



**Dietary Diversity Intentions, Nutritional Status and Mortality
Among Adult People Living with HIV in Jimma Zone Southwest
Ethiopia**

Aderajew Nigusse Teklehaimanot



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JIMMA, ETHIOPIA

Promoters:

Dr. Lelisa Sena Dadi (PhD)

Department of Epidemiology, Jimma University, Jimma, Ethiopia

Professor Tefera Belachew (MD, MSc, PhD)

Department of Human nutrition and dietetics, Jimma University, Jimma,
Ethiopia

Professor Esayas Kebede Gudina (MD, DTM&H, PhD)

school of Internal Medicine, Jimma University, Jimma, Ethiopia

Dean: Dr.Mulumemnebet Abera, Dean Faculty of Public Health

President: Dr. Jemal Abafita, President of Jimma University

Members of the Jury

Chairperson

Prof/ Dr. Beyene Wondafrash Date: July 14/2022

External Examiner

Prof/ Dr: Kedr Teji Date: July 14/2022

Internal Examiner

Prof/ Dr: Daniel Yilma Date: July 14/2022

Dr. Lelisa Sena Dadi (**Promoter**)

Department of Epidemiology, Jimma University, Jimma, Ethiopia

Prof. Dr. Tefera Belachew (**Promoter**)

Department of Human nutrition and dietetics, Jimma University, Jimma,
Ethiopia

Prof. Dr. Esayas Kebede Gudina (**Promoter**)

school of Internal Medicine, Jimma University, Jimma, Ethiopia

Aderajew Nigusse Teklehaimanot

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Acronyms and Abbreviations

AH	Agaro Hospital
AIDS	Acquired Immune Syndrome
ART	Antiretroviral Therapy
ASMC	Appointment Spacing Model Care
AOR	Adjusted Odds Ratio
AU	African Unity
BB	Behavioral belief
BC	Behavioral control
BFS	Baseline Functional Status
BMI	Body Mass Index
CD4	Cell Cluster of differentiation4
COR	Crude Odd Ratio
DATT	Direct attitude
DDs	Dietary diversity score
DSN	Direct subjective norm
DPBC	Direct perceived behavioral control
FAO	Food and Agricultural Organization
HAART	Highly Active Antiretroviral Therapy
Hgb	Hemoglobin
HIV	Human Immunodeficiency Virus
HFIAS	Household Food Insecurity Access Scale
HRD	Humanitarian Requirements Document
IFAD	International Fund for Agricultural Development
IFRCRCS	International Federation of Red Cross and Red Crescent Societies
ILO	International Labor Organization
IATT	Indirect attitude
IPBC	Indirect perceived behavioral control
ISN	Indirect subjective norm
OIS	Opportunistic Infections
PBC	Perceived behavioral control
PCA	Principal Component Analysis
PLWHIV	People Living With HIV
PSSA	Pension Social Security Authority
PSNP	Productive Safety Net Programme
QOL	Quality of Life
SP	Social pressure
SN	Subjective norm
SSA	Sub Saharan Africa
TPB	Theory of planned behavior
UK	United Kingdom
VIF	Variance inflation factor
WHO	World Health Organization

Table of Contents

Acknowledgements	v
Acronyms and Abbreviations	vi
Chapter 1 : General Introduction	1
1: Overview	2
1.1. Global Epidemiology of HIV	2
1.2. Ethiopia/ Country profile	2
1. 3. Health Service Structure	3
1.4. HIV and HIV care services in Ethiopia	4
1.5. The Challenges of HIV Continuum care (HCC).....	7
1.6. Development of anti-retroviral therapy and treatment outcomes	12
1.7. HIV Related Mortality	14
1.8. Predisposing factors for HIV Related Mortality	17
1.9. Predictors of Under Nutrition among Adult People Living with HIV	18
1.10. The Relationship of HIV and malnutrition	19
1.10.1. Intention towards Dietary Diversity among Adult People Living with HIV	21
1.10.2. Summary of the Introduction	24
1.10.3. Theoretical Model.....	26
1.10.4. Conceptual frame work of the project of the three research questions	29
1.10.5. SIGNIFICANCE OF THE STUDY	30
1.10.6. Aims of the study.....	31
1.10.8. SPECIFIC OBJECTIVES	31
1.10.7. Research HypoDissertation.....	31
1.10.9. Outline of the Dissertation.....	31
Chapter 2: Methods and Materials	34
2.1 Study setting and participants	35
2.2. Study design.....	36
2.3. Source population.....	36
2.5. Sample Size Determinations	37
2.6. Data Collection Instrument and Procedures	38
2.7. Data processing and Analysis	40
2.9. Quality assurance	42
2.10. Ethics Approval and Consent to Participate	42
2.11. Communication of findings.....	44
Chapter 3: Predictors of Mortality among Adult People Living with HIV and Its Implications for	

Appointment Spacing Model Approach Care	45
Abstract.....	46
Introduction.....	47
Methods and Materials	49
Ethical Approval.....	50
Results	51
Discussion.....	59
Chapter 4: Predictors of Under Nutrition and Its Implication toward HIV Continuum Care among Adult People Living with HIV in Jimma Zone Public Hospitals, Southwest Ethiopia: A Mixed Method Study.....	61
Abstract.....	62
Introduction.....	63
Methods and Materials	64
Ethical Approval and Informed Consent.....	66
Results	66
Qualitative Results:	69
Discussion.....	72
Limitation	73
Conculssion.....	73
Chapter 5: Intention Toward Dietary Diversity Among Adult People Living With HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior. A Mixed Methods Study....	74
Abstract.....	75
Introduction.....	77
2. Methods and Materials	78
2.8. The Theory of planed behavior (TPB/IBM)	79
2.7. Operational Definition of Terms	80
Results	84
Discussion.....	90
Limitation.....	91
Conculssion.....	91
Explanatory Findings/In-depth interview findings	89
Chapter 6: General Discussion, Future Research Perspectives and Conclusion	94
6.1. Introduction.....	95
6.2. Summary of the main findings.....	96
6.3. Implications of the Findings.....	96
8.3.1. Implication of the Findings for Appointment Spacing Model Approach Care.....	97

8.3.2. Implication of the Findings food by prescription program	99
6.3.3. Implication of the Findings for HIV Continuum Care	100
6.3.4. Implication of the Findings for Behavioral Intention towards Dietary Diversity practice.....	100
6.3.5 Methodological Considerations.....	101
8.3.6. Future Research Perspectives.....	103
6.3.7. Conclusions	104
6.3.8. Recommendations	106
7. References.....	108
8. Annexes.....	139
8.1 CV of PhD Candidate	140
8.2 Information Sheet for study participants.....	142
8.3 Consent Form.....	147
8.4 Questioner.....	150

Summary

HIV prompted immune impairment and its occasioning opportunistic infections (OIs) can diminish Appetite; intensification energy outflow; effect on malabsorption; and varies the body's capability to operate and evacuate nutrients prominent to nutritional deficits and unfortunate overall nutritional status. Nutritional shortfalls can, in turn, accelerate the movement of HIV infection and raise the hazard of emerging Opportunistic infections (OIs) and death. Highly active antiretroviral therapy (HAART) is believed to be a key to HIV allied degenerative.

Nonexistence of diet, food insecurity, and the concern about diet has been shown to decrease treatment faithfulness. Furthermore, starvation and medicine for opportunistic infections may interact in ways that reduce the efficacy of HAART, and HAART itself might influence metabolism, as well as causing side effects that lead to reduce desire for food. Ethiopia has been reducing incidence of adult HIV status from 6.5% to 1.5%, but this symbol represents a huge number of adults: 793,700 people living with HIV/AIDS (PLWHA) plus 200,300 children of whom 420,000 (59% of those in need) are now receiving HAART.

It is, realistic to expect that many PLWHA receiving HAART in Ethiopia can't get sufficient, worth and amount diet. Alternatively, nutritional support with early initiation of ART has been known to have a substantial role to interruption then vicious circle between HIV and malnutrition. However, thoughtful of in what manner starvation, HIV behavior and what factors stimulus individuals' risk of undernutrition while on HAART in developing countries like Ethiopia is still marked with a relatively few studies conducted given the huge overlap among food insecurity, undernutrition, and the HIV care continuum framework aims to provide a linked continuum of care through diagnosis, effective treatment and patient monitoring.

Significant progress has been achieved in the antiretroviral therapy (ART) era, but several challenges have also hampered its ultimate success. These include: malnutrition, poor livelihood, discontinuation from ART, poor dietary diversity behavior, individual and behavioral factors, clinical failure and immunological failure. However, no study elucidated Dietary Diversity Intentions, Nutritional status and Mortality among Among Adult People Living with HIV in Jimma Zone Southwest Ethiopia.

The aims of this dissertation were to: (i) Identify predictors of mortality, (ii) examine the whole predictors under nutrition and (iii) explore the facilitators, barriers and solutions of behavioral intention toward dietary diversity as impact of HIV continuum care (HCC).

The **first chapter** presents an overview of the negative outcomes of the whole HIV care and treatment (HCT) cascade was aimed to assess using five years' retrospective data from five public hospitals of Jimma zone, Southwest Ethiopia. The negative outcomes to be investigated comprise predictors of mortality as implication of appointment spacing model care, and both immunologic and clinical failure of adult people living with HIV (PLWHIV).

The **second chapter** discusses the methodology of the study of adult people living with HIV who enrolled to ART clinic in Jimma zone Southwest Ethiopia.

Chapter three: presented the findings of predictors of mortality among adult people living with HIV who enrolled to ART clinic in Jimma zone Public hospitals. Accordingly the study revealed that, the total person-time contributed was 28,209 personmonths with an overall mortality incidence rate of 11 per 1000 person-months observation. The cumulative mortality incidence among females over the study period was 16.8%. Severe undernourishment and moderate malnutrition at baseline, younger age, female sex, single, divorced, illiterate, lack of disclosure, advanced WHO clinical stage, seeking treatment outside catchment area, rural residence and immunological failure were found to be independent predictors of mortality.

Accordingly, the odds of Adult PLWHA who suffered from severe malnutrition at baseline had nearly four times (AHR: 3.7; 95% CI: 1.6, 6.7) risk of death while those with moderate malnutrition had more than twice (AHR: 2.5; 95% CI: 1.7, 7.5) risk of dying early compared to those with normal BMI. Those PLWHA who did not disclose their HIV status to anyone (family or friend) had more than three times (AHR: 3.6, 95% CI: 1.7, 9.5) risk of dying compared to those who have disclosed their HIV status.

Chapter four: explains the case control study in titled with Predictors of Under Nutrition and Its Implication toward HIV Continuum Care among Adult People Living with HIV in Jimma Zone Public Hospitals, Southwest Ethiopia, The finding showed that, rural residence, female in gender, unstable livelihood, low meal frequency, less diversified foods and advanced WHO clinical stage were independent predictors of undernourishment.

Accordingly Rural residents were about two times (AOR: 1.8; 95% CI: 1.2, 6.4) more likely to be undernourished compared to urban residents. Female respondents were almost three times (AOR: 2.9; 95% CI 1.14, 4.3) more likely to be undernourished compared to males. Similarly, the likelihood of being undernourished was more than three times higher among households who were food insecure (AOR: 3.3; 95% CI: 4.3, 14.4). PLWHA who were in unstable livelihood were five times (AOR: 5.1; 95% CI: 4.2, 19.6) more likely to be

undernourished compared to those who had stable livelihood. Those who reported lower meal frequency were six times (AOR: 6.6; 95% CI: 5.2, 21.1) more likely to be undernourished compared to their counterparts. The in-depth interview data were explored the finding of quantitative study in the following themes; Household Food Insecurity situation, Challenges with Food by Prescription program and Food Aid, Stigma and discrimination as challenge of HIV Continuum care and Dietary diversity and Coping Mechanisms of PLWHA.

Chapter five: describes the Assessment of behavioral intention towards dietary diversity showed the significant predictors of intention to use dietary diversity to be attitude ($\beta = 0.196, p < 0.01$) and subjective norm ($\beta = 0.390, p < 0.01$) of the adult PLWHIV. This indicates that a unit positive change in the individual's perception about any counseling support from health professionals to use diversified food in their usual feeding as a normative action will increase the intention to use dietary diversity by 0.39 provided that the other conditions and medical care are in place.

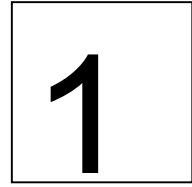
The constructs of theory of planned behavior (TPB) independently explained the variance in intention towards dietary diversity by 25.7%. At the same time, a unit positive change in the attitude towards the advantage associated with the use of diversified food for PLWHIV will change the intention to use dietary diversity by 16.6%, keeping all the comprehensive HAART care and livelihood factors constant. PBC and subjective norm explained 25.9% of the variance. When perceived behavioral control and sociodemographic factors were added to attitude and subjective norm, there was an additional 6.5% variance in the intention and all the intermediate, proximal and distal components of the TPB explained the final model by 32.2% of the variance in consistent use of dietary diversity in the home.

The solution towards the socio-cultural, economic, and health-system factors inhibit ideal patient nutritional status were Better tracking, enhanced livelihood and social support along with drug therapy, food aid need to be considered for PLWHA. It is also worthwhile to understand behavioral intention as a potential determinant of malnutrition and the poor ART outcomes rather than symptomatic treatment of malnutrition with food by prescription. The HIV continuum care (HCC) programs were affected by patient, HIV care provider, and community and policy-levels barriers. The qualitative findings suggested that delivery of HIV care requires a sense of livelihood development, economical improvement and creating a sense of ownership for sustainable HIV care by creating behavioral change at the individual level.

It is also worthwhile to understand behavioral intention as a potential determinant of malnutrition and the poor ART outcomes rather than symptomatic treatment of malnutrition with food by prescription. The HIV continuum care (HCC) programs were affected by patient, HIV care provider, and community and policy-levels barriers.

From the Behavioral Intention of PLWHIV towards Dietary Diversity: More than half (55.7%) of the study participants positively perceived dietary diversity depending on what significant others believed and half (50.5%) of them had good motivation to comply. Close to two-thirds (60.7%) of the respondents reported favorable behavioral beliefs and a similar proportion (59.7%) of the outcome evaluations were desirable towards intention to use dietary diversity when eating at home. Regarding the subjective norm, more than half (59.4%) of them reported a high value of social pressure as to what significant others said regarding favorable intentions to use diversified foods in their usual feeding habits.

Chapter six: presents the general discussion and implications of the findings, conclusions, and recommendations for further research.



Chapter 1 : General Introduction

1: Overview

1.1. Global Epidemiology of HIV

Human immunodeficiency virus (HIV) is an extraordinary known global epidemic, which has affected individuals of all ages, sexes, races and income status (Moore RD, 2011). Globally, between 1980 and 2019, almost 78 million people have been infected by HIV, and about half of these people have died (WHO, 2017). According to the latest estimates of Global Burden of Diseases (GBD, 2019), across the world 2.1 million people had new HIV infections, 38.8 million people had HIV infection, and 1.2 million people died due to the virus in 2015 (Wang H, Wolock TM, Carter A, 2017).

High income countries contributed the least to these figures, including 0.02% to the total number of new infections, 0.04% to the total number of people with HIV, and 0.03% to the total number of deaths in 2015 (Wang H, et al., 2016) while Africa contributes only 11% of the global population and 1.5% of the health workforce, the continent accounted for 65% of adult and 90% of pediatric HIV infections, the highest contribution of all regions (WHO, 2013). The highest rates of HIV in sub-Saharan Africa (SSA) were recorded in the Southern Africa countries. In 2015, countries such as South Africa, Botswana, Swaziland, Lesotho, Namibia, and Zimbabwe had an estimated HIV prevalence of 10% of the total population (Wang H, et al. 2016). Ethiopia contributed 2% to the total number of HIV-infected people in Africa in 2013 (UNAIDS, 2014).

The epidemiology of HIV peaked in the early 1990s; however, the trend has been declining in most countries in the last three decades. Describes the epidemiological trend of HIV from 1990-2015 (Max R, Hannah R. 2018). For example, the chart shows that the number of global new infections in 1997 was 3.5 million per year but it was reduced to 2.1 million per year in 2015. Similarly, AIDS-related deaths declined from 2 million in 2004/5 to 1.1 million in 2015. The graph also demonstrates a continuing increase in the number of HIV infected people but a slow rate after 2000s in comparison to the 1990s.

1.2. Ethiopia/ Country profile

The Federal Democratic Republic of Ethiopia (FDRE) is a landlocked country located in East Africa, covering an area of 1.2 million square kilometers (World Bank.Population, GDP, Gini-coefficient, 2016). Ethiopia shares borders with Eritrea to the north and northeast, Djibouti and Somalia to the east, the Republic of Sudan and South Sudan to the west, and Kenya to the south. The nation has nine regional states and two chartered cities and about

80% of the population is in rural areas.

According to the central statistical agency (CSA, 2007), Ethiopia is the second most populous country in Africa, next to Nigeria, with an estimated population over 102 million. Demographically, 44% of the population is aged under 15 years, and the estimated male to female ratio is 101 to 100. The Ethiopian economy is based on agriculture providing 40.5% of gross domestic product (GDP), 81% of exports and 85% of labour force. Education is free in Ethiopia; estimated adult literacy status in 2015 was 49% (Genet G, 2015).

1. 3. Health Service Structure

Ethiopia has a vision to attain universal health coverage through primary health care. The country has a three-tier health system, namely primary, secondary and tertiary level of health care (Figure 1.2) (CSA, ICF, 2016). As shown in Figure 1.2, health center and health post are the gateways to primary level health care in the country. Health centers provide preventative and curative services delivered by health officers, nurses, and laboratory and pharmacy professionals.

A health center coordinates five health posts and serves about 25,000-40,000 people. Health posts are based in kebele (lowest administrative unit in Ethiopia) and serve 3,000-5,000 population. The professionals deployed in health post are called health extension workers (HEWs) and provide Health Extension Program (HEP) packages that include preventive programs, family planning and delivery services. Two or three HEWs are deployed in one health post based on the distribution and total number of households.

In recent years, Ethiopia has shown marked improvement in most key health indicators, and availability and accessibility of the basic health services. Between 2000 and 2016, there was a reduction in under five mortality rates from 166 to 67 per 1000 live births, neonatal mortality rates from 49 to 29 per 1000 live births and maternal mortality ratio from 871 to 412 per 100,000 live births (Fetene N, Linnander E, Fekadu B, 2016). The total government and private expenditure on health, health professional density per population and life expectancy at birth are also improved through time (Fetene N et al.2016). Furthermore, the number of health posts and health centers increased from 76 and 412 in 1996/79 to more than 16000 and 3500 in 2016 (DAG , 2015) Respectively.

Ethiopia collaborated with its development partners in a number of innovative programs and structures to achieve the improvements noted above. The HEP is one of the widely acknowledged innovative programs in which 16 essential health packages are implemented

through house-to-house visit (FDRE, 2007; Wang H *et al.*,2016). The program has contributed significantly to the reduction of maternal and child mortality, with a motto of ‘*No mother should die while giving birth*’ (FDRE, 2007). Health development army (HDA) is another program that strengthened the local health systems. In this, over three million volunteers, predominantly women, have been trained by the HEWs to perform ‘multi-purpose’ health promotion activities such as community empowerment and disease prevention (FDRE/MoE, 2014; Damtew ZA *et al.*, 2018).

Despite the improvements in health care services and outcomes, the burden of mortality and mortality in Ethiopia remains high (Hailay T *et al.*, 2018; Misganaw A *et al.*,2017). Lower respiratory infections, HIV/AIDS, diarrheal diseases, Malnutrition and tuberculosis (Tb) were the top five diseases that caused deaths in 2005. A decade later, in 2016, diarrheal diseases, lower respiratory infections, ischemic heart disease, malnutrition and Tb were the top four diseases that caused deaths, and HIV was the sixth killer disease (GBD, 2016).

1.4. HIV and HIV care services in Ethiopia

Similar to other countries in SSA, Ethiopia has also been threatened by the HIV/AIDS epidemic, which in Ethiopia is generalized and heterogeneous (Assefa Y *et al.*, 2017). The overall prevalence among adults is 0.9%, in pregnant women is 0.4%, and in women with concurrent sexual partners (five or more) is more than 6% (Fetene N *et al.* 2016). The prevalence of HIV in women (1.2%) in Ethiopia is twice as higher than men (0.6%), and is seven times greater in urban settings (2.9%) than rural settings (0.4%).

The burden of HIV is also disparate by region ranging from <0.1 % in Somali regional state to 4.8% in Gambela regional state. In 2016, a total of 19,743 people died of AIDS related causes in the country and about 792,840 children lost either or both of their parents due to HIV (EHNRI, MoH, 2012; EPHI, 2017).

The magnitude of HIV in Ethiopia has been decreasing in the recent years. HIV is not curable disease; however, a lifelong treatment called antiretroviral therapy (ART) was introduced in 1990s to halt the manifold impacts of the virus (Carpenter CC *et al.*,1997) Many local, national and international organizations including HIV/AIDS Prevention and Control Office (HAPCO), President’s Emergency Plan for AIDS Relief (PEPFAR), Management Science for Health (MSH), Global Fund to fight AIDS, Tb and Malaria, and others are investing their resources to increase ART coverage (DAG, 2015).

Ethiopia introduced ART in 2003 for the first time at cost of patients, and two years later ART started to be provided for free (Mekonnen Yared *et al.*, 2010). A total of 535,069 PLWHA have ‘ever started’ on ART and 375,811 people were on ART in over more than 1000 health facilities by 2014/2015. As a result of ART treatment, in 2017 it was reported that HIV incidence, AIDS related mortality and overall HIV prevalence had fallen by 95%, 73% and 29% respectively over the past 14 years (UNAIDS, *Ending AIDS*, 2017).



Figure 1: Percentage of HIV positive patients in Ethiopia (2005-16)

Ethiopia has been implementing a wide range of HIV related programs with a range of services including preventative, treatment and care, national systems strengthening and programme management, orphan and vulnerable children support, and enabling environment activities (MoH, 2014). Prevention thematic areas have included: voluntary counseling and testing (VCT), prevention of mother to child transmission (PMTCT), behavioral change communication and community mobilization. Treatment and care themes have included ART, laboratory monitoring, provider initiated testing and counseling (PITC), nutritional support, palliative care and home-based care activities. In 2002, the Ethiopian HIV/AIDS prevention and control office (HAPCO) was established to coordinate these activities and this system was decentralized from federal to ‘woreda’ (district) level (EHNRI, MoH, 2012).

HAPCO has also branches in higher institutions (EHNRI, MoH, 2012). Ethiopia has implemented a public health approach to accelerate mega-scale provision of HIV counseling and testing and ART services. These include decentralizing and integrating services, shifting of task, delivering free service at the point of care (POC), strengthening supply management and evaluating progress (Assefa Y *et al.*, 2010; Gilks CF *et al.*, 2006). A number of development partners have been participating in planning and implementation of major

initiatives and programs for HIV treatment, prevention, care and support in Ethiopia and Africa. For example, “3 by 5” initiative (WHO, UNAIDS, 2003) was designed to treat three million people in 2005. “Getting to Zero” (UNAIDS, 2018) was a theme of the 2015 World AIDS Day commemoration targeting to achieve “Zero new HIV infections.

Zero discrimination. Zero AIDS- related deaths.” “Treat all” (WHO, 2015) is strategies that eloquently promote the universal HIV care coverage to ensure that all HIV positive individuals received ART irrespective of their CD4 count, World Health Organization (WHO) clinical stage or viral load. The food by prescription, the “90-90-90” targets and appointment spacing model care (UNAIDS, 2018) was recently launched by The Joint United Nations Program on HIV/AIDS (UNAIDS). Despite the efforts mentioned above, there are numerous gaps and challenges in timely initiation of ART, ART retention in care and prevention of HIV related mortality in Ethiopia (Assefa Y et al. 2010; Assefa Y et al., 2017).

Furthermore, there are significant inequities in the nation particularly in ART coverage, which varies between children (23%) and adults (60%), females (54%) and male (69%), and from 5.6% to 9.3% among regions (Assefa Y et al., 2017). Somali, Gambela, Afar and Oromia regional states have the lowest ART coverage in the nation. To help HIV patients fully benefit from ART, attain national goals and use resources most effectively, Ethiopia uses the HIV care continuum (HCC) framework initially incepted by the Centers for Disease Control and prevention (CDC) in Atlanta, USA, in 2017 (Kranzer K et al., 2018).

The HCC comprises HIV testing and diagnosis, nutritional support, ART eligibility, long term ART retention, and achieving and maintaining viral suppression through ARV adherence. The sequence of HCC is shown to HIV care begins when a person has positive test for HIV. Next, individuals are assessed for ART eligibility based on their CD4 count testing and/or WHO clinical staging. While the WHO clinical staging is diagnosed immediately, the CD4 count involves obtaining a blood sample and sending it for processing, with results received after a couple of weeks.

However, following the introduction of test and treat strategy in 2016 (WHO, 2016), no CD4 count is needed in hospitals and selected health centers, but eligibility assessment for ART based on their CD4 count testing and/or WHO clinical staging is still applied in most health centers in the country. Once eligible and ready for ART, then the patient starts the treatment and is expected to take it for the remainder of his or her life. The ultimate goal of ART intake is to reduce the number of viral counts in the bloodstream (viral suppression) and

achieve immunological gain.

If an HIV infected patient fails to pass through each step in the HCC there will be respective negative consequences. Specifically, if a patient is not diagnosed or linked to HIV care timely, the negative outcome will be late presentation for HIV care; if a patient failed to remain in care, the negative outcome will be ART discontinuation; if a patient on ART failed to achieve virological suppression, the negative outcome will be clinical, immunological or virological failure; and finally, a patient may die.

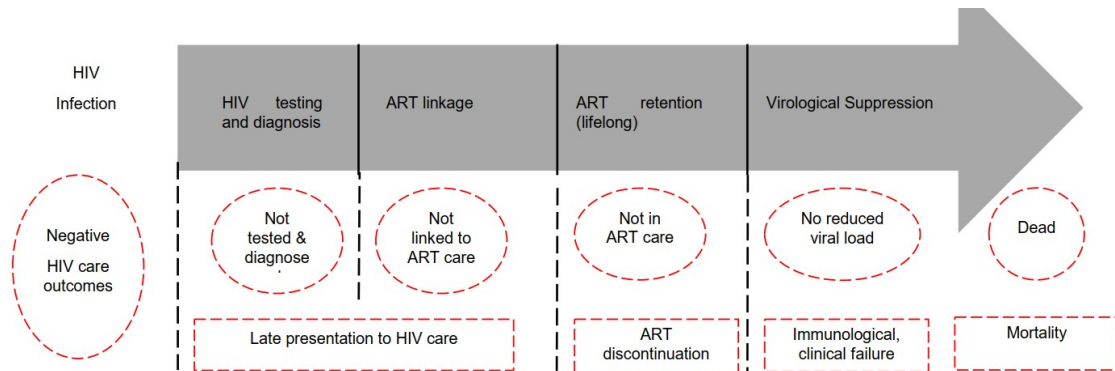


Figure 2: HIV care framework for assessing negative outcomes of HIV care and treatment, Southwest Ethiopia, 2018 (Adapted based on Kranzer et al, 2012).

The box with grey arrow shows the steps on the pathway of HIV care: HIV testing and diagnosis, ART linkage, lifelong ART retention and virological suppression. The dotted lines, circles or rectangles in red outside the grey arrow show negative outcomes in the pathway of HIV care: late presentation for HIV care, ART discontinuation, immunological, clinical or virological failure, and mortality (Moore RD, 2011).

1.5. The Challenges of HIV Continuum care (HCC)

The HCC is a series of stages from the time a person is diagnosed with HIV through assessment for ART eligibility, retention in care, and immunologic success and virologic suppression via treatment adherence (Cheng W et al., 2016; Jeong SJ et al., 2016). Many activities have attempted to address negative HIV outcomes in the continuum (Thelma et al., 2016; Tesfahuneygn G et al., 2015) especially after the advent of ART (Anguzu R, Turyagyenda F, 2015).

Nevertheless, there have been challenges at every stage of the continuum. These include late HIV care presentation high rate of mortality, malnutrition (Jamieson D, Kellerman SE, 2016; Ankomah A et al., 2016), discontinuation of pre-ART and ART (Hontelez JA et al., 2016),

poor ART adherence (Tesfahuneygn G *et al.*, 2015; Anguzu R, Turyagyenda F, 2015, Nabukeera N *et al.*, 2015), immunologic (Bezalem Eshetu Yirdaw, Wencheke E, 2014; Kokeb M, Degu G, 2016), clinical (Makadzange AT *et al.*, 2015; Zheng J, Zhao D, 2012), treatment (Makadzange AT *et al.* 2015) and virologic (Petersen ML *et al.* 2008); Purchase S *et al.* 2016) failures.

Malnutrition and late presentation (LP) for HIV care can result from delayed HIV diagnosis and/or delays in accessing HIV care (Gesese H *et al.* 2016). Although there are different definitions of LP, most are derived from the threshold for ART eligibility (Fox MP *et al.* 2016). For example, LP may be defined as having a baseline CD4 count below 200 or 350 cells/mm³ and/or AIDS defining disease (Gesese HA *et al.*, 2013; Abaynew Y *et al.*, 2019).

Predictors of malnutrition have been acknowledged as a challenge to achieving the UNAIDS HCC targets (Aniley AB *et al.* 2016; Longo B *et al.*, 2005) and it can lead to several complications. It is associated with high risk of HIV transmission (UNAIDS, 2016; Lahuerta M *et al.*, 2017) resistance to ART drugs and medical care costs (Krawczyk CS *et al.*, 2016; Fleishman JA *et al.*, 2015).

Malnutrition has been reported as a significant problem across the globe, with a magnitude of between 25–35% in Africa (Geng EH *et al.*, 2011; Abebe N *et al.* 2014), 19–27.3% in Asia (Jeong SJ *et al.* 2016) and 13–21% in Europe (Bucciardini R *et al.*, 2017; Biru M *et al.*, 2018). In Ethiopia, there are limited studies of predictors of under nutrition, mortality and behavioral intention towards dietary diversity. There have been several studies assessing prevalence of under nutrition and mortality (Gesese HA *et al.* 2013; Abaynew Y *et al.*, 2011; Aniley AB *et al.*, 2016), but all except one are from the northern part of the country. It is, therefore, imperative to understand mortality, predictors of under nutrition and behavioral intention of dietary diversity contextually as part of efforts to improve quality life of the PLWHA.

In Ethiopia, attrition – interruption of active engagement in ART for any reason including death – has been identified as the most common challenge in the continuum (Bucciardini R *et al.*, 2017; Biru M *et al.*, 2018). After thirty years of targeted HIV diagnosis and 20 years of ART rollout, attrition has remained a constant challenge in the country. Evidence shows that discontinuation from ART (here after discontinuation) is the main contributor to attrition and to poor quality of life and mortality among patients on ART (Assefa Y *et al.*, 2014; Assefa Y

et al., 2015).

Discontinuation is a challenge to the success of ART programs and has been recognized as a barrier to meeting the second 90 of the UNAIDS targets, because it interrupts the sustainable intake of the treatment. Discontinuation includes interruption to ART when patients are lost to follow up (LTFU), if they default, or if they stop medication while remaining in care (Rosen S.*et al.*, 2007). Discontinuation diminishes the immunologic benefit of HIV treatment and aggravates HIV related complications such as AIDS related readmission, mortality, malnutrition, drug resistance, poor dietary diversity and mortality (Rosen S.*et al.*, 2007; Li X *et al.*, 2005).

Several studies have been conducted to determine the rate of discontinuation. The global rate ranges from 5%–60% (Bradley H *et al.*, 2014; Jose S *et al.*, 2018; Zhu H *et al.*, 2012; Blutinger EJ *et al.*, 2014; Makunde WH *et al.*, 2012; Schöni F *et al.* 2011), while previous studies in Ethiopia have reported that the magnitude of dietary diversity ranges between 9.8% (Tadesse K, Fisiha H, 2014) and 31.4% (Wubshet M *et al.*, 2012). The available literature in Ethiopia shows that demographic, behavioral and clinical factors affect intention of dietary diversity (Asefa T *et al.*, 2011; Dessalegn M *et al.*, 2015; Berheto TM *et al.*, 2014).

Nevertheless, these studies show conflicting associations, and predisposing factors are still poorly understood. In addition, there has been no published systematic review and meta-analysis to demonstrate the conflicting associations in particular, and the predictors of malnutrition and mortality in general. One systematic review (Desta H *et al.*, 2011) carried out on ART non-adherence in Ethiopia did not specifically identify predictors of loss to follow up (LTFU), default or stopping treatment. Until a comprehensive understanding of these factors is obtained, efforts to enhance retention rates would be *ad hoc* and cost ineffective.

In addition, the lack of high-quality data on the relationship between predictors of under nutrition and its contributing factors is a challenge that prevents HIV/AIDS control programs from delivering accurate data to inform tailored intervention strategies. As described above, both malnutrition and mortality are prevalent; nevertheless, few studies have assessed the problem contextually. Only two case control studies (Asefa T *et al.*, 2011; Deribe K *et al.*, 2008) have been conducted in the southwest part of Ethiopia. These studies only assessed predictors of defaulting and the magnitude of malnutrition was not determined. The major contributor to ART poor outcome, RTFU, was also not measured.

Immunologic failure is another challenge in the sequence of HIV continuum care (HCC) (Auld AF *et al.*, 2014; Vermund SH *et al.*, 2014; Gouveia PA *et al.*, 2014; Raffi F *et al.*, 2017; Huang P *et al.*, 2015; Bayou B *et al.*, 2015). WHO has set definitions for immunologic failure (WHO, 2013). Through ongoing viral replication, immunologic failure enhances the risk of resistant mutations that challenges the efficacy of available or future drug options (Hatano H *et al.*, 2006). Being a surrogate marker for virological failure (Singini I *et al.*, 2016; Rohr JK *et al.*, 2016), immunologic failure influences the performance of the third (Raffi F *et al.*, 2017) of the UNAIDS targets (UNAIDS, 2014).

The magnitude of immunologic failure ranges from 23–33.1% in Europe (Raffi F *et al.*, 2017), 9–18% in Asia (Huang P *et al.*, 2015; Prabhakar B *et al.*, 2011), 11–39% in Africa (Jespersen S *et al.*, 2015) and 6.8–21% in Ethiopia (Bayou B *et al.*, 2015; Ayalew MB *et al.*, 2016). There have been a few studies investigating immunologic failure in Ethiopia but all of them were conducted in the northern and western parts of Ethiopia, and no study has been conducted in the Southwest region of the country.

Further to predictors of under nutrition, poor dietary diversity practice, ART discontinuation and immunologic failure, HIV related mortality is another problem observed in the era of universal ART. Mortality estimates in 2015 indicated 0.3 million deaths in high-income countries and 0.9 million deaths in low- and middle-income countries (UNAIDS, 2014). Evidence shows that deaths mainly occur in the first two years of ART follow up (Tadesse K *et al.*, 2014; Alemu AW *et al.*, 2010). There have been numerous studies of the prevalence of mortality in Ethiopia (Tadesse K *et al.*, 2014; Alemu AW *et al.*, 2010; Setegn T *et al.*, 2015; Damtew B *et al.*, 2015) and these show an incidence rate of 3.2–10.3% (Tadesse K *et al.*, 2014; Alemu AW *et al.*, 2010).

Synthesizing the studies conducted in Ethiopia, the following gaps were observed: i) early mortality, i.e. mortality in the first two years of ART follow up, was not assessed despite high mortality occurring in this period; ii) no studies assumed that death could be an outcome for malnutrition patients, instead all studies that assessed prevalence of mortality considered discontinuation as censored. Previous work found that 40–86% of lost patients failed to re-engage with care (Hickey MD *et al.*, 2015), and 50% of lost patients were found dead (Assefa Y *et al.*, 2015; Wubshet M *et al.*, 2013). iii) No studies were undertaken in Southwestern Ethiopia; and iv) short follow up periods and small sample sizes were used in previous retrospective cohort studies.

Considering HCC as a whole, it is possible to assess Southwest Ethiopia's performance as measured by the UNAIDS 90-90-90 targets. Yemen was the poorest performer; with 11% and 3% achievement respectively for the first and second markers (Levi J *et al.*, 2016). Like other SSA countries, Ethiopia adopted the UNAIDS 90-90-90 targets in 2014 (UNAIDS, 2016); however, limited information is available about its progress.

A time series analysis covering 26 years reported a 67-88-86 performance (Girum T *et al.*, 2018). A 2017 UNAIDS HIV update also reported an estimated performance of (UNAIDS, 2017). When considering the overall picture, it is possible to see that research is lacking into key factors leading to negative HCT outcomes. While some patient-related characteristics are recorded, we do not know why these individuals were at risk of negative HCC outcomes, because behavioral factors at the individual level have not been explored. Furthermore, studies (Berhanemeskel E *et al.*, 2016; Gils T *et al.*, 2018) elsewhere have revealed factors that influence HCC beyond individual levels.

