

OPEN ACCESS

Journal of  
**Public Health and  
Epidemiology**



October 2018

ISSN: 2141-2316

DOI: 10.5897/JPHE

[www.academicjournals.org](http://www.academicjournals.org)



**ACADEMIC  
JOURNALS**

expand your knowledge

## About JPHE

The Journal of Public Health and Epidemiology (JPHE) is a peer reviewed journal. The scope of the journal covers all areas of the subject such as health observatory, biostatistics, occupational health, behavioural medicine, disease surveillance, outbreak and investigation, preventive healthcare, health economics, community health, and public policy.

## Open Access Policy

Open Access is a publication model that enables the dissemination of research articles to the global community without restriction through the internet. All articles published under open access can be accessed by anyone with internet connection.

The Journal of Public Health and Epidemiology is an Open Access journal. Abstracts and full texts of all articles published in this journal are freely accessible to everyone immediately after publication without any form of restriction.

## Article License

All articles published by Journal of Public Health and Epidemiology are licensed under the [Creative Commons Attribution 4.0 International License](#). This permits anyone to copy, redistribute, remix, transmit and adapt the work provided the original work and source is appropriately cited. Citation should include the article DOI. The article license is displayed on the abstract page the following statement:

This article is published under the terms of the [Creative Commons Attribution License 4.0](#)

Please refer to <https://creativecommons.org/licenses/by/4.0/legalcode> for details about [Creative Commons Attribution License 4.0](#)

## Article Copyright

When an article is published by in the Journal of Public Health and Epidemiology , the author(s) of the article retain the copyright of article. Author(s) may republish the article as part of a book or other materials. When reusing a published article, author(s) should;

Cite the original source of the publication when reusing the article. i.e. cite that the article was originally published in the Journal of Public Health and Epidemiology . Include the article DOI

Accept that the article remains published by the Journal of Public Health and Epidemiology (except in occasion of a retraction of the article)

The article is licensed under the Creative Commons Attribution 4.0 International License.

A copyright statement is stated in the abstract page of each article. The following statement is an example of a copyright statement on an abstract page.

Copyright ©2016 Author(s) retains the copyright of this article.

### **Self-Archiving Policy**

The Journal of Public Health and Epidemiology is a RoMEO green journal. This permits authors to archive any version of their article they find most suitable, including the published version on their institutional repository and any other suitable website.

Please see <http://www.sherpa.ac.uk/romeo/search.php?issn=2141-2316>

### **Digital Archiving Policy**

The Journal of Public Health and Epidemiology is committed to the long-term preservation of its content. All articles published by the journal are preserved by [Portico](#). In addition, the journal encourages authors to archive the published version of their articles on their institutional repositories and as well as other appropriate websites.

<https://www.portico.org/publishers/ajournals/>

### **Metadata Harvesting**

The Journal of Public Health and Epidemiology encourages metadata harvesting of all its content. The journal fully supports and implement the OAI version 2.0, which comes in a standard XML format.. [See Harvesting Parameter](#)

### **Contact**

Editorial Office: [jphe@academicjournals.org](mailto:jphe@academicjournals.org)

Help Desk: [helpdesk@academicjournals.org](mailto:helpdesk@academicjournals.org)

Website: <http://www.academicjournals.org/journal/JPHE>

Submit manuscript online <http://ms.academicjournals.org>

Academic Journals  
73023 Victoria Island, Lagos, Nigeria  
ICEA Building, 17th Floor,  
Kenyatta Avenue, Nairobi, Kenya

## Editors

**Dr. Mohammad Mohsin Khan**

Community Health Sciences  
Amna Inayat Medical College and Research Institute  
Lahore, Pakistan.

**Prof. Mostafa A. Abolfotouh**

King Abdullah International Medical Research Center  
King Saud Bin-Abdulaziz University for Health Sciences  
National Guard Health Affairs,  
Saudi Arabia.

**Dr. Smith Stella Ifeanyi**

Nigerian Institute of Med. Research,  
Yaba, Lagos State,  
Nigeria.

**Dr. Areej Hussein**

Department of Microbiology  
College of Medicine  
University of Diyala  
Iraq.

**Dr. Edlaine Villela**

Institute of Health Sciences  
Federal University of Goiás (UFG)  
Brazil.

**Dr. Xiaoliang Qiu**

Department of Physiology and Biophysics  
Stony Brook University  
USA.

