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Research Paper

Full Length Research Paper

Assessment of impediments affecting health systems response to neurocysticercosis in two districts (Gulu and Amuru) of Northern Uganda: A cross sectional study

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Northern Uganda is recovering from the effects of prolonged war which devastated most of the health systems in the region. The aim of the study was to identify health sector impediments affecting health systems response to Neurocysticercosis in the districts of Gulu and Amuru. A cross sectional study was conducted on two hospitals and 10 health centers. Two hundred and three (n=203) respondents were involved. Questionnaires were used to collect the data. One hundred and forty two (70.0%) of the respondents are permanently employed (P=0.01). Seventy three point nine percent (73.9%) of respondents are residents from Gulu districts (P=0.024). One hundred and nine (53.4%) of respondents reported they received training on infectious diseases (P=0.507). One hundred and forty three (70%) reported their health facilities have polices (P=0.04). One hundred and forty seven (72.4%) reported in-charges reside at health facilities (P=0.01). One hundred and twenty four (61%) of the respondents reported Government is the primary source of funding (P=0.02). One hundred and seventeen (57.6%) of the respondents reported funding are irregular (P=0.23). Eighty seven percent (87%) reported inadequate physical infrastructure (P=0.04). Seventy three point six have limited knowledge on the diagnosis of Neurocysticercosis (P=0.01) and many prescribe anti-helminthic drugs to patients (P=0.27). Despite improvement in the healthcare services in the health sectors, health systems response to Neurocysticercosis in Gulu and Amuru, Northern Uganda is weak with most health facilities operating minimally. There is need for holistic approach to improvement of health systems in the region through increased Government funding and advocacy.

Key words: Impediments, health systems, neurocysticercosis, communities, northern Uganda.

INTRODUCTION

There is growing evidence that the global health agenda needs to shift from an emphasis on disease-specific approaches of interventions to strengthening of health systems, including dealing with social, environmental and economic determinants through multi-sectorial responses (Lancet, 2004; Senkubuge et al., 2014). The World health

Organizations (WHO) defines health systems as all organizations, people and actions whose primary intent is to promote, restore and maintain health (WHO, 2008). The health systems framework consists of six building blocks, namely; service delivery, health work force, health information systems, medical products including vaccines and other technologies, health financing, leadership and governance (WHO, 2007). These building blocks interact with other facets to constitute a system (Senkubuge et al., 2014). Improvement of healthcare service delivery requires synergies in the functionality of the building blocks at all levels of implementation including the district (Sengkubuge et al., 2014). Effectiveness of the organization and management of service delivery in the district depend among others, on the competence and number of members of the district health management team as well as relevant management teams in health centers, health post and communities (Sengkubuge et al., 2014; WHO, 2007).

Recent studies demonstrate that good governance, especially at the decentralized levels, can improve health outcomes (Anwari et al., 2015; Olafsdottir et al., 2011). On the other hand, previous studies have shown that poor governance especially in the health sectors contribute to poor health outcomes (Björkman et al., 2009; Gupta et al., 2002). The breakdowns in the health systems due to technical and administrative inefficiencies affect healthcare services delivery in a substantial manner (Gupta et al., 2002).

Over the last 20 years, Northern Uganda has been in a protracted war with serious negative consequences on the health systems (UNISDR report, 2015). The health systems and social determinants of health were devastated resulting in poor health indications and lack of productivity among rural communities (UNISDR report, 2015). Previous studies have shown that armed conflicts occur more frequently in low income countries of the world where their impact is more severe, thus compounding the poor situation of the social determinants of health and weak health systems associated with such countries (World Bank report, 1998). Northern Uganda is an area where majority of the communities live in extreme abject poverty. The region has experienced serious turmoil and most health systems were ravaged resulting in disruption of health services, reduced access to and utilization of health services (Vreeman et al., 2009). These attributable factors together with other physical challenges are serious impediments in the functionality of health systems particularly in response to the threat posed by infectious diseases. With the rising challenges of emerging infectious diseases coupled with inadequate number of health professionals, the functionality and readiness of

health systems response to neurocysticercosis (NCC) in the region is limited.

NCC is an infection of the central nervous systems (CNS) with the larval stage of *Taenia solium* cyst. The disease may be asymptomatic or present with a number of nonspecific manifestations, such as seizures, headaches, focal neurological deficits, increased intracranial pressure or cognitive decline (Del Brutto and García, 2014). Approximately 50 million people worldwide are infected with *T. solium* parasites and 50,000 people die of cysticercosis related diseases annually (Fleury et al., 2006; Lescano et al., 2007). In developed countries particularly, United States of America, cases of human cysticercosis have been reported among immigrants (Lescano et al., 2007). *T. solium* infections are prevalent in rural areas in developing countries particularly in Central and South America, Asia and sub-Sahara Africa (Lescano et al., 2017). In Uganda, information on human cysticercosis/neurocysticercosis is still scanty. However, a recent study conducted in the districts of Gulu, Moyo and Amuru, Northern Uganda indicated that 15% of patients with epilepsy in the region were positive to *T. solium* cysticercosis (Alarakol et al., 2017). *T. solium* is one of the parasites that cause serious public health and socioeconomic problems in endemic region (Alarakol et al., 2017). Taeniasis is acquired when one eats raw or undercooked pork containing cysticerci, the larval stage of *T. solium* (Basem et al., 2010; Waiswa et al., 2009). When ingested, the cysticerci migrate to mucosal of the intestine where they attach and become adults. These adult worms shed proglottids containing eggs in human feces and become the source of infection that can infect other human or pigs by direct or indirect contamination of food or water (Alarakol et al., 2017). *T. solium* causes human cysticercosis when one ingests embryonated eggs in food or water contaminated with fecal matter of persons harboring the adult tapeworm (Xu et al., 2010). When the CNS is infected with the larval stage of *T. solium*, NCC occurs which manifest as epileptic seizures.

Strong health systems play a pivotal role in the prevention of infectious diseases including NCC in the region (Ekouevi et al., 2011). When health systems are synergistically functional, the impediments are minimized. Health systems governance refers to a wide range of steering and rule-making related functions carried out by governments and/or decisions makers in order to achieve national health policy objectives that promote universal health coverage.

In this study, the six health systems building blocks as defined by WHO namely: service delivery, governance, health financing, medical technologies and health information systems, were examined and the functionality and readiness of health systems based on these

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essential features were assessed. The objective of the present study was to identify impediments that affect the functionality of health systems response to NCC in two districts of Northern Uganda: Amuru and Gulu.

MATERIALS AND METHODS

Study design

The present study is mainly a cross sectional one but a mixed method approach was adopted to answer the stated research questions. The research questions investigated identified impediments affecting the functionality of health systems response to neurocysticercosis within the health systems framework in Amuru and Gulu districts, Northern Uganda. Semi structured questionnaires and interviews were used to collect quantitative and qualitative data. Qualitative data were collected and analyzed as described by Bryman (2001). The qualitative approach was employed to investigate in depth dimensions of the health systems from the expert point of views. Real life experiences and opinions were collected as described by De Vaus (2014). The research protocol was approved by Gulu University, Research Ethic Committee (GUREC) and Uganda National Council of Science and Technology (UNCST) (Ref: HS987).

Study settings

This study was conducted in the two districts of Amuru and Gulu, Northern Uganda from August, 2016 to June, 2017. The two districts cover a total area of over 3000 km^2 with an estimated population of 600,000 inhabitants (Uganda Bureau of statistics, 2006). These areas experienced the ravage of the brutal war which occurred in Northern Uganda from 1987 to 2006 during which the health systems virtually collapsed. The communities in these areas practice largely subsistence farming where peasant farmers focus on growing food stuffs to feed themselves and their families. These areas have high level of poverty, lack sanitation infrastructure and the communities practiced free range pig farming which provide suitable environment for survival of *T. solium* in the study population (Alarakol et al., 2017). The pigs are usually kept at night in pens and released in the morning to scavenge for foods in the environment. In addition, these areas have shortage of toilets/pit latrines as well as safe sources of water (Alarakol et al., 2017). The toilets/pit latrines coverage is estimated at 89% (Uganda Bureau of statistics, 2006).

The main sources of water in these areas are: spring, wells, bore holes, tape water and protected wells (Uganda Bureau of statistics, 2006). Recent study conducted in the area has indicated that the communities in the areas have been exposed to *T. solium* infections (Alarakol et al., 2017). Key informant participants were selected from one government referral hospital (GRH) and one large private not-for-profit hospital (PNH) in the region. These hospitals were selected because they are centrally located and have large catchment areas of the communities in Northern Uganda. Additionally, they employ large number of health professionals. The selected privately owned hospital, is one of the WHO accredited sentinel site for data collection in Uganda. It receives the largest numbers of patients from rural communities in Northern Uganda. The sample population was constituted from key informants, health professionals and village health teams who are resident in the two districts of Gulu.

Sample size

Estimation of the sample size for the functionality of the health systems was done according to a formula described by Kish (1965). Since, the functionality of the health systems in the two districts is unknown, 50% estimate was considered at 95% confidence interval, with a 10% precision. A total of 96 samples were required. In order to minimize the sampling error and to increase the power of the study, this was doubled to 192 samples. A 20% samples were allocated to cater for non-responses from respondents. Thus, the overall sampled size was 203.

Sampling

Convenient sampling was conducted in which two hospitals namely: GRH, PNH and a total of 10 health centers II, III and IV were selected. However, no hospital was selected in Amuru district since it does not have one. Only health centers II, III and IV in the area were included. A total of 500 health workers in the two hospitals and the health centers were registered for the study. The proportion of health workforce investigated includes: doctors, 20 (9.8%), nurses, 110 (54.2%), clinical officers, 30 (14.8%), laboratory technologist/technicians, 15 (7.4%), physiotherapists 5 (2.5%), orthopedic technologists, 13 (6.4%) and other allied workers 10 (4.9%) which constituted the majority of the health work force. All participants who consented to participate in the study were recorded in the register using identification number. Simple random sampling was used to select the participants from the sampling frame of 500. Random numbers were generated from a sampling frame of 500. These were then aligned to the participants register. Each participant assigned a random number was included in the study. Thus, a total of 203 participants were enrolled in the study.

Data collection tool

This study was preceded by initial visits to the study area to mobilize the communities and to seek for permissions from the health authorities and local leaders to conduct the research in the area. When permissions were granted, the research team visited the health facilities and identified the research assistants to assist in the administration of the questionnaires. Semi structured questionnaires were administered to the health workers. The questionnaires investigated issues related to the functionality of health systems in the two districts under study. This includes issues related to: governance, human resource, health financing, medical technologies and supplies, service delivery and health information systems. In addition, the questionnaires assessed demographic information such as age, gender, education level, time lived in the area and occupation.

Data management and confidentiality

The study data were collected with no identification information included in the database except personal identification numbers. Participants' register, data, paper surveys, transcripts and field note books were stored in a secured cabinet in the faculty throughout the study period. After data collection, computer with the study data were kept in a secured cabinet in Faculty of Medicine, Gulu University. Therefore, participants' confidentiality was ensured.

Statistical analysis

The categorical data are presented as mean, standard deviation, interquartile range or percent frequency. Data were analyzed using Pearson's Chi-square to test for statistical difference between proportions. The probability value ($P<0.05$) were considered to be statistically significant. Statistical analysis of data was performed using SPSS version 19.

Table 1. Socio-demographic characteristics in relation to functionality of the health system.

Study population data	Frequency	Percent	P-value
Age	Mean, 33.5		
	SD, 8.5		
Sex			
Male	87	42.9	0.074
Female[a]	116	57.1	
Marital status			
Married	87	42.9	0.34
Single[b]	140	68.9	
Staff			
New staff	37	18.2	0.03
Old staff[c]	116	81.8	
Employment status			
Permanent[d]	142	70	0.001
Contract	61	30	
Residence			0.024
Within Gulu[e]	150	73.9	
Other areas	53	26.1	
Training	109	53.4	0.507

n: Total number of respondents, a: most respondents were female (*P*=0.074), b: most respondents were single (*P*=0.34), c: most respondents were old staffs (*P*=0.03), c: most staffs were on permanent terms (*P*=0.01), d: most respondents originates from Gulu district (*P*=0.024).

RESULTS

Socio-demographic characteristics in relation to functionality of health systems

Table 1 describes the socio-demographic characteristics of the study participants. A total of 203 health workers in the districts of Amuru and Gulu were included in the study. Two hospitals: LH and GRRH, and 10 health centers (II, III and IV) were assessed for the functionality of the health systems. The ages of the respondents ranged from 20 to 65, with a mean age of 33.5 years and SD 8.5. Majority, 140 (68.9%), of the respondents were single *(P*=0.34). Most of them, 142 (70.0%) are permanently employed with experience ranging from 1 to 30 years (*P*= 0.01). Of the 203 respondents sampled, majority, 116 (57.1%) were female. There was no statistical difference in proportion between the male and female (*P*= 0.074). One hundred and fifty, 150 (73.9%) of the respondents are staff who are residents of Gulu districts (*P*=0.024).

Additionally, 109 (53.4%) of the respondents reported they received training on infectious diseases (Table 1) and there was no statistical difference between those who received the training or not (*P*=0.507). One hundred and nineteen, 119 (58.6%) of the respondents reported they received training every six months since they were recruited into the health service (*P*=0.33). Twenty two percent (22%) of the respondents reported receiving training at least between 1 and 2 years. Every health worker attended at least training in the past 10 years. Most of the respondents received training on HIV, 108 (91.6), hepatitis B, 59 (29.1%) and Ebola, 22 (10.8%). Others received training on infectious diseases such as neurocysticercosis, cancer, nodding syndromes among others.

Governance in relation to functionality of health systems

Respondents were interviewed at various hospitals and health centers in Gulu and Amuru with to respect to key aspects of governance (Table 2). Of the 203 respondents, 143 (70%) reported their health facilities have functional polices. Chi-square analysis showed no statistical difference (*P*=0.04) between those who reported presence of the policies or not. When asked for the persons in charge at the health facilities, the responses were quite variable for the 203 respondents

Table 2. Governance in relation to functionality of health systems.

Variable related to governance	Frequency (n=203)	Percent	P-value
In-charge, director[a]	86	42.4	0.07
Residency at facility[b]	147	72.4	0.001
Availability at facility[c]	139	68.5	0.003
Departmental meetings[d]	180	80.0	0.02
Frequency			
Once a month[e]	127	62.6	0.056
Policy	143	70.4	0.04

n: Total number of respondents, a: titles, 'directors' were mostly used, b: most respondents think the in-charge resides at their health facilities (P=0.01), c: most respondents think the in-charge are available at their health facilities (P=0.03), d: departmental meetings are held in most health facilities (P=0.02); e: most departmental meetings are held once a month.

Table 3. Health financing in relation to functionality of health systems.

Variable related to health financing	Frequency (n=203)	Percent
Funding		
Government**	124	61.1
Donor	48	23.6
Faith based organizations	23	11.3
Private	8	3.9
Support		
Regular	90	44.3
Inadequate	117	57.6

**Government is the primary source of funding for most health facilities in the region (P= 0.02) though the funding are usually inadequate.

sampled, 42.4% reported the director as the one in charge, while 44, 39, 14 and 20% reported clinical officers, medical superintendent, medical assistant and others (enroll nurse and focal person/chairman), respectively. One hundred and forty seven, 147 (72.4%) of the respondents reported that the in-charges reside at their health facilities (P=0.02), while 19 (9.4%) did not know whether the in-charge are resident or not at the facilities. However, most of the respondents, 139 (68.5) reported the presence of in-charges at their health facilities (P=0.07), while some (46%) reported irregularities of the in-charge at the health facility.

Additionally, 127 (62.6%) of the respondents reported they hold departmental meetings once every month (P=0.02) and that these meeting are regularly held at the facilities (P=0.056).

Health financing

In the present study, 124 (61%) of the respondents reported that the government is the primary supporter of the health facilities in the districts (P=0.02) (Table 3), statistical difference (P=0.04) between those who reported presence of the policies or not. When asked for

the persons in charge at the health facilities, the responses were quite variable for the 203 respondents sampled, 42.4% reported the director as the one in charge, while 44, 39, 14 and 20% reported clinical officers, medical superintendent, medical assistant and others (enroll nurse and focal person/chairman), respectively. One hundred and forty seven, 147 (72.4%) of the respondents reported that the in-charges reside at their health facilities (P=0.02), while 19 (9.4%) did not know whether the in-charge are resident or not at the facilities. However, most of the respondents, 139 (68.5) reported the presence of in-charges at their health facilities (P=0.07), while some (46%) reported irregularities of the in-charge at the health facility.

Additionally, 127 (62.6%) of the respondents reported they hold departmental meetings once every month (P=0.02) and that these meeting are regularly held at the facilities (P=0.056).