These include institution level factors such as lack of ART trained health professionals (Jamieson D, Kellerman SE *et al.*, 2016), lack of transport (Pellowski JA, 2013; Hontelez JA *et al.*, 2016; Joseph D *et al.*, 2017), and indirect cost of ART (Agbonyitor M, 2019); community level factors such as stigma (Marya G *et al.*, 2017; Miho S *et al.*, 2016; Porter KE *et al.*, 2017) and traditional healing (Shamila L, 2010; Tso LS *et al.*, 2016; Kagee A *et al.*, 2011; Loeliger KB *et al.*, 2016); and program level factors such as political commitment (Harman S, 2010; Newman C, Persson A, 2009) and lack of coordinated HIV care activities (Mugavero MJ *et al.*, 2011).

However, there have been no comprehensive studies in Ethiopia that explore challenges to HCC from the viewpoints of stakeholders at these levels. Additionally, no studies have investigated these stakeholders' views on what could be done to rectify negative HIV care outcomes. Furthermore, there have been no mixed methods studies despite the value of such designs in addressing the complex nature of ART sustainable care. This research project was designed to address the gaps in knowledge identified above. In phase one, of the project the negative outcomes of the whole HIV care and treatment (HCT) cascade was aimed to assess using five years' retrospective data from five public hospitals of Jimma zone, Southwest Ethiopia.

The negative outcomes to be investigated comprise predictors of mortality, discontinuation as implication of appointment spacing model care, and both immunologic and clinical failure

of adult people living with HIV (PLWHIV). In phase two a case control with mixed method of data collection was planned to identify the available evidence on predictors of under nutrition among adult HIV patients in Jimma zone public hospitals, south west Ethiopia. The case control was designed to identify the following: (i) malnutrition evidence, (ii) factors affecting HCC; (iii) outcomes of ART care, including immunologic failure and; (iv) Clinical failure.

Considering the clinical and public health importance of the above-mentioned gaps and implications, to assess the relevance, feasibility and acceptability of these proposed solutions, in phase three of the project, a mixed method approach in addition to the theory of planed behavior constructs was used with a different level key informants including ART coordinators, case managers, service providers and HIV program managers, who were asked to rank and evaluate expert advice from key stakeholders.

The outcomes from this approach were used to improve practice, guide future feeding practice, HIV policy development and generate new research ideas for further studies to improve responses to sustainable HIV care. In summary, this multi-phase project was designed to assess the complex characteristics of the HCC through reviewing the available evidence, assessing status and predictors of all HCC outcomes, further exploring the facilitators and barriers to the cascade, and recommending solutions after discussing with respected experts.

1.6. Development of anti-retroviral therapy and treatment outcomes

The development of ART has been indispensable in prolonging life of people with HIV (Stringer JS *et al.*2009; Gesesew HA *et al.*2017; Gesesew HA *et al.*, 2018). Introduced in 1987, zidovudine (AZT) was the first drug against HIV (Carpenter CC *et al.*, 1997). It was effective in viral suppression, but at \$12,000/person a year, was among the most expensive drug therapy ever (Artery,2015). Since the invention of ART, more than 20 drugs against the virus have been approved based on clinical efficacy and effect on plasma HIV RNA concentration (Palmisano L, Vella S, 2011).

The treatment regimen hanged, however, at the end of 1995, from mono/dual to triple therapy, now called highly active ART (HAART), following the acceptance of the first protease inhibitor (Carpenter CC *et al.*, 1997). ART is not curative; however, the treatment reduces the number of viruses in the blood and controls their multiplication, even to the point of undetectable status (viral load suppression). Treatment increases the number of CD4 cells,

boosting the immune system. Viral load suppression and the increased CD4 count help to reduce the development of opportunistic infections (OIs), improve quality of life and survival.

ART drugs are classified in to six classes: Nucleoside/nucleotide reverse-transcriptase inhibitors (NRTI), non-nucleoside reverse transcriptase inhibitors (NNRTI), protease inhibitors (PI), fusion inhibitors or “entry inhibitors” (FI), CCR5 antagonists and integrase inhibitors (II). Under WHO recommendations, HAART involves a combination of at least three different ARV drugs for ART- naïve adults:

- AZT+3TC+EFV AZT +3TC+NVP
- TDF +3TC or FTC + EFV
- TDF +3TC or FTC + NVP, where (AZT/ZDV=Zidovudine, 3TC=lamivudine, EFV=efavirenz, NVP=nevirapine, TDF=tenofovir disoproxil fumarate, FTC=emtricitabine) (WHO, 2010).

Currently, the preferred first line regimens for adult include TDF + FTC + EFV; ZDV+ 3TC+ EFV; or ZDV+3TC+ NVP. However, if treatment failure is detected, first line regimens are used. TDF + 3TC + LPV/r (Lopinavir) or ATV/r (Atazanavir) are the preferred second line drugs if AZT was used in the first line ART, but if TDF was used in the first line ART, AZT + 3TC + LPV/r or ATV/r are the preferred second line regimens. For children, ABC (Abacavir) + 3TC + LPV/r or AZT + 3TC + LPV/r are the recommended ART drugs. If children develop treatment failure, the optional second line regimens include AZT + 3TC + EFV or ABC or TDF + 3TC + EFV.

In Ethiopia, ART program was first offered in July 2003 in few public hospitals and patients were charged, but after two years ART became a free service (Mekonnen Yared *et al.*, 2010). The current treatment protocol in Ethiopia is based on the National Guidelines for Comprehensive HIV Prevention, Care and Treatment: FDRE, Ministry of Health version 2014 (MoH, 2014) which was based on the WHO ART treatment guideline version 2010 (WHO, 2010).

According to the Ethiopian National Guidelines for Comprehensive HIV Prevention, Care and Treatment protocol (MoH, 2014), eligibility criteria for adults who are HIV positive to commence ART has been revised four times and is as follows:

- ✓ CD4 cell count <200, 200-350, and < 500 cells/mm³ before 2012, 2012-2015

and 2015-late 2016 irrespective of WHO clinical stage respectively

- ✓ WHO clinical stage 3 or 4 irrespective CD4 cell count, and
- ✓ Pregnant, breast feeding women, sero-discordant couples or diagnosed with active irrespective CD4 cell count. ART is recommended for all children with HIV irrespective of WHO clinical stage and CD4 cell count. However, a test and treat strategy that allows every HIV positive to start ART was launched in Ethiopia since the end of 2016 (WHO, 2015), but the strategy is yet to be rolled over across the country.

ART was provided free of charge in 22 hospitals in Ethiopia in 2005 through the aid of Global Fund, World Bank, and PEPFAR and other partners. The service was expanded from four facilities in 2003 to 913 in 2013 (Mekonnen Yared et al., 2014; Assefa Y et al., 2014). The number of people on ART has also been increasing dramatically in the last decades (Assefa Y et al., 2017). The number of patients ever started on ART increased from 900 in 2004/5142 to 535,069 in 2014/2015.

At a global or national level, the success of ART programs depends on the following indicators (Assefa Y et al., 2017): (i) access, utilization, coverage and equity of ART, (ii) early presentation for ART care programs, (iii) retention in ART care, and (iv) early identification of treatment failure and shift to second-line regimens. Therefore, in each of these indicators, significant impediments have been observed including: ART inequity, ART attrition, immunologic failure, and mortality. The literature review about these negative outcomes is presented in the next sections.

1.7. Prevalence of HIV Mortality

HIV related mortality (hereafter mortality) refers to death due to any cause in the reporting period (Assefa Y et al. 2015). Despite the scaling up of ART coverage, HIV/AIDS continued to become among the top ten mortal lists of causes (Gonzalez MA et al., 2011). Globally, between 1980 and 2015, about 78 million people were infected and half of them have died of the disease (UNAIDS, 2014; Ansa GA, Sifa JS, 2015). According to the 2016 report of Global Burden of Diseases (GBD), worldwide 38.8 million people had HIV infection; 2.1 million people had been newly infected and 1.2 million died due to the virus in 2015 (Celentano D & Beyrer C, 2018).

Ethiopia has adopted the appointment spacing model (ASMC) of service delivery by considering the sociocultural situation, degree of awareness, stigma and discrimination,

resource demand and its sustainability. Implementation of ASM improves service quality, results in cost savings, improves health outcomes, accelerates the achievement of the 90-90-90 target by offloading workload from overburdened health facilities, and improves adherence and retention (Stringer JS *et al.*, 2018). As ART cohorts mature, a growing number of people in treatment programs will virally suppress. In this case frequent laboratory and clinical monitoring is not required. Further, by reducing the burden of stable clients visiting health facilities, resources can be reallocated to clients most in need (Johannessen A *et al.*, 2008).

Ethiopia is among African countries hard hit by the HIV pandemic. The overall prevalence of the disease among adults, pregnant women and, women who had multi sexual partners was reported to be 0.9%, 0.4%, and more than 6%, respectively (FDRE FHPCO, 2012). The prevalence among women (1.2%) was twice that of men (0.6%), seven times in urban residence (2.9%) compared to rural settings (0.4%). In 2016, a total of 19,743 people were died of AIDS and about 792,840 children lost either or both of their parents due to AIDS (Braitstein P *et al.*, 2016).

To alleviate the impact of HIV/AIDS, Ethiopia introduced ART in 2003 for the first time at cost of patients, and two years later ART started to be provided for free (Chan K *et al.*, 2016; Coetzee D *et al.*, 2014; Lawn SD *et al.*, 2016). Following the 3 by 5 program, 535,069 PLWHA who had ‘ever started’ ART and 375,811 PLWHA who did not yet started ART were put on ART in more than 1000 health facilities in 2014/5 (Coetzee D *et al.*, 2014). Subsequently, report of 2017 revealed that HIV incidence, AIDS related mortality and overall HIV prevalence were fallen by 95%, 73% and 29%, respectively (Ferradini L *et al.*, 2012; Abebe N *et al.*, 2014).

Ethiopia has also been implementing prevention, treatment and care interventions. The prevention activities include voluntary counseling and testing (VCT), prevention of mother to child transmission (PMTCT), behavioral change communication and community mobilization. The treatment and care theme encompasses ART, laboratory monitoring, provider initiated testing and counseling (PITC), nutritional support, palliative care and home-based care activities (Biadgilign S *et al.*, 2012).

Despite the efforts devoted to limit the impact of HIV, still numerous gaps and challenges remain unsolved. Among others, timely initiation of ART, retention in care and prevention of HIV related mortality, narrowing significant inequities in ART coverage, which varies between children (23%) versus adults (60%), females (54%) versus male (69%), and

disparities among regions ranging from 5.6% to 9.3% are worth mentioned (Alemu AW, San SM, 2010; Bhatta L *et al.*, 2013). To help HIV patients fully benefit from ART, attain national goals and use resources most effectively, Ethiopia uses the HIV continuum care (HCC) framework initially incepted by the Centers for Disease Control and prevention (CDC) in Atlanta, USA, in 2013 (Mutevedzi PC *et al.*, 2010).

The HIV continuum care is a series of stages from the time a person is diagnosed with HIV through assessment for ART eligibility, retention in care, and immunologic success and virological suppression via treatment adherence towards reduction of mortality and ART care success outcomes (Tadesse K *et al.*, 2014; Poka MV *et al.* 2013; Koye DN *et al.*, 2012).

Many activities have been attempted to address negative ART care outcomes, nevertheless, there have been challenges at every stage of the HCC. These include late HIV care presentation (LP) (Lawn SD *et al.*, 2015), discontinuation of ART (Azar MM *et al.* 2010), poor ART adherence (Amedee AM *et al.* 2014), immunologic (Braithwaite RS, Bryant KJ, 2017), clinical (Chander G *et al.*, 2018), treatment (Wang H *et al.*, 2016) and virological failures (Assefa Y *et al.*, 2017).

Currently, Ethiopia is implementing a new care approach known as “appointment spacing model care (ASMC)”, which mainly focuses on a few visits of hospitals (two times per year) and comprehensive care at a time. However, there are still massive challenges pertaining to ART program regardless of the efforts being devoted by both governmental and non-governmental organizations (Gilks C *et al.*, 2016). Consequently, patients usually experience different unintended health care outcomes such as loss of many from the ART schedules (Kranzer K *et al.*, 2012), failure to recover their immunity (Cheng W *et al.*, 2016) and deaths from the disease (Tsefahuneygn G *et al.*, 2015).

The overall picture shows that research is lacking to identify key factors that lead to negative ART care outcomes, including mortality. Furthermore, studies conducted in Africa have revealed that factors affecting ART care are beyond individual level. The factors are related to health care institutions such as lack of ART trained health professionals (Nabukeera N *et al.*, 2015), and lack of quality care (Bezalem E, Wencheke E, 2014); community level factors such as stigma (Kokeb M, Degu G, 2016) and traditional healing (Purchase S *et al.*, 2016); and program level factors such as political commitment (Assefa Y *et al.*, 2014; Koye DN *et al.*, 2012) and lack of coordinated HIV care activities (Jamieson D, Kellerman SE, 2016; Ankomah A *et al.*, 2016; Hontelez JA *et al.*, 2016).

Literature shows that Southern Africa had the highest crude mortality rates followed by East

and West Africa, Central Africa, Latin America and Asia Pacific (Anderegg N *et al.*, 2017). A multi-centre study found a cumulative mortality of 5%, 15% and 17% in Europe, North America and South Africa, respectively (Bouille A *et al.*, 2014). These studies reported that the death rate was high in the first 12 months of ART treatment.

Number of studies assessed mortality in Ethiopia and found a magnitude of 2-25.9% (Damte B *et al.*, 2015; Biressaw S *et al.*, 2013; Tachbele E, Ameni G, 2016). Most of these studies also found high death rates in the early period of ART treatment. HIV mortality in the era of HAART in Africa is markedly declining. For example, according to the research from South Africa, 12-month corrected mortality ratio was 4%, 5% and 3.7% among patients who started treatment in calendar years 2007, 2008 and 2009 respectively (Tran DA *et al.*, 2013). Likewise, the HIV-attributable mortality in Tanzania showed a reduction from more than 50% in 2000 to around 35% in 2010 (Gesese HA *et al.*, 2018). In general, studies reported a low death rate and these deaths occurred in the initial period following initiation of ART care.

1.8. Factors associated HIV Related Mortality

Predictors of mortality among adults have been identified in few studies. They include age (Tadesse K *et al.*, 2014), gender and education (Alemu AW *et al.*, 2010; Setegn T *et al.*, 2015), baseline WHO clinical stage (Damte B *et al.*, 2015; Tachbele E, Ameni G, 2016), baseline CD4 count (Alemu AW *et al.*, 2010; Tachbele E, Ameni G, 2016), adherence (Mulissa Z *et al.*, 2010) and functional status. Additional child related factors affecting mortality included developmental milestone (Ramlal RT *et al.*, 2013) and nutritional status (Shivakoti R *et al.*, 2016).

Death rate was high among older, male and less educated patients with HIV. One study, showed that mortality among older adult HIV patients aged above 35 was two times higher than among young adult patients (Shivakoti R *et al.*, 2016). This supports findings reported from reporting high Late Presentation, high discontinuation and immunologic failure among older adults. Mortality rates were also found higher among men than women. For example, one study found a death rate of 9% in women compared with 13.5% in men (Bouille A *et al.*, 2015). As described above, there were few programs that targeted men, and adherence rates for men were lower than for women (Gesese H *et al.*, 2014; Cornell M *et al.*, 2019).

Furthermore, alcohol consumption is high among men and this could contribute to the high

rates of death among men than women (Mshana GH *et al.*, 2016). People who completed secondary school or above were 65% less likely to die compared with those who did not attend school (Tadesse K *et al.*, 2014; Setegn T *et al.*, 2015). This could be linked with the level of awareness needed to seek the ART care.

Not surprisingly, risk of mortality was increased among patients with baseline CD4 count below 100 cells/mm³, WHO stages 3 and 4, bedridden functional status and those who were non-adherent to ART (Cornell M *et al.*, 2010; Tachbele E, Ameni G, 2010; Shivakoti R *et al.*, 2016). For example, patients who had baseline WHO clinical stage of 3 or 4 were four times more likely to die than those who had stage 1 or 2.

Similarly, the risk of death was 60% less in patients with higher baseline CD4 count. Patients with poor baseline performance scale compared with normal activity were at four times higher risk of death (Cornell M *et al.*, 2010). Tb/HIV co-infected patients were also at higher risk of death than patients with HIV only (Tachbele E, Ameni G, 2010; Shivakoti R *et al.*, 2016). In one hospital-based study in Ethiopia, patients with poor adherence to ART were 28 times at higher risk to death than their comparator (Setegn T *et al.*, 2015). The presence of low immunologic and clinical gain, comorbidities such as TB/HIV, is being debilitated at the start of the treatment and poor compliance to the treatment lead to fast progression to AIDS stage and subsequently death (Assefa Y *et al.*, 2015).

In addition to being younger, having low CD4 count and advanced WHO clinical stage (Han N *et al.*, 2015; Yirdaw KD *et al.*, 2015), delayed developmental stage and under nutrition were the predictors of mortality among children. If children were delayed or regressed developmental milestone at initiation of ART there was six times increased risk of mortality (Babo YD *et al.*, 2017). Such delayed growth and malnutrition impeded ART adherence, exposed to other comorbidities, and hasten progression to advanced stage and finally death.

Therefore, demographic and clinical predictors were the factors mostly reported as associated with death. This review showed that there were many factors correlated with HIV mortality among children and adults. Inconsistencies among factors affecting mortality were noticed, and these factors were assessed in relation to the overall mortality. Nevertheless, comprehensive study has not been carried out in Ethiopia to adequately address the challenges of ART care and mortality from the viewpoints of stakeholders.

1.9. Predictors of Under Nutrition among Adult People Living with HIV

Under nutrition is defined as the condition in which nutrient intake is continuously below a

minimum requirement for maintaining healthy life. According to the global conceptual framework, the causes of under nutrition are multiple and interrelated requiring intricate series of approaches, multifaceted, and multispectral interventions to address it (University of The Western Cape (UWC, 2012; Sirotin *et al.*, 2012; United States Agency for International Development (USAID, 2014).

Human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) has become one of the daunting challenges to socio-economic development in the world. The first cases were reported in 1981 and at the moment, nearly 36.9 million people were living with HIV and many had died of AIDS and associated mortality since the start of the pandemic. Although, new cases were being reported in all regions of the world, almost 70% are in sub-Saharan Africa AIDS (Chipeta *et al.*, 2019; Ile-Ife, 2014; Henry, 2014).

It has been reported that having low body mass index (BMI < 18.5 kg/m²) strongly associated with mortality in HIV-infected individuals (Sharma *et al.*, 2015). In Ethiopia, the prevalence of HIV infection among adults and number of deaths due to AIDS and related problems was estimated to be 1.1% and 26,489 in 2015 (Ethiopian Health Nutrition Research Institute (EHNRI, 2012). The overall death toll in 2013 was estimated to be 793,700 out of which 200,300 were children (Federal HIV/AIDS Prevention and Control Office (FHAPCO, 2014). HIV/AIDS and under nutrition are interrelated and exacerbate one another in a vicious cycle. HIV could affect nutritional status through several pathways including increasing energy requirements, reducing food intake, and adversely affecting nutrient absorption and metabolism.

Asymptomatic and symptomatic adults have energy requirements by 10 and 30%, respectively to maintain body weight and physical activity (USAID, 2010; Raiten *et al.*, 2015). WHO recommends that adults with HIV should get 10 to 30% higher energy than a healthy adult without HIV, and children with HIV 50 to 100% higher than their normal counterparts to meet their requirement of diet. Food availability and good nutrition are thus essential to keep people with HIV healthy and enable them resist opportunistic infections such as tuberculosis for longer (Regional Centre for Quality of Health Care-Food and Nutrition Technical Assistance (RCQHC-FANTA) Project, 2010).

1.10. The Relationship of HIV and malnutrition

HIV prompted immune impairment and its occasioning opportunistic infections (OIs) can diminish Appetite; intensification energy outflow; effect on malabsorption; and vary the

body's capability to operate and evacuate nutrients prominent to nutritional deficits and unfortunate overall nutritional status (Food and, Nutrition Technical Assistance Project, 2004). Nutritional shortfalls can, in turn, accelerate the movement of HIV infection and rise the hazard of emerging OIs (Ivers LC *et al.*, 2009; De Pee S, Semba RD, 2010; Johannessen A *et al.*, 2018; Argemi X *et al.*, 2012).

In people with high HIV prevalence the adverse interactions between undernourished and HIV can influence health system of a nation (Liu E *et al.*, 2011; Kalofonos IA, 2010; UNAIDS, 2016; Colecraft E, 2008; Ivers LC *et al.* 2015). Highly active Antiretroviral therapy (HAART) is believed to be a key to HIV allied degenerative. Nonexistence of diet, food insecurity, and the concern about diet has been shown to decrease treatment faithfulness (Wanke C *et al.*, 2017; Singer AW *et al.*, 2015; Berhe N *et al.*, 2013; Musumari PM *et al.*, 2014; Au JT *et al.*, 2016; Cantrell RA *et al.* 2018; Musumari PM *et al.* 2013). Furthermore, starvation and medicine for opportunistic infections may interact in ways that reduce the efficacy of HAART, and HAART itself might influence metabolism, as well as causing side effects that lead to reduce desire for food (Mangili A *et al.*, 2016).

Ethiopia has been reducing incidence of adult HIV status from 6.5% to 1.5%, but this symbol represents a huge number of individuals: 793,700 PLWHA plus 200,300 children (Benzekri NA *et al.*, 2015 ;Demographic E. *Health Survey*, 2014; Global Nutrition Report, 2018). of who 420,000 (59% of those in need) are now receiving HAART (Tiyou A *et al.*, 2010). Alternatively, around 9% of Ethiopia's people is undernourished and the country's rate of stunting is 38% (Tesfamariam K *et al.* 2016; Hailemariam S *et al.*, 2013).

It is, realistic to expect that many PLWHA receiving HAART in Ethiopia can't get sufficient, worth and amount diet. Alternatively, nutritional support with early initiation of ART has been known to have a substantial role to interruption the vicious circle between HIV and malnutrition (Hadgu TH *et al.*, 2013; Koethe JR *et al.*, 2019; Ndekha M *et al.*, 2019; Rawat R *et al.*, 2010). The interaction of HIV/AIDS with nutritional status has been a distinctive characteristic of the disease course since the earliest days of the epidemic, when the term "slim disease" was often used in endemic areas such as sub-Saharan Africa to indicate the wasting syndrome typically connected with HIV/AIDS and related diseases (Quinn, 2001).

Both HIV and under nutrition can lead to progressive deterioration of the immune system and increased up to 50% of PLWHA have under nutrition, especially in sub-Saharan Africa (USAID, 2010; WHO, 2015). Optimal nutrition could be achieved through consumption of a balanced healthy diet from locally available foods and fortified foods and/or micronutrient

supplements when appropriate and this is vital for wellbeing and survival of all individuals regardless of HIV status (United Nations Programme on HIV/AIDS (UNAIDS), 2019). Nutritional assessment and counseling should be an integral part of all HIV treatment programs.

Improved attention to diet and nutrition may augment ART acceptability and effectiveness, helps prevent metabolic complications, and improves adherence and response to antiretroviral therapy (UNAIDS, 2019; Sunguya *et al.*, 2014; World Food Programme (WFP), WHO, UNAIDS, 2016). HIV could lead to weight loss and wasting through the pathways of low food intake and increased energy requirement. Once a patient is on antiretroviral therapy (ART), progressive wasting and consequent mortality can often be reversed and nutritional requirements may revert to normal, although metabolic changes might continue to be evident (UNAIDS, 2019; Sunguya *et al.*, 2014; WFP, WHO, UNAIDS, 2016; Heikens and Manary, 2019).

Most of the studies were conducted outside Ethiopia, and evidences were from quantitative studies. Socio-cultural barriers were not explored well in Africa, and even less so in Ethiopia. The great majority of predictors or barriers were identified as characteristics of patients. For some factors such as gender, education, Kchat chewing and alcohol consumption, there were contradictory association with under nutrition. Other predictors were studied in limited contexts. For example, the influence of being heterosexual or homosexual on continuum ART care and malnutrition were assessed in Europe, Asia, US and Canada but not in Africa.

However, thoughtful of in what manner starvation, HIV behavior and what factors stimulus individuals' risk of under- nutrition while on HAART in developing countries like Ethiopia is still marked with a relatively restudies conducted given the huge overlap among food insecurity, under nutrition, and HIV-infection. As far as the author's knowledge, there is no evidence regarding the predictors of under nutrition and its implication towards HIV continuum care among PLWHIV in the area and even in Ethiopia. Thus, this study aimed to assess under nutrition and its implication towards HIV continuum care among PLWHI, which is timely demanding.

1.10.1. Intention towards Dietary Diversity among Adult People Living with HIV

A many-sided and negative emphasis is given to the role of behavioral intention in people infected with human immune deficiency virus (HIV) and behavioral intention (Ajzen I, 1991; Ajzen I, 1989). Poor dietary diversity can, in turn, hasten the progression of HIV infection and increase the risk of developing opportunistic infections (OIs). There is a similarity in the

cellular effects of malnutrition and HIV—the immune system becoming compromised by decreasing CD4 T cells, suppression of delayed hypersensitivity and abnormal B-cell responses.

Providing sufficient food and nutrition to meet people’s basic needs for health, growth and development has been a longstanding challenge for African countries (Mangili, A *et al.*, 2016). Thus they require greater protein and micronutrient intake in order to improve the weakened immune system (Ahoua L *et al.*, 2011; Bandura A, 2017). Optimal nutrition can help boost the immune function, maximize the effectiveness of antiretroviral therapy (ART), reduce the risk of opportunistic infections (OIs) and improve the overall clinical care and life expectancy of PLWHIV (Food and Nutrition Technical Assistance, 2016).

HIV-positive individuals require 20–30% more energy than HIV-negative individuals of the same age, sex and physical activity level (Ogle BM *et al.*, 2011). Dietary diversity scores (DDs) have been positively correlated with increased mean micronutrient density adequacy of complementary foods and micronutrient adequacy of the diet in adults (Foote JA *et al.* 2014). Even then there is complex interaction between dietary diversity/intake, immune function and HIV/ AIDS and malnutrition (Bukusuba J *et al.*, 2017).

According to the World Health Organization (WHO), nutritional support is an integral part of a comprehensive response to HIV/AIDS and receiving appropriate nutrition can help improve the health and quality of life of HIVinfected individuals (Heikens and Manary, 2015; Republic of Rwanda Ministry of Health, 2015). In resource-limited countries across the world including Ethiopia, low quality monotonous diets are common but food insufficiency and low dietary diversity are known contributors to poor health. Despite advancements in the treatment modality, the effects of the overlap between under nutrition and HIV infection are not well understood (Woldemariam *et al.*, 2015; UNAIDS, 2012).

In Ethiopia, 9% PLWHIV are severely malnourished and 25% are moderately malnourished (Castleman T *et al.*, 2014; Central Statistical Agency of Ethiopia and ICF International, 2011). Assuring adequate access to food in highly active antiretroviral therapy (HAART) treatment programs has been a central demand of PLWHIV in low-income countries and, as such, nutrition by prescription and therapeutic feeding has been assimilated (depee S, Semba RD, 2010; Kalichman SC *et al.*, 2010; DiBari F *et al.*, 2011; Adal, M, 2019; Global HIV Prevention working Group, 2016).

Nutritional problems are among the first negative effects of HIV infection. These problems are due to inadequate diet intake and altered metabolic conditions, provoking impaired

balance of energy and nutrients in patients even when they are treated with antiretroviral therapy (ART) (Mangili A *et al.*, 2016). The effect of poor nutrition in the case of PLWHIV is more urgent as they have to grapple with opportunistic infections. Dietary management of PLWHIV is the key to sustaining the ability to continue participating in the workforce and contributing to socioeconomic development (Uthman OA, 2018). Food insecurity and poor nutritional status may speed up progression of acquired immune deficiency syndrome (AIDS)-related illnesses (Braun J, Olofinbiyi T, 2017).

The dietary diversity score at the individual level is a proxy indicator of adequate intake of energy and micronutrients (Rawat R *et al.*, 2010). Eating a diversity of foods (varieties of food groups) is an internationally accepted recommendation for a healthy diet, and is associated with positive health outcomes such as reduced incidence of mortality (Tiyou A *et al.*, 2012). Dietary diversity is therefore a key concept that should be promoted in managing the nutritional situation of PLWHIV (Adal, M, 2019). The relationship between nutrition and HIV infection is very complex and can fluctuate due to factors such as nutritional status, including wasting or weight loss and micronutrient deficiencies, HIV disease stage and other physiological factors and diets (Kaye HL, Moreno CJ, 2010).

A number of development partners have participated in the planning and implementation of major initiatives and programs for HIV treatment, prevention, care and support in Ethiopia and Africa at large. For example, the “3 by 5” initiative was designed to treat 3 million people in 2005. “Getting to zero” was a theme of the 2015 World AIDS Day commemoration targeted to achieve “zero new HIV infections, zero discrimination and zero AIDS-related deaths. “Treat all, food by prescription”, appointment spacing model care and HIV continuum care are other strategies that eloquently promote the universal HIV care coverage to ensure that all HIV-positive individuals receive ART irrespective of their CD4 count, World Health Organization (WHO) clinical stage or viral load.

From the above list, a program directly concerned with nutritional care is the Food by Prescription program that involves nutritional assessment, counseling and support to decrease nutritional problems in malnourished patients with HIV. However, food insecurity often occurs. The program is challenged by individual, institutional, community and health system-related factors. Scholars criticize this program by saying “symptomatic treatment is very expensive”/“the cheap intervention is very expensive”. As far as the author’s knowledge, there is no evidence regarding the behavioral intention towards dietary diversity of PLWHIV in Ethiopia. Thus, this study aimed to assess behavioral intention of PLWHIV towards dietary

diversity, which is very critical in settings where multicultural practices prevail, such as Ethiopia.

1.10.2. Summary of the Introduction

In this chapter, we have reviewed definitions, magnitude, predisposing factors and interventions for each stage of HCC outcomes. Except for mortality, the definitions for malnutrition, discontinuation and immunologic failure outcomes were inconsistent. In Ethiopia, these outcomes were reported to be a significant burden although most of the studies were geographically skewed to the north and northwest parts of the nation.

The current introduction about these outcomes for children and older patients with HIV remained poor. The review also showed that there were several determinants of these outcomes including socio demographic, economic, behavioral, clinical, structural and cultural barriers. There were conflicting findings between studies on the associations between variables and outcomes of interest. Retrospective cohort studies were overrepresented in the literature and some studies relied on small sample sizes and short follow-up periods. Baseline clinical and nonclinical characteristics were reported frequently across the literature. This illustrates that most studies assessed links between patient-related factors and outcomes.

Some qualitative studies reported cultural barriers such as stigma and traditional healing, and behavioral barriers such as alcohol consumption and having contact with commercial sex workers; however, the effects of policy or health worker factors on outcomes were explored inadequately. There was very little evidence from mixed methods studies on links between patient characteristics and barriers and either one or all outcomes of HIV care and treatment. No study assessed the whole HCC. The review highlighted that the predictors of under nutrition were prevalence studies, and most countries of the world, except Europe and USA, have same problem in their health system.

The existing global evidence showed that reaching the first 90 was more challenging than achieving the other two. Studies assessing the targets were scanty, and none using ideal measures had been carried out in Ethiopia. Despite poor achievement of the three targets and assessing several factors of HIV continuum care, discontinuation, immunologic failure and mortality, malnutrition, stigma and discrimination individual behavioral factor and evidence on interventions to improve each stage of the continuum of care was insufficient.

Most interventions were facility-based, a few were community-based and self-based interventions were rare. Interventions for under nutrition was simply food by prescription

which is symptomatic treatment and project derive approach, community-based HIV testing, HIV self-testing, decentralization, task shifting, point of care CD4, measurement and peer educator-based HIV testing. Interventions for discontinuation included the *seek-test-treat* succeed model, service integration, peer educator-based lost patient tracing or use of patient tracers, and community-supported programs.

For immunologic failure, the interventions were HIV care support from peer health workers, DOT for ART, use of treatment partner-assisted therapy and home-based ART care. From reviewing the literature on the ways to improve HCT, there were limited data that showed interventions to address each stage in the continuum of HIV care. There was no exhaustive listing of possible contextual interventions and no prioritization of available solutions was performed using consensus methods.

No assessment of combinations of interventions was observed. For example, there were no studies investigating questions such as “...what happens if food by prescription and behavioral change on dietary diversity are implemented in combination?” The evidence from the literature review also showed there were sparse data on Adults, Mothers, children, homosexuals, and developing countries for all aspects of the problem. Overall, the literature review in Ethiopia showed that there were no advanced studies that comprehensively assessed mortality, under nutrition and behavioral intention towards dietary diversity.

Additionally, the different stages of HCC outcomes were studied inadequately, and the whole sequence of HCC was not assessed completely. Existing studies had conflicting findings in relation to the association of some factors and HCC outcomes, and most only used clinical and non-clinical characteristics of patients when discussing mortality, malnutrition, livelihood, discontinuation, immunologic failure and mortality. While negative HIV outcomes are determined by multiple ecologic level factors, the literature review found that factors affecting negative HCC outcomes beyond patient-level factors, such as institutional, community and policy level factors, were not explored.

The literature review also confirmed that potential interventions for mortality, malnutrition, poor behavioral intention towards dietary diversity, and ART attrition were assessed insufficiently. Furthermore, no consensus study has been published that attempts to prioritize interventions based on their relevance, feasibility and acceptability. Finally, the literature review found no studies that used mixed methods to research the complex nature of the HIV continuum care. No studies in Ethiopia considered the effect of implication of mortality

towards the new approach care called ASMC, predictors of under nutrition and behavioral intention toward utilization and practice of dietary diversity at home.

Very few studies were conducted on children, pregnant mothers and older people, and most studies have been in developed countries despite the growing number of adults on ART in developing countries. In this regard, several studies have focused on assessing recovery rate and benefit of nutritional support, the magnitude and distribution of undernourished. The intention of this research was to assess the predictors of under nutrition and its implication towards Human Immuno virus and HIV continuum care (HCC) among adults PLWHA in south west Ethiopia.

1.10.3. Theoretical Model

The research reported in this Dissertation was guided by a model called the social-ecological model (SEM). Investigation of the HIV continuum sustainability care pathway needs multi-level involvement and interaction (Kranzer K *et al.*, 2012). Previous work attempted to explain HIV care needs has lacked multifaceted characterization incorporating several levels or sites of action, namely individual, community, institution, and policy levels (Campbell C, Cornish F, 2010; Seeley J *et al.*, 2012). When using HIV continuum sustainability care pathway as challenges, the relationships that exist between an individual and the environment – interpersonal, community, organizational and policy levels were assessed (Yakob B, Ncama BP, 2016).

The SEM was established from the Ecological Systems Theory of Bronfenbrenner 1989 (Bronfenbrenner U, 1989), Ecological Model of Health Behaviors of Leroy 1988 (McLeroy KR, 1988), and SEM of Health Promotion of Stokols 1996 (Stokols D, 1996). The works of these and other researchers have been applied, modified, and developed into what is currently coined the SEM. There are several versions of the SEM that use slightly dissimilar grouping of levels (Belinda Chimphamba G *et al.*, 2012). For the present study, the enablers, barriers and possible solutions for HCC were explored at four levels with reference to Bronfenbrenner 1989 (Bronfenbrenner U, 1989).

These are the individual, healthcare, community, and policy levels. In the model, the overlapping circles demonstrate how factors at a level affect factors at another level. The first level, individual level, pinpoints biological and personal exposures that intensify the risk of becoming vulnerable to the topic of interest (McLeroy KR *et al.*, 1989) such as negative HIV care outcomes. Given that the SEM demonstrates the complex interaction at multiple levels,

the knowledge and behavior of an individual are constructed from social interactions such as morals, symbols, and beliefs at these levels (Jonathan S, Mike O,2007).

These social interactions are imperative in determining how individuals describe meaning under the face of culture and livelihood. In this project, the individual related perspectives comprised the demographic, socio-economic, knowledge, experience, expectations, attitudes, disclosure and beliefs of patients with HIV. The second level, health care or microsystem level focuses on the interactions with health workers, and access and availability of the healthcare service itself. Availability and access to healthcare particularly HIV care is a vital element of health development for patients with HIV patients.

In addition, a warm welcome, courteous interactions and attention to patients' concerns have a substantial impact on the efficacy of services provided in a health care facility (Yakob B, Ncama BP, 2016). In this project, the health care level comprised the interaction with HIV health care providers, distance, logistics, availability, and administration. The third level, community or meso system level, targets on the institution of a community. The characterization of whom and what institutes a 'community' is commonly described as involved networking, interactions between groups and organizations, and geographical settings (McLeroy KR, 1988).