# JOURNAL OF PUBLIC HEALTH AND EPIDEMIOLOGY

## Table of Content

**Prevalence of premarital sexual practices and its associated factors among high school students in Addis Zemen Town, South Gondar, Ethiopia, 2017**

Netsanet Habte, Ayanalem Adu, Tizita Gebeyehu, Shimeles Alemayehu, Yemane Tesfageorgis and Terefe Gatiso

**Mental health status of students attending tertiary institutions in Bayelsa State, Nigeria**

Ebenezer Amawulu and Kurokeyi Eniyekedidei Prosper

**Sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia: A community based cross-sectional study**

Biniyam Sahiledengle, Fessahaye Alemseged, Tefera Belachew

**Investigating risk factors associated with the persistence of malaria in the Obang valley, North West Region, Cameroon**

Tiburce Gangue, Laurentine Sumo, Ngum Helen Ntonifor, Etso I. Che and Hugues C. Nana-Djeunga

*Full Length Research Paper*

# **Prevalence of premarital sexual practices and its associated factors among high school students in Addis Zemen Town, South Gondar, Ethiopia, 2017**

**Netsanet Habte<sup>1\*</sup>, Ayanalem Adu<sup>2</sup>, Tizita Gebeyehu<sup>3</sup>, Shimeles Alemayehu<sup>3</sup>, Yemane Tesfageorgis<sup>3</sup> and Terefe Gatiso<sup>3</sup>**

<sup>1</sup>Department of Medical Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

<sup>2</sup>Department of Surgical Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

<sup>3</sup>Department of Comprehensive Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

Received 18 June, 2018; Accepted 6 August, 2018

**Pre-marital sex is a penetrative vaginal or anal sexual intercourse performed before formal marriage in younger population. Moreover, these population groups are less likely than adults to have the information, skills and support to protect themselves against HIV/AIDS and other consequences of premarital sex. The aim of this study was to assess the prevalence of pre-marital sexual practice and its associated factors among high school students in Addis Zemen town. A cross sectional study design was conducted in purposefully selected site from April to June 2017. Single population proportion formula was used to select 284 study subjects. Study participants were selected randomly from grade 9 and 10 students. Structured pre-tested questionnaire was used to collect the data and data were checked and entered to EpiInfo v.3.5. Statistical Packages for Social Sciences v.20 used to analyze the data. Bivariant analysis results with p-value <0.2 was included in multivariate logistic regression. The study showed a prevalence of 32.6% premarital sex. Being lower age groups (13-18) were 2.48 times at higher risk than those who are at high age groups (19-25), (AOR=2.48, CI= 1.24-4.95). Having girl/boyfriends were 20.66 times at higher risk than those who have no girl/boyfriend, (AOR=20.66, CI= 9.39-45.46). Premarital sexual practice among the study participants was strongly associated with being lower age groups and having boy/girlfriends. The most mentioned reason for students to start their first sexual practice was love affair and interest. Health education should be encouraged and the clinic at school level should be strengthened as well as establishing a club to teach about premarital sexual practices are suggested.**

**Key words:** Premarital sex, sexual practice, prevalence.

## **INTRODUCTION**

Premarital sex is a penetrative vaginal or anal sexual intercourse performed before formal marriage. Some people may be engaged in such sexual practices with

many sexual partners and therefore they may have high number of life time sexual partners that could be liable to acquire sexually transmitted infections (STIs) including

Human Immunodeficiency Virus (HIV) (Vos, 2004). Young adults are highly affected by sexual related problems and early onset of sexual practice among people in different countries of the world (Laumann, 2006). Most young people often challenged with strong social, peer and cultural pressure to engage in premarital sex (Alemu et al., 2017), which increased their risk of early pregnancy, abortion and exposure to STDs including HIV/AIDS (5). In addition, unwanted pregnancy among female students may lead to school dropout and a failure to complete their education. Hence, unwanted pregnancies may end up with illegal and unsafe abortions, which may lead to death. Therefore, studying premarital sexual practice and associated risk factors among high school students is an essential issue.

On the sexual behavior of the youth the individual, family, drinking alcohol, chewing chat, use of substances other than chat and the peer variables have considerable influences to practice premarital sex (Alemu et al., 2017; Adisu and Abdulbasit, 2014). However, it is one of the least researched topics in the current study area, due to the sensitivity of the topic of premarital sexuality; youth receive inadequate education, guidance and services on reproductive health. To fill the gap, it is thus imperative to study the prevalence of premarital sex and the factors surrounding premarital sex in the context of high school students to inform Ministry of Health, Ministry of Education and planners to develop appropriate and timely intervention programs to prevent high risk sexual behavior such as premarital sex and unsafe sexual practices in these population. Therefore, this study aimed to assess the prevalence of premarital sexual practice and associated factors among high school students in Addis Zemen, South Gondar, Ethiopia.

