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Full Length Research Paper

Knowledge of effect of exercise on HIV infected persons among physiotherapy students in Nigeria

Maduagwu, S. M.^{1*}, Sokunbi G. O.¹, Jaiyeola, O. A.¹, Shuaibu, I.¹, Maduagwu, B. C.² and Ojiakor, A. C.³

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Despite the recognition and knowledge of the beneficial effects of exercise on persons living with HIV and AIDS in the developed world, there is global paucity of published studies on knowledge of effect of exercise on HIV infected persons. This study was therefore designed to determine whether physiotherapy students in Nigeria have the basic knowledge on the effect of exercise on HIV infected persons. Simple random sampling was employed to select four out of seven universities in Nigeria that already have existing and established Physiotherapy Departments. The instrument for this study was a validated and reliable 20 item questionnaire on knowledge of effects of exercise on HIV infected persons used in a previous study to investigate knowledge of effect of exercise on HIV infected persons among health care professionals in North eastern Nigeria. This questionnaire was administered to 346 respondents with a response rate of 74%. The mean and age range of the participants were 24.27 ± 2.68 and 20 to 39 years, respectively with majority (97.7%) between the ages of 20 and 31 years. More than one-quarter (29%) of the respondents lacked good knowledge on effect of exercise on HIV infected persons. Overwhelming (80%) Physiotherapy students in Nigeria lacked very good knowledge on effect of exercise on HIV infected persons.

Key words: Persons living with HIV and AIDS, physiotherapy students in Nigeria, existing and established physiotherapy departments, validated and reliable 20 item questionnaire, very good knowledge.

INTRODUCTION

The dawn of highly active antiretroviral therapy (HAART) in 1996 transformed human immunodeficiency virus (HIV) infection, a previously lethal condition to a manageable chronic illness. The implication of this medical

advancement is increase in number of infected persons who now live longer by overcoming the health related consequences and challenges posed by HIV (Cade et al., 2004). According to Fido and Kazemi (2002),

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this augmented population has sequentially escalated the societal burden of the disease, and placed high demand on health care services and resources. Notwithstanding the health benefits of HAART, some known and previously unrecognized adverse reactions that were not detected at the early clinical trials are now present. Thus, apart from several health problems associated with HIV infection itself, Boufassa et al. (2001) observed that affected individuals also experience adverse effects arising from HAART that could affect the physical, physiological and psychosocial components of health of this population, similar to those caused by HIV itself.

Consequently, persons living with HIV face a lot of health challenges that arise from the infection itself; knowledge of the fact that one is infected, the therapy used in the treatment of the disease, the accessibility of this therapy, pill burden or a combination of all these factors. While many of these health challenges are manageable with pharmacological agents, Ciccolo et al. (2004) advised that it is not practicable or wise to rely on additional medications to achieve this effect. The authors therefore advocated for the use of non-pharmacological methods as adjunct to HIV management to reduce the adverse effects of drugs, pill burden and possible drug interactions. Ciccolo et al. (2004) argued that adding other pills to treat these adverse effects of HIV and HAART is likely to further compromise the benefits of HAART and also increase pill burden. Standish et al. (2001) reported that exercise is consistently listed as the most common, most effective, non-toxic and the least expensive complementary therapy utilized by HIV infected persons in the United States (US). This report was subsequently corroborated by various studies (Djordjevic et al., 2007; Hand et al., 2009; O'Brien et al., 2006; Tiozzo et al., 2013).

It is therefore plausible to expect HIV infected persons all over the world to utilize exercise as a strategy to cope with the health problems imposed by HIV and its drug therapy. Despite the recognition and knowledge of the beneficial effects of exercise on persons living with HIV and AIDS in the developed world, there is global paucity of published studies on knowledge of effect of exercise on HIV infected persons. In most parts of the developing world, including Nigeria, in spite of the burden and complications of HIV infection and its treatment, there is dearth of data on the effect of exercise on HIV infected individuals, let alone on the knowledge of effect of exercise on this population apart from a recent study by Maduagwu et al. (2014) on the knowledge of effect of exercise on HIV infected persons among health care professionals in North eastern Nigeria. In that study, Maduagwu et al. (2014) posited that the lack of knowledge on the effect of exercise on HIV infected persons among Nigerian health care professionals might be the reason for the dearth of literature on the effect of

exercise on the overwhelming population living with HIV and AIDS in the country, notwithstanding the country's ranking as one of the countries with the highest inhabitants of HIV infected persons in the world.

In this present study, we hypothesize that for exercise (the bed rock of physiotherapy practice) to be utilized as an effective strategy in managing complications posed by HIV and its drug therapy, it is imperative for physiotherapy students (who are indeed the future physiotherapists) to have knowledge of effect of exercise on HIV infected persons right from the period of training. The aim of the study was therefore to determine whether physiotherapy students in Nigeria have the basic knowledge on the effect of exercise on HIV infected persons.

MATERIALS AND METHODS

Settings, participants and design

Nigeria is divided into six geographical zones. Each zone has at least one university that offers physiotherapy program. In all, there are currently nine universities that offer physiotherapy courses in the country. Two of these were newly established, hence were not part of this study. Physiotherapy training in Nigeria presently lasts for five years. Students that participated in the study were those in the 4th and 5th years of study. The remaining seven universities and their locations are as follows: The Universities of Ibadan and Lagos, and Obafemi Awolowo University located in the South west; University of Nigeria, Nsukka and Nnamdi Azikiwe University in the South east; Bayero University, Kano in the North west and University of Maiduguri in the North east. Simple random sampling was used to select one university each from the universities in the South west (University of Lagos {Unilag}) and South east (University of Nigeria, Nsukka {UNN}). Bayero University, Kano (BUK) being the only university in the North west that offers physiotherapy was automatically selected, so also the University of Maiduguri (Unimaid) in the North east.

In essence, the study comprised two universities offering physiotherapy from the southern Nigeria and two from the northern part of the country. Every 4th and 5th year students in each of these selected universities were implored to participate in the study. This comprehensive recruitment was to enhance the number of participants as well as reduce rate of attrition. The study employed cross-sectional design with data collection through self-administered questionnaire. Ethical approval for the study was granted by the Research and Ethical Committee of the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria. The researchers explained the purpose of the study to each participant on a sheet of paper attached to the questionnaire. Consent to participate was implied by signing informed consent form which was also attached to each questionnaire, completing the questionnaire and returning it.

Questionnaire

The instrument for this study was a 20 item questionnaire on knowledge of effect of exercise on HIV infected persons. Maduagwu et al. (2014) developed and used this questionnaire to investigate knowledge of effect of exercise on HIV infected persons

among health care professionals in North eastern Nigeria. Two experts in cardiopulmonary physiotherapy and an exercise physiology professor studied the instrument at the stage of development for face and content validity.

The developers also subjected the tool for test-retest reliability and found r as 0.82. It consists of two sections. Section A comprises questions on participants' socio-demographic characteristics. This section was modified by the investigators to suit the purpose of this present study which was conducted on students. Section B contains 20 item closed - ended questions, each with three domains (Agree, Disagree or Undecided responses) for assessing the knowledge of effect of exercise on HIV infected persons. Some of the item questions on the questionnaire are on what the students thought were the impact of exercise on CD4 cell count, immune status, and patients' well being and resistance to diseases.

Scoring of the questionnaire

A correct answer to each question scored 1. Hence the maximum score was 20 and minimum 0. An "agree" and "disagree" responses to a correct and wrong statement respectively scored 1 each, while an "undecided" response was disregarded. Based on these, the higher the score, the higher the knowledge of the student(s) on effect of exercise on HIV infected persons. For simplicity and descriptive purposes only, the developers ranked scores as follows; 0 to 5 indicates poor knowledge of effect of exercise on HIV infected persons, 6 to 10 implies fair knowledge, 11 to 15 connotes good knowledge and 16 to 20 signifies very good knowledge. In other words, this ranking was not meant for inferential statistics.

Distribution of the questionnaire

The researchers were all residents of Maiduguri, North eastern Nigeria at the time of the study. They contacted the physiotherapy departmental secretaries of the four selected universities who gave the numbers of 4th and 5th year physiotherapy students at each of the universities. Based on these numbers, the researchers sent equivalent number of copies of questionnaire by courier to each secretary at Unilag, UNN and BUK, while those for Unimaid were issued to the secretary by hand. The researchers then implored each of the secretaries to assist in distributing the questionnaire to all the 4th and 5th year students willing to participate in the study. The researchers instructed each secretary not to receive the completed questionnaire by hand, but informed the students to drop the questionnaire in an enclosed carton which had an opening just enough to enter the completed questionnaire. This distribution method and the adopted comprehensive recruitment of every willing 4th and 5th year students guaranteed anonymity and aimed to increase the response rate, respectively.

Data analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 17.0 software (SPSS Inc. Chicago, Illinois, USA). Descriptive statistics summarized the sociodemographic characteristics of the participants. Independent Student t-test analyzed the difference in the mean score of knowledge of effect of exercise on HIV infected persons between male and female participants, 4th and 5th year students, and geographical location of universities of training in terms of Northern

and Southern Nigeria.

One way analysis of variance (ANOVA) analyzed difference in the mean score of knowledge of effect of exercise on HIV infected persons among the participants at different universities. Least of square difference (LSD) post hoc test was employed to determine where any significant difference existed. An alpha value of $p < 0.05$ was considered significant.

RESULTS

Two hundred and fifty five (138 males and 117 females) out of the 346 participants, returned their questionnaire duly completed, translating to 74% response rate. The age of the participants ranged from 20 to 39 years with a mean age of 24.27 ± 2.68 and majority (97.7%) were in the age group of 20 to 31 years. Male participants accounted for 54.1% and most (88.2%) were unmarried. Students from BUK constituted the majority (33.3%). Fourth year students accounted for 51.8% and the participants from Northern Nigeria comprised 53.3%.

Table 1 depicts details of the sociodemographic characteristics of the participants. Table 2 displays the ranking of scores on knowledge of effect of exercise on HIV infected persons. Substantial number (51%) of the participants exhibited good knowledge on the effect of exercise on HIV infected persons. Table 3 presents the mean scores and significant level on knowledge of effect of exercise on HIV infected persons among the participants. Table 4 shows the post hoc test to determine where significant difference exists among the participants' universities of training.