Additionally, communities may be bound via religious, economic, cultural or geographic links, or any combination of these. Such interaction influences the promotion of wellbeing or could be a source of isolation or stigma and poor negative behavior. Therefore, interpretation of these community norms could enhance or deprive the ART care services within a community (Baral S, *et al.*, 2013).For instance, interventions targeted at norms of simultaneous use of traditional and modern medicine could demonstrate efficacy in ART care. In this project, the community level factors comprised care and support, stigma, traditional healing, and social networks. The fourth level, policy or *macro system* level focuses on the policies and programs related with HIV continuum care.

It is evident that *policies* of a state give a general framework of service provision for the generalized population and marginalized groups (Berkman LF *et al.*, 2000). The planning, implementation and evaluation of these policies and programs can intensify or lessen the community's ability to use the available health care services (Baral S *et al.*, 2013). Policies determine allocation of services to various settings or groups within the population, logistics or capacity building, development assistance and other services.

These play a significant role in influencing structural contexts of HIV care services (Wellings K et al. 2006). In this project, the policy or program level contained health policy, HIV/AIDS policy, distribution and referral systems, guidelines and standards. The SEM guided the data collection and analyses (methods), and interpretation of findings. The ‘*individual level*’ of the model helps to explain the predictors of negative HCC outcomes. The methods that guide this are presented in sections 3.4 and 3.5 of Chapter three, and the findings are presented and interpreted in Chapters four and five.

The *micro-* and *meso system levels* of the model help in exploration of additional barriers and respective interventions of negative HCC outcomes. The method to guide this is presented in section 3.6 of Chapter three, and the findings are presented and interpreted in Chapter six. Finally, the *macro system level* of the model helps to prioritize the possible interventions that were explored at the micro- and meso system level. The method to guide this is presented in sections 3.7 of Chapter three, and the findings are presented and interpreted in Chapter four.

In summary, based on the designed conceptual framework, HIV diagnosis, ART care linkage and retention in care services of patients on ART depend on individual, community, organization, and policy level factors. The figure below shows the application of SEM in the HCC framework. *Individual level* refers to patient level factors, *Microsystem level* refers to health care related factors, *Mesosystem level* refers to community related factors, and *Macrosystem level* refers to policy level factors. The overlapping circles in the model shows how factors at one level affect factors at another level.

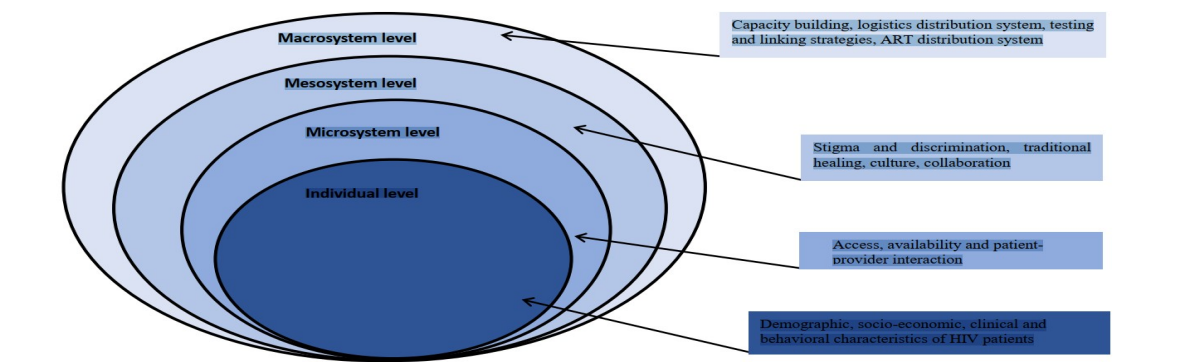


Figure 3: Factors influencing negative HIV care continuum outcomes, adapted from the social-ecological systems theory (source: Bronfenbrenner, 1989)

1.10.4. Conceptual frame work of the project of the three research questions

As we have stated evidence above in the theoretical models, we adapt and customize to the general objective of the project (Figure 4).

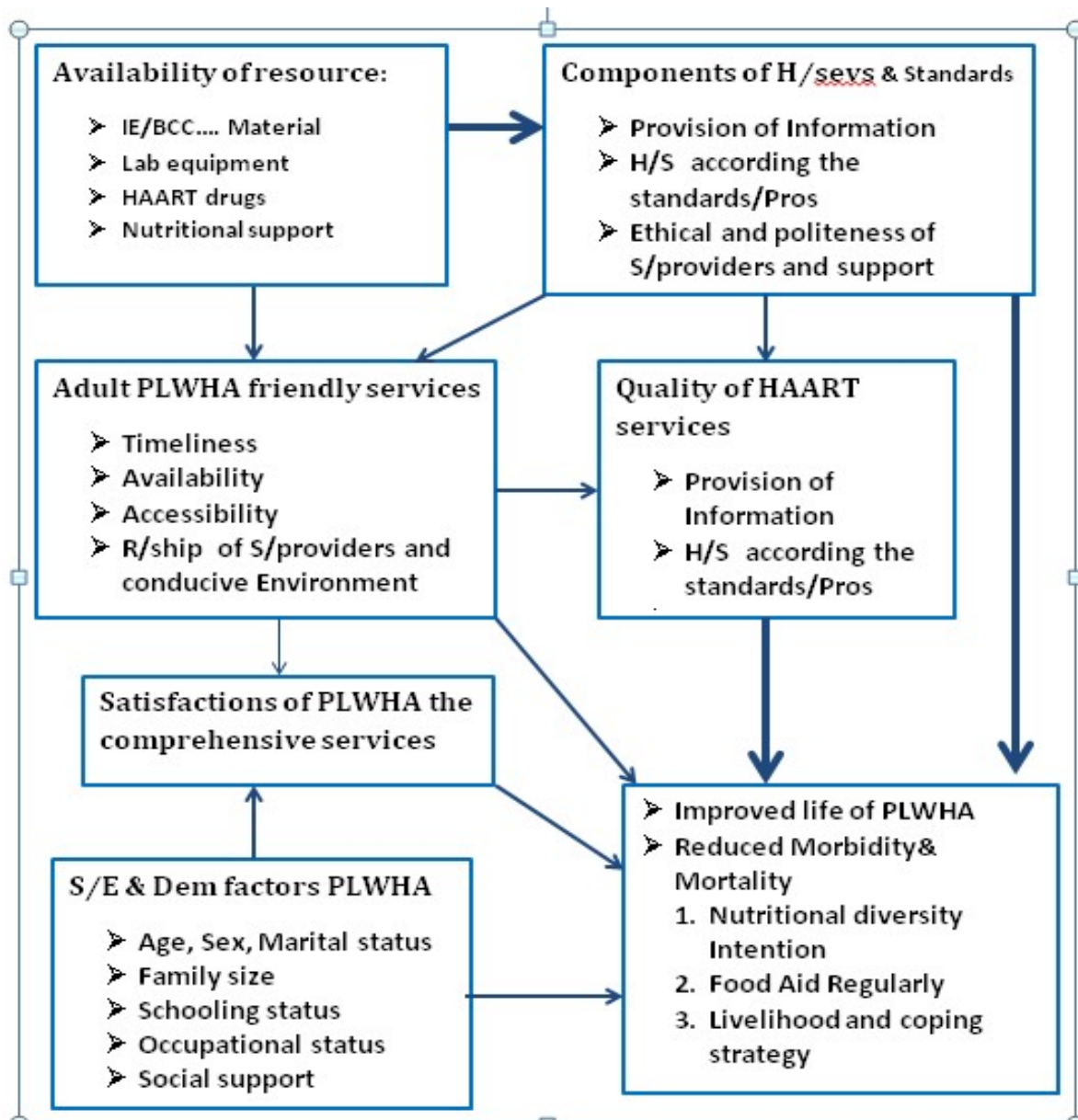


Figure 4. Over all CFW of the three objectives/we adapted from literature (Auld AF *et al.*, 2014; Vermund SH *et al.*, 2014; Gouveia PA *et al.*, 2014; Raffi F *et al.*, 2017; Huang P *et al.*, 2015; Bayou B *et al.*, 2015).

1.10.5. Significance of the Study

This study will contribute to the better outcome of HCT not only in Southwest Ethiopia but also in Ethiopia and beyond. This work, in a nutshell, contributes to improve the number of people who know their HIV status, number of diagnosed HIV patients accessing HIV treatment sustainably, and number of HIV patients with clinical and immunological successes. The primary beneficiary targets of this study are HIV patients, HIV care providers, policy makers and researchers.

For HIV patients, the identified facilitators and barriers along with the suggested solutions will help to enhance their knowledge and decision to know their HIV status early, improve the trust in ART care, encourage consistent HAAT utilizations and improve quality of life.

For HIV care providers, the findings will help them to identify and prioritize vulnerable patients with high likelihood of negative HIV outcomes by considering contextual factors. This also helps the health workers to conduct targeted HIV for malnutrition and to diagnose patient's timely and targeted counseling on dietary diversity, to reduce attrition and enhance consistent ART utilization.

For policy makers, the barriers from the analysis will help them to design a new strategy to meet the UNAIDS targets of HCC. The findings will foster them to recognize the strengths and weaknesses of the existing strategies, programs and policies. For future researchers, the suggested solutions require further robust and large-scale studies before implementation. This study will also serve as a springboard in conducting new studies and further investigations. The dissertation produced a significant original contribution to the HIV community.

The significant original contribution to knowledge of the current project includes: a) use of sequential multiphase mixed methods; b) assessment of the whole sequence of HCC; c) identification of mortality, under nutrition, intention as problem towards dietary diversity practice and recommended new solutions at each stage of HIV care evaluating the relevance, feasibility and acceptability of each solution using a consensus method study; and d) positive response to the implementation of translating the findings to produce output in terms of potential strategies to improve the HCC.

1.10.6. Aims of the study

The overall aim of the study is to determine Dietary Diversity Intentions, Nutritional status and Mortality among Adult People Living with HIV in Jimma Zone Southwest Ethiopia. A Multiphase Mixed Study

1.10.8. SPECIFIC OBJECTIVES

1. To measure predictors of under nutrition and its implication towards HIV continuum care among adult people living with HIV in Jimma zone public hospitals, southwest Ethiopia: a mixed method study
2. To assess predictors of Mortality among Adult People Living with HIV and Its Implications for Appointment Spacing Model Approach Care
3. To explore Intention towards Dietary Diversity among Adult People Living with HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior

1.10.7. Research Hypothesis

- There is no significant relationship between Undernutrition and the new approach care” appointment spacing model of ART care.
- There is no significant relationship between mortality and undernutrition
- Poor Intention towards dietary diversity and related practices are associated with increased risks of developing malnutrition.

1.10.9. Outline of the Dissertation

This Dissertation has **six** major chapters. The **first chapter** presents an overview of the negative outcomes of the whole HIV care and treatment (HCT) cascade was aimed to assess Mortality, under Nutrition and Intention towards dietary diversity from five public hospitals of Jimma zone, Southwest Ethiopia. The **second chapter** discusses the methodology of the study of adult people living with HIV who enrolled to ART clinic. **Chapter three:** presented the findings of predictors of mortality among adult people living with HIV who enrolled to ART clinic in Jimma zone Public hospitals.

Chapter four: explains the case control study in titled with Predictors of Under Nutrition

and Its Implication toward HIV Continuum Care among Adult People Living with HIV in Jimma Zone Public Hospitals, Southwest Ethiopia. The in-depth interview data were explored the finding of quantitative study in five themes; Household Food Insecurity situation, Challenges with Food by Prescription program and Food Aid, Stigma and discrimination as challenge of HIV Continuum care and Dietary diversity and Coping Mechanisms of PLWHA.

Chapter five: describes the Assessment of behavioral intention toward dietary diversity found that, the significant predictors of intention to use dietary diversity. The unit positive change in the individual's perception about any counseling support from health professionals to use diversified food in their usual feeding as a normative action will increase the intention to use dietary diversity by 0.39 provided that the other conditions and medical care are in place. **Chapter Six:** summarizes the salient issues of all studies and their implications, conclusions, and recommendations for future studies. The schematic presentation of the dissertation is depicted in the figure below (Figure 5).

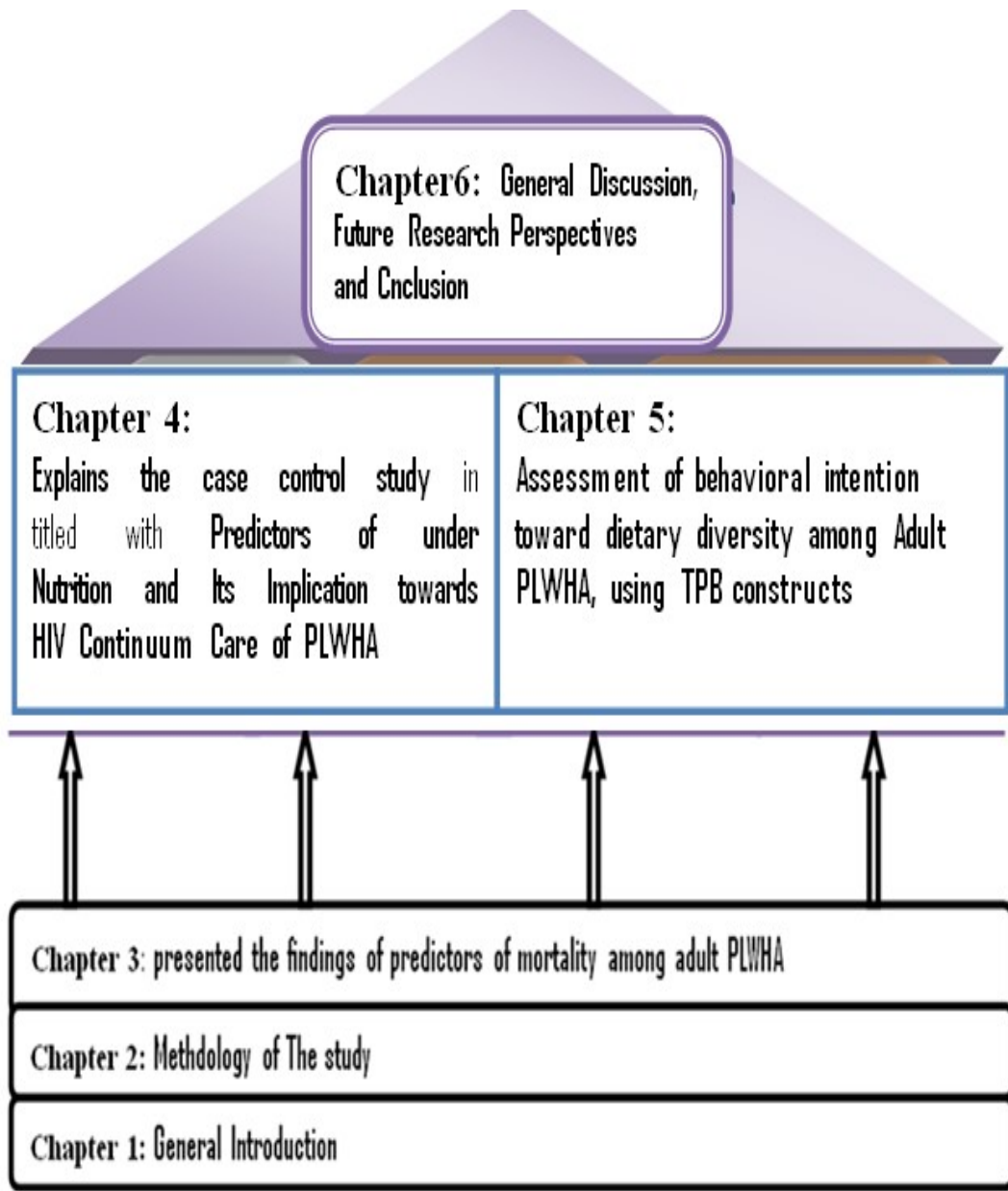
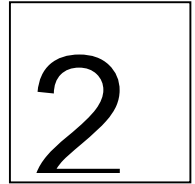


Figure 5. Schematic presentation of the PhD dissertation



Chapter 2: Methods and Materials

2.1 Study setting and participants

The studies were conducted in Jimma zone public Hospitals, Southwest Ethiopia. Jimma is located 357 km southwest of Addis Ababa and has a total area of 4,623 hectares. Jimma town is the capital city of Jimma zone and one of the 18 zones (councils) in Oromia Region. The zone has a projected total population of 3 million, of which 89.69% are rural inhabitants.

The zone is divided into 18 *woreda* and 198 *Kebeles* (lowest administrative units in Ethiopia). It is Situated at an altitude of 1750–2000 mm³ above sea level, the temperature ranges from 20–30 °C, and average annual rainfall is 800–2500mm³. The health coverage of the zone is 68% in rural and 80% in towns. A map of Jimma is shown in Figure 5. Jimma zone is located in Oromia region, a region that has the highest number of people infected with HIV in Ethiopia and one of the regions with least ART coverage (CSA, ICF, 2011). It is near Gambela region, which had the highest prevalence rate of HIV in Ethiopia (CSA, ICF, 2011).

There is a refugee camp near the zone where refugees from different African countries (mostly from South Sudan) live. The presence of high migration from and to the city creates the risk of high HIV transmission. The study was conducted in five public hospitals found in southwest Ethiopia; namely: Jimma Medical center, Shenen Gibe, Seka, Agaro and Limugent Hospitals. Of these, Jimma Medical center is the biggest hospital in the town and zone and it provides services for people from Jimma zone and other surrounding areas including Gambela. During the study period, a total of 11,186 adults and 2,683 pediatric PLWHA were on chronic HAART care.

JUMC, a hospital established in 1938, started to provide ART since 2003, while the others hospitals had started in 2007(limmu Hospital) and in 2014(seka, Agaro and shenengibe). The hospitals serve a catchment area of three million people. In all settings, VCT, PMTCT, ART and OIs treatment services are available. Once the patient confirmed his/her HIV status, an intake form is filled after the exhaustive counseling, and appointment made for further testing at six-months interval until the patient fulfills the criteria for ART.

This procedure was introduced at the beginning of 2016. However, since mid- 2016, every person who tests positive for HIV can start ART irrespective of baseline CD4 count or WHO clinical stage. Patients who start ART have follow-up appointments every three months, and CD4 would be monitored every six months for the first year and yearly thereafter. CD4 cell count machines are available in all institutions. The ART care facilities have an ART clinic with a minimum of one trained clinician who manages patients, a data clerk who ensures data

management including electronic data update, a case manager and two peer educators (adherence supporters) to trace clients who miss appointments or are lost to follow-up from care.

Every health professional working at ART clinics undertakes comprehensive and refresher training about ART before commencing work. In addition to routine government support, the institutions are supplied by the International Center for AIDS Care and Treatment Programs (ICAP). ICAP, based at Columbia University in New York is an NGO established in 2004 that provides family centered HIV services at 3,300 sites across 21 countries. ICAP is known for developing capacity building and providing innovative and effective programs in the most challenging and resource meager areas. ICAP mainly supports hospitals. Data were collected between February 10/2018 and March 30/2018 consecutively for the three objectives.

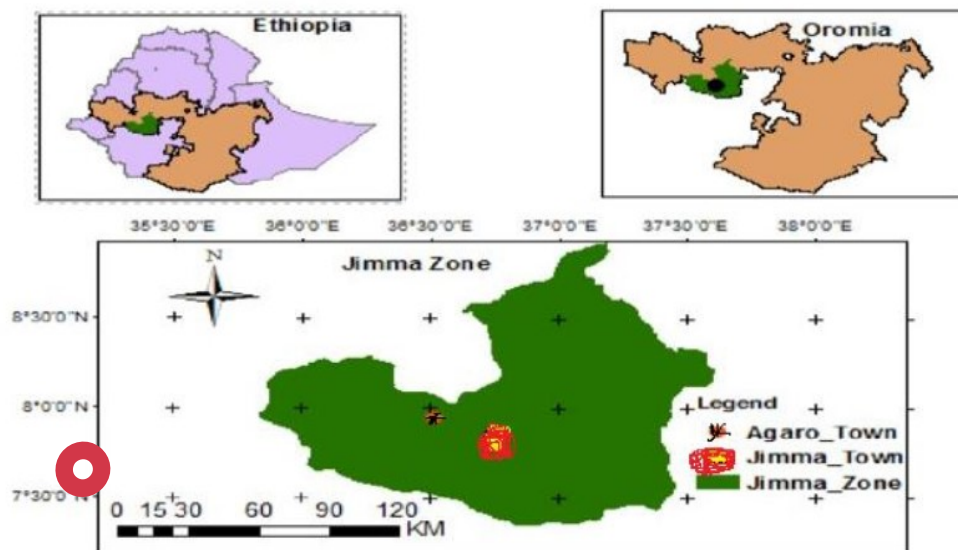


Figure7. Map of the study area (Source: Municipal administration of Jimma zone as cited by Edae & Mulu, 2017)

2.2. Study design

The study designs comprise Retrospective Cohort study, a case-control, cross-sectional study triangulated with descriptive qualitative studies described in detail under each study.

2.3. Source population

All adult PLWHA (≥ 18 years old who were on ART chronic care follow up and thier clinical data in Jimma zone public Hospitals were the source population of the study. For the

Retrospective Cohort study all adult PLWHA (≥ 18 years old) who were on ART chronic care follow up and their clinical data. For the case control study All adult PLWHA (≥ 18 years old) and above. Medical records were reviewed from February 15/2018-march 16/2018 covering a period of five years (from 01 September 2012 to 30 August 2016) and using appropriate case reporting format prepared in English.

For the case control study: This was unmatched case-control study conducted among PLWHA aged 18 years and above. Cases/undernourished were defined to be those PLWHA who had body mass index (BMI) less than 16 kg/m², which implies severe under nutrition or those who had moderate mild under nutrition (BMI 16.5-17.5 kg/m²). Controls were PLWHA who had normal nutritional status (BMI between 18.5 kg/m² and 24.9 kg/m²) using the routing records of ART care services. In addition in-depth interviews of ART service providers, ART coordinators, community advocates, and adult PLWHA were conducted and supplemented to the quantitative data.

For the Institutional based survey a sampled adult (≥ 18 years) PLWHIV were randomly selected and included in the study. However, patients who were too sick (WHO stage/grade IV) and HIV-positive adults with additional chronic non-communicable diseases such as diabetes mellitus, hypertension and current pregnancy were excluded from the study.

2.5. Sample Size Determinations

To the retrospective cohort study designs applied the aforementioned outcomes using five-years of data from 01 September 2012 to 30 August 2016. This Retrospective cohort study design, also termed as historical or non-concurrent cohort study, is a design in which association between exposure and outcome is determined using historically or retrospectively collected data. For This retrospective cohort study A total of 676 clinical and their socio demographic data were randomly selected from All adult (≥ 18 years old) who were on chronic care follow up. The Sample size was estimated using two population proportions formula. Based on BMI measurement data, those PLWHA, who had undernourishment's at the initiation of ART were considered to be exposed (n_1) whereas those who had normal BMI were taken to be non-exposed group (n_2). Accordingly, 281exposed and 395 non-exposed samples were estimated, implying total of 676 samples of PLWHA for the study. Patient's data with unknown nutritional status at ART initiation, those who defaulted, those with incomplete information and those transferred out to other facilities were excluded from the study.

For the case control study, the sample size was calculated using G-Power software using double-population proportion formula. Our outcome of interest was predictors of under nutrition for PLWHA. We estimated the proportion of the patient population that would be malnourished by reviewing patient records to find how many patients had reported problems with severe or moderate under nutrition at intention of ART by BMI. The percentage of PLWHA with undernourished was 19% and the adjusted odds ratio for the association between consumption problems was 2.4, one-to-one ratio of control to a case, (Wasie B *et al.*,2010) a 5% level of significance and a power of 80% were considered. Accordingly, the overall sample size was 678 (339 cases and 339 controls) PLWHA. We selected our sample by extracting a list of all of the eligible patients on ART in the clinic from the clinic registration book.

This list was divided into cases and controls based on the patient BMIs recorded in the registration book. We then used simple random sampling to select participants from the case and control lists using SPSS (version 20).The sample size was allocated to each of the hospitals based on probability proportional to sample size of cases (1,231) and controls (9,955). An in-depth interview was conducted to explore rich and relevant information on the predictors of under nutrition among participants from HAART service providers, community advocator, HAART coordinators, and adult PLWHA, who were purposively selected considering their roles and experiences they had. Finally, research team leader made further probe the content of the field notes and key points were repeated and no significant new information emerged.

The asample size for the institutional based survey was done from a single population proportion formula used to estimate the study sample size with the assumptions of prevalence of 50%, confidence level of 95%, 5% margin of error, and 5% allowance for non-response rate. The study participants were allocated proportionally based on the number of highly active antiretroviral therapy (HAART) patients in each hospital; then, 403 samples were drawn from the total listed patients' records.

2.6. Data Collection Instrument and Procedures

Medical records were reviewed from February 15/2018-murch 16/2018 covering a period of five years (from 01 September 2012 to 30 August 2016).Using appropriate case reporting format prepared in English. The data were collected by 10 BSc professional nurses using data collection format. All the five hospitals have an electronic patient database called

Comprehensive Care Centre Patient Application Database (C-PAD). C-PAD is Electronic Medical Records (EMR) system database that contains patients' both clinical and non-clinical information. This was the main source of data in this study. Data were extracted using a data extraction check list from the database. When data were incomplete, we tried to refer the patients' cards, registration and log books using patient medical record number and ART registration number.

To the case control study, Data was collected using interview administered questionnaire. Economic status was assessed using wealth index, which was determined by Principal Component Analysis (PCA). Out of 24 variables namely source of income in the last 12 months 8 variables were extracted in the final iteration. After communality, antiimage and correlation between the items were checked three variables were highly loaded on the first and second PCA components, namely own mobile, bed with sponge, fuel, charcoal, household farmland, Households own sheep, goats and two variables in the third component namely having a refrigerator and fuel electricity.

Therefore, the wealth index score was made by eight variables with three components that explained a total variance of 66.86% and Kaiser Meyer Olkin measure of sampling suitability 0.75 with Bartlett's test of sphericity at a worth of 0.001. The data collection tool for dietary practices was adapted from a validated Food Frequency Questionnaire (FFQs), ([Desta et al., 2019](#); [Feyesa et al., 2020](#); [Tollosa, D.N. et al., 2017](#)) to 27 local food items.

Height of the study participants was measured to the nearest 0.1 cm using a stadiometer (Seca Germany) with the subjects positioned at the Frankfort Plane and the four points (heel, calf, buttocks and shoulder) touching the vertical stand and their shoes taken off. Before starting the measurement, the stadiometer was checked using calibration rods. Weight was measured using an electric powered digital scale connected to the plethysmography (BodPod) to the nearest 0.1 kg with the subjects wearing light clothes and shoes taken off. The validity of the scale was checked using an object of a known weight every morning and between the measurements. Standardization of the anthropometrists was done using a coefficient of variation of <0.03. Body mass index (BMI) was calculated as the weight in kg divided by height in meters squared (kg/m^2). All hospitals use following cut points: 18.5-25 kg/m^2 = Normal (1), 16-17.5 kg/m^2 = Moderate chronic energy deficiency (2), < 16 kg/m^2 = severe chronic energy deficiency.

Regarding the institutional based survey, we had adapted from the theory of planned behavior (TPB) (Ajzen I, 1991; Ajzen I, 1989). The format for the questionnaire consisted of seventy-five items separated into nine domains. The first domain assessed PLWHIV's knowledge, past experience and economic status on dietary diversity (14 items), the second domain was to ascertain the future and past behavioral intention of PLWHIV (2 items), the third domain was about behavioral beliefs (6 items), the fourth domain was about outcome evaluation (6 items), the fifth, sixth, seventh and eighth dealt with normative beliefs (9 items), motivation to comply (9 items), control beliefs (4 items) and power of control (4 items), respectively, and the ninth domain was background information (20 items).

Finally, data were collected through face-to-face interviews by five BSc nurses and supervised by two masters of public health. Additionally, in-depth interviews were conducted to explore factors related to intention towards dietary diversity behavior and to explore the quantitative findings.

The overall aim of the in-depth interviews was to explore factors affecting behavioral intention towards dietary diversity of PLWHIV, plus to strengthen capacity for quality and sustainable clinical care of PLWHIV towards the new approach to care via the appointment spacing model (ASMC). The approach helps to reduce direct and indirect costs of clients, stigma and discrimination, improve satisfaction by two visits per year (every six month) to answer the following three questions. (a) First, to what extent are patients who began HIV treatment after the rollout of ART continuing to engage in ART care? (b) Second, what are the characteristics of patients and the existing support of PLWHIV other than ART? (c) Third, why do people fail to improve their nutritional status, including availability of food at home, practice of dietary diversity, knowledge of dietary diversity and challenges of dietary diversity among PLWHIV.

In this regard, a mixed-methods approach within a specific economic and sociocultural context was used as exploratory of the predictors for under nutrition among participants (key informants) from HAART service providers, community advocates, HAART coordinators, and adult PLWHIV, who were purposively selected considering the roles and experiences they had to provide rich and relevant information. Finally, the research team leader further probed the content of the field notes and debriefing sessions.

2.7. Data processing and Analysis

Cleaned and coded data were entered into EPI-data version 3.14, manufactured in 2017.USA and then exported to SPSS version 20.0 manufactured in 2017.USA for analysis. Kaplan

Meier (KM) survival function and Log rank test was used to test the statistical difference in the KM curve. Bivariate Cox regression analysis was done to estimate the unadjusted Hazard Ratios (HRs)/ AOR and standard Beta respectively to the three objectives. Descriptive statistics were computed and presented in frequencies and percentages for categorical variables, while means with standard deviations were reported for continuous variables.

The food items were categorized into cereal-based foods, dairy products, meat, eggs, legumes and pulses, vegetables and fruits, fats and oils, and sweets. The cumulative weekly intake of each food group was found by summing the frequency of consumption of individual food items in the same group and ranked into terciles as low, medium, and high terciles.

Independent variables with $p \leq 0.25$ at bivariate analysis level were entered into the multivariable cox, logistic and linear regression model to control potential confounders. Finally, variables, which had $p \leq 0.05$ and non-null values within respective confidence intervals (cis) at multivariable analysis were considered to be independent predictors each outcomes. All analyses were performed using spss for windows version 20.0 (spss, Illinois Chicago, USA). We have checked all assumptions: (1), the hr remains constant over time and each covariate to be included in the model. (2) First, logistic regression does not require a linear relationship between the dependent and independent variables. Second, the error terms (residuals) do not need to be normally distributed. Third, homoscedasticity is not required. Finally, the dependent variable in logistic regression is not measured on an interval or ratio scale. (3) Linearity: the relationship between outcome and the mean of independent is linear. homoscedasticity/ the variance of residual is the same for any value.

Independence/ observations are independent of each other.

Before the inclusion of predictors to the final model, the multi-collinearity was checked using the Variance Inflation Factor (VIF) < 10 for continuous independent variables and Multicollinearity was checked using standard error < 2.0 for none continuous dependent variables.

A-recorded interviews were transcribed verbatim immediately after the in-depth interview Afaan Oromoo and Amharic and then, translated into English by a qualified professional. The transcripts were read repeatedly line-by-line to identify codes that capture major participants' perceptions (Baxter, J., & Eyles, J. 1997). Data were coded by using Atlas Ti Version 7.0.71 software (Scientific Software Development GmbH, Berlin). Finally analyzed according to thematic framework analysis techniques (Vaismoradi *et al.*, 2013).

2.9. Quality assurance

The adapted questionnaires were prepared in English, translated to local language both Afaan Oromo and Amharic, and later back to English by two different experts qualified in MSc and fluent in local languages. Two days of training were provided for data collectors and supervisors regarding study objectives and interview techniques. Pretest was conducted on 5% of the proposed sample size and amendments were made accordingly. The supervisors strictly followed the data collection procedures and feedback was given daily.

2.10. Ethics Approval and Consent to Participate

Ethical approval was applied for and obtained for the mega project by considering all study in general. This study was apart from study mega project which comprises five research questions (three for this PhD work and two for MPH students. Ethics approval was not required for every research question because it was comprise in detail all the study questions. The mega project study was submitted at concept level to Jimma university institute of health postgraduate director office to compute a research grant.

Then the office was assigned reviewers and accepted as project number two to be presented in public and evaluated in 2nd phase by experts. At the next step the office arrange public defense and assigned experts to evaluated in person with all the invited staffs finally our mega project was selected as number two out of 27 mega projects in the fiscal year of 2018. Finally this study was approved by the institutional review board of the Institute of Health Jimma University, Ethiopia ([Ref. No. IHRPGC/1095/2017](#)).

All participants provided written. Information gathered was treated as confidential and accessible only to the PhD student in both research question one and three. No participants were directly involved in the study with only anonymised data being extracted from the electronic medical system. No information about the project was published in any form that allowed any individual person in the participating organizations to be identified. All data and collected information were kept in a locked filing cabinet only accessible to the PhD student and computer files were protected with passwords that only the PhD student knew.

For the 1st objective, Permission was received from their respective institutions to approach study participants clinical data. All hospitals were assured that the information we collected would be treated with the strictest confidence and no identifying information would be published. It would remain confidential and would not be shared with any party without their knowledge or consent. However, complete anonymity could not be guaranteed given the

involvement of the ART nurse/physician.

Individual participants were informed about the voluntary nature of participation in the study, so that they were free to withdraw from the study at any time or decline to answer some questions. Their decision would never affect access to services, their relationship with the HIV health care providers or the clinic in general. Data collection instruments would not contain respondents' names. All study participants were assured that the information they gave would remain confidential and anonymous and would not be shared with any party or in any report, publication, or presentation without their knowledge or consent.

The co-researcher(s) who would be involved in translation, interview and transcription of the interviews knew the ethical issues, respect for persons (autonomy, volunteer participation and confidentiality), beneficence (benefits, risks and its assessment) and justice. The PhD student would also strictly inform the researcher about the basic principles of ethics, particularly anonymity, confidentiality, benefits and risks, and obtain a signed confidentiality agreement.

The information was kept and locked in a filing cabinet with the key only accessible to PI and the computer files were protected with passwords that only the PhD student knew. Although this research project may not have a direct benefit for the study participants, the study findings will benefit the discipline of public health by providing multi-dimension critiques of the nexus of patients with HIV in care of public hospitals.

The study will benefit individuals newly infected with HIV indirectly, to remain in care, improve their immunity and subsequently enhance their survival ensuring their quality of life. The study will help health workers to prioritize groups of people at risk of discontinuation from treatment, prone to treatment failure and death. Policy makers will also get insights enabling them to revise policies for interventions for people with HIV including best time to commence treatment.

There were no risks for people participating in the study or for the researcher during the interview processes. However, participants might feel burdened by the amount of time spent in the interview, negative concerns (such as service denial) of being identified as having been involved in the study, and stress while talking about HIV.

The following measures were taken to manage any anticipated risks that happened: i) participants were informed that their participation was entirely voluntary and at any level of the interview they could discontinue the interview; ii) participants would be referred to a

counseling service within the respective hospitals if they felt stressed during the discussion about HIV; iii) participants were not reimbursed any Birr for costs incurred because of their participation in the interview; iv) participants were interviewed in a quiet, secure and confidential area, and they were asked to nominate another place in the hospital or work setting if they preferred; and v) although not expected to happen, if a participant preferred the interview to be conducted in his/her own home and their home is inside the town, the researcher would notify a colleague about the location and time of the interview.

The research team didn't have any association with the clinic. They wore a badge that showed him as a researcher. Secondly, the participants were informed that their decision would never affect access to services, their relationship with the HIV health care providers or clinic in general. Thirdly, the participants were informed that their participation was exclusively for research purposes and that they may not get direct benefit from participation in the study. All key informants were assured that the information they gave would be treated with confidence and no identifying background would be published. In addition, respondents were asked not to identify their backgrounds in the self-administered questionnaire and audio-record discussion to ensure their anonymity.

The key informants were informed about the voluntary nature of participation in the discussion. There was no risk for members in taking part in the meeting or for the researcher during the discussion processes. Nonetheless, members might have felt burdened by the amount of time spent in the discussion and stress during discussion about HIV. The participants informed that their participation was entirely voluntary, and can choose to discontinue at any time.

2.11. Communication of findings

The dissertation report was submitted to the following offices: department of nutrition and Dietetics, Research Higher Degree of Jimma university, faculty of Public Health, Jimma university. The research findings of this project have been disseminated through publications and workshops. The findings 1st paper was from the case control study, which was presented (**Oral**) at Jimma university 2019 international conference

The 2nd paper reporting the findings from the cohort study was presented (**poster**) at the 31th Ethiopian public health association annual conference in the year of 2020. The 3rd paper reporting the findings from the institutional based survey study was presented (**Oral**) at the 32th Ethiopian Public Health Association annual conference in the year of 2021.

Chapter 3: Predictors of Mortality among Adult People Living with HIV and Its Implications for Appointment Spacing Model Approach Care.



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JIMMA UNIVERSITY, P. O. Box: 378, Jimma, Ethiopia,

+251-471-110331, +251-921-324889, FAX: +251-471-114484 OR +251-471-112040



Aderajew NigusseTekelehaimanot^{1*}, Tefera Belachew¹, Esayas Kebede Gudina², Masrie Getnet³, Demuma Amdisa⁴, Lelisa Sena Dadi : Predictors of Mortality among Adult People Living with HIV and Its Implications for Appointment Spacing Model Approach Care, 31(5),2021.

Abstract

Background: our country Ethiopia is motivated to achieve a goal of “appointment spacing model approach care.” However, little has been documented the predictor of mortality and challenges of sustainable HIV care. Therefore, the aim of this study was to determine predictors of mortality among adult people living with HIV/AIDS on antiretroviral therapy (ART).

Methods: A retrospective cohort study was conducted among 676 adult People living with HIV who enrolled to ART clinic from September 1st, 2012 - August 30, 2016. Multivariable Cox Regression analysis was used to identify predictors of mortality using 95% confidence interval (CI) and at P value ≤ 0.05 cut of point.

Results: The total person-time contributed was 28,209 person-months with an overall mortality incidence rate of 11 per 1000 person-months observation. The cumulative mortality incidence among females over the study period was 16.8%. Severe Undernourishment and moderate malnutrition at base line, younger age, female, single, divorced, illiterate, lack of disclosure, advanced WHO clinical stag, seeking treatment out of catchment area, rural residence and immunological failure were found to be independent predictors of mortality.

Conclusions: Poor nutritional status at baseline, advanced HIV disease, occurrence of treatment failure, female sex, substance use disorders, lack of social support, immunological failures, clinical failures, and younger age, low level of education and poor physical access to healthcare facility were found to be important predictors of mortality. Intervening, those factors as routine and part of “appointment spacing model care” can improve survival of PLWHA.

Key words: Adult, Appointment Spacing Modals, ART, PLWHA, Predictors, Jimma zone

Introduction

Globally, between 1980 and 2015, about 78 million people were infected and half of them have died of the disease (UNAIDS, 2014; Ansa GA,2015). According to the 2016 report of Global Burden of Diseases (GBD), worldwide 38.8 million people had HIV infection; 2.1 million people had been newly infected and 1.2 million died due to the virus in 2015 (Celentano D *et al.*, 2018).

Ethiopia has adopted the appointment spacing model (ASM) of service delivery by considering the sociocultural situation, degree of awareness, stigma and discrimination, resource demand and its sustainability. Implementation of ASM improves service quality, results in cost savings, improves health outcomes, accelerates the achievement of the 90-90-90 target by offloading workload from overburdened health facilities, and improves adherence and retention (Stringer JS *et al.*, 2016). As ART cohorts mature, a growing number of people in treatment programs will virally suppress. In this case frequent laboratory and clinical monitoring is not required. Further, by reducing the burden of stable clients visiting health facilities, resources can be reallocated to clients most in need (Johannessen A, 2018).

Ethiopia is among African countries hard hit by the HIV pandemic. The overall prevalence of the disease among adults, pregnant women and, women who had multi sexual partners was reported to be 0.9%, 0.4%, and more than 6%, respectively (Stringer JS *et al.*, 2016). The prevalence among women (1.2%) was twicethat of men (0.6%), seven times in urban residence (2.9%) compared to rural settings (0.4%). In 2016, a total of 19,743 people were died of AIDS and about 792,840 children lost either or both of their parents due to AIDS (Braitstein P, 2016).

To alleviate the impact of HIV/AIDS, Ethiopia introduced ART in 2003 for the first time atcost of patients, and two years later ART started to be provided for free ((Stringer JS *et al.*, 2016; Lawn SD *et al.*, 2016). Following the 3 by 5 program, 535,069PLWHA who had ‘ever started’ ART and 375,811 PLWHA who did not yet started ART were put on ART in more than 1000health facilities in 2014/5 (9). Subsequently, report of 2017 revealed that HIVincidence, AIDS related mortality and overall HIV prevalence were fallen by 95%, 73% and29%, respectively (Abebe N *et al.*, 2016).

Ethiopia has also been implementing prevention, treatment and care interventions. The prevention activities include voluntary counseling and testing (VCT), prevention of mother to child transmission (PMTCT), behavioral change communication andcommunity mobilization. The treatment and care theme encompasses ART, laboratorymonitoring,

provider initiated testing and counseling (PITC), nutritional support, palliative care and home-based care activities (Biadgilign S *et al.*, 2014).

Despite the efforts devoted to limit the impact of HIV, still numerous gaps and challenges remain unsolved. Among others, timely initiation of ART, retention in care and prevention of HIV related mortality, narrowing significant inequities in ART coverage, which varies between children (23%) versus adults (60%), females (54%) versus male (69%), and **disparities** among regions ranging from 5.6% to 93% are worth mentioned (Alemu AW *et al.*, 2015; Abebe N *et al.*, 2014).

To help HIV patients fully benefit from ART, attain national goals and use resources most effectively, Ethiopia uses the HIV continuum care (HCC) framework initially incepted by the Centers for Disease Control and prevention (CDC) in Atlanta, USA, in 2013 (Bhatta L, 2016). The HIV continuum care is a series of stages from the time a person is diagnosed with HIV through assessment for ART eligibility, retention in care, and immunologic success and virological suppression via treatment adherence towards reduction of mortality and ART care success outcomes (Bhatta L, 2016; Mutevedzi PC *et al.*, 2011).

Many activities have been attempted to address negative ART care outcomes, nevertheless, there have been challenges at every stage of the HCC. These include late HIV care presentation (LP) (Koye DN, 2012), discontinuation of ART (Lawn SD *et al.*, 2015), poor ART adherence (Mutevedzi PC *et al.*, 2011), immunologic ((Alemu AW *et al.*, 2015; Abebe N *et al.*, 2014).) and virological failures (Koye DN, 2012).

Currently, Ethiopia is implementing a new care approach known as “appointment spacing model care (ASM)”, which mainly focuses on a few visits of hospitals (two times per year) and comprehensive care at a time. However, there are still massive challenges pertaining to ART program regardless of the efforts being devoted by both governmental and non-governmental organizations (Assefa Y *et al.*, 2017). Consequently, patients usually experience different unintended health care outcomes such as loss of many from the ART schedules, failure to recover their immunity (Kranzer K *et al.*, 2012) and deaths from the disease (Assefa Y *et al.*, 2017).

The overall picture shows that research is lacking to identify key factors that lead to negative ART care outcomes, including mortality. Furthermore, studies conducted in Africa have revealed that factors affecting ART care are beyond individual level. The factors are related to health care institutions such as lack of ART trained health professionals (Tesfahuneygn G *et al.*, 2015), and lack of quality care and community level factors such as stigma (Bezalem E,

2014) and traditional healing (Kokeb M, 2016); and program level factors such as political commitment (Purchase S *et al*, 2017; Assefa Y *et al.*, 2014) and lack of coordinated HIV care activities ((Tesfahuneygn G *et al.*, 2015); Assefa Y *et al.*, 2014)). Nevertheless, comprehensive study has not been carried out in Ethiopia to adequately address the challenges of ART care and mortality from the viewpoints of stakeholders. Therefore, the aim of this study was to assess predictors of mortality among adult PLWHA in Jimma Zone Public Hospitals.

Methods and Materials

Study Setting and period: The study was conducted in the Jimma zone five public hospitals (Jimma Medical Center, Shenen Gibe, Agaro, Seka and Limmu-Genet hospitals). Jimma zone is one of the 20 administrative zones in Oromia Regional State located in southwest Ethiopia. Jimma Medical Center is the only tertiary hospital in southwest Ethiopia. The other four hospitals are primary hospitals with catchment population of about a million each. At the time of the study, a total of 11,186 adults and 2,683 children were in chronic HIV care at the hospitals. The data was collected from February 15/2018 to March 16/2018 and the study involved patients on chronic HIV care at the hospitals during period of 01 September 2012 to 30 August 2016.

Enrolment procedures/Retrospective cohort study

A total of 676 adult PLWHA was randomly selected from All adult (≥ 18 years old) who were on chronic care follow up. The Sample size was estimated using two population proportions formula. Based on BMI measurement, those PLWHA, who had undernourishments at the initiation of ART were considered to be exposed (n_1) whereas those who had normal BMI were taken to be non-exposed group (n_2). Accordingly, 281 exposed and 395 non-exposed samples were estimated, implying total of 676 samples of PLWHA for the study.

The study population was all adult **PLWHA** enrolled in ART care in the selected hospitals. Patients with unknown nutritional status at ART initiation, those who defaulted, those with incomplete information and those transferred out to other facilities were excluded from the study. Recruitment and informed consent procedures take place within the Ethiopian HIV Program clinics; any client's clinical records who present to hospital are approached by a Doctors/nurse or another allied healthcare provider and asked whether they are willing to speak to a research assistant about participating in a research project.

If a client is agreeable, a research assistant meets with them to explain the purpose, context

and methods for this cohort study, and reviews the informed consent form to determine whether the person is interested, willing and able to participate. The results were also maintained using aggregated report rather than individual characteristics in any aspect of the data throughout all steps and manuscript preparation. These data were not identifiable; therefore informed consent was not required.

Data source and collection procedure: Medical records were reviewed from February 15/2018-murch 16/2018 covering a period of five years (from 01 September 2012 to 30 August 2016).Using appropriate case reporting format prepared in English. The data were collected by 10 BSc professional nurses using data collection format. All the five hospitals have an electronic patient database called Comprehensive Care Centre Patient Application Database (C-PAD). C-PAD is Electronic Medical Records (EMR) system database that contains patients' both clinical and non-clinical information. This was the main source of data in this study. Data were extracted using a data extraction check list from the database. When data were incomplete, we tried to refer the patients' cards, registration and log books using patient medical record number and ART registration number.

Data processing and analysis: Cleaned and coded data were entered to EPI-data version 3.14, and then exported to SPSS version 20.0 for analysis. Kaplan Meier (KM) survival function and Log rank test was used to test the statistical difference in the KM curves. Bivariate Cox regression analysis was done to estimate the unadjusted Hazard Ratios (HRs). Independent variables with $P \leq 0.25$ at bivariate analysis level were entered into the multivariable Cox regression model to control potential confounders. Finally, variables, which have $P \leq 0.05$ and non-null values within respective confidence intervals (CIs) at multivariable analysis were considered to be independent predictors of mortality among the PLWHA.

Ethical Approval

Waiver of the consent was obtained from the office of institutional ethicalreview board (IRB) of the Institute of Health Jimma University and thereference number was (IHRPG/807/17). The data access permission wasobtained from Jimma zone five public hospitals (Jimma Medical Center, Shenen Gibe, Agaro, Seka and Limmu-Genet hospitals) board. We couldn't use any individual-level data from inception to this manuscript. The results were also maintained using aggregated report rather than individual characteristics in any aspect of the data throughout all steps and manuscript preparation. These data were not identifiable;

therefore informed consent was not required.

Results

3.1. Socio demographic Characteristic of Adult PLWHA in Jimma zone Public Hospitals

In this study, records of 382 (56.5%) females and 294 (43.4%) males were reviewed. The mean age of the study participants at the time of ART initiation was 30.4 years (\pm SD 7.4); 487 (72%) were between 25 and 44 years of age. More than half (55.6%) of them were married and 132 (19.5%) of them were divorced ones. Most of the participants (79.3%) reported to have attended at least a primary school. About 61% of the participants (412) were urban residents and 128 (18.9%) were living outside the catchment area of the respective hospitals. About 80% (540) and 58.6% of the study participants reported to have used Khat and alcohol respectively (Table 2).

Table2. Socio demographic Characteristic of Adult PLWHA in Public Hospitals, September 2012 –August 2016

Variables	Classification	Number	Percent
Sex	Male	294	43.4
	Female	382	56.5
Age group	18-24	97	14.3
	25-34	244	36.1
	35-44	243	35.9
	45-54	72	10.6
	>55	20	2.9
Marital status	Single	92	13.6
	Married	376	55.6
	Divorced	132	19.5
	Widowed	77	11.3
Level of Education	Illiterate	140	20.7
	Primary	271	40.1
	Secondary	190	28.1
	12 and above	75	11.1
Residence	Urban	412	60.9
	Rural	264	39.1
Catchment area	In catchment	548	81.1
	out of Catchment	128	18.9
Have Care giver	Yes	448	66.3
	No	228	33.7
Disclosure	Yes	467	68.9
	No	211	31.1
Hx of alcohol	Yes	397	58.6

Hx of Chew <i>khat</i>	No	281	41.4
	Yes	540	79.6
	No	138	20.4

3.2 Baseline clinical status of PLWHA who were on ART care

Regarding the baseline medical and nutritional status of PLWHIV who were ART, 339 (50.1%), 192 (28.4%) and 145(21.4%) were started on ART on the basis of clinical, CD4 count, and both clinical and CD4 count approaches, respectively. One hundred eighty (26.6%) and 201 (29.7%) of them respectively had severe and moderate malnutrition at ART initiation. Two hundred six (30.5%) and 34 (5.0 %) PLWHA was classified as either WHO clinical stage III or IV respectively. Regarding functional status, 63.0% of the study participants were in working condition (Table 3).

Table 3: Baseline medical and nutritional status of ART users, September 2012 –August 2016

Variables	Categories	Number	Percent
Eligibility criteria	Clinical only	339	50.1
	CD4 count only	192	28.4
	Clinical and CD4 count	145	21.4
BMI at baseline	1/Not malnourished	395	58.4
	2/Moderate	181	26.8
	3/Severe malnutrition	100	14.8
	Not recorded	21	3.1
Weight category	≤40kg	460	68.0
	41-60kg	118	17.5
	> 61kg	98	14.5
WHO clinical stage	Stage I	190	28.1
	Stage II	246	36.4
	Stage III	206	30.5
	Stage IV	34	5.0
Functional status	Working	426	63.0
	Ambulatory	216	31.9
	Bedridden	34	5.0
History of any OI	Yes	487	72.0
	No	189	27.5

	No	333	49.3
History of TB	INH prophylaxis	102	15.0
	With treatment/re-treatment	240	35.5
	Negative	484	71.6
Baseline AFB result	Positive	138	20.4
	Not recorded	54	7.9

Four hundred eighty-seven (72.0%) of the participants had history of opportunistic infections (OIs) at ART initiation. TB was the most common OI identified contributing for 35% of the OI cases (pulmonary TB – 29% and extra pulmonary TB – 6%). However, 71.6% patients on TB treatment were negative for Acid Fast Bacilli (AFB). The other OIs were diarrhea 101 (21.0%), chronic diarrhea (18.0%) and Herpes zoster (12.0%) (Figure 1).

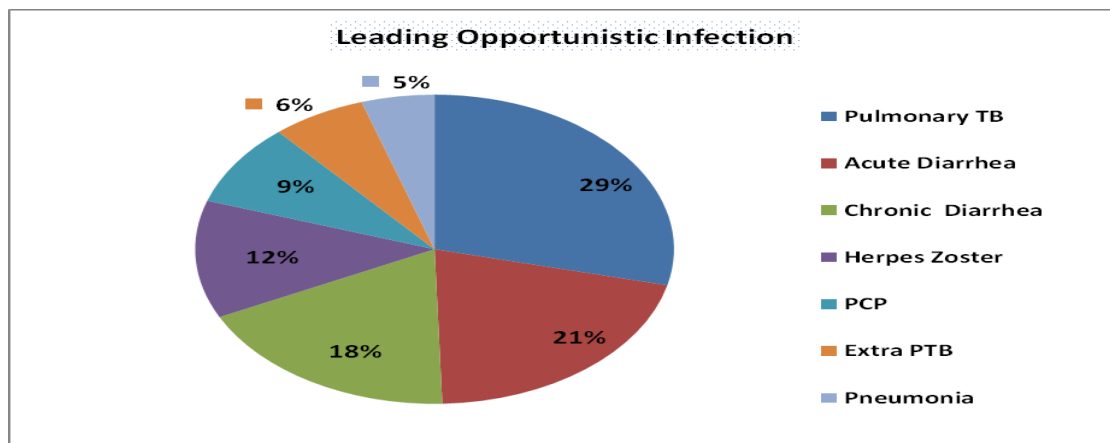


Figure 1: leading opportunistic infection among adult PLWHA on ART, Jimma zone Public Hospitals, September 2012 –August 2016

3.3. Laboratory profiles and treatment of PLWHA on ART

More than half, 353 (52.3%) of the study participants had hemoglobin level of less than 11mg/dl at ART initiation. With regard to other laboratory parameters, 51.5% of them had normal liver functional test and 52.9% had CD4 cell count below 200 cells/ μ L. Stavudine based regimens, 1a (d4T + 3TC +NVP) and 1b (d4T + 3TC +EFV), were the most common ART regimens used in 53% of the participants. Less than half, 286 (43.3%) of the study participants reported to have had good adherence to OI prophylaxis, whereas the rest had fair 241(35.7%) or poor 149 (22.0 %) adherences (Table 4).

Table 4: Laboratory, clinical care and behavior related factors in the initiation of ART in Jimma zone Public Hospitals, Southwest Ethiopia, September 2012 –August 2016

Variables	Categories	Number	Percent
Adherence to Cotri at 6month	Good	286	42.3
	Fair	241	35.7
	Poor	149	22.0
ART regimen	1a (d4T + 3TC +NVP)	154	22.8
	1b (d4T + 3TC +EFV)	212	31.4
	1c (AZT+ 3TC+NVP)	96	14.2
	1d (AZT +3TC +EFV)	93	13.8
	1e (TDF +3TC +EFV)	117	17.3
	1f (TDF + 3TC+NVP)	104	15.3
Liver functional test	Normal (0-50)	348	51.5
	Abnormal (>50)	279	41.3
	Not done	49	7.2
CD4 count	< 200	358	52.9
	201 – 350	249	36.8
	>350	69	10.2
Hemoglobin Level	<11mg/dl	353	52.5
	11.5-16 mg/dl	255	37.7
	>17mg/dl	68	9.8
Adherence to all clinical care 6m	Good	264	39.0
	Fair	71	10.5
	Poor	341	50.4
Patient Status at death	Not Known	12	12.2
	Clinical failure	36	36.7
	Immunologic failure	24	24.4
	Virologic Failure	26	26.5

4.1.4 *Cumulative Incidence and Incidence rate of mortality*

Ninety-eight (14.5%) patients were died during the five-year of ART follow up period. The cumulative incidence among females was 16.8% (64/382). The total follow up time was 28,209 person-months when an overall incidence rate of 11 deaths per 1000 person-months was observed. The death rates among those PLWHA who had severe and moderate

malnutrition were 5.7 and 2.9 deaths per 1000 person-months, respectively.

The overall survival probability of the adult PLWHA was 86.6%. The overall estimated mean (\pm SD) survival time of adult PLWHA on ART follow up was 42.8 (SD = 17.8) months. In the five-year time interval, the highest mortality was observed during 18 to 24 months of follow up, followed by the months of 30 to 36 and 24 to 30, respectively. The lowest mortality was observed during the follow up period from 48 to 54 months followed by 54-60 months of follow up, followed and during the period 6 to 12 months (Table 5).

Table5: Overall life table of PLWHA on ART follow up in Jimma zone public Hospitals south west Ethiopia, September 2012 –August 2016

Interval	Beginning	Death/98	Lost/134	Survival	Sta/ error	95% CI	
0-6	676	10	0	0.9783	0.0042	0.9766	0.9941
6-12	666	5	0	0.8781	0.0056	0.9639	0.9867
12-18	661	8	34	0.9325	0.0091	0.9209	0.9570
18-24	608	19	13	0.9211	0.0106	0.8965	0.9386
24-30	558	14	12	0.9022	0.0118	0.8763	0.9230
30-36	561	17	23	0.8853	0.0129	0.8582	0.9091
36-42	521	9	25	0.8748	0.0137	0.8451	0.8992
42-48	487	11	16	0.8608	0.0158	0.7289	0.8874
48-54	476	1	10	0.8500	0.0159	0.8157	0.8782
54-60	470	4	2	0.8453	0.0565	0.7096	0.9748

The overall probability of survival among adult PLWHA on follow up in Jimma zone public hospitals showed a decrement with an increment of WHO classification stages. Those PLWHA on ART follow up classified as WOH stage I, II, III and IV had a survival probability of 96.3%, 94.9%, 92.9%, 76.5% and 48.6%, respectively (*Fig 2*).

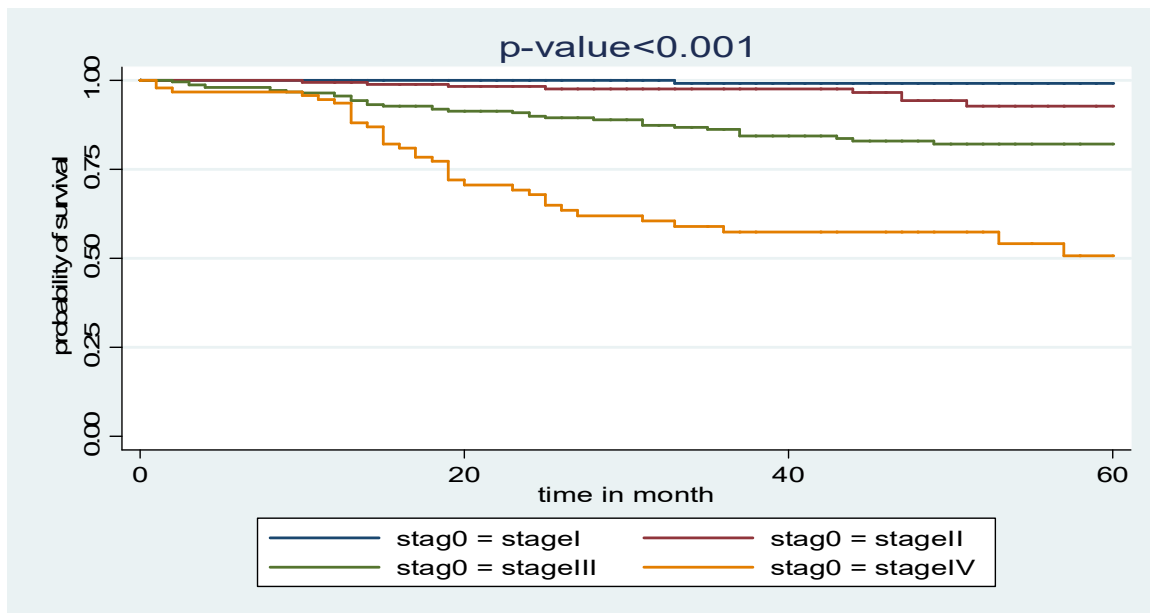


Fig 2: Kaplan Meier survival curve of PLWHA on ART follows up Jimma zone public hospitals by baseline WHO stages September 2012 –August 2016

3.4. Predictors OF MORTALITY AMONG ADULT PLWHA ON ART

Adult PLWHA who suffered from severe malnutrition at baseline had nearly four times (AHR: 3.7; 95% CI: 1.6, 6.7) risk of death while those with moderate malnutrition had more than twice (AHR: 2.5; 95% CI: 1.7, 7.5) risk of dying early compared to those with normal BMI. The risk of early death was nearly three times higher among females (AHR: 2.8; 95% CI: 2.1, 4.6) compared to males. Deaths among single (AHR: 2.6; 95% CI: 1.8, 3.8), divorced (AHR: 2.4; 95% CI: 1.3, 3.9), and widowed (AHR: 2.3; 95% CI: 1.7, 3.7) PLWHA on ART follow up were higher compared to married PLWHA on ART follow up.

The risk of death among adults PLWHA decreases as educational status increases. The risk of death was more than two times among illiterate (AHR: 2.5; 95% CI: 1.9, 4.8) and those who attend primary school (AHR: 2.1; 95% CI: 1.8, 3.6) compared to PLWHA on ART follow up who attend secondary or above schools.

Those PLWHA who did not disclose their HIV status to anyone (family or friend) had more than three times (AHR: 3.6, 95% CI: 1.7, 9.5) risk of dying compared to those who have disclosed their HIV status. Those adult PLWHA with TB Co-infection at the initiation of ART were nearly three times (AHR: 2.9, 95% CI: 1.5, 5.5) more likely to die within five years of treatment follow up period compared to those who did not have it. Individuals who were at stage IV HIV diseases (bedridden) at the initiation of ART were more than three times (AHR: 3.7, 95% CI: 2.4, 13.8) more likely to die within five years of treatment follow up

period as compared to those with working functional status.

The risk of death was four times in those with elevated liver enzymes (>50 IU/L) (AHR: 4.2; 95% CI: 2.4, 6.7) and nearly three times higher in those with OI (AHR: 2.5; 95% CI: 1.9, 7.1) compared to their counterparts.

Those PLWHA on ART follow up whose causes of death confirmed to be clinical failure (AHR: 2.1; 95% CI: 1.4, 2.8) and immunological failure (AHR: 1.7; 95% CI: 1.3, 2.7) were two times at higher risk of wasting syndrome (severe malnutrition /stage three malnutrition and leading to death) within five year treatment follow up period compared to their counterparts. The risk of death was also found to be high among PLWHA living outside catchment area of the hospital (AHR: 3.6; 95% CI: 1.5, 5.4) compared to their counterparts (Table 6).

TABLE 6: PREDICTORS MORTALITY AMONG ADULT PLWHA IN JIMMA ZONE PUBLIC HOSPITALS, SOUTH WEST ETHIOPIA, 2012 –August 2016

VARIABLES	CLASSIFICATION	DEATH 98 (%)	CENSORED 578 (%)	CHR (95%)	AHR (95%)	P
AGE GROUP	18-24	40(40.8)	57(9.8)	4.1 (1.5,11.3)	2.1 (1.7, 3.3)	0.01
	25-34	23(23.5)	221(38.2)	2.3 (1.8, 6.6)	0.8(0.3, 2.4)	0.04
	35-44	10(10.2)	232(40.1)	1	1	
	45-54	8(8.2)	64(11.1)	2.1 (1.4,16.3)	0.9 (0.4, 9.3)	0.38
	>55	17(17.3)	4(0.7)	3.7 (0.8, 6.6)	1.8 (0.8, 7.6)	0.02
SEX	MALE	34(34.7)	260(44.9)	1	1	
	FEMALE	64(65.3)	318(55.0)	3.1(1.5, 5.5)	2.8 (2.1,4.6)	0.03
MARITAL STATUS	MARRIED	9 (9.2)	36(6.2)	1	1	
	SINGLE	56(57.1)	367(63.5)	4.3(2.0, 7.9)	2.6 (1.8, 3.8)	0.01
	DIVORCED	14 (14.3)	118(20.4)	4.1(2.2, 7.2)	2.4 (1.3, 3.9)	0.02
	WIDOWED	19 (19.4)	58(10.0)	3.6 (2.5, 6.7)	2.3 (1.7, 3.7)	0.03
EDUCATION LEVEL	ILLITERATE	53(54.1)	87(15.1)	5.7(3.3,9.8)	2.5 (1.9, 4.8)	0.00
	PRIMARY(1-8)	26 (26.5)	242(41.9)	2.5(1.6, 6.7)	2.1 (1.8, 3.6)	0.01
	SECONDARY(9-12)	15 (15.3)	24(4.2)	1.5 (1.1, 5.3)	0.5 (0.3, 3.6)	0.21
	COLLEGE	4(4.1)	71(12.3)	1	1	
DISCLOSURE STATUS	YES	17 (17.3)	450(77.9)	1	1	
	No	211(31.)	128(22.1)	5.6 (4.3,11.4)	3.6 (1.7, 9.5)	0.03
BMI	NORMAL	6 (6.1)	240(41.5)	1	1	
	MODERATE MALNUTRITION	31(3.1)	298(51.6)	3.6 (2.3,9.4)	2.5(1.7, 7.5)	0.01
	SEVERE MALNUTRITION	61(6.1)	40(6.9)	5.6 (4.3,8.3)	3.7 (1.6, 6.7)	0.01
FUNCTIONAL STATUS	WORKING	29 (29.6)	372(64.4)	1	1	
	AMBULATORY	37 (37.8)	189(32.7)	1.3 (1.9, 3.6)	1.04(0.9,2.2)	0.04
	BEDRIDDEN	32 (32.6)	17 (2.9)	6.1 (4.7,18.6)	3.7(2.4,13.8)	0.03

TB-CO INFECTION	No TB		19 (19.4)	224(38.8)	1	1	
	INH PROPHYLAXIS		21 (21.4)	172 (29.8)	1.2 (0.8, 3.1)	1.1(0.7, 2.9)	0.04
WEIGHT	TB TREATMENT <40KG		58 (59.2)	182(31.5)	4.5 (3.5, 7.8)	2.9(1.5, 5.5)	0.02
	40-60KG		52 (53.1)	408 (70.6)	4.6(1.9, 6.7)	1.8(0.5, 3.7)	0.01
	>60KG		30 (30.6)	88(15.2)	1.1(0.7, 2.4)	0.7(0.4,1.7)	0.04
WHO CLINICAL STAGE	STAGE I&II		16 (16.3)	82(14.2)	1	1	
	STAGE III		8(8.2)	394(68.2)	1	1	
	STAGE IV		58 (59.2)	177(30.6)	3.5(2.1, 5.4)	1.7 (1.4, 3.2)	0.01
CD4 COUNT	STAGE IV		32 (32.6)	7 (1.2)	7.1(3.8, 11.8)	3.7 (1.7, 5.3)	0.00
	<200		57 (58.2)	301 (52.1)	4.2 (1.5,10.3)	2.3(1.8, 6.3)	0.01
	201-350		28 (28.6)	221 (38.2)	2.3 (0.8, 6.6)	1.7(0.6, 4.9)	0.02
FOLLOW UP WITHIN CATCHMENT AREA	>350		13 (13.2)	56 (9.7)	1.60(1.04, 2.)	1	
	YES		19 (19.4)	524(90.7)	1	1	
HAVE CARE GIVER	NO		79(80.6)	54(9.3)	6.9 (3.9, 9.2)	3.6 (1.5, 5.4)	0.01
	YES		17 (17.3)	401(69.4)	1	1	
RESIDENCE	NO		81(82.7)	177(30.6)	4.9(1.2, 4.9)	2.9 (2.0,17.2)	0.03
	URBAN		24 (24.4)	338(58.5)	4.10(1.5,11.3)	1	
ALCOHOL AND KCHAT USE	RURAL		74 (75.6)	240(41.5)	2.3 (0.8, 6.6)	2.1(1.4, 3.3)	0.02
	YES		68(69.4)	329(56.9)	3.6 (1.1,2.6)	1.8 (1.4, 5.4)	0.03
INFECTION	NO		30(30.6)	249(43.1)	1	1	
	YES		92(93.9)	395(68.3)	5.9 (3.9, 9.3)	2.5 (1.9, 7.1)	0.03
PATIENT STATUS	NO		7(6.1)	183(31.7)	1	1	
	NOT KNOWN		12 (12.2)	156(26.9)	1	1	
	CLINICAL FAILURE		36 (36.7)	142(24.6)	4.1 (1.5,10.3)	2.1 (1.4, 2.8)	0.02
	IMMUNOLOGIC FAILURE		24 (24.5)	127(21.9)	2.4(0.7, 5.6)	1.7 (1.3, 2.7)	0.02
ART REGIMEN	VIROLOGIC FAILURE		26 (26.5)	153(26.5)	2.8(1.3,3.7)	1.7 (1.3, 2.3)	0.02
	1A		24(24.5)	136(23.5)	1	1	
	1B		18(18.4)	204(35.3)	1.8(0.7, 3.3)	1.3(0.1, 3.5)	0.04
	1C		21(21.4)	85(14.7)	4.1 (1.5,11.3)	2.3 (1.8, 7.2)	0.03
	1D		15(15.3)	88(15.2)	3.1 (1.7,10.1)	1.3(1.0, 8.8)	0.03
	1E		11(11.2)	122(21.1)	1.9(0.5, 5.6)	1.5(1.3,8.4)	0.41
	1F		9(9.2)	105(18.2)	1.7(0.4,9.4)	0.6(0.2, 7.3)	0.04
LIVER F TEST	NORMAL (0-50)		12(12.2)	267(46.2)	1	1	
	ABNORMAL (>50)		69(70.4)	284(49.1)	6.4(3.8, 7.4)	4.1(2.4, 6.7)	0.01
	NOT DONE		17(17.3)	32(5.5)	1.7(1.5,9.3)	0.6(0.2, 6.4)	0.04

N.B HR, hazard ratio; CI, confidence interval; ART, antiretroviral therapy; WHO, World Health Organization; BMI, body mass index

Discussion

ART Program has created a significant change in improving both health status and life expectancy of PLWHA. However, first-line drug resistance and death from HIV related causes are quiet formidable challenges in Sub-Saharan Africa, including Ethiopia. In this study, 14.9% cumulative incidence of HIV mortality was reported in patient on ART. This is lower than finding of a study conducted in Cameroon (Tadesse K *et al.*, 2014). The variation could be due to the fact that in the earlier study, participants were recruited both from health centers and hospitals and the service from health Center is not comprehensive as Hospital.

The study revealed that mortality was found to be higher among femels Adult PLWHA (65.3 %). This finding is in line with the study conducted Northwest Ethiopia, in which the prevalence of HIV infection among females was two, times higher than males (Poka-Mayap V, Pefura-Yone, 2013). Studies from African countries also support this finding. The prevalence of HIV related death among female and male was reported to be 6.5% and 4.7% in Sub-Saharan Africa (Gilks C *et al.*, 2016), and 7.5% and 4.3% in china (Kranzer K, Govindasamy D, 2018), respectively. The fact that rates of HIV infection and death among women are higher imply not only gender difference but also gender inequality, leaving women more vulnerable to its impact, which implies the need for strengthening HIV care and support more among females to curb the challenge.

In this study, the highest number of deaths was noticed in the 2nd and 3rd years of follow up. This could be attributed to eligibility criteria, change of guideline for ART initiation and project driven approach care as well as using test and treat immediately, regardless of CD4 count and WHO clinical staging (Alemu AW *et al.*,2015; Abebe N *et al.*, 2014). The other reason may be because of Ethiopia doesn't implement strict follow up care (33) for patients with good adherence at 1st year and 2nd the trust in and awareness of modern medicine was poor, and conversely high in traditional medicine, which patients could consider as an alternative option ((Kranzer K, Govindasamy D, 2018).

The presence of nutrition by prescription program and accessibility of ART was deprived during the period as compared to today. On the other hand, mortality declined in years 2015 and 2016 as compared with earlier years. This might be because of improvement, accessibility and awareness of ART users in Northwest Ethiopia and Asian countries/Nepal (Pefura Y *et al.*, 2017; Govindasamy D, 2018).

Marital status was significantly associated with the survival status of ART users. Those who were not married were more affected by HIV related death compared to married ones. This

finding is similar to finding of a study done in developing countries ([Govindasamy D, 2018](#), [Alemu AW et al.,2015](#); [Abebe N et al., 2014](#)). This might be due to the fact that those adult PLWHA who were out of marriage were at higher risk of exposure to unhealthy lifestyles, as well as they might have been challenged with stigma and discrimination emanated from the community, which can in turn lead to poor compliance to treatment.

Lack of or minimal participation in any working opportunity to generate income can push them to more risks compared to individuals who have social and family support. On the other hand, those who were not married might have wider sexual network, which leads to super infection of HIV and infections of sexually transmitted diseases that can result in double burden increasing risk of mortality.

In this study, mortality was higher among adult PLWHA who had developed immunologic failure, WHO clinical stages III and IV, low CD4 count, severe and moderate malnutrition, bed ridden in functional status and abnormal liver function test results compared to their counterparts in the five year follow up period. These findings are in line with other middle and low income countries ([Ankomah A et al., 2016](#); [Hontelez JA et al., 2016](#)). This indicates that those vulnerable PLWHA to having an advanced stage of the disease are usually accompanied by multiple challenges, co-morbidities and humble prediction of outcome. In addition, such outcome indicates a very low performance to meet the expected UNAIDS targets for Ethiopia by 2020 in spite of the fact that Ethiopia has launched “appointment spacing model approach care (few/two visit per year of clinics by PLWHA)”.

Conclusion: the incidence of HIV mortality was 11 deaths per 1000 person- months, whereas most deaths (20%) occurred during the 18-24 month follow up period interval. Females are at higher probability of dying from AIDS related causes. Marital status, functional status, education level, disclosure of HIV status, having care givers/support, abnormal test of liver function, presence of opportunistic infection, malnutrition were found to be independent predictors of AIDS related mortality.

These findings imply that applying an action/intervention towards these leading cases of mortality as routine and as part of the new approach care “appointment spacing model care (ASMC)” can reduce mortality and can be a sustainable clinical care other than project driven intervention of HIV care. Further longitudinal study that explores on the address real lively hood and methods of tracing is recommended.

Finally, it is price mentioning some weaknesses of this study. First, mortality might be underestimated, since patients lost to follow-up probably include individuals dying at home

without being reported. In addition to this, since secondary data was used for this study, it was impossible to include some key variables such as economic status and psychological distress that need to be included in this study. There was also incompleteness of records for some of the patients enrolled on ART. On the plus side, because the study was done during the time when Ethiopia is striving to achieve its recently planned “with the new approach of ASMA,” the findings may give better insights into the problems that shall be considered to achieve the goal.

4

Chapter 4: Predictors of Under Nutrition and Its Implication toward HIV Continuum Care among Adult People Living with HIV in Jimma Zone Public Hospitals, Southwest Ethiopia: A Mixed Method Study



Aderajew Nigusse Tekelehaimanot, MPH1 ,Tefera Belachew Lemma, MD, MSC, PHD1, Esayas Kebede Gudina, MD, PhD1 , Masrie Getnet, MsC1, Demuma Amdisa, MPH1, and Lelisa Sena Dadi, MPH/EP, PhD1: Predictors of Under Nutrition and Its Implication toward HIV Continuum Care among Adult People Living with HIV in Jimma Zone Public Hospitals, Southwest Ethiopia: A Mixed Method Study 19(5); 2021.

Abstract

Background: A bidirectional relationship exists between nutrition and HIV/AIDS. Poor nutrition has been associated with unsuppressed viral loads among People Living with HIV/AIDS (PLWH) while HIV infection leads to poor nutrition. HIV treatment, care and support efforts should thus incorporate nutrition management. Despite the fact that various scholars have researched the dietary status of PLWH, there is paucity of explorative research exploring factors that drive feeding practice among adult PLWH. This study therefore aimed to explore the predictors of under nutrition among adult PLWH.

Objectives: The study aimed to see predictors of undernourished and its implication towards HIV continuum care.

Study Design: unmatched case-control study was conducted among 678 individuals in Jimma zone, southwest Ethiopia.

Methods: This is unmatched case-control study conducted among PLWHA aged 18 years and above. Cases/undernourished were defined to be those PLWHA who had body mass index (BMI) less than 16 kg/m², which implies severe under nutrition or those who had moderate mild under nutrition (BMI 16.5-17.4 kg/m²). Controls were PLWHA who had normal nutritional status (BMI between 18.5 kg/m² and 24.9 kg/m²). In addition in-depth interviews of ART service providers, ART coordinators, community advocators, and adult PLWHA were conducted and supplemented to the quantitative data.

Randomly selected data of 339 PLWHA who had poor nutritional outcomes (cases) and 339 without undernourished (controls) were analyzed. Logistic regression was used to identify forecasters of undernutrition. The quantitative results were supplemented from key informants who work closely on HIV care, and data were coded and analyzed thematically

Results: Rural residence (AOR :1.8; 95% CI: 1.2, 6.4), female (AOR: 2.9; 95% CI: 1.1, 4.3), unstable livelihood (AOR: 5.1; 95% CI: 4.2, 19.6), low meal frequency (AOR: 6.6; 95% CI: 5.2, 21.1), less diversified foods (AOR: 3.5; 95% CI: 1.2, 14.3), and advanced WHO clinical stage (AOR: 4.3; 95% CI: 3.6, 13.7) and were found to be independent predictors of undernourishment. No social support advanced clinical stage, and unstable livelihood adversely affect nutritional status of PLWHA from the qualitative data.

Conclusions: The socio-cultural, economic, and health-system factors inhibit ideal patient nutritional status. Better tracking, enhanced livelihood and social support along with drug therapy, food aid needs to consider for PLWHA.

Key terms: Adult, BMI, PLWHA, Public Hospitals, Undernutrition

❖ **What do we already know about this topic?**

HIV-induced immune impairment and its resulting opportunistic infections (OIs) can decrease food intake; increase energy expenditure; cause nutrient malabsorption; and alter the body's ability to utilize and excrete nutrients leading to nutritional deficiencies health problems. Nutritional deficits can, in turn, hasten the progression of HIV infection and increase the risk of developing OIs. This, in turn, affects overall clinical outcomes, quality of life, and chances of survival.

❖ **How does your research contribute to the field?**

Nutritional support and improvement of livelihood are very crucial to ensure HCC for the following reasons: (1) low BMI is associated with higher mortality and have poor outcome of ART (2), food and nutrition can improve adherence to treatment and retention in care. (3) in addition to Food and nutritional support stable livelihood can support the quality of life for PLWHA.

❖ **What are your research's implications toward theory, practice, or policy?**

Ethiopia badly needs, improvement of livelihood/income generation opportunities and behavioral change on dietary diversity to address nutritional problems at the grass root level, rather than symptomatic treatment and donor driven program **food by** prescription which may affect the outcome of HCC.

Introduction

HIV prompted immune impairment and its occasioning opportunistic infections (OIs) can diminution Appetite; intensification energy outflow; effect on malabsorption; and vary the body's capability to operate and evacuate nutrients prominent to nutritional deficits and unfortunate overall nutritional status ([Food and, Nutrition Technical Assistance Project, 2014](#)). Nutritional shortfalls can, in turn, accelerate the movement of HIV infection and rise the hazard of emerging OIs ([Dagus C et al., 2019](#); [Ivers LC et al., 2018](#)).

In people with high HIV prevalence the adverse interactions between undernourished and HIV can influence health system of a nation ([Kalofonos IA ,2010](#); [UNAIDS, 2016](#); [Colecraft E ,2018](#)). Highly active antiretroviral therapy (HAART) is believed to be a key to HIV allied degenerative. Nonexistence of diet, food insecurity, and the concern about diet has been shown to decrease treatment faithfulness ([Dagus C et al., 2019](#); [Ivers LC et al., 2018](#); [Kalofonos IA ,2010](#)). Furthermore, starvation and medicine for opportunistic infections may interact in ways that reduce the efficacy of HAART, and HAART itself might influence metabolism, as

well as causing side effects that lead to reduce desire for food (Shutes E, *et al.*, 2017 ; Musumari PM *et al.*, 2018; Cantrell RA *et al.*, 2018).

Ethiopia has been reducing incidence of adult HIV status from 6.5% to 1.5%, but this symbol represents a huge number of individuals: 793,700 PLWHA plus 200,300 children (Kalofonos IA ,2010; UNAIDS, 2016; Colecraft E ,2018). of who 420,000 (59% of those in need) are now receiving HAART(Cantrell RA *et al.*, 2018). Alternatively, around 9% of Ethiopia's people is undernourished and the country's rate of stunting is 38% ((Shutes E, *et al.*, 2017 ; Musumari PM *et al.*, 2018; Cantrell RA *et al.*, 2018). It is, realistic to expect that many PLWHA receiving HAART in Ethiopia can't get sufficient, worth and amount diet. Alternatively, nutritional support with early initiation of ART has been known to have a substantial role to interruption the vicious circle between HIV and malnutrition (Ndekha M *et al.*, 2019; Rawat R *et al.*, 2010).

However, thoughtful of in what manner starvation, HIV behavior and what factors stimulus individuals' risk of undernutrition while on HAART in developing countries like Ethiopia is still marked with a relatively few studies conducted given the huge overlap among food insecurity, undernutrition, and HIV-infection. In this regard, several studies have focused on assessing recovery rate and benefit of nutritional support, the magnitude and distribution of undernourished (Lewis S *et al* ; 2018; Fufa H *et al.*, 2019). The intention of this research was to assess the predictors of undernutrition and its implication towards Human Immuno virus and HIV continuum care (HCC) among adults PLWHA in in south west Ethiopia.

Methods and Materials

Study setting: The study was conducted in five public hospitals found in southwest Ethiopia; namely: Jimma Medical center, Shenen Gibe, Seka, Agaro and Limugent Hospitals. Jimma zone is found in Oromia Regional State, to Southwest of Ethiopia at a distance of 355 kilometers from from the Capital city of the country Addis Ababa. During the study period, a total of 11,186 adults and 2,683 pediatric PLWHA were on chronic HAART care.

Study design and population: This is unmatched case-control study conducted among PLWHA aged 18 years and above. Cases/undernourished were defined to be those PLWHA who had body mass index (BMI) less than 16 kg/m², which implies severe undernutrition or those who had moderate mild undernutrition (BMI 16.5-17.4 kg/m²). Controls were PLWHA who had normal nutritional status (BMI between 18.5 Kg/m² and 24.9 kg/m²). In addition in-depth interviews of ART service providers, ART coordinaters, community advocators, and

adult PLWHA were conducted and supplemented to the quantitative data.

Sample size and sampling procedures: The sample size was calculated using G-Power software using double-population proportion formula. Our outcome of interest was predictors of undernutrition for PLWHA. We estimated the proportion of the patient population that would be malnourished by reviewing patient records to find how many patients had reported problems with severe or moderate undernutrition at initiation of ART by BMI.

The percentage of PLWHA with undernourished was 19% and the adjusted odds ratio for the association between consumption problem was 2.4, one-to-one ratio of control to a case (Wasie B *et al.*, 2013), a 5% level of significance and a power of 80% were considered. Accordingly, the overall sample size was 678 (339 cases and 339 controls) PLWHA. We selected our sample by extracting a list of all of the eligible patients on ART in the clinic from the clinic registration book. This list was divided into cases and controls based on the patient BMIs recorded in the registration book. We then used simple random sampling to select participants from the case and control lists using SPSS (version 20). The sample size was allocated to each of the hospitals based on probability proportional to sample size of cases (1,231) and controls (9,955).

The aim of in-depth interviews were used as exploratory of the predictors for undernutrition among 14 study participants from HAART service providers, community advocator, HAART coordinators, and adult PLWHA, who were purposively selected considering their roles and experiences they had to provide rich and relevant information. Finally, research team leader made further probe the content of the field notes and debriefing sessions.

Data collection and instrument: Data was collected using interview administered questionnaire. Economical status was assessed using wealth index, which was determined by Principal Component Analysis (PCA). Out of 24 variables namely source of income in the last 12 months 8 variables were extracted in the final iteration. three variables were highly loaded on the first and second PCA components, namely own mobile, bed with sponge, fuel, charcoal, household farmland, households own sheep, goats and two variables in the third component namely having a refrigerator and fuel electricity.

Therefore, the wealth index score was made by eight variables with three components that explained a total variance of 66.86% and Kaiser Meyer Olkin measure of sampling suitability 0.75 with Bartlett's test of sphericity at a worth of 0.001.

Data analysis: The data were entered into Epi data version 3.14 Software and transferred to

SPSS for window version 20.0 Software. At the outset, frequencies tables were computed to summarize socio demographic information of the study participants. Secondly, bivariate analysis was carried out to identify candidates of the outcome variables at P-value ≤ 0.25 . Multivariable logistic regression was used to assess the adjusted odds ratio and variables were considered significant if the p-value is <0.05 . Before the inclusion of predictors to the final logistic regression model, the multi-collinearity was checked using the Variance Inflation Factor (VIF) <10 for continuous independent variables. The goodness of fit of the final logistic model was tested using Hosmer and Lemeshow test at a p-value of >0.05 . Outcome measures were indicated by the odds ratio with 95% confidence interval, and the significant association was declared at $p < 0.05$ for the final model.

We have developed a four team of the qualitative data as exploratory indicators of the quantitative data, such as: household food insecurity situation, challenges with food by prescription program and Food Aid, stigma and challenge of HIV continuum care and dietary diversity and coping mechanisms of PLWHA.

Ethical Approval and Informed Consent

This study was approved by the institutional review board of the Institute of Health Jimma University, Ethiopia (Ref. No. IHRPGC/1095/2017). All participants provided written informed consent prior to enrollment into the study, and data were explained in aggregated way to maintained confidentiality throughout the data analysis and manuscript preparation.

Results

4.1 Background characteristics of People living with HIV

Majority of the study participants were females who constituted 239 (70.5%) and 215 (63.4%) among cases and controls, respectively. Urban residents comprised more than two-third both in cases 216 (63.7%) and controls 248 (73.3%). Close to three in ten of both cases (29.7%) and controls (28.9%) were able neither to write nor to read. Another three in ten of cases (30.9%) and controls (29.6%) were either unemployed or daily laborers (**Table 1**).

Table 1. Socio-Demographic Characteristics of Adult PLWHA, Jimma Zone Public Hospital, South West, Ethiopia, September 2018.

Variables		Cases No (%)	controls No (%)
sex	Female	239 (70.5)	215 (63.4)
	Male	100 (29.5)	124 (36.6)
Residence	Rural	123 (36.3)	91 (26.84)
	Urban	216 (63.7)	248 (73.3)
Age	18-24	16 (2.5)	19 (5.6)
	25-34	180 (24.7)	179 (52.8)
	35-44	88 (48.1)	92 (27.1)
	≥45	55 (24.7)	49 (14.45)
Marital status	single	84 (24.8)	120 (35.4)
	married	155 (45.7)	149 (43.9)
	divorced	66 (19.5)	10 (2.9)
	separated	19 (5.6)	23 (6.8)
	widowed	15 (4.4)	37 (10.9)
Religion	Orthodox	145 (42.8)	185 (54.3)
	Muslim	131 (38.6)	120 (35.4)
	Protestant	38 (11.2)	24 (7.1)
	Others	25 (7.4)	10 (2.9)
Ethnicity	Oromo	178 (52.5)	168 (49.5)
	Amhara	84 (24.7)	95 (28.0)
	Kaffa	38 (11.3)	44 (12.9)
	Dawro	24 (7.0)	19 (5.6)
	Others	15 (4.4)	13 (3.8)
	Educational status	Illiterate	101 (29.7)
Read and write		48 (14.1)	57 (16.8)
5-8 primary		94 (27.7)	103 (30.3)
9-12(secondary)		40 (11.7)	46 (13.5)
Collage and above		56 (16.6)	35 (10.3)
Employment status	Gov't employee	69 (20.3)	72 (21.2)
	Farmer/student/retired	73 (21.5)	67 (19.7)
	Unemployed	29 (8.5)	40 (11.7)
	House wife	28 (8.2)	34 (10.0)
	Daily laborer	76 (22.4)	61 (17.9)
	Merchant/private business	64 (18.8)	65 (19.1)
		49 (14.6)	334 (98.6)
Household food security status	Food secure	290 (85.4)	5 (1.4)
	Food insecure	290 (85.5)	5 (1.5)
Wealth index	Poor	43 (12.7)	128 (37.8)
	Middle	43 (12.7)	128 (37.8)
	Rich	6 (1.8)	206 (60.8)

House hold food security and livelihood of PLWHA

A hundred percent of cases reported to have worried about availability of food. While only 55(16.1%) of the controls reported worries about food availability. The study also found that 98.6% of cases and 1.4% controls had household food insecurity. A total of 103 (30.4%) of cases have reported experience of coping mechanisms to support their livelihood. The mechanisms include: borrowing money from family, borrowing food or selling agricultural products, selling property, use of previous savings, mortgaging/renting property and loan from micro-finance /bank/friends. (**Table 2**).

Table 2. Responses Household Food Security Status and Livelihood of Adult PLWHA in Public Hospitals of Jimma Zone, September, 2018

Variables	Cases		Controls	
	Yes (#/%)	No (#/%)	Yes (#/%)	No (#/%)
Availability of food	-	339 (100)	284 (87.7)	55 (16.1)
Utilization of Variety food	7 (2.0)	332 (97.8)	302 (89.0)	37 (10.8)
Respect of counseling service	104 (30.6)	237 (69.3)	314 (92.6)	25 (7.3)
Preparation your food	29 (8.5)	310 (91.4)	309 (91.1)	30 (8.7)
Assurance of livelihood & frequency of feeding	18 (5.3)	321 (94.5)	296 (87.3)	43 (12.5)
availability of support	14 (4.1)	335 (98.7)	301 (88.7)	38 (11.1)
access of Variety food	16 (4.7)	323 (95.2)	318 (93.8)	21 (6.1)
Information on food	11 (3.2)	328 (96.7)	268 (79.1)	71 (20.9)
Way of assurance on stable livelihood	7 (2.0)	321 (94.6)	326 (96.7)	13 (3.8)
Food Aid	103 (30.4)	236 (69.6)	41 (12.0)	298 (88.0)
Household food security status	49 (14.6)	334 (98.6)	290 (85.4)	5 (1.4)

N.B. Way of assurance on stable livelihood: Borrow money from family, Borrow food or sell agricultural products, selling property, previous savings, mortgaging/renting property, Loan from microfinance /bank/friends.

Nutritional diversity practice and livelihood of PLWHA

The study also indicated that majority of the cases 297(87.4 %) reported eating less than the mean dietary diversity while only 58 (17.1%) of the controls reported to have had eaten less diversified foods during the preceding 24 hours of the study. The food types frequently consumed by the controls were cereals 334 (98.4%), oil/fats 324 (95.5%) and condiments/coffee/tea 293 (86.3%), whereas Fish/sea foods 9 (2.7%), eggs 87 (25.6%) were least consumed food groups (**Table 3**).

Table 3. Nutritional Diversity Practice and Livelihood of PLWHA on ART, JIMMA Zone Public Hospitals, September 2018.

Variables	Cases		Controls	
	Yes (#/%)	No (#/%)	Yes (#/%)	No (#/%)
Cereals	254 (74.9)	85 (25.1)	334 (98.4%)	5 (1.6)
Oil/fats	16 (4.7)	323 (95.3)	324 (95.5%)	15 (4.5)
Honey/sugar	18 (5.3)	221 (94.6)	314 (92.6)	25 (7.3)
Pulses/legumes	19 (5.6)	320 (94.4)	309 (91.1)	30 (8.7)
condiments/coffee/tea	3 (0.9)	336 (99.1)	293 (86.3%)	46 (13.7)
Fruits	10 (2.9)	329 (97.1)	301 (88.7)	38 (11.1)
Vegetable	6 (1.8)	333 (98.2)	318 (93.8)	21 (6.1)
Meat	3 (0.9)	336 (99.1)	268 (79.1)	71 (20.9)
Milk/milk product	3 (0.9)	336 (99.1)	326 (96.2)	13 (3.8)
Eggs	-	339 (100)	87 (25.6%)	252 (74.4)
Fish/sea food	-	339 (100)	9 (2.7%)	330 (97.3)
Miscellaneous	27 (8.0)	312 (92.0)	281 (82.9)	58 (17.1%)

No: not use, #: Number, Miscellaneous: three and more foods.

Predictors associated with undernourishment among Adult PLWHA

Rural residents were about two times (AOR: 1.8; 95% CI: 1.2, 6.4) more likely to be undernourished compared to urban residents. Female respondents were almost three times (AOR: 2.9; 95% CI 1.14, 4.3) more likely to be undernourished compared to males. Similarly, the likelihood of being undernourished was more than three times

higher among households who were food insecure (AOR: 3.3; 95% CI: 4.3, 14.4). PLWHA who were in unstable livelihood were five times (AOR: 5.1; 95% CI: 4.2, 19.6) more likely to be undernourished compared to those who had stable livelihood. Those who reported lower meal frequency were six times (AOR: 6.6; 95% CI: 5.2, 21.1) more likely to be undernourished compared to their counterparts (Table 4).

Table 4. Predictors of Undernutrition among Adult PLWHA in Jimma Zone Public Hospitals, South West Ethiopia, September 2018

Variables	Categories	Cases	Controls	COR (95%CI)	AOR (95%CI)	P value
Residence	Rural	No (%) 123 (36.3)	No (%) 91 (26.84)	1.6 (0.3, 4.9)	1.8 (1.2, 6.4) *	0.044
	Urbane	216 (63.7)	248 (73.3)	1		
sex	female	239 (70.5)	215 (63.4)	1.9 (1.3, 5.5)	2.9 (1.1, 4.3) *	0.035
	male	100 (29.5)	124 (36.6)	1		
Kchat chewing	Never	14 (4.1)	29 (8.5)	1		0.498
	Once/twice/monthly	146 (43.4)	130 (38.3)	0.2 (0.1, 4.1)	1.3 (1.1, 17.8)	
	Weekly	90 (26.5)	102 (30.0)	1.8 (0.9, 3.8)	3.4 (2.4, 20.1) *	
WHO at initiation of ART	Daily	89 (26.2)	78 (23.0)	2.2 (0.9, 5.6)	5.3 (2.0, 14.3)**	0.032
	I, II	238 (81.1)	329 (97.1)	1		
Current WHO	III, IV	101 (18.9)	10 (2.9)	2.3 (2.1, 11.2)	3.1 (3.0, 8.6) **	0.001
	I, II	275 (81.1)	339 (100.0)	1		
Hgb at initiation of ART	III, IV	64 (18.9)	0 (0)	3.1 (0.3, 6)	4.3 (3.6, 13.7)**	0.001
	I, II	275 (81.1)	339 (100.0)	1		
Household food security status	8-12mg/dl	282 (83.1)	14 (4.1)	2.5 (1.5, 4.3)	4.1 (1.7, 9.7)	0.003
	Severe (<7mg/dl)	13 (3.8)	4 (1.1)	5.5 (2.8, 10.9)	3.1 (1.6, 8.7) **	
Livelihood status	≥12mg/dl	44 (13.1)	321 (94.6)	1		0.006
	Food secure	49 (14.6)	334 (98.6)	1		
	Food insecure	290 (85.4)	5 (1.4)	2.7 (1.3, 3.6)	3.3 (4.3, 14.4) *	
Meal frequency	Not recorded	23 (6.7)	14 (4.1)	0.2 (0.1, 3.2)	1.3 (1.2, 15.3)	0.052
	Unstable	265 (78.1)	27 (7.9)	3.5 (2.8, 10.9)	5.1 (4.2, 19.6)**	
Dietary diversity	Stable	74 (21.8)	312 (92.1)	1		0.001
	High	18 (5.3)	283 (83.4)	1		
CD4countat initiation of ART	Low	321 (94.8)	56 (12.6)	6.4 (2.8, 10.9)	6.6 (5.2, 21.1) *	0.037
	High	298 (87.9)	22 (6.4)	4.8 (2.4, 11.9)	3.5 (1.2, 14.3) *	
CurrentCD4 count	≥ 500	41 (12.1)	317 (93.6)	1		0.001
	200-499	21 (6.1)	141 (41.5)	1		
	<200	130 (38.3)	153 (45.1)	3.3 (0.65, 8.4)	3.6 (1.4, 9.4)	
Food Aid	≥ 500	188 (55.6)	45 (13.2)	4.5 (3.6, 12.8)	7.2 (6.0, 14.7)**	0.001
	200-499	62 (18.3)	10 (2.9)	4.3 (0.7, 9.4)	4.6 (1.5, 11.3)	
	< 200	34 (10.0)	43 (12.6)	6.3 (3.7, 10.8)	5.4 (4.5, 15.4)**	
Wealth index	Absent	236 (69.6)	298 (88.0)	2.3 (1.8, 3.8)	3.3 (1.9, 7.9) *	0.035
	Present	103 (30.4)	41 (12.0)	1		
Wealth index	Poor	290 (85.5)	5 (1.5)	3.2 (1.4, 8.6)	4.5 (1.8, 9.3)	0.302
	Middle	43 (12.7)	128 (37.8)	2.3 (0.9, 11.4)	3.6 (1.5, 10.0)	
	Rich	6 (1.8)	206 (60.8)	1		

*:P < 0.05, **:P < 0.01, AOR: adjusted odds ratio, CI: confidence interval. The AOR was calculated after adjusting for other independent variables, religions, marital status, and employment status at p < 0.05.

Qualitative Results:

The in-depth interview data were collected to explore the findings of the quantitative study. Finally, we have developed the following themes; Household Food Insecurity situation, Challenges with Food by Prescription program and Food Aid, Stigma and discrimination as a challenge of HIV Continuum care and Dietary diversity and Coping Mechanisms of PLWHA.

A. Household Food Insecurity situation of PLWHA:

Most of the participants were sensitive when they were chatting about food insecurity condition of PLWHA. One of the female ART advocater participants said*“Live alone with the disease and the limited capacity because of the disease HIV, now a day it is difficult to survive even for one BSc graduate Ethiopian with his/her monthly income. Another 36 years old ART coordinator participant explained the food security status of PLWHA by saying “.....You better leave asking such a question because PLWHA is wasted thinking of food and becoming difficult taking their pill without food”.*

Similarly, a 46 years old respondent from PLWHA explained the impact of household food shortage on ART compliance as follows *“.....You have been asking me, what I didn't want to talk; I am suffering in thinking of food and becoming difficult taking the pill without getting food. I can say it is difficult to consume any food on time in my home and I know similar problems with others too.”*

Another 35 years old female participant from rural residence said that.....*“Living is getting expensive for PLWHA; you see “.....I need to eat 6 times per day. The drug needs that much”, But most of the time I couldn't even afford to eat three times per day. Sometimes I feelshame when I visit my friends and eat any food they give me without any hesitation”.*

B. Challenges with food by Prescription program and Food Aid:

The participants also mentioned that the food ration/support they were getting from the program of Food by prescription was inadequate. In addition, it reported to be very small in amount and inconsistent to cover dietary needs of the PLWHA. The discussants mentioned that the problem of getting enough food aid of what one likes is not confined to PLWHA on ART. But when there is increased need to eat and the stakeholders and health system denies the chance of accessing food through BMI as criteria of nutritional wellbeing. Things become worst for nutritional problems and lead to be hopeless for PLWHA.

In addition, almost all participants mentioned some dangerous coping strategies that could even exacerbate the existing prevalence of the pandemic. One 36 years old female from the PLWHA participant said: *“.....Had it not been for God help, you know when you fail to find any food to eat you are obliged to do anything.....anything including changing sex for money”.* All participants recommended some sort of income generating

activities and creating job opportunity for PLWHA on ART as the state-of-the-art food security strategy to sustainably respond the increasing support need of PLWHA on ART regularly other than the symptomatic treatment and criteria based approach of food aid.

A 35 years old male participant of ART service provider said “..... *ART took PLWHA far away from illness and death. But to keep the sustainability of this promising outcome and to start thinking more about their health, they need to have access to job and sustainable livelihood. If they work, they support themselves and their country, thus they don't want any food ration if they have food at home*”.

C. Stigma and discrimination as challenge of HIV Continuum care (HCC):

Stigma and discrimination by relatives, poor counseling, lack of home-based care service, being away from home, religious reasons (wholly water), simply forgetting the pills and especially lack of food were mentioned to reasons for interruption of HCC. A 40 years old female advocator participant said that.....*“I know a PLWHA who discontinued ART. They came to Hospital long after they stopped taking their drugs. I asked some of them friendly why they discontinued their ART. Most of them said that ‘their families and community at large were stigmatizing them a lot. Even they couldn't sell something to their community. People buy from others by passing them; they think as if they put their blood in the goods they sell”*.

Another participant aged 28 years who was ART coordinator explained stigma and discrimination as negative implication of HCC by stating: “.....*If clients are sex workers, they prefer to be happy and live temporary life without thinking about their future. They mostly don't even get social support and become hopeless. This group will not share and communicate their ideas with the community members. They feel loneliness owed to worry of shame and refinement. At the same time, individuals in the community consider as if they would attack them, so such PLWHA may not regularly follow their ART care according the HCC*”.

D. Dietary diversity and Coping Mechanisms of PLWHA:

For majority of the patients food is their big head ache; however, they take their ART despite of adverse effects and insufficient food. Right of entry medicine on the Right time was extremely prized and PLWHA described HAART and food aid as “a new courage for the upcoming life”. When patients were asked directly about what makes them happy in their lives, majority of them mentioned that availability of ART and food by prescription program. But the availability of food at home as demanding is a very critical challenge for

economically poor PLWHA.

The participants also reported some coping strategies; reducing the portion of the food they consume, passing part or whole of meals of the day, selling fixed asset they have, borrowing money from relatives & friends and sending their children to their families were some of the coping mechanisms they mentioned”.

Discussion

In this study, the main predictors of undernutrition were found to be rural residence, less meal frequency, less dietary diversity, Kchat chewing, low level of hemoglobin, difficult livelihood, female, advanced WHO stages both at ART initiation and during the study, presence of OIs and low level of CD4 counts during the study, household food insecurity and lack of food aid.

In this study PLWHA who live in rural settings were more adversely affected nutritionally. This finding is similar with studies done in African countries ([Wasie B et al., 2013](#); [Gary B et al., 2017](#); [Koethe J et al., 2011](#)) which showed that rural residents were prone to undernourishment and poor clinical outcomes. This similarity might be because access and utilization of services are rendered in urban areas as compared to rural. Regarding behavioral factors, participants who chew Kchat frequently were more affected by undernourishment. This is similar to the findings of Butajura ([Gedle D et al., 2015](#); [Kenea MA et al., 2015](#)). This could be because of PLWHA who use substances /alcohol poorly adhere to ART, which in turn may adversely affect nutritional status.

Those PLWHA in an unstable livelihood were more likely to be undernourished. This finding is similar with studies conducted in African countries ([Mfinanga F et al., 2017](#); [Andrade C et al., 2012](#)) which shows that unstable livelihood was strongly associated with poor nutritional status. This could be because of low economic status and poor working capacity, both of which lead to a lack of access to sufficient foods, consequently resulting in undernourishment.

PLWHA who had advanced WHO stages at ART initiation were more likely undernourished than those who had WHO stage I and II. This finding is inline with the studies conducted in Kenya and South Africa ([Gedle D et al., 2015](#); [Kenea MA et al., 2015](#)) that patients with WHO stage III and IV reported to have a poor nutritional status than their counterparts. On the other hand, studies conducted in similar settings ([Wasie B et al., 2013](#); [Gary B et al., 2017](#); [Koethe J et al., 2011](#)) revealed that symptomatic patients significantly presented with undernutrition. In this regard, Ethiopia has only one program which is called “ food by

prescription” which mainly focuses on symptomatic PLWHA.

The present study identified clinical related predictors of undernourishment were low level CD4 count at ART initiation , advanced WHO stage both at ART initiation and during the study and , low level of hemoglobin. Similarly, behavioral and demographic factors such as kchat chewing, low meal frequency, household food insecurity, absence of food Aaid and low dietary diversity, rural residence, female gender, unstable livelihood were significantly associated with undernourishment.

The qualitative findings indicated that, nutritional support and improvement of livelihood are very crucial to ensure HCC for the following reasons: (1) low BMI is associated with higher mortality and have poor out come of HAART (2), food and nutrition can improve adherence to treatment and retention in care.(3)in addition to Food and nutritional support stable livelihood can support the quality of life and HCC for PLWHA.

Limitation

A limitation of this study is that BMI has been used as criteria for the selection of cases and controls. BMI detects simply protein-energy malnutrition/macronutrient problems. A further prospective study on a large size of study participants or randomized clinical trials is needed to better understand the actual predictors of undernourishment both macro and micro nutrients among PLWHA for evidence based action.

Conculssion

Ethiopia badly needs, improvement of livelihood/income generation opportunities and behavioral change on dietary diversity to address nutritional problems at the grass rout level, rather than symptomatic treatment and donor driven program food by prescription which may affect the outcome of HCC.

HIV-induced immune impairment and its resulting opportunistic infections (OIs) can decrease food intake; increase energy expenditure; cause nutrient malabsorption; and alter the body’s ability to utilize and excrete nutrients leading to nutritional deficiencies health problems.

Nutritional deficits can, in turn, hasten the progression of HIV infection and increase the risk of developing OIs. This, in turn, affects overall clinical outcomes, quality of life, and chances of survival. Nutritional support and improvement of livelihood are very crucial to ensure

HCC for the following reasons: (1) low BMI is associated with higher mortality and have poor out come of ART (2), food and nutrition can improve adherence to treatment and retention in care, (3) in addition to Food and nutritional support stable livelihood can support the quality of life for PLWHA.

5

Chapter 5: Intention Toward Dietary Diversity Among Adult People Living With HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior. A Mixed Methods Study



Aderajew Nigusse Tekelehaimanot, Mph¹, Tefera Belachew, MD, MSC, PHD¹ , Esayas Kebede Gudina, MD, PhD² , Masrie Getnet, MSc³ , Demuma Amdisa, MPH⁴ , and Lelisa Sena Dadi, MPH/EP, PhD³:Intention Toward Dietary Diversity Among Adult People Living With HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior. A Mixed Methods Study. 58 (5).2022.

Abstract

Dietary diversity is a crucial element of inclusive care for people living with HIV (PLWHIV). Particularly, in resource-limited countries where undernutrition and food insecurity prevail, low intention and poor attitude towards diversified diets are the common challenges. The aim of this study was to assess the intention towards dietary diversity behavior among adult PLWHIV in Jimma Zone Public Hospitals, Southwest Ethiopia. Hospital based survey study was carried out in five public institutions among sampled 403 adult PLWHIV. Data were entered into Epi-Data and exported to SPSS version 20 for analysis. Relationships among variables were assessed using correlation coefficients. Multivariable linear regression model was fitted to assess predictors of behavioral intention towards dietary diversity at P values < 0.05 . The quantitative data was supplemented by qualitative data, which was collected through key informant interviews and analyzed thematically. The significant predictors of intention to use dietary diversity were attitude ($\beta = 0.196$, $P < 0.01$) and subjective norm ($\beta = 0.390$, $P < 0.01$) of the adult PLWHIV. The constructs of theory of planned behavior (TPB) independently explained the variance in intention towards dietary diversity by 25.7%. All the intermediate, proximal and distal components of TPB explained the final model by 32.2% of variance in the intention to use dietary diversity. The qualitative findings indicated that, delivery of HIV care requires a sense of livelihood development, economical improvement, creating sense of ownership for sustainable HIV care by creating behavioral change at individual level. Dietary inadequacy was strongly correlated with being in the sociodemographic groups that are at high risk of adverse clinical outcomes. It worth's while to intervened behavioral intention as a potential determinant of the clinical outcomes rather than symptomatic treatment of malnutrition.

Key words: Behavior, dietary diversity, Intention, Jimma Zone, PLWHIV

What do we already know about this topic?

- Poor dietary diversity can, in turn, hasten the progression of HIV infection and increase the risk of developing opportunistic infections (OIs).
- Optimal nutrition can help boost the immune function, maximize the effectiveness of ART, reduce the risk of OIs, and improve the overall clinical care and life expectancy
- Under nutrition is more common among PLWHIV with advanced clinical stage, untreated ones, those who experience poor livelihood.

How does your research contribute to the field?

- Assuring adequate access to food in HAART treatment programs has been a central demand of PLWHIV in low-income countries
- Food by Prescription Program involves nutritional assessment, counseling and support to address nutritional problems in malnourished patients with HIV.
- Food by Prescription program is challenged by individual, institutional, community and health system-related factors

What are your research's implications towards theory, practice, or policy?

- Intention can be used to extend theories and to design interventions, which can increase the ability of those programs to change behavior rather than treating only malnutrition of the PLWHIV
- Scholars criticize this program by saying” symptomatic treatment is very expensive/the cheap intervention is very expensive
- It worth's while to intervened behavioral intention as a potential determinant of the clinical outcomes for sustainable HIV care.
- The paradigm model is supportive and can be suggested for application of any behavioral change programs considered to prevent under nutrition and improve quality of life through education to be focused on subjective norm, attitude, and social norms other than food by prescription program which is focused on symptomatic treatment.

Introduction

A many-sided and negatively emphasizing the liaison occurs among infection with Human Immune Deficiency Virus (HIV) and behavioral intention (Ajzen, I, 1991). Poor dietary diversity can, in turn, hasten the progression of HIV infection and increase the risk of developing opportunistic infections (OIs).thus; they require greater protein and micronutrient intake in order to improve the weakened immune system (Mangili, A *et al.*, 2011; Ahoua, L *et al.*, 2017). Optimal nutrition can help boost the immune function, maximize the effectiveness of ART, reduce the risk of OIs, and improve the overall clinical care and life expectancy of PLWHIV (Ahoua, L *et al.*, 2017).

Undernutrition is more common among PLWHIV with advanced clinical stage, untreated ones, those who experience poor livelihood and food insecurity (Bandura A, 1997) is understood to be the best solution to HIV-related wasting syndrome and under nutrition (HDDS,2018).

In Ethiopia, 9% PLWHIV are severely malnourished and 25% are moderately malnourished (Bukusuba J *et al.*, 2017; Castleman T *et al.*, 2017). Assuring adequate access to food in HAART treatment programs has been a central demand of PLWHIV in low-income countries and, as such, nutrition by prescription and therapeutic feeding has been assimilated (Pee S *et al.*, 2010; Adal M , 2019; Global HIV Prevention working Group, 2017).

A number of development partners have been participated in planning and implementation of major initiatives and programs for HIV treatment, prevention, care and support in Ethiopia and Africa at large. For example, “3 by 5” initiative was designed to treat 3 million people in 2005. “Getting to Zero” was a theme of the 2015 World AIDS Day commemoration targeted to achieve “Zero new HIV infections, Zero discrimination and Zero AIDS- related deaths.” “Treat all” food by Prescription, appointment spacing model care and HIV continuum care, are other strategies that eloquently promote the universal HIV care coverage to ensure that all HIV positive individuals received ART irrespective of their CD4 count, World Health Organization (WHO) clinical stage or viral load.

From the list above the direct program to nutritional care is Food by Prescription Program involves nutritional assessment, counseling and support to address nutritional problems in malnourished patients with HIV. However, lack of food exists. the program is challenged by individual institutional, community and health system-related factors and scholars criticize this program by saying” symptomatic treatment is very expensive/the cheap intervention is very expensive”. As far as authors’ knowledge is concerned, there is no evidence regarding

the behavioral intention towards dietary diversity condition of PLWHIV in Ethiopia. Thus, this study was assessed behavioral intention of PLWHIV towards dietary diversity which is very critical in settings like our country Ethiopia with multi-cultural practice.

2. Methods and Materials

2.1. Study area and period: Hospital-based study was conducted in the Jimma zone five public hospitals (Jimma Medical Center, Shenen Gibe, Agaro, Seka and Limmu hospitals) from March to May 2018. During the study period, a total of 11,186 adults and 2,683 pediatric individuals were on chronic HIV care (from five public hospital data base).

2.2. Study population: Randomly selected 403 adult (≥ 18 years) PLWHIV were included into the study. However, patients who were too sick and HIV positive adults with additional chronic non communicable disease such as: diabetes mellitus, hypertension and current pregnancy were excluded.

2.3. Sample size and sampling procedure: Single population proportion formula was used to estimate the study sample size with the assumptions of prevalence of 50 %, confidence level of 95%, 5% margin of error, and 5 % allowance for non- response rate.

The study participants were allocated proportionally based on the number of HAART patients in each hospital, then, 403 samples were drawn from the total listed patients' records.

2.4. Data collection tools and procedure: Based on their relevance, most of the question items in the tools were adapted from TPB (Uthman A, 2017, Ajzen, I, 1989). The format for the questionnaire consists of seventy five items separated into nine domains. The first domain was assessed PLWHIV knowledge on dietary diversity (14 items), the second domain was to ascertain the future and past behavioral intention of PLWHIV (2 items), the third domain was about behavioral beliefs (6 items), the fourth domain was about outcome evaluation (6 items), the fifth, sixth, seventh and eighth deal with normative beliefs (9 items), motivation to comply (9 items), control beliefs (4 items) and power of control (4 items), respectively and the ninth domain was background information (20 items).

Additionally, in-depth interview was conducted to explore facts related to intention to wards dietary diversity behavior and to exploring the quantitative findings. The interview was undertaken among 14 informants including: adult PLWHIV who were on chronic follow up of HAART in the hospitals, HIV-care providers working in ART clinic, case managers, and HIV care system administrators who work as focal person of ART clinic.

2.5. Data processing and analysis: data were coded and entered to EPI-data version 3.14, and then exported to SPSS version 20.0 for analysis. Independent variables with $P \leq 0.25$ at

bivariate analysis level were entered into multiple linear regressions to control potential confounders. Finally, variables, which have $P \leq 0.05$ within respective confidence intervals (CIs) at multiple linear regression analysis, were considered to be independent predictors of dietary diversity behavior of PLWHIV. The relationship and steps of data analysis indicated in the conceptual framework stated below (fig 1).

2.8. The Theory of planned behavior (TPB/IBM)

The construction of a new questionnaire for this study was according to the guidelines for the construction of a standard theory of planned behavior questionnaire (Depee S, Semba RD, 2010). A new questionnaire is formulated for this study using question items from the Mozambique study on impact of individual differences on the willingness of dietary diversity(DDS) ([Global HIV Prevention working Group,2016](#); [Uthman OA,2018](#)) to fit the HCC in Ethiopian context.

The format for the questionnaire consists of seventy five items separated into nine domains. The first domain were assessed knowledge on of DDS (14 items), the second domain were ascertain in the future and past behavioral intention (02 items), the third domain were asked about their behavioral beliefs (6 items), the fourth domain were ask about their outcome evaluation (6 items), the fifth, sixth, seventh and eighth were ask their normative beliefs (9 items), motivation to comply (9 items), control beliefs(4 items) and power of control (4 items) respectively and the ninth domain were ask their background information (8 items).

The questionnaire was developed in a way that multiple questions can be collapsed into one or a set of variables whose reliability can be measured.

Most of the questions were prepared on a Likert scale where respondents were asked to indicate how strongly they agree or disagree (having a scale ranging from 1 strongly disagree to 5 strongly agree). This type of response format allows the study participants to choose carefully response that best represents their opinion or feelings. The face and content validity of the questionnaire were assessed by experts and health educators and the feedbacks from the revision were incorporated into the questionnaire for the data collection exercise. The Cronbach Coefficient Alpha for each measure was calculated to assess the reliability - a cut-off of 0.75 or higher scores were accepted for all the scales. (Fig 1).

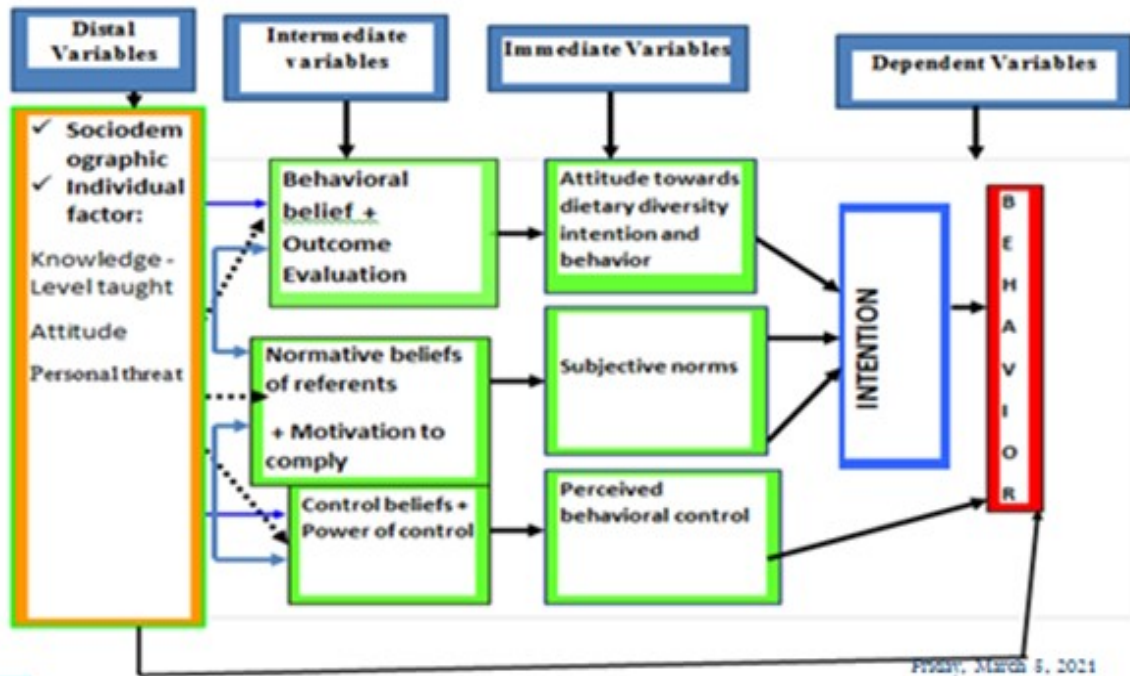


Fig 1. The Conceptual the conceptual frame work of the study Adapted from theory of planned behavior, Ajzen 1991

2.6. Ethical Approval and Informed Consent: This study was approved by the institutional review board of the Institute of Health Jimma University, Ethiopia (Ref. No. IHRPGC/1095/2017). All participants provided written informed consent prior to enrollment into the study, and data were explained in aggregated way to maintained confidentiality throughout the data analysis and manuscript preparation.

2.7. Operational Definition of Terms

Chronic Energy Deficiency (CED): is inadequate amount and combination of energy or nutrients to carry out needed physiological functions with BMI <18.49kg/m².

CED: it was determined by calculating BMI as $WT (kg)/Ht(m)^2$.

Chronic CED: is BMI <18.49kg/m².

CED (BMI = < 18.49 Kg/m²), not CED (BMI > 18.5) ([Global HIV Prevention working Group,2016](#); [Uthman OA,2018](#))

Drug adherence status: it was estimated by percent of missed dose enclosed in the last 6 month follow-up time from patient ART follow-up form combined with self-reported adherence measurement technique by asking the patients about the number of times they have missed taking their pills in the last month (for patients coming every month) and two months (for patients coming every two months). The category was based on WHO classification.

Good adherence: there is good adherence if the average adherence is greater than 95% (If he/she missed):-

- ≤ 2 doses of 30 doses (1 month)
- ≤ 3 doses of 60 doses (2 month)

Fair adherence: there is fair adherence if the average adherence is 85%–94% (If he/she missed):-

- 3–5 doses of 30 doses (for 1 month)
- 3–9 doses of 60 doses (for 2 month)

Poor adherence: there is poor adherence if the average adherence is $< 85\%$ (If he/she missed):-

- ≥ 6 doses from 30 doses (for 1 month)
- > 9 doses of 60 doses (for 2 month)

Functional status

- Working-Able to perform usual work in or out of the house, harvest, goes to school.
- Ambulatory-Able to perform activities of daily living.
- Bedridden-Not able to perform activities of daily living (Senna, A et al., 2014; Sztam, K et al., 2013).

Body mass index (BMI): was calculated as the weight in kg divided by height in meters squared (kg/m^2). All hospitals use following cut points.

- 18.5-24.9 kg/m^2 = Normal (1)
- 16-17.5 kg/m^2 = Moderate chronic energy deficiency (2)
- < 16 kg/m^2 = severe chronic energy deficiency (3)

Household food insecurity access scale (HFIAS): It reflects 3 different domains of food insecurity such as anxiety or uncertainty, insufficient quality and insufficient quantity. Each one of the question refers to a previous period of four weeks (30 days). The subject that was interviewed is first asked about the occurrence of food insecurity, in other words if the condition reflected in the question took place in the last four weeks (yes or no). If the subject answers affirmatively to this type of question, another question is asked about the frequency to determine if the condition has occurred a few times (once or twice), sometimes (between three to ten times) or frequently (more than 10 times) in the last four weeks. In this manner,

Food insecurity status was measured using household food insecurity access scales (HFIAS)

Food security- study participants who has 0 score (no occurrence) of HFIAS questionnaires.

Mildly food insecure household: worries about not having enough food sometimes or often, and/or unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely and but not experience running out of food, going to bed hungry, or going a whole day and night without eating

A moderately food insecure household: sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes, But it does not experience any of the three most severe conditions.

high food insecure household: has move on cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating) or experiences one of these three conditions even once in the last 30 days is considered severely food insecure

Dietary Diversity Score: indicator guide adopted from Food and Nutrition Technical Assistance (FANTA), 2006 was utilized to obtain data on dietary diversity. The HDDS was further used as a proxy measure of food access component of food security because enhanced food access ensures intake of more diverse diets within the household.

Attitude towards the use of diversified food: An individual's predisposition to respond in favorable or otherwise was constructed from items of behavioral belief and evaluation of belief. Attitude score was, therefore, derived by multiplying each of the items in belief about use of diversified food with the corresponding items.

Household food security : the ability of household members to have the type of food they need at the time they need it sufficiently to meet their dietary needs and food preferences for an active and healthy life. It is assessed by asking whether the household has enough food or money to meet its basic food needs and on the normal behavioral and subjective responses to that condition, as these have been observed.

Dietary Diversity: the number of different foods and food groups consumed in a household provides a measure of the quality of the diet by reflecting dietary diversity, thus serving as an important complement to the eating occasion indicator.

To accurately capture dietary diversity, this indicator should be evaluated in terms of the variety of food groups (meats, milk, fruits, and vegetables) consumed, rather than by simply totaling all types of foods consumed. Increases in dietary diversity are associated with increase in consumption, caloric availability and calories from staples and non-staples. Hence, dietary diversity is a promising proxy indicator of household food security. The disadvantage of this measure is that the simple form of this measure does not record quantities ([Thang et al., 2016](#)).

Intention to use diversified food: Respondents' plan to use diversified food in the near future during their usual feeding was measured through three questionnaire items. Responses to each of the three questionnaire items ranged from 1=not likely at all to 5=very likely, resulting in summation scores for intention that range from three to fifteen.

Normative belief towards using diversified food: The perception held by an individual whether significant others think that s/he should use diversified food consistently was constructed through five questionnaire items. Responses to each of these items ranged from 1 strongly disagree to 5 strongly agree, resulting in summation scores that range from five to 25.

Motivation to comply with normative beliefs: Individual's motivation to comply with referents' wishes about using diversified food was measured through five questionnaire items. Responses to each of these items ranged from 1 strongly disagree to 5 strongly agree, resulting in summation scores that range from five to 25.

Subjective norm: Individual's perception that significant others think her/him to use diversified food as a normative action was constructed from items of normative belief and motivation to comply. Subjective norm score was, therefore, derived by multiplying each of the items in normative belief with the corresponding items in motivation to comply.

Belief in control of use diversified food: One's belief about the presence of factors that might hinder or facilitate the use of diversified food was measured through four questionnaire items. Responses to each of these items ranged from 1 very unlikely to 5 very likely, resulting in summation scores that range from four to 20.

Power of control belief: Perceived ability of individuals to control the factors that might hinder the use of diversified food consistently was measured through four questionnaire items. The responses to each of these items ranged from 1 completely uncertain to 5 completely certain, resulting in summation scores that range from four to 20.

Behavioral control): perceived easiness or difficulty associated with the use of diversified food was constructed by multiplying each item in belief with the power to use belief.

Results

5.1. Socio demographic Characteristic of Adult PLWHA in Jimma zone Public Hospitals

A total of 403 adult PLWHIV, of whom 196 (48.6%) were females, participated in this study. The mean age of the study participants was 29.5 (± 8.4) years. Concerning to marital status, 233 (57.8%), 81 (20.1%) and 46 (11.4%) were married, divorced and single, respectively. More than half, 236 (58.6%), of the study participants were urban residents.

Only less than a third (31.8%) of the respondents reported to be food secured whereas more than a third (37.8%) of them reported to be food insecure with either moderate (20.8%) or severe (16.8%) hunger (Table 1).

Table1. Sociodemographic characteristics of adult people living with HIV, In Jimma Zone public hospitals, Southwest Ethiopia, May 2018.

	Variables	Frequency	Percentage (%)
Sex	Female	196	48.6
	Male	207	50.4
Residence	Rural	167	41.4
	Urban	236	58.6
Age in Years	18–24	84	20.8
	25–34	140	34.7
	35–44	111	27.5
Marital Status	≥ 45	68	16.9
	Single	46	11.4
	Married	233	57.8
	Divorced	81	20.1
Religion	Separated	26	6.5
	Widowed	20	4.2
	Muslim	186	46.2
Educational Status	Orthodox	142	34.9
	Protestant	72	17.7
	Others	3	0.7
	Cannot read and write	51	12.7

	Read and write	47	11.7
	5–8 Primary	64	15.9
	9–12(Secondary)	97	24.1
	Collage and above	144	35.7
Employment Status	Merchant	155	38.5
	Government employee	122	30.0
	Farmer	98	24.3
	Others	28	6.9
	Secure	128	31.8
Food Security Situation	Insecure without hunger	123	30.5
	Insecure with moderate hunger	84	20.8
	Insecure with severe hunger	68	16.8

5.2. Intention of Adult PLWHIV towards Dietary Diversity Behavior

A total of 234 (58.1%) respondents did not have intention towards dietary diversity. The most frequently mentioned reasons for not consuming diversified food in their usual diets were household food insecurity (275 or 68.2%) and lack of information on the importance of diversified food (127 or 31.5%). From the constructs of theory of planned behavior indicates that direct attitude, subjective norm and perceived behavioral compliance (PBC) had mean values of 23.26 (SD = 6.19), 15.55 (SD = 3.47) and 20.40 (SD = 7.14), respectively which explained behavioral intention towards dietary diversity (Table 2).

Table2. Perceived risk of under nutrition, perceived risk of severe clinical outcome and intention of dietary diversity behavior of people living with HIV (PLWHIV) in Jimma Zone, Ethiopia, May 2018.

Components	Number	Items	Scale range	Scale Mean (SD)
Direct SN	403	5	5–20	15.55 (3.47)
Intention	403	5	5–20	10.55 (3.82)
Direct PBC	403	5	5–28	20.40 (7.14)
Direct attitude	403	5	5–28	23.26 (6.19)
Motivation to comply	403	5	5–25	16.37 (7.06)
Control belief	403	5	5–25	16.75 (4.76)

Behavioral belief (BB)	403	6	6–30	25.47	(4.24)
Evaluation of behavioral belief (EBB)	402	6	6–30	22.26	(5.36)
Indirect attitude = (BB) _i (EBB) _i	401	6	6–150	92.43	(33.19)
Normative belief (NB)	403	6	6–30	23.82	(5.21)
Motivation to comply (MC)	402	6	6–30	21.15	(5.74)
Indirect SN = (NB) _i (MC) _i	403	6	6–150	79.55	(32.99)
Control belief (CB)	401	6	6–30	24.85	(5.19)
Power of control (PC)	403	6	6–30	21.94	(5.87)
Indirect PBC = (CB) _i (PC) _i	403	6	6–150	52.45	(28.52)

5.3. Overall Descriptive Findings of Behavioral Intention of PLWHIV towards Dietary Diversity

More than half (55.7%) of the study participants positively perceived dietary diversity depending on what significant others believed and half (50.5%) of them had good motivation to comply. Close to two-thirds (60.7%) of the respondents reported favorable behavioral beliefs and a similar proportion (59.7%) of the outcome evaluations were desirable towards intention to use dietary diversity when eating at home. Regarding the subjective norm, more than half (59.4%) of them reported a high value of social pressure as to what significant others said regarding favorable intentions to use diversified foods in their usual feeding habits (Table 3).

Table 3. Overall descriptive findings of the theory of planned behavior constructs of adult PLWHIV on highly active antiretroviral therapy (HAART) in Jimma Zone public hospitals, May 2018.

Variables	Frequency in %	Mean	SD	Min.	Max.
Behavioral belief					
Favorable	60.70%	4.35	0.68	1.65	5
Unfavorable	39.30%				
Outcome evaluation					
Desirable	59.70%	4.48	0.76	1	5
Undesirable	40.30%				
Normative belief					
Perceived positively	50.70%	3.61	0.75	1	5

Perceived negatively	49.30%				
Motivation to comply					
Good	50.50%	3.74	0.88	1	5
Bad	49.50%				
Control belief strength					
Facilitating	47.50%	3.88	0.76	1	5
Hindering	52.50%				
Control belief power					
Above the mean	54.00%	3.75	1.14	1	5
Below the mean	46.00%				
Intention to use DDs					
Good	48.20%	3.68	1.33	1	5
Bad	52.80%				
Attitude to DDs					
Good	52.20%	74.62	17.59	17	100
Bad	48.80%				
Subjective norm					
High value to S/P	59.40%	74.36	28.19	9	125
Low value to S/P	40.60%				
Perceived BC					
Perceived easy S/P	60.20%	60.12	22.66	8	100
Perceived difficulty S/P	39.80%				

S/P: social pressure

5.4. Correlation of Dietary Diversity Behavioral Intention to Theory of Planned Behavior Constructs

Among the constructs, subjective norm showed the highest correlation ($r = 0.42, p < 0.001$) followed by perceived behavioral control ($r = 0.39, p < 0.001$) and attitude ($r = 0.38, p < 0.001$). The Cronbach's alphas measures for attitude, subjective norm, perceived behavioral control and intention to use were 0.63, 0.73, 0.74 and 0.96, respectively (Table 4).

Table 4. Correlation of the indirect and direct measures of theory of planned behavior among adult PLWHIV, Jimma Zone public hospitals, 2018

Components	DATT	DSN	DPBC	IATT	ISN	IPBC
Attitude	0.63 ^{++ 1}					
Subjective norm	0.42 ⁺⁺	1				
PBC	0.46 ⁺⁺	0.39 ⁺⁺	1			
IATT	0.57 ⁺⁺	0.49 ⁺	0.38 ^{+,t}	1		
ISN	0.24 ⁺	0.52 ⁺⁺	0.25 ⁺	0.36 ^{+,t}	1	
Intention	0.18 ⁺⁺	0.25 ⁺⁺	0.45 ⁺⁺	0.31 ⁺⁺	0.30 ⁺⁺	1

Note: Correlation is significant at ⁺⁺ $p < 0.001$, ⁺ $p < 0.05$, DATT: direct attitude, IATT: indirect attitude, DSN: direct subjective norm, ISN: indirect subjective norm, PBC: perceived behavioral control, DPBC: direct perceived behavioral control, IPBC: indirect perceived behavioral control.

4.3.5 Predictors of Intention towards Use of Dietary Diversity

Statistically significant predictors of intention to use dietary diversity were found to be attitude ($\beta = 0.196$, $p < 0.01$), subjective norm ($\beta = 0.390$, $p < 0.01$), perceived behavioral control (PBC) ($\beta = 0.048$, $p = 0.001$), and motivation to comply ($\beta = 0.03$, $p < 0.01$). This indicates that a unit positive change in the individual's perception about any counseling support from health professionals to use diversified food in their usual feeding as a normative action will increase the intention to use dietary diversity by 0.39 provided that the other conditions and medical care are in place.

At the same time, a unit positive change in the attitude towards the advantage associated with the use of diversified food for PLWHIV will change the intention to use dietary diversity by 16.6%, keeping all the comprehensive HAART care and livelihood factors constant. PBC and subjective norm explained 25.9% of the variance. When perceived behavioral control and Sociodemographic factors were added to attitude and subjective norm, there was an additional 6.5% variance in the intention and the model explained 32.2% of the variance in consistent use of dietary diversity in the home (Table 5).

Table 5. Distal, intermediate and proximal constructs of the theory of planned behavior among adult PLWHIV with intention to use dietary diversity in Jimma Zone public hospitals, May 2018.

Variables	Unstandardized	Standardized	T	95% Confidence	p
	β Coefficients	β Coefficients		Intervals	
Constant	0.57	3.37	0.873	(1.86, 5.61)	<0.001
Sociodemographic	0.85	0.038	9.360	(-0.86, 3.21)	<0.001
Direct attitude	0.92	0.196	7.033	(0.05, 0.22)	<0.01
Direct s/norm	0.135	0.39	4.887	(0.42, 0.57)	<0.001
Direct PBC	0.234	0.048	3.352	(-0.04, 0.12)	0.011
Motivation to comply	0.222	0.03	2.674	(-0.08, 0.14)	0.563
Control belief	0.291	-0.029	3.418	(-0.12, 0.06)	0.471

Statistically significant predictors at $p < 0.05$. VIF: variance inflation factor <10.

Explanatory Findings/In-depth interview findings

Better tracking, enhanced livelihood and social support along with drug therapy, food aid need to be considered for PLWHA. It is also worthwhile to understand behavioral intention as a potential determinant of malnutrition and the poor ART outcomes rather than symptomatic treatment of malnutrition with food by prescription. The HIV continuum care (HCC) programs were affected by patient, HIV care provider, and community and policy-levels barriers.

The qualitative findings suggested that delivery of HIV care requires a sense of livelihood development, economical improvement and creating a sense of ownership for sustainable HIV care by creating behavioral change at the individual level. It is also worthwhile to understand behavioral intention as a potential determinant of malnutrition and the poor ART outcomes rather than symptomatic treatment of malnutrition with food by prescription. The HIV continuum care (HCC) programs were affected by patient, HIV care provider, and community and policy-levels barriers.

Most common problems regarding dietary diversity were explored and the findings were presented in five themes. These were household food security, health system, income opportunity, individual behavior and support-related hindering factors.

5.1. Lack of Food at Home

Lack of food at home is one of the problems of adult PLWHIV on ART; follow-up was found to be critical according to the quantitative findings. Most of the in-depth interviewees mentioned emotionally the problem of availability and access to food at home. A female participant explained the condition by saying: “Let alone living with the disease and the limited capacity we have now, it is difficult to survive in Ethiopia even for a bachelor graduate who has regular monthly salary. Life for PLWHIV is getting very difficult”.

Another health care provider for PLWHIV participant said that: “All PLWHIV have a demand to eat four to six times a day. The drug needs that much. But in most of the cases, they couldn’t even afford to eat two to three times a day. Sometimes, I feel shame when I hear such sound of PLWHIV”.

5.2. Problems of the Health System

The study participants also suggested the health system design routine behavioral change initiatives as a coping strategy to encourage dietary diversity at home for all PLWHIV rather than design a treatment protocol for under nutrition. In addition to the issue of individual behavioral change, creating income opportunities for PLWHIV on HAART as a strategy to sustainably reduce malnutrition and improve quality of life was mentioned.

A male participant said that, “Taking HAART can effectively prevent suffering and death. However, to sustain this promising outcome longer and to start thinking more about our health, we need to have a healthy diet differently from people free of HIV. In addition, when they have behavioral change and have their own job, they can support their own life and even they can bring impact on the primary prevention program of HIV in the country”.

5.3. Income Generating Opportunities

A majority of the discussants reported repeatedly that they passed days without food to eat but they did not miss doses of their HAART for they said it is their life. A male discussant said that, “The issue of HAART is serious. You can argue about food after taking your pills but you can’t say anything about any issue by discontinuing your pills because this is a life issue. Sometimes you need to take the pills without food if conditions didn’t allow you to access food”.

One female participant was quoted as saying that, “The difference in the effectiveness of the treatment is a matter of access to the food you want at the time and amount you need. I even believe the disease could be eliminated from the face of the world if PLWHIV on HAART

could access the required food needed for the drug from government or non-governmental stakeholders”.

5.4. Individual Behavior

The participants also reflected that HAART improved their general health status, decreased frequency of infections, improved appetite, enhanced a sense of wellbeing, self-esteem, hope to live indefinitely, weight gain and increased CD4 count, but they did not know the importance of dietary diversity at home. A servant in the health institutions said that 30% weight gain, 43% increased CD4 count, 29% improved BMI and 27% reduced opportunistic infection were detected in the past two years/before data collection time among the individuals who had positive behavior on dietary diversity, meaning trying their best to eat diversified food at home was documented.

A female participant was quoted as saying that: “When PLWHIV started the treatment their CD4 count was only 1 per micro liter. Now, it is more than 600 per micro liter. Their weight was also 40 kg and now their weigh is 60 kg. But this improvement is not merely due to HAART; rather it is the combined effects of HAART and diversified food eating at home. It is also due to the psychological stability, pleasure and care they are getting from health professionals who are taking care of us in the hospital”.

Almost all discussant perceived that lack of food to take with the HAART had an impact on the level of the benefits PLWHIV would gain from the treatment, if not on the level of behavioral change towards dietary diversity.

5.5. Absence of Food AID/Support

The discussants from the in-depth interviews agreed that lack of food/absence of food at home was an issue that is overlooked by the program and a challenge to the successful implementation of the food by prescription program for PLWHIV in the stage of under nutrition.

On the other hand, the discussant mentioned that PLWHIV continued to depend on the food aid and food by prescription programs without behavioral change; consequently they may withdraw from their treatment due to lack of food and become hopeless/negligent, which in turn may lead to a new strain of the virus resistant to drugs appearing in the community, which could lead to failure of the whole program.

Discussion

The components of the theory help to explain determinants for a certain behavior to be endorsed or avoided by clients in their usual feeding habit. In addition, the theory explains that intention to practice a preferred behavior is a function of attitudes toward charming in that behavior without any pressure to perform and believe that the health practice is crucial to their life and perceived behavioral control.

The study revealed that more than 50 % of respondents in each construct have had desirable beliefs/were in control of their beliefs in terms of the intention for using dietary diversity in their home while all the comprehensive HAART cares are in place. The fact that the TPB explained more than a quarter of the intention of using dietary diversity is in line with study conducted in Addis Ababa and Kenya (Von Braun J , 2017; Rawat R *et al.*, 2010) where explained by 35% variation in the intention for use of healthy diet.

Similarly, a study conducted in Burkina and Hariri (Tiyou, A *et al.*, 2012; Hailemariam *et al.*, 2010), explained 30% and 31% variation in the intention for dietary diversity use and the social cognitive aspects explained 27% and 29% in south Africa and Mozambique (Kiene S *et al.*, 2016; Kaye H *et al.*, 2010) where the theory explained about two-thirds of the variance in intention for diversified feeding at home.

Each of the model constructs was positively correlated with the intention towards using dietary diversity and this is consistent with the results of another study done in Addis Ababa and other African countries to predict intention to use HAART comprehensive services (Kozal, M *et al.*, 2014; Liu E *et al.*, 2014; Ivers, L *et al.*, 2010). From the constructs of TPB model the subjective norm was the first strong positively correlated variable ($\beta = 0.390$, $P < 0.01$) followed by attitude ($\beta = 0.196$, $P < 0.01$).

This suggests that each variable explained the variation in intention dietary diversity use. From this point of view the detected findings can help in terms of identifying the variables of focus in intervention programs intended to bring about the desired healthy feeding and reduction of under nutrition.

This has significant impact and warrants counseling on the practice of dietary diversity as part of comprehensive HAART intervention programs. Both PBC and subjective norm explained 25.9% of the variance in the intention towards dietary diversity, which is less than the findings of studies done in both developing and developed countries on healthy diet behavior of PLWHIV (Mirkuzie A *et al.*, 2010; Nagata J *et al.*, 2014; Bahwere P *et al.*, 2019). This difference could be because of the personal and cultural difference and the low contribution

of attitude observed in the present study. Ajzen also argues magnitude of PBC–intention relationship is depending upon the type of behavior & nature of situation.

The highest predictor of intention towards dietary diversity was subjective norm followed by attitude. This finding corresponds with study conducted in developing countries (Cantrell, R *et al.*, 2015; Nikiema L, 2014). This might be due to similarity in terms of source of social pressures & underlying normative beliefs. In addition, Salient belief measures nature of TPB, which is local & culture sensitive might be contributed for the instances of the findings.

Conclusion: From this study it was understood that PLWHIV’s intention towards dietary diversity was low which was explained 32.2% of variation in intentions towards using dietary diversity of PLWHIV. The predictors of behavioral intention towards dietary diversity were the direct and indirect attitude, direct and indirect subjective norm, direct and indirect perceived behavioral control. Additionally the study documented that the intermediate variables and proximal variables of TPB explained nearly equal variance suggesting both variables are equally important and should be taken into account in behavioral change interventions. Therefore, Intention can be used to extend theories and to design interventions, which can increase the ability of those programs to change behavior rather than treating only malnutrition of the PLWHIV. The paradigm model is supportive and can be suggested for application of any nutritional programs considered to prevent under nutrition and reduce HARRT care resistance and improve quality of life through pointing nutritional education to be focused on subjective norm, attitude, and social norms and perceived behavioral control other than food by prescription program which is focused on symptomatic treatment.

Strength: quantitative data was supported by qualitative data. The instrument was developed according to standard guideline, relevant literatures and an elicitation study was conducted to identify the salient beliefs of intention to apply the theory in to local context.

Limitation: Finally, this study has its own limitation that did not account for the actual behavior to be predicted based on the theory of planned behavior constructs which may show how much behavioral intention could be transformed into the actual behavior. The TPB is purely psychological and lack of similar local literatures may affect the scope of the study. In addition there might be a possibility for bias to emerge in systematic sampling, since the samples were selected by randomly throwing into the air and the researcher uses his own discretion.

6

Chapter 6: General Discussion, Future Research Perspectives and Conclusion

6.1. Introduction

Since the emergence of HIV more than 30 years ago, there have been extraordinary global responses in inventing drugs to treat this scourge and establishing national programs including the \$44.3 billion budget (2004–2012) by PEPFAR to prevent the disease (RCQHC, FANTA, food by priscrpsion and Food and Nutrition Technical Assistance, 2010). Despite the efforts to date, HIV and AIDS remain global public health problems. Literature confirmed that efforts to halt the global HIV epidemic go well beyond distribution of condoms or ART adherence. Rather, Food Aid, HCT comprises complex behaviors that are affected by multiple ecologic levels (Seeley *J et al.*, 2012).

Various studies have shown that HIV infection, food insecurity and malnutrition are intricately linked to each other. In the absence of proper nutrition and treatment, HIV infection can lead to malnutrition which in turn impairs the immune system thereby progressing HIV to AIDS (UNAIDS, 2017). Undrnitron is a condition where macro and /or micronutrient supply are below the minimum dietary requirement which eventually leads to changes in body composition and diminished function (Seres DS, 2015). People living with HIV (PLHIV) with undernourishment manifests different conditions such as weight loss, muscle wasting, compromised immune system, micronutrient deficiency etc. and hence susceptible to the opportunistic infection and death (Seres DS, 2015; Seeley *J et al.*, 2012).

Both HIVand and Malnutrition have been an issue of public health discourse since the past three decades, the remarkable social evolution that mainly include green disaster and poverty have made people leading divasteting life. In addition, the doner driven intervention/projecte based intervention affects the HCC practice in develpin world (Saklayen, 2018; Thapa R,2015). This state of affair requires the collaboration and concerted effort of researchers, policy makers and program implementers by considering the cultural, behavioral and livelihood of PLWH (Thapa R, 2015; Saklayen, 2018). Beyond any pandemic across the globe, HIV and malnutrition are affecting millions of people (Duggal A, 2018; Darebo *et al.*, 2019).

Therefore, energies to defy this situation should be verified with scientific context relevant evidence. This is a serious landmark when we especially think of Ethiopia's HIV continuum care and the new approach of appointment spacing model care (ASMC) (National Planning Commission of FDRE, 2016). Little was known about the entities of the whole HCC burden in regard to Dietary Dieversty Behavioral Intention, Mortality, under nutriton, facilitators, barriers and solutions, from multiple perspectives. Hence, taking the above-mentioned vision

of the country into account, this study using a case of Jimma zone, Southwest Ethiopia, has addressed these gaps through a Three-phase sequential mixed methods approach plus all other relevant predictors in general aimed to implement workable intervention and will help as spring board for policy makers to sustain HCC.

6.2. Summary of the main findings

- The main findings of this research emerge from three consecutive studies: retrospective cohort (**Chapter 3**), Case control study (**Chapter 4**) and cross-sectional designs (**Chapter 5**). Severe undernourishment and moderate malnutrition at baseline, younger age, female sex, single or divorced marital status, being illiterate, non disclosure, advanced WHO clinical stage, seeking treatment outside catchment area, rural residence and immunological failure were independent predictors of mortality among adult PLWH (Chapter 3)'Predictors of Mortality among Adult People Living with HIV and Its Implications for ASMC. EJSci.2021;31(5):925.doi:<http://dx.doi.org/10.4314/ejhs.v31i5>'.
- The findings from the second Article indicated that, rural residence, female gender, unstable livelihood, low meal frequency, less diversified foods, and advanced WHO clinical stage and were found to be independent predictors of undernourishment. Lack of social support, advanced clinical stage, and unstable livelihood adversely affected nutritional status of PLWHA from the qualitative data. The socio-cultural, economic, and health-system factors inhibited ideal patient nutritional status. Better tracking, enhanced livelihood and social support along with drug therapy, food aid needs to be considered for PLWHA(**Chapter 4**).(*Journal of the International Association of Providers of AIDS Care Volume 19: 1-9 The Author(s) 2020 Article reuse guidelines: sagepub.com/journals-permissions DOI: [10.1177/232595822097](https://doi.org/10.1177/232595822097)*).
- Intention towards Dietary Diversity Among Adult People Living With HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior. A Mixed Methods Study (**Chapters 5**). The results showed that dietary inadequacy was strongly associated with being in the sociodemographic groups that are at risk of adverse clinical outcomes. It is worthwhile to investigate behavioral intention as a potential determinant of the clinical outcomes rather than choose symptomatic treatment of malnutrition(*INQUIRY: The Journal of Health Care Organization, Provision, and Financing*Volume 58: 1–12 © The Author(s) 2021 Article reuse guidelines:sagepub.com/journals-permissions DOI: [10.1177/00469580211060805](https://doi.org/10.1177/00469580211060805) journal).

6.3. Implications of the Findings

8.3.1. Implication of undernutrition on mortality among HIV positive people.

In this study it was observed that moderate and severe undernutrition are significantly associated with mortality among PLWA (Chapter 3). Nutrition and HIV are reciprocally related, this may impact the course of HIV-infection through a variety of mechanisms, including compromising host immune function, diminishing response to therapies, and promoting co-morbidities (Beisel, 2016; Wanke C *et al.*, 2017; Singer AW *et al.*, 2015; Berhe N *et al.*, 2013; Musumari PM *et al.*, 2014; Au JT *et al.*, 2016; Cantrell RA *et al.* 2018; Musumari PM *et al.* 2013). None existence of diet, food insecurity, and the concern about diet has been shown to decrease treatment faithfulness. From this finding Ethiopia need for considering the nutritional care and support as part of the continuum of care to prevent mortality among PLWHA, Although the Ethiopian Government has Nutrition care and support guideline (EFMOH, 2010; National Nutrition Strategy, 2011, ANTA, 2010) for HIV positive people, the service needs to be strengthened. The Implication begins with HIV related mortality linkage to poor clinical care outcomes (Kranzer K *et al.*, 2012). Evidence has shown that frequently visit Health institutions and timely engagement with ART has substantial benefits, including enhancing the efficacy of ART, improving the quality of life and increasing survival (Roura M *et al.*, 2019). Nevertheless, the cohort study revealed that most patients with HIV who presented who get treatment out of catchment area were present with poor outcomes, and this has been confirmed by the work of (Yombi JC *et al.*, 2014; O'Connell S *et al.*, 2016; Brown JP *et al.*, 2016).

Factors indicated that, several reasons why patients didn't expose their status to family and community, exposing their status affects their livelihood. Stigma related to HIV, using traditional healing as an alternative option, and lack of awareness of and access to HIV counseling and testing services challenged early HIV care. These barriers were also found in other studies (Miho S *et al.*, 2016; Porter KE *et al.*, 2017; Tso LS *et al.*, 2016).

The cohort study revealed that patients who were female, younger age and co-infected with Tb/HIV were the patients with HIV who were at higher risk of mortality. Additionally, the current study also found that about two-thirds of women in the cohort had problem of Opportunistic infections (OIs). The possible justification could be that women were and younger age at higher risk of mortality, because the majority of them dependent /house wife. This may be associated with lower knowledge of modern treatments and autonomy to use

health service ([Shamila L, 2010](#)).

WHO suggests that to keep people calm and improve their coping skills and utilization of HIV care services could be undertaken by someone who is trusted by the individuals concerned ([Palmisano L, Vella S, 2010](#)). The other big challenge of ART care that participants challenges were that the program could be inconvenient for some groups of the population, particularly younger people and those with low literacy status to take medicine regularly. This was also a concern of the international scholars, although they suggested the development of a special algorithm to identify specific at-risk groups. For example, HAART/ART could be suitable for commercial sex workers, females, village residence, and long-distance truck drivers who are potentially underserved or hard to reach populations ([Palmisano L, Vella S, 2010](#)).

ART Program has created a significant change in improving both health status and life expectancy of PLWHA. However, first-line drug resistance and death from HIV related causes are quite formidable challenges in Sub-Saharan Africa, including Ethiopia. In this study, 14.9% cumulative incidence of HIV mortality was reported in patient on Art. This finding is in line with the study conducted Northwest Ethiopia, in which the prevalence of HIV infection among females was two, times higher than males ([Koye DN et al., 2012](#)). The fact that rates of HIV infection and death among women are higher imply not only gender difference but also gender inequality, leaving women more vulnerable to its impact, which implies the need for strengthening HIV care and support more among females to curb the challenge by empowering them.

In this study, the highest number of deaths was noticed in the 2nd and 3rd years of follow up. This could be attributed to eligibility criteria, change of guideline for ART initiation and project driven approach care as well as using test and treat immediately, regardless of CD4 count and WHO clinical staging ([Tsefahuneygn G et al., 2015](#); [Nabukeera N et al., 2015](#)). The other reason may be because of Ethiopia doesn't implement strict follow up care ([Bezalem E, Wencheke E, 2014](#); [Kokeb M, Degu G, 2016](#)) for patients with good adherence at 1st year and 2nd the trust in and awareness of modern medicine was poor, and conversely high in traditional medicine, which patients could consider as an alternative option ([Purchase S et al., 2016](#); [Assefa Y et al., 2014](#)). In addition, such outcome indicates a very low performance to meet the expected UNAIDS targets for Ethiopia by 2020 in spite of the fact that Ethiopia has launched "appointment spacing model approach care (few/two visit per year of clinics by PLWHA)".

8.3.2. Implication of diversified diet in preventing undernutrition

Our findings showed that unstable livelihood adversely affected nutritional status of PLWHA (**Chapter 4**). PLWHA could have less diversified diet which could negatively impact of their nutritional status. Dietary diversity among PLWHA could be negatively affected due to several reasons like: No social support, poverty, poor attitude and intention, advanced clinical stage, and unstable livelihood. The presence of nutrition by prescription program and accessibility of ART was deprived during the period as compared to today. On the other hand, mortality declined in years 2015 and 2016 as compared with earlier years. This might be because of improvement, accessibility and awareness of ART users in Northwest Ethiopia and Asian countries/Nepal ([Koye DN *et al.*, 2012](#); [Jamieson D, Kellerman SE, 2016](#)). In this regard, better tracking, enhanced livelihood and social support along with drug therapy, food aid needs to be considered for PLWHA regularly like the ART treatment.

Mortality was higher among adult PLWHA who had developed immunologic failure, WHO clinical stages III and IV, low CD4 count, severe and moderate malnutrition, bed ridden in functional status and abnormal liver function test results compared to their counterparts in the five year follow up period. These findings are in line with other middle and low income countries ([Ferradini L *et al.*, 2016](#), [Koye DN *et al.*, 2012](#); [Assefa Y *et al.*, 2017](#)). This indicates that PLWHA are vulnerable to multiple challenges, co morbidities and humble prediction of outcome. In addition, such outcome indicates a very low performance to meet the expected UNAIDS targets for Ethiopia by 2020 in spite of the fact that Ethiopia has launched “appointment spacing model approach care (few/two visit per year of clinics by PLWHA)”. In this regard, such consequence indicates a very low performance to meet the expected “three 90” UNAIDS targets for Ethiopia by 2025 in spite of the fact that Ethiopia has implemented food by prescription program which is symptomatic treatment.

6.3.3. Implication dietary change on HIV Continuum Care

The main predictors of under nutrition were found to be rural residence, less meal frequency, less dietary diversity, Kchat chewing, low level of hemoglobin, difficult livelihood, advanced WHO stages both at ART initiation and during the study, presence of OIs and low level of CD4 counts during the study, household food insecurity and lack of food aid(Chapter 4). This finding is similar with studies done in African countries (Jennifer C *et al.*, 2011; HIV AIDS Prevention and Control Organization ,2011; Cristina A *et al.*2014; Koethe J *et al.*2011; Gebremichael D *et al.*, 2018; Gedle D *et al.*, 2015; Kenea MA *et al.*, 2015) which showed that poverty were prone to undernourishment and poor clinical outcomes. This similarity might be because access and utilization of services are rendered by individual livelihood. Regard to behavioral factors, participants who chew Kchat frequently was more affected by undernourished. This is similar to the findings of (Mfinanga F *et al.*, 2017) (Andrade C *et al.*, 2012). This could be because of PLWHA who use substances /alcohol poorly adhere to ART, which in turn may adversely affect nutritional status. The over all findings indicated that, nutritional support and improvement of livelihood are very crucial to ensure HCC for the following reasons: (1) low BMI is associated with higher mortality and have poor out came of HAART (2), food and nutrition can improve adherence to treatment and retention in care. (3) In addition to Food and nutritional support stable livelihood can support the quality of life and HCC for PLWHA. From this point of view, Ethiopia badly needs and improvement of livelihood as core points of HCC References (HIV AIDS Prevention and Control Organization ,2011; Cristina A *et al.*2014; Koethe J *et al.*2011).

6.3.4. Policy Implications of the findings on Behavioral Intention towards Dietary Diversity practice

Absence of food aid and duration of antiretroviral treatment were significantly associated with intention towards dietary diversity. It is noted that HIV-positive adults who were on ART for less than 2 years and 2–3 years were more likely to have low dietary diversity, which exacerbated the weight loss and nutritional problems experienced by PLWHIV. It is known that taking the drugs without adequate food, and antiretroviral side effects such as nausea, taste changes and loss of appetite, may reduce food consumption, while inadequate food and side effects such as diarrhea and vomiting may increase nutrient losses (Soyiri I., Laar N,2014). From this point of view, the findings of this study can help identify the variables of focus in Behavioral intervention programs other than food Aid intended to bring

about the desired healthy feeding and reduction of malnutrition. Additionally this has a significant impact and warrants counseling on the practice of dietary diversity as part of comprehensive HAART intervention programs.

Both PBC and subjective norm explained 25.9% of the variance in the intention towards dietary diversity, which is less than the findings of a study done in Kenya (Muthamia O.G *et al.*, 2014) on healthy diet behavior of PLWHIV. As a result Nutrition interventions that support, educate and create income generation opportunities for low-income PLWHIV are very critical if healthy eating is to be embraced. Changes at policy level should be well thought out to increase affordability and accessibility of healthful food in low-income settings (USAID, 2012). This could be because of the personal and cultural difference and the low contribution of behavioral intention observed in the present study. Ajzen also argues the magnitude of the PBC–intention relationship is dependent upon the type of behavior and nature of the situation. In addition, salient belief measures the nature of TPB, which is locally and culturally sensitive and might contribute to the instances of the findings.

It worth's while to intervened behavioral intention as a potential determinant of the clinical outcomes for sustainable HIVcare. The paradigm model is supportive and can be suggested for application of any behavioral change programs considered to prevent under nutrition and improve quality of life through education to be focused on subjective norm, attitude, and social norms other than food by prescription program which is focused on symptomatic treatment (HIV AIDS Prevention and Control Organization ,2011; Cristina A *et al.*2014; Koethe J *et al.*2011). This implies that Ethiopia need an approach wich considered local livelihood of PLWHA to address the risk factors even regardless of their clinical stage is very crucial. Therefore, it is critical to identify key intervention strategies. Given the above context, the report of this dissertation on the Mortality (**Chapter 3**), predictors of under nutrition (**chapter 4**) and behavior Intention towards dietary dieversity (**Chapter 5**) on HIV continium care have wider practical implications (Jennifer C *et al.*, 2011; HIV AIDS Prevention and Control Organization ,2011; Cristina A *et al.*2014; Koethe J *et al.*2011; Gebremichael D *et al.*, 2018; Gedle D *et al.*, 2015; Kenea MA *et al.*, 2015).

6.3.5 Methodological Considerations

This section presents the overall strengths and limitations of the dissertation, and practical, pragmatic reflections on the methodology. We tried to use multiple study designs and statistical approaches to make the findings from this study more comprehensive and plausible. However, in addition to the limitations that was mentioned in detail under each

chapter as follows: since secondary data was used for the 1st study, it was impossible to include some key variables such as economic status and psychological distress that need to be included in this study. There was also incompleteness of records for some of the patients enrolled on ART. On the plus side, because the study was done during the time when Ethiopia is striving to achieve its recently planned “with the new approach of ASMA,” the findings may give better insights into the problems that shall be considered to achieve the goal.

The findings of the dissertation add to the global literature on the new approach of appointment spacing care (ASMC) and to the whole HIV continuum care, as Ethiopia’s progress to achieving the UNAIDS 90-90-90 treatment targets. The rationale for the choice of mixed methods in the present project has general, practical and procedural perspectives. At a general perspective, it minimizes the limitations of both qualitative and quantitative approaches and draws adequate information from both methods to address the research problem. This dissertation used multi-phase mixed methods to address three research questions.

A retrospective cohort studies were used in phase one to assess the magnitude and predictors of mortality and the whole HIV continuum care. In Phase two, case control study was used to identify predictors of under nutrition in south west Ethiopia. In phase three, an institutional based survey with mixed method of data collection using TPB towards dietary diversity was used to explore the facilitators, barriers and ways to improve nutritional status.

Due to the complex nature of the problem of study, the project required deep explanation and understanding of multiple aspects of the mortality, under nutrition, behavioral intention and other factors like, (ART care, ART linkage and retention) from multiple stakeholders (HIV patients, HIV care providers, community advocates and HIV program managers– to obtain multiple entities) facilitators, barriers and solutions for better care. At a procedural perspective, this provided an option to obtain a more complete understanding of the research.

This could be achieved through comparing different perspectives from both methods and explaining quantitative findings of the project with the qualitative component. With the above underpinning epistemology in mind, multiphase mixed methods were applied to design different studies in this project. Three phases with three different study designs were implemented sequentially. From the above experiences viable, the research team provided further opportunity to improve thier capacity for both quantitative and qualitative study

methodologies. For example, multiple phases with mixed method of data generating approach were some of the new skills they learned.

Despite the above strengths, the study has some limitations. First, the study was conducted using the pragmatic mixed methods approach. In this approach positivist and Interpretivist Epistemologies, and quantitative and qualitative methodologies were mixed. Such mixing of approaches may be against the principles held by purists that argue the incompatibility of mixing of approaches with different paradigms. Second, all the target population for studies was adults living with HIV and issues surrounding children, adolescent and other segment of population were not fully addressed in the assessment of the entire ART care. Third, the data were collected from one are/south west Ethiopia and hospitals and didn't include other areas/context and health centers.

The rationale for this was that the types of patients being treated in a health center and hospital are different, in that most patients coming to hospital are seriously ill. Thus, the number of patients who present with advanced HIV treatment outcomes in the hospital could be different from those in the health center, and this would have implications for factors affecting the external validity of the whole study. Finally, the theory of planned behavior constructs, which may show how much behavioral intention, could be transformed into actual behavior.

8.3.6. Future Research Perspectives

Further research is also needed to address the complex nature of PLWHA. Rural dwellers, being female in gender and those with low literacy status were also found to be at higher risk of poor HIV outcomes. These findings imply that applying anaction/intervention towards these leading causes of mortality as routine and as part of the new approach care “appointment spacing model care (ASMC)” can reduce mortality and can be a sustainable clinical care other than project driven intervention of HIV care (**Cahpter one**).

It is worth mentioning some weaknesses regarding chapter one, mortality might be underestimated, since patients lost to follow-up probably include individuals dying at home without being reported. Additionally, since secondary data was used for this study, it was impossible to include some key variables such as economic status and psychological distress that need to be included in this study. There was also incompleteness of records for some of the patients enrolled on ART. On the other side, the study was done during the time when

Ethiopia is striving to achieve its recently planned “with the new approach of ASMA,” the findings may give better insights into the problems that shall be considered to achieve the goal by conducting prospective cohort study (**Chapter one**).

The qualitative study revealed that trust in the ART care system had improved gradually. However, other study participants believed this was still a challenge. Therefore, institutional and interpersonal trust in ART care systems must be studied in depth. Overall, it will be essential to shift the research interest from assessing and exploring barriers to interventions and context sensible (**chapter four**).

The study was conducted using the pragmatic mixed methods approach. In this approach, positivist and interpretivist epistemologies, and quantitative and qualitative methodologies were mixed. Such mixing of approaches may be against the principles held by purists that argue the incompatibility of mixing of approaches with different paradigms. Second, all the target population for studies was adults living with HIV and issues surrounding children, adolescent and other segment of population were not fully addressed in the assessment of the entire ART care (**chapter five**).

Third, the data were collected from one are/south west Ethiopia and hospitals and didn't include other areas/context and health centers. The rationale for this was that the types of patients being treated in a health center and hospital are different, in that most patients coming to hospital are seriously ill. Thus, the number of patients who present with advanced HIV treatment outcomes in the hospital could be different from those in the health center, and this would have implications for factors affecting the external validity of the whole study (**Chapter one –Three**).

6.3.7. Conclusions

In several countries, including Ethiopia, instituting a “**treat all**” policy with appointment spacing model care, more people who are HIV positive but who feel healthy will demand and become eligible for ART. This implies the need for more evidence to understand and address ART attrition and sustainable care. Understanding why patients with HIV die, develop nutritional problem, initiate ART, and take ART without interruption entails explicating the complex risks of HIV and treatment seeking behaviors that are predisposed by predictors at multiple levels.

In this dissertation, three interrelated and sequential studies were employed to assess the overall continuum of HIV care and treatment using primary and secondary data from

Southwest Ethiopia public hospitals. In the 1st study the incidence of HIV mortality was 11 deaths per 1000 person- months, whereas most deaths (20%) occurred during the interval of 18-24 months of follow up period. Females were at higher probability of dying from AIDS related causes. Factors such as marital status, functional status, education level, disclosure of HIV status, having care givers/support, abnormal test of liver function, presence of opportunistic infection, malnutrition were found to be independent predictors of AIDS related mortality.

These findings imply that applying an action/intervention towards these leading causes of mortality as routine and as part of the new approach care “appointment spacing model care (ASMC)” can reduce mortality and can be a sustainable clinical care other than project driven intervention of HIV care.

The 2nd study identified clinical related predictors of undernourishment were low level CD4 count at ART initiation, advanced WHO stage both at ART initiation and during the study and, low level of hemoglobin. Similarly, behavioral and demographic factors such as kchat chewing, low meal frequency, household food insecurity, absence of food Aid and low dietary diversity, rural residence, female gender, unstable livelihood were significantly associated with undernourishment.

The qualitative findings indicated that, nutritional support and improvement of livelihood are very crucial to ensure HCC for the following reasons: (1) low BMI was associated with higher Mortality and have poor outcome of HAART (2), food and nutrition can improve adherence to treatment and retention in care (3). Food and nutritional support stable livelihood can enhance the quality of life and HCC for PLWHA. From this point of view, Ethiopia badly needs, improvement of livelihood/income generation opportunities and behavioral change on dietary diversity to address nutritional problems at the grass root level, rather than symptomatic treatment and a donor driven program of food by prescription, which may affect the outcome of HCC.

From 3rd study, it was understood that PLWHIV intention towards dietary diversity was low, which explained 32.2% of variation in intentions towards using dietary diversity among adult PLWHIV. The predictors of behavioral intention towards dietary diversity were direct and indirect attitude, direct and indirect subjective norm, and direct and indirect perceived behavioral control. Additionally, the study documented that the intermediate variables and

proximal variables of TPB explained nearly equal variance, suggesting both variables are equally important and should be taken into account in behavioral change interventions.

Therefore, intention can be used to extend theories and to design interventions, which can increase the ability of those programs to change behavior rather than treating only malnutrition of the PLWHIV.

The paradigm model is supportive and can be suggested for application of any nutritional programs considered to prevent undernutrition and reduce HAART care resistance and improve quality of life through nutritional education to be focused on subjective norm, attitude, and social norms and perceived behavioral control other than the food by prescription program, which is focused on symptomatic treatment.

6.3.8. Recommendations

There are numerous key results from this dissertation with potential implications for clinical outcomes and public health practice, strategic development for future policy and further research into HIV sustainable care.

- Although this research has the potential to strengthen the existing and new policy and program development, the inferences of findings of this study are contemplation of how existing national policies can be changed into practice contextually, as detailed in the discussion section.
- Furthermore, if the livelihood and food Aid other than the usual service of ART and food by prescription improves through the existing and new approach ASMC recommended in this dissertation, the number of patients on ART should increase. Thus, in addition to the established ASMC and treat strategy, access to ART at all existing health facilities should be increased.
- For ART sustainable care strategies must be contextualized, individual centered and the community should take part in the HIV care system as bigg agenda of the Ministry of health, department of HAPCO plus, as the study revealed, interventions must aimed at the prevention, control and management of PLWHA demands in organized efforts and multiple approaches. Therefore, comprehensive long-term and workable interventions should be designed to reduce the risk of under nutrition, escape an avoidable sadness and untimely mortality of PLWHA like: Organizing mutually supportive multi-sectoral and multi-disciplinary stakeholders for the prevention and control of mortality and under nutrition.
- Further research is also needed to address the complex nature of the continuum of HIV

care and treatment. Research is needed to assess HIV care among all segments of population and addressing different areas to prioritize which groups of PLWHA are most at risk of negative outcomes. Rural dwellers, being female in gender and those with low literacy status were also found to be at higher risk of poor HIV outcomes. This calls for action to address the role of social determinants in women, rural dwellers and people with low literacy that has HIV.

- The qualitative study revealed that trust in the ART care system had improved gradually. However, other study participants believed this was still a challenge. Therefore, institutional and interpersonal trust in ART care systems must be studied in depth. Overall, it will be essential to shift the research interest from assessing and exploring barriers to interventions in conditions where several barriers are assessed in similar contexts.

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8. Annexes: CV of PhD Candidate

PERSONAL INFORMATION : Aderajew Nigussie Teklehaimanot



 P.O. Box378,JimmaUniversity,Jimma,Ethiopia
 +251912914777 or 25142129446
 aderajewnu@yahoo.com , or
aderajewnu@gmail.com
▪ Sex = male
▪ Date of birth =18/5/1985
▪ Nationality = Ethiopian

1. **Full name:** Aderajew Nigussie Teklehaimanot, he borne from his father Nigussie Teklehaimanot and his mother Almaz Tarekegn in the town of Selekleka, Tigray in 1985.
2. **School:** He attends primary(1-8) and secondary school (grade 9-10) in the same town and his preparatory school (11-12) in shire Endaslase secondary school in 2003. He joined to mekelelle university in 2004 and Graduated in Public health Officer in 2008.

4. Work Experience

- He joined to Samera University in 2009 and stay for one year as assistance lecture.
- In 2010 he changes his working environment to Axum Teaching Hospital and work for two years as clinician and lecturer.
- In 2012 he Joined to Jimma university and served as junior assistant lecture in the department of Health Education and behavioral science
- In 2012/2013 he joined his master's program in the discipline of population and family health (MPH in RH program) and he graduated in 2014. Starting from 2014 to date he have been serving in the same department as lecture, advisor and researcher.
- In 2015– 2016 he have been learn his second masters in the field of Medical Education (masters of health professional Education from the collaboration program of Jimma university and Lauding maxi Milan university(LMU) Germany.
- In 2016/17 he have been joined his PhD program in human Nutrition
- He have been advising as Primary and secondary advisor for about 32 masters students from Jimma university and other university's
- He had opportunity to participated in many national trainings and International like: ATTC and International health trainings
- He have 45 published articles as author and coauthor in reputable journals

5. Project and Research experience

A. External: four projects as PI and co PI

- Large country survey (LQS) for three consecutive years on Focused ANC and IFAS in collaboration with Micronutrient Initiative Ethiopia and Canada
- HPV vaccine acceptability for two years Incolabration With GABY and MOH
- Development Guideline for health extinction (Quality of family planning) with AMRIF and MOH Ethiopia
- Nutritional Intervention among School adolescent in Jimma zone southwest Ethiopia

B. Internal: Four projects (as PI and co PI)

- Sustainability of health Extinction program in south west Ethiopia
- PMTCT service quality and acceptability in Jimma zone
- Food security ,dietary diversity and pridictors of mortality among PLWHA
- Barriers and challenges of adolescent health service in Jimma zone

C. Conference presentation

- He have been presented more than 10 abstracts in international and national conferences

D. Journal Reviewer

1. African journal of reproductive health
2. Ethiopian journal of health science
3. BMC Health and quality of life out comes
4. Ethiopian Journal of health and development

CURRENT DUTIES, ACTIVITY'S AND TRAINING ON EXTRA SKILLS (My PhD work)

Courses Attended in Jimma University:

- Nutrition in Emergency.....**3 ECTS**
- Nutritional Epidemiology.....**5 ECTS**
- Nutritional Assessment.....**5 ECTS**
- Nutrition programming, Intervention and Policy.....**5 ECTS**

Transferable skills

- Grant writhing6 ECTS
- Advanced biostatistics / LDA.....5 ECTS
- Risk assessment and Infectious disease4 ECTS
- Gender health and Risk of infection..... 6 ECTS
- GCP(Clinical trial training).....5 ECTS
- Advanced Biostatics and Epidemiology With PHD infectious disease6 ECTS
- Advanced Biostatics 5 ECTS

Additional Research related and organizational activities performed

1. **Give Training on ANC Sentinel surveillance** by EPHA Ethiopia from December 26-Januaruy 3/2017.....**5 ECTS**
2. Advise 8 Masters students in psychiatry and MPH students on their research work..... **15 ECTS**
3. I am currently working as chairperson of promotion and recruitments commute for the department , Jimma University..... **5 ECTS**
4. Reviewer of African journal of Reproductive health..... **5 ECTS**
5. **Academic TT in LMU/Munich, Germany, 201**.....**7 ECTS**

REFERENCE (SELECTED)

1. **Dr Lelisa Sena(PhD, Associated professor of Epidemiology)**
Head department of Epidemiology, Jimma University
Mobile: +251 9118662161
Fax:+251 937, Jimma-Ethiopia
E-mail: lelisajitu@gmail.com
2. **Tefera Belachew (MD, PhD) Professor**
Director, School of Graduate Studies
P.O.Box 378 Jimma, Ethiopia
Phone No.:Office:+251 471 111461
Mobile: +251 917 80 40 72
Fax:+251 471 110969/+251 471 111450
E-mail: tefera.belachw@ju.edu.et
3. **Professor Esayas Kebede Gudina (MD, DTM&H, PhD)**
Professor of Medicine, Jimma University
P.O.Box, 5058, Jimma, Ethiopia
Telephone: **+251917550576** OR **+251911718500**
Skype: Sanqalla

Training and Conference presentation certificate





Certificate of Completion

This Certificate is hereby granted to

Aderajew Nigussie

for successful completion of

Good Clinical Practice training

24th-25th July 2017, Jimma University- Ethiopia

Trainers: Getnet Yimer (MD, PhD)



Solomon Ali (TDR-clinical research fellow)



Ethiopian Public Health Association

Certificate

Presented this certificate of merit to

Aderajew Nigussie

for his/her contribution as a presenter of a scientific paper at the 28th
Annual Conference of the EPHA.

February, 2017

Dr Fikreab Kebede
President, EPHA

Dr Alemayehu Mekonnen
Executive Director, EPHA






JIMMA UNIVERSITY
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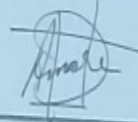
GKEN
Global Knowledge Exchange Network

CERTIFICATE

This is to certify that Aderajew Nigusie has given a research paper oral presentation titled “Predictors of Under Nutrition among Adults PLWHA in Jimma Zone Public Hospitals, South West Ethiopia: A Mixed Method Study” at the 10th Annual Research Conference of Jimma University and the 9th GKEN Annual Event which was jointly organized from April 18 - 19, 2019 in Jimma, Ethiopia.


President, Jimma University





GKEN's Chair & EDMA's Director


We are in the Community!

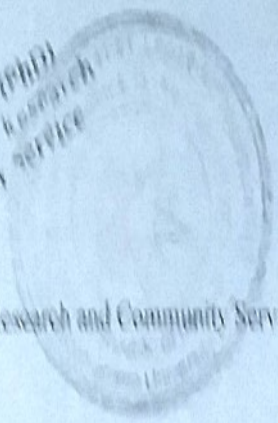
Ref No. JU/48/452
Date 05.11.2019

Testimonial letter to Mr. Aderajew Nigussie

I am writing this testimonial letter in recognition of Mr. Aderajew Nigussie's contribution for Research activities at Jimma University under the office of Vice President for Research and Community Services. Mr. Aderajew was one of the co-investigators of a research project funded by Ministry of Health, Ethiopia, in 2016 and entitled 'Assessment Of Human Papilloma Virus Vaccine Coverage In Gomma Woreda, Jimma Zone, Oromia Region, Southwest Ethiopia'. During his stay with us, he has shown utmost dedication, responsibility, and institutional commitment. Considering all his contributions to our university, we provided him this letter of testimony. Should you have any query, please do not hesitate to contact us.

Research


Tejge Ketema (PhD)
Vice President for Research
& Community Service



► Vice President for Research and Community Services
Jimma University



8.2. Information Sheet for study participants

Dear study participant, this study is conducted on Dietary Diversity Intentions, Nutritional status and Moratlity among Adult People Living with HIV in Jimma Zone Southwest Ethiopia

Investigator:

Dr Lelisa Sena, Professor Tefera Belachew and Professor Esayas kebede from the institute of health Jimma university, Ethiopia, Phone: +251 912914777

Description of the study:

This study is part of the project entitled ‘

To Assess Nutritional States and Dietary Diversity Behavior among Adult People Living with HIV/AIDS in Jimma Zone, Southwest Ethiopia. A Mixed Methods Approach’. The research aims to explore the perspectives and experiences of the HIV patients, HIV-care providers,

advocates/ members of communities, and health care system administrators on barriers, facilitators and ways to improve the nutritional status of PLWHA. This study will be carried out with ethical approval from Jimma University Institute of Health and as well as with the permission from Jimma zone Public Hospitals

Purpose of the study:

This study aims to explore: Dietary Diversity Intentions, Nutritional status and Mortality among Adult People Living with HIV in Jimma Zone Southwest Ethiopia.

What will I be asked to do?

You are invited to attend a one-on-one interview with the researcher who will ask you a few questions about your views, perceptions and experiences towards the HIV care and nutrition in Jimma zone. The interview will take about 45-60 minutes. The interview will be recorded using a digital voice recorder to help with looking at the results. Once recorded, the interview will be transcribed (typed-up) and stored as a computer file and then destroyed once the results have been finalized. This is voluntary.

What benefit will I gain from being involved in this study?

The sharing of your perspectives will improve the planning and implementation of future programs about the HIV care and Nutrition. We are very keen to deliver a service and resources which are as useful as possible to people

Will I be identifiable by being involved in this study?

Your name is not needed and you will be anonymous. The voice file will be destroyed once the interview has been transcribed and saved as a file. Any identifying information will be removed and the typed-up file stored on a password-protected computer that only the principal researcher will have access to.

Are there any risks or discomforts if I am involved?

The investigator anticipates no risks from your involvement in this study. However, you may feel burdened by the amount of time spent in the interview, negative concerns (such as service denial) of being identified as having been involved in the study, and stress while

talking about HIV. If you have any concerns regarding any risks or discomforts, please raise them with the researcher.

How do I agree to participate?

Your participation is voluntary. You could tell us your decision within 30 minutes once you got the services. If you are willing to participate, please contact the interviewer in Room No (TBD) in this building. You may answer ‘no comment’ or refuse to answer any questions and you are free to withdraw from the interview at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form.

How will I receive feedback?

The participants will not get direct feedback provided but they have a choice to receive summary reports or debriefing following the interview. The summary report of the project will be disseminated to the Jimma University, EMOH and Jimma zone health office Center through which other facilities, institutions and interested parties can access the report too. The study will also be published in different journals or conference proceedings and presented during different annual conferences.

Many thanks for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

8.3. Consent Form

Dear respondent, my name is _____. We are working as data collector for the study conducted by staff of Jimma University Institute of health on Dietary Diversity Intentions, Nutritional status and Moratlity among Adult People Living with HIV in Jimma Zone Southwest Ethiopia. I am here to enroll and take interview you. This questionnaire will be filled only if you agree to take part in the study. In addition, your genuine and true responses give value for success of the study and also will help for better understanding of the problem that would eventually help in designing appropriate intervention to solve the problems and we sincerely ask you to give your genuine and true responses to the questions provided. The questionnaire contains five parts and will take not more than 40 minutes. The information in this questionnaire will be kept strictly confidential, will not be disclosed to any

one and only the research team will have access to the information you gave but your name and address will not be recorded or identified even by the research team.

So, would you like to participate in the study?

Thank you for your cooperation!

Yes/agree _____ No/disagree _____

PAHSE I :ENGLISH PART QUESTIONAR

1. SOCIO-DEMOGRAPHIC CHARACTERISTICS

<i>No</i>	<i>QUESTIONS AND FILTERS</i>	<i>CODING CATEGORIES</i>	<i>CODE</i>
1	Age of the study participant	<input type="text"/> Years	
2	Sex of study participant	Male Female	
3	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Other	

4	Ethnicity	1. Amhara 2. Oromo 3. Tigre 4. Gurage 5. Other(s) _____	
5	Marital Status	1. Married 2. Single 3. Divorced 4. Separated 5. Widowed	
6	Education	1. Illiterate 2. Read & write 3. Elementary 4. High school 5. 12+	
7	Monthly Income (Birr)	<input type="text"/>	
8	Working situation	1. Farmer 2. Merchant 3. Government employer 4. Unemployed	
9	With whom do you live with?	1. Alone 2. Family 3. Parents 4. Others _____	
10	Treatment duration (months)	----- Month	
11	Monthly income	-----Birr	
12	Housing condition		
12.1	Number of Rooms	<input type="text"/>	
12.2	Number of people in the household	<input type="text"/>	
12.3	Running Water	1. Yes 2. No	
12.4	Electricity	1. Yes 2. No	
13	Does anyone else know about your HIV status?	1. Yes 2. No	
14	If yes, who?	1. Wife/husband 2. Own child 3. Parents 4. Brothers	If no skip

		5. Relatives 6. Friends 7. Others _____	
15	(If female) Are you currently breastfeeding?	1. Yes 2. No	
16	(If yes to Q 114) For how long?	<input type="text"/>	
17	Are you receiving any food ration from any organization?	1. Yes 2. No	
18	If yes, what is the type of food you are receiving?	<input type="text"/> <input type="text"/> <input type="text"/>	If no skip
19	Are you receiving any food ration from any organization?	1. Yes 2. No 3. Don't Know	
20	If yes to Q19, from where? (THE ORGANIZATION THAT AIDS YOU)	-----	
21	If yes to Q19, what is the type of food you are receiving?	-----	

3. DIETARY DIVERSITY AND MEAL FREQUENCY

<i>No</i>	<i>QUESTIONS AND FILTERS</i>	<i>CODING CATEGORIES</i>	<i>CODE</i>
22	<i>During the previous 24-hours period (from this time yesterday day and night), did you eat the following?</i>		
22 A	Any bread, biscuits or any other foods made from millet, sorghum, maize, rice, wheat, or [insert any other locally available grain]	1. Yes 2. No 3. Don't remember	
22 B	Any potatoes, yams, carrot, cassava or any other foods made from roots or tubers?	1. Yes 2. No 3. Don't remeber	
22 C	Any vegetables?	1. Yes 2. No 3. Don't remember	
22 D	Any fruits?	1. Yes 2. No 3. Don't remember	

22 E	Any beef, pork, lamb, goat, chicken or other birds, liver, kidney, heart, or other organ meats?	1. Yes 2. No 3. Don't remember	
22 F	Any eggs?	1. Yes 2. No 3. Don't remember	
22 G	Any fresh or dried fish or shellfish?	1. Yes 2. No 3. Don't remember	
22 H	Any foods made from beans, peas, lentil or nuts?	1. Yes 2. No 3. Don't remember	
22 I	Any cheese, yogurt, milk or other milk products?	1. Yes 2. No 3. Don't remember	
22 J	Any foods made with oil, fat or butter?	1. Yes 2. No 3. Don't remember	
22 K	Any sugar or honey?	1. Yes 2. No 3. Don't remember	
22 L	Any other foods, such as condiments, coffee or tea?	1. Yes 2. No 3. Don't remember	
23	During the previous 24-hours period (yesterday day and night), did you or anyone in your household consume		
23 A	Any food before a morning meal	1. Yes 2. No 3. Don't remember	
23 B	A morning meal	1. Yes 2. No 3. Don't remember	
23C	Any food between morning and mid-day meals	1. Yes 2. No 3. Don't remember	
23D	A mid-day meal	1. Yes 2. No 3. Don't remember	
23E	Any food between mid-day and evening meal	1. Yes 2. No 3. Don't remember	
23F	Any evening meal	1. Yes	

		2. No 3. Don't remember	
23 G	Any food after the evening meal	1. Yes 2. No 3. Don't remember	

3.HOUSEHOLD FOOD-SECURITY/HUNGER SURVEY MODULE

<i>NO</i>	<i>QUESTIONS AND FILTERS</i>	<i>CODING CATEGORY</i>	<i>skip</i>
24	Which of these statements best describes the food eaten in your household in the last 12 months	1. Enough of the kinds of food 2. we want to eat Enough but not always the kind of food we want 3. Sometimes not enough to eat 4. Often not enough 5. Don't remember	
24 A	<i>[IF OPTION 3 OR 4 SELECTED, ASK] Here are some reasons why people don't always have enough to eat. For each one, please tell me if that is a reason why YOU don't always have enough to eat. [READ LIST. MARK ALL THAT APPLY]</i>		
24B	Not enough money for food	1. Yes 2. No 3. Don't remember	
24C	Not enough time for shopping or cooking	1. Yes 2. No 3. Don't remember	
24D	On a diet	1. Yes 2. No 3. Don't remember	
24E	No cooking tools available	1. Yes 2. No 3. Don't remember	
24F	Not able to cook or eat because of health problems	1. Yes 2. No 3. Don't remember	
25	<i>[IF OPTION 2 SELECTED in Q24, ASK] Here are some reasons why people don't always have the quality or variety of food they want. For each one, please tell me if that is a reason why you don't always have the kinds of food you want to eat. [READ LIST. MARK ALL THAT APPLY]</i>		
25A	Not enough money for food	1. Yes 2. No 3. Don't remember	
25B	Kinds of food (I/we) want not available	1. Yes 2. No 3. Don't remember	
25C	Not enough time for shopping or cooking	1. Yes 2. No	

		3. Don't remember	
25D	On a special diet	1. Yes 2. No 3. Don't know	
<i>Now I'm going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for (you/your household) in the last 12 months, that is, since last (name of current month)</i>			
26	"(I/We) worried whether (my/our) food would run out before (I/we) got money to buy more." in the last 12 months?	1. Often true 2. Sometimes true 3. Never true 4. Don't know	
27	"The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." in the last 12 months?	1. Often true 2. Sometimes true 3. Never true 4. Don't know	
28	"(I/we) couldn't afford to eat balanced meals." in the last 12 months?	1. Often true 2. Sometimes true 3. Never true 4. Don't know	

4. ART SITUATION AND FOOD SECURITY

<i>NO</i>	<i>QUESTIONS AND FILTERS</i>	<i>CODING CATEGORIES</i>	<i>CODE</i>
29	Most anti-HIV medications need to be taken on a schedule, such as “2 times a day” or “3 times a day” or “every 8 hours.” How closely did you follow your specific schedule over the last four days?	1. Never 2. Some of the time 3. About half the time 4. Most of the time 5. All of the time	
30	Does any of your anti-HIV medications have special instructions, such as “take with food” or “on an empty stomach” or “with plenty of fluids?”	1. Yes 2. No 3. Don’t remember	
31	If yes, how often did you follow those special instructions over the last four days?	1. Never 2. Some of the time 3. About half the time 4. Most of the time 5. All of the time	
32	When was the last time you missed any of your medications? Check one	1. 1-2 weeks ago 2. 3-4 weeks ago 3. 1-3 months ago 4. 4-12 months ago 5. >12 months 6. Never	
33	Height	_____cm	
34	Weight	_____Kg	
35	Waist circumference	-----CM	

5. Section 1: Individual Dietary Diversity /REASONS FOR SKIPPING THE DOSES

<i>NO</i>	<i>QUESTIONS AND FILTERS</i>	<i>CODING CATEGORY</i>	<i>CODE</i>
36	What caused you to miss dosage of HAART medications?		
36A	Had no food to take with medication?	1. never 2. rarely 3. sometimes 4. often	
36B	Were away from home?	1. never 2. rarely	

		3. sometimes 4. often	
37C	Simply forgot?	1. never 2. rarely 3. sometimes 4. often	
38D	No many for transportation?	1. never 2. rarely 3. sometimes 4. often	
39E	No enough food to feed my family	1. never 2. rarely 3. sometimes 4. often	
40	THE OVERALL HEALTH CONDITION OF THE STUDY PARTICIPANT IS	1. Excellent 2. Very good 3. Good 4. Fair 5. Bad	

Section 2: Household Dietary Diversity

This section should be administered to the female respondent about her own consumption.		In the past 7 days, did you personally eat:	If yes, how many total times in the past 7 days did you personally consume these foods?
		Yes=1 No=0	<i>Write number of times</i>
3.2.1.	Any grain or any food made from grains: injera, teff, millet, sorghum, maize, rice, wheat, bread, biscuits, or any other grain product?		
3.2.2.	Vitamin A-rich roots or tubers? (,orange fleshed sweet potato, yams,)		
3.2.3.	White roots or tubers? (potato, white sweet potato, enset, godere,cassava, anchiote)		
3.2.4.	Any s, legumes, oil seeds (nuts,beans, lentils, peas)?		
3.2.5.	Any dark green leafy vegetables? (Spinach, kale, chard)		
3.2.6.	Any other vegetables?(green beans, tomatoes, cabbage etc.)		
3.2.7.	Any vitamin A rich fruits? (e, mangoes, papaya,)		
3.2.8.	Any other fruits avocado, Casmir, banana,)?		
3.2.9.	Any organ meat (Liver, Kidney, etc)		
3.2.10.	Any flesh meat? (chicken, goat, beef)		
3.2.11.	Any eggs?		
3.2.12.	Any fish or seafood?		
3.2.13.	Any dairy products - milk, cheese, yogurt (not including butter)?		
3.2.14.	Any sugar or honey?		
3.2.15.	Any oil, fats, or butter?		
3.2.16.	Any Miscellaneous?		

	A	B	C
	In the past 24 hours, did you or anyone in your household eat:	In the past 7 days, did you or anyone in your household eat?	In the past 7 days, how many total daysdid you or anyone in your household consumes these foods?
	Yes=1 No=0 (If Yes, Skip to column C)	Yes=1 No=0 (If No, skip to next food group)	<i>(Write number of days)</i>

3.3.1	Any food made from grains: teff, millet, sorghum, maize, rice, wheat, bread, biscuits, or any other grain product?			
3.3.2	Any food made from roots or tubers: potatoes, sweet potatoes, beets, carrots, or other roots or tubers?			
3.3.3	Any pulses, legumes, or nuts (beans, lentils, peas)?			
3.3.4	Any vegetables (green beans, tomatoes, cabbage etc.)?			
3.3.5	Any fruits (avocado, Casmir, banana,)??			
3.3.6	Any meat, fish, or eggs? (beef, lamb, goat, wild game, fish, chicken, or other birds, eggs, liver, kidney, or other organ meats?)			
3.3.7	If yes, was it meat, poultry, offal?			
3.3.8	If yes, did you consume any eggs?			
3.3.9	If yes, did you consume any fish or seafood?			
3.3.10	Any dairy products - milk, cheese, yogurt (not including butter)?			
3.3.11	Any sugar or honey?			
3.3.12	Any oil, fat, or butter?			
3.3.13	Any Miscellaneous?			

D. HOUSEHOLD WEALTH

Does the household have any of the following properties? (Circle)		Yes
D1	Functioning CD player	1
D2	Functioning Flat screen Television	1
D3	Cylinder stove	1
D4	Refrigerator(fridge)	1
D5	Electric stove	1
D6	Bicycle	1
D7	Motor Cycle	1
D8	Cart/Gari	1
D11	Sofa	1
D12	Spring mattress	1
D13	Car	1
D14	Bajaj	1
D15	Taxi	1
D16	Own house	1
D17	Ipad	1
D18	Video camera	1
D19	Digital Camera	1
D20	Washing machine	1

[FOR THE DATA COLLECTOR] NEXT ARE SOME STATEMENTS THAT YOU ARE EXPECTED TO GENUINELY TREAT BEFORE YOU COMPLETED YOUR INQUIRY

	TAKE THE STUDY PARTICIPANT'S WEIGHT (KG)	<input type="text"/>
	TAKE THE STUDY PARTICIPANT'S HEIGHT (CM)	<input type="text"/>
	CHECK FROM THE RECORD THE STUDY PARTICIPANT'S CD4+ CELL COUNTS BEFORE YOU START TAKING THE ART DRUGS	<input type="text"/>

PHASE II: ENGLISH PART QUESTIONER

Part I: Socio demographic variables

Direction: Before starting please provide some personal information about yourself. This information is very important. Please make sure you reply all the questions without skipping. Just as with the rest of the questionnaire, your answer to these questions is completely confidential.

S/No	Questions	Response
1	Age in complete years	_____
2	Marital status	1. Married 2. Divorced 3. Widowed 4. Separated
3	Religion	1. Muslims 2. Orthodox 3. Others, Specify _____
4	Income per month (in birr)	-----
5	Educational status	1. can't read and write 2. read and write 3. 1-6 grade 4. 7-10grades 5. 11-12 grade 6. >12
6	occupation	1. Merchant 2. governmental employee 3. farmer. 4. other.....
7	Did you experience any problems regarding feeding?	1. yes 2. no

Part II: Knowledge items

Directions: for each statement below please reply whether the statement is true (1), false(2), or whether you are not sure(3) of the reply.

S/no	questions	1	2	3
8	Dietary Diversity Intention and Behavior are same			
9	individuals who have who practice Dietary Diversity Behavior have more illnesses than who didn't			
10	Dietary Diversity Behavior helps bonding between HAART and Health			
11	Dietary Diversity feeding Behavior prevents a patient from returning pre-HAART weight			
13	If individuals have good Dietary Diversity Behavior they can work as healthy person.			
14	Vegetables and fruits are unhygienic and can spread germs if not use disinfectant or frizz			
15	Individuals who practice good Dietary Diversity Behavior at house hold have			

	less risk of OIs.			
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Part III theory of planned behavior constructs

Direct measurement of attitude for **Dietary Diversity intention and Behavior**. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]. You may choose any number from 1 to 5.

S/N	questions	1[SD]	2[D]	3[N]	4[A]	5[SA]
16	How do you rate the nutritional benefits of dietary you feel and practice					
17	Diversified food feeding is more convenient than one item food.					
18	Diversified food increases immunity.					
19	Packed food is more likely to be overfed than other food.					
20	Animal food is lacking in iron.					
21	Patients should not feed in Public places such as church/mosk.					
22	Diversified food are more likely to be Useful than undiversified food.					

Direct measurement of **Intention** for Dietary Diversity intention and Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]. You may choose any number from 1 to 5.

	Questions	SD 1	D 2	N 3	A 4	SA 5
23	I expect all PLWHIV should feed Diversified food					
34	I want to feed Diversified food always					
25	I intend to use Diversified food with my family.					

Direct measurement of Behavioral beliefs for Dietary Diversity intention and Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
26	If I fed diversified food I feel that my body will have health benefit.					
27	If I fed diversified food, It will it will improve my daily activities.					
28	If I fed diversified food in public, I feel embarrassed.					
29	If I fed diversified food, it would be very convenient for me.					
30	If I fed diversified food, it will take much of my many.					
31	If I fed diversified food, it will increase my immunity.					
32	If I fed diversified food, I will not nsave some money.					
33	If I fed diversified food, it will prevent me from OIs.					

Direct measurement of **outcome evaluation** for Dietary Diversity intention and Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
34	If I fed diversified food, it will limit me from other social activities.					
35	Being convenient for me to fed diversified food is likely					
36	Taking much of my money/resource during diversified food feeding is likely					
37	Increasing my immunity is likely.					
38	Saving some money is important for me					

Direct measurement of **direct measure of subjective norms** for Dietary Diversity intention and Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
39	Most people who are important to me think that should feed diversified food.					
40	It is expected of me that diversified food feeding always					
41	People who are important to me want to feed diversified food.					

Direct measurement of **indirect measure of subjective norms** for Dietary Diversity intention and Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Direct measurement of **Perceived behavioral control (direct measurement)** for Dietary Diversity intention and

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
42	Your family think that you should feed diversified food					
43	You think my partner would approve if I fed diversified food					
44	I think my close friends approve if I feed diversified food					
45	I think the nurses /Dr want me to feed diversified food					

Behavior. For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
46	I am confident that I could feed diversified food					
47	For me to fed diversified food is simple.					
48	The decision to feed diversified food is beyond my control.					
49	Whether I feed diversified food is entirely up to me.					

Direct measurement of **indirect measurement of behavioral control** for Dietary Diversity intention and **Behavior.** For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion (1) = strong disagreement [SD], 2 = disagreement [D], 3 = neutral [N], 4 = agreement [A], 5 = strong agreement [SA]). You may choose any number from 1 to 5.

Directions: For each of the following statements, please indicate how much you agree or Disagree by choosing the number that most closely corresponds to your opinion		SD	D	N	A	SA
		1	2	3	4	5
50	The change in the immunity with diversified food is unlikely					
51	The physical problem encountered during diversified food feeding is unlikely					
52	When you diversified food tiredness is unlikely					
53	Support from others when diversified food is unlikely					
54	When I feed diversified food taking much money is unlikely					
55	When health problems occur, I'm likely to continue to diversified food.					
56	Feeling of tiredness during diversified food makes it difficult to continue feeding.					
57	Support from others when I feed diversified food makes it easier to continue.					
58	Taking much of my time and many during diversified food feeding makes it difficult to continue					

6.BEHAVIOURAL MEASUREMENTS

Tobacco Use Practice

B1. Have you ever smoked any tobacco products such as cigarettes, cigars, shisha or pipes?

Yes 0. No

B2. Do you **currently** smoke any **tobacco** products, such as cigarettes, cigars, shisha or pipes? *(Circle ONLY ONE answer)*

1. Yes
0. No

B3. Do you currently smoke tobacco products **daily**?

1. Yes
0. No

B4. If Yes to B2, how old were you when you **first started** smoking?

_____ Years

B5. If **yes**, which of the following best describes your smoking status?

1. Current smoker
0. Ex-smoker

B6. If B5 is 1, for how long you have been smoking?

_____ Years

B7. On average, **how many cigarette sticks** do you smoke **each day/ week**?

_____ No. of sticks/ day
_____ No. of sticks/week

B8. If B5 is 0, age at the initial onset of Smoking and Age at which smoking was quit?

_____ started smoke
_____ stopped smoke

B9. Average number smoking per day at time of regular Smoking **(Ex-smoker)**.

_____ number of smoking

Alcohol Use Practice

B10. Have you ever consumed any alcoholic drink?

1. Yes 0. No

B11. Have you consumed any alcohol within the **past 12 months**? *(Circle ONLY ONE answer)*

1. Yes
0. No

B12. During the past 12 months, **how frequently** have you had at least one standard alcoholic drink? *(Circle ONLY ONE answer)*

1. Daily
2. 5-6 days per week
3. 3-4 days per week
4. 1-2 days per week
5. 1-3 days per month
6. Less than once a month

B18. During each of the **past 7 days**, how many standard drinks did you have each day?

Monday _____	Friday _____
Tuesday _____	Saturday _____
Wednesday _____	Sunday _____
Thursday _____	

KHAT Chewing

B19. Do you chew Khat?

1. Yes 0. No

B20. If Yes, In a typical week how many days do you chew Khat?

_____ Days

B21. For how many years you chewed khat?

_____ years

B22. Have you chewed khat in the last one month?

1. Yes 0. No

Dietary practices:

The next questions ask about the fruits and vegetables that you usually eat. As you answer these questions please think of a typical week in the last year.

B23. In a typical week, on how many days do you **eat fruit**?

_____ Days

B24. In a typical week, on how many days do you **eat vegetables**?

_____ Days

B25. In a typical week, on how many days do you **eat protein source foods from animals** (beef, lamb, chicken, fish, egg)?

_____ Days

B26. In a typical week, on how many days do you **eat protein source foods from plants** (pea, bean, chickpea, nuts, ground nuts)?

_____ Days

B27. In a typical week, on how many days do you **eat energy source foods** (cereal grains, energy rich tubers such as potato, sweet potatoes)?

_____ Days

B28. In a typical week, on how many days do you **eat milk and milk products** (milk, cheese, Yogurt)?

_____ Days

B29. In a typical week, on how many days do you **eat fats** (fats and oils)?

_____ Days

B30. In a typical week, on how many days do you eat /drink discretionary calories (soft drinks, sugar, chocolates, honey...)

_____ Days

B31. In a typical week, on how many days do you eat foods fried /baked in an oil (eg. Chips, Biscuits, crackers, cakes)

_____ Days

B32. On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch or dinner.

_____ No of meals

B33. 'Do you skip breakfast?'

1. Yes 0. No

B34. How often do you skip breakfast within a week?

1. Once
2. Two times
3. Three or more times

B35. Do you eat snacks?

1. Yes 0. No

Functional status

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

C1. Does your work involve vigorous-intensity activity that causes large increases in **breathing or heart rate like** *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously?

1. Yes 0. No

C2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?

_____ Days

C3. How much time do you spend doing vigorous-intensity activities at work on a typical day?

_____ Hours _____ Minutes

C4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously?

1. Yes 0. No

C5. In a typical week, on how many days do you do moderate-intensity activities as part of your work?

_____ Days

C6. How much time do you spend doing moderate-intensity activities at work on a typical day?

_____ Hours _____ Minutes

Travel to and From Places

The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. *[Insert other examples if needed]*

C7. Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?

1. Yes 0. No

C8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?

_____ Days

C9. How much time do you spend walking or bicycling for travel on a typical day?

_____ Hours _____ Minutes

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (*leisure*).

C10. Do you do any vigorous-intensity sports, fitness or recreational (*leisure*) activities that cause large increases in breathing or heart rate like *[running or football]* for at least 10 minutes continuously?

1. Yes 0. No

C11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (*leisure*) activities?

_____ Days

C12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

_____ Hours _____ Minutes

C13. Do you do any moderate-intensity sports, fitness or recreational (*leisure*) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, and volleyball] for at least 10 minutes continuously?

1. Yes 0. No

C14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (*leisure*) activities?

_____ Days

C15. How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?

_____ Hours _____ Minute

Sedentary Behavior

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, taxi, reading, playing cards or watching television, but do not include time spent sleeping

C16. How much time do you usually spend sitting or reclining on a typical day?

_____ Hours _____ Minutes

PHASE III: ENGLISH PART QUESTIONER

PART I SOCIO DEMOGRAPHY AND PSYCHOSOCIAL RELATED FACTORS:

Question NO.	Question	Response category	Remarks
q101	Unique ART record number	_____	
q102	Age at the start of ART	_____ years	
q103	Sex of the patient	1. Male 2. Female	
q104	Patient's residence	1. Urban 2. Rural	
q105	Marital Status	1. Never Married 2. Married 3. Divorced 4. Widow	
q106	Educational level	1. No education 2. Primary 3. Secondary 4. Tertiary	
q107	Religion	1. Muslim 2. Orthodox 3. Protestant 4. Catholic 5. Other specify _____	
q108	Occupation	1. Employed 2. Self employed 3. Unemployed 4. Other Specify _____	
q109	Client resides within catchment area?	1. Yes 2. No	
q110	Has the patient disclosed his/her HIV status?	1. Yes 2. No → skip to q115	
q111	Has the patient disclosed to His/her Family member	1. Yes 2. No	

q112	Has the patient disclosed to his/her Friend	1. Yes 2. No	
q113	Has the patient disclosed to Relative	1. Yes 2. No	
q114	Write if disclosed to any other		
q115	Does patient has care giver?	1. Yes 2. No	

Part-II: HIV Care and ART Information

Question NO.	Question	Response category	Remarks
q201	Date of confirmed HIV positive	___/___/___	
q202	Date of enrolment	___/___/___	
q203	Date of eligibility	___/___/___	
q204	Why eligible for ART	1. Clinical only 2. CD4 3. Transfer in 4. pregnancy	
q205	Date of ART start	Date ____, Month ____, Year ____	
q206	Interval of confirmed to start of ART	in month	
q207	How long on HAART (in months)	in month	

Part-III: Follow up information from patient card

Q.No		Questions	Record	Remark
q301	wt0	Weight at the start of ART	_____ kgms	99. Not done
q302	wt6	Weight at the 6 months of start of ART	_____ kgms	99. Not done
q303	wt12	Weight at the 12months of start of ART	_____ kgms	99. Not done
q304	wt18	Weight at the 18 months of start of ART	_____ kgms	99. Not done
q305	wt24	Weight at the 24 months of start ART	_____ kgms	99. Not done
q306	wt30	Weight at the 30 months of start of ART	_____ kgms	99. Not done
q307	wt36	Weight at the 36 months of start of ART	_____ kgms	99. Not done
q308	wt42	Weight at the 42 months of start ART	_____ kgms	99. Not done
q309	wt48	Weight at the 48 months of start of ART	_____ kgms	99. Not done
q310	wt54	Weight at the 54 months of start ART	_____ kgms	99. Not done
q311	wt60	Weight at the 60 months of start ART	_____ kgms	99. Not done
		1. Not malnourished(>18.5kg/m ²) 2. Moderate mal ⁿ (16-18.5) 3. Severe mal ⁿ (<16kg/m ²)		
q312	bmi0	Body mass index at 0 month	1 2 3	99. Not done
q313	bmi6	Body mass index at 6 month	1 2 3	99. Not done
q314	bmi12	Body mass index at 12 month	1 2 3	99. Not done
q315	bmi18	Body mass index at 18 month	1 2 3	99. Not done
q316	bmi24	Body mass index at 24 month	1 2 3	99. Not done
q317	bmi30	Body mass index at 30 month	1 2 3	99. Not done

q318	bmi36	Body mass index at 36 month	1	2	3	99. Not done	
q319	bmi42	Body mass index at 42 month	1	2	3	99. Not done	
q320	bmi48	Body mass index at 48 month	1	2	3	99. Not done	
q321	bmi54	Body mass index at 54 month	1	2	3	99. Not done	
q322	bmi60	Body mass index at 60 month	1	2	3	99. Not done	
q334	fs0	Functional status at the start of ART	1. Working 2. Ambulatory 3. Bedridden			99. Not done	
q335	fs6	Functional status at 6 months	1	2	3	99. Not done	
q336	fs12	Functional status at 12 months	1	2	3	99. Not done	
q337	fs24	Functional status at 18 months	1	2	3	99. Not done	
q338	fs30	Functional status at 24 months	1	2	3	99. Not done	
q339	fs36	Functional status at 36months	1	2	3	99. Not done	
q340	fs42	Functional status at 42 months	1	2	3	99. Not done	
q341	fs48	Functional status at 48 months	1	2	3	99. Not done	
q342	fs54	Functional status at 54 months	1	2	3	99. Not done	
q343	fs60	Functional status at 60 months	1	2	3	99. Not done	
q344	stag0	WHO staging at the start of ART	1. Stage-I 2. Stage-II 3. Stage-III 4. Stage-IV				
q345	stag6	WHO staging at 6 months	1	2	3	4	99. Not done
q346	stag12	WHO staging at 12 months	1	2	3	4	99. Not done
q347	stag18	WHO staging at 18 months	1	2	3	4	99. Not done
q348	stag24	WHO staging at 24 months	1	2	3	4	99. Not done
q349	stag30	WHO staging at 30 months	1	2	3	4	99. Not done
q350	stag36	WHO staging at 36 months	1	2	3	4	99. Not done
q351	stag42	WHO staging at 42 months	1	2	3	4	99. Not done
q352	stag48	WHO staging at 48 months	1	2	3	4	99. Not done
q353	stag54	WHO staging at 54 months	1	2	3	4	99. Not done
q354	stag60	WHO staging at 60 months	1	2	3	4	99. Not done
q355	tb0	TB status at the start of ART	1. No sign 2. INH 3. TB RX			99. Not done	
q356	tb6	TB status at the 6 months	1	2	3	99. Not done	
q357	tb12	TB status at the 12 months	1	2	3	99. Not done	
q358	tb18	TB status at the 18 months	1	2	3	99. Not done	
q359	tb24	TB status at the 24 months	1	2	3	99. Not done	
q360	tb30	TB status at the 30 months	1	2	3	99. Not done	
q361	tb36	TB status at the 36 months	1	2	3	99. Not done	
q362	tb42	TB status at the 42 months	1	2	3	99. Not done	
q363	tb48	TB status at the 48 months	1	2	3	99. Not done	
q364	tb54	TB status at the 54 months	1	2	3	99. Not done	
q365	tb60	TB status at the 60 months	1	2	3	99. Not done	

q366	spt0	If sputum at start, what was the result	1.Negative 2.Positive	
q367	spt6	If sputum at 6 month, what was the result	1 2	99. Not done
q368	spt12	If sputum at 12 month, what was the result	1 2	99. Not done
q369	spt18	If sputum at 18 month, what was the result	1 2	99. Not done
q370	spt24	If sputum at 24 month, what was the result	1 2	99. Not done
q371	spt30	If sputum at 30 month, what was the result	1 2	99. Not done
q372	spt36	If sputum at 36 month, what was the result	1 2	99. Not done
q373	spt42	If sputum at 42 month, what was the result	1 2	99. Not done
q374	spt48	If sputum at 48 month, what was the result	1 2	99. Not done
q375	spt54	If sputum at 54 month, what was the result	1 2	99. Not done
q376	spt60	If sputum at 60 month, what was the result	1 2	99. Not done
		1. NOI 2. Z 3. BP 4. PTB 5. EPTB 6. TO 7. TE 8. UM 9. DC 10. DA 11. PCP 12. CT 13. CM 14. NHL 15. KS 16. CCa 17. O		
		Use the options listed above for the q377-q387 (multiple answers are possible)		
q377	oi0	OIs at the start of ART		99
q378	oi6	OIs at 6 months		99
q379	oi12	OIs at 12 months		99
q380	oi18	OIs at 18 months		99
q381	oi24	OIs at 24 months		99
q382	oi30	OIs at 30 months		99
q383	oi36	OIs at 36 months		99
q384	oi42	OIs at 42 months		99
q385	oi48	OIs at 48 months		99
q386	oi54	OIs at 54 months		99
q387	oi60	OIs at 60 months		99
q388	cotr0	Cotrimoxazole at the start of ART	1. Yes 2. No	99
q390	cotr6	Cotrimoxazole at 6 months	1. Yes 2. No	99
q391		If yes, adherence at 6 months	1. G 2. F 3. P	99
q392	cotr12	Cotrimoxazole at 12 months	1. Yes 2. No	99
q393		If yes, adherence at 12 months	1. G 2. F 3. P	99
q394	cotr18	Cotrimoxazole at 18months	1. Yes 2. No	99
q395		If yes, adherence at 18months	1. G 2. F 3. P	99
q396	cotr24	Cotrimoxazole at 24months	2. Yes 2. No	99
q397		If yes, adherence at 24months	1. G 2. F 3. P	99
q398	cotr30	Cotrimoxazole at 30months	3. Yes 2. No	99
q399		If yes, adherence at 30months	1. G 2. F 3. P	99
q400	cotr36	Cotrimoxazole at 36months	4. Yes 2. No	99
q401		If yes, adherence at 36months	1. G 2. F 3. P	99
q402	cotr42	Cotrimoxazole at 42months	5. Yes 2. No	99
q403		If yes, adherence at 42months	1. G 2. F 3. P	99
q404	cotr48	Cotrimoxazole at 48 months	1. Yes 2. No	99
q405		If yes, adherence at 48months	1. G 2. F 3. P	99
q406	cotr54	Cotrimoxazole at 54 months	1.Yes 2. No	99
q407		If yes, adherence at 54months	1. G 2. F 3. P	99

q408	cotr60	Cotrimoxazole at 60 months	1. Yes 2. No	99
q409		If yes, adherence at 60 months	1. G 2. F 3. P	99
q410	cd40	CD4 count at the start of ART	(cells/mm ³)	99
q411	cd46	CD4 count at 6 month	(cells/mm ³)	99
q412	cd412	CD4 count at 12 month	(cells/mm ³)	99
q413	cd418	CD4 count at 18 month	(cells/mm ³)	99
q414	cd424	CD4 count at 24 month	(cells/mm ³)	99
q415	cd430	CD4 count at 30 month	(cells/mm ³)	99
q416	cd436	CD4 count at 36 month	(cells/mm ³)	99
q417	cd442	CD4 count at 42 month	(cells/mm ³)	99
q418	cd448	CD4 count at 48 month	(cells/mm ³)	99
q419	cd454	CD4 count at 54 month	(cells/mm ³)	99
q420	cd460	CD4 count at 60 month	(cells/mm ³)	99
q421	tlc0	Total lymphocyte count at the start of ART	(cells/mm ³)	99
q422	tlc6	Total lymphocyte count at 6 months	(cells/mm ³)	99
q423	tlc12	Total lymphocyte count at 12 months	(cells/mm ³)	99
q424	tlc18	Total lymphocyte count at 18 months	(cells/mm ³)	99
q425	tlc24	Total lymphocyte count at 24 months	(cells/mm ³)	99
q426	tlc30	Total lymphocyte count at 30 months	(cells/mm ³)	99
q427	tlc36	Total lymphocyte count at 36 months	(cells/mm ³)	99
q428	tlc42	Total lymphocyte count at 42 months	(cells/mm ³)	99
q429	tlc48	Total lymphocyte count at 48 months	(cells/mm ³)	99
q430	tlc54	Total lymphocyte count at 54 months	(cells/mm ³)	99
q431	tlc60	Total lymphocyte count at 60 months	(cells/mm ³)	99
<p>If there is regimen change at 6, 12, 18, 24, 30, 36, 42, 48, 54 or 60 months, consider the following options for reasons (multiple response is possible)</p> <p>1. Toxicity/side effects 2. Risk of pregnancy 3. due to new TB 4. New drug available 5. Drug out of stock 6. Other reason 7. Clinical treatment failure 8. Immunologic failure 9. Virologic failure</p>				
q432	reg0	ART drug regimen started		99
q433	reg6	ART drug regimen at 6 months		99
		If change in regimen at 6months, reason for change (describe type)		99
q434	reg12	ART drug regimen at 12 months		99
q435		If change in regimen at 12 months, reason for change (describe type)		99
q436	reg18	ART drug regimen at 18 months		99
q437		If change in regimen at 18 months, reason for change (describe type)		99
q438	reg24	ART drug regimen at 24 months		99
q439		If change in regimen at 24		99

		months, reason for change (describe type)		
q440	reg30	ART drug regimen at 30 months	_____	99
q441		If change in regimen at 30 months, reason for change (describe type)	_____	99
q442	reg36	ART drug regimen at 36 months	_____	99
q443		If change in regimen at 36 months, reason for change	_____	99
q444	reg42	ART drug regimen at 42 months	_____	99
q445		If change in regimen at 42 months, reason for change	_____	99
q446	reg48	ART drug regimen at 48 months	_____	99
q447		If change in regimen at 48 months, reason for change	_____	99
q448	reg54	ART drug regimen at 54 months	_____	99
q449		If change in regimen at 54 months, reason for change	_____	99
q450	reg60	ART drug regimen at 60 months	_____	99
q451		If change in regimen at 60 months, reason for change	_____	99
	<p>If the adherence status for ARV at any of the 6, 12, 18, 24, 30, 36, 42, 48, 54 or 60 is either poor or fair, use the following options to fill q453, q455, q457, q459, q461, q463, q465, q467, q469, q471</p> <p>1. Toxicity/side effects 2. Share with others 3. Forgot 4. felt better 5. Too ill 6. Stigma, disclosure or privacy issue 7. Drug stock outs 8. Patient lost/run out of pills 9. Delivery/travel problems 10. Inability to pay 11. Alcohol 12. Depression 13. other (multiple response is possible)</p>			
q452	adhr6	Adherence status at 6 months	1. G (Good) 2. F (Fair) 3. P (Poor)	99
q453	reason6	If poor/fair adherence at 6month, reason(s) for poor/ fair adherence (multiple response possible)	_____ _____ _____	99
q454	adhr12	Adherence status at 12 months	1. G 2. F 3. P	99
q455	reason12	If poor/fair adherence at 12 month, reason(s) for poor/ fair adherence (multiple response possible)	_____ _____ _____	99
q456	adhr18	Adherence status at 18 months	1. G 2. F 3. P	99
q457	reason18	If poor/fair adherence at 18 month, reason(s) for poor/ fair adherence (multiple response possible)	_____ _____ _____	99
q458	adhr24	Adherence status at 24 months	1. G 2. F 3. P	99
q459	reason24	If poor/fair adherence at 24	_____	99

		month, reason(s) for poor/ fair adherence (multiple response possible)	_____	
q460	adhr30	Adherence status at 30 months	1. G 2. F 3. P	99
q461	reason30	If poor/fair adherence at 30 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q462	adhr36	Adherence status at 36 months	1. G 2. F 3. P	99
q463	reason36	If poor/fair adherence at 36 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q464	adhr42	Adherence status at 42 months	1. G 2. F 3. P	99
q465	reasn42	If poor/fair adherence at 42 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q466	adhr48	Adherence status at 48 months	1. G 2. F 3. P	99
q467	reasn48	If poor/fair adherence at 48 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q468	adhr54	Adherence status at 54 months	1. G 2. F 3. P	99
q469	reasn54	If poor/fair adherence at 54 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q470	adhr60	Adherence status at 60 months	1. G 2. F 3. P	99
q471	reasn60	If poor/fair adherence at 60 month, reason(s) for poor/ fair adherence (multiple response possible)	_____	99
q472	adhrcar6	Interval of Scheduled to actual date of visit at 6 month in day	_____	99
q473	Adhrcar12	Interval of Scheduled to actual date of visit at 12 month in day	_____	99
q474	adhrcar18	Interval of Scheduled to actual date of visit at 18 month in day	_____	99
q475	Adhrcar24	Interval of Scheduled to actual date of visit at 24 month in day	_____	99
q476	Adhrcar30	Interval of Scheduled to actual date of visit at 30 month in day	_____	99
q477	Adhrcar36	Interval of Scheduled to actual date of visit at 36 month in day	_____	99
q478	Adhrcar42	Interval of Scheduled to actual date of visit at 42 month in day	_____	99

q479	Adhrcar48	Interval of Scheduled to actual date of visit at 48 month in day	_____	_____	99
q480	Adhrcar54	Interval of Scheduled to actual date of visit at 54 month in day	_____	_____	99
q481	Adhrcar60	Interval of Scheduled to actual date of visit at 60 month in day	_____	_____	99
q492	wbc/neut 0	WBC total & Neutrophil % at the start of ART	_____	_____	99
q493	wbc/neut 6	WBC & neutrophil % at 6 months	_____	_____	99
q494	wbc/neut 12	WBC & neutrophil % at 12 months	_____	_____	99
q495	wbc/neut 18	WBC & neutrophil % at 18 months	_____	_____	99
q496	wbc/neut 24	WBC & neutrophil % at 24 months	_____	_____	99
q497	wbc/neut 30	WBC & neutrophil % at 30 months	_____	_____	99
q498	wbc/neut 36	WBC & neutrophil % at 36 months	_____	_____	99
q499	wbc/neut 42	WBC & neutrophil % at 42 months	_____	_____	99
q500	wbc/neut 48	WBC & neutrophil % at 48 months	_____	_____	99
q501	wbc/neut 54	WBC & neutrophil % at 54 months	_____	_____	99
q502	wbc/neut 60	WBC & neutrophil % at 60months	_____	_____	99
q503	hgb/plt0	Hemoglobin& platelet at the start of ART	_____	_____	99
q504	hgb/plt6	Hemoglobin& platelet at 6 months	_____	_____	99
q505	hgb/plt12	Hemoglobin& platelet at 12 months	_____	_____	99
q506	hgb/plt18	Hemoglobin& platelet at 18 months	_____	_____	99
q507	hgb/plt24	Hemoglobin& platelet at 24 months	_____	_____	99
q508	hgb/plt30	Hemoglobin& platelet at 30 months	_____	_____	99
q509	hgb/plt36	Hemoglobin& platelet at 36 months	_____	_____	99
q510	hgb/plt42	Hemoglobin& platelet at 42 months	_____	_____	99
q511	hgb/plt48	Hemoglobin& platelet at 48	_____	_____	99

		months		
q512	hgb/plt54	Hemoglobin& platelet at 54 months	_____	99
q513	hgb/plt60	Hemoglobin& platelet at 60months	_____	99
q514	sgot/sgpt0	SGOT & SGPT at the start of ART	_____	99
q515	sgot/sgpt6	SGOT & SGPT at the 6 months	_____	99
q516	sgot/sgpt12	SGOT & SGPT at the 12 months	_____	99
q517	sgot/sgpt18	SGOT & SGPT at the 18 months	_____	99
q518	sgot/sgpt24	SGOT & SGPT at the 24 months	_____	99
q519	sgot/sgpt30	SGOT & SGPT at the 30 months	_____	99
q520	sgot/sgpt36	SGOT & SGPT at the 36 months	_____	99
q521	sgot/sgpt42	SGOT & SGPT at the 42 months	_____	99
q522	sgot/sgpt48	SGOT & SGPT at the 48 months	_____	99
q523	sgot/sgpt54	SGOT & SGPT at the 54 months	_____	99
q524	sgot/sgpt60	SGOT & SGPT at the 60 months	_____	99
q525	bun/creat0	BUN & creatinine at start ART	_____	99
q526	bun/creat6	BUN & creatinine at 6 months	_____	99
q527	bun/creat12	BUN & creatinine at 12 months	_____	99
q528	bun/creat18	BUN & creatinine at 18 months	_____	99
q529	bun/creat24	BUN & creatinine at 24 months	_____	99
q530	bun/creat30	BUN & creatinine at 30 months	_____	99
q531	bun/creat36	BUN & creatinine at 36 months	_____	99
q532	bun/creat42	BUN & creatinine at 42 months	_____	99
q533	bun/creat48	BUN & creatinine at 48 months	_____	99
q534	bun/creat54	BUN & creatinine at 54 months	_____	99

	54			
q535	bun/creat	BUN & creatinine at 60 months	_____	99
1 no side effect 2 nausea 3 diarrhea 4 fatigue 5 headache 6 numbness 7 rash 8 anemia 9 abdominal pain 10 jaundice 11 fat change 12 dizzy/anxiety 13 other				
q536	ADR6	Side effect at one month follow up		99
q537	Otcom	Patient outcome	1. On follow up 2. Died 3. Lost 4. drop	99
q538	Dtwhn	If outcome is death when?	Day __ month __ year __	99