## METHODS

### Study setting and design

A cross-sectional study design was employed at Addis Zemen High School from April to June 2017. Addis Zemen is found in South Gondar Administration Zone in the Amhara region of north western Ethiopia and is around, at a distant of 640 km far from the capital city of Ethiopia. Addis Zemen is the capital town of libokemkem weeds (district) which has average population of 198,374. It has an average altitude of 2,000 m above sea level. Addis Zemen has only one high school named Addis Alem High School which is located 2 km away the main road and it was found in the gate way of Bahir dar

### Source population

All Addis Zemen High School regular students enrolled in 2009 E.C

academic calendar were the source population.

### Study population

The population of the study consist of all Addis Zemen High School students attending their regular education at the time of data collection

### Inclusion and exclusion criteria

#### Inclusion criteria

All regular high school students and attending their regular education at the time of data collection were included.

### Sample size determinations and sampling technique

#### Sample size determination

The required sample size was calculated by single population proportion formula and p-value obtained from study conducted in Nekemte, where prevalence of premarital sex among high school

adolescents was 21.4%. A formula, 
$$n = \frac{(z \frac{\alpha}{2})^2 p(1-p)}{d^2}$$
, was used to estimate the sample size. where, n= sample size, Z=1.96, p=proportion and d=precision (0.05), (p = 0.214), 95% confidence interval, margin of error 5% (d = 0.05). Computing with the above formula and 10% of contingency for non-response rate gives a total sample size of 284. A Simple random sampling technique was used and the sample size allocated proportionally to 9<sup>th</sup> and 10<sup>th</sup> grade students.

### Data collection tools and procedures

Structured, pretested and self- administered Amharic version questionnaires were used to collect the data. The questionnaires contain socio-demographic, premarital sexual practice and associated factors. Data were collected by six data collectors after training. Participants were informed about the study and written consent were obtained from them.

### Data quality management

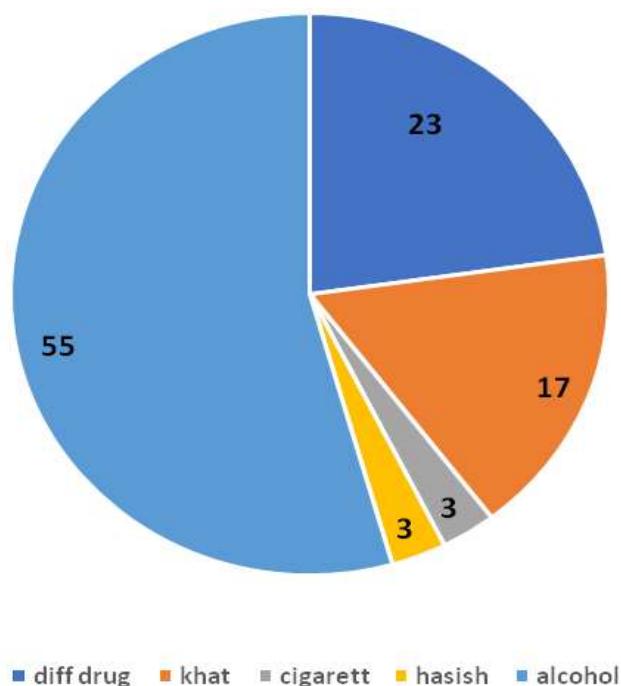
The questionnaires were initially developed in English and translated to Amharic language then back to English to ensure consistency. It was assessed for clarity and completeness where missed pattern was rephrased. Then it was pre-tested with 10% of total population at Woreta High School students. The data were double entered in EpiEnfo to check the consistency and were cleaned and edited before analysis.

### Data processing and analysis

The data were analyzed using Statistical Packages for Social

\*Corresponding author. E-mail: netmersy@gmail.com, Tel: 0918775130

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)



**Figure 1.** Types substance abused by high school students in Addis Zemen Town, 2017.

Sciences (SPSS) Microsoft ware. Descriptive statistics were used and logistic regression was applied to see the risk factors. Those variables with p values <0.2 were included to the multivariate analysis and significant was considered when the P value is  $\leq 0.05$ .