DISCUSSION

This study on knowledge of effect of exercise on HIV infected persons among physiotherapy students in Nigeria may seem to be the first published data among students population on this subject, but ranks second to a recent similar study (Maduagwu et al., 2014) pioneered by the principal author. In essence, the authors attempt to fill the obvious gap on knowledge of effect of exercise on HIV infected persons, despite substantial studies by several scholars, especially in the developed nations on effect of exercise on HIV and AIDS. Male participants accounted for 54.1% as against their female counterparts. This can be attributed to the fact that most health care professions in Nigeria (except nursing) are dominated by males right from training periods. This male preponderance is similar to the findings of Maduagwu et al. (2014) in a study conducted on knowledge of effect of exercise on HIV infected persons among health care professionals in north eastern Nigeria. This male preponderance can also be attributed to the fact that the north which accounts for 53.3% of the participants faces

Table 1. Sociodemographic characteristics of the participants.

Variables	Frequency (%)	Percentage
Age Group		
20 - 23	102	40.0
24 - 27	131	51.3
28 - 31	16	6.3
32 - 35	4	1.6
36 - 39	2	0.8
Gender		
Male	138	54.1
Female	117	45.9
Marital Status		
Single	225	88.2
Married	28	11.0
Divorced	2	0.8
Year of study		
4th	132	51.8
5th	123	48.2
Universities of training		
Buk	85	33.3
Unilag	46	18.1
Unimaid	51	20.0
Unn	73	28.6
Region		
North	136	53.3
South	119	46.7

socio-cultural and religious factors that restrict females to public or work life as corroborated by a previous study (Akinpelu et al., 2011) in the north eastern Nigeria.

Overwhelming number of the participants was between the ages of 20 and 27 years. This is not surprising, because this age bracket constitutes the age of graduation or near graduation for most students in Nigeria studying professional courses that last for five to six years. Also for a Nigerian student to qualify for National Youth Service in Nigeria, a pride of every Nigerian student, he/she must be less than 30 years at the year of graduation. In view of this, every concerned post secondary student looks forward to enter the university and graduate before the age of 30 years. Most participants were unmarried, this is expected, because most Nigerian undergraduate students either because of age, lack of finance (for male students who have to pay bride price and provide for the family), inexperience as regards marital life or busy academic schedules, or combination of these, remain unmarried until after graduation and employed. More than 50% of the participants were in the fourth year of study. This may be as a result of busy schedules of the 5th year student who

Table 2. Ranking of scores on knowledge of effect of exercise on HIV infected persons.

Categories of score	Frequency (n)	Percentage
0 - 5 (poor knowledge)	12	4.7
6 - 10 (fair knowledge)	62	24.3
11 - 15 (good knowledge)	130	51.0
16 - 20 (very good knowledge)	51	20.0

were in their final year; hence some might not had participated in the study. It could also be that the 4th year students were more in number. Also the students from the universities situated in northern Nigeria participated more in the study. The reason for this may not be far-fetched, since the study was conducted in Maiduguri, a northern city, hence most if not all eligible students in Unimaid might had participated in the study.

Data from this study showed that sizeable number of the participants had good knowledge of effect of exercise on HIV infected persons. This is similar to the findings of Maduagwu et al. (2014) in a study on knowledge of effect of exercise on HIV infected persons among healthcare professionals in northeastern Nigeria in which substantial number of the participants demonstrated good knowledge. This good knowledge demonstrated by the participants could be attributed to the fact that exercise therapy is part of the curriculum of physiotherapy training in Nigeria and is continuously used as means of intervention not only for HIV infected persons but also for those having other conditions in which exercise is not contraindicated. In addition, exercise therapy is the pedestal of physiotherapy profession. However, only one-fifth of the physiotherapy students had very good knowledge, while more than a quarter lacked good knowledge on the subject. This discovery is not astounding because earlier related studies in Nigeria had reported similar findings. Oyeyemi et al. (2008) reported that Nigerian physiotherapists were not comfortable and not willing to manage persons living with HIV and AIDS. Also, Oyeyemi et al. (2011) concluded that Nigerian physiotherapists exhibited unsatisfactory knowledge of universal precautions and AIDS pathophysiology, and most of them did not feel comfortable and showed low ethical disposition when it comes to caring for persons infected with HIV and AIDS.

Maduagwu et al. (2014) reported that more than a quarter of the health care professionals in their study lacked good knowledge on the beneficial effect of exercise on persons living with HIV. This observation is not limited to Nigerian physiotherapists alone. In Canada, O'Brien et al. (2006) reported that few physiotherapists work with persons living with HIV. Worthington et al. (2005) also in Canada had earlier observed that most

Table 3. Mean scores and significant levels on knowledge of effect of exercise on HIV-infected persons.

Variable	N-score	Mean	Test statistic	P- value
Gender				
Male	138	2.35 ± 3.768	0.058 ¶	0.811
Female	117	12.40 ± 3.674	-	-
Years of study				
4th	132	12.45 ± 3.751	0.010 ¶	0.989
5th	123	12.28 ± 3.697	-	-
Region				
North	136	3.10 ± 3.642	0.424 ¶	0.516
South	119	1.54 ± 3.642	-	-
Universities				
Buk	85	13.19 ± 3.844	4.467 §	0.004*
Unilag	46	12.07 ± 3.235	-	-
Unimaid	51	12.96 ± 3.310	-	-
Unn	73	11.21 ± 3.862	-	-

¶ = independent T-test; § = one way ANOVA; * = the mean difference is significant at 0.05.

Table 4. LSD Post hoc test for knowledge of effect of exercise on HIV infected persons among participants at various universities.

Comparison among universities	Mean difference	Significance	
Buk vs.	UniLag	1.123	0.094
	UniMaid	0.227	0.725
	UNN	-1.983	0.001*
Unilag vs.	BUK	-1.123	0.094
	UniMaid	0.896	0.228
	UNN	0.860	0.211
Unimaid vs.	BUK	-0.227	0.725
	UniLag	0.896	0.228
	UNN	1.755	0.009*
Unn vs.	BUK	-1.983	0.001*
	UniLag	-0.860	0.211
	UniMaid	-1.755	0.009

Key: * = the mean difference is significant at 0.05 level.

physiotherapists never managed persons living with HIV, were uncomfortable with the idea and reported not receiving HIV training in their rehabilitation degree program. Findings from this study revealed no statistical significant difference ($p > 0.05$) in terms of gender, years of study and region in which university of training is located. However based on gender, females, regardless of their lower number, displayed higher mean score

compared to the males, which means they had better knowledge of effect of exercise on HIV infected persons. This non significant but higher mean score demonstrated by females in this study somehow disagreed with the findings of Tsuda et al. (1982) and Maduagwu et al. (2014) in which male participants had significant higher knowledge than females. This however, should be interpreted with caution because the populations used by

Tsuda et al. (1982) and Maduagwu et al. (2014) were different from that of the present study.

The non significant but higher mean scores by the participants from the universities situated in northern Nigeria and those in the 4th year of training may be difficult to ascertain. It could be probably as a result of their larger numbers in the study compared to their counterparts. The result on knowledge of effect of exercise on HIV infected persons based on universities of training revealed a statistical significant difference ($p < 0.05$) with participants from Bayero University Kano (BUK) having the highest mean score (13.19). This can be attributed to their preponderance over other institutions of training that participated in this study. It may also be as a result of their existent knowledge on the subject, since participants from University of Nigeria Nsukka (UNN), the second to BUK in terms of number of participants had the least mean score. Moreover, the mean scores of the participants from other universities in this study, except that of the participants from University of Lagos (probably due to their number, which was the least) were significantly higher than that of the participants from UNN.

LIMITATIONS

As a result of dearth of studies on this subject, the findings of this study seemed to form the bedrock of the discussion. Based on this, scholars should endeavour to conduct studies on the knowledge of effect of exercise on HIV infected persons. Hence, the findings of this present study and those of Maduagwu et al. (2014) may form the bases and precursors to achieve this purpose.

In addition, the discrepancy in the proportions of the participants from each university selected for this study might have somehow skewed the result of the study and its findings. Further studies may attenuate this effect (if feasible) during recruitment process.

KEY POINTS

- 1). One hundred and thirty (51%) participants had good knowledge of effect of exercise on HIV infected persons.
- 2). One-fifth of the physiotherapy students had good knowledge, while more than 25% lacked good knowledge on the subject.
- 3). There was no statistical significant difference in knowledge of effect of exercise on HIV infected persons between male and female participants.

CONCLUSION

Substantial number of the respondents had good

knowledge on the subject, while 80% of the Physiotherapy students in Nigeria lacked very good knowledge on the effect of exercise on HIV infected persons. This revelation calls for urgent need to incorporate HIV and exercise related courses in the syllabus of every Physiotherapy training institution in Nigeria. This in the long run may produce future scholars in the country who may be interested in conducting HIV and exercise studies, since HIV has transmuted to a chronic manageable disease.

Conflicts of interest

Authors have none to declare.

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Full Length Research Paper

Community home based care for people living with HIV: an overview of client needs, actors and services provided in Ethiopia

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In Ethiopia, it was shown that funding levels are far from compatible to the needs for care and support services for people living with human immuno-deficiency virus (PLHIV) and orphaned and vulnerable children (OVC). The aim in this study is to map the relationship between client needs, actors, care and support services provided for PLHIV and OVC in Ethiopia. A case study of the Ethiopian community care program was carried out using multiple methods of data collection as part of a multi-country research of four countries. Three program cases providing care and support services throughout the country were studied. A total of 35 in-depth interviews, 9 focus group discussions, 60 guided interviews, and 3 community mapping exercises were carried out. Analysis was conducted using the thematic framework approach with coding and mapping of the transcripts in the ATLAS.ti version 5.0. The expansion of antiretroviral therapy (ART) has reduced the number of bed-ridden PLHIV in need of home based nursing care. Currently, inadequate access to food and lack of income to cover health care and other expenses are the major concerns of PLHIV in Ethiopia. Community Home Based Care (CHBC) in Ethiopia can be categorised into two types; clinical and non-clinical. Non-clinical care (psychosocial, economic, home nursing care, material, food, and other social supports) is mainly provided by non-governmental care-giving organizations. Clinical care was provided mainly by government health facilities which comprised services such as early detection and treatment for opportunistic infections (OIs), ART services and PMTCT. A clear shift of the need of PLHIV from basic nursing care at home to social and material support needs was observed. A coordinated effort from the key players including governmental entities, non-governmental organizations (NGOs) and faith-based organizations (FBOs), the community, associations of PLHIV and volunteers is required to meet the current needs of PLHIV and OVC in the country.

Key words: Caregiver, community home based care, patient needs, service provision, care and support, people living with human immuno-deficiency virus (PLHIV), Ethiopia, qualitative methods, mapping.