Health financing

In the present study, 124 (61%) of the respondents reported that the government is the primary supporter of the health facilities in the districts (P=0.02) (Table 3),

Table 4. Health service delivery in relation to functionality of health systems.

Variables related to health service delivery	Frequency (n=203)	Percent
Inadequate physical infrastructure**	176	86.6
Out patients services/hospital visits**	201	99.0
In patients service/admissions**	191	94.1
Referral systems**	189	93.1
Diagnosis of NCC at the facilities*	81	40.0
Access to anthelminthic drugs*	122	61.1
Prescriptions of anthelminthic drugs*	123	60.6
NCC control/prevention programs	94	46.3

n: Total number of respondents, **most respondents reported inadequate physical infrastructure (P=0.04) presence of inpatients and out patients at health facilities (P= 0.154), *only few respondents know how diagnosis of NCC is done (P=0.04) and yet many health workers prescribe anthelminthic drugs to their patients (P=0.03), only few respondents know there is a NCC control/prevention program (P=0.043).

while, 48 (23.6) reported the donors, and faith based organizations and private enterprises 8 (3.9%) as the sources of funding at their health facilities in the two districts. More than 117 (57.6%) of the respondents reported funding at the health facilities are irregular (P=0.23) and that it received very limited healthcare support in the last financial year. In addition, the funding is received late at the health facilities; therefore, affecting the day to day operations.

Health service delivery

Table 4 describes the health attributes and outcomes at health facilities. The findings indicate that of the 203 respondents interviewed, 176 (87%) reported inadequate physical infrastructure at all health centers (II, III, IV) (P=0.041). Two hundred and one (99.0%) of the respondents reported they receive patients at their health facilities (P=0.01). One hundred and ninety one (94.1 %) and 201 (99.0%) of the respondents reported that they have in-/out- patients currently at the health facilities, respectively. In addition, the respondents reported receiving more than 100 out-patients per day at each health facility. Many of these patients are referred from other health facilities in the region. One hundred and eighty nine (93.1%) of respondents reported a functional referral systems with Lacor Hospital (23.6%), Gulu Regional Referral Hospital 48 (23.6%), Gulu independent hospital (GIH) 15 (7.4%) and Mulago Hospital (MH) 92 (45.3%) respectively being the most favored primary health facility.

Additionally, 40% of the respondents reported having seen patients diagnosed of NCC at the health facilities. One hundred and twenty two (60.1%) of respondents reported there are adequate anthelminthic drugs at health facilities with most health workers, 123 (60.6%) prescribing them to patients. Chi-square analysis showed significant statistical difference in the number of respondents who prescribed anthelminthic drugs (P=0.03) and those who did not give out these drugs. In addition, statistical significant difference was observed between respondents who did not know the dangers associated with prescribing anthelminthic drugs to NCC patients and those who knew about it (P=0.001). Furthermore, more than 109 (53.7%) of the respondents did not know of any program at health facilities that address issues on NCC in the region (P=0.043).

Health information systems (HIS)

The current study also investigated the functionality of the HIS at the health facilities. Up to 185 (91.1%) reported the presence of HIS (P=0.01). One hundred and sixty seven, 167 (82.3%) of the respondents reported that there is a technical person in-charge of the HIS (Table 5). Chi-square analysis showed significant difference between those who reported the presence of HIS at the facilities and those who did not know (P=0.023). Additionally, more than 114 (56.2%) reported that the HIS is linked to GRH and PNH. Majority of the respondents reported that monthly reports from health centers II, III and IV are submitted to both GRH and PNH (P=0.034). Up to 157 (77.3%) of the respondents reported the inpatient reports are submitted in these health facilities. While, 147 (72.4%) reported that the outpatients reports are also sent to these higher health facilities. Other records sent include: records of the meetings, referral of cases as well as epidemiology reports.

Medical equipment and supplies

One hundred and fifty four (75.9%) of the respondents reported that there are functional medical equipment at their facilities (P=0.01) (Table 6). However, these do not include specialized medical equipment such as MRI and

Table 5. Health information systems in relation to functionality of health systems.

Variables related to HIS	Frequency (n=203)	Percent	P-value
Health information systems**	185	91.1	0.001
In-charge**	167	82.3	0.023
Records of meeting*	124	61.1	0.056
Records of referrals of cases*	153	75.3	0.023
Records of epidemiology report*	120	59.1	0.336
Inpatients monthly report*	157	77.3	0.041
Outpatients monthly report*	147	72.4	0.021

n: Total number of respondents, **Majority of respondents reported presence of HIS (*P*=0.001); also most respondents reported presence of a technical person in-charge of HIS (*P*=0.023). *Most reports from health centers II, III and IV are submitted to GRRH and Lacor Hospital monthly (*P*=0.034).

Table 6. Medical equipment and supplies in relation to functionality of health systems.

Variable related to medical supplies	Frequency (n=203)	Percent	*P*-value
Medical Equipment***	154	75.9	0.001
Condition of equipment	65	31.9	0.088
MRI and CT scan	55	27.1	0.073
Access to medical equipment to the community***	139	68.5	0.021
Servicing of Medical equipment	83	40.9	0.063
Referral for MRI and CT scan	92	45.3	0.099
Medical supplies	122	60.1	0.252

n: ***Significant numbers of respondent reported the presence of medical equipment (*P*=0.01); *only few actually know the conditions of these equipment (*P*=0.088); *only few respondents think MRI scans and CT scans are at health facilities(*P*=0.073); ***most respondents think access to MRI and CT scans is impossible for the community (*P*=0.021); *some respondents are not sure whether medical equipment are serviced at health facilities or not (*P*=0.065); ***most respondents reported they receive medical supplies (*P*=0.0252); **most MRI and CT scans referrals are sent to Mulago Hospital (*P*=0.099).

CT scans which are expensive. Sixty five (31.5%) of the respondents reported that there are MRI and CT scans; however, 55 (27.1%) did not know whether these equipment are in good working condition (*P*=0.088). Most of the respondents, 139 (68.5%) reported that these equipment are not available to local community (*P*=0.021).

In addition, most of respondents are not sure whether the services derived from this equipment are either free or not. 94 (46.3%) reported that these equipment are not free, 64 (31.5%) reported that the equipment are free while, 45 (22.2%), do not know. A good number of respondents, 83 (40.9%) are not sure whether these equipment are serviced at the health facilities (*P*=0.065). Only few, 58 (28.6%), reported that some services may be provided at the facilities. More than 92 (45.3%) have reported that patients in need of the services of MRI and CT scans are usually sent to MH (92: 45.3%), LH (48: 23.6%), GRRH (48: 23.6%) and GIH (15: 7.4%) (*P*=0.099). Additionally, more than half of the respondents, 122 (60.1%), reported that they frequently receive medical supplies at their facilities. However, 73 (36.0%) of them do not know how frequent these medical supplies are delivered to health facilities (*P*=0.0252).

DISCUSSION

Governance

Although, health facilities in Northern Uganda have survived on very limited resources in order to provide healthcare services to the community, they have continued to operate dismally. In the present study, measurable indicators of governance as a function of a health system were assessed. The findings of the current study indicate that majority of the health authorities in the region have played their functional administrative role or leadership oversight. Respondents at GRH and PNH, and health centers in Gulu and Amuru were interviewed with respect to key aspects of governance. Seventy percent (70%) reported that their health facilities have operational policies and are functional (*P*=0.04).

When asked for the persons in charge of the health facilities, most respondents used variable titles to describe the in-charges at their health facilities. The titles such as: director, medical superintendent, clinical officers, medical assistant, Enroll nurse/in-charge or focal persons were commonly used. Most health workers refer to the in-charges as directors (42.4%), while 44, 39, 14

and 20% referred to them as: clinical officers, medical superintendent, medical assistant and others (enroll nurse and focal person/chairman), respectively. These different titles of the in-charges have been used to relate to the types of health facilities. The two prominent hospitals: GRH and PNH are headed by directors, while the health centers (II, III and IV) are usually headed by focal persons/Enroll nurse, medical assistant/clinical officers or medical officers/medical superintendent.

More than 72.4% of the respondents reported that the in-charges reside at their health facilities; this in essence does not really show an indication of good healthcare service to the community, but rather demonstrates the extent of commitment of the in-charges at the health facilities. It is interesting to note that 9.4% of the respondent do not know whether the in-charges are resident or not at the facilities. This is rather interesting but it is also a concern that should be noted. It appears some of the health workers do not come to work, so, they do not know about the availability of in-charges at their health facilities. Forty six percent (46%) of the respondents reported on irregularities of the in-charges at the health facility. This is an indication of lack of commitment to service at health facilities. It also demonstrates why there are evidence of poor health care service delivery at some health facilities in the region.

Recent studies demonstrate that good governance, especially at the decentralized levels, can improve health outcomes (Olafsdottir et al., 2011). Thus, the availability of the in-charges at the health facilities have contributed to improved health outcomes in the region. This in essence underscores the importance of technical oversight at health facilities with regard to prevention and control of infectious diseases, particularly the NCC. While the rural communities struggles with limited access and utilization of healthcare services in the region, the governance attributes have significantly enhanced the health outcomes and no doubt contributed to a certain extent, the control of the disease in the region. This finding agrees with previous studies which show that good governance in the health sectors, contribute to improved health outcomes (Lindelow and Serneels, 2006).

While governance, an essential component of a health system, remains a misunderstood concept (Siddiqi et al., 2009; Thidar et al., 2017), different conceptual frameworks have been proposed to define and measure governance, and its potential effect on health system performance and health service delivery (Lopez et al., 2011; Anwari et al., 2015). While this diversity of frameworks help in understanding governance as a construct in the context of health, these do not illustrate ways to apply effective governing practices in the fragile and conflict affected environments (Anwari et al., 2015). The districts of Gulu and Amuru are just recovering from a brutal rebellion which ravaged most of the health systems in the region. It is faced with health systems challenges as reported by VreeMan et al. (2009). The

governance attributes such as presence of policies, good infrastructure, good health information systems, regular departmental meetings among others are known to contribute to improved health sector performance in terms of good healthcare. The current findings indicate positive correlation of good governance with 62.6% of the respondents reporting they have functional policies, 70.4% hold departmental meetings once every month and that these meeting are regularly held at the facilities. Additionally, previous studies have demonstrated that significant health sector performance was found to be better in the provinces and districts where leaders were more committed to a people-centered approach as inferred from the extent of completion of their governance development action plans (Anwari et al., 2015; Thirdar et al., 2017). Therefore, governance as a construct to context of health provides a platform for technical and leadership oversight at health facilities with corresponding positive effects on the prevention and control of neurocysticercosis at the community level.

Socio-demographic characteristics

Human resource is a valuable asset that plays significant roles in a functioning health system. However, in a resource limited setting, limited number of skilled workforce exists at various health facilities in the region. The socio-demographic characteristics of the respondents from the study area were examined. The findings showed that most respondents ranged from 20 to 65 years old with majority (69.0%) being married. Most of the respondents are permanently employed with work experience ranging from 1 to 30 years. Women constitute up to 57.1% of this workforce and more than 73.9% of the respondents are residents from Gulu districts. This finding is in agreement with the World Bank information that shows that most of Ugandan work force consists of the youngest and most rapidly growing populations (World Bank Report, 2015). In addition, the current findings show that majority of the health workers are young people who mostly originate particularly from Gulu district. Interestingly, this may be attributed to strategic location of Gulu and it being the older district than Amuru. Therefore, the diversity and dominance of the populace at the work place with people from Gulu is not a mistake but historical.

Many of the health workers have spent more than two decades and have witnessed the collapse of the health systems in the region. However, this may also be an opportunity for the populace to demonstrate commitment to develop their homeland through hard work. It is worth noting that many of these health workers have had several training at the health facilities on infectious diseases and this has strengthened health systems effort in the prevention and control of NCC in the region. Up to 53.4% of the respondents have reported they received

training on infectious diseases. However, there was no statistical difference between those who received the training or not (P= 0.506). More than 119(58.6%) of the respondents reported they received training every six months since they were recruited into the health service. Twenty two percent (22%) of the respondents reported receiving training at least between 1 and 2 years ago. Every health worker attended at least training in the past 10 years. Most of the respondents received training on HIV (91.6%), hepatitis B (29.1%) and Ebola (10.8%). Others received training on infectious diseases such as neurocysticercosis, cancer and nodding syndromes. Previous studies have reported that young people constitutes a work force for future development. African Development Bank Report (2016) indicates that young people continues to be a powerful work force for development. Additionally, Adeloye et al. (2017) reported that shortage of human resources for health has been the main barrier to scale-up health systems and health specific interventions. Previous studies have shown direct links between efficient health system governance and promising health workers outputs, which ultimately have positive effects on overall health outcomes (Adeloye et al., 2017).

Health service delivery

Although, Uganda has significantly improved access to healthcare services in the health sector, challenges still exist. Health workers were interviewed on the extent of healthcare service delivery at their facilities. Focus was mainly on health outcomes such as access to health facilities, hospital visits/admissions as indications for functionality of health systems. The findings indicate that 87% of the respondent interviewed reported inadequate physical infrastructure at all health centers (II, III and IV). This in essence is a serious factor in any health systems concerns. Most health facilities in the study were ravaged during the war and post war reconstructions of some of these facilities are in progress. While the government is making significant progress in this direction, there are still concerns with resolving infrastructure. In addition, the current findings show that community access to and utilization of health services is constrained by a number of factors such as opening and closing time, limited budget allocation to health facilities.

Most of the respondents reported that government funds provided are inadequate to run health center activities. Additionally, the funds are often disbursed late and these greatly affect the day to day operations. Ninety nine (99.0%) of the respondents reported they receive patients at their health facilities. This is an in indication of functional health facilities. However, the functionality of the health systems should not be misunderstood in this context since all the core pillars as described by WHO should interact together as a system. As shown, more

than 94.1% of the respondents have reported to have in-patients currently at the health facilities, implying interaction of the interfaces between the health facilities in the region and the community with each health facility receiving more than 100 out-patients per day.

Many of these patients are referred from other health facilities in the region. One hundred and eighty nine (93.1%) of the respondents reported having a functional referral systems with LH (48: 23.6%), GRRH (48: 23.6%), GIH (15: 7.4%) and MH (92: 45.3%), respectively being the most favored primary health facilities. Additionally, 40% of the respondents have reported the diagnosis of patients positive to NCC at the health facilities; however, most interviewed 104 (51.2%) did not know whether these patients exist at the health facilities in the region. One hundred and twenty two, (60.1%) of respondents reported access to adequate quality anthelminthic drugs at health facilities with most, (123: 60.6%) giving out these drugs to patients. Chi-square analysis showed significant statistical difference in the number of respondents who prescribed anthelminthic drugs (P=0.03). This means significant numbers of the health workers are prescribing anthelminthic drugs to patients. Though this may be with good intention, there is possibility of clinical conditions of patients getting worse if not well attended to (Garcia et al., 2002). Statistical significant difference was also observed between respondents who did not know the dangers associated with prescribing anthelminthic drugs to NCC patients (P=0.023). Previous studies show that anthelminthic drugs should be prescribed with caution to NCC patients (Garcia et al., 2002).

Furthermore, more than 109 (53.7%) of the respondents did not know of any program at health facilities that address issues on NCC in the region. This explains the need for more focus on issues of the neurocysticercosis in the region. Government has focused more on other diseases such as HIV/AIDS, malaria and TB, leaving out diseases such as NCC with equally serious consequences to the rural community in the region. It is high time the government considered the issues of Neglected Tropical Diseases, such as NCC in the region.

Conclusion

Despite improvement in the healthcare services in the health sector, health systems response to neurocysticercosis in Gulu and Amuru, Northern Uganda is weak with most health facilities operating minimally. There is need for holistic approach towards improvement of health systems in the region. Further studies need to be conducted on understanding community perspective towards health systems in the area and assessment of performance of different players involved in the strengthening of health systems of the Northern Uganda.

CONFLICT OF INTERESTS

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Full Length Research Paper

Compliance to treatment regimen among diabetic patients attending outpatient department of selected hospitals in Benin City, Edo State

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Diabetes is a global health issue as it is a metabolic disease that affects individuals of all ages. The success of long term maintenance therapy for diabetes mellitus depends largely upon the patient's compliance with a therapeutic plan. This study investigated the level of compliance with treatment regimen among clients with diabetes mellitus in selected hospital in Benin City, Edo state. A descriptive cross sectional design was used, A total of 300 hundred and six (306) diabetic patients were selected using the convenient sampling technique. The instrument for data collection was a self-structured questionnaire. Data collected were analyzed using descriptive statistic in Statistical Package for Social Sciences (SPSS) version 21. Results from the study showed that 59.3% of the respondents had good knowledge of diabetes while 37.7% of the respondents had fair knowledge, and 3.0% of the respondents had poor knowledge. Majority 184 (61.3%) of the respondent had poor compliance to their treatment regimen. Significant relationship between the level of compliance and demographic characteristics of the respondents like sex (p=0.0011), religion (p=0.040) and ethnic group (p=0.007) was found. There was also a significant relationship (p=0.000) between the knowledge of diabetes and rate of compliance of the respondents. More also, a significant difference was found in the level of knowledge of diabetes among the respondents in the two hospitals (p. = 0.000). Similarly, there was a significant relationship in the rate of compliance to diabetic regimens among the respondents in the selected hospitals (p = 0.010) Therefore, it is recommended that government should subsidized drugs and laboratory investigation for diabetics patient as well made the drugs available in the government owned pharmacy.

Key words: Non-compliance, compliance, diabetic patient, diabetes treatment regimen.

INTRODUCTION

Diabetes is a serious public health problem that threatens the quality of life of patients with the disease; it can lead to acute and chronic complications. It is a significant cause of disability and death in many countries (Amokute

and Hussein, 2011).

Diabetes is a chronic disease of life long duration and its management requires a fundamental change in the patients' life style. The most important member of the diabetic care team is the patient. The success of long term maintenance therapy for diabetes mellitus depends largely upon the patient's compliance with a therapeutic plan (Adejoh, 2014).

Compliance has been defined as the extent to which individuals follow the instructions they are given for prescribed treatments (Haynes et al., 2008). The term 'compliance ' is intended to be non-judgemental -a statement of fact rather than of blame of the individual, the prescriber or the treatment. Compliance with a prescribed therapeutic regimen is a complex health behaviour and can reduce morbidity or mortality of chronic illness where information provided to the patient increases their knowledge and understanding of the risk factors for their illness and teaches preventive behaviours like exercises, smoking cessation, dietary changes, medication and stress management (Evans and Haynes, 2013).

Non-compliance is the failure or refusal to conform to a prescribed medication, diet or to follow a prescribed course of treatment. It is described as an act of not yielding, cooperating or responding to a particular demand, regimen, and request. In spite of advanced technology in the medical field and the management of diabetic clients in terms of drugs and diet, the problem of non-compliance to prescribed therapy continues to occur among diabetic clients. This attitude of non-compliance has called for a greater concern in the follow- up of clients to treatment and the overall response to the diabetic management in our hospitals. Despite several approaches and strategies taken to tackle the problem of non-compliance of client to diabetic treatment, noncompliance to diabetes treatment remains a public health challenge (Alberta et al., 2012). For example, a descriptive correlational design study by Nadia (2011), to examine the level of non-compliance to diabetes management in Zagazig university hospital, Zagazig city, Egypt . Results showed that more than half of the patients (56.3%) had adequate total compliance to diabetes management. The highest compliance was with follow up (88.8%) while the lowest compliance was with self-care activities (17.5%) and self-testing (36.3%).

In another study conducted by Samia (2010), to assess the level of non-compliance to treatment regimen among diabetic clients attending the internal medical department and outpatient clinic at Assiut university hospital. Results revealed that most of the patients had good compliance with treatment regimen and 60% had good compliance with diet regimen, while only 26% of patient had good compliance with foot care, 15% did not follow regimen at all, 35% of the subjects considered that routine daily physical activities as exercise and only 2% of the subjects considered walking as exercise but not daily.

Majority of the patients (78%) adhered to medical treatment prescribed.

Also, according to a retrospective cohort study conducted by Donnan et al. (2011), in the Tayside centre for general practice, department of medicine, university of Dundee, Uk to examine the diabetic clients level of non compliance to their therapeutic regimen. Results showed that in those prescribed sulphonyureas alone, 31% had adequate compliance compared with 34% in those metformin alone. Those with better compliance tended to be younger and have a significantly shorter duration of diabetes. For the sulphonyureas, 35% of those taking one tablet a day had adequate compliance compared with 27% of those taking more than one tablet per day.

However, a descriptive correlational design was conducted by Simon (2007), to examine the level of non-compliance to treatment regimen among diabetic patients in department of medicine, veterans Administration hospital, university of Washington. Results revealed that non-compliance was common among patients prescribed oral hypoglycemic medications; the average population of non-compliance was 53.7%. 47.8% of the population engaged in exercise sessions only once a week or less, whereas 10% reported that they rarely followed a healthy diet plan.

Furthermore, a cross sectional study by Taruna (2014), among diabetic patients attending Doon Government hospital, Dehradu, Uttarakhnad, India to assess the level of non compliance of among diabetic clients. Results revealed that non-compliance was highly significant (61.5%) associated with frequent dosing and multiple drugs in the prescription, especially attributed to the forgetfulness in the older/occupationally retired age groups. Only 23.3 and 31.7% of the participants were found to be compliant to diet and exercise regimen.

Similarly , a cross sectional descriptive study by Abdulazeez (2014), to assess the level of non-compliance of diabetic clients to their treatment regimen in the outpatient clinic of the university of Ilorin teaching hospital, Nigeria. Result shows the number of males was 45.45% and the female 54.55%, and the total number of male patients that were found to be compliant with their medications was 22.3% as compared to the female patients that were compliant with their medication which was 36.2%. The numbers of female and male patients found not to be compliant with their medication were 58% and those not compliant to be 25.8%. This shows that about one third or more of patients have poor compliance with prescribed medications. Individuals with diabetes are of greater risk of long term complications such as kidney disease, infections, peripheral vascular disease, lower extremity ulcers, amputations, neuropathy and retinopathy.

Statement of the problem

According to the data from the World Health Organisation

(2011), over 3million people die worldwide from diabetes and its related complications every year as a result of non-compliance. In 2011,about 282,000 emergency room visits for adults aged 18years or older had hypoglycaemia as a result of non-compliance to their diet while about 175000 emergency room visits for people of all ages had hyperglycaemic crisis for example, diabetic ketoacidosis due to non-compliance to their treatment regimen.

In 2010, among adults aged 20years or older, hyperglycaemic crisis caused 2361 deaths. In 2009 to 2012, of adults aged 18years or older with diagnosed diabetes, 71% had blood pressure greater than 140/90 mmhg, 65% had blood low density lipoprotein (LDL) cholesterol greater than or equal to 100mg/dl. In 2011, 49677 people of all ages began treatment for kidney failure due to non-compliance to diabetic therapy. In 2010, about 73000 non-traumatic lower limb amputations were performed in adults aged 20years or older due to non-compliance to therapeutic regimen.

In 2009, death rates were about 1.5 times higher among adults aged 18 years or older with diagnosed diabetes who did not comply to their treatment (WHO, 2011). Omorogiuwa et al. (2010) in a survey carried out on a university community, Ekpoma, Edo State, Southern Nigeria, reported an overall prevalence of as high as 9.8%. In another study among adults aged 18 years and above residing in five rural communities in Edo State, an overall crude prevalence of 4.6% with sex differences (males 1.9%, females 5.8%, P = 0.012) was reported (Isara and Okundia, 2015).

The researcher's curiosity was prompted during clinical posting in one of the hospital, where a diabetic patient was brought in for amputation for severe diabetic foot ulcer. From the history taken, it was observed that the patient has been non-compliant with his diet and medication which led to the complication. There are few empirical studies on compliance to diabetic treatment regimen in this part of the country especially from Edo state, hence the need for this study.

Purpose of the study

The purpose of this study is to assess the compliance to treatment regimen among clients with diabetes mellitus in selected hospitals in Benin City, Edo state.

Objectives of the study

The Objectives of this study is to;

(1) Assess the level of knowledge of diabetic client on diabetes mellitus in selected hospitals in Benin City, Edo state
(2) Assess the level compliance with treatment regimen among clients with diabetes mellitus in selected hospitals in Benin City, Edo state.
(3) To find out the relationship between the diabetic

patients level of compliance and social demographic characteristics (sex, age, educational status, economic status) among other patients in selected hospitals in Benin City, Edo state.

Research hypothesis

(1) There is no significant relationship between the level of knowledge about diabetes mellitus and the rate of compliance among diabetic patients in selected hospitals in Benin City, Edo state.
(2) There is no significant difference in knowledge of diabetic mellitus among the clients in the selected Hospitals.
(3) There is no significant difference in the level of compliance to diabetic treatment regimen among the diabetic patients in the selected Hospitals.

Significance of the study

The results of the study will contribute to increase the knowledge of diabetic patients, the family, community, society, and the country as a whole about nutrition, exercise, medication and preventive strategies. It will also help the health care institutions in conducting education and training programs which are directed to promote sound practice and improved participation in patient's care. It will also increase the awareness of the health professionals on strategies to enhance patients compliance and efforts to improve the health care services rendered to the diabetic clients which in -return will encourage the patients. It will also motivate the nurses, dieticians, social welfare workers, community and religious leaders to provide help for the less privileged clients through non-governmental organisations (NGOs) and philanthropic organisations to assist in the improvement of diabetic patient's compliance. Further-more, this study will add to an existing body of knowledge on the level of non-compliance among diabetic patients and will also serve as secondary data for further researches.

METHODOLOGY

Research design

The researcher adopted a cross- sectional research design.

Research setting

University of Benin Teaching hospital and Central hospital, Benin City were purposely selected for this study.

University of Benin Teaching hospital (UBTH)

UBTH is a tertiary health facility located on the Benin Lagos Express-way, in Egor Local Government Area of Edo state, Benin City and came into being in 1973 following the enactment of an

Table 1. Distribution of target population.

Setting	Average monthly attendance from January to July 2017
University of Benin teaching hospital	415
Central hospital	497
Total	912

edict (number 12). As the sixth of the it's generation teaching hospitals in Nigeria. It was established to complement her sister institution, University of Benin and to provide secondary and tertiary care to the then Mid-western Region (now Edo and Delta state) and it's environs.

Central hospital

Central hospital was created in 1902 by the then colonial masters who were owned by the British government before independence under the colonial master. It is a government hospital located in the serene centre of Benin, on Sapele road, Oredo Local Government Area of Edo state, Benin City.

Target population

The target population comprised of 415 and 497 diabetic patients both males and females attending the out -patient department in the University of Benin Teaching hospital and Central hospital, Benin city respectively. This population was gotten by taking a retrospective review of daily attendance to the outpatient diabetic clinic in both hospitals from January to July 2017. This review shows an average monthly attendance of 415 and 497 in both hospitals respectively. Making the total population to 912 as seen in Table 1.

Sample size

A sample size of three hundred and nine (306) was used for the study. This was gotten from the total population of 912, using Taro Yamane (1967) formula as shown below:

$$n = \frac{N}{1 + N(\mathrm{d})^2}$$

Where:

n = sample size, N = population size, d = level of precision (confidence interval)
N = 912, d = 0.05
Thus = 912/1+912(0.05)2
n = 912/1+912*0.0025
n = 912/1+2.28
n = 912/3.28
n = 278
10% Attrition rate =27.8
278 +27.8 =305.8
= 306, Therefore, sampling size is 306.

Sampling technique

Convenient sampling techniques were used.

Instrument for data collection

The instrument was a self-structured questionnaire comprising of three sections:

Section A: Comprises of 7 items of demographic data of the participants.
Section B: Comprises of 11 items close ended questions on the level of knowledge about diabetes. The knowledge will be classified as poor (0 to 3), average (4 to 7) and good (8 to11).
Section C: Comprises of 13 items close ended questions on compliance to diabetic therapy using 4-point lirket scale. This compliance will be classified as poor compliance and good compliance based on an average mean score for each item using 2.5 as the decisional rule.

Validity of the instrument

Validity of the instrument was ensured by two consultant endocrinologist from the selected hospital and an expert in measurement and evaluation from University of Benin.

Reliability of the instrument

This was done by administering 20 of the questionnaire to similar respondents with same characteristics in another hospital. Data generated were analysed using split-half method, and the cronbachs Alpa scored was 0.780 which shows that the instrument is reliable and can be used for the study.

Method of data collection

Two research assistants, a male and a female nurse who worked in the selected hospital were recruited. They were trained by the principal researcher on how to administer the questionnaire. The research assistant after training were subjected to interrater reliability test and to know if both will achieve the same result as stated in the objective of the study. The result shows that both were able to measure the same thing using the instrument. The researcher and the assistants visit the hospital on the various clinic days to obtain data from the respondent after due explanation of the purpose of the study to them. Questionnaires were distributed to them while waiting for their turn to see the doctor or after seeing the doctor to ensure that their major aim of coming to the clinic was not obstructed or denied. Immediately after filling, the questionnaires were retrieved from them.

Method of data analysis

The researcher used descriptive statistics. Statistical Package for Social Sciences (SPSS) version 21 was used to analyse the data.

Ethical consideration

Ethical clearance with protocol number ADM/E22/AVOL.VII/14571

Table 2. Demographic characteristics of respondents.

Variable	Frequency	Percentage
Age		
1 - 20 yrs	67	22.3
21 - 40 yrs	168	56.0
41 - 60 yrs	54	18.0
61 - 80 yrs	11	3.7
Sex		
Male	104	34.7
Female	196	65.3
Marital status		
Single	199	66.3
Married	75	25.0
Divorced	26	8.7
Level of education		
Primary	15	5.0
Secondary	85	28.3
Tertiary	174	58.0
No formal education	26	8.7
Occupation		
Government employee	49	16.3
Non-government employee	56	18.7
Self-employed	69	23.0
Student	91	30.3
Unemployed	35	11.7
Religion		
Christian	241	80.4
Muslim	41	13.7
ATR	18	6.0
Ethnic group		
Edo	134	44.7
Igbo	63	21.0
Yoruba	52	17.3
Delta	51	17.0

was obtained from the ethical and research committee of the university of Benin teaching hospital, Benin City after thorough review the proposal. Administrative permit was also obtained from the Nursing Services Department of UBTH and Central Hospital. Consent of the respondents was sort for before proceeding and confidentiality was held in high esteem.

RESULTS

Socio-demographic characteristics

Table 2 shows that majority 168 (56.0%) are between the ages of 21 to 40 years which is the highest, 67 (22.3%)

are between 1 to 20 years, 54 (18.0%) are in the 41 to 60 years range, while the lowest 11 (3.7%) are in the age group 61 to 8 years. Majority 196 (65.3%) of the respondents are females, most of the respondents in this study are single 199 (66.3%) with only 75 (25.0%) married and 26 (8.7%) divorced. 174 (58.0%) of the respondents had tertiary education, this is followed by secondary school with 85 (28.3%), the least was primary education 15 (5.0%). Occupation had majority 91 (30.3%) as students, this was followed by 69 (23.0%) who are self-employed and 35 (11.7%) unemployed. Majority 241 (80.4%) of the respondents are Christians.

Objective one: Respondents knowledge of diabetic mellitus

The knowledge of diabetes was tested and is shown in Table 3. 253 (84.3%) said diabetes is characterized by high blood glucose level, 241 (80.3%) said diabetes is manifested by increased urination, increased thirst and increased appetite. 256 (82.0%) said diabetes can lead to hypertension, 239 (79.7%) said diabetes can be effectively managed. A person with diabetes should eat less concentrated sugar was mentioned by 235 (78.3%) respondents, diabetes is caused by obesity had 174 (58.0%), 185 (61.7%) of the respondents said diabetes can lead to blindness, while diabetes is hereditary was mentioned by 197 (65.7%) of the respondents. 253 (84.3%) said a person with diabetes should eat more of fruits and vegetables, 200 (66.7%) said diabetes can lead to weight loss and 204 (68.0%) said 80 to120 mg/dl is the normal blood glucose level.

Classification of respondent's knowledge of diabetes mellitus

Table 4 shows the knowledge of diabetes of respondents. For the general knowledge of the respondents, 9 (3.0%) had poor knowledge, 113 (37.7%) had fair knowledge and 178 (59.3%) had good knowledge. The knowledge of the UBTH respondents also follow the same trend of the knowledge of the general population by reporting, 3 (2.1%) had poor knowledge, 37 (26.4%) had fair knowledge and 100 (71.4%) had good knowledge. A similar upward trend was also recorded for the central hospital respondents with 6 (3.8%) having poor knowledge, 76 (47.5%) with fair knowledge and 78 (48.8%) with good knowledge.

Objective two: Compliance to diabetic treatment regimen by respondents

Table 5 shows the general rate of compliance to diabetic treatment regimen by respondents. The analysis revealed that items 1 (2.82±0.990), 2 (2.91±0.880), 4 (2.51±0.927), 5 (2.63±0.936), 6 2.59±0.993), 9 (2.50±0.931), 10

Table 3. Knowledge of diabetes by general respondents.

Variable	Yes	No	Mean	SD
Diabetes is characterized by high blood glucose level	253 (84.3)	47 (15.7)	1.16	0.364
Diabetes is manifested by increased urination, increased thirst and increased appetite	241 (80.3)	59 (19.7)	1.20	0.398
Diabetes can lead to hypertension	246 (82.0)	54 (18.0)	1.18	0.385
Diabetes can be effectively managed	239 (79.7)	61 (20.3)	1.20	0.403
A person with diabetes should eat less concentrated sugar	235 (78.3)	65 (21.7)	1.22	0.413
Diabetes is caused by obesity	174 (58.0)	126 (42.0)	1.42	0.494
Diabetes can lead to blindness	185 (61.7)	115 (38.3)	1.38	0.487
Diabetes is hereditary	197 (65.7)	103 (34.3)	1.34	0.476
A person with diabetes should eat more of fruits and vegetables	253 (84.3)	47 (15.7)	1.16	0.364
Diabetes can lead to weight loss	200 (66.7)	100 (33.3)	1.33	0.472
What amount of blood glucose level can be considered as normal	204 (68.0)	96 (32.0)	1.32	0.467

Table 4. Classification of respondent's knowledge of diabetes mellitus.

Variable	Scores	Frequency	Percentage
General respondents			
Poor knowledge	0-3	9	3.0
Average knowledge	4-7	113	37.7
Good knowledge	8-11	178	59.3
UBTH respondents			
Poor knowledge	0-3	3	2.1
Average knowledge	4-7	37	26.4
Good knowledge	8-11	100	71.4
Central hospital respondents			
Poor knowledge	0-3	6	3.8
Average knowledge	4-7	76	47.5
Good knowledge	8-11	78	48.8

(2.65±0.971) and 11 (2.54±0.992), had good compliance with treatment regimen. Items 3 (2.39±1.053), 7 (2.17±0.898), 8 (2.48±1.049), 12 (2.34±1.058) and 13 (2.36±0.977) showed poor compliance.

Rate of compliance to diabetic treatment regimen of respondents

Table 6 shows the rate of compliance to diabetic treatment regimen of respondents. For the general rate of compliance of respondents, 184 (61.3%) had poor compliance, 116 (38.7%) had good compliance to diabetic treatment regimen. The rate of compliance for UBTH respondents also follow the same trend of the general population, were majority 80 (57.1%) had poor rate of compliance and 60 (42.9%) had good rate of compliance to treatment regimens. A similar downward trend was also recorded for the central hospital respondents with majority 104 (65.0%) having poor rate of compliance, while 56 (35.0%) having good knowledge to treatment regimen.

Perceived factors affecting compliance to diabetes treatment among the general respondents

Table 7 shows that lack of finance (2.93), diabetic medications and investigations are too expensive (2.77), and unavailability of the medication in the hospital (2.63). As the average mean of this item on a four point lirket scale are above 2.5, hence they are consider as strong determinant of non-compliance.

Objective three: To find out the relationship between the diabetic patients level of compliance and social demographic characteristics (sex, age, educational status, economic status) among other patients in selected hospitals in Benin City, Edo state

Table 8 shows the relationship between rate of compliance to diabetic treatment regimen and the demographic characteristics of respondents. The results shows that the rate of compliance to diabetic treatment

Table 5. Respondents general level of compliance to treatment regimen.

S/N	Variable	SD	D	A	SA	Mean	Std. D	Remark
1	I don't always take my medications because I get tired of taking them	39 (13.0)	62 (20.7)	114 (38.0)	85 (28.3)	2.82	0.990	Good compliance
2	I stop taking my medicines when I feel I am getting better	24 (8.0)	58 (19.3)	138 (46.0)	80 (26.7)	2.91	0.880	Good compliance
3	I don't think there is any need to follow the required prescription when taking the drugs	73 (24.3)	93 (31.0)	77 (25.7)	57 (19.0)	2.39	1.053	Poor compliance
4	I need others to always remind me before I take my drugs	43 (14.3)	110 (36.7)	99 (33.0)	48 (16.0)	2.51	0.927	Good compliance
5	I don't take my medicines because I always forget to take them	36 (12.0)	99 (33.0)	105 (35.0)	60 (20.0)	2.63	0.936	Good compliance
6	I don't take some of the drugs because I don't have the money to buy them	54 (18.0)	73 (24.3)	116 (38.7)	57 (19.0)	2.59	0.993	Good compliance
7	There is no need to take my medicines when I don't feel better when I take it	79 (26.3)	110 (36.7)	91 (30.3)	20 (6.7)	2.17	0.898	Poor compliance
8	I only take my drugs when my blood glucose level is high	68 (22.7)	78 (26.0)	95 (31.7)	59 (19.7)	2.48	1.049	Poor compliance
9	I can't take those medication because of the side effect on me	47 (15.7)	100 (33.3)	108 (36.0)	45 (15.0)	2.50	0.931	Good compliance
10	Eba and rice are my major food, there is no way I can stop eating them	46 (15.3)	73 (24.3)	120 (40.0)	61 (20.3)	2.65	0.971	Good compliance
11	I prefer ripe plantain to unripe plantain because it is my favourite	54 (18.0)	85 (28.3)	105 (35.0)	56 (18.7)	2.54	0.992	Good compliance
12	There is no need to check my blood sugar regularly because it is a waste of time and money	75 (25.0)	108 (36.0)	58 (19.3)	59 (19.7)	2.34	1.058	Poor compliance
13	Traditional medicine is more effective than western medicine	63 (21.0)	110 (36.7)	82 (27.3)	45 (15.0)	2.36	0.977	Poor compliance

2.5 and above = good compliance, 2.49 and below poor compliance.

Table 6. Rate of compliance to diabetic treatment regimen of respondents.

Variable	Frequency	Percentage
General respondents		
Poor compliance	184	61.3
Good compliance	116	38.7
UBTH respondents		
Poor compliance	80	57.1
Good compliance	60	42.9
Central Hospital respondents		
Poor compliance	104	65.0
Good compliance	56	35.0

regimen did not show any relationship with the age of respondents (p=0.999), sex on the other hand had a significant relationship with rate of compliance to diabetic treatment regimen (p=0.011), marital status (p=0.691) showed no significant relationship with the rate of compliance to diabetic treatment regimen. The rate of compliance to diabetic treatment regimen and educational level also did not show any significant relationship (p=0.388), also with the occupation of the respondents (p=0.483). Religion and ethnic group on the other hand showed a

Table 7. Perceived factors affecting compliance to diabetes treatment among the general respondents.

S/N	Variable	SD	D	A	SA	Mean	Std. D	Remark
1	Lack of finance	20 (6.7)	67 (22.3)	128 (42.7)	85 (28.3)	2.93	0.878	High factor
2	Diabetic medications and investigations are too expensive	37 (12.3)	78 (26.0)	101 (33.7)	84 (28.0)	2.77	0.993	High factor
3	Unavailability of the medication in the hospital	36 (12.0)	93 (31.0)	117 (39.0)	54 (18.0)	2.63	0.914	High factor

2.5 and above = Highly dependent factor, 2.49 and below poor dependent factor.

Table 8. Relationship between respondent level of compliance and demographic characteristics.

Variable	Rate of compliance		Total	χ^2
	Poor compliance	Good compliance		
Age				
1 - 20 yrs	41 (22.3)	26 (22.4)	67	
21 - 40 yrs	103 (56.0)	65 (56.0)	168	0.999
41 - 60 yrs	33 (17.9)	21 (18.1)	54	
61 - 80 yrs	7 (3.8)	4 (3.5)	11	
Sex				
Male	74 (40.2)	30 (25.9)	104	0.011
Female	110 (59.8)	86 (74.1)	196	
Marital status				
Single	120 (65.2)	79 (68.1)	199	
Married	49 (26.6)	26 (22.4)	75	0.691
Divorced	15 (8.2)	11 (9.5)	26	
Level of education				
Primary	11 (6.0)	4 (3.5)	15	
Secondary	57 (31.0)	28 (24.1)	85	0.388
Tertiary	101 (54.9)	73 (62.9)	174	
No formal education	15 (8.2)	11 (9.5)	26	
Occupation				
Government employee	34 (18.5)	15 (12.9)	49	
Non-government employee	38 (20.7)	18 (15.5)	56	
Self-employed	42 (22.8)	27 (23.3)	68	0.483
Student	52 (28.3)	39 (33.6)	91	
Unemployed	18 (9.8)	17 (14.7)	35	
Religion				
Christian	142 (77.2)	99 (85.3)	241	
Muslim	26 (14.1)	15 (12.9)	41	0.040
ATR	16 (8.7)	2 (1.7)	18	
Ethnic group				
Edo	83 (45.1)	51 (44.0)	134	
Igbo	45 (24.5)	18 (15.5)	63	0.007
Yoruba	35 (19.0)	17 (14.7)	52	
Delta	21 (11.4)	30 (25.9)	51	

significant relationship with the rate of compliance to diabetic treatment regimen (p=0.040 and 0.007) respectively.

Hypothesis one

Table 9 shows the relationship between the rate of

Table 9. Relationship between respondent's level of compliance to diabetes treatment regimen and knowledge of diabetes.

Variable	Knowledge of diabetes			Total	χ^2
	Poor knowledge	**Average knowledge**	**Good knowledge**		
Compliance					
Poor compliance	4 (44.4)	87 (77.0)	93 (52.2)	184	0.000
Good compliance	5 (55.6)	26 (23.0)	85 (47.8)	116	

Table 10. Difference in knowledge of diabetes between respondents of UBTH and Central hospital.

Variable	Hospital	Mean	SD	F	Sig.	t
Knowledge	UBTH	2.69	0.507	14.651	0.000	3.875
	Central Hospital	2.45	0.570			

Table 11. Difference in level of compliance of diabetes patients between respondents of UBTH and Central hospital.

Variable	Hospital	Mean	SD	F	Sig.	t
Compliance	UBTH	1.43	0.497	6.776	0.010	1.394
	Central Hospital	1.35	0.478			

compliance of diabetic patients to treatment regimen and knowledge of diabetes. The results shows that there is a highly significant relationship (p=0.000) between the knowledge of diabetes and rate of compliance of the respondents.

Hypothesis two

Table 10 shows the difference in the knowledge of diabetes between respondents of UBTH and Central hospital. The result shows that there is a significant difference in the level of knowledge of diabetes between the two hospitals (Sig. = 0.000).

Hypothesis three

Table 11 shows the difference in the rate compliance of diabetic regimens of respondents in UBTH and Central hospital. The result shows that there is a significant relationship in the rate of compliance to diabetic regimens between the hospitals (Sig. = 0.010).

DISCUSSION

Findings from the study shows that majority 168 (56.0%) are between the ages of 21 to 40 years which while the lowest 11 (3.7%) are in the age group 61 to 80 years. Majority 196 (65.3%) of the respondents are females,

with only 75 (25.0%) of the respondents being married. 174 (58.0%) of the respondents had tertiary education and primary education 15 (5.0%). majority 91 (30.3%) are students, 69 (23.0%) self-employed and 35 (11.7%) unemployed. Majority 241 (80.4%) of the respondents are Christians. 134 (44.7%) are of the Edo ethnic group.

This study revealed that majority of the respondents 59.3% had good knowledge of diabetes, 37.7% had average knowledge, while 3.0% had poor knowledge of diabetes. This is in line with the study conducted by Jansirani (2013) who revealed that most of the clients (59.9%) had adequate knowledge of diabetes while those with poor knowledge were 32.4%, majority of the informants expressed that the disease can cause damage to vital organs while few declared that they did not know anything about the complications.

Also, Nwaokoro (2010) in Owerri, Imo state of Nigeria, reported that most of the patients (62%) understood the value of blood glucose control; the others were not knowledgeable about diabetes (40.3%). This finding is higher than that reported by Chutiyami (2016) in Maiduguri Borno state, Nigeria, who revealed that almost less than half (47.2%) of respondent were able to defined diabetes mellitus correctly as a disease characterised by high blood sugar level as against various opinions by other clients. These findings indicated that quite a high percent of the clients are not knowledgeable about diabetes which by implication will reduce compliance to diabetes treatment regimen. Also Nadia (2011), in Zagazig city, Egypt reported that the knowledge of the

clients about diabetes was even low with only 28.8% reaching satisfactory level and 68.7% are not knowledgeable about diabetes.

Similar findings was also reported by Mohamed (2010), who showed that only 38% of the clients had adequate knowledge about diabetes mellitus which prompted their compliance while 62% of the clients did not properly understand what diabetes is all about and treatment. The high level of knowledge recorded in this index study is highly associated with social-demographics characteristics such as educational level, level of income and religion. As majority had tertiary education meaning they are well read and can source for information themselves, majority are Christians, many churches dedicate some days or Sundays to teach their member some of these non-communicable diseases, their causes and management and prevention,

Findings from the study show a low level of compliance as 61.3% of the respondents had poor compliance to treatment regimen. This is in line with the study conducted by Taruna (2014) which revealed that majority of the respondents had poor compliance with treatment regimen (61.5%). Similar findings were reported by Taruna (2014), in India who revealed that 61.5% of the respondents were non complaint to treatment, as only 23.3 and 31.7% of the participants were found to be compliant to diet and exercise regimen.

Further collaborating the findings of this index study is Simon (2007), in Washington. Who revealed that non-compliance was common among patients prescribed oral hypoglycaemic medications; the average population of non-compliance was 53.7%. 47.8% of the population engaged in exercise sessions only once a week or less, whereas 10% reported that they rarely followed a healthy diet plan.

However, in contrast with these findings is that of Nadia (2011), in Egypt who reported that more than half of the patients (56.3%) had adequate total compliance to diabetes management. The highest compliance was with follow up (88.8%) while the lowest compliance was with self-care activities (17.5%) and self-testing (36.3%). Also, Samia (2010) revealed that majority of the patients (78%) adhered to medical treatment prescribed, and 60% had good compliance with diet regimen. Furthermore, Abdulazeez (2014), Ilorin Nigeria reported 58% of the respondents in his study were found to be compliant with their medication were while 42% were not compliant.

Nadia (2011) study also differs from the findings of this index study, the study shows that more than half of the respondents were compliant (56.3%). Many factors could be attributed to the poor compliance reported in this index study; lack of finance, diabetic medications and investigations being too expensive and unavailability of the medication in the hospital were the major reason given by the respondents. This reason might be connected to the fact that majority of the respondents were single who by implication may not have a job, are

job seeker or even students as reported in the study. This no doubt might have resulted in the poor compliance as diabetic treatments are quite expensive and life style medications that accompany it need money for it to be effective.

However this is another area that calls for more studies. This study found significant relationship between the level of compliance and demographic characteristics of the respondents like sex (p=0.0011), religion (p=0.040) and ethnic group (p=0.007) but showed no significant relationship with age, marital status, educational level and occupation (p = 0.999, 0.691, 0.388 and 0.483). There is also a highly significant relationship (p=0.000) between the knowledge of diabetes and rate of compliance of the respondents. This shows that the more knowledgeable a patient is about diabetic, the more the rate of compliance to treatment.

More also, a significant difference was found in the level of knowledge of diabetes between the two hospitals (p. = 0.000) with respondent in UBTH having more knowledge than those in central hospital. Similarly, there was a significant relationship in the rate of compliance to diabetic regimens between the hospitals (p = 0.010) as those in UBTH were more compliant to treatment than those in central hospital, this might be associated to the higher knowledge reported by the respondents in UBTH.

Conclusion

There appears to be a high level of knowledge about diabetes, and the effect of family support towards diabetic patients is good. However, the rate of compliance was poor; this therefore means that the nurses and medical personnel need to enlighten the patients on the importance of compliance to treatment regimen.

IMPLICATION FOR NURSING AND OTHER HEALTH CARE PROFESSIONALS

Due to the important role nurses play in health care, they are in the best position to educate and provide enlightenment to these patients so as to enhance the compliance to diabetic treatment, educating patients on diabetes, causes and various complications. Creating a good nurse and patient relationship in order to give room for patient to confide in the nurse is also recommended. Good interprofessional relationship with other health care professionals' for example, doctors, pharmacist etc is needed to ensure that patients are seen regularly and drugs given to them regularly as well is one of the key to encourage compliance among patients.

RECOMMENDATION

(1) Government should subsidize the cost of management of diabetes, for example, drugs and

laboratory investigations
(2) More community health facilities should be established to reduce the travelling distance of these patients going for check-up.
(3) Government in conjunction with the health facility should ensure the pharmacy of the government-owned hospitals is well stocked to reduce the burden of searching for prescribed medications in private pharmacy at exorbitant prices.

SUGGESTIONS FOR FURTHER STUDIES

Study should be conducted on the following:

(1) Factors affecting the level of compliance with treatment regimen among diabetic patients in selected rural communities of Edo state.
(2) Satisfaction with treatment regimen among diabetics patient attending selected tertiary institution in south-south Nigeria.
(3) Perception of health care workers towards compliance of diabetic patients to treatment regimen in selected hospitals in Edo state.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Factors associated with utilization of institutional delivery care and postnatal care services in Ethiopia

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Ethiopia is one of the sub-Saharan African countries with high maternal mortality rate due to complication of delivery. Institutional delivery care and postnatal care are key health services that can reduce maternal mortality. The main objective of this study was to identify factors affecting utilization of institutional delivery and postnatal care services. The data for this study were obtained from the 2014 EDHS which is a national representative of women aged 15-49 years. The total number of women included in the study was 3710. Descriptive analysis and binary logistic regression model were used to analyze the data. The descriptive results showed that about 26.2 and 23.6% of women used institutional delivery and postnatal care services, respectively. Binary logistic regression analysis was performed to examine the effect of each predicator variable on the use of institutional delivery and postnatal care among women. Accordingly, educational level, place of residence, sex of household head, wealth index, region and ANC visits were found to be significant determinants of utilizing both institutional delivery and postnatal care at 5% level of significance. Number of living children was also found to be a significant predictor of institutional delivery use. Women who reside in rural areas were less likely to use maternity health care services than those who live in urban areas. Education and wealth index were found to be statistically significant in the use of IDC and PNC. Thus, great attention should be given to women who are living in rural areas, in low wealth index and in illiterate group.

Key words: Ethiopian Demographic and Health Survey (EDHS), Ethiopia, Institutional Delivery Care (IDC), postnatal care (PNC), logistic regression model.

INTRODUCTION

The WHO estimated that 536,000 women of reproductive age die each year due to pregnancy related complications worldwide. Developing countries accounted for 99% of these deaths (533,000). 51% of maternal deaths (270,000) occur in the sub-Saharan Africa regions, followed by 35% (188,000) in South Asia. Thus, sub-Saharan Africa and South Asia accounted for 86% of the global maternal deaths. This showed that a high proportion of maternal deaths occur in sub-Saharan Africa (WHO, 2005). In 2005, maternal mortality ratio was

Table 1. Description and coding of response variables.

Dependent variables	Categories and coding
Place of delivery	0= Home
	1= Health institution
Using postnatal care	0 = No
	1 = Yes

the highest in developing countries with 450 maternal deaths per 100,000 live births. In contrast, maternal mortality ratio for developed regions was 9 deaths per 100,000 live births and in countries of the Common Wealth of Independent States, it was 51 maternal deaths per 100,000 live births. Among the developing countries, sub-Saharan Africa including Ethiopia had the highest maternal mortality rates (MMR) with 900 maternal deaths per 100,000 live births in 2005, followed by South Asia (490), Oceania (430), South-Eastern Asia (300), Western Asia (160), Northern Africa (160), Latin America and Caribbean (130), and Eastern Asia (50) (WHO, 2005). Ethiopia is one of the countries with the highest MMR in the world. The MMR was 871 per 100,000 live birth in the year 2000; it was also 673 per 100,000 live births in year 2005 and 676 per 100,000 live birth in year 2011, that is, maternal mortality ratio has not changed in the country.
A study by Miteku et al. (2016) revealed that increasing awareness about postnatal care, preventing maternal and neonatal complication, and scheduling mothers based on the national postnatal care follow-up protocol would increase postnatal care service utilization.

According to the 2011 Ethiopian Demographic Health Survey report, only 34, 10 and less than 9% of women had antenatal care, delivery care and postnatal care services by skilled providers, respectively (CSA, 2011). Institutional delivery and postnatal care services are the crucial issues to reduce the risk of complications and infections that can cause the death or serious illness of a mother and newborn. Despite the fact that utilization of institutional delivery care and postnatal care services are essential for further improvement of mothers and newborn health, a small proportion of babies are delivered in health facilities and majority of the women with a live birth are not checked by skilled health providers. Different studies have shown that the use of skilled delivery attendants and postnatal care services are very low in Ethiopia because of socio-economic and demographic factors. Majority of births occurred at home without the help of skilled providers and many mothers do not go for checkup after delivery. There is unbalanced distribution of using maternal health care service between regions (Kasu, 2013).

Therefore, the objective of this study was to identify factors affecting utilization of institutional delivery and postnatal care services, and assess variation in the use of these services among different regions of Ethiopia.

MATERIALS AND METHODS

Source of data

The source of data is the 2014 Ethiopia Demographic and Health Survey which is obtained from Ethiopian Central Statistical Agency designed to provide estimates for the health and demographic variables of interest for the following domains: Ethiopia as a whole, urban and rural areas of Ethiopia, and all geographical areas (nine regional states and two chartered cities), namely: Tigray, Affar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples, Gambela, Harari, Addis Ababa and Dire Dawa.

Data collection

In order to achieve the objective of the survey, a total of 9135 households aged 15 to 49 were selected, of which, 8,727 were found to be occupied during the data collection. Among the occupied households, 8492 eligible women were identified for individual interview; then interviews were completed for 8070 women yielding an individual response rate of 95%. Women were asked whether they have practiced ANC, institutional delivery and postnatal care services in the five years preceding the survey. Only 3710 of them responded and gave information on their practice of IDC, IDC and PNC (CSA, 2014).

Variables of the study

In this study, two response variables influenced by explanatory variables were obtained from questions in the maternal health component of EDHS questionnaire. The main focus was a number of specific questions that were addressed to women about their last child in the five years preceding the survey. Women were asked whether they: 1) delivered their last child from health institutions; 2) received a medical checkup within two days after delivery. As indicated in Table 1, the response variable was coded as "1" if the woman used this service and "0" if not.

Explanatory variables included in the study for the purpose of the analysis were chosen by referring and reviewing related literatures. These variables are coded as indicated in Table 2 and are expected to influence the dependent variable (institutional delivery, postnatal care services) in Ethiopia.

RESULTS AND DISCUSSION

Descriptive analysis

The main socio-economic and demographic factors of maternal health care service utilization of women are presented in Table 3. The total number of women included in the study is 3710. Among those, 972 (26.2%) delivered their last child at health facility while 2738 (73.8%) delivered at home. Similarly, 877 (23.6%) received postnatal care whereas 2833 (76.3%) did not. Women who lived in different states had unequal status of using institutional delivery and postnatal care services. The proportion of mothers who delivered their last child at health facilities in Affar, Amhara, Somali, Oromiya, Ben-Gumuz, SNNP, Gambela, Tigray, Hrarari, Dire Dawa and Addis Ababa are 3.2, 5.1, 5.0, 7.9, 6.2 and 8.6, 9.1, 9.8,

Table 2. Description and coding of independent variables.

Independent variables	Categories and coding
Woman's educational level (Education)	0 = No education (ref) 1 = Primary 2 = Secondary and above
Place of residence (Residence)	0 = Urban (ref) 1 = Rural
Region of respondents (Reg)	0 = Addis Ababa (ref) 1 = Tigray 2 = Afar 3 = Amhara 4 = Oromiya 5 = Somali 6 = Ben-Gumuz 7 = SNNP 8 = Gambela 9 = Hareri 10 = Dire Dawa
Woman's age at birth (Age)	0 < 20 Years (ref) 1 = 20-34 Years 2 = 35-49 Years
Sex of household head (Sexhhd)	0 = Male (ref) 1 = Female
Number of antenatal visits during pregnancy (ANC)	0 = No visit (ref) 1 = 1 - 2 Visits 2 = 3 - 4 Visits 3 = 5 or More visits
Number of living children Children)	0 <= 2 Children (ref) 1 = 3 - 4 Children 2 = 5+ Children
Birth order (Order)	0 = 1 (ref) 1 = 2-3 2 = 4+
Respondent's marital status (Marital)	0 = Divorced (ref) 1 = Widowed 2 = Married
Household wealth index (Wealth)	0 = Poor (ref) 1= Middle 2 = Rich

12.8, 15.9 and 16.4% respectively. Similarly, the proportion of mothers that received postnatal care in Affar, Amhara, Somali, Oromiya, Ben-Gumuz, SNNP, Gambela, Tigray, Hrarari, Dire Dawa and Addis Ababa are 3.6, 5, 1.7, 7.5, 8.3, 10.3, 10.7, 8.6, 11.2, 15.8 and 17.2%, respectively. The proportion of using institutional

Table 3. Descriptive analysis of delivery and postnatal care services.

Variables	Categories	Place of delivery				PNC use			
		Home		Health facility		No		Yes	
		Count	%	Count	%	Count	%	Count	%
Place of residence	Urban	180	6.6	565	58.1	271	9.6	474	54
	Rural	2558	93.4	407	41.9	2562	90.4	403	46
Sex of household head	Male	2394	87.4	765	78.7	2462	86.9	697	79.5
	Female	344	12.6	207	21.3	371	13.1	180	20.5
Woman's educational level	No education	2048	74.8	333	27.7	2061	72.7	320	26.7
	Primary	639	23.3	369	34.3	685	24.2	323	36.5
	Secondary+	51	1.9	270	38.0	87	3.1	234	36.8
Household wealth index	Poor	1671	61.0	167	17.2	1649	58.2	189	21.6
	Middle	841	30.7	217	22.3	857	30.3	201	22.9
	Rich	226	8.3	588	60.5	327	11.5	487	55.5
Number of antenatal visits	No visit	1532	56.0	89	6.9	1540	54.4	81	6.3
	1-2 Visits	373	13.6	67	9.2	381	20	59	9.2
	3-4 Visits	531	19.4	292	30.0	568	13.4	255	29.1
	5+ Visits	302	11.0	524	53.9	344	12.1	482	55
Woman's age at birth	<20	139	5.1	52	5.3	149	5.3	42	4.8
	20-34	1854	67.7	751	77.3	1948	68.8	657	74.9
	35-49	745	27.2	169	17.4	736	26.0	178	20.3
Region	Addis Ababa	24	0.9	155	16.4	40	1.4	139	17.2
	Tigray	214	7.8	95	9.8	215	7.6	94	10.7
	Affar	343	12.5	31	3.2	342	12.1	32	3.6
	Amhara	340	12.4	50	5.1	346	12.2	44	5.0
	Oromiya	383	14.0	77	7.9	394	13.9	66	7.5
	Somali	298	10.9	49	5.0	332	11.7	15	1.7
	BEN-Gumuz	248	9.1	60	6.2	235	8.3	73	8.3
	SNNP	430	15.7	84	8.6	424	15	90	10.3
	Gambela	214	7.8	88	9.1	227	8.0	75	8.6
	Harari	133	4.9	124	12.8	159	5.6	98	11.2
	Dire Dawa	111	4.1	159	15.9	119	4.2	151	15.8
Birth order	1	484	17.7	210	21.6	500	17.6	194	22.1
	2-3	821	30.0	291	29.9	848	29.9	264	30.1
	4+	1433	52.3	471	48.5	1485	52.4	419	47.8
Marital status	Divorced	139	5.1	75	7.7	148	5.2	66	7.5
	Widowed	51	1.9	17	1.7	51	1.8	17	1.9
	Married	2548	93.0	880	90.5	2634	93.0	794	90.5
Number of living children	<=2	887	32.4	563	57.9	986	34.8	464	52.9
	3-4	849	31.0	228	23.5	852	30.1	225	25.7
	5+	1002	36.6	181	18.6	995	35.1	188	21.4

	Category	Women	Percent
Delivery	Home	2738	73.8
	Health facility	972	26.2
PNC	Not used	2833	76.4
	Used	877	23.6
	Total	3710	

Table 4. Results of univariate analysis for the selected important variables.

Explanatory variables	Place of delivery			Postnatal care use		
	Chi-square	df	Sig.	Chi-square	df	Sig.
Region	529.834	10	0.000	497.880	10	0.000
Place of residence	874.097	1	0.000	669.071	1	0.000
Sex of household head	42.333	1	0.000	28.755	1	0.000
Woman's educational level	543.182	2	0.000	464.579	2	0.000
Economic status	896.803	2	0.000	646.102	2	0.000
Number of antenatal visits	746.990	3	0.000	671.559	3	0.000
Number of living children	197.086	2	0.000	97.360	2	0.000
Birth order	7.997	2	0.018	9.935	2	0.007
Age of woman at birth	36.873	2	0.000	12.612	2	0.002
Marital status	9.080	2	0.011	6.580	2	0.037

delivery and postnatal care services also differed by place of residence. Among the women who resided in urban areas, 58.1 and 54% used institutional delivery and postnatal care services, respectively, while among the rural women, 41.9% delivered at health facility and 46% received postnatal care services. Table 3 also showed that the highest distribution of using institutional delivery and postnatal care were 38 and 36.8% for women who had secondary or above education and followed by 34.3 and 36.5% for women who had primary education. Among mothers with male household head, 78.7% used institutional delivery care, while only 21.5% of mothers with female household head used this care. Similarly, mothers with male headed household (79.5%), used postnatal care service, whereas 20.5% of mothers with female headed household received postnatal care service.

Women with the higher wealth index see medical professionals for their child birth than women in lower wealth index. 60.5 and 55.5% of women whose household wealth index is rich used institutional delivery and postnatal care services. 22.3 and 22.9% of women with middle wealth index used IDC and PNC services, respectively. On the other hand, only 17.2 and 21.6% of mothers with poor wealth index used IDC and PNC, respectively. Regarding the number of children, 57.9 and 52.9% of mothers who had less than two children received IDC and PNC services, while only 18.6 and 21.4% of mothers with five or more children used IDC and PNC services, respectively.

Using IDC and PNC services increase as antenatal care practice increases. Among mothers who did not follow antenatal visits, only 6.9% delivered at health facility and 6.3% received postnatal care services. Institutional delivery and postnatal care services were observed by 9.2% of women who used one or two antenatal visits.

Similarly, 30 and 29.1% of women with three or four antenatal visits experienced institutional delivery and postnatal care services, respectively. 53.9 and 55% of mothers who used institutional delivery and postnatal care were observed with five or more antenatal visits. Table 3 also showed that the observed proportions of using institutional delivery and postnatal care for mothers with the first child birth were 21.6 and 22.1%, respectively. With two or three birth orders, women (29.9 and 30.1%) used institutional delivery and postnatal care services.

Bivariate analysis

Bivariete analysis is used to describe the effect of individual explanatory variable on the outcome variables without considering other predictors. It showed the relationship between the response variable (IDC, PNC) and explanatory variables. The analysis was carried out for each predictor independently using enter method and variables were statistically significant at 5% significance level since P- value < 0.05 (Table 4). These variables are important for the multiple logistic regression analysis.

Results of binary logistic regression analysis for delivery care services

Multiple logistic regressions were applied to analyze the effect of each independent variable on institutional delivery care utilization controlling for the effect of the other independent variables. A statistical significance of the individual regression coefficients was tested using the Wald Chi-square statistic. Accordingly, region, place of residence, educational level of women, sex of household head, wealth index, and number of living children and frequency of antenatal visits were found to be significant predictors for the use of institutional delivery care services.

Based on the result in Table 5, the final estimated regression equation consisting of the significant variables is given by:

$$\begin{aligned}
\text{logit}(P(X)) = {}&-1.627 - 1.319\text{Res}_1 + 0.437\text{sex}_1 + 0.388\text{edu}_1 + 1.38\text{edu}_2 + 0.519\text{wealth}_1 + 1.351\text{wealth}_2 \\
&+ 1.027\text{ANC}_1 + 1.827\text{ANC}_2 + 2.242\text{ANC}_3 - 0.419\text{child}_1 - 0.306\text{child}_2 - 0.185\text{reg}_1 \\
&- 1.124\text{reg}_2 +, \dots, -0.041\text{reg}_{10}
\end{aligned}$$

When all explanatory variables are removed in the model, an average probability of using institutional delivery care service by Ethiopian women is predicted to be $\frac{e^{-1.627}}{1+e^{-1.627}} = 0.164$.

The logistic regression model revealed that there is a statistically significant effect between mother's place of residence and the use of institutional delivery care services. The women who lived in rural area were 73% lower than those who delivered their last children at health facility as compared to those who live in urban area (OR=0.267; CI: 0.193-0.370) controlling for the other variables in the model. The result of the model also showed that women who are living in households where a female is the head of household were 1.549 times more likely to use institutional delivery care service as compared to women where the head of household is male.

The findings of the model revealed that the odds ratio of using institutional delivery care for women who lived in Amhara and Oromia regions relative to those women living in Addis Ababa were 0.496 (CI: 0.260-0.945) and 0.440 (CI: 0.239-0. 809). Similarly, the odds ratios of using delivery care for women who lived in SNNP and Ben- Gumuze as compared to women who reside in the reference category were 0.506 (CI: 0.271-0.945) and 0.501 (CI: 0.266-0.944), respectively. This implied that women who live in SNNP and Ben-Gumuze were about 49 and 50% lower with respect to delivering at health facilities as compared to women who live in Addis Ababa, controlling for the other variables in the model. Moreover, the likelihoods of using delivery care in health institutions for mothers who live in Somali and Affar region as compared to mothers who reside in the base category were 0.330 (CI: 0.170-0.638) and 0.325 (CI: 0.161-0.655), respectively, controlling for the other variables in the model. Meaning that women who reside in Somali and Affar are about 67 and 67.5% less likely to use institutional delivery service as compared to women who reside in the reference region, controlling for other variables in the model. This showed that majority of the women who live in Somali and Affar regions delivered their last children at home.

On the other hand, the odds of using IDC for women who live in Dire Dawa, Tigray, Harari and Gambela were not significantly different from that of women who live in Addis Ababa.

The other important significant predictor of woman's utilization of institutional delivery care services is their educational level. Mothers with primary education were 47% more likely to use institutional delivery care relative to those without education (OR =1.474, IC: 1.161-1.870). Similarly, the odds ratio of using institutional delivery care was 3.973 times more likely for mothers who had secondary or above education as compared to mothers who had no education, controlling for the other variables in the model. A model also explained that household wealth index has a statistically significant association with utilization of mother's delivery care. The likelihoods of using delivery care in a health institution were 1.68 and 3.861 times more likely for women from middle and rich families, respectively, as compared to those from poor families, controlling for the other variables.

Antenatal care during pregnancy has a statistically significant effect on the use of delivery care service. Women with one or two antenatal visits, three or four visits and five or above visits are 2.792, 6.214 and 9.408 times more likely to use institutional delivery care respectively, as compared to those without antenatal visit, while controlling for the other variables in the model. This indicated that women with more antenatal visits during pregnancy were better to deliver their child at health center. In the contrary, the study identified the inverse relationship between using institutional delivery care of women and their living children. The odds ratio of using delivery care in health facility was 34% less likely for women who had three or four children relative to those who had two or less children (OR = 0.658, 95% CI: 0.505-0.856).

Results of binary logistic regression analysis for PNC

Accordingly, region, place of residence, educational level of women, sex of household head, wealth index and frequency of antenatal visits were found to be significant determinants for the use of postnatal care services at 5% level of significance. The maximum likelihood estimates (MLE) of predicting the use of postnatal care services of Ethiopian women is presented in Table 6. Based on this result, the final regression equation consisting of the significant variables is given by:

$$\begin{aligned}
\text{logit}(P(X)) = {}&-1.227 - 1.069\text{Res}_1 + 0.321\text{Sex}_1 + 0.388\text{Edu}_1 + 1.064\text{Edu}_2 + 0.221\text{Wealth}_1 + 0.595\text{Wealth}_2 \\
&+ 0.833\text{ANC}_1 + 1.576\text{ANC}_2 + 2.11\text{ANC}_3 - 0.065\text{Reg}_1 - 1.019\text{Reg}_2 +, \dots, -0.098\text{Reg}_{10}
\end{aligned}$$

Table 5. Maximum likelihood estimates of predicting the use of institutional delivery of women.

Variables	Categories	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Place of residence	Urban (ref) Rural	-1.319	0.165	63.608	1	0.000**	0.267	0.193	0.370
Sex of household head	Male(ref) Female	0.437	0.164	7.118	1	0.008**	1.549	1.123	2.135
Education	No educate (ref)			40.198	2	0.000**			
	Primary	0.388	0.122	10.173	1	0.001**	1.474	1.161	1.870
	Secondary+	1.380	0.221	38.798	1	0.000**	3.973	2.574	6.133
Household wealth index	Poor (ref)			60.441	2	0.000**			
	Middle	0.519	00.129	16.085	1	0.000**	1.680	1.304	2.165
	Rich	1.351	00.174	60.311	1	0.000**	3.861	2.746	5.430
ANC visits	No ANC (ref)	1.027	0.198	209.745	3	0.000**	2.792	1.896	4.113
	1-2 visits	1.827	0.158	27.020	1	0.000**	6.214	4.562	8.463
	3-4 visits	2.242	0.163	134.263	1	0.000**	9.408	6.837	12.946
	5+ visits			189.409	1	0.000**			
Region	Addis Ababa (ref)			82.374	10	0.000**			
	Tigray	-0.185	0.317	0.340	1	0.559	0.831	0.446	1.547
	Affar	-1.124	0.358	9.863	1	0.002**	0.325	0.161	0.655
	Amhara	-0.702	0.329	4.549	1	0.033*	0.496	0.260	0.945
	Oromiya	-0.822	0.311	6.971	1	0.008**	0.440	0.239	0.809
	Somali	-10.11	0.337	10.849	1	0.001**	0.330	0.170	0.638
	Ben-Gumuz	-0.691	0.323	4.577	1	0.032*	0.501	0.266	0.944
	SNNP	-0.682	0.319	4.571	1	0.033*	0.506	0.271	0.945
	Gambela	-0.043	0.320	0.018	1	0.893	0.958	0.511	1.795
	Harari	-0.165	0.316	0.274	1	0.601	0.848	0.457	1.574
	Dire Dawa	0.-0.041	0.319	0.017	1	0.896	0.960	0.514	1.794
Living children	≤ 2 Children (ref)			9.810	2	0.007**			
	3-4	-0.419	0.135	9.707	1	0.002**	0.658	0.505	0.856
	5+	-0.306	0.134	5.216	1	0.023*	0.736	0.566	0.958
Constant		-1.627	0.452	120.965	1	0.0000**	0.197		

**Significant at 1% level; significant at 5% level, Ref = reference category.

If all explanatory variables are removed in the model, an average probability of receiving postnatal care service of women from skilled providers is estimated to be = 0.227. The model revealed that there is a strong association between mother's place of residence and the use of postnatal care services. The women who lived in rural area were about 66% lower for use of postnatal care service as compared to those who live in urban area (OR=0.343; 95% CI: 0.249-0.474), controlling for the other variables in the model. The result of the model also showed that women living in the household where a female is the head of household were 1.379 times more likely to receive postnatal care services as compared to women where the head of household is male. The model also showed that women who reside in Amhara and Oromia are 62.2 and 62.5% less likely to use postnatal care service, respectively, as compared to women who live in Addis Ababa, controlling for the other variables in the model. That is, the odds ratio of using postnatal care for women who live in Amhara and oromia as compared to women who reside in the reference category were 0.378 (CI: 0.216-0.661) and 0.375 (CI: 0.223-0.631), respectively. Similarly, the odds ratio of using postnatal care service for women who live in SNNP and Ben-

Table 6. MLE of predicting the use of postnatal care services of Ethiopian women.

Variables	Categories	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Place of residence	Urban (ref)								
	Rural	-1.069	0.165	42.095	1	0.000	0.343	0.249	0.474
Sex of household head	Male (ref)								
	Female	0.321	0.156	4.243	1	0.039	1.379	1.016	1.873
Education	No educate (ref)			33.675	2	0.000			
	Primary	0.388	0.118	10.888	1	0.001	1.474	1.170	1.855
	Secondary+	1.064	0.187	32.442	1	0.000	2.898	2.010	4.180
Household wealth index	Poor (ref)			11.400	2	0.003			
	Middle	0.221	0.126	3.087	1	0.079	1.248	.975	1.597
	Rich	0.595	0.177	11.347	1	0.001	1.813	1.283	2.563
ANC visits	No ANC (ref)			202.058	3	0.000			
	1-2 Visits	0.833	0.192	18.806	1	0.000	2.300	1.578	3.350
	3-4 Visits	1.576	0.151	109.204	1	0.000	4.837	3.599	6.501
	5+ Visits	2.110	0.154	187.192	1	0.000	8.249	6.097	11.161
Region	Addis Ababa (ref)			99.771	10	0.000			
	Tigray	-0.065	0.266	0.060	1	0.807	0.937	0.556	1.578
	Affar	-1.019	0.306	11.069	1	0.001	0.361	0.198	0.658
	Amhara	-0.973	0.285	11.615	1	0.001	0.378	0.216	0.661
	Oromiya	-0.981	0.265	13.678	1	0.000	0.375	0.223	0.631
	Somali	-10.526	0.360	18.008	1	0.000	0.217	0.107	0.440
	Ben-Gumuz	-0.864	0.272	10.090	1	0.002	0.421	0.247	0.718
	SNNP	-0.506	0.251	4.064	1	0.044	0.603	0.369	0.986
	Gambela	-0.442	0.273	2.628	1	0.105	0.643	0.377	1.097
	Harari	-0.550	0.262	4.393	1	0.036	0.577	0.345	0.965
	Dire Dawa	-0.098	0.264	.138	1	0.710	0.907	0.540	1.521
Constant		-1.227	0.421	8.486	1	0.004	0.293		

Gumuze as compared to women who reside in the reference category were 0.603 (CI: 0.369-0.986) and 0.421 (CI: 0.247-0.718), respectively. This indicated that women who live in SNNP and Ben-Gumuze were about 40 and 58% less likely to receive postnatal care services as compared to women who live in Addis Ababa, controlling for the other variables in the model. Moreover, the odds of using postnatal care for mothers who settled in Affar and Somali region as compared to mothers who live in the reference category were 0.361 (CI: 0.198-0.658) and 0.217 (CI: 0.107-0.440), respectively, controlling for the other predictors in the model. In other words, women who reside in Somali and Affar are 78 and 64% less likely to use postnatal care service as compared to women who reside in the reference region, controlling for the other variables in the model. This showed that majority of the women who live in Somali and Affar region did not receive postnatal care service. On the other hand, the odds of using postnatal care service for women who live in Dire Dawa, Tigray and Gambela were not significantly different from that of women who live in Addis Ababa. The other important significant predictor of woman's utilization of postnatal care services is educational level. Mothers with primary education were about 47% more likely to use postnatal care service relative to those without education (OR =1.474, IC: 1.170-1.855). Similarly, the odds ratio of using postnatal care service is 2.898 times more likely for mothers who had secondary or above education as compared to mothers who had no education, controlling for the other predictors in the model. A model also explained that household wealth index has significant positive association with utilization of mother's postnatal care service. The likelihoods of using postnatal care

Table 7. Model summary for Institutional Delivery Care (IDC).

-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
2419.763[a]	0.392	0.574

Table 8. Omnibus tests of model coefficients for delivery care.

	Chi-square	Df	Sig.
Step	1847.723	27	0.000
Block	1847.723	27	0.000
Model	1847.723	27	0.000

Table 9. Hosmer and Lemeshow test for IDC.

Chi-square	df	Sig.
11.325	8	0.184

service were 1.248 and 1.813 times more likely for women from middle and rich families, respectively as compared to those from poor families. Antenatal care during pregnancy had also a positive association with the use of maternal postnatal care service. Women with one or two antenatal visits, three or four visits and five or above visits were 2.3, 4.837 and 8.249 times more likely to receive postnatal care, respectively, as compared to those without antenatal visit while controlling for the other variables in the model. This indicated that more antenatal visit during pregnancy to checkup after delivery is better for mothers.

Testing goodness of fit of the model

After logistic regression model has been fitted, goodness of fit test of the resulting model was performed. It is necessary to show the adequacy and usefulness of the fitted model. The most common techniques are Pearson's Chi-square test, likelihood ratio test, Hosmer- Lemeshow test and the Wald goodness of fit test.

The Omnibus or likelihood-ratio test (LRT) for delivery care

LRT is the common assessment of the overall model fit in logistic regression, which is simply the Chi-square difference between the reduced model with the constant only and the full model including a set of predictors. As indicated in Table 7, the -2 log likelihood statistics is 2419.763. This statistic shows how much improvement is needed before the predictors provide the best possible

prediction of IDC, the smaller value of statistic is the better of the model. The statistic for the model (Table 8) with only the intercept is given by -2LL0 = 1847.723+2419.763 = 4267.486. The model with predictors reduced the -2 Log Likelihood statistics (null model) by 4267.486– 2419.763 = 1847.723, which is observed in the model Chi-square for omnibus test. The omnibus test can be interpreted as a test of the ability of all explanatory variables in the model jointly to predict the response variable. The omnibus test of model coefficients is used to assess the overall fit of logistic regression model. The results (X^2=1847.723, d.f=27, p-value = 0.000) in Table 8 showed that the model fit is good, at least one of the predictors is statistically significant to predict the use of institutional delivery services. Deleting independent variables from the model change its predictive ability or the null hypothesis that there is no difference between the model with only a constant and the model with predictors was rejected.

Hosmer-Lemeshow goodness of fit test for delivery care service

The Hosmer-Lemeshow goodness of fit test divides subjects into ten groups based on predicted probabilities, then a Chi-square is computed from observed and expected frequencies in a 10x2 table. A non-significant value of a Chi-square test indicated that there is no difference between the observed and the predicted values and hence the estimated model goodly fit the data. Since the p-value = 0.184 is greater than 0.05, it is not significant, which is an indication that the overall fitted model is good (Table 9).

Table 10. Classification table for IDC

Observed		Predicted		Percentage Correct
		Place of delivery		
		Home	Health facility	
Place of delivery	Home	2615	123	95.5
	Health facility	359	613	63.1
Overall percentage				87.0

Table 11. Model summary for postnatal care service.

-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
2668.245[a]	0.312	0.470

Table 12. Omnibus tests of model coefficients for PNC.

	Chi-square	df	Sig.
Step	1389.610	27	0.000
Block	1389.610	27	0.000
Model	1389.610	27	0.000

The classification table for IDC

The classification table showed the validity of predicted probabilities. The accuracy of the classification is measured by sensitivity (ability to predict an event correctly) and specificity (ability to predict the non-occurrence of an event correctly). Table 10 shows that 63.1% of women who delivered at health center were correctly classified, whereas 95.5% of women that delivered at home were correctly classified.

Model diagnostics for IDC and PNC

The adequacy of the fitted model was checked for possible presence of outliers and influential values. Results of the diagnostic test for detection of outliers and influential values are presented in Appendix 1 (Tables 1 and 2). The DFBETA for model parameters is small (all values are less than one). This means that there are no influential observations for the individual regression coefficients. Cook's distance less than one implied that an observation had no overall impact on the estimated vector of regression coefficients β. A small value of leverage statistic showed that no subject has a substantial large impact on the predicted values of the model. Another method of detecting outliers is normalized residuals. The absolute value of normalized residual is less than 3. This indicated the absence of outlying observation (Appendix 1: Table 1). Hence, from the

above goodness of fit test and diagnostic checking, it can be said that our model is adequate to predict the data.

The omnibus or likelihood-ratio test for postnatal care

On Table 11, it was considered that the -2 log likelihood statistics equals 2668.245. This statistic shows how much improvement is needed before the predictors provide the best possible prediction for the use of postnatal care of women.

The statistic for the null model is given by -2LL0 = 1389.610+2668.245=4057.855. The inclusion of parameters reduced the -2 Log Likelihood statistics of null model by 4057.855–2668.245 = 1389.610, which is observed in the model Chi-square of omnibus test. The results, Chi-square = 1389.610, df = 27, p-value=0.000 showed that the model fit is good, that is, at least one of the predictors is statistically significant to predict the use of postnatal care service (Table 12). This is the null hypothesis that there is no difference between the model with only a constant and the model with predictors was rejected.

Hosmer-Lemeshow goodness of fit test for PNC

The Hosmer-Lemeshow goodness of fit test divides subjects into ten groups based on predicted probabilities,

Table 13. Hosmer-Lemeshow test for postnatal care services.

Chi-square	df	Sig.
11.53	8	0.173

Table 14. Classification table for PNC.

Observed		Predicted		
		PNC use		Percentage correct
		No	Yes	
PNC use	No	2683	150	94.7
	Yes	400	477	54.4
Overall percentage				85.2

The cut value is 0.500.

then a Chi-square is computed from observed and expected frequencies in a 10x2 table. A non-significant Chi-square indicated that there is no difference between the observed and the predicted values and hence estimates of the model adequately fit the data. Since the p-value 0.173 in Table 13 is greater than 0.05, the model is good fit to the data.

The classification table for PNC

A classification table shows the validity of predicted probabilities. The accuracy of the classification is measured by sensitivity (ability to predict an event correctly) and specificity (ability to predict the non-occurrence of an event correctly). Table 14 shows that 54.4% of women who received postnatal care were correctly classified, whereas 94.7% who did not receive postnatal care were correctly classified.

Model diagnostics for PNC

The adequacy of the fitted model was checked for possible presence of outliers and influential values. Results of the diagnostic test for detection of outliers and influential values are presented in Appendix 1 (Table 2). The DFBETA for model parameters is small (all values are less than one). This means that there are no influential observations for the individual regression coefficients. Cook's distance less than one implied that an observation had no overall impact on the estimated vector of regression coefficients β. A small value of leverage statistic showed that no subject has a substantial large impact on the predicted values of the model. Another method of detecting outliers is normalized residuals. The absolute value of normalized residual is

less than 3. This indicated the absence of outlying observation (Appendix 1: Table 2). Hence, from the above goodness of fit test and diagnostic checking, it can be said that our model is adequate to predict the data.

Test of heterogeneity

A Chi-square test statistic was applied to assess heterogeneity in the proportion of women who had an experience of maternal health care services between regions. The test yield Chi-square = 529.834 for place of delivery and 497.880 for postnatal care, df =10, P- value <0.05. Thus, there was an evidence of heterogeneity with respect to using institutional delivery and postnatal care services across regions.

Conclusion

A total of 3710 women were included in the study to investigate determinant factors influencing utilization of institutional delivery and postnatal care services. The descriptive analysis of this study showed that 26.2 and 23.6% of women use institutional delivery and postnatal care services, respectively. The study identified major socio-economic and demographic factors of institutional delivery and postnatal care services in Ethiopia. The study revealed that place of residence, women's educational level, region, wealth index of the household, number of antenatal visits during pregnancy and sex of household head were significant factors for both institutional delivery use and postnatal care services. Number of living children is also a significant predictor of using institutional delivery service, while age, marital status and birth order were found to be insignificant variables of utilizing institutional delivery and postnatal

care services. The study showed that utilization of institutional delivery care service was significantly associated with place of residence. Women who resided in rural areas and with lower wealth index were at less advantage to deliver in health facilities and receive postnatal care. This is in agreement with the findings of others studies (Mesfin et al., 2004; Eyerusalem, 2010; Asmeret, 2013). The finding also showed that place of residence was statistically a significant predictor for the use of postnatal care service. Rural women are less likely to use postnatal care service relative to urban women. This confirmed the finding of the other studies (Mitiku et al., 2016; Mekonen, 2002; Asma, 2013). The reason for this difference is unfair distribution of health care services; most of the health care services are concentrated in urban areas than rural and various health promotion programs that use urban-focused mass media leads to the advantage of urban residents to use maternal health service. In addition, women living in rural residence are more influenced by traditional or cultural practice regarding delivery and postnatal than urban women.

The finding revealed that mother's education has a strong positive association with the use of institutional delivery and postnatal care services. Women with primary, secondary or higher level of education were more likely to deliver at health facility and receive postnatal care than women who had no education. This finding, in agreement with Mekonnen and Mekonnen (2002), Umurungi (2010) and Abeje et al. (2014), revealed that the lower use of maternal health care was observed among illiterate women. The reason might be that a higher education can enable women to develop the confidence of utilizing health facility services and greater awareness of the need for their care during delivery and after delivery. Wealth index of the household is one of the most positive determinants of using institutional delivery and postnatal services among Ethiopian women. According to the current study, giving birth at health facility as well as receiving postnatal services were higher for women in middle and rich households as compared to women living in lower economic status. This finding is consistent with other studies carried out by Fort et al. (2011) and showed that women with middle and rich households were more likely to utilize delivery and postnatal services in health center. Similar studies (Adamu, 2011; Kasu, 2013) revealed that household wealth index was a significant predictor for women to deliver at health facilities and to use postnatal care. As recommended by WHO, at least, four ANC visits are important for maternal health.

The results of this study showed a significant difference in the proportion of health facility delivery among women who followed one or more ANC visits as compared to women who had no ANC visits. This confirmed the findings of other studies (Mesfin et al., 2004; Asmeret, 2013) showing that women with ANC visits were more likely to deliver at health facility as compared to those

without ANC visits. The study also showed a positive association of ANC visits during pregnancy with mother's utilization of postnatal care service, which is consistent with the findings of the other studies (Asma et al., 2013; Daniel et al., 2014), that following the higher antenatal care increases the use of postnatal care services. Sex of household head is also statistically a significant predictor for utilization of institutional delivery and postnatal services among women.

The finding showed that women who live in female headed households were more likely to deliver at health facility and receive postnatal care services as compared to those who live in male headed households. This result is in agreement with Kasu (2012), which showed that the estimated odds ratio of mothers who live in house where the head of household is female were more likely to receive delivery and postnatal care from a health facilities as compared to women who live in household where the head is male.

ABBREVIATIONS: AIC, Akaike information criterion; **ANC,** antenatal care; **BIC,** Bayesian information criterion; **CSA,** Central Statistical Agency; **EDHS,** Ethiopian demographic and health survey; **EMDHS,** Ethiopian mini demographic and health survey; **ESPS,** Ethiopian society of population study; **GTP,** growth and transformation plan; **HSDP,** health sector development program; **ICC,** intra-class correlation coefficient; **IDC,** institutional delivery care; **MDG,** millennium development goal; **MMR,** maternal mortality rate; **PNC,** postnatal care; **SNNP,** southern nations nationalities and people; **UNFPA,** united nations population fund; **UNICEF,** united nations children fund; **USAID,** united states agency for international development; **WHO,** world health organization.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Appendix 1.

Table 1. Results of diagnostic tests for outliers and influential value for IDC.

Variables	N	Minimum	Maximum
Analog of Cook's influence statistics	3710	0.00000	0.017470
Leverage value	3710	0.00071	0.00245
Normalized residual	3710	-2.5383	2.8558
DEFBATA for constant	3710	-0.03270	0.03120
DEFBATA for Residence (1)	3710	-0.02195	0.02023
DEFBATA for Sexhhd (1)	3710	-0.02217	0.02307
DEFBATA for Education (1)	3710	-0.01021	0.01153
DEFBATA for Education (2)	3710	-0.03013	0.03199
DEFBATA for Wealth (1)	3710	-0.01107	0.01270
DEFBATA for Wealth (2)	3710	-0.01765	0.02508
DEFBATA for ANC (1)	3710	-0.01937	0.02666
DEFBATA for ANC (2)	3710	-0.01995	0.01610
DEFBATA for ANC (3)	3710	-0.01892	0.01346
DEFBATA for Reg (1)	3710	-0.02060	0.02730
DEFBATA for Reg (2)	3710	-0.01430	0.01987
DEFBATA for Reg (3)	3710	-0.02908	0.02767
DEFBATA for Reg (4)	3710	-0.01913	0.01722
DEFBATA for Reg (5)	3710	-0.02721	0.02436
DEFBATA for Reg (6)	3710	-0.02895	0.01303
DEFBATA for Reg (7)	3710	-0.03170	0.03244
DEFBATA for Reg (8)	3710	-0.03012	0.03097
D DEFBATA for Reg (9)	3710	-0.03099	0.03102
EFBATA for Reg (10)	3710	-0.03203	0.03007
DEFBATA for Children (1)	3710	-0.01236	0.01396
DEFBATA for Children (2)	3710	-0.01960	0.01771

Table 2. Results of diagnostic tests for outliers and influential value for PNC.

Variables	N	Minimum	Maximum
Analog of Cook's influence statistics	3710	0.00001	0.01900
Leverage value	3710	0.00102	0.003291
Standardized residual	3710	-2.3638	2.8377
DEFBATA for constant	3710	-0.02842	0.02734
DEFBATA for Residence (1)	3710	-0.02164	0.02153
DEFBATA for Sexhhd (1)	3710	-0.01965	0.02115
DEFBATA for Education (1)	3710	-0.00814	0.01286
DEFBATA for Education (2)	3710	-0.02352	0.02265
DEFBATA for Wealth (1)	3710	-0.00917	0.01321
DEFBATA for Wealth (2)	3710	-0.01613	0.02798
DEFBATA for ANC (1)	3710	-0.01639	0.02397
DEFBATA for ANC (2)	3710	-0.01726	0.01458
DEFBATA for ANC (3)	3710	-0.01684	0.01320
DEFBATA for Reg (1)	3710	-0.03232	0.03078
DEFBATA for Reg (2)	3710	-0.03170	0.02849
DEFBATA for Reg (3)	3710	-0.03138	0.03063
DEFBATA for Reg (4)	3710	-0.02936	0.03172
DEFBATA for Reg (5)	3710	-0.03097	0.02930
DEFBATA for Reg (6)	3710	-0.03267	0.03197
DEFBATA for Reg (7)	3710	-0.02683	0.03262
DEFBATA for Reg (8)	3710	-0.03053	0.03164
D DEFBATA for Reg (9)	3710	-0.02901	0.03080
EFBATA for Reg (10)	3710	-0.03228	0.03217

Full Length Research Paper

Assessment of community knowledge, attitude and practice on milk borne zoonoses disease in Debre-Birhan town, north Shewa, Ethiopia

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A cross-sectional questionnaire survey was conducted in Debre-Birhan town, North shoa, Ethiopia, with the objectives of assessing the knowledge, attitude and practices (KAP) of the study participants with respect to milk borne zoonoses; and to determine the effect of demographic character of respondents on knowledge, attitude and practice of zoonotic diseases. Data were collected from the respondents through administering semi-structured questionnaire across the randomly selected collection centers, retailers, consumers and smallholder dairy farmers of the towns. The questionnaire was administered to 230 respondents (5 milk collection centers, 100 consumers, 40 retailers and 85 smallholder dairy farms). The study result showed that 63.5% of the respondents from the total study population knew diseases can be acquired through consumptions of raw cow milk, 61.3% of respondents did not know the names of milk borne zoonotic diseases, and 50.9% of the respondents' forms of milk preference were raw milk. Of the total respondents, 35.2% had no idea of prevention of milk borne zoonotic diseases. In this study, 92.2% of the respondent did not get formal training on zoonotic diseases. Statistically there was strong association between educational level and KAP of the respondents on milk borne zoonosis, (p<0.05). There was statistically significance difference (p<0.05) on KAP of milk borne zoonosis of the respondents between urban and peri-urban areas. In the current study, the study population has low level of awareness regarding milk borne zoonoses. One way to approach this problem would be to develop educational outreach programs for dairy producers, and public at large, that focuses on issues related to the preventions of consumption of raw milk and milk borne zoonoses.

Key words: Debre-Birhan, milk borne zoonotic diseases, respondents.

INTRODUCTION

Ethiopia, one of the developing countries, constitutes both urban and peri-urban dairying as an important sub-sector of the agricultural production system. For smallholder farmers, dairying provides various

opportunities to efficient use of land, labor and feed resources and generates regular income (Yitaye et al., 2009). However, the productivity of the livestock resources and the benefits obtained from the sector does not proportionate with the high livestock population. Given the considerable potential for smallholder employment and income generation from high-value dairy products, development of the dairy sector in Ethiopia can contribute significantly to poverty alleviation and nutrition in the country (Mohammed et al., 2004).

Researchers conducted in Ethiopia revealed that the microbial counts of milk and milk products produced and marketed in the country are generally much higher than the acceptable limits on the microbial properties of marketed milk and milk products. Samples taken from 10 dairy potential areas in the country reported a similar observation and mentioned that microbial counts in samples of whole milk are higher than the standard (Yilma, 2010). The higher count in milk could be attributed to the substandard hygienic conditions practiced during production and subsequent handling, while the high count in fermented milk products can also be partly explained by the presence of lactic acid bacteria (Yilma, 2010).

Nutritional-balanced foodstuff milk is a well-known medium that favors growth of several microorganisms. Up to 90% of all dairy related diseases are due to pathogenic bacteria found in milk. Several documented pathogens are known to cause milk-borne zoonotic diseases in humans including brucellosis, tuberculosis, leptospirosis, Q fever and campylobacteriosis (Shirima et al., 2003). Food-borne diseases are serious threat to people in Africa, and responsible for 33-90% cases of mortality in children (Flint et al., 2005). Although foods of animal origin are minor constituent in most diets, animal origin diets are responsible for the majority of incidents of food-borne illnesses; dairy products being implicated (De Buyser et al., 2001).

There has been emergence of new pathogenic bacteria along the food chain. For example, emergence of milk-borne bacterial pathogens with very serious health effects such as *Eschericia coli* 0157:H7 has been reported (Sivapalasingams et al., 2004). Some of the microbial contaminants are responsible for milk spoilage while others are pathogenic with potential health effects which cause milk–borne diseases (Kivaria et al., 2006). Pathogenic bacteria contaminants pose serious threat to human health, and constitute to about 90% of all dairy related diseases (Donkoret al., 2007). The common raw milk pathogenic bacteria contaminants include: *Brucellaabortus, Mycobacterium bovis, Campylobacter* spp*., Coxiellaburnetii, Leptospira*spp*., Listeria monocytogene, Yersinia enterocolytica,* Shiga toxin producing *E. coli, Staphylococcus aureus, Salmonella* spp*.,* and *Clostridium* spp. (Koo, 2008); most of which are pathogenic and zoonotic (Mosalagae et al., 2010).

Dairy-cattle feces and raw milk are sources of zoonotic bacteria such as *Campylobacter, Salmonella,* Shiga toxin producing *E. coli* and *Listeria* (Karns et al., 2005). Outbreaks of food-borne disease in humans are often caused by raw or improperly pasteurized milk and milk products that are contaminated with these bacteria (Denny et al., 2008). The traditional way of processing of milk plus the length of storage time with its high microbial count lead to serious health damage on consumers (Abebe et al., 2013).

Resource constrained countries, especially those in Sub-Saharan Africa, often lack information on the distribution of zoonotic diseases (Zinsstag et al., 2007). The link among humans, animal population and the surrounding environment is very close in many developing countries, where animals provide transportation, draught power, fuel, clothing and source of protein in the form of milk, meat and eggs. In the absence of proper care, this linkage can lead to a serious risk to public health with huge economic consequences (WHO, 2010). Furthermore, many African communities associate diseases shared between livestock and humans with misbehavior or witch-craft (Marcotty et al., 2009). Zoonotic diseases can be transmitted to humans in a number of ways which include consumption of infected raw milk and coming in contact with infected dairy animals, animal products and infected farm environments (Zinsstag et al., 2007). Milk plays a vital role in transmitting zoonotic and food borne diseases unless handled in very strict hygienic conditions. Producing quality milk that is safe for consumption is a major challenge in the Ethiopian context (FAO, 2009). Over 80% of the milk produced in the developing world is consumed unregulated. Of the total milk produced in Ethiopia, only less than one percent is consumed after pasteurizing (FAO, 2009).

Information regarding the impact of milk borne diseases is very limited in Ethiopia. However, taking the large amount of unregulated milk consumed and the risk associated with it, the impact is likely to be tremendous. During the past decade, the Ethiopian dairy sector has been progressing at a very fast rate while little attention has been paid to the importance of safety of milk and milk products produced by farmers and milk processors. To institute an appropriate intervention on public health impact of milk-borne zoonotic pathogens on the community, there is a need to have properly documented baseline information regarding to milk borne zoonoses diseases (Eyasu et al., 2016).

Currently, there is inadequate data on the knowledge, attitude and practice of our community towards food borne zoonotic diseases in general and milk borne zoonotic diseases in particular. This study was, thus, aimed at assessing the knowledge, attitude

and practices of the members of Debre-birhan collection centers, retailers, consumers and smallholder dairy farmers. Therefore, the objectives of the present study were: 1) to assess the knowledge, attitude and practice of the community on milk borne zoonoses and to determine the effect of demographic back ground on knowledge, attitude and practice of milk borne zoonoses.

MATERIALS AND METHODS

Study area

The study was conducted in Debre-Birhan town, which is one of the highest milk producing towns in the national regional states of Amhara, located at latitude of 9°36`N and longitude of 39°38`E; 130 kms North East of Addis Ababa, the capital city of Ethiopia. It is situated at an altitude of 2,828 meters above sea level. The climate is characterized by bimodal rainfall consisting of a long rainy season (June- September), short rainy season (February/March-April/May) and a dry season (October-January).

The mean annual rainfall of the area ranges from 781 to 1279 mm. The mean annual temperature ranges from 5 to 23°C (Ermias, 2007).

Sample size determination and Study population

The sample size for this study was calculated using the formula for estimation of single proportion with 95% CI, 5% of marginal error and rate of knowledge on zoonotic disease (82%) found in one study conducted in Arsi-Negelie, Ethiopia, taken as one component in the formula to calculate the sample size (Amenu et al., 2010).

$$ n = \frac{\left(Z1 - \frac{\alpha}{2}\right)2\, p(1-p)}{d2} $$

Where, n= sample size; Z1-α/2 critical value= 1.96 for 95% CI; p= rate of knowledge on zoonotic disease (82%); d= marginal error (precision) =0.05.

Given this, n= $(1.96)^2$ 0.82(1-0.82)/0.05^2 =226.
A total of 230 questionnaires were administered to milk collection center (5), consumers (100), retailers (40) and smallholder dairy farmers (85) by using simple random sampling techniques. The population under this study was considered to be heterogeneous comprising of varied gender and age groups.

Study design

A cross–sectional questionnaire based study was employed to assess knowledge, attitude and practicing (KAP) of smallholder dairy farmers (SDF), consumers, milk collection centers and retailers on milk borne zoonotic disease.

Data collection

Smallholder dairy farmers, consumers, milk collection centers and retailers were visited and the questionnaires were administered to randomly selected sample of the population in the study area. A close-ended questionnaire was developed and pre-tested to assess knowledge, attitudes and practice towards milk borne zoonoses.

Statistical analysis

The collected data was entered and stored to MS- excel sheet (version-2010). Statistical analysis was performed by using statistical software of SPSS version-20; descriptive analysis was employed and expressed in terms of percentage and frequencies. Chi-square analysis was used to determine statistical associations of outcome and explanatory variables. The level of significant was held at 95% confidence interval and 0.05 level of precision.

RESULTS

Demographic characteristics of respondents

Out of 230 respondents, 148 (64.3%) were females and 82 (35.7%) were males. Most of the respondents participating in milk value chain were females constituting 4(80%) of milk collection center, 28 (70%) of retailers, and 61 (71.8%) of SDHs. In educational level perspectives, 42.6% of the respondents were illiterate followed by elementary level comprising 27% part of respondents. High school and greater than high school each covers 15.2% of the total study sample (Table 1).

KAP of the respondents

In this study, only 7.8% of the respondent took formal training on milk borne zoonosis. Of the total study population, 73.5% of the respondents had the habit of checking milk quality; however, most (72.6%) of the respondents employed organoleptic method of checking milk quality. Majority (61.5%) of the respondents in this study used boiling of milk as a method to prevent milk borne disease. In this study, 61.3% of the respondents did not know milk borne diseases that were transmitted through consumptions of infected milks (Table 2).

The effect of educational level on KAP of milk borne zoonosis

In this study, 64.3% of the illiterate respondents did not know prevention methods of milk born zoonosis diseases. 25 and 0% of the respondents with educational level of high school and greater than high school did not know prevention of milk born zoonosis. Most (57.1%) of the illiterate respondents did not check milk for its quality. However, 91.1% of elementary, 100% of high school and greater than high school had the habit of checking milk quality. In this study, there was strong association between educational level and KAP of the respondents against zoonotic disease (p<0.05) (Table 3).

The effect of place of residence on KAP of milk borne zoonosis

Most (75.9%) of the urban respondents thought diseases

Table 1. Demographic characters of respondents.

Demographic characters		Frequencies (%)	Total sampled
Gender	Male	82(35.7)	230
	Female	148(64.3)	
Residence	Urban	112(48.7)	230
	Peri-urban	118(51.3)	
Educational status	Illiterate	98(42.6)	
	Elementary	62(27)	
	High school	35(15.2)	230
	>high school	35(15.2)	
Age	<25	53(23)	230
	≥25	177(77)	

Table 2. KAP of the respondents on milk borne zoonosis.

Variables	Number of respondents (%)	Total sampled
Got training yet?		
Yes	18(7.8)	230
No	212(92.2)	
Milk borne disease prevention methods		
Pasteurization	8(3.5)	
Boiling	141(61.5)	230
I do not know	81(35.2)	
Disease transmission through milk		
Yes	146(63.5)	230
No	84(36.5)	
Name of milk borne disease you know		
Brucellosis	5(2.2)	
Tuberculosis	49(21.3)	
Typhoid	35(15.2)	230
I do not know	141(61.3)	
Checking of milk quality		
Yes	169(73.5)	230
No	61(26.5)	
Method of checking milk quality		
Organoleptic	167(72.6)	
Specific gravity	2(0.9)	230
Decision for bad milk		
Boil	9(3.9)	
Discard	84(36.3)	
Sell	18(7.8)	230
Mix with normal	35(15.2)	
Forms of milk preference		
Boiled	113(49.1)	230
Raw	117(50.9)	

Table 3. Effects of educational levels of the respondents on KAP of zoonotic disease.

Variable		Education level (frequency, %)				χ^2(p-value)
		Illiterate	Elementary	High school	>high school	
Knowledge						
	Brucellosis	1(1)	0(0)	0(0)	4(11.4)	
	TB	5(5.1)	17(27.4)	8(22.9)	19(54.3)	
Milk borne Diseases you know	Typhoid fever	0(0)	12(19.4)	11(31.4)	112(34.3)	118.055(0.000)
	Nothing	92(93.9)	33(53.2)	16(45.7)	0(0)	
	Pasteurization	1(1)	1(1.6)	0(0)	6(17.1)	
Prevention methods known	Boiling	34(34.7)	52(83.9)	26(74.3)	29(82.9)	86.694(0.000)
	I do not know	63(64.3)	9(14.5)	9(25.7)	0(0)	
Attitude						
Transmission through cow milk?	Yes	23(23.5)	53(85.5)	35(100)	35(100)	120.889(0.00)
	No	75(76.5)	9(14.5)	0(0)	0(0)	
Practice						
Habit of checking milk quality	Yes	42(42.9)	57(91.9)	35(100)	35(100)	83.257(0.000)
	No	56(57.1)	5(8.1)	0(0)	0(0)	
Method of checking	Organoleptic	42(42.9)	57(91.9)	35(100)	33(94.3)	93.337(0.000)
	Specific gravity	0(0)	0(0)	0(0)	2(5.2)	
Forms of milk preference	Boiled	22(22.4)	35(56.5)	24(68.6)	32(91.4)	59.593(0.000)
	Raw	76(77.6)	27(43.5)	11(31.4)	3(8.6)	

can be transmitted through consumption of raw cow milk, and 1.8, 26.8, and 26.8% of urban respondents knew brucellosis, TB and typhoid, among the diseases transmitted by raw milk, respectively. Large proportion (48.3%) of the respondents from peri-urban area thought that diseases could not be transmitted through cow milk and 77.1% did not know any milk borne diseases. This study showed that there was statistically significance difference (p<0.05) on KAP of the respondents on milk borne diseases between urban and pre-urban areas (Table 4).

KAP of milk collection centers, retailers, users and smallholder dairy farmers (SDFs)

In this questionnaire survey, the respondents were categorized into milk collection centers, retailer, users and smallholder dairy farms. Most of the classes had significant relation with KAP (p<0.05). There was statistically significant difference (p-value<0.05) between prevention method and respondents types. There was no statistically significant difference (p-value> 0.05) between knowledge of diseases transmission through milk and respondents types. There was no statistically significance difference (P>0.05) between respondents types and milk of preference. 20% of milk collection centers, 12.5% of retailers, 2% of users and 0% of SDHs use pasteurization as prevention method of milk born zoonosis (Table 5).

Influence of demographic characteristics on milk collection centers, retailers, users and smallholder dairy farms

This study also shows that there was no significant difference between respondent types and sex (p>0.05). However, there was significant difference between respondent types and age (p<0.05). There was no statistically significant difference between respondent types and educational level (p-value>0.05). In contrast, there was statistically significance difference between place of residence and respondent types (p-value<0.05). (Table 6)

DISCUSSION

A total of 230 respondents from Debre-Birhan town were selected randomly and most of them had low level of awareness on milk borne zoonosis. The fact that most (92.2%) respondents had no formal training in milk borne zoonosis was a cause for having the low level of knowledge, attitude and practice concerning milk borne zoonosis. So, education changes the knowledge and practice of persons. In this study, most of the respondents were held by traditional believe and attitude; not by scientific reason. This is due to the lack of awareness about the health risks of milk borne diseases. A similar result was recorded in the coastal savannah

Table 4. The effect of place of residence on KAP milk borne zoonotic disease of respondents.

Variable		Residence place (frequency, percentage)		χ^2(p-value)
		Urban	Peri-urban	
Knowledge				
Prevention methods you know	Pasteurization	7(6.2)	1(0.8)	28.311(0.0000)
	Boiling	84(75)	57(48.3)	
	I do not know	21(18.8)	60(50.8)	
Milk borne diseases you know	Brucellosis	2(1.8)	3(2.5)	32.314(0.000)
	TB	30(26.8)	19(16.10	
	Typhoid fever	30(26.8)	5(4.2)	
	I do not know	50(44.6)	91(77.1)	
Attitude				
Thought of diseases Transmission through cow milk	Yes	85(75.9)	61(51.7)	14.513(0.00)
	No	27(24.1)	57(48.3)	
Practice				
Habit of checking milk quality?	Yes	102(91.1)	67(56.8)	34.673(0.000)
	No	10(8.9)	51(43.2)	
Method of checking	Organoleptic	100(89.3)	67(56.8)	35.946(0.000)
	Specific gravity	2(1.8)	0(0)	
Forms of milk preference	Boiled	81(72.3)	32(27.1)	46.978(0.000)
	Raw	31(27.7)	86(72.9)	

Table 5. KAP of milk collection centers, retailers, users, and SDFs on milk borne disease.

Variables		Respondent types(frequency, percentage)				χ^2	p-value
		Mcc	Retailor	User	SDH		
Knowledge							
Prevention methods you know	Pasteurization	1(20)	5(12.5)	2(2)	0(0)	36.42	0.00
	Boiling	4(80)	12(30)	61(61)	64(75.3)		
	I do not know	0(0)	23(57.5)	37(37)	21(24.7)		
Diseases known	Brucellosis	0(0)	1(2.5)	2(2)	2(2.4)	20.893	0.013
	TB	4(80)	11(27.5)	24(24)	10(11.8)		
	Typhoid fever	1(20)	5(12.5)	19(19)	10(11.8)		
	Nothing	0(0)	23(57.5)	55(55)	63(74.1)		
Attitude							
Diseases Transmission thought through milk	Yes	5(100)	21(52.5)	63(63)	57(67.1)	5.436	0.143
	No	0(0)	19(47.5)	37(37)	28(32.9)		
Practice							
Habit of checking milk quality	Yes	5(100)	28(70)	66(66)	70(82.4)	8.358	0.039
	No	0(0)	12(30)	34(34)	15(17.6)		
Method of checking	Organoleptic	3(60)	28(70)	66(66)	70(82.4)	98.001	0.000
	Specific gravity	2(40)	0(0)	0(0)	0(0)		
Forms of milk preference	Boiled	4(80)	19(47.5)	43(43)	47(55.3)	4.745	0.191
	Raw	1(20)	21(52.5)	57(57)	38(44.7)		

mcc. = milk collection centers.

Table 6. Influence of demographic characteristics on vendors, retailers, users and SDFs.

Variables	Respondents type(frequency, percentage)				X²	P- value
	Mcc.	Retailers	Users	SDH		
Age						
<25 years	2(40)	11(27.5)	29(29)	11(12.9)	8.151	0.043
≥25 years	3(60)	29(72.5)	71(71)	74(87.1)		
Sex						
Female	4(80)	28(70)	55(55)	61(71.8)	6.938	0.074
Male	1(20)	12(30)	45(45)	24(28.2)		
Educational status						
Illiterate	0(0)	13(32.5)	48(48)	37(43.5)		
Elementary	2(40)	12(30)	22(22)	26(30.6)	11.444	0.247
High school	1(20)	9(22.5)	12(12)	13(15.3)		
>high school	2(40)	6(15)	18(18)	9(10.6)		
Residence						
Urban	5(100)	25(62.5)	44(44)	38(44.7)	9.743	0.021
Peri-urban	0(0)	15(37.5)	56(56)	47(55.3)		

mcc. = milk collection centers.

zone, one of the six agro-ecological zones in Ghana by Addo et al. (2011); 83.9% of the respondent did not take formal training.

In this study most of respondents from smallholder dairy farms were female. This may be from the traditional attitude that male most of the time do not participate with milk related issues and tasks. Similar to this finding, Mosalagae et al. (2010) who studied in selected smallholder and commercial dairy farms of Zimbabwe reported higher involvement of females.

In this finding, 42.6% of the respondents were illiterate followed by 27% of elementary level, 15.2% of high school and 15.2% of greater than high school. This descending of respondent percentage with increasing education level reflects unwillingness of the educated society to participate in dairy business. This high percentage of illiterate with low level of zoonosis diseases awareness may expose the public to critical health risks. In contrast to the findings of the present study; studies conducted by Juma, (2013) in Tanzania revealed that majority of the respondents from all categories; milk vendors (97.1%, n=34), milk retailers (88.6%, n= 31) and smallholders dairy farmers (94.3%, n=33) reported that milk-borne zoonoses diseases associated by consumption of raw milk could be prevented through boiling of milk.

In this study, 80% of milk collection centers are elementary and greater than high school (40% each) while 20% were high school level; however, there was 0% of illiterate in vending business. 43.5% smallholder dairy farmers were illiterate, followed by 30.6, 15.3, and 10.6% for elementary, high school and greater than high school respectively. Contrary to this finding, Juma (2013)

from Tanzania had reported that 94.3% of the sampled smallholder dairy farmers were elementary and 5.7% were secondary level, but there was no respondents from greater than high school education level.

This study indicated that 61.3% of respondents do not know any milk borne diseases. This might reduce hygienic cares during handling and consumption of raw milk. Tuberculosis and typhoid fever were first and second known diseases of the respondents; 21.3 and 15.2% of the respondent known tuberculosis and typhoid fever as milk borne zoonosis disease respectively. Brucellosis was the least known diseases, only 2.2% know it. Addo et al. (2011) from Ghana reported that TB was known by 88% of the respondents and brucellosis by 76% which is far from the findings of this study. This might be due to the educational status and life experience of the respondents in Ghana. Mihiret-ab (2012) also reported that 5.6% of the respondents were aware of the zoonotic importance of brucellosis in and around Dire Dawa, Ethiopia. Dawit et al. (2013) reported contrary to the present findings that none of the respondents from Jimma knew about zoonotic importance of brucellosis.

Even though 63.5% of respondents were aware of diseases that might be transmitted through cow milk, but 61.3% of the respondents did not know the particular names of diseases of milk borne zoonotic diseases. This study indicated that respondents were to some extent aware of general milk borne zoonosis but did not know specific names of the diseases. Similar observations were noticed in Kenya (Ekuttan, 2005) where dairy farmers were generally aware of zoonosis but lack of knowledge on specific milk-borne zoonosis.

In this finding, only 3.5% of the respondents knew pasteurization as means of prevention of milk borne zoonosis. Similarly, 61.3% of the respondents knew boiling as means of prevention of milk borne zoonosis. The unpasteurized or un-boiled milk have been reported to be associated with milk borne zoonotics diseases such as brucellosis and bovine tuberculosis (Fetene et al., 2011).

Most of the respondents from the total study population knew diseases can be acquired through cow milk. This result was due to the fact that 100% of high school and greater than high school knew diseases can be acquired from consumption of raw cow milk but 76.5% of illiterate did not know this fact. In this study, even though 63.5% respondents were aware of diseases that are transmitted through the consumption of raw cow milk, 50.9% of the respondents' forms of milk preference were raw milk. Hundal et al. (2016) from Punjab were reported that 69.6% of the respondents drink raw milk and 55.6% of the respondents knew diseases can be transmitted through consumption of contaminated milk. Large amounts of *E. coli*, *S. aureus*, *Candida albicans* and other health hazard microbes have been reported in raw milk, cultured pasteurized milk and naturally soured raw milk (Gran et al., 2003), and this emphasizes need for improved hygienic practices and precaution at all levels of milk processing value chain. Ingestion of infected raw/unpasteurized milk was cited as the most possible way of contracting milk-borne zoonosis (Chahota et al., 2003).

Study by Kilango et al. (2012) reported that boiling of milk prior to consumption is the best approach to prevent milk-borne diseases especially in low income communities but in this study only 61.3% of respondents know that boiling of milk can prevent milk born zoonosis.

The difference in awareness of milk borne zoonosis is due to various circumstances present in the study area. Most of the variation in developing country described by Ameni and Erkihun (2007) which includes remoteness, lack of health facilities, poor extension services, low training status on rearing and handling animals and low literacy rate had been reported as major contributors to low level of awareness among smallholder dairy farmers. Furthermore, many African communities associate diseases shared between livestock and humans with misbehavior or witchcraft (Marcotty et al., 2009), and all these practices are due to little information or lack of knowledge about milk quality at farm level and on different aspects of dairy husbandry issues (Marcotty et al., 2009).

CONCLUSION AND RECOMMENDATIONS

In this study survey, the respondents knowledge, attitude and practice concerning milk borne zoonosis was found at lower level. This was mostly due to low level of educational status. Without information on milk-borne zoonosis, milk collection centers, retailers, users, and smallholder dairy farmers are neither informed nor motivated to take the simple precautions necessary to protect themselves, their families, workers and the public. Generally, the sampled population had low level of awareness regarding milk borne zoonosis. Based on the above findings the following recommendations are forwarded: 1) awareness about zoonotic disease and trainings on zoonotic risks of milk borne diseases and their prevention methods should be given to milk producers, collection centers, retailers, consumers and also people working with milk handling and processing and 2) the public should be educated and informed on public health significance of milk borne zoonotic diseases.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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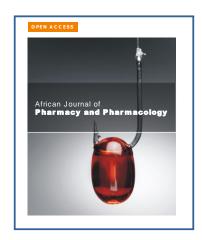
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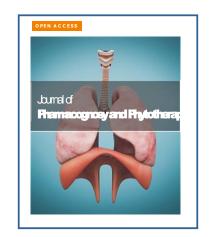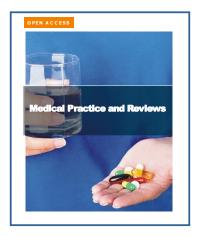Diagnosis

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