#### Ethical consideration

Ethical clearance was obtained from Ethical Review Comittie (ERC) of department of Comprehensive Nursing, School of Nursing College of Medicine and Health Sciences and letter of permission from the school was obtained. The study was conducted after getting oral consent from the study participants. Students were not subjected to any harm as far as the confidentiality was kept. No personal identifiers were used on data collection form.

## RESULTS

### Socio demographic characteristics of the respondent

The response rate was 97.18% and the age ranges of the respondents 'were from 13-25 years with the mean age of  $17.51 \pm 1.796$ . One hundred fifty (54.3%) of the study subjects were female. Most of the students were grade 10<sup>th</sup> 158(57.2%). Most of the study participants, 271(98.2%), were Amhara, 243(88%) were Orthodox. Majority of the student's family 111(40.2%) can read and write. Monthly income of most of the study subjects' family ranges from 500-1000 Birr which accounts 93(33.7%). Regarding their school payment were covered

by both parents 238(86.2%). One hundred ninety-five (70.7%) study subjects work different jobs to get money. Majority of them were farm workers (158(57.2%) (Table 1).

### Alcohol and drug consumptions

Among 276 study participants, 55(19.9%) and 23(8.3%) used to drink alcohol and different types of drugs respectively (Figure 1).

### Premarital sex

Out of 276 study participants 32.6% had the practice of premarital sexual. Eighty four points four percent (84.4%) were experienced sexual intercourse with only one sexual partner. The minimum age at which the study subjects had sexual intercourse was 13 years and the maximum age was 23 years with the mean age of 17.51. Forty four percent of the respondents responded that falling in love with their sexual partner is their main reason of having the first sexual intercourse (Table 2).

### Factors associated with premarital sex

The risk factors associated with premarital sex among the



**Table 1.** Socio demographic characteristics of high school adolescent students in Addis Zemen Town, South Gondar, 2017 (N=276).

Variables	Characteristic	Frequency	Percent
Age(year)	13-18	194	70.3
	19-25	82	29.7
Sex	Male	126	45.7
	Female	150	54.3
Grade	Ninth	118	42.8
	Tenth	158	57.2
Ethnicity	Amhara	271	98.2
	Tigray	5	1.8
Religion	Orthodox	243	88
	Muslim	29	10.5
	Protestant	4	1.4
Living place	Urban	147	59.3
	Rural	129	40.7
With whom you live	Father and Mother	196	71.1
	Mother only	31	11.2
	Father	1	.4
	Brother	13	4.7
	Sister	12	4.3
	Alone	23	8.3
Family educational status	Cannot read and write	71	25.7
	Can read and write	111	40.2
	1-8 grade educated	45	16.3
	9-12 grade educated	30	10.3
	High grade level educated	19	6.9
Family monthly income	<500	69	25
	500-1000	93	33.7
	1000-1500	29	10.5
	1500-2000	27	9.8
	>2000	58	21
School payment covered by	Father and mother	238	86.2
	Myself	22	8
	Sister	4	1.4
	Brother	6	2.2
	Boy/Girl friend	5	1.8
	Other	1	0.4
Do you work to get money	Yes	195	70.7
	No	81	29.3

**Table 1. Contd.**

Types of jobs	Shop	62	22.5
	Waiter	15	5.4
	Listro	3	1.1
	Farming	107	38.8
	Selling of khat and shisha	3	1.1
	Others	5	1.8

**Table 2.** Pre-marital sexual practices among high school adolescent students in Addis Zemen, Town, 2017 (N=276).

Variables	Characteristic	Frequency	Percent
Ever had sexual intercourse	Yes	90	32.6
	No	186	67.4
Age at first sexual intercourse	13-18	68	75.55
	19-25	22	24.45
Age at first sexual partner	13-18	60	66.66
	19-25	30	33.33
Reason to start sex	Fall in love	40	44.44
	Interest	40	44.44
	Peer pressure	6	6.66
	For money	2	2.22
	By drug abuse	2	2.22
Relation of the first sexual partner	Girl /boy friend	30	33.33
	Fiancé	37	41.11
	Short time knowing	23	25.6
Total number of sexual partner	One	76	84.4
	Two	3	3.33
	Three	4	4.44
	>four	7	7.77

study subjects are age and having boy/girlfriend. Lower age group (13-18) students are 2.48 times high risky than those of high age group (19-25), (AOR=2.48, CI= (1.24-4.95)). Having girl/boy friends are 20