis to detect proportional bias was also estimated using SPSS 27.0.

Results

Overall scores and observation-specific scores obtained by using the two data collection tools to assess ANC service provision in the same health facility are displayed in Tables 4 and 5 respectively. Overall higher scores were obtained when using the SLI tool (SLI) compared to the ANC module of the SPA tool (SPA). The sample statistics and

one sample T-test are presented in Tables 6 and 7. The mean difference (*dÞ*) and standard

deviation (*SD*), were estimated as 0.1 and 0.507 respectively. This finding implies that

the SLI tool scores on average 0.1 higher than the ANC module of the SPA tool. The

results of regression analysis to detect proportional bias are presented in Table 8. The

standardized beta-coefficient is -0.205 (p-value = 0.276) which indicates no proportional

bias. Figure 4 shows the Bland Altman plots for the 30 corresponding observations

measured by the two data collection tools. The limits of agreement are -0.9 and 1.1

(lower, upper LOA) respectively. The limits of agreement range from -0.9 to 1.1 implies

that the SLI tool can score as much as 1.1 higher and 0.9 lower than the ANC module of

the SPA.

Table 4

Overall Scores Obtained by Using the Two Data Collection Tools to Assess ANC Service
Provision in the Same Health Facility

Observation	SLI Tool (S1)	SPA Tool (S2)	S1 – S2	Mean (S1+S2)/2
ANC Service Availability	14	12	2	13
ANC Service Content	20	17	3	18.5
ANC Service Organization	2	3	-1	6.5
Overall Score	36	32		

Table 5

Bland Altman Analysis Comparing the Service Provision Assessment Tool (ANC Module) and the Service Level Index Tool

Observation	SLI	SPA	Mean	Diff
Adult stethoscope	3	1	2	2
Blood pressure apparatus (may be digital or manual sphygmomanometer with stethoscope)	1	1	1	0
Fetal stethoscope (pinard or electronic)	1	1	1	0
Light source (lamp or hand torch, with power source)	1	1	1	0
Fetoscope	1	1	1	0
Weighing scale	1	1	1	0
Syphilis rapid tests	1	1	1	0
HIV rapid tests	1	1	1	0
Urosticks (protein)	1	1	1	0
Tetanus vaccine (prevention care)	1	1	1	0
Iron and folate (anti-anemia)	1	1	1	0
Sulfadoxine-pyrimethamine (Fansidar) (anti-malarial)	1	1	1	0
Iron supplementation	1	1	1	0
Folic supplementation	1	1	1	0
Tetanus toxoid caccination	1	1	1	0
Intermittent preventive treatment for malaria	1	1	1	0
HIV rapid diagnostic test	1	1	1	0
Urine protein testing	2	1	2	1
Urine glucose testing	2	1	2	1
Rapid test for syphilis	1	1	1	0
Diagnosis and treatment of STIs	2	1	2	1
Counseling on recommended minimum number of ANC visits for each pregnancy	1	1	1	0
Counseling on birth preparedness	1	1	1	0
Family planning counseling	1	1	1	0
HIV counseling and testing	1	1	1	0
Counseling on use of insecticide treated nets to prevent mosquito bites and malaria	1	1	1	0
Nutrition counseling	1	1	1	0
Counseling about breastfeeding	1	1	1	0
Counseling on newborn care	1	1	1	0
How many days per week does this facility offer antenatal care services?	2	3	2.5	-1

Table 6

One Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Diff	30	.13	.507	.093

Table 7

One Sample t Test

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Diff	1.439	29	.161	.133	-.06	.32

Figure 4

Plot of Histogram and Normal Probability Plot of the Differences (Evaluation of Assumptions)
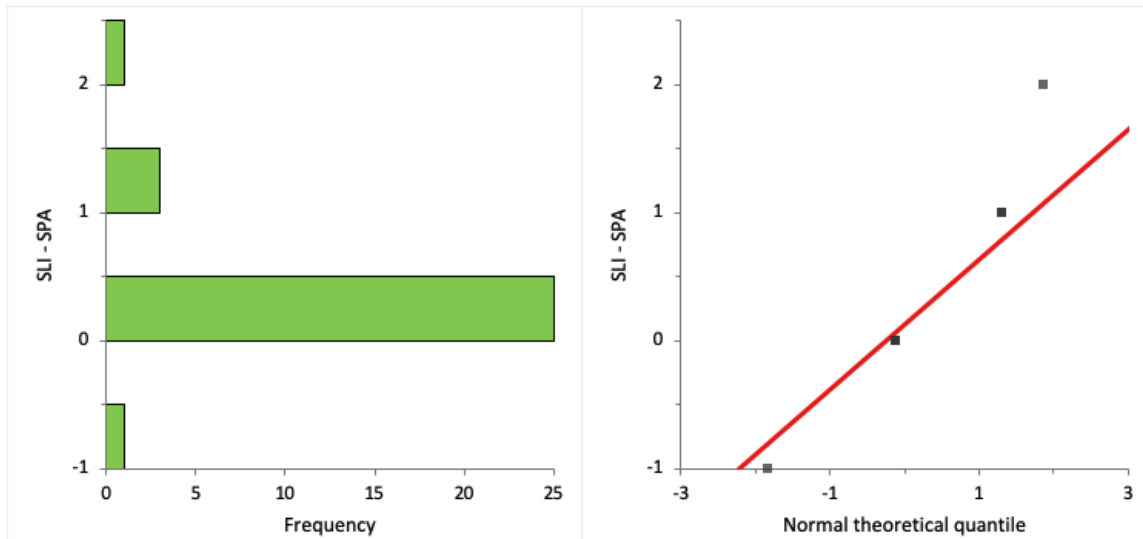
Note. Using the Shapiro-Wilk test of normality, the W-test is 0.55 (p-value < 0.0001) which indicates distribution of the population is not normal.

The majority of differences between observation scores (n= 30) was zero (25 observations), a difference of 1 was recorded for 3 observations and a difference of -1 and -2 for the remaining 2 observations.

Table 8

Regression Analysis to Detect Proportional Bias

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.205a	.042	.008	.505
a. Predictors: (Constant), Mean				

ANOVAa					
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.315	1	.315	1.233	.276b
	Residual	7.152	28	.255		
	Total	7.467	29			
a. Dependent Variable: Diff						
b. Predictors: (Constant), Mean						

Coefficients a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.263	.149		1.766	.088
	Mean	-.103	.092	-.205	-1.110	.276
a. Dependent Variable: Diff						

Figure 5

Bland Altman Plots
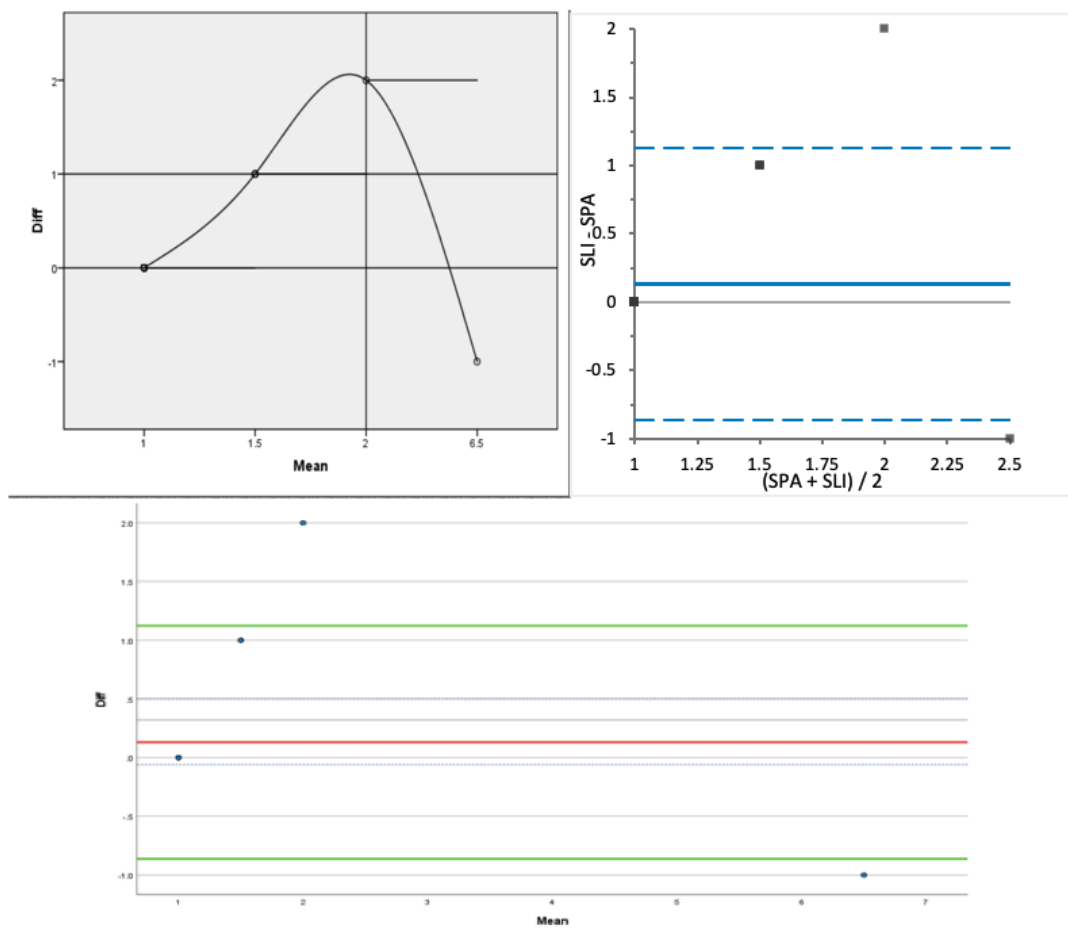
Note. Solid red horizontal line shows the mean difference, dotted blue line shows the 95 % confidence interval of the mean difference, solid green lines show limits of agreement (±1.96 standard deviation of the differences).

Figure 6

Inter-Tool Agreement Analysis
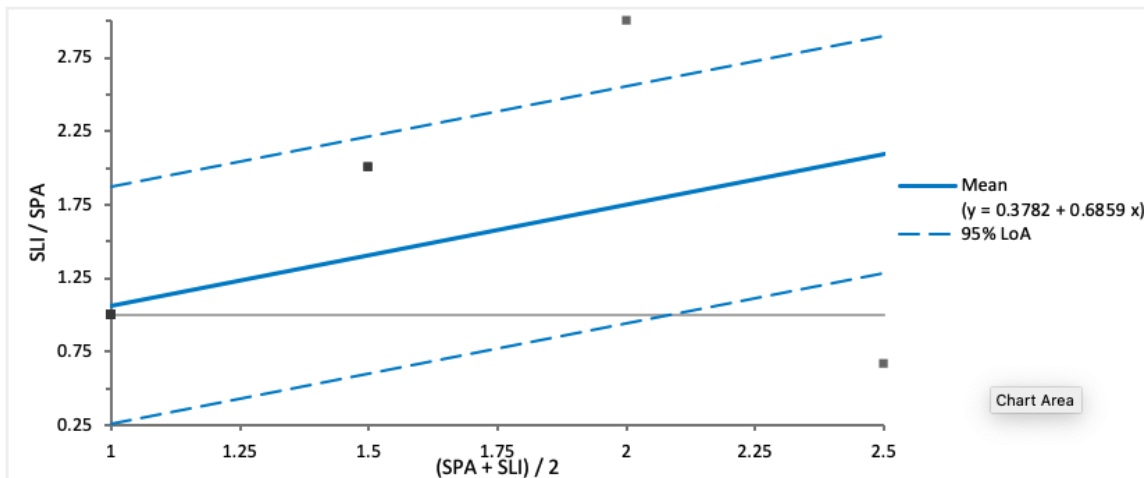
The Bland–Altman plot in Figure 6 for interrater agreement analysis (n = 30) shows the limits of agreement with 95% confidence intervals and regression fit of the differences on the means. 95% LOA quantifies whether the tools agree sufficiently for use in assessment of ANC service provision. In Table 9, 95% LOA between the two tools (-1.19 to 1.46) indicates that for 95% of observations, scoring of ANC service provision made by the SLI tool was between 1.19% less and 1.46 % more than a score made by the reference (SPA) tool.

Table 9

Fit Differences

Parameter	Estimate	95% CI		SE
Mean difference	0.1	-0.06	to 0.32	0.09
95% Lower LoA	-0.9	-1.19	to -0.53	0.16
95% Upper LoA	1.1	0.80	to 1.46	0.16
SD	0.5			

Discussion

The primary purpose of this study was to assess the level of agreement between the novel SLI tool and the ANC module of the SPA tool (reference tool) with the aim of demonstrating applicability of an alternative tool for use in assessment of ANC service provision.

It was not possible to identify similar studies reporting results of levels of agreement between the MEASURE-DHS SPA tool and other tools. This study has demonstrated that there is close agreement between the SLI tool and ANC module of the SPA tool. Ideally the Bland-Altman results should have very small bias, narrow limits of agreement and few outliers (Scott et al., 2003). The current study found no evidence of proportional bias (β= -0.205, p-value = 0.276), restricted limits of agreement (-1.19 to 1.46) and a mean difference of 0.13 which is close to zero. For 83% of the assessed measures of ANC service provision that corresponded on both tools, there was no difference in health facility scores.

For three of the observations, the SLI tool consistently registered a higher score than the ANC module in the SPA tool by one point. These three observations were found under the ANC range of services domain and included urine protein testing, urine glucose testing and diagnosis and treatment of STIs. Differences in scores for these observations are likely due to design differences between the tools. For example, the ANC module of the SPA tool requires assessor observation of urine testing for protein and provides for three responses: action observed (score 1) action reported but not seen (score 2) and action not routinely done (score 3). On the other hand, the SLI tool relies solely on health

provider responses for assessment of the same service and provides for three responses: yes, always provided (score 1), sometimes provided (score 2) and not provided at all (score 3). This means that if the action was observed using the SPA tool, the facility would score 1 point but if the same service was only sometimes provided despite being observed at the time of conducting the study, the SLI would assign a score of 2 for the same service. For urine glucose testing and STI diagnosis and treatment, the ANC module of the SPA tool assesses the availability of tests as a basis for scoring service content while the SLI tool again relies on provider responses as to the routine and consistent provision of the specific services.

Conversely for assessment of equipment availability under the service availability domain, while the SLI tool combines availability and functionality of medical equipment into a single score, the SPA tool separates availability and functionality scores for individual equipment, making final scoring more cumbersome for the assessor. For example, for a stethoscope, the SLI provides for three responses and three scores: available and functional (score 1), available but not functional (score 2) and not available (score 3). Using the SLI tool, any equipment not physically verified by the assessor is therefore scored as not available (3). The SPA tool provides for five responses and five scores for the same piece of equipment: observed (score 1), reported, not seen (score 2), not available (score 3), if observed or reported and not seen; yes, functional (score 1) or no, not functional (score 2). Using this example, SPA tool would assign a score of 2 for a stethoscope that was reported as available but not seen by the assessor and thereafter assign a score of 1 if the equipment was reported as being functional. The SLI tool would

however assign a score of 3 (not available) if availability of this equipment could not be physically verified by the assessor at the time of conducting the study.

The single observation assessed under the timing of services domain was number of days per week that the facility provided ANC services to client. This observation gave rise to an outlier value likely explained by the design effect. This observation is not assigned a score in the SPA tool while for the SLI tool, the number of service provision days are assigned a specific score making comparability prone to errors in analysis and interpretation. These factors could explain the disagreement between the tools for these observations.

An interesting finding from the study is that the Service Level Indicator tool presents some advantages over the ANC module of the SPA tool. The SLI tool is focused only on ANC services and therefore more comprehensively covers this aspect of service provision.

<div align="center">**Limitations**</div>

Although a minimum of 30 observations (sample size) has been recommended by some scholars, the Bland Altman analysis is considered sensitive to outliers in the data, a limitation that is best addressed by a larger number of observations (Gerke et al., 2017). The limitation of this study is the use of a relatively low number of observations for assessing the level of agreement of the scores obtained from the ANC SPA tools as this was dictated by the number of corresponding measures on the tools being compared.

Implications for Practice and Social Change

Evidence on agreement between existing and new health facility assessment tools has the potential to reduce the costs of health facility assessments and increase the use of data from assessments by health managers at the microlevel for service provision improvements. This study contributes to the field by introduction of a tool that can be used interchangeably with an already existing tool to gather more comprehensive information with a specific focus on the provision of ANC services. The study paves the way for development of similar tools focused on other aspects of service provision but designed and tested for agreement with already existing and validated tools such as the MEASURE-DHS SPA. This has implications for service providers, researchers, and policy makers with the view of expanding the number of tools available to support decision making and strengthening health systems.

Recommendations for Further Research

Further research is needed on the design of new facility assessment tools and testing of levels of agreement with already existing and validated tools. Future research should aim at demonstrating the level of rigor and standards required to build confidence in new, simplified assessment tools. In addition, future research could provide insights into the use and validation of the SLI tool in contexts other than Uganda.

Conclusion

In conclusion, in the present study the level of agreement between two tools for measuring ANC service provision was assessed and the results indicate that the tools can be used interchangeably within Uganda. The results also demonstrated that the SLI tool is

a potential alternative to the ANC module of the SPA tool for reviewing ANC services at

the microlevel.

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Completion of Four or More ANC Visits Among Women of Reproductive Age in a

Rural District in Uganda: A Quantitative Study on the Role of Service-Level Factors

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Outlet for Manuscript

The target journal for this manuscript is the Reproductive Health Journal. URL:

https://reproductive-health-journal.biomedcentral.com/. All articles submitted to this

journal must include a Plain English Summary of not more than 250 words in addition to

the abstract. References should be prepared strictly according to the Vancouver style

(Reproductive Health Journal, 2019a). The selection of this journal is based on being a

peer-reviewed, open access journal that aims at providing a platform for research on a

wide array of reproductive health issues including social and gender issues, sexual health,

country and population specific issues, assessment of service provision, education and

training and broader aspects of gynecological and obstetrical topics related to

reproductive health (Reproductive Health Journal, 2019b). In addition, the journal has a

favorable policy on researchers based in low- and middle-income countries who are

encouraged to make submissions and are eligible for waivers of the article processing fee

as a mechanism of ensuring a global outlook for the journal (Reproductive Health

Journal, 2019c).

Abstract

Uganda is one of 24 countries in the world where 70% of global maternal deaths occur. Evidence indicates that antenatal care (ANC) has both indirect and direct effects on maternal and perinatal morbidity and mortality reduction. In Uganda, the ANC attendance rate stands at 97.3% for one visit, but 59.9% for four or more visits. The aim of this quantitative study was to assess service-level factors affecting completion of ANC attendance defined by completion of four or more visits among women of reproductive age in a rural district in Uganda to contribute to design of patient-centered ANC services. Facility assessment scores on the service-level factors of interest for health facilities were obtained using a service level index tool. The relationship between the ANC completion rates of clients sampled from records at the health facilities and facility scores on service-level factors of interest were analyzed. Regression was conducted to determine the predictive relationship between ANC service availability, ANC service content, and ANC service organization, and completion of ANC attendance. The model was statistically significant, $\chi 2$ (6) = 26.118, p < 0.05, and accounted for approximately 17.3% of the variance of ANC attendance completion ($R2$ = .173). Completion of ANC attendance was primarily predicted by better timing of provision of ANC services, and to a lesser extent by higher levels of availability of medicines and medical supplies. This study demonstrated that service-level factors have a predictive value for completion of ANC attendance. The findings can be used to improve availability, content, and organization of ANC services with the aim of enhancing positive experiences for clients and motivating them to complete the recommended number of ANC visits.

Background

Maternal mortality in Uganda decreased over the 5-year period between 2011 and 2016, dropping from 438 deaths per 100,000 live births to 336 deaths per 100,000 live births (UBOS & ICF, 2017). Despite this progress, the current maternal mortality ratio is high by global standards, with Uganda being among 24 countries where 70% of maternal deaths globally occur (United States Agency for International Development [USAID], 2015). Of the 1.5 million babies born in Uganda annually, 38,000 are stillborn (Mbonye et al., 2012). More than half the stillbirths in sub-Saharan Africa are antepartum (occurring during pregnancy before the onset of labor) with the major underlying causes being hypertensive disorders of pregnancy, infections, and placental complications resulting in antepartum hemorrhage (Alliance for Maternal and Newborn Health Improvement [AMANHI], 2018; Hirst, 2018). Together, these three conditions account for three quarters of antepartum stillbirths in sub-Saharan Africa for which the cause is known (AMANHI, 2018). In Uganda, specifically, hypertensive disorders, anemia, and syphilis are some of the leading maternal conditions associated with stillbirths (Uganda Ministry of Health [MOH], 2016). Evidence indicates that antenatal care (ANC) has both indirect and direct effects on maternal and perinatal morbidity and mortality reduction (Carroli et al., 2001). For example, Lawn et al. (2016), demonstrated that higher national coverage of ANC is strongly associated with lower antepartum stillbirth rates. Furthermore, 50% of stillbirths and 60% of early neonatal deaths are not linked to specific maternal conditions, underscoring the need for early identification of at-risk pregnancies during the prenatal period (Allanson et al., 2015). ANC from a skilled

provider is a proven intervention aimed at monitoring pregnancy to reduce morbidity and

mortality risks for the mother and child that may occur during pregnancy, delivery, and

the postnatal period (World Health Organization [WHO], 2016a). This is attributed to the

opportunity that the ANC platform provides to detect and treat pregnancy-related

complications and to ensure early identification and mitigation of risk factors for

complications during labor and delivery (Carroli et al., 2001). In Uganda, the ANC

attendance rate stands at 97.3% for one visit but drops to 59.9% for four or more visits

(UBS&ICF, 2017). Rural regions in Uganda have rates as low as 58% for four or more

visits, indicating noncompletion of up to 42% among pregnant women in rural areas, with

the worst performing region in the country having a rate of only 44.5% (UBOS&ICF,

2017).

Figure 7

Model of Factors Affecting Health Care Utilization
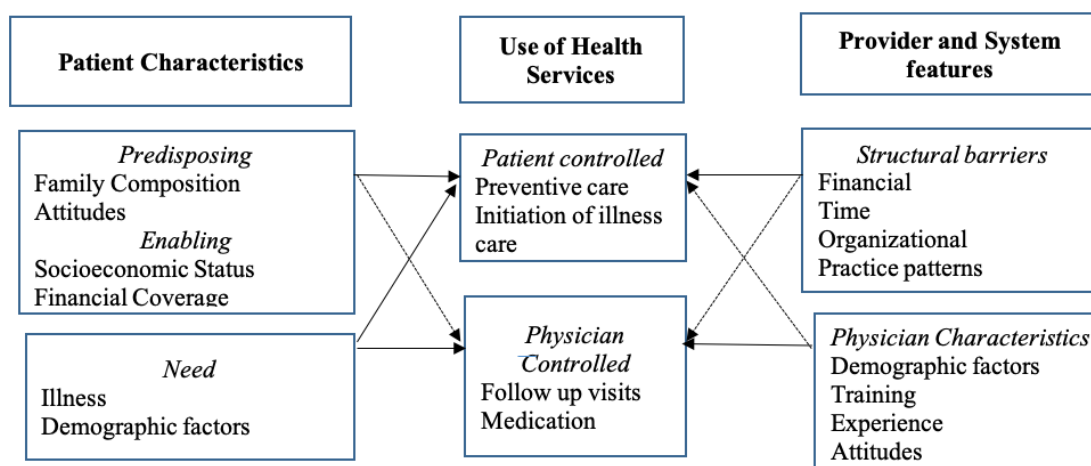
Note. Solid arrows denote expected major relationships, while dashed arrows denote less

important relationships (Dutton, 1986).

The theoretical framework for this study was based on Dutton's (1986) framework for understanding health services utilization as illustrated in Figure 7 above. Dutton's framework suggests that health services' utilization is a product of characteristics of service users and provider and system attributes (Levesque et al., 2012). Building on Andersen's behavioral model of health care utilization and aligning well with the organizational approach to health service utilization described by Anderson, the author of this framework postulated that the role of providers and system factors has been overlooked in previous attempts to understand the factors affecting service utilization (Andersen & Newman, 1973; Anderson, 1973, Dutton, 1986). Although initially applied in a developed country setting, the model considers various health service settings and their interaction with poor populations, which makes it applicable to a developing country setting. Dutton postulated that the interaction between individual characteristics, health-provider characteristics, and health-system attributes influence patterns of initial and continued service utilization for a given condition or need. Dutton (1986), further postulated that first contact is initiated by the service user and is controlled by individual characteristics and health system attributes. However, according to this service utilization model, subsequent contacts are controlled by health provider characteristics, implying that health provider training and actions could influence continued utilization of a specified service (Dutton, 1986).

Scholars have highlighted the limited applicability of the Andersen-Newman framework for health service utilization and the Dutton model in low-income countries, arguing these frameworks were designed with more advanced health systems in mind

(Buor, 2004). Travassos and Martins (2004), however, argued that existing service utilization frameworks are relevant for developing countries when appropriately adapted to capture the unique characteristics of the context where each study is based.

In this study, an adapted Dutton framework was used for service utilization to examine factors affecting completion and noncompletion of recommended ANC attendances by women in rural Uganda. Utilization of ANC services measured by ANC attendance rates for completers and non-completers was the dependent variable. The independent variables included service-level barriers and facilitators such as ANC service availability, ANC service content, and ANC service organization.

Aim of the Study

The purpose of this quantitative study was to assess service-level factors possibly affecting completion of ANC attendance defined by completion of four or more visits among women of reproductive age in a rural district in Uganda to contribute to the design of patient-centered ANC services in this setting.

Study Significance

Maternal and perinatal survival are currently a high priority for the government of Uganda (GOU). as indicated in the government's Sharpened Plan and Investment Case for Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH) (MOH, 2016). Strategic shifts, such as those envisioned in GOU's RMNCAH Sharpened Plan and Investment Case, are required to push the needle for subgroups that bear a disproportionate burden of morbidity and mortality for the country to reach the next level of progress. This calls for efficient investment of available but limited resources at high

impact points along the continuum of care while supporting effective models of service delivery. ANC service provision is part of Cluster 2 of the maternal and child health cluster in the Uganda Minimum Health Care Package for pregnant women in Uganda (MOH, 2010). While the country is currently implementing a minimum of four ANC visits, the government has incorporated an eight-contact model into the national sexual and reproductive health(SRH) policy guideline and in 2018 started initiating activities to support a gradual switch to the eight-contact ANC model recently recommended by WHO for low- and middle-income countries (MOH, 2018). The eight-contact model emphasizes completion of the first visit as early as possible in the first trimester of pregnancy, with the next visit scheduled at 20 weeks and then repeat visits at 26 weeks, 30 weeks, 34 weeks and then every two weeks until delivery (WHO, 2016a). Given the imminent shift to the eight-contact ANC model of service delivery level in Uganda, combined with a prevailing lack of universal coverage for completion of four ANC visits, there is need for research that provides current information on the factors that differentiate completers of recommended ANC attendances from noncompleters, particularly in the rural areas of the country (Benova et al., 2018).

Research Question

This study was framed around the following research question and hypotheses:

RQ: What is the relationship, if any, between ANC service availability, service content, and service organization and completion of four or more ANC visits?

H_0: There is no statistically significant relationship between ANC service

availability, ANC service content, and ANC service organization, and completion

of four or more ANC visits.

H_A: There is a statistically significant relationship between ANC service

availability, ANC service content, and ANC service organization, and completion

of four or more ANC visits.

Summary of Existing Literature

ANC Service Availability in Uganda

ANC service availability data in Uganda are retrievable from national service

provision assessments (SPA), service readiness and availability assessments (SARA), and

smaller research studies conducted by individuals and institutions. The most recent

national SPA survey for Uganda was conducted in 2007 and collected information on

overall availability of facility-based services, including ANC services. The 2007 survey

data indicated that 70% of health facilities surveyed offered ANC services, but only 20%

of health facilities had all the equipment and medical supplies necessary for provision of

basic ANC services (MOH & Macro International, 2008). 62% of health facilities had

ANC guidelines and protocols available, but only 22% of health facilities had all five

essential equipment and supply items necessary for provision of basic ANC services

(MOH & Macro International, 2008). Findings from a 2013 survey indicated that 70% of

the health facilities visited offered ANC services, but actual provision of discrete

components of the recommended ANC service package varied from 69% providing

intermittent preventive treatment for malaria in pregnancy to only 12% of health facilities

providing advanced distribution of misoprostol to pregnant women (MOH, 2013b). The findings of this survey demonstrated that six percent of health facilities had all the tracer equipment and medical supplies necessary for provision of basic ANC services (MOH, 2013b). 44% of health facilities had ANC guidelines and protocols available, and 52% of health facilities had at least one health worker with training in ANC service provision (MOH, 2013b). Chowfla et al. (2018), conducted a subnational study in one health region of Uganda and found varying availability of essential equipment, medicines, and supplies for antenatal service provision across the health facilities surveyed. Blood pressure machines, human immunodeficiency virus (HIV) test kits, and antiretrovirals (ARVs) were available in over 80% of facilities; however, equipment for hemoglobin testing and reagents for syphilis testing were available in less than 60% of the health facilities (Chowfla et al., 2018).

ANC Service Content

Less than 30% of health facilities had the diagnostic capacity to conduct tests recommended as part of the ANC package including tests for anemia, urine protein, urine glucose, syphilis, and blood grouping (MOH & Macro International, 2008). 87% of providers integrated STI management into routine ANC service provision and only six percent had medicines available for management of common pregnancy complications (MOH & Macro International, 2008). The recommended service content was not consistently delivered with providers more likely to measure blood pressure than to conduct urinalysis, screening for anemia or provide counselling on vaginal bleeding (MOH & Macro International, 2008). A study conducted in 2018, found that the trend in

inconsistent delivery of the comprehensive ANC service content has persisted over a

twenty-year period with the lowest overall coverage being having a urine sample taken at

27.9% and the highest overall coverage being having been weighed at 83.6% (Benova et

al., 2018). Benova et al (2018), also found that only 9.6% of women who completed four

or more ANC visits received all eight ANC care components.

MoH (2013b), conducted a Service Availability and Readiness Assessment in

2013 and revealed that although mean availability in health facilities of all tracer items

needed for comprehensive diagnostic capacity to conduct tests recommended as part of

the ANC package was 47%, only six percent of health facilities visited had all the tracer

items available on the day of the survey with referral level facilities more likely to have

diagnostic capacity than primary care level facilities. Chowfla et al. (2018), found that

screening, diagnosis, and management of common causes of maternal and neonatal

morbidity and mortality during pregnancy was poorly conducted in health facilities

surveyed with only three percent of expected cases of pre-eclampsia being diagnosed on

a monthly basis.

ANC Service Organization

From the results of the 2007 SPA, 58% of the health facilities provided ANC

services for five or more days per week while 37% offered the services for only two days

per week. Lower frequency of ANC service provision per week was more likely for

primary care facilities than for higher-level and referral facilities such as hospitals (MOH

& Macro International, 2008). Conrad et al. (2012), found gaps in ANC provision in

Uganda including ineffective organization of educational sessions, selective omission of

certain services, lack of explanation of important clinical and laboratory procedures, failure to link the performed procedures with preventive information, and occasional lack of respect for clients.

Factors Affecting Completion of Four or More ANC Visits

Findings from the 2016 DHS in Uganda revealed that 90% of women who gave birth in the five years preceding the survey received ANC from a skilled provider at least once for their last birth (UBOS&ICF, 2017). These findings are similar to the National Service Delivery survey data that indicated 97% of women who needed ANC services utilized them (UBOS, 2016). However, nationally only 60% of women received ANC from a skilled provider four or more times (UBOS&ICF, 2017). At a regional level, the rate for completion of four or more ANC visits varied widely with the highest rate at 68% for Ankole region and the lowest being 45% for Bunyoro region (UBOS&ICF, 2017). The most notable finding on ANC utilization from this survey are the disparities by residence which are absent for completion of one visit (98% of women in urban areas and 97% of women in rural areas) but marked for completion of four or more visits (65% of women in urban areas and 58% of women in rural areas). As with other studies in Uganda, this survey found that the proportion of women who reported having completed four or more ANC visits during their last birth increased with level of education and household wealth (UBOS&ICF, 2017).

Kawungezi et al (2015) and Bbaale (2011), focused mainly on the role of non-facility level factors on ANC utilization. Kawungezi et al (2015), found that individual level factors such as religion, occupation, level of education, and parity influenced place

of ANC attendance, number of ANC visits, and ANC booking time in Uganda. Bbaale (2011), also found significant associations between individual level factors such as regional disparities, religion, access to media, maternal decision-making autonomy, wealth status, timing of pregnancy, birth histories, birth order, and frequency, and timing of ANC attendance in Uganda. Bbaale (2011), strengthened the evidence that women in rural areas of Uganda have lower utilization rates of ANC compared to their urban counterparts.

Gap in the Literature

Studies on ANC service utilization in Uganda have focused on ANC service availability, service content, and to a limited extent service organization. Few studies have focused on the relationship if any, between these factors and ANC service utilization defined by completion of the recommended ANC visits.

Methods

Study Design and Setting

This was a quantitative study involving investigation of the possible relationship between completion rates of users of ANC services which is the dependent variable and a set of independent variables namely: provider availability, services hours, range of services, and level of service integration. Deductive techniques that are core to quantitative research were used to test the null hypothesis that there is no statistically significant relationship between provider availability, service hours, range of services, the level of service integration, and ANC completion (Creswell, 2009).

The setting for the study were selected public and private not for profit health facilities in a rural district in Uganda.

Using WHO's outgoing standard model of ANC visits, completion of ANC attendance is defined in this study as a client having attended four or more ANC visits during her most recent pregnancy while non-completion is defined as having attended less than four ANC visits (Measure Evaluation, n.d.; WHO, 2002).

Characteristics of Study Participants

The study population consisted of all adult clients of reproductive age (18 – 49 years) who attended ANC services in the selected health facilities over a 12-month period prior to the study. The health workers included clinical health facility staff and/or administrative staff directly involved in management of the selected health facilities.

Consenting Strategy

The District Health Officer contacted each selected health facility in this study to communicate the research aims and logistics for data collection. A copy of this letter was presented to the medical officer in-charge at each facility before beginning any data collection.

The study objectives and outline were reviewed with each medical officer/health facility in-charge. Written consent was requested from the medical officer/health facility in-charge and documented as part of the study.

At all selected health facilities ANC attendance records in patient registers from the maternity departments for the twelve months prior to the study were examined. As this was a retrospective data collection process, the patients whose records were

examined were no longer physically at the facility; instead, permission to conduct the patient record abstract data collection was sought from the medical officer in-charge at the facility. No identifiable information, such as the patient's name, phone number, address, or otherwise was captured. The selected health facility respondents were informed that they could stop the questionnaire at any point in time without any adverse consequences.

Ethical Considerations

In accordance with Ethics Guidelines for Health Research Involving Human Participants in Uganda and Walden University's Human Research Guidelines, approval was sought from Walden University's Internal Review Board (IRB) and a local (Ugandan-based) IRB accredited by the Uganda National Council of Science and Technology.

Variables and Sources of Data

This was one of a set of concurrent quantitative studies involving investigation of the relationship between ANC services utilization assessed as completion of four or more visits and progression beyond one visit which are the dependent variables and a set of independent variables namely: ANC service availability, ANC service content, and ANC service organization. Moderating variables are individual level factors (knowledge, decision making ability, age, gender, parity, religion, previous pregnancy experience), Health System factors (distance to health facility, cost, alternative providers (e.g., Traditional Birth Attendants (TBAs) and health provider factors (for example attitudes of health workers).

Data sources included integrated ANC facility registers, summary HMIS reports and health facility manager interviews.

Instrumentation and Measures

Data collection involved conducting structured quantitative in-person interviews with facility managers and record reviews using the SLI tool and patient chart abstraction using a patient chart abstract tool.

Service Level Index Tool

Facility assessment scores on the service level factors of interest for selected public and private not for profit health facilities were obtained using the SLI tool. The indicators proposed for inclusion in the SLI tool are listed in Table 10. Pre-testing of the SLI tool was done as part of Study 1 of this set of studies (Level of Agreement of the SLI tool with the standard SPA tool for measurement of ANC service provision) at a selected health facility in the study district.

Table 10

Key Parameters of ANC Service Provision in the Service Level Index Tool

ANC service availability	Availability of trained health provider
	Availability of medicines and medical supplies
	Availability of medical equipment
ANC service content	Range of recommended services provided
ANC service organization	Timing of services
	Integration with other services

Patient Chart Abstract Tool

The patient abstract tool included information on the client's age and total number of ANC visits completed. No identifiable information, such as the client's name, phone number, address, or otherwise was captured as part of this module. To maintain client

anonymity, each client enrolled in ANC over the 12-month period preceding the study was assigned a unique code/number as part of the data collection process.

At all selected health facilities, handwritten patient registers from the integrated ANC register were examined. The data in the ANC registers included data on ANC users who accessed the static ANC clinic as well as ANC outreach data tallied into the register by the health workers. Electronic health records are rarely available at health facilities in this setting except perhaps for the largest regional referral hospitals. ANC cards or Mother-Baby passports are given directly to the clients to take home and were therefore not available for review. As this was a retrospective data collection process, the patients whose records were examined were no longer physically at the facility, instead, permission to conduct the patient record abstract data collection was sought from each medical officer in-charge of a study facility.

Statistical Analysis

Logistic regression was conducted to determine the predictive relationship between ANC service availability, ANC service content, and ANC service organization and completion of ANC attendance. The independent variables were ANC service availability, service content. and service organization. The dependent variable was dichotomized to create a variable with two levels: less than four visits completed, and four or more visits completed. Each of the independent variables were categorized as ordinal variables using the actual values from the SLI scores of health facilities. The regression model contained six variables (range of recommended services provided, timing of services, integration with other services, availability of medical equipment,

availability of medicines & medical supplies and availability of trained health provider).

Details of categorization of the variables are provided in Table 11.

Table 11

Categorization of Independent Variables

ANC Service Domain	Key Variables	Categorization	Codes for analysis
ANC service organization	Timing of services	Good – score equal to or more than 17	1
		Medium – score 10 - 17	2
		Poor – score 10 or below (Ref)	3
	Integration with other services	Good – scores less or equal to 6	1
		Poor - score above 6 (Ref)	2
ANC service content	Range of recommended services provided	Good – scores less or equal to 23	1
		Fair scores 24 - 25	2
		Poor – scores 26 or more (Ref)	3
ANC service availability	Availability of medicines and medical supplies	High- less or equal to 106	1
		Low - more than 106 (Ref)	2
	Availability of medical equipment	High – less than 14,	1
		Medium (14 – 17)	2
		Low - more than 17 (Ref)	3
	Availability of trained health provider	High - 80+% health providers trained	1
		Medium - 50-79% health providers trained	2
		Low - below 50% health providers trained (Ref)	3

The relationship between the ANC completion rates of clients sampled from records at the health facilities and facility scores on service level factors of interest were analyzed. Listwise deletion was used to handle missing data. Using this approach, any

cases with missing data were excluded and the remaining data were analyzed. Sensitivity analysis was conducted to determine the robustness of the results to the deviations from the missing at random assumption (Kang, 2013). The multiple R-statistic was used to determine the strength of the relationship between the independent variables and the dependent variable (Heiman, 2011).

Power Calculation

A district that meets nationally approved criteria for classification as high burden for poverty and maternal mortality was purposively selected. Stratified random sampling was used to sample health facilities using a complete list of health facilities in the selected district as the sampling frame compiled in consultation with the District Health Management Team. Stratification ensured increased precision since the stratum are internally homogenous, but each stratum differs from the other (Cochran, 1950). A district in Uganda has on average sixteen (16) HC IIIs, two (2) HC IV and one (1) hospital. The following formula was applied for determining the overall sample size of health facilities needed (Turner et al., 2001)

$$n = \frac{[(z^2*p*q) + ME^2]}{[ME^2 + z^2*p*q/N]} * d$$

n = required sample size

z = normal deviate needed to provide an estimate at the required confidence limit (1.96 for 95%)

p = estimated prevalence of the indicator, p has been taken as 0.9 since ANC services are almost universally provided at these levels of care

q = 1 – p therefore q = 0.1

d = design effect (deff), d = 1.2 assuming the sample design effect is low

ME = relative variance (i.e., margin of error), ME = 0.15

N = Size of the stratum

n = 10 for HC III, 2 for HC IV, 1 for hospital giving a total of 13 health facilities

Since the population is pre-determined (19 health facilities) and n/N ≥ 5%, the sample size was multiplied by the Finite Population Correction (FPC) factor as follows:

New n = n/1 + (n-1)/N

Where:

New n = the adjusted new sample size

N = the population size

n = the sample size obtained from the general formula

Giving New n = 8 health facilities

Proportionate sampling is then applied as follows:

nh = (Nh / N) * n

where nh is the sample size for stratum h,

Nh is the population size for stratum h,

N is total population size, and

n is total sample size.

HC III, nh = 6, HC IV, nh = 1, Hospital, nh = 1

Determination of the sample size for health records in this study was based on a standard formula for calculating an appropriate sample size for estimating

magnitude/level of the dependent variable (completion of four or more ANC visits). The

overall ANC completion rate for rural areas in Uganda was used to determine the

required sample size. According to the Uganda DHS 2016, the aggregated ANC

completion rate for women in rural areas in Uganda is 58% (UBOS&ICF, 2017).

The sample size formula for this study based on the normal approximation to the

binomial is:

$$n = P(1-P)(Z^2_{1-\alpha/2})/e^2,$$

Where:

P is the expected proportion (completion of four or more ANC visits),

e is the margin of error (5%), and

$Z^2_{1-\alpha/2}$ is the normal Z value corresponding to a cumulative probability of $1 - \alpha/2$, Z is

1.96 for a confidence interval of 95%

Sample size, n = 0.58*0.42*(1.96)2 / 0.052

n = 374.

Three hundred seventy-eight client records in total were collected from all eight

participating health facilities. Based on the power analysis the study needed a minimum

of three hundred seventy-four participants. Systematic random sampling was used to

select these client records from the facility registers. To select client records for review, a

selection skip number (sampling interval) was determined by dividing the total number of

ANC attendances over the preceding 12-month period by the number of required client

records. Then a random number between 1 and the number of ANC attendances was

selected using the raffle technique to determine the starting point. Systematic random

sampling was then used to include every ith client in the sample. This approach is accurate and ensures that every record has the same probability of inclusion (Cochran, 1950).

Results

Table 12 summarizes the general characteristics of the eight study sites. 100% of the study sites were public sector facilities under direct management of the government of Uganda. 75% offered ANC services 5 days a week, while 12.5% offered these services 6 days a week and 12.5% offered the services only two days a week. 88% were open 24 hours for routine service provision, but only 12.5% provided ANC services on a 24-hour basis.

Table 12

Study Site Characteristics

Characteristic	Total (N=8)	HC III	HC IV	Hospital
Managing authority				
Government of Uganda	8	6	1	1
Days per week the facility offers ANC services				
2 days	1	1	0	0
5 days	6	4	1	1
6 days	1	1	0	0
Hours per day the facility is open for routine services				
5 to 8 hours	1	1	0	0
24 hours	7	5	1	1
Hours per day the facility is open for ANC services				
5 to 8 hours	4	3	0	1
9 to 16 hours	3	2	1	0
24 hours	1	1	0	0
Hours per day someone on call available to provide services as needed at this facility. (including the time that a facility is open for routine services).				
5 to 8 hours	1	1	0	0
24 hours	7	5	1	1

Table 13 summarizes the cross-tabulation findings taking ANC visit completion among ANC service users in the eight study sites between July 2019 and June 2020. Under the service availability domain, only four percent of ANC completers utilized a facility with a high medical equipment availability score compared to 80% completers utilizing a facility with a low medical equipment score (p = 0.006), 28% of ANC completers utilized a health facility that was assigned a high availability score for medicines and medical supplies compared to 72% of ANC completers utilizing facilities with low scores for availability of medicines and medical supplies at the time the study was conducted (p = 0.01). For the service content domain, the majority of ANC

completers (56%) utilized facilities whose range of ANC service provision was fair, but
majority of non-completers utilized facilities whose range of service provision was good
(p-value = 0.002). For the sub-domain of ANC service organization, 64% and 92% of
ANC completers and non-completers respectively utilized health facilities whose timing
of service provision was good (p = 0.000) while 24% and 54% of ANC completers and
non-completers respectively utilized facilities that were practicing good integration of
ANC with other services (p = 0.004).

Table 13

ANC Visit Completion Against Key Parameters of ANC Service Provision in the Service
Level Index Tool

	ANC visit completion	
	Pearson correlation	Sig. (2-tailed)
Availability of medical equipment	−.150**	.003
Availability of medicines and medical supplies	−.161**	.002
Availability of trained staff	−.163**	.001
Range of recommended services provided	.130*	.011
Timing of services	−.240**	.000
Integration of services	−.150**	.004

** = Correlation is significant at the 0.01 level (2-tailed); * = Correlation is significant at
the 0.05 level (2-tailed).

The full model containing all predictors was statistically significant, χ^2 (6)
=26.118, p < 0.05, indicating that the model could distinguish between women who
completed four or more ANC visits and those who did not complete four or more ANC
visits. The χ^2 in the Hosmer-Lemeshow goodness of fit test was 0.732 with a significance
level of 0.994 indicating a good model fit (Table 14). The model as a whole explained
17.3% (Nagelkerke R squared) of the variance in ANC completion and correctly

classified 93.4% of respondents. As displayed in Table 15 below, only two of the

independent variables made a unique statistically significant contribution to the model

and that was availability of medical supplies and timing of ANC services. The results

indicate that the odds of completing four or more ANC visits decrease by 0.02 for every 1

unit decrease in availability of medical supplies scores and increase by 4.6 for every 1

unit increase in ANC timing score when availability of medical equipment, trained staff,

service integration and range of ANC services are controlled for (exp (B) = 0.02, p < 0.05

and exp (B) = 4.6, p < 0.05 respectively).

Table 14

Goodness of Fit Tests

Model Co-efficients			
	Chi-square	df	Sig.
Model	26.118	6	.000
Hosmer-Lemeshow Test			
Step 1	Chi-square	df	Sig.
	.732	6	.994

Table 15

Wald Statistic and Odds Ratio

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1a	Availability of medical equipment	1.696	1.257	1.820	1	.177	5.453	.464	64.105
	Availability of medicines and medical supplies	-3.822	1.822	4.401	1	.036	.022	.001	.778
	Availability of trained health provider	-.310	.522	.353	1	.553	.734	.264	2.039
	Range of recommended services	-.547	.453	1.455	1	.228	.579	.238	1.407
	Timing of services	1.528	.595	6.600	1	.010	4.607	1.436	14.774
	Integration with other services	-1.520	1.302	1.363	1	.243	.219	.017	2.805
	Constant	8.096	2.855	8.044	1	.005	3282.854		

a. Variable(s) entered on step 1: Availability of Medical Equipment, Availability of

Medicines and Medical Supplies, Availability of trained health provider, Range of

recommended services, Timing of services, Integration with other services.

Table 16

Model Summary for Stepwise Regression

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	157.991a	.067	.173
2	158.351a	.066	.171
3	159.553a	.063	.163
4	160.499a	.061	.157
5	161.357a	.058	.152

Table 17

Results of Stepwise Regression Analysis

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1a	Availability of medical equipment	1.696	1.257	1.820	1	.177	5.453	.464	64.105
	Availability of medicines and medical supplies	-3.822	1.822	4.401	1	.036	.022	.001	.778
	Availability of trained health provider	-.310	.522	.353	1	.553	.734	.264	2.039
	Range of recommended services	-.547	.453	1.455	1	.228	.579	.238	1.407
	Timing of services	1.528	.595	6.600	1	.010	4.607	1.436	14.774
	Integration of services	-1.520	1.302	1.363	1	.243	.219	.017	2.805
	Constant	8.096	2.855	8.044	1	.005	3282.854		
Step 2a	Availability of medical equipment	1.386	1.144	1.468	1	.226	4.000	.425	37.659
	Availability of medicines and medical supplies	-3.677	1.808	4.134	1	.042	.025	.001	.876
	Range of recommended services	-.382	.338	1.274	1	.259	.683	.352	1.325
	Timing of services	1.363	.512	7.072	1	.008	3.906	1.431	10.664
	Integration of services	-1.065	1.069	.992	1	.319	.345	.042	2.804
	Constant	7.187	2.439	8.685	1	.003	1321.951		
Step 3a	Availability of medical equipment	1.386	1.144	1.468	1	.226	4.000	.425	37.659
	Availability of medicines and medical supplies	-4.058	1.776	5.220	1	.022	.017	.001	.562
	Timing of services	1.504	.506	8.852	1	.003	4.500	1.671	12.120
	Integration of services	-.924	1.066	.750	1	.386	.397	.049	3.209
	Constant	6.904	2.433	8.053	1	.005	996.148		
Step 4a	Availability of medical equipment	.592	.613	.931	1	.335	1.807	.543	6.014
	Availability of medicines and medical supplies	-3.264	1.491	4.794	1	.029	.038	.002	.710
	Timing of services	1.633	.495	10.891	1	.001	5.121	1.941	13.511
	Constant	5.851	2.135	7.512	1	.006	347.551		
Step 5a	Availability of medicines and medical supplies	-2.207	1.039	4.511	1	.034	.110	.014	.843
	Timing of services	1.507	.469	10.329	1	.001	4.511	1.800	11.306
	Constant	5.513	2.114	6.803	1	.009	247.812		

a. Variable(s) entered on step 1: Availability of Medical Equipment, Availability of

Medicines and Medical Supplies, Availability of trained health provider, Range of

recommended services, Timing of services, Integration with other services.

The prediction model contained two of the six predictors and was reached in five steps. The model was statistically significant, $\chi2 (2) = 22.752$, $p < .001$, and accounted for approximately 15.2% (Nagelkerke R squared) of the variance of ANC attendance completion while correctly classifying 93.4% of study participants. Completion of ANC attendance was primarily predicted by better timing of ANC services, and to a lesser extent by higher levels of availability of medicines and medical supplies. Timing of ANC services was found to be the most important factor for completion of ANC attendance (p value = 0.001). Facilities having timing of ANC service scores higher than 17 were at increased odds (4.5) of having their clients complete ANC attendance compared to those whose timing scores were less than 17. Health facilities having medicines and medical supplies scores higher than 106 which represented low availability of medicines and medical supplies in the SLI tool were at decreased odds (0.1) of having their clients complete ANC attendance compared to those whose scores were less than 106.

Discussion

The study investigated whether service level factors independently predict completion of ANC attendance among pregnant women in Uganda. A statistically significant predictive relationship was found between timing of ANC services under the service organization domain, and completion of ANC attendance. Women were more likely to complete four recommended visits if they received ANC services at a health facility that reported more working hours during the day dedicated to ANC service provision and providing ANC services with higher frequency per week. There was also a statistically significant relationship between availability of medicines and medical

supplies and completion of ANC attendance. There was no statistically significant

predictive relationship between availability of trained health providers, availability of

medical equipment, range of recommended services provided, and integration of ANC

services with other services, and completion of ANC attendance. In relation to the

research hypothesis, the study demonstrated that there is a statistically significant

relationship between ANC service availability, ANC service organization and completion

of four or more ANC visits.

These results are supported by previous findings that show that provision of ANC

services on restricted days of the week presented a barrier to optimal completion of

services within the ANC package such as intermittent preventive treatment in pregnancy

(IPTp) (Malaria Consortium, n.d.) and the absence of scheduling, increased uncertainty

among clients which in turn affected ANC attendance (Gong et al., 2019). Timing of

provision of ANC services and improved awareness among clients about what specific

services in the package to expect on different days of the week has been shown to

influence consistent ANC attendance (Conrad et al., 2012, Mathole et al., 2005).

Similarly, the availability of medicines and medical supplies has emerged in previous

studies as a factor that influences ANC attendance. However, Ediau et al., (2013),

demonstrated that while improved availability of basic medical supplies for ANC service

provision led to significant improvements in first ANC visit attendance, by itself this

intervention was insufficient to enhance completion of at least four ANC visits. Provision

of a standardized range of recommended services within ANC underpins quality of ANC

services and is currently considered an increasingly critical link to achieving higher

coverage of ANC completion rates (Hodgkin's & D'Agostino, 2014; Kanyangarara et al.,

2017; Saad-Haddad et al., 2016).

Availability of trained health providers may not influence completion of ANC

attendance since it has been demonstrated that provider training by itself is insufficient to

improve quality of care and positive ANC experiences for clients (Do et al., 2017). It is

plausible that the lack of a predictive relationship between availability of medical

equipment, availability of trained health providers and completion to ANC attendance is

explained by client levels of awareness about the purpose of medical equipment for ANC

and their ability to correctly gauge competence levels of health providers. Alufani et al

(2019), found that 30% of ANC service users in Migori county, Kenya did not understand

the purposes of tests and medicines received during ANC attendance, but this proportion

decreased with increased education levels. This is similar to earlier findings by Pell et al.,

(2013), that demonstrated through qualitative interviews that while women commonly

recalled receiving medicines during ANC visits, specific mentions of receipt or non-

receipt of HIV and syphilis testing, hemoglobin analysis or blood pressure measurement

were rarely mentioned. The authors concluded that understanding of screening /

diagnostic procedures and possibly the related importance of medical equipment for these

procedures was low. Furthermore, studies have shown that users of ANC services are

more likely to be motivated by the perceived quality of interaction with the health

provider than by the service provider's level training and competence (Do et al., 2017).

ANC is a platform that can facilitate the provision of multiple health interventions

therefore integration with other services is considered a best practice for effective ANC

service provision (Lincentto et al., 2006). Some studies have found that integration of

ANC services with other services as a component of service organization results in

improved user satisfaction but there is limited evidence of a link between integration with

other services and completion of recommended ANC visits (de Jongh et al., 2016;

Munkhuu et al., 2009).

<center>**Limitations of the Study**</center>

Although this study generated new insights into the relationship between service

level factors and completion of ANC attendance, there are some limitations. The low

ANC completion rates in the study population translated into a very small sample size of

ANC completers which may have affected the external validity of the study.

<center>**Implications for Practice**</center>

Health managers at sub national and facility levels could utilize the findings of

this study to improve the organization of ANC services with the aim of optimizing

opportunities to achieve increased coverage of completion of the recommended ANC

visits. Specifically, with regard to the organization of ANC services this study has

demonstrated that the timing of ANC service provision may positively influence client

decision making to complete the recommended number of visits. Timing in this study

focused on the number of hours per day and the number of days per week that ANC

services were provided. Higher flexibility with service provision timing provides clients

with expanded choice on when to attend the services and is likely to decrease congestion

and the resultant long waiting hours associated with service provision on restricted days

and within restricted hours of the day. Effective implementation would require tailored

approaches which could potentially include establishment of scheduling and appointment systems for ANC visits all of which contribute to improved planning, time management, and predictability from the perspective of ANC service users.

The findings of this study also under-score the need for an increased focus on ensuring availability of medicines and medical supplies as an approach for motivating ANC service users to complete the recommended number of visits. With prevailing constraints on service delivery such as limited human resources, and financing in this and similar contexts, this may entail improvements in planning, forecasting and management of medicines and medical supplies for ANC provision at health facility level.

<h2 style="text-align:center">Recommendations for Future Research</h2>

This study assessed the relationship between completion of ANC attendance and service level factors using the limited information available from health facility registers and structured interviews with facility managers. Further investigation of this relationship is needed using both quantitative and qualitative research methods and broader data sources including client perceptions of service level factors. Second, although specific subcategories (timing of services, availability of medicines, and medical supplies) of each of two broad service level domains, service organization and service availability, showed statistically significant relationships with the outcome of interest, neither one of these service level domains as a whole accounted for the variance in ANC attendance completion. Further research is needed to provide additional insights into definition and measurement of ANC service level factors to facilitate comparability of research studies.

Conclusion

This study has demonstrated that service level factors have a predictive value for completion of ANC attendance. The findings can be used to improve availability, content, and organization of ANC services with the aim of enhancing positive experiences for clients and motivating them to complete the recommended number of visits. Timing of service provision and the availability of medicines and medical supplies should be prioritized by managers at different levels of the health system. Further research is needed to improve measurement of service level factors and how these interact with ANC service completion incorporating perceptions of service users themselves.

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Progression Beyond One Antenatal Care Visit Among Women of Reproductive Age in a Rural District in Uganda: A Quantitative Study on the Role of Service-Level Factors

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Outlet for Manuscript

The target journal for this manuscript is the Reproductive Health Journal. URL: https://reproductive-health-journal.biomedcentral.com/. All articles submitted to this journal must include a Plain English Summary of not more than 250 words in addition to the abstract. References should be prepared strictly according to the Vancouver style (Reproductive Health Journal, 2019a). The selection of this journal is based on being a peer-reviewed, open access journal that aims at providing a platform for research on a wide array of reproductive health issues including social and gender issues, sexual health, country and population specific issues, assessment of service provision, education and training and broader aspects of gynecological and obstetrical topics related to reproductive health (Reproductive Health Journal, 2019b). In addition, the journal has a favorable policy on researchers based in low- and middle-income countries who are encouraged to make submissions and are eligible for waivers of the article processing fee as a mechanism of ensuring a global outlook for the journal (Reproductive Health Journal, 2019c).

Abstract

Optimal antenatal care (ANC) has been defined by global health experts as an essential set of interventions comprising a standard package designed to be delivered using recommended parameters for timing, frequency, and content. Performance of countries' achievement of universal ANC coverage has been standardized to the minimum number of recommended visits for women in need of ANC during their most recent pregnancy as the key performance measure. Scholars argue there is a need for more attention on measures that enable assessment of progress toward universal coverage. Analysis of patterns of partial ANC attendance could provide insights into the underlying drivers of suboptimal use of ANC services in individual countries. The aim of this quantitative study was to assess the relationship between service-level index scores for ANC service provision and progression to ANC completion among women of reproductive age at the first, second, and third ANC visits in a rural district in Uganda. The regression model was statistically significant, $\chi 2\ (24) = 54.092$, $p < .001$, indicating the model could distinguish between respondents who progressed beyond the first ANC visit and those who did not progress but accounted for only approximately 15% of the variance of progression beyond the first visit ($R2 = .145$). These results demonstrate that, except for the timing of ANC service provision, service-level factors do not have predictive value for continued use of ANC services after the initial visit. The findings can be used to improve resource allocation for ANC service delivery at lower levels of the health system due to continued utilization of ANC services at these levels despite poor performance in the ANC service availability domain.

Background

Antenatal care (ANC) from a skilled provider is a proven intervention aimed at monitoring pregnancy to reduce morbidity and mortality risks for the mother and child, which may occur during pregnancy, delivery, and the postnatal period (World Health Organization [WHO], 2016a). This is attributed to the opportunity that the ANC platform provides to detect and treat pregnancy-related complications and ensure early identification and mitigation of risk factors for complications during labor and delivery (Carroli et al., 2001).

Over the period 2007–2014, a global increase in ANC utilization was registered in part due to introduction of the focused ANC model by WHO (2016a) for use in developing countries. An estimated over 80% of women worldwide access ANC with a skilled health personnel at least once during pregnancy, but this figure drops to 62% for women who receive at least four antenatal visits (United Nations Children's Fund [UNICEF], 2017). Uganda's policy on ANC currently recommends eight ANC contacts with the first contact occurring before 12 weeks, the second and third contacts occurring at 20 and 26 weeks, the third to fifth visits occurring between 30 and 36 weeks, and the last two contacts occurring at 38 and 40 weeks; this recommendation is a policy shift to a new ANC model that needs to be effectively implemented (Uganda Ministry of Health [MOH], 2018).

Researchers have shown that a lower quantity of ANC—measured both by frequency of visits and content of ANC provided during each visit—received by pregnant women is associated with low birth weight, preterm delivery, stillbirth risk, and

prevalence of delivery through caesarean section (Lavin & Pattison, 2017; Nimi et al., 2016). On this basis, optimal ANC care has been defined by global health experts as an essential set of interventions comprising a standard ANC package designed to be delivered at recommended parameters of timing, frequency, and content (Kunht & Volmer, 2017). Performance of countries' achievement of universal ANC coverage has therefore been standardized to the minimum number of recommended visits attained by women in need of ANC during their most recent pregnancy as the key performance measure (Kunht & Volmer, 2017). Scholars argue there is a need for more attention on measures that enable assessment of progress toward universal coverage. For instance, some countries have been able to increase the proportion of women who have attained between two and three ANC visits or partial attendance, but this achievement is not routinely tracked as a mechanism for recognizing progressive realization of universal coverage (Ataguba, 2018). In addition, scholars argue that ANC use patterns of partial attendance should be analyzed in further detail beyond completion of a minimum recommended number of visits or contacts to enable a better understanding of the underlying drivers of suboptimal use of ANC services in individual countries (Saad-Haddad et al., 2016).

The theoretical framework for this study was based on Dutton's (1986) framework for understanding health services utilization which is illustrated in Figure 8 below.

Figure 8

Model of the Factors Affecting Health Care Use
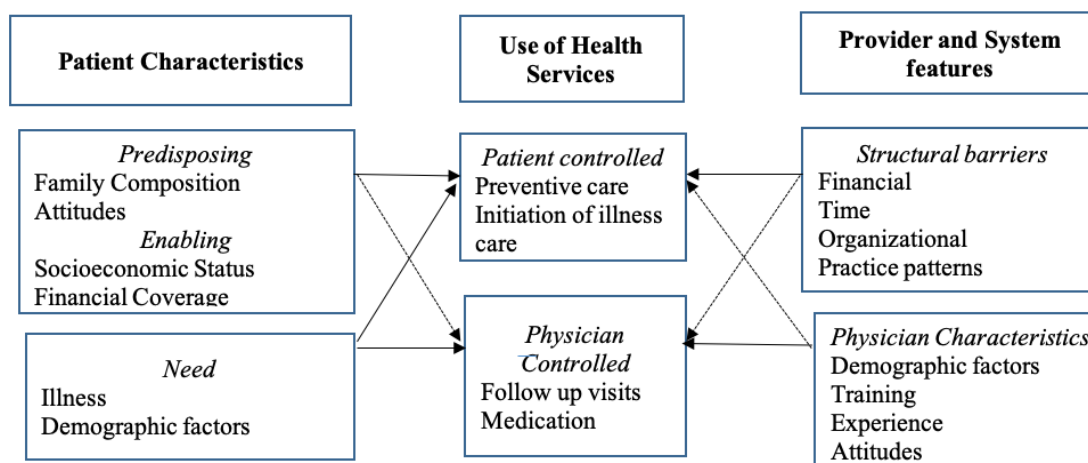
Note. Solid arrows denote expected major relationships, while dashed arrows denote less important relationships (Dutton, 1986).

Dutton's (1986) framework suggests that health services' utilization is a product of characteristics of service users and provider and system attributes (Levesque et al., 2012). Building on Andersen's behavioral model of health care utilization and aligning well with the organizational approach to health service utilization described by Anderson, the author of this framework postulated that the role of providers and system factors has been overlooked in previous attempts to understand the factors affecting service utilization (Andersen & Newman, 1973; Anderson, 1973, Dutton, 1986). Although initially applied in a developed country setting, the model considers various health service settings and their interaction with poor populations, which makes it applicable to a developing country setting. Dutton postulated that the interaction between individual characteristics, health provider characteristics, and health system attributes influences

patterns of initial and continued service utilization use for a given condition or need. Dutton (1986) further postulated that first contact is initiated by the service user and is controlled by individual characteristics and health system attributes. However, according to this service utilization model, subsequent contacts are controlled by health provider characteristics, implying that health provider training and actions could influence continued utilization of a specified service (Dutton, 1986).

Scholars have highlighted the limited applicability of the Andersen-Newman framework for health service utilization and the Dutton model in low-income countries, arguing these frameworks were designed with more advanced health systems in mind (Buor, 2004). Travassos and Martins (2004) argued that existing service use frameworks are relevant for developing countries when appropriately adapted to capture the unique characteristics of the context where each study is based.

In this study, an adapted Dutton framework was used for service utilization to examine factors affecting completion and noncompletion of recommended ANC attendances by women in rural Uganda. Utilization of ANC services measured by ANC attendance rates for completers and non-completers was the dependent variable. The independent variables included service-level barriers and facilitators such as ANC service availability, ANC service content, and ANC service organization.

Aim of the Study

The aim of this quantitative study was to assess the relationship between Service-level index scores for ANC service provision and progression to ANC completion among

women of reproductive age at the first, second, and third ANC visits in a rural district in Uganda to contribute to design of patient-centered ANC services in this setting.

Study Significance

Maternal and perinatal survival are currently a high priority for the government of Uganda (GOU) as indicated in the government's Sharpened Plan and Investment case for Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCAH; MOH, 2016). Strategic shifts such as those envisioned in GOU's RMNCAH Sharpened Plan and Investment Case are required to push the needle for subgroups that bear a disproportionate burden of morbidity and mortality for the country to reach the next level of progress. This calls for efficient investment of available but limited resources at high-impact points along the continuum of care while supporting effective models of service delivery. ANC service provision is part of Cluster 2 or the maternal and child health cluster in the Uganda Minimum Health Care Package for pregnant women in Uganda (MOH, 2010). The government has begun rolling out activities to support a gradual switch to the eight-contact ANC model recently recommended by WHO for low- and middle-income countries. The eight-contact model emphasizes completion of the first visit as early as possible in the first trimester of pregnancy, with the next visit scheduled at 20 weeks and then repeat visits at 26 weeks, 30 weeks, 34 weeks and then every two weeks until delivery (WHO, 2016a). Given the imminent shift to the eight-contact ANC model at the service delivery level in Uganda combined with a prevailing lack of universal coverage for completion of four ANC visits, there is a need for research that provides current information on the factors that differentiate completers of recommended

ANC attendances from non-completers, particularly in the rural areas of the country

(Benova et al., 2018).

Research Question

This study was framed around the following research question and hypotheses:

RQ: To what level if any, do ANC service level index (SLI) scores predict

progression to ANC completion among women at the first, second and third ANC visits?

H_0: There is no statistically significant relationship between ANC SLI scores at

health facilities and ANC attendance progression among service users.

H_A: There is a statistically significant relationship between ANC SLI scores at

health facilities and ANC attendance progression among service users.

Summary of Existing Literature

Factors Affecting Frequency of ANC Service Use

Scholars have found distinctions between factors affecting the decision to initiate

ANC attendance and the decision to continue utilizing ANC services once attendance is

initiated. These studies indicate that, though both the utilization of ANC and the number

of antenatal visits is influenced by a range of individual, household, and community-level

characteristics, both the set of relevant variables and the magnitude of the effects vary

across the two decisions (Guliani et al., 2014). Finalayson & Downe (2013), conducted a

meta-analysis of qualitative studies in low- and middle-income countries and revealed

that the disconnect between design of ANC services and socio-cultural beliefs of women

who do not access ANC at all is a likely explanation for the lack of initial access to ANC.

Finalayson & Downe (2013), also demonstrated that an additional disconnect between

antenatal service provision and the expectations of service users is a likely explanation for the lack of continued engagement resulting into partial attendance by women in need of ANC services. Guliani et al (2014), found that unobserved community-level variables have been shown to influence the utilization of ANC but not the number of visits. Guliani et al (2014), also postulated that several variables that affect initial antenatal attendance appear to have no influence on the number of visits and even when the same variable appears to influence both the use and frequency of ANC decisions, the magnitude of its effect is quite different across the two decisions.

Saad-Haddad et al (2016), reviewed data from Demographic Health Surveys in seven countdown countries to assess determinants of utilization of ANC services by frequency of ANC visits, comparatively, and through inferential analyses. Saad-Haddad et al (2016), reported similar findings as Guliani et al (2014), in that while education was a significant determinant for initiating ANC, it was less significant for reporting continued utilization of ANC services. Saad-Haddad et al (2016), found that for Uganda specifically, the proportion of women who reported receiving ANC decreased as the number of visits increased with a marked drop out occurring between three and four or more visits. Furthermore, the proportions of Ugandan women who reported four or more visits showed a considerable decline across all the wealth quintiles, educational levels and by urban–rural residence, matched by a widening of the gap across categories of the three characteristics (wealth, education, and residence) as the number of visits reached four or more ANC visits (Saad-Haddad et al., 2016). In this study, 66% and 13% of Ugandan women reported initiating ANC during their second and third trimester,

respectively, implying less time to complete the recommended number of ANC visits in this context. (Saad-Haddad et al., 2016). These findings are further corroborated by the results of the Uganda Demographic and Health Survey (UDHS) which reported a national ANC attendance rate of 97.3% for one ANC visit which dropped to only 59.9% for four or more ANC visits among a representative sample of women of reproductive age (UBS&ICF, 2017). The UDHS reported ANC utilization rate of 2.4% for one visit only, 35.3% for 2 – 3 visits and 59.9% for four or more visits, indicating a progressive increase in the proportion of women utilizing ANC services across the continuum of minimum recommended visits (UBOS & ICF, 2017).

Gap in the Literature

Studies on ANC service utilization in Uganda have focused on the predictive association between individual factors and ANC service utilization. However, documented evidence from Uganda on the relationship if any, between facility level factors and continued utilization of ANC services after initiation of ANC attendance is currently limited.

Methods

Study Design and Setting

This was a quantitative study involving investigation of the predictive relationship between progression to ANC completion at the first, second and third visits by users of ANC services which is the dependent variable and facility scores on the SLI.

The setting for the study was selected public health facilities in a rural district in Uganda.

Characteristics of Study Participants

The study population consists of all Ugandan females of reproductive age (18 –

49 years) who attended ANC services in the selected health facilities over a 12-month

period prior to the study. The health workers include clinical health facility staff and/or

administrative staff directly involved in management of the selected health facilities.

Consenting Strategy

The District Health Officer contacted each selected health facility in this study to

communicate the research aims and logistics for data collection. A copy of this letter was

presented to the medical officer in-charge at each facility before beginning any data

collection.

The study objectives and outline were reviewed with each medical officer/health

facility in-charge. Written consent was requested from the medical officer/health facility

in-charge and documented as part of the study.

At all selected health facilities ANC attendance records in patient registers from

the maternity departments for the twelve months prior to the study was examined. As this

was a retrospective data collection process, the patients whose records was examined

were no longer be physically at the facility; instead, permission to conduct the patient

record abstract data collection was sought from the medical officer in-charge at the

facility. No identifiable information, such as the patient's name, phone number, address,

or otherwise was captured. The selected health facility respondents were informed that

they can stop the questionnaire at any point in time without any adverse consequences.

Ethical Considerations

In accordance with Ethics Guidelines for Health Research Involving Human Participants in Uganda and Walden University's Human Research Guidelines, approval was sought from Walden University's Internal Review Board (IRB) and a local (Ugandan-based) IRB accredited by the Uganda National Council of Science and Technology.

Variables and Sources of Data

This was one of a set of concurrent quantitative studies involving investigation of the relationship between ANC services utilization assessed as progression to ANC completion at the first, second and third visits by users of ANC services which is the dependent variable and facility scores on the SLI which is the independent variable.

The relationship between ANC SLI scores for health facilities in the study and extent of progression to ANC completion by service users was assessed. Sources of data were facility SLI scores and ANC attendance records extracted from the integrated ANC registers. The data in the ANC registers included data on ANC users who accessed the static ANC clinic as well as ANC outreach data tallied into the register by the health workers.

Instrumentation and Measures

Data collection involved conducting in-person interviews and record reviews using the SLI tool and patient chart abstraction using a patient chart abstract tool.

Service Level Index Tool

Facility assessment scores on the service level factors of interest for selected health facilities were obtained using the SLI tool. The indicators proposed for inclusion in the SLI tool are listed in Table 18. Pre-testing of the SLI tool was already done as part of Study 1 of this set of studies (Accuracy and Reliability of the SLI tool for measurement of ANC service provision) at a selected health facility in the study district.

Table 18

Key Parameters of ANC Service Provision in the Service Level Index Tool

ANC service availability	Availability of trained health provider
	Availability of medicines and medical supplies
	Availability of medical equipment
ANC service content	Range of recommended services provided
ANC service organization	Timing of services
	Integration with other services

Patient Chart Abstract Tool

The patient abstract tool included information on the client's age and total number of ANC visits completed. No identifiable information, such as the client's name, phone number, address, or otherwise were captured as part of this module. To maintain client anonymity, each client enrolled in ANC over the 12-month period preceding the study were assigned a unique code/number as part of the data collection process.

At all selected health facilities, handwritten patient registers from the integrated ANC register were examined. Electronic health records are rarely available at health facilities in this setting except perhaps for the largest regional referral hospitals. ANC cards or Mother-Baby passports are given directly to the clients to take home and were therefore not available for review. As this was a retrospective data collection process, the

patients whose records were examined were no longer physically at the facility; instead, permission to conduct the patient record abstract data collection was sought from each medical officer in-charge of a study facility.

Statistical Analysis

Logistic regression was used to determine the predictive relationship between ANC service availability, ANC service content and ANC service organization and continued utilization of ANC services. The independent variable was ANC service provision categorized as an ordinal variable at different levels based on a SLI score. The dependent variables were the four groups of service users categorized based on number of visits completed and coded as a nominal variable. Listwise deletion was used to handle missing data. Using this approach, any cases with missing data were excluded and the remaining data were analyzed. Sensitivity analysis was conducted to determine the robustness of the results to the deviations from the missing at random assumption (Kang, 2013).

Power Calculation

A district that meets nationally approved criteria for classification as high burden for poverty and maternal mortality was purposively selected. Stratified random sampling was used to sample health facilities using a complete list of health facilities in the selected district as the sampling frame compiled in consultation with the district health management team. Stratification ensured increased precision since the stratum are internally homogenous, but each stratum differs from the other (Cochran, 1950). A district in Uganda has on average sixteen (16) HC IIIs, two (2) HC IV and one (1)

hospital. The following formula was applied for determining the overall sample size of health facilities needed (Turner et al., 2001)

$$n = \frac{[(z^2*p*q) + ME^2]}{[ME^2+z^2*p*q/N]} * d$$

n = required sample size

z = normal deviate needed to provide an estimate at the required confidence limit (1.96 for 95%)

p = estimated prevalence of the indicator, p has been taken as 0.9 since ANC services are almost universally provided at these levels of care

q = 1 – p therefore q = 0.1

d = design effect (deff), d = 1.2 assuming the sample design effect is low

ME = relative variance (i.e., margin of error), ME = 0.15

N = Size of the stratum

n = 10 for HC III, 2 for HC IV, 1 for hospital giving a total of 13 health facilities

Since the population is pre-determined (19 health facilities) and n/N ≥ 5%, the sample size was multiplied by the Finite Population Correction (FPC) factor as follows:

New n = n/1 + (n-1)/N

Where:

New n = the adjusted new sample size

N = the population size

n = the sample size obtained from the general formula

Giving New n = 8 health facilities

Proportionate sampling is then applied as follows:

nh = (Nh / N) * n

where nh is the sample size for stratum h,

Nh is the population size for stratum h,

N is total population size, and

n is total sample size.

HC III, nh = 6, HC IV, nh = 1, Hospital, nh = 1

Determination of the sample size for health records in this study is based on a standard formula for calculating an appropriate sample size for estimating magnitude/level of the dependent variable (completion of four or more ANC visits). The overall ANC completion rate for rural areas in Uganda has been used to determine the required sample size. According to the Uganda Demographic and Health Survey 2016, the aggregated ANC completion rate for women in rural areas in Uganda is 58% (UBOS & ICF, 2017). The sample size formula for this study based on the normal approximation to the binomial is

$n = P(1-P)(Z^2_{1-\alpha/2})/e^2,$

Where:

P is the expected proportion (completion of four or more ANC visits),

e is the margin of error (5%), and

$Z^2_{1-\alpha/2}$ is the normal Z value corresponding to a cumulative probability of $1 - \alpha/2$, Z is 1.96 for a confidence interval of 95%

Sample size, $n = 0.58*0.42*(1.96)^2 / 0.05^2$

$n = 374$.

= Three hundred and seventy-eight client records in total were assessed from all eight participating health facilities. Based on the power analysis the study needed a minimum of three hundred and seventy four participants. Systematic random sampling was used to select these client records from the facility registers. To select client records for review, a selection skip number (sampling interval) was determined by dividing the total number of ANC attendances over the preceding 12-month period by the number of required client records. Then a random number between 1 and the number of ANC attendances was selected using the raffle technique to determine the starting point. Systematic random sampling was then used to include every ith client in the sample. This approach is accurate and ensures that every record has the same probability of inclusion (Cochran, 1950).

Results

Table 19 summarizes the general characteristics of the eight study sites. 100% of the study sites were public sector facilities under direct management of the government of Uganda. 6 sites (75%) were level III facilities, 1 site (12.5%) was a level IV health facility, and 1 site (12.5%) was a hospital.

Table 19

Characteristics of Study Sites

Health facility name	Level of Care	Ownership
Nawandala	Level III	Public
Nambale	Level III	Public
Namungalwe	Level III	Public
Bunyiiro	Level III	Public
Bulamagi	Level III	Public
Busowobi	Level III	Public
Bugono	Level IV	Public
Iganga	Hospital	Public

Table 20 summarizes the number of women by ANC visits completed. Of the 378 patient records of women attending ANC between July 2019 and June 2020, 168 (44.4%) completed only one ANC visit, 118 (31.2%) completed two ANC visits, 67 (17.7%) completed three visits, 20 (5.3%) completed four visits and only 5 (1.3%) completed five or more visits. As illustrated in Figure 9, the number of women progressing to four or more visits after the first ANC visit, dropped sharply after completion of the second ANC visit. This trend was also observed for each of the individual study sites (Table 21).

Table 20

Number and Proportion of Women by ANC Visits Completed

ANC visit	Number of women	Percent	Cumulative Percent
1	168	44.4	44.4
2	118	31.2	75.7
3	67	17.7	93.4
4	20	5.3	98.7
5	5	1.3	100.0
Total	378	100.0	

Table 21

Trends in ANC Progression by Study Site

ANC_Visit	Bugono HCIV		Bulamagi HCIII		Buniro HCIII		Buowobi HCIII		Iganga hospital		Nambale HCIII		Namungawe HCIII		Nawandala HCIII		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	14a, b	36.8	10b	27.8	23a	65.7	23a, b	60.5	52a, b	41.9	13a, b	37.1	15a, b	41.7	18a, b	50.0	168	44.4
2	10a	26.3	9a	25.0	7a	20.0	9a	23.7	48a	38.7	11a	31.4	13a	36.1	11a	30.6	118	31.2
3	10a	26.3	8a	22.2	2a	5.7	4a	10.5	23a	18.5	10a	28.6	7a	19.4	3a	8.3	67	17.7
4	4a, b	10.5	6b	16.7	3a, b	8.6	2a, b	5.3	1a	0.8	1a, b	2.9	1a, b	2.8	2a, b	5.6	20	5.3
5	0a, b	0.0	3b	8.3	0a, b	0.0	0a, b	0.0	0a	0.0	0a, b	0.0	0a, b	0.0	2a, b	5.6	5	1.3
Total	38	100.0	36	100.0	35	100.0	38	100.0	124	100.0	35	100.0	36	100.0	36	100.0	378	100.0

Note. Each subscript letter denotes a subset of health facility categories whose column proportions do not differ significantly from each other at the .05 level.

Figure 9

Number of Women by ANC Visits Completed
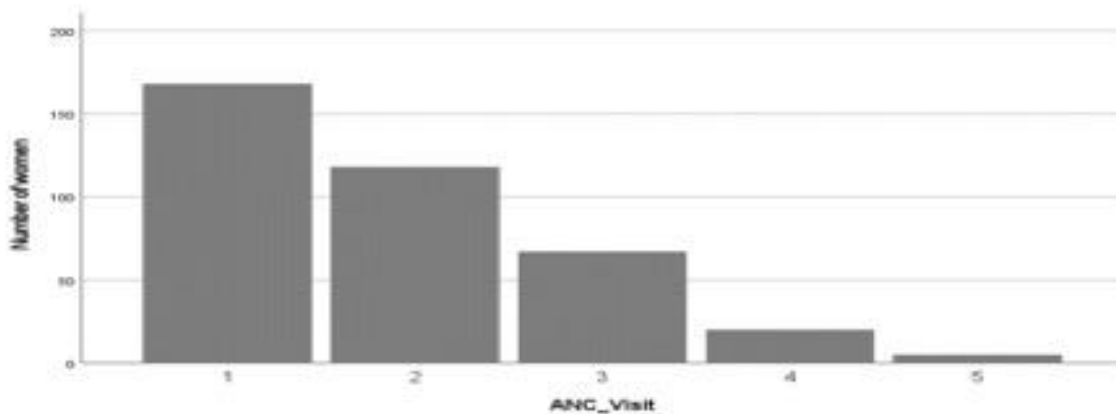
Table 22

Individual Health Facility Performance by Key Parameters of ANC Service Provision in the Service Level Index Tool

Health Facility Name	Rating	SLI Score
Domain: ANC Service Availability		
Availability of medical equipment		
Bugono HCIV	Fair	Score 14 - 17
Bulamagi HCIII	Low	Score more than 17
Buniro HCIII	Low	Score more than 17
Buowobi HCIII	Low	Score more than 17
Iganga hospital	High	Score less than 14
Nambale HCIII	Low	Score more than 17
Namungawe HCIII	Low	Score more than 17
Nawandala HCIII	Low	Score more than 17
Availability of medicines and medical supplies		
Bugono HCIV	Low	Score more than 106
Bulamagi HCIII	Low	Score more than 106
Buniro HCIII	Low	Score more than 106
Buowobi HCIII	Low	Score more than 106
Iganga hospital	High	Score less than 106
Nambale HCIII	Low	Score more than 106
Namungawe HCIII	Low	Score more than 106
Nawandala HCIII	Low	Score more than 106
Availability of a trained Health Provider		
Bugono HCIV	Medium	50-79% health providers trained
Bulamagi HCIII	High	80+% health providers trained
Buniro HCIII	Low	Less than 50% health providers trained
Buowobi HCIII	High	80+% health providers trained
Iganga hospital	Medium	50-79% health providers trained
Nambale HCIII	Low	Less than 50% health providers trained
Namungawe HCIII	Medium	50-79% health providers trained
Nawandala HCIII	High	80+% health providers trained
Domain: ANC Service Content		
Range of recommended services provided		
Bugono HCIV	Fair	Score 24 - 25
Bulamagi HCIII	Fair	Score 24 - 25
Buniro HCIII	Good	Score less or equal to 23
Buowobi HCIII	Good	Score less or equal to 23
Iganga hospital	Good	Score less or equal to 23
Nambale HCIII	Fair	Score 24 - 25
Namungawe HCIII	Good	Score less or equal to 23

Health Facility Name	Rating	SLI Score
Nawandala HCIII	Poor	Score 26 or more

Domain: ANC Service Organization

Timing of ANC service provision		
Bugono HCIV	Good	Score equal to or more than 17
Bulamagi HCIII	Poor	Score 10 or below
Buniro HCIII	Good	Score equal to or more than 17
Buowobi HCIII	Good	Score equal to or more than 17
Iganga hospital	Good	Score equal to or more than 17
Nambale HCIII	Good	Score equal to or more than 17
Namungawe HCIII	Good	Score equal to or more than 17
Nawandala HCIII	Good	Score equal to or more than 17

ANC Integration with other services		
Bugono HCIV	Good	Less or equal to 6
Bulamagi HCIII	Poor	Above 6
Buniro HCIII	Good	Less or equal to 6
Buowobi HCIII	Poor	Above 6
Iganga hospital	Good	Less or equal to 6
Nambale HCIII	Good	Less or equal to 6
Namungawe HCIII	Poor	Above 6
Nawandala HCIII	Poor	Above 6

Higher level facilities (Hospital and Level IV) were more likely to perform better under the service availability domain (Table 22). Both Iganga Hospital and Bugono HC IV registered medium scores for availability of trained providers, and high and fair respectively for availability of medical equipment. All the level three sites had low scores for availability of medical equipment, medicines, and medical supplies but only 2 out of 6 level three sites had low scores for availability of trained health providers. These discrepancies by level of care were less marked for the service content domain as well as timing of service provision under the service organization domain. However, integration of ANC with other services registered higher scores at the hospital and level IV site and only 2 out of 6 level three sites.

Figure 10 illustrates that despite women attending ANC in facilities with low service level scores in the different domains, progression to completion was still achieved**.**

Figure 10

Relationship Between Progression to Completion and Low Service Level Scores

(a) 2 Availability of medical equipment

(a) 3 Availability of medicines and supplies

(a) 3 Availability of trained health provider services

(a) 4 Range of recommended

a) 3 Integration with other services
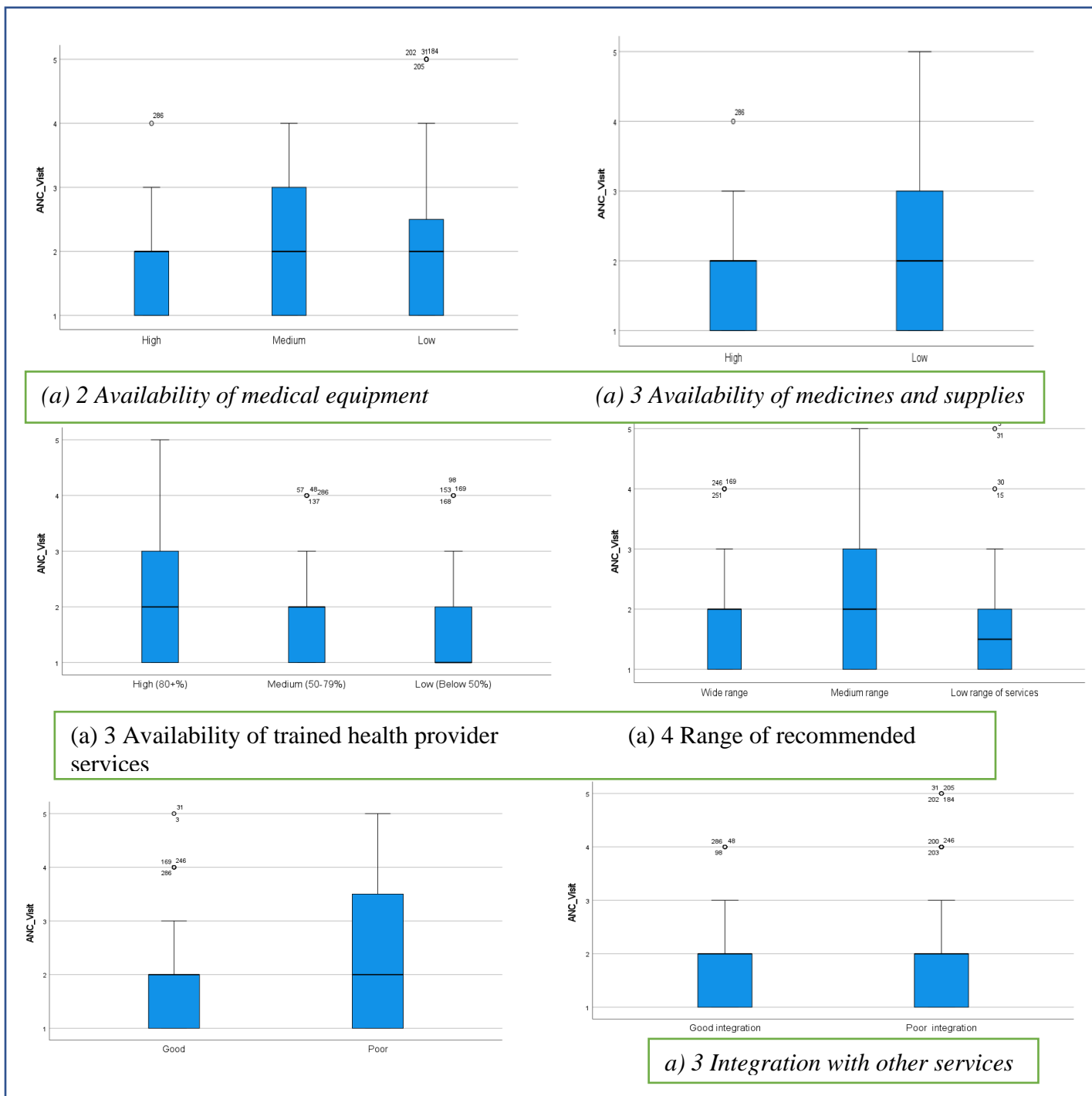
As illustrated in table 23, the regression model was statistically significant, $\chi 2$ (24) = 54.092, p < .001, indicating that the model could distinguish between respondents who progressed beyond the first ANC visit and those who did not progress. The good model fit is further illustrated by lack of statistical significance of both Pearson, $\chi 2$ (4) = 7.273, p=0.122, and Deviance $\chi 2$ (4) = 7.213, p=0.125, tests summarized in Table 24.

Table 23

Goodness of Fit Summary

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	146.083			
Final	91.991	54.092	24	.000

Table 24

Pearson and Deviance Goodness of Fit Tests

	Chi-Square	df	Sig.
Pearson	7.273	4	.122
Deviance	7.213	4	.125

Table 25 summarizes the overall contribution of each variable to the model. Only timing of services made a statistically significant contribution to the model. Health facilities with higher service level scores for timing of services were more likely to have clients who progressed beyond the first ANC visit.

Table 25

Likelihood Ratio Tests

Effect	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	150.803	245.241	102.803	10.812	4	.029
Availability of medical equipment	142.724	237.162	94.724	2.733	4	.603
Availability of medicines and medical supplies	146.592	241.029	98.592	6.601	4	.159
Availability of trained health provider	140.787	235.224	92.787	.795	4	.939
Range of recommended services	143.663	238.100	95.663	3.672	4	.452
Timing of services	152.639	247.077	104.639	12.648	4	.013
Integration of services	146.026	240.463	98.026	6.034	4	.197

Table 26 summarizes the regression coefficients of the predictors together with the odds of ANC attendance progression. Timing of services is a positive predictor of progression beyond the first ANC visit. The regression coefficient for timing of services indicates that health facilities that score higher on the timing of services index have a higher likelihood of their clients progressing to the third and fourth visits for ANC. For every 1 unit increase in timing scores, the odds of progressing to the third visit increased by a factor of 1.9 and the odds of progressing to the fourth visit increased by a factor of 2.5. Availability of medicines and medical supplies showed predictive value for progression to the fourth visit but not to the second and third visits. For every 1-unit improvement in availability of medicines and medical supplies scores, the odds of progressing to the fourth visit increased by a factor of 114 and this relationship was

statistically significant. The range of recommended services provided, integration of

ANC with other services, availability of medical equipment, and availability of trained

health provider, did not statistically significantly improve the odds of progression to

ANC completion.

Table 26

Wald Statistic and Odds Ratio

ANC_Visit[a]		B	Std. error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower bound	Upper bound
2	Intercept	.087	1.283	.005	1	.946			
	Availability of medical equipment	-.400	.645	.385	1	.535	.670	.189	2.372
	Availability of medicines and medical supplies	.741	.982	.570	1	.450	2.098	.306	14.372
	Availability of trained health provider	-.103	.276	.140	1	.708	.902	.525	1.550
	Range of recommended services	.076	.258	.086	1	.770	1.079	.650	1.789
	Timing of services	.231	.264	.771	1	.380	1.260	.752	2.113
	Integration of services	-.608	.628	.936	1	.333	.545	.159	1.865
3	Intercept	-.072	1.661	.002	1	.965			
	Availability of medical equipment	-.030	.721	.002	1	.967	.970	.236	3.988
	Availability of medicines and medical supplies	1.076	1.098	.960	1	.327	2.933	.341	25.231
	Availability of trained health provider	-.232	.378	.377	1	.539	.793	.378	1.664
	Range of recommended services	-.230	.385	.358	1	.550	.794	.374	1.688
	Timing of services	.669	.305	4.805	1	.028	1.953	1.073	3.553
	Integration of services	-1.764	.805	4.807	1	.028	.171	.035	.829
4	Intercept	-9.106	3.083	8.724	1	.003			
	Availability of medical equipment	-1.901	1.307	2.114	1	.146	.149	.012	1.938
	Availability of medicines and medical supplies	4.738	1.932	6.016	1	.014	114.220	2.591	5035.656
	Availability of trained health provider	.252	.531	.225	1	.635	1.287	.454	3.645
	Range of recommended services	.198	.528	.140	1	.708	1.218	.433	3.427
	Timing of services	.942	.369	6.511	1	.011	2.565	1.244	5.288
	Integration of services	.674	1.354	.248	1	.619	1.963	.138	27.898

Note. a. The reference category is: 1.

Discussion

The study investigated whether service level factors independently predict progression beyond the first ANC visit among pregnant women in a rural district in Uganda. A statistically significant predictive relationship was found between timing of ANC service provision under the service organization domain and continued utilization of ANC services after the initial first visit. Facilities with higher availability of medicines and medical supplies scores were more likely to have clients proceed to their fourth ANC visit. There was no statistically significant predictive relationship between availability of trained health providers, availability of medical equipment, provision of the recommended range of services within ANC, integration of ANC services with other services and progression beyond first visit. In relation to the research hypothesis, the study demonstrated that not all ANC SLI scores significantly predict progression to ANC completion among women at the first, second and third ANC visits. However, there is a statistically significant predictive relationship between timing of service provision scores and progression to third and fourth visits among women utilizing ANC services.

These results are supported by previous findings that show that provision of ANC services on restricted days of the week presented a barrier to utilization of specific services within the ANC package such as intermittent preventive treatment in pregnancy (IPTp) (Malaria Consortium, n.d.) and in the absence of scheduling, increased uncertainty among clients which in turn affected continued ANC attendance (Gong et al., 2019). Timing of provision of ANC services and improved awareness among clients about what

specific services in the package to expect on different days of the week has been shown to influence consistent ANC attendance (Conrad et al., 2012; Mathole et al., 2005).

Related to the finding that other service level factors did not significantly predict continued utilization of ANC services, is the demonstration that higher-level facilities tended to be better equipped and to have higher levels of trained health providers than level three facilities. Level three facilities had low scores for medical equipment and adequate availability of medicines and medical supplies at the time the study was conducted. However, even with low availability of medical supplies, the study demonstrated achievement of progression in these study sites. Previous studies in Uganda and similar contexts have revealed that distance to the health facility affects utilization of ANC services with longer distances resulting into lower utilization (Akouwah et al., 2018; Benova et al., 2018; Nausad et al., 2018). This could explain the continued utilization of ANC services at poorly equipped and stocked level three sites since hospitals and level IV centres tend to be located further away from the villages.

Important to note is that the model accounted for only about 15% of variance in the continued utilization of ANC services. Drawing from the theoretical and conceptual frameworks underpinning this paper, the study findings suggest that most of the variance in continued utilization of ANC services is likely explained by patient characteristics such as attitudes, socio-economic status, health seeking behavior, and individual decision-making ability in line with previous studies (Bbaale, 2011; Wilunda, 2017).

The significant predictive relationship between timing of ANC services and progression beyond the first ANC visit implies that time poverty and the weight of

opportunity costs likely play an important role in individual decision making on continued utilization of ANC services after the initial visit (Akouwah et al.,2018).

Limitations of the Study

Although this study contributed new evidence on the relationship between service level factors and progression to completion of recommended ANC visits, there are some limitations. The low numbers of women progressing to third and fourth ANC visits in the study population translated into a very small sample size after two visits which may have affected the external validity of the study.

Data from patient records was reviewed for the period July 2019 to June 2020. Between March 2020 and June 2020, the government of Uganda implemented strict lockdown measures that impacted utilization of routine health services across the country due to restrictions on the use of public transportation (Tusingwire, 2020). This factor was not controlled for during analysis but may have affected the continued utilization of ANC services among women whose records were reviewed.

Implications for Practice

Health managers at sub national and facility levels could utilize the findings of this study to improve the allocation of resources to health facilities at lower levels of the health system. Level three health facilities as demonstrated in this study remain an option for women to continue utilization of ANC services despite poor performance on availability of medical equipment and medicines and medical supplies probably due to geographic proximity. However, this may have negative implications for quality of ANC therefore undermining the coverage levels of progression beyond the first ANC visit.

The findings of this study under-score the need for an increased focus on ensuring that ANC services are offered on multiple days during the week, that there is flexibility in scheduling of ANC services on a daily basis, and that women have the option of scheduled appointments. More convenient timing of ANC service provision could also be achieved by use of the community outreach model that ensures that women receive prior information on outreach days and do not have to invest significant amounts of time travelling to static health facilities for care.

Recommendations for Future Research

This study assessed the relationship between progression beyond the initial ANC visit and service level factors using information available from health facility registers and structured interviews with facility managers. Further investigation of this relationship is needed using both quantitative and qualitative research methods and broader data sources including client perceptions of service level factors. Second, although timing of service provision showed a statistically significant relationship with the outcome of interest, none of the broad service level domains as a whole in this study significantly influenced ANC attendance progression. Further research is needed to provide additional insights into definition and measurement of ANC service-level factors to facilitate comparability of research studies.

Conclusion

This study has demonstrated that with the exception of the timing of ANC service provision, service level factors do not have predictive value for continued utilization of ANC services after the initial visit. The findings can however be used to improve

resource allocation for ANC service delivery at lower levels of the health system due to continued utilization of ANC services at these levels despite poor performance in the ANC service availability domain. Timing of ANC service provision should be prioritized by managers at different levels of the health system. Further research is needed to improve measurement of service level factors and how these interact with continued utilization of ANC services incorporating qualitative experiences and perceptions of ANC clients.

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Part 3: Summary

Integration of the Studies

The three studies have demonstrated that new tools to accurately assess health service provision can be developed and compared in the field with already existing and validated service provision assessment (SPA) tools. The results of study 1 specifically demonstrated that the Service Level Index (SLI) tool is a potential alternative to the ANC module of the SPA tool for reviewing ANC services at the micro-level. In study 2, the SLI tool was used to assess the role of service-level factors in the completion of four or more ANC visits among women of reproductive age in a rural district in Uganda. The findings demonstrated that some service-level factors have a predictive value for completion of ANC attendance.

Timing of service provision and availability of medicines and medical supplies were identified as significantly affecting completion of at least four ANC visits by service users. Similarly, in study 3, while service-level factors were largely nonpredictive for progression beyond first ANC visit, the timing of service provision emerged as having a statistically significant relationship with progression beyond one ANC visit, among women of reproductive age. The studies underscored the utility of simplified assessment tools that can be affordably deployed at the micro-level to understand performance of health facilities against service-level indices and how resources should be allocated to address gaps and improve the ANC experience for clients.

Previous studies have demonstrated that individual-level factors, such as socioeconomic status and knowledge, play an important role in initial and continued

131

utilization of ANC services (Bbaale, 2011; Wilunda, 2017). Factors such as long

distances to health facilities and long waiting times have also featured prominently in

studies that looked at barriers to ANC service utilization (Akouwah et al., 2018). These

findings are in line with the findings from study 2 and study 3 that timing of provision of

services in terms of hours per day and days per week plays an important role in affecting

completion and continued utilization of services. Drawing from the theoretical and

conceptual frameworks underpinning these studies, the findings suggest that most of the

variance in continued utilization of ANC services is likely explained by patient

characteristics, such as attitude, socioeconomic status, health-seeking behavior, and

individual decision-making ability—in line with previous studies (Bbaale, 2011;

Wilunda, 2017).

While medicines and medical supplies availability influence completion of at least

four ANC visits based on the results of study 2, women continued to utilize ANC services

at health facilities performing poorly on these indices in study 3, possibly due to

geographic factors associated with the relative proximity of lower-level centers compared

to better stocked hospitals and higher-level facilities. This insight is important for

emphasizing the need to improve the allocation of resources to health facilities at lower

levels of the health system and, as study 2 demonstrated, the need to focus scarce

resources on availability of medicines and medical supplies as well to ensure that a full

range of services are provided where women access care.

The overall study tested the level of agreement of a new SPA tool with an existing

tool and generated evidence on the relationship between service-level factors and optimal

ANC attendance among rural women in Uganda. The potential social change implications

are anchored on the use of this evidence to inform the implementation of ANC services

and to determine how resources are allocated to improve ANC experiences and

motivation of clients. Proposed areas of future research include the need to continuously

design new facility assessment tools and testing their levels of agreement with already

existing and validated tools, the need for further investigation of the interaction between

service-level factors and optimal ANC attendance with incorporation of the perceptions

of service users, and the need to provide additional insights into definition and

measurement of ANC service-level factors to facilitate comparability of research studies,

including in contexts other than Uganda.

In conclusion, the SLI tool is a potential alternative to the ANC module of the

SPA tool for assessing ANC services at the micro-level. Timing of service provision and

availability of medicines and medical supplies should be prioritized by managers at

different levels of the health system. Resource allocation for ANC service delivery at

lower levels of the health system should be prioritized due to continued utilization of

ANC services at these levels despite poor performance in the ANC service availability

domain. Further research is needed to improve measurement of service-level factors and

how these interact with continued utilization of ANC services, incorporating qualitative

experiences and perceptions of ANC clients.

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Appendix A: Data Collection Instruments

ANC modules of the Service Provision Assessment Tool (ANC Specific Readiness)

SECTION 14: ANTENATAL CARE

1400	**CHECK Q.102.05** ANC SERVICES NOT ANC SERVICES AVAILABLE IN FACILITY AVAILABLE IN FACILITY ☐	NEXT SECTION OR SERVICE SITE	

ASK TO BE SHOWN THE LOCATION IN THE FACILITY WHERE ANTENATAL CARE SERVICES ARE PROVIDED. FIND THE PERSON MOST KNOWLEDGEABLE ABOUT ANTENATAL CARE SERVICES IN THE FACILITY. INTRODUCE YOURSELF, EXPLAIN THE PURPOSE OF THE SURVEY AND ASK THE FOLLOWING QUESTIONS.

1401	How many days in a month are antenatal care services offered at this facility? USE A 4-WEEK MONTH TO CALCULATE # OF DAYS	NUMBER OF DAYS	

1402	Do ANC providers provide any of the following services to pregnant women as part of routine ANC?	YES	NO	
01	IRON SUPPLEMENTATION	1	2	
02	FOLIC ACID SUPPLEMENTATION	1	2	
03	INTERMITTENT PREVENTIVE TREATMENT (IPT) FOR MALARIA	1	2	
04	TETANUS TOXOID VACCINATION	1	2	

1403	**CHECK Q1402.04** TT VACCINATION TT VACCINATION PROVIDED NOT PROVIDED ☐	→ 1406

1404	Is tetanus toxoid vaccination available on all days that ANC services are available in this facility?	YES. . . . . 1 NOT ALL ANC DAYS. 2	1406

1405	How many days each week are tetanus toxoid vaccinations available at this facility?	DAYS PER WEEK. . . . . LESS OFTEN THAN ONCE/WEEK. 0	

1406	Do ANC providers in this facility provide any of the following **tests** from this site to pregnant women as part of ANC? IF YES, ASK TO SEE THE TEST KIT OR EQUIPMENT. IF TEST NOT DONE IN ANC, PROBE TO DETERMINE IF THE TEST IS DONE ELSEWHERE IN THE FACILITY	(A) OBSERVED		(B) NOT OBSERVED		
		AT LEAST ONE VALID	AVAILABLE NON VALID	REPORTED AVAILABLE NOT SEEN	AVAILABLE ELSEWHERE IN FACILITY	NO, OR E VER AVAILABLE
01	HIV RAPID DIAGNOSTIC TEST	1 2 3 4 5				
02	URINE PROTEIN TEST	1 2 3 4 5				

03	URINE GLUCOSE TEST	1 2 3 4 5
04	ANY RAPID TEST FOR HEMOGLOBIN	1 2 3 4 5
05	SYPHILIS RAPID DIAGNOSTIC TEST	1 2 3 4 5

1407	As part of ANC services, please tell me if providers in this facility provide the following services to ANC clients	YES	NO
01	COUNSELING ON RECOMMENDED MINIMUM OF 4 ANC VISITS FOR EACH PREGNANCY	1 2	
02	COUNSELING ON BIRTH PREPAREDNESS OR PREPARATION FOR DELIVERY	1 2	
03	COUNSELING ABOUT FAMILY PLANNING	1 2	
04	COUNSELING ABOUT HIV/AIDS	1 2	
05	COUNSELING ABOUT USE OF ITNs TO PREVENT MOSQUITO BITES AND MALARIA	1 2	
06	COUNSELING ABOUT BREASTFEEDING	1 2	
07	COUNSELING ABOUT NEWBORN CARE	1 2	
08	COUNSELING ON POSTNATAL CARE VISITS	1 2	

1408	Do ANC providers in this facility routinely diagnose and treat STIs, or are STI clients referred to another provider or location for diagnosis and treatment?	ROUTINELY DIAGNOSE AND TREAT STIs. . . . 1 REFER ELSEWHERE IN FACILITY. . . . . 2 REFER OUTSIDE FACILITY. . . . . 3 NO DIAGNOSIS / TREATMENT / REFERRAL. . 4	
1409	Do you have the **national ANC guidelines** available in this service area today?	YES. . . . . 1 NO. 2	1411
1410	May I see the national ANC guidelines? ACCEPTABLE IF PART OF OTHER GUIDELINES	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	1413
1411	Do you have **any other ANC guidelines** available in this service area today?	YES. . . . . 1 NO. 2	1413
1412	May I see the other guidelines?	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	
1413	Do you have **IPT guidelines** available in this service area?	YES. . . . . 1 NO. 2	1415
1414	May I see the IPT guidelines? ACCEPTABLE IF PART OF OTHER GUIDELINES	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	
1415	Do you have visual aids for client education on subjects related to pregnancy or antenatal care available in this service area today?	YES. . . . . 1 NO. 2	1417
1416	May I see the visual aids for client education?	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	
1417	Are individual client cards or records for ANC and PNC clients maintained at this service site?	YES. . . . . 1 NO. 2	1419

1418	May I see a blank copy of the client records or cards?	OBSERVED. . . . . .1 REPORTED NOT SEEN. 2	
1419	Does this facility have a system whereby observation or parameters for ANC clients are routinely carried out before the consultation? IF YES, ASK TO SEE THE PLACE WHERE THESE ACTIVITIES TAKE PLACE.	YES. . . . . .1 NO. 2	1421

1420	OBSERVE IF THE BELOW ACTIVITIES ARE BEING DONE ROUTINELY. IF YOU DO NOT SEE AN ACTIVITY, ASK: Is [ACTIVITY YOU DO NOT SEE] routinely	ACTIVITY ACTIVITY NOT ACTIVITY REPORTED ROUTINELY DON'T OBSERVED NOT SEEN DONE KNOW
01	Weighing of clients	1 2 3 8
02	Taking blood pressure	1 2 3 8
03	Conducting group health education sessions	1 2 3 8
04	Urine test for protein	1 2 3 8
05	Blood test for anemia	1 2 3 8
06	Malaria rapid diagnostic testing	1 2 3 8

EQUIPMENT AND SUPPLIES FOR ROUTINE ANC

1421	I would like to know if the following items are available in this service area and are functioning.	(A) AVAILABLE			(B) FUNCTIONING		
		OBSERVED	REPORTED NOT SEEN	NOT AVAILABLE	YES	NO	DON'T KNOW
01	DIGITAL BP APPARATUS	→	→	1 b 2 b 3 ↵ 02	1 2 8		
02	MANUAL BP APPARATUS	→	→	1 b 2 b 3 ↵ 03	1 2 8		
03	STETHOSCOPE	→	→	1 b 2 b 3 ↵ 04	1 2 8		
04	EXAMINATION LIGHT (FLASHLIGHT	→	→	1 b 2 b 3 ↵ 05	1 2 8		

05	FETAL STETHOSCOPE	1 b 2 b 3 06	1 2
06	ADULT WEIGHING SCALE	1 b 2 b 3 07	1 2 8
07	EXAMINATION BED OR COUCH	1 2 3	

1422	Please tell me if any of the following medicines are available at this services site today. I would like to see them. CHECK TO SEE IF AT LEAST ONE IS VALID (NOT EXPIRED)	(A) OBSERVED		(B) NOT OBSERVED		
		AT LEAST ONE	AVAILABLE NONE VALID	REPORTED AVAILABLE NOT SEEN	NOT AVAILABLE TODAY/DK	NO, OR NEVER AVAILABLE
01	IRON TABLETS (INDIVIDUAL TABLETS)	1 2 3 4 5				
02	FOLIC ACID TABLETS (INDIVIDUAL TABLETS	1 2 3 4 5				
03	COMBINED IRON AND FOLIC ACID TABLETS	1 2 3 4 5				
04	SP / FANSIDAR FOR IPTp	1 2 3 4 5				
05	TETANUS TOXOID VACCINE	1 2 3 4 5				

STANDARD PRECAUTIONS

1450	ASSESS THE ROOM OR AREA FOR THE ITEMS LISTED BELOW. FOR ITEMS THAT YOU DO NOT SEE, ASK YOUR RESPONDENT TO SHOW THEM TO YOU. IF THE SAME ROOM OR AREA HAS ALREADY BEEN ASSESSED, INDICATE WHERE THE DATA ARE RECORDED	GENERAL INFORMATION [Q710]. . . . . 11 CHILD VACCINATION [Q1051]. . . . . 12 CHILD CURATIVE CARE [Q1251] . . . . 13 FAMILY PLANNING [Q1351]. . . . . 14 PMTCT [Q1551]. . . . . 16 DELIVERY [Q1651]. . . . . 17 STI SERVICES [Q1851] . . . . 18 TUBERCULOSIS [Q1951]. . . . . 19 HIV TESTING [Q2051]. . . . . 21 NCD [Q2351]. . . . . 22 MINOR SURGERY [Q2451]. 23	NEXT SECTION / SERVICE SITE

1451	STANDARD PRECAUTIONS AND CONDITIONS FOR CLIENT EXAMINATION	OBSERVED	REPORTED, NOT SEEN	NOT AVAILABLE
01	RUNNING WATER (PIPED, BUCKET WITH TAP OR POUR PITCHER)	1 2 3		
02	HAND-WASHING SOAP (MAY BE LIQUID SOAP)	1 2 3		
03	ALCOHOL-BASED HAND RUB	1 2 3		
04	WASTE RECEPTACLE (PEDAL BIN) WITH LID AND PLASTIC BIN LINER	1 2 3 06 ↵		
05	OTHER WASTE RECEPTACLE	1 2 3		
06	SHARPS CONTAINER ("SAFETY BOX")	1 2 3		
07	DISPOSABLE LATEX GLOVES	1 2 3		
08	DISINFECTANT [E.G., CHLORINE, HIBITANE, ALCOHOL]	1 2 3		

09	SINGLE-USE STANDARD DISPOSABLE SYRINGES WITH NEEDLES OR AUTO-DISABLE SYRINGES WITH NEEDLES	1 2 3
10	MEDICAL MASKS	1 2 3
11	GOWNS	1 2 3
12	EYE PROTECTION [GOGGLES OR FACE PROTECTION]	1 2 3
13	GUIDELINES FOR STANDARD PRECAUTIONS	1 2 3
1452	DESCRIBE THE SETTING OF THE ANC SERVICE ROOM OR AREA.	PRIVATE ROOM. . . . . .1 OTHER ROOM WITH AUDITORY AND VISUAL PRIVACY. . . . . 2 VISUAL PRIVACY ONLY. 3

THANK YOUR RESPONDENT AND MOVE TO YOUR NEXT DATA COLLECTION POINT IF DIFFERENT FROM CURRENT LOCATION.

SECTION 15: PMTCT OF HIV INFECTION

1500	**CHECK Q102.06** PMTCT SERVICES NO PMTCT SERVICES IN FACILITY OFFERED IN FACILITY ↓	☐
	NEXT SECTION OR SERVICE SITE →	

CAUTION!!!
THIS SECTION SHOULD BE COMPLETED ONLY AFTER COMPLETING THE ANC SECTION

ASK TO BE SHOWN THE LOCATION IN THE FACILITY WHERE PMTCT SERVICES ARE PROVIDED. FIND THE PERSON MOST KNOWLEDGEABLE ABOUT PROVISION OF PMTCT SERVICES IN THE FACILITY. INTRODUCE YOURSELF, EXPLAIN THE PURPOSE OF THE SURVEY AND ASK THE FOLLOWING QUESTIONS.	→

1501	As part of PMTCT services, please tell me if providers in this facility provide the following services to clients	YES	→ NO
01	PROVIDE HIV COUNSELING AND TESTING SERVICES TO PREGNANT WOMEN	1	2
02	PROVIDE HIV TESTING SERVICES TO INFANTS BORN TO HIV POSITIVE WOMEN	1	2
03	PROVIDE ARV PROPHYLAXIS TO HIV POSITIVE PREGNANT WOMEN	1	☐ 2 →
04	PROVIDE ARV PROPHYLAXIS TO NEWBORNS OF HIV POSITIVE WOMEN	1	2
05	PROVIDE INFANT AND YOUNG CHILD FEEDING COUNSELING FOR PMTCT	1	2 →
06	PROVIDE NUTRITIONAL COUNSELING FOR HIV POSITIVE PREGNANT WOMEN AND THEIR INFANTS	1	2
07	PROVIDE FAMILY PLANNING COUNSELING TO HIV POSITIVE PREGNANT WOMEN	1	2
1502	**CHECK Q1501.01** HIV COUNSELING AND NO HIV COUNSELING AND TESTING FOR PREGNANT WOMEN TESTING FOR PREGNANT WOMEN ↓	☐ → 1506

1503	IS THIS THE SAME LOCATION AS THE ANC SERVICE SITE?	YES, ANC SERVICE SITE. . . . . 1 NO, DIFFERENT LOCATION. 2	1506
1504	Is HIV rapid diagnostic testing available from this service site?	YES. . . . . 1 NO. 2	1506
1505	May I see a sample HIV rapid diagnostic test (RDT) kit? CHECK TO SEE IF AT LEAST ONE IS VALID	OBSERVED, AT LEAST 1 VALID. . . . . 1 OBSERVED, NONE VALID. 2	
1506	**CHECK Q1501.02** INFANT HIV NO INFANT HIV COUNSELING COUNSELING AND TESTING AND TESTING		1509
1507	Do providers use filter paper to collect dried blood spots (DBS) for HIV diagnosis in infants at this service site?	YES. . . . . 1 NO. 2	1509
1508	May I see sample DBS filter paper cards? CHECK TO SEE IF AT LEAST ONE IS VALID	OBSERVED, AT LEAST 1 VALID. . . . . 1 OBSERVED, NONE VALID. . . . . 2 REPORTED AVAILABLE, NOT SEEN. 3	
1509	Do you have the *national guidelines* for PMTCT available in this service area?	YES. . . . . 1 NO. 2	1511
1510	May I see the national PMTCT guidelines? MAY BE PART OF ANOTHER GUIDELINE	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	1513
1511	Do you have *any other guidelines* for PMTCT available in this service area?	YES. . . . . 1 NO. 2	1513
1512	May I see the other guidelines?	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	
1513	Do you have guidelines for *infant and young child feeding counseling* available in this service area?	YES. . . . . 1 NO. 2	1515
1514	May I see the guidelines for infant and young child feeding and counseling?	OBSERVED. . . . . 1 REPORTED NOT SEEN. 2	
1515	Do you stock any ARVs for PMTCT in this service area?	YES. . . . . 1 NO. 2	1550

1516	Please tell me if any of the following antiretroviral medicines are available at this services site today. I would like to see them. CHECK TO SEE IF AT LEAST ONE IS VALID (NOT EXPIRED)	(A) OBSERVED		(B) NOT OBSERVED		
		AT LEAST ONE	AVAILABLE NONE VALID	REPORTED AVAILABLE NOT SEEN	NOT AVAILABLE TODAY/DK	NO, OR NEVER AVAILABLE
01	ZIDOVUDINE (AZT) TABS	1	2	3	4	5
02	NEVIRAPINE (NVP) TABS	1	2	3	4	5
03	LAMIVUDINE (3TC) TABS	1	2	3	4	5
04	LOPINAVIR (LPV/r) TABS	1	2	3	4	5
05	ABACAVIR (ABC) TABS	1	2	3	4	5
06	EFAVIRENZ (EFV) TABS	1	2	3	4	5
07	TENAFOVIR DISOPROXIL FUMARATE (TDF) TABS	1	2	3	4	5
08	EMTRICITABINE (FTC)	1	2	3	4	5

09	ZIDOVUDINE (ZDV) + LAMIVUDINE (3TC)	1 2 3 4 5
10	NEVIRAPINE (NVP) SYRUP	1 2 3 4 5
11	ZIDOVUDINE (AZT) SYRUP	1 2 3 4 5

STANDARD PRECAUTIONS

| 1550 | ASSESS THE ROOM OR AREA FOR THE ITEMS LISTED BELOW. FOR ITEMS THAT YOU DO NOT SEE, ASK YOUR RESPONDENT TO SHOW THEM TO YOU. IF THE SAME ROOM OR AREA HAS ALREADY BEEN ASSESSED, INDICATE WHERE THE DATA ARE RECORDED | GENERAL INFORMATION [Q710]. 11
CHILD VACCINATION [Q1051] 12
CHILD CURATIVE CARE [Q1251]. 13
FAMILY PLANNING [Q1351]. 14
ANTENATAL CARE [Q1451]. 15
DELIVERY [Q1651]. 17
STI SERVICES [Q1851] 18
TUBERCULOSIS [Q1951]. 19
HIV TESTING [Q2051]. 21
NCD [Q2351]. 22
MINOR SURGERY [Q2451]. . . . . 23 | NEXT SECTION / SERVICE SITE |

1551	**STANDARD PRECAUTIONS AND CONDITIONS FOR CLIENT EXAMINATION**	OBSERVED	REPORTED, NOT SEEN	NOT AVAILABLE
01	RUNNING WATER (PIPED, BUCKET WITH TAP OR POUR PITCHER)	1 2 3		
02	HAND-WASHING SOAP (MAY BE LIQUID SOAP)	1 2 3		
03	ALCOHOL-BASED HAND RUB	1 2 3		
04	WASTE RECEPTACLE (PEDAL BIN) WITH LID AND PLASTIC BIN LINER	1 2 3 06↵		
05	OTHER WASTE RECEPTACLE	1 2 3		
06	SHARPS CONTAINER ("SAFETY BOX")	1 2 3		
07	DISPOSABLE LATEX GLOVES	1 2 3		
08	DISINFECTANT [E.G., CHLORINE, HIBITANE, ALCOHOL]	1 2 3		
09	SINGLE-USE STANDARD DISPOSABLE SYRINGES WITH NEEDLES OR AUTO-DISABLE SYRINGES WITH NEEDLES	1 2 3		
10	MEDICAL MASKS	1 2 3		
11	GOWNS	1 2 3		
12	EYE PROTECTION [GOGGLES OR FACE PROTECTION]	1 2 3		
13	GUIDELINES FOR STANDARD PRECAUTIONS	1 2 3		

1552	ASK TO SEE ROOM OR AREA WHERE PMTCT SERVICES ARE PROVIDED DESCRIBE THE SETTING OF THE ROOM OR AREA.	PRIVATE ROOM. . . . . 1 OTHER ROOM WITH AUDITORY AND VISUAL PRIVACY. . . . . 2 VISUAL PRIVACY ONLY. 3

THANK YOUR RESPONDENT AND MOVE TO YOUR NEXT DATA COLLECTION POINT IF DIFFERENT FROM CURRENT LOCATION.