INTRODUCTION

Before the introduction of Antiretroviral Therapy (ART) in sub-saharan Africa, Community Home-Based Care

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(CHBC) programs were developed as an unsystematic and need-based effort to meet the demand for palliative care in absence of (or limited options for) medical care at health facility level (Ncama, 2005). These later developed into organized services as part of the HIV prevention and control response by governmental and non-governmental organizations.

A sub-Saharan multi-country study showed that CHBC is effective and affordable for people living with HIV (PLHIV) and has a positive impact on the health and social status of patients, families and the community at large (Mohammad and Gikonyo, 2005). Though the contributions of CHBC have been significantly popular before the introduction of ART, they still prove to be important in taking care of the needs of PLHIV even after enrolment into ART services. A study in sub-Saharan Africa indicated that patients exposed to community-based supportive services experienced a more rapid and greater overall increase in CD4 cell count than unexposed patients. In the study, the patients also had higher levels of adherence, attributed primarily to exposure to Home-Based Care (HBC) services (Kabore et al., 2010).

In addition, an article concluded that HBC potentially reduces stigma, thus improving uptake of HIV testing, and access to care and support (Alison et al., 2010). Reported community care programs are confronted with many unmet needs of clients. A Nigerian study reported that nearly 80% of the subjects reported unmet health needs out of which medication needs were most often unmet (48.3%), followed by HBC. It was noted that HBC was lacking and more PLHIV were forced to find treatment in hospitals (Adedigba et al., 2008). This is contrary to the fact that HBC services emerged because patients could not easily access services at the health facilities for several reasons. In Guyana, it was reported that not all clients had access to safe drinking water and some experienced difficulties in tasks, such as sitting, standing, lifting, carrying, pushing or pulling. There were also worries about the quality of care and some volunteers did not meet the needs of the respondents. Another unmet need was the desire to receive job and skill training. Mainly, the respondents reported unmet needs in the areas of economic opportunities, food and children support (Boryc et al., 2010). Before the introduction of ART, PLHIV in Ethiopia fully depended on the goodwill of the community and NGOs to support them during their illnesses and in dying with dignity (Aantjes and Jerene, 2010).

On the basis of information obtained from PLHIV and community representatives, the most important needs of PLHIV at that time were emotional and psychological, physical and socio-economic, clinical and health care, legal and human rights (Hailu and Stuer, 2002). Stigma surrounded PLHIV even in the health facility (Feyissa et al., 2012) where their health care needs were only marginally addressed. However, as of 2005, PLHIV are increasingly accessing free ART and the majority of their

medical care needs are now being addressed by public health facilities. As a consequence, the emphasis in their demands has shifted from basic nursing care in the home to nutritional and material support and means of income generation in the long run (Aantjes and Jerene, 2010). Cognizant of the contribution of community care programs implied by reports from different countries is a multi-country study on the historic development of care-giving, its evolution, extent of integration into existing health system(s) and potential role in expanded HIV and PHC programs was initiated by the Care-givers Action Network (CAN), Cordaid and United Nation's Joint program on HIV/AIDS (UNAIDS).

In this article, we are reporting findings on client needs, actors involved and service provision in the Ethiopian context. Focus on the relationship between client needs, actors, care and support services provided is timely, given the fact that there are needs of PLHIV which are not met by the formal health system of the country (Aantjes and Jerene, 2010). Hence, the questions we intend to answer in this article are: What are the felt needs of PLHIV? What is the role of community home based care activities in meeting these needs? Who are the key actors and what specific roles do they play in the provision of care and support services to PLHIV in Ethiopia?

MATERIALS AND METHODS

Study design and participants

Ethiopia was part of a multi-country study conducted in 2011. Other African countries in this study included Malawi, South Africa and Zambia. In each country, in-depth case studies were conducted among three large care-giving organizations following a phased research approach. The cases were selected on the basis of the following criteria: care-giving organizations running their activities in most or all parts of the country and those older than 10 years. This was supplemented by the recommendation of the Advisory board of the research project. Accordingly, two of the three cases (OSSA-Jimma and Medan ACTS-Hawassa) were taken from the two largest regional states in the country while the third one (Mekdim Ethiopia-Asossa) was taken from an emerging regional state. Three big care-giving organizations namely; Mekdim Ethiopia National Association of PLHIV and AIDS Orphans in Asossa, OSSA in Jimma and Medan ACTS in Hawassa were taken as model care and support organizations and included in the study. The major actors for national level interviews and the three large care-giving organizations were selected by the Advisory Board (composed of key governmental and non-governmental organizations and community volunteers) and were considered to be representatives (models) of care and support activities in Ethiopia. The study's participants included a group of senior managers who represent major national stakeholders of care and support for PLHIV situated in the capital city of Ethiopia, Addis Ababa. For each of the three cases, managers, program officers, community representatives, clients, primary caregivers and community volunteers (secondary caregivers) were included in the study.

Data collection procedures

A common research protocol guided the research process in all of

the four countries. All of the tools used in the study were developed by the coordination team of the multi-country research and further contextualised by the country research team with the help of the Advisory Board. There were different phases in the conduct of the study. During phase 1, we conducted 10 in-depth interviews with national representatives of major players of care and support activities in Ethiopia. In the second phase, data were collected from the managers, program officers, community representative, clients and community volunteers relating to the three cases. A total of 25 in-depth interviews and 9 FGDs were carried out with managers (of public health system and care-giving organizations), program staff of NGOs¹ community representatives and volunteers. Guided interviews were conducted with 30 clients and 30 primary caregivers (10 for each case in both categories). Community mapping of key actors of care and support activities relating to each of the three cases was performed by participants of the FGDs with volunteers with verification by community representatives. Interviews were conducted by the principal and co-principal investigators of the country research team with the assistance of four researchers who had ample experience in qualitative data collection. All of the interviews were recorded with a digital voice recorder and notes were taken to assist the transcription of the interviews. All the interviews were conducted in Amharic.

Data analysis

After completing the data collection, verbatim translation and transcription of the recorded interviews was done by the research assistants involved in the interviews. Then coding of the transcripts using ATLAS-ti 5.0 software was performed based on the common codes created for the multi-country research as a whole. Query reports generated by ATLAS-ti were used to analyse and narrate the research findings. Based on the reports from the first two phases, a concluding validation phase with additional data collection was carried out. In this phase (phase 3), telephone interviews with four national level key informants were carried out to validate the main findings of the countrywide study. Validation of research findings among medium to large care and support organisations in Ethiopia was also conducted through a questionnaire to which 10 of the 13 care-giving organizations contacted responded.

Ethical considerations

The protocol for the conduct of this study, contextualized from the multi-country protocol, was ethically cleared by the Ethical Review Board of Jimma University and the VU University of Amsterdam. Written and signed consent was obtained from each of the study participants before their involvement in the study. In case of minors who were included in the primary caregivers' interview, assent of the respondents and consent of their parents were obtained. All of the data obtained from the participants were not linked to any personal identifiers and were accessed by the research team only. All digital records of interviews and discussions for the research were destroyed after transcription was finalised.

¹ The rationale behind selecting older programmes is that there is a wealth of information and experience within these programmes. Such programmes would have been able to (firmly) establish themselves, adapt to contextual changes and achieve a level of embedding within the community and linkages with other actors in community care. Importantly, they would have provided services to people living with HIV both when ART was and was not available, offering an important perspective regarding the changes seen over time. It is this type of evolution that we would like to bring to the fore in the country case study.

Operational definitions

Primary care-givers are family members and friends who provide immediate care to family members and/or loved ones. Secondary care-givers are care-givers who work on an individual basis or as staff on a paid, unpaid or voluntary basis at clinics, for non-governmental organizations (NGOs) or for the government. As such, the term secondary care-givers refers to both employees of health ministries and of NGOs, including faith-based organizations (FBOs), while community care-givers refers to both primary and secondary care-givers.

RESULTS AND DISCUSSION

Description of the study participants

As it was already implied in the methods section, senior managers representing major players of care and support for PLHIV and three model care-giving organizations were included in this study. There were 10 key informants involved in the national level in-depth interviews. A total of 25 managers (of public health system and care-giving organizations) were interviewed as key informants. Each of the 9 FGDs had 6 to 10 participants from community representatives, program staff of NGOs and community volunteers. Three FGDs were conducted, one for each of these groups, for every care-giving organization. In the guided interview with clients (beneficiaries) and primary care-givers, 10 participants were interviewed from each category for each of the three cases (n = 60). Twenty four (80.0%) of the 30 beneficiaries interviewed were females while 15 (50.0%) of the 30 primary care-givers interviewed were females. The age of the primary care-givers ranged from 11 to 50 years of age and 8 (26.7%) of these were younger than 20 years. Majority (70.0%) of the beneficiaries had age of 30 years or older with only one client younger than the age of 20 years.

Patient needs

In the 1990s, care and support of PLHIV was started in Ethiopia by some NGOs like Mekdim Ethiopia and NEP+ because of the following reasons; first, there was no sort of treatment for PLHIV. The only treatment available during that time was psychosocial support and basic nursing care in the form of symptom relief. Secondly, there were large numbers of bedridden PLHIV who were in need of care and support. Thirdly, stigma and discrimination against PLHIV was very high.

Finally, during those days, the hospitals were busy with AIDS patients. As a key informant from Addis Ababa HAPCO described, out of the total hospital beds in Addis Ababa, 60% were occupied by AIDS patients. It then became challenging to give treatment at health facilities. As a result, there was a need to engage communities in care and support services so that HIV/AIDS patients would get the necessary support at home resulting in task shifting to primary and secondary care-givers. There is a

common understanding among almost all key informants that in the early 1990s, many of the PLHIVs were bedridden and they needed more intensive home based care. During that time, volunteers (who were very few in number) were overloaded in the provision of HBC. By then, home based care was thought to be providing physical care alone, such as hygiene, treatment of opportunistic infections (OIs) and facilitating ART enrolment when it became available (2004/2005) at the health facilities.

Later on, psychosocial aspects of care, such as nutrition, psychological support, social support and economic support, were included in the home based care package. Attention was also given to the prevention of exposure to the virus by the volunteers. During the last decade, changes have been observed with regard to the needs of people living with HIV in Ethiopia. The increased access to ART has resulted in a clear shift in their needs from basic nursing care in the home to livelihood support, including food security, other material support, and means of income generation.

The successful scale up of ART and its implication in the country has been reported earlier (Assefa et al., 2009). Moreover, similar pattern in the shift of needs following ART use among PLHIV has been documented in Malawi, South Africa and Zambia (CAN, 2013). Clients and other respondents interviewed in the study indicated that the main problem of PLHIV currently is a shortage of food and lack of livelihood to cover other expenses. This was mainly related to the loss of jobs following a positive HIV status. Moreover, participants commented that most people affected by the HIV have financial problems. Only few of them are government employees with the majority having unreliable means of income.

Food by prescription (FBP) at government health facilities providing ART has been initiated using the BMI of the client as a criterion. However, clients with a normal BMI may as well not have anything to eat. whereas, clients previously had access to food support from the care-giving organizations. The study observed that this is no longer the case following the reduction of funds available to the care-giving organizations. During the validation interviews, all of the informants reported that their organizations perceived nutrition to be a growing and particular need of patient on ART.

However, it was also indicated by some that the nutritional need for patients on ART should not be over emphasized. While admitting the importance of this need, one key informant noted, "... there is an exaggeration of this need by the people (staff of the NGOs and FBOs, clients and volunteers) since they assume that PLHIV need special diet while on ART.' He recommended that 'if the patients take whatever is available as usual' this problem may not be as significant as it appears. Another informant added that 'patients have the misconceptions of the need for special food while taking ART medications'. This finding illustrates the different opinions

that exist on patient needs in Ethiopia. While patients depend on the support services received from various institutions in the country, they also indicated that this is not sufficient. Primary care-givers and clients implied that majority of the PLHIV want to get involved in income generating activities (IGAs) following the health improvements they get after ART. For that purpose, they need initial capital or seed money and skill training. However, some PLHIV are not skillful enough to save money and therefore they need lifelong support. Moreover, there are PLHIV who do not have relatives or care-givers at their home requiring home based nursing care by a secondary caregiver. Key informants mentioned that nowadays, the need for economic support among PLHIV is extremely high. Particularly, widows and orphans are in serious conditions and they need psychosocial and economical support.

Moreover, the living cost is becoming increasingly expensive, thereby aggravating the troubles faced by the PLHIV. There are also many clients in need of shelter. Moreover, many PLHIV do not have job security, when they remain in bed everything will stop, they also exhaustively use their resources, they do not have capacity to be productive and they are psychologically affected. Moreover, there are PLHIV who do not have a relative or care-giver at their home and there are so many OVCs in the towns. The number of AIDS orphans in Ethiopia was estimated to be 800,000 to 1.2 million (UNAIDS, 2000; AHOPE, 2005). These children need to be supported in order for them to continue their education, eat adequate food, pay schooling expenses and have shelter.

The conclusion that 'PLHIV today in Ethiopia predominantly have support needs as opposed to basic nursing care at home' (Aantjes and Jerene, 2010) was confirmed to be correct by the key informants during the validation interviews. While the informant from the Federal Ministry of Health (MOH) estimated that the proportion of PLHIV who still need basic nursing care is 25% throughout the country. The respondent from the Addis Ababa HAPCO claimed that this proportion has now come to close to zero percent in Addis Ababa. This relates to the fact that ART coverage for eligible patients is much higher in the capital because of the better access to health facilities providing the services. The WHO estimated that the ART coverage of Ethiopia in 2012 was 61%, most part of which is contributed by big cities including Addis Ababa (WHO, 2013).

This resulted to care-givers being limited to mainly provision of support services including food, shelter, and economic support particularly in urban centers. The table below provides the list of unmet needs as identified by the clients of the care-giving organizations (Table 1). The major achievements of care and support organizations, since their appearance 8 to 11 years ago, as listed by participants include:

(1). Improvement in the economic status of clients.

Table 1. Services missing in the study areas as commented by clients of the care-giving organizations.

Type of service	Service availability	Implications
Health services	It was free in the past and NGOs covered costs of all services. Now, clients have to buy drugs except for ART and laboratory tests. In Kebele, there is no more support letter for free drugs. While in Idirs, they do not allow purchasing drugs from private pharmacies and drugs are mostly not available at the government health facilities.	Weight loss, problem in ART adherence, coming back without purchasing drugs and some may be obliged to visit traditional practitioners
Food support	In the past it was available for free. Now NGOs are no more able to provide due to lack of funds.	Weight loss, immunity worsening and health professionals complain about ART adherence
Shelter	Before, house rent was paid by NGOs. Currently there are no such supports leaving the clients without a shelter.	Owners ask for house evacuation when client is unable to pay who is always worried about this. May forget to take ART and other medicines as scheduled due to the stress
Hygiene facilities	No latrine No drainage system No safe water to drink Use of spring water, and is usually not well protected	Poor environmental hygiene. Frequent gastro-intestinal up set. Frequent malarial attacks
Basic nursing care	Earlier provided by volunteers supported by the NGOs. Now discontinued due to lack of funds	Missing those days of care and affection. No chance of getting reminders for ART adherence and other health information. Some do not have anybody to care for them

*Kebele is the lowest administrative unit in the country; ** Idir is an association established among neighbours to raise funds that will be used during emergencies, such as death within these groups and their families.

- (2). Improvement in the nutritional status of clients.
- (3). Improvements in ART enrolment and adherence.
- (4). Reduction of death from AIDS.
- (5). Reduction of stigma and discrimination against PLHIV.
- (6). Provision of shelter and clothing to PLHIV.
- (7). Support of OVC to complete their school (some have joined university).
- (8). Increased uptake of VCT and PMTCT.
- (9). Empowering Idirs to take up the role of care-giving.
- (10). Establishment of self-support/help groups.
- (11). Urban gardening programs (in school OVC).

Actors and services provided to PLHIV

In the Ethiopian context, HBC consists of two components: clinical and non-clinical services. Non-clinical care consists of services such as psychosocial support, economic support, materials support, food, and other social supports. Clinical care provided by the MOH facilities include provision of services such as

early detection and treatment for opportunistic infections (OIs), ART services, and PMTCT. Non-clinical services are provided by different organizations, ranging from individuals to both local and national governmental and non-governmental organizations.

Although the government sector coordinates these activities, in Ethiopia HBC is mainly supported and delivered by NGOs and their volunteers. Caregiver organizations, local self-support groups and different government organizations provide and facilitate the care and support services, whereas, volunteers, mother support groups and primary care givers are involved in providing physical and psychological support at home. On top of their leading role of directly providing care and support, NGOs are directly involved in the mobilization of resources and the community.

For example, OSSA is involved in organizing income generating activities for PLHIV, community dialogue, discussions, information dissemination through various mechanisms, condom distribution, and VCT services, establishing anti-AIDS clubs in schools and out of schools. The key informants from OSSA mentioned have

established more than five hundred clubs throughout the country. Moreover, OSSA has different VCT service modalities which include mobile, standing, home based and outreach VCT. The Network of HIV Positives (NEP+), an umbrella organization for associations of PLHIV, works on developing the capacity of associations of PLHIV through trainings, advocacy, resource mobilizations and greater involvement of PLHIV in response to the epidemic. Once PLHIV recover from their acute conditions, these associations provide economic support through involvement in IGAs. NEP+ is also involved in the capacity building of faith based organizations working on HIV/AIDS related activities. As a part of the capacity building, they undertake different activities such as resource mobilizations, capacity building activities in terms of finance, materials, technical and institutional capacity building.

They also have other social accountability programs such as environmental protection, natural resource management, food security, and gender and development issues. Care-giving organizations such as OSSA, Medan Acts, and Mekdim provide care and support services for PLHIV in two ways. Firstly, they provide care and support for bed ridden patients; this is a family centered support which includes provision of food, financial, medical and psychosocial support. They provide training for volunteers and for the families of PLHIV on how to give care and support at home. The second type is the care and support for individuals who are not acutely sick, mainly supporting involvement in IGAs.

Home based care is delivered by volunteers and primary care givers. Before engaging volunteers in HBC, care-giving organizations provided the volunteers training on: HIV, STI and TB/HIV related symptoms, communication skills with clients, provision of care for a bed-ridden client, assessing the felt needs of a client, prevention of bedsores, preparation of the corpse for burial or embalming without any fear, and conducting community conversations during coffee ceremonies. A volunteer could visit a beneficiary twice a week. He/she interacts with primary care-givers as they do with beneficiaries. Volunteers create awareness in the community on PMTCT and VCT while doing their HBC activities. Moreover, the volunteers use coffee ceremonies as opportunities for demonstrating condom use, educating the importance of VCT and enrolment and adherence to ART. The support to OVCs included the following, according to the national guideline for care and support on OVCs:

- (1). Nutritional support.
- (2). Medical care.
- (3). Educational support.
- (4). Psychosocial support.
- (5). Legal support and protection.
- (6). Household economic strengthening.
- (7). Vocational training.

In addition, some organizations provide informal education programs and link children with the appropriate organizations for legal protection of children and women. All orphans in the community get support regardless of their HIV status. Care-giver organizations also provide training for PLHIV on IGA skills. In addition, the organizations provide PLHIV with material and financial support.

Moreover, these organizations follow up on PLHIV to determine how they are managing the money given for IGAs. Others cover the cost of house rent and construction of houses for PLHIV in collaboration with the kebele administration and Idirs. Yet other organizations cover medical expenses of their beneficiaries, including cost of transportation to and from the health facility. There is also an NGO called BIGA, which facilitates post-delivery home care where HIV positive pregnant women can stay for two months after they give birth. The informants of the validation interviews implied that CHBC programs (mainly run by NGOs) "have done a lot in taking care of the needs of PLHI in the early days and will keep on doing so in areas of treatment adherence and health information provision, defaulter tracing, promotion of positive and healthy living and prevention". It was also indicated that organizations such as Mekidim Ethiopia do have their own ART clinics to provide treatment services to their clients.

The community facilitates the provision of HBC services. Members of the community are involved in activities such as identifying needy people (needy elders, needy disabled people and so on), PLHIV and OVCs. The government health extension workers (HEWs) in the kebeles are responsible for identifying individuals who are eligible for enrolment in care and support organizations while conducting their routine house to house visits. They then link the potential beneficiaries with the organizations providing care and support services. They also refer PLHIV for clinical matters to nurses at the health centres. Religious organizations are actively involved in providing spiritual counselling to clients in need of the services.

The Ethiopian Interfaith Forum for Development Dialogue and Action (EIFDDA), an umbrella organization for faith-based organizations, has programs such as: an OVC program, care and support program for PLHIVs, home based care and PMTCT program, emergency nutrition program, infant feeding practice program and extended program of immunization (EPI). Looking into governmental entities involved in care and support, it can safely be concluded that both the health and other sectors take some share at some point. While the FMOH mainly concentrates on clinical aspects of HIV/AIDS prevention and control activities, Regional Health Bureaus (RHBs), Zonal Health Departments (ZHDs) and Woreda Health Office (WrHOs) work closely with care and support organizations in selection of project sites, capacity building and reporting of activities. The WrHO

regularly receives activity reports from all health projects in the woreda (district). Public health facilities (hospitals and health centres) accept referral of cases from care and support organizations (although there is no formally established system to do so) and they also connect people who test positive for HIV with care and support organizations if the client is willing.

Moreover, the volunteers take clients to the health facility if the conditions of the patient get worse while on treatment at home. The selection of beneficiaries is done² in collaboration with kebele/village leaders of the government structures. The government officials at village level also work with Idir leaders in the process of selection. Associations of PLHIV, such as Kuntsu PLHIV association also work on awareness creation activities among women living with HIV. Idirs also help OVC's in providing educational material support for students like uniforms and in involving PLHIV in IGA's. Youth associations, women's associations and Anti-AIDS clubs also work on prevention activities such as raising young people's awareness, distribution of condoms and awareness creation leaflets.

They are working on awareness creation activities in the form of campaigns on the issue of prevention of mother to child transmission of HIV (PMTCT) in collaboration with health offices. HIV/AIDS prevention and control activities carried out by health care institutions include: individual-based health education activities, provider initiated counselling and testing service in all out patient departments, mobile VCT services, outreaches in colleges, schools and in the community, and distribution of condoms. In the case of treatment services for PLHIV, ART services are largely limited to the government health facilities.

The current contribution of care-givers in the ART services in the country is the promotion of enrolment and adherence. The care-givers remind the clients to take medications timely. Some of them visit the client two times daily to make sure that the clients take their medications. They also take the clients to the hospital when they need medical attention as in the case of treatment of opportunistic infections.

The care-givers collect the medications from the health facilities in cases where clients are too sick to come to the facilities. However, most of the study respondents doubt if the volunteers can handle the responsibility of providing ART themselves. None of the participants thought that this is a possibility in Ethiopia given the fact that the MOH policy does not allow this level of devolution. Hospitals provide food for malnourished HIV positive adults (FBP). ART adherence is being

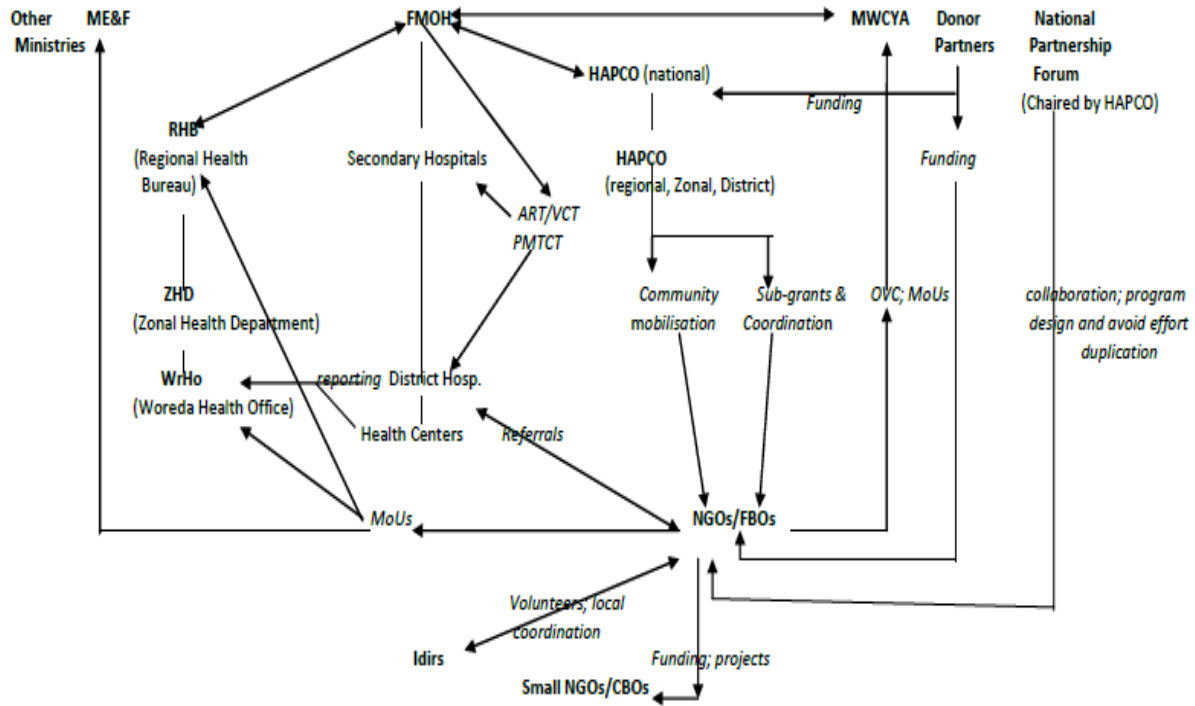
monitored through adherence supporters assigned by NGOs at the hospitals. Adherence supporters/promoters are HIV positive individuals on ART themselves. They give counselling on ART adherence, condom use and positive living to reduce the risk of HIV transmission in the community.

The major role of HEWs in relation to ART is identifying bedridden patients they may find during their house to house visits and refer him/her to the health centre. Once the person is on ART, they follow the person to ensure proper use of the medications. If the patient is bedridden, they give the drugs according to the schedule if there are no family members to do so. They also collect the drugs for the clients from health institutions if the person is unable to do so. As such the HEW's role in ART services is very similar to the activities carried out by the community volunteers functioning under the care-giving organizations. However, participants of the FGD with volunteers concluded that the HEWs of the rural kebeles are barely involved in HIV/AIDS activities since they are already intensely occupied by other activities. It was also noted that the HEWs in the rural areas do not provide counselling services, follow up of adherence to ART and tracing ART defaulters, although they perform HIV testing. Urban HEWs (nurses by training) help in identifying women and children who have not disclosed their HIV positive status to any organization during their house to house visits.

Moreover, in cities like Jimma, Addis Ababa and Hawassa, the HEWs are involved in defaulter tracing and promotion of adherence to ART services. Schools (mainly public) are also working on facilitating NGO support to OVCs (education materials, food and money). They facilitate IGA/small businesses for OVC students by availing different materials. In schools, there are also HIV/AIDS prevention and control programs such as awareness creation activities, peer education, life skill training and student conversation programs. At the beginning, care and support organizations were providing food items, cash and cost of medical care to clients.

However, the amount of food items and cash provided declined gradually and stopped totally with enrolment of clients in IGAs during 2010. When IGA first initiated, initial capitals were directly given to a self-support group which is formed by the clients. Currently however, the self-support group is linked with the micro-finance enterprise through which they receive their initial capital. This arrangement was considered to be more successful than the earlier one. The following figure depicts the various actors of care and support services for PLHIV in the Ethiopian context (Figure 1). The interaction of the actors indicated in this figure is also informed by the findings of the mapping exercises conducted by the community volunteers and community representatives. The figure depicts all the groups or organizations involved in care and support activities in Ethiopia. The roles and the names of specific organizations in each of the categories are given in the table to follow (Table 2). The figure

² Health extension workers (HEWs) are government employed health cadres who staff the health posts in each of the kebeles. They receive training of one year duration in several vocational schools throughout the country. The health post is the first point of contact between the Primary Health Care system and the community. The HEWs conduct mainly preventive activities together with treatment of childhood fever, diarrhoea and pneumonia. They are expected to spend 75% of their time in house to house visits.



Notes

- HAPCO currently works mainly on care and support not clinical matters
- Report from all the health facilities flow to the RHB through the WrHO and ZHD
- HAPCO is not separately organized in some regional states (e.g Oromia)
- National partnership forum has NGOs and GOs working in care and support as its members

Figure 1. Relationship between actors of care and support services for PLHIV in Ethiopia. ME&F = Ministry of economy and finance; FMOH = federal ministry of health; HAPCO = HIV AIDS prevention and control office; ART = antiretroviral therapy; VCT = voluntary counseling and testing; MWCYA = ministry of women, children and youth affairs; OVC = orphans and vulnerable children; NGOs = non-governmental organizations; CBOs = community based organizations; MoU = memorandum of understanding; Source: CAN multi-country research synthesis report (CAN, 2013).

above provides a reflection of the main actors of care and support of PLHIV in Ethiopia. It is shown that from the government side, the FMOH, HAPCO and other sectors (Ministry of Finance and Economic Development and Women, Children and Youth Affairs) play thorough roles related to their offices at different levels. NGOs and FBOs are shown to be at the heart of the community care programs of the country. But it has to be noted that these organizations receive support from the government, donors and the community to discharge their responsibilities (Figure 1).

Challenges and the way forward

It was noted that the resources available to the care and support programs is far less than the need of PLHIV. This is due to the fact that some of the care-giving organizations phased out their community care projects after the global fund and other funds supporting their projects ceased.

Monitoring and evaluation of care and support activities in the country by the governmental structure was considered to be minimal. The multi-sectoral response office was considered to be just a means of crisis management with little contribution in the coordination of HIV/AIDS related activities. Lack of follow up on the activities initiated by the care-giving organizations by the government health system (when the projects phased out) was also identified as a challenge. As reported by the participants, there is a lack of treatment options for OIs at the health facilities. Although the FMOH claimed that it has purchased the drugs, the drugs are not always available at the local clinics. Furthermore, some of the drugs that are specially purchased for OIs are used in clinics to treat other conditions and this contributes to the shortage. Currently, although accessibility of ART to people in need of the service is limited, it is very clear that there are no moves towards the devolution of ART in Ethiopia. Informants felt that the only feasible opportunity for devolution of ART to the community level is to make use of the already deployed HEWs.

Table 2. Actors and their roles in care and support of PLHIV in Ethiopia, April 2012.

Type of organization	Name of organization	Roles
Civil society organizations	Community based organizations (e.g. Idir)	Identification of volunteers. Advocate for minimizing stigma and discrimination. Creating awareness among community members.
	Kebele youth and women associations	
	Teachers associations	
	Anti-AIDS clubs	
	Family members	
	PLHIV associations	
Non-governmental organizations (care-giving organizations)	Trade unions	Set selection criteria of volunteers. Identify volunteers with the community. Training of volunteers. Deployment of volunteers. Supervision of volunteers. Availing necessary resources to the volunteers (e.g. kits to care and support the patients). Reporting to government health offices and their donors.
	Organization for social services for AIDS (OSSA)	
	Mekidim Ethiopia	
	Medan acts	
	CARE Ethiopia	
	Save the Children	
	Hiwot integrated development association	
	Path international	
	Pact Ethiopia	
	World vision	
Community members	Missionaries of charity	Directly provide care for bedridden patients. Link patients to the health facilities with the help of their supervisors. Help patients on ART to be more adherent. Work in mitigating stigma and discrimination among the community. Advocate VCT.
	Family health international (FHI)	
	Primary care-givers (family members) Secondary care-givers (volunteer individuals who are positive or negative).	
Donors	ART promoters	Provision of resources for care-giving organizations. Financial and non-financial.
	USAID, Global fund, UNAIDS, PEPFAR, WFP, UNICEF, UNFPA, CDC, World child planned national, EDD-Germany, CIDA and SIM-Canada, European union.	
Sub-granting organizations	Network of positives (NEP+)	Receive funds from the donor organizations. Sub-grant care and support programs to be implemented by the care-giving organizations. Receive financial reports from the care-giving organizations.
	CCRDA	
	EIFDDA	
Government system	Federal HAPCO	Develop policies and guidelines. Oversee HIV/AIDS prevention and control efforts. Accept patients referred from the care and support organizations. Connect HIV positive individuals with the care and support organizations.
	National HIV/AIDS council	
	HAPCO (federal, regional and district)	
	Federal ministry of health	
	Hospitals	
	Health posts (Health extension workers)	
	Regional health bureau	
	Zonal health department	
Woreda/town health offices		
	Other sector offices (Ministry of women, children and youth affairs, Ministry of education, Ministry of	

Table 2. Cont'd.

	labour and social affairs etc).	
Faith based organizations	Ethiopian Kalehiwot church development department Ethiopian orthodox church - development and inter-church aid commission (EOC-DICAC) The Ethiopian Islamic affairs supreme council - Ethiopian muslims development agency (EIASC - EMDA) The Ethiopian evangelical church Mekaneyesus development and social service commission (EECMY - DASSC).	Establish organizations directly involved in care and support. Mobilize and allocate resources for care and support. Raise awareness of the community against stigma and discrimination. Raise awareness in the importance of adherence to treatment with ART.
Forums	NGO-forums National partnership forum (NPF) NGO-government forum Forum for faith based organizations, Idirs etc.	To create communications between the member organizations. Aims to avoid duplication of effort by the member organizations.

Table 3. Summary of challenges faced by actors of community care and support programs.

Organization/party facing the challenge	Challenges
Care-giving organizations (NGO/FBO)	Discrepancy between the load of beneficiaries and resources available. Interruption of funding (mainly from the Global Fund). Declining number of volunteers. Interruption of food support from WFP. Expectation of clients/dependency syndrome. Failure of clients to properly use the supports received. Unwillingness of local micro-financing institutions to take over IGAs. Failure to sustain activities initiated by the care-giving organizations on the part of the community and the government. Slow decision making process and feedback on the part of the government. Over emphasis on clinical care by the government. Lack of means of transportation to remote districts. Unfair selection of beneficiaries.
Government agencies	Poor coordination (monitoring and follow up). Failure of NGOs to report. NGOs follow short term strategies without long lasting effects. Failure of NGOs to stick to the MoU during implementation. Inaccessibility of ART.
Care-givers/volunteers	Shortage of food support. Variable mood of clients. No more support from the care-giving organizations. Change in the address of the client. Having different sex from the client. Failure of clients/family members to cooperate. Stigma and discrimination of clients by health professionals and school mates. Husband may not allow volunteering. Too much burden when added on family and workplace responsibilities. Negative attitude of community members. Poor record keeping at the health facilities. Long waiting time at the health facilities.

Table 3. Cont'd.

Health facilities	<p>Difficulty of convincing clients to disclose ones status to partner. Failure of primary caregivers to take care of a family member.</p> <p>Poor medication adherence. High dropout rate. Shortage of trained health human power. High cost of training. Lack of drugs to treat opportunistic infections. Failure of CD4 counter machine.</p>
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Source: (Woldie et al., 2013).

This will definitely require training the HEWs to take the responsibility. In some parts of the country, the community has not developed sense of ownership for care and support programs. This was said to be particularly true in areas where the kebele administration and Idirs are not cooperative to the care-giving organizations. The selection of beneficiaries was also identified as one of the challenges encountered. Organizations cannot support everyone, so a selection needs to be made. Especially in care and support projects for OVC, this becomes very challenging, according to what several key informants mentioned. Table 3 provides a summary of the challenges faced by actors of community care and support programs in Ethiopia as voiced by representatives of the actors. Some of the solutions proposed to solve challenges regarding resource scarcity for treatment and care were the need for community mobilization and capacity building of local Faith Based Organizations (FBOs).

It was identified that care-giving organizations should create direct linkages with local FBOs, but not directly with the beneficiaries. For example, EIFDDA aims to have no direct contact with PLHIV, but give responsibility to local organizations, such as Idirs, churches, mosques and local women associations. A reason for this is that the local organizations have existed for centuries despite change of governments which contributes for better sustainability. Several key informants agreed that the focus should be on economic strengthening and empowerment of PLHIV and their families through the creation of income generating projects, provision of vocational training, and support for those who discontinue school, or support at workplace so that they will be competitive and productive. With regard to increasing access to ART services, the provide the service. To this end, the Sidama Zonal Health Department (ZHD) is looking for funds to train health professionals on the provision of ART services.

The feared future challenges in the provision of ART include drug resistance, interruption of donor support including ART drug provision, lack of drugs to treat

opportunistic infections, absence of home based care for PLHIV and difficulty in defaulter tracing in the absence of the current volunteers supported by the NGOs. Another concern at the ART clinics in the hospitals was the high flows of clients despite the fact that services are decentralized to the health centres. Addressing this particular problem requires tackling the fear of stigma and discrimination as clients tend to opt for services outside their locality.

Conclusion

Currently, the main problem of PLHIV in Ethiopia is to have access to adequate food which is required while taking their regular medications (Aantjes and Jerene, 2010). Other support needs are socioeconomic support through involvement in IGAs, support for school fee and educational materials for OVC and psychosocial support to clients and family members. Similar findings were also recorded in Zambia and Malawi (CAN, 2013). We have also confirmed that the emphasis in patient needs has now clearly shifted from 'basic nursing care in the home to livelihood support' (Aantjes and Jerene, 2010). The need for clinical and health care needs is evidently palpable. The services provided to PLHIV are categorized into 'clinical' and non-clinical. Initially, care and support services ('non-clinical') in Ethiopia were mainly delivered by NGOs (Aantjes and Jerene, 2010). Later on, the involvement of the government through provision of opportunity for involvement in IGAs and food support by the health offices and health facilities at different levels was indicated. Services provided to PLHIV and their families are psychosocial, economic, material and nutritional support services, and clinical care mainly provided by the MOH facilities (VCT for early detection, treatment for opportunistic infections (OIs), ART services, and PMTCT). Major actors of care and support of PLHIV in Ethiopia are the community (primary and secondary care-givers, ART promoters and civil society organizations), care-giving organizations (mainly

NGOs), government structures (the health system and other sector offices), religious organizations, donors, sub-granting organizations and forums of these organizations.

Conflict of Interest

The authors have not declared any conflict of interest.

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Abbreviations: **AIDS**, Acquired immunodeficiency syndrome; **ART**, antiretroviral therapy; **BMI**, body mass index; **CAN**, caregivers action network; **CHBC**, community home based care; **EIFDDA**, ethiopian interfaith forum for development dialogue and action; **FGD**, focus group discussion; **FHAPCO**, federal hiv/aids prevention and control office; **FHI**, family health international; **FMoH**, federal ministry of health; **HAPCO**, hiv/aids prevention and control office; **HBC**, home based care; **HEW**, health extension workers; **HIV**, human immunodeficiency virus; **IGA**, income generating activities; **JHU**, john hopkins university; **MoWCYA**, ministry of women, children and youth affairs, **NEP+**, network of networks of hiv positives; **NGO**, non-governmental organizations; **OSSA**, organization for social services for aids; **OVC**, orphan and vulnerable children; **PLHIV**, people living with hiv; **PMTCT**, prevention of mother to child transmission; **STI**, sexually transmitted infection; **TB**, tuberculosis; **TBA**, traditional birth attendant; **UNAIDS**, joint united nations program on hiv/aids; **USAID**, united states agency for international development; **VCT**, voluntary counselling and testing.

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Full Length Research Paper

The prevalence of diabetes mellitus in human immunodeficiency virus seropositive subject's co-infected with mycobacterium tuberculosis

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Diabetes mellitus (DM), mycobacterium tuberculosis (TB) and human immunodeficiency virus (HIV) are important health issues. A bi-directional association between them has been demonstrated by many researchers. The link of DM and TB/HIV is more prominent in developing countries where TB and HIV are endemic and the burden of diabetes mellitus is increasing. A total of 845 subjects were recruited for this study. Fasting blood sugar was determined by the glucose oxidase method while HIV serology was performed using the National Algorithm. The method adopted for mycobacterium tuberculosis identification was the geneXpart as described by Tenover. The prevalence of DM in HIV seropositive subject co-infected with mycobacterium tuberculosis was 107 (12.6%). Out of the 350 patient that tested positive for HIV, 38 (4.5%) had DM, 11 (1.3%) were of Type-1 origin while 27 (3.2%) were of Type-2 origin. On the other hand, 450 patients were TB positive, 45 (5.3%) had DM, 9 (1.0%) were of Type-1 origin while 36 (4.3%) were of Type-2 origin while that of HIV seropositive subjects co-infected with TB: 24 (2.8%) had DM, 5 (0.5%) were Type-1 origin while 19 (2.2%) were of Type-2 origin. There are highly more female 57 (6.7%) with DM than male 50 (5.9%). Our finding has shown no significant increase in the mean blood glucose concentration of HIV seropositive subjects compared with individuals infected with TB ($P < 0.05$). A significant increase was observed in HIV seropositive subjects co-infected with TB compared with HIV seropositive individuals ($P > 0.05$). The same pattern was observed in HIV seropositive subjects co-infected with TB compared with individual infected with HIV ($P > 0.05$). It is recommended that all patients with HIV and mycobacterium tuberculosis infections should be screened for diabetes mellitus as this would help in effective management of the disease conditions.

Keywords: Diabetics mellitus, TB, HIV, mycobacterium tuberculosis, seropositive.

INTRODUCTION

Diabetes mellitus (DM), human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) and mycobacterium tuberculosis (TB) are associated with immune suppression at different levels (Brown et al., 2010; Houben et al., 2006; Ledergerber et al., 2007; Nnoaham and Clarke, 2008). Human immunodeficiency virus and mycobacterium tuberculosis are chronic communicable diseases which often lead to impaired system in patients (Brown et al., 2010 Houben et al., 2006). Diabetes mellitus on the other hand is a chronic non communicable and metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action or both (Ronald et al., 2013).

The epidemiology of HIV are well known to be associated with immunological break down of immune system which often expose the individual to communicable disease such as mycobacterium tuberculosis (Nnoaham and Clarke, 2008; Jeon and Murray, 2008). Intriguingly in the recent past, evidences were accumulating on the association between mycobacterium tuberculosis and diabetes mellitus, as well as HIV/AIDS and diabetes mellitus, which gained importance to the communicable and non-communicable disease association (Young et al., 2009) Nevertheless, the HIV-TB link was well recognized since the beginning of HIV epidemic (Ahmed and Hasnain, 2011).

Human immunodeficiency virus is a major risk factor for mycobacterium tuberculosis (Harris and Dye, 2006; Reid et al., 2006; Nijland et al., 2006; Strachan et al., 2005). The risk of developing mycobacterium tuberculosis is estimated to be between 20 to 37 times greater in people living with HIV than among those without HIV infection (Leung et al., 2007; Davies et al., 2006; Restrepo, 2011). In 2009, there were 9.4 million new cases of mycobacterium tuberculosis of which 1.2 (13%) million were among people living with HIV. Of the 1.7 million people who died of mycobacterium tuberculosis, 400,000 (24%) were living with HIV (Leung et al., 2007). It has been observed that HIV seropositive individuals face a 3 - fold risk of developing diabetes mellitus (Nnoaham and Clarke, 2008). A higher association has been found between Type-2 diabetes mellitus and mycobacterium tuberculosis in study populations from central America, Europe, and Asia (Nnoaham and Clarke, 2008). Diabetes mellitus is an important risk factor that is increasing in developing countries (Kumar et al., 2007). Developing countries with exponential economic growth such as India

and China that account for 40% of incidence of TB cases in 2010 are estimated to have 69% increase in people with diabetes mellitus and these are of major concern for the joint burden of disease between diabetes mellitus and mycobacterium tuberculosis (Nnoaham and Clarke, 2008).

The association between human immunodeficiency virus infection and Type-2 diabetes mellitus is poorly understood and complicated, the prevalence risk factors of Type-2 diabetes mellitus in HIV infected individuals compared with HIV uninfected persons is conflicting (Goulet et al., 2005; Kilbourne et al., 2001). Few studies have directly compared HIV infected subjects with HIV uninfected, and the results are conflicting (Brown et al., 2005). Other disease state that can increase the risk of developing mycobacterium tuberculosis and Type-2 diabetes mellitus are hodgkin lymphoma, end-stage renal disease, chronic lung disease, malnutrition, alcoholism and drugs (Moller and Hoal, 2010). Low body weight is also associated with risk of mycobacterium tuberculosis. A body mass index (BMI) below 18.5 increases the risk by 2 to 3 times (Restrepo, 2007). An increase in body weight lowers the risk (Restrepo, 2007). People with Type-2 diabetes mellitus are at increased risk of contracting mycobacterium tuberculosis (Nijland et al., 2006). And they have a poorer response to treatment, possibly due to poorer drug absorption in the gastrointestinal mucosa (Strachan et al., 2005). Other clinical conditions that have been associated with active TB include gastrectomy with attendant weight loss and malabsorption, jejunoileal bypass, renal and cardiac transplantation, carcinoma of the head or neck, and other neoplasms (e.g., lung cancer, lymphoma, and leukemia) (Restrepo, 2007).

Overcrowding especially in prisons, poor nutrition may contribute to the strong link observed between mycobacterium tuberculosis and Type-2 diabetes mellitus (Spence et al., 1993; Larouze et al., 2008). Incidence of mycobacterium tuberculosis is greatest among individual with impaired immunity (Houben et al., 2006), though co-infection of human immunodeficiency virus with mycobacterium tuberculosis are increasing daily, we cannot overlook Type-2 diabetes mellitus which have shown a higher prevalence in TB patients compared to HIV. The determination of the prevalence of diabetes mellitus in human immunodeficiency virus subject co infected with mycobacterium tuberculosis may help to X-ray this question by evaluating the prevalence of diabetes

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mellitus in HIV seropositive subjects co-infected with mycobacterium tuberculosis.

MATERIALS AND METHODS

Study population

The research work was carried out in mile four specialist hospital Abakaliki. The hospital is a center of excellence for mycobacterium tuberculosis and human immunodeficiency virus management. Gene (Xpert MTB/RIF) Model GXXVI-16-D was used to analyze the sample for TB patients while spectrophotometer model 6505 was used for fasting glucose analysis. A total of eight hundred and forty five (845) patients were analyzed in this study. The subjects were grouped into three categories: 250 HIV infected patients, 350 individuals infected with mycobacterium tuberculosis and 245 HIV seropositive individuals co-infected with mycobacterium tuberculosis. Most of the HIV seropositive individuals were on ART, HAART and anti-cough, respectively. HIV seropositive individuals, diabetic patients and subjects infected with mycobacterium tuberculosis, and HIV seropositive individual co-infected with mycobacterium tuberculosis were included in this study, while patients below 10 years and those above 80 years were excluded. All patients gave informed consent for study participation. Ethical approval for the study was received from mile four hospital management prior to sample collection and analysis.

Collection of blood samples

About 5 mls of whole blood were collected from each patients and 3 mls were dispensed into a fluoride-oxalate container for glucose estimation, while the remaining 2 mls were used for HIV status screening on the subjects.

Sputum sample collection procedures

Three consecutive sputum samples (spot, early morning, spot) were collected from the patients in sterile wide capped containers before eating or drinking. The subjects were asked to breathe in and out deeply 2 to 4 times, to give a series of low deep coughs to raise sputum from the lungs and deposit material into the container. The containers were covered with a screw cap cover to prevent leakage, and then labeled with date and time of collection. The sputum specimens were collected from subjects for three day each morning with three containers, respectively. The demographic information of each of the patients was obtained with a well structured questionnaire and corresponding medical records. The result of HIV status of such patient and confirmation were extracted from the patient's medical records obtained from mile four hospital referral HIV and TB Laboratory center.

Estimation of glucose

Glucose concentrations were determined according to the glucose oxidase method as described by Carl et al. (2008).

Identification of acid fast bacilli (AFB)

This was performed using the geneXpert techniques as described

by Tenover and Baron, (2012). This procedure is essentially a PCR technique.

Determination of HIV seropositivity

The method adopted in this study is the National Algorithm for HIV screening utilization determine, Stak Pak and Uni-Gold kits (WHO, 2008).

Statistical analysis

Data collected were subjected to statistical analysis using the chi square and students'-test. Values were deemed significant if $P < 0.05$.

RESULTS

Between May 2013 and January 2015, a fasting glucose concentrations of 845 patients infected with human immunodeficiency virus infection, mycobacterium tuberculosis positive patients and those suffering from HIV co-infection with TB comprising of 350 seropositive HIV subject, 450 TB positive patients and 245 HIV subjects co-infected with mycobacterium tuberculosis were analyzed. The age distributions are shown in Table 1. Data collected and analyzed shows that HIV seropositive patients within the age bracket of 31 to 40 years has the highest HIV occurrence with 86 (10.2%). Mycobacterium tuberculosis occurred more within the age group of 31 to 40 years with 111 (13.1%). While patients with HIV co-infected with TB appeared high within the age group of 41 to 50 with 88 (10.4%). Table 2 presents the gender distribution of Type-1 and Type-2 DM in HIV seropositive patient, TB positive patients and HIV subject's co-infected with TB. Out of the 350 patient that tested positive for HIV, 38 (4.5%) had DM, 11 (1.3%) were of Type-1 origin while 27 (3.2%) were of Type-2 origin. On the other hand, 450 patients that tested TB positive 45 (5.3%) had DM, 9 (1.0%) were of Type-1 origin while 36 (4.3%) were of Type-2 origin while that of HIV seropositive subjects co-infected with TB 24 (2.8%) had DM, 5 (0.5%) were Type-1 origin while 19 (2.2%) were of Type-2 origin. There are highly more female 57 (6.7%) with DM than male 50 (5.9%).

Analysis of clinical data generated from the clinical record of the patients as presented in Table 3 shows that 20 (2.4%) of the HIV seropositive patients with DM are on ART while 18 (2.1%) are not taking ART. 24 (2.8%) are on HAART and 14 (1.7%) not on HAART. Among the 45 TB cases with DM, 32 (3.8%) are on anti - cough while 13 (1.5%) are not on anti - cough drugs. While that of HIV seropositive patients co-infected with TB shows that 20 (2.4%) are on anti - cough, 4 (0.5%) are not on anti - cough. 15 (1.7%) and 14 (1.7%) are on ART and HAART, respectively. While 9 (1.1%) and 10 (1.1%) are not taking

Table 1. Age distribution of HIV seropositive patients, mycobacterium tuberculosis positive patients and HIV seropositive patients co-infected with mycobacterium tuberculosis.

Age group (years)	HIV positive (%)	TB positive (%)	HIV co - TB positive (%)	Total
11 - 20	11 (1.3)	9 (1.1)	5 (0.5)	25 (3.0)
21 - 30	40 (4.7)	75 (8.9)	37 (4.4)	152 (17.9)
31 - 40	86 (10.2)	111 (13.1)	74 (8.8)	271 (32.1)
41 - 50	62 (7.3)	102 (12.0)	88 (10.4)	252 (29.8)
51 - 60	31 (3.7)	37 (4.4)	30 (3.6)	98 (11.6)
>60	20 (2.4)	16 (1.9)	11 (1.3)	47 (5.6)
Total	250 (29.6)	350 (41.4)	245 (29.0)	845 (100)

Legend: the incidence of human immunodeficiency virus, TB and HIV seropositive patients co-infected with TB were higher within the age group of 21 to 50 years.

Table 2. Gender distributions of Type-1 and Type-2 diabetes mellitus in HIV seropositive patients, mycobacterium tuberculosis positive patients and HIV seropositive subjects co infected with mycobacterium tuberculosis.

Disease	N	Type-1 DM (%)	Type-2 DM (%)	Male (%)	Female (%)	Total with DM (%)	Glucose concentration {(Mean U/L \pm SD) (Mmol/L)}
HIV +ve	250	11 (1.3)	27 (3.2)	15(1.7)	23 (2.7)	38 (4.5)	8.24 \pm 0.96
TB +ve	350	9 (1.0)	36 (4.3)	25 (3.0)	20 (2.4)	45 (5.3)	8.54 \pm 1.38
HIV co TB +ve	245	5 (0.6)	19 (2.2)	10 (1.2)	14 (1.4)	24 (2.8)	8.89 \pm 1.18
Total	845	25 (2.9)	82(9.7)	50 (5.6)	57 (6.7)	107 (12.6)	-

Legend: The incidence of diabetes mellitus were higher in female than their male counterpart.

any ART and HAART, respectively. The mean CD4 counts of patients with HIV seropositive were higher than HIV seropositive counterpart co-infected with mycobacterium tuberculosis were 456.3 and 335.8, respectively.

Table 4 shows the comparison of glucose concentrations of HIV seropositive patients with mycobacterium tuberculosis positive patients, Our finding has shown no significant increase in the mean blood glucose concentration of HIV seropositive subjects compared with individuals infected with TB ($P < 0.05$). The minimum and maximum blood glucose concentration for HIV positives were 7.30 and 10.6 Mmol/L, respectively while that of TB positive counterpart where 7.50 and 13.50, respectively. On the other hand, a significant increase was observed in the mean blood glucose concentration of HIV seropositive subjects co-infected with TB compared with HIV seropositive individuals ($P > 0.05$). The minimum and maximum blood glucose concentration for HIV positive were 7.30 and 10.60 Mmol/L, while that of HIV seropositive subjects co-infected with TB were 7.50 and 11.40, respectively. The same pattern was observed in HIV seropositive subjects co-infected with TB compared with individual infected with TB ($P > 0.05$). With minimum and maximum blood glucose concentration of 7.50 and 13.50 Mmol/L for

TB positive patients alone and 7.50 and 11.40 for HIV seropositive subject's co-infected with TB.

DISCUSSION

In the recent decades, the number of human immunodeficiency virus and mycobacterium tuberculosis infections and those with HIV co-infected with mycobacterium tuberculosis has increased in several folds especially in sub-African countries, The growing association between HIV and TB is globally recognized (Ahmed et al., 2007; Thuy et al., 2007; Nsubuga et al., 2002). Similar reports are found in Nigeria (Okogun et al., 2002; Umeh et al., 2007; Nwobu et al., 2004). In this work, Table 1 shows the age group with highest rate of HIV and TB are within the age group of 21 to 50 years and this is in contrast with the studies of (Taura et al., 2008; in Kano, Umeh et al., 2007; Nasarawa and Nwachukwu et al., 2009) in Abia all in Nigeria.

A possible mechanism of the association of diabetes mellitus and mycobacterium tuberculosis is the depression of the immune response from protective immune mechanism, which in turn facilitates the progression of latently infected mycobacterium tuberculosis to active TB (Sulaiman et al., 2011; Blanca

Table 3. Clinical profile/data of diabetes mellitus in HIV seropositive patients, mycobacterium tuberculosis positive patients and HIV seropositive subject's co-infected with mycobacterium tuberculosis.

Disease	N	No. with DM	Anti cough	No. - anti cough	ART	No. ART	HAART	No. HAART	CD4 Count {(Mean U/L \pm SD) (Cells/ μ L)}
HIV +ve	250	38 (4.5)	-	-	20 (2.4)	18 (2.1)	24 (2.8)	14 (1.7)	456.3 \pm 2739.1
TB +ve	350	45 (5.3)	32 (3.8)	13 (1.5)	-	-	-	-	-
HIV co TB +ve	245	24 (2.8)	20 (2.4)	4 (0.5)	15 (1.7)	9 (1.1)	14 (1.7)	10 (1.1)	335.8 \pm 1576.3
Total	845	107 (12.6)	52 (6.2)	17 (2.0)	35 (4.1)	27 (3.2)	38 (4.5)	24 (2.8)	-

Legend: the prevalence of DM in HIV seropositive subject co infected with TB were 107 (12.6). The Mean CD4 count of patients with human immunodeficiency virus were increased than patients with HIV.

Table 4. Comparison of glucose concentrations of HIV seropositive patients, mycobacterium tuberculosis positive patients and HIV seropositive subjects co-infected with mycobacterium tuberculosis.

Disease	N	No. with DM	Minimum glucose con (Mmol/L)	Max glucose con (Mmol/L)	Glucose concentration {(Mean U/L \pm SD) (Mmol/L)}	P-Value
HIV +ve	250	38	7.30	10.60	8.24 \pm 0.96	0.021
TB +ve	350	45	7.50	13.50	8.54 \pm 1.38	-
HIV +ve	250	38	7.30	10.60	8.24 \pm 0.96	0.750
HIV and TB	245	24	7.50	11.40	8.89 \pm 1.18	-
TB +ve	250	45	7.50	13.50	8.54 \pm 1.38	0.790
HIV and TB	245	24	7.50	11.40	8.89 \pm 1.18	-

Legend 1: No significant increase was observed in the mean blood glucose concentration of HIV seropositive subject compared with individual infected with TB ($P < 0.05$). But there was a significant increase in the mean blood glucose concentration of HIV seropositive subjects co infected with TB compared with HIV seropositive subjects ($P > 0.05$). The same pattern was seen in HIV seropositive subjects co infected with TB compared with individual infected with TB ($P > 0.05$).

et al., 2011). Fehmida et al. (2004) had reported that subjects with human immunodeficiency viral infection have a high prevalence of diabetes mellitus due to impaired immunity seen in HIV subjects. Various reports from Africa, Asia and India showed a significant increase of diabetes mellitus in human immunodeficiency virus infection in every 100, 000 population studied

(Grens et al., 2008; Gale et al., 2010; Cooke et al., 2014). In this study, the prevalence of DM in HIV seropositive subjects co-infected with mycobacterium tuberculosis was 107 (12.6%). The gender distribution of Type-1 and Type-2 DM in HIV seropositive patients, TB positive patients and HIV subject's co-infected with TB shows that, out of the 350 patient that tested positive for HIV,

38 (4.5%) had DM, 11 (1.3%) were of Type-1 origin while 27 (3.2%) were of Type-2 origin. On the other hand 450 patients that tested TB positive 45 (5.3%) had DM, 9 (1.0%) were of Type-1 origin while 36 (4.3%) patients were of Type-2 origin while that of HIV seropositive subjects co-infected with TB 24 (2.8%) had DM, 5 (0.5%) where Type-1 origin while 19 (2.2%) were

of Type-2 origin. There are highly more female 57 (6.7%) with DM than male 50 (5.9%). And this work is in contrast with the work of (Onubogu et al., 2010). The difference in the infection rate in females could be as a result of biological factors such as higher susceptibility to infection due to low immunity seen in women (Onubogu et al., 2010). Analysis of clinical data generated from Table 3 shows that 20 (2.4%) of the HIV seropositive patients with DM are on ART while 18 (2.1%) not on ART. Among the 45 TB cases with DM, 32 (3.8%) are on anti - cough while 13 (1.5%) where not on anti - cough drugs].

HIV seropositive patients co-infected with TB shows that 20 (2.4%) where on anti - cough while 4 (0.5%) not on anti - cough. 15 (1.7%) and 14 (1.7%) are on ART and HAART, respectively while 9 (1.1%) and 10 (1.1%) are not taking any ART and HAART, respectively. The effect of these drugs could be the major reason for the increase in prevalence rate of DM in HIV and those co-infected with TB. More so, a substantial decrease in the mean CD4 count was recorded among the group with HIV co-infected with TB, where a decreased CD4 count was lower than their counterpart with HIV 335.8 ± 1576.3 and 456.3 ± 2739.1 cell/ μ l, respectively. The sharp decrease recorded among this group in their CD4 count, could also be as a result of the afore mentioned drugs given to this group where majority of HIV seropositive subject. Co-infected with TB are subjected to ART, HAART and at the same time anti - cough. Brown et al. 2005 had directly compared the HIV uninfected individuals and 7% of the HIV infected subjects not taking CART had prevalent diabetes at baseline, compared with 14% of subjects who were on CART. Some protease inhibitors (PIs) and reverse transcriptase nucleoside inhibitors (NRTIs) which are normal baseline drugs for HIV and TB infection confer added risk of Type 2 diabetes mellitus, and these medications may exacerbate the underlying diabetes mellitus in HIV subjects co-infected with TB (Rinin et al., 2012). Despite mild toxicity and adverse effects, human immunodeficiency virus (HIV) protease inhibitors (PIs), used in combination with reverse transcriptase nucleoside inhibitors (NRTIs), have turned AIDS into a chronic inflammatory disease (Rinin et al., 2012).

Finally, the blood glucose concentrations of the three groups were compared. In the first comparison, Data generated showed no significant difference among the patients infected with HIV virus and TB positive patients $P \leq 0.05$. The minimum and maximum blood glucose concentration of HIV positives were 7.30 and 10.6 Mmol/L, respectively while that of TB positive counterpart where 7.50 and 13.50Mmol/L, respectively. Interestingly, a significant difference was recorded in the blood glucose concentration of patients infected with HIV and HIV subjects co-infected with TB $P \geq 0.05$. The same pattern was observed when the blood glucoses concentration of patients with TB positives and HIV seropositive patients

co-infected with TB was compared $P \geq 0.05$. The minimum and maximum glucose concentration for HIV seropositive subjects co-infected with TB where 7.50 and 11.40 Mmol/L, respectively. Diabetes mellitus, a metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action or both, has been linked with depressed immunity (Metzger, 2007; Ledergerber et al., 2007). The condition relatively present a long-term microvascular complication affecting the eyes, kidneys, the nerves cells and the lungs (Ledergerber et al., 2007), leading to risk of HIV and mycobacterium tuberculosis infections (Jeon and Murray, 2008; Butt et al., 2009). It has been reported that patient with mycobacterium tuberculosis taking anti - cough drugs duely develop multi-drug resistant to TB (MDR-TB) which might lead to impaired absorption of anti - TB drugs in the gastrointestinal mucosa especially in DM patients, this MDR-TB often result to sub-lethal dose achievement at the tissues levels where the bacteria exist and facilitate the development of drug resistance (Fisher-Hoch et al., 2008; Subhash et al., 2003).

CONCLUSION

The interaction of diffenents drugs methabolic activities on DM patients, HIV and TB counterpart could contribute to long-term macrovascular complications affecting the immune system in these patients. It is recommended that all patients with human immunodeficiency virus and mycobacterium tuberculosis infections should be screened for diabetes mellitus at the time of diagnosis and at the initiation of highly active antiretroviral therapy ART and (HAART), and three to six months thereafter. It is highly recommended to place this patient early in DM special diet so as to maintain their sugar levels at base line, further research efforts in the interactions between diabetes mellitus, human immunodeficiency virus and mycobacterium tuberculosis interplay should also be encouraged.

Conflicts of interest

Authors have none to declare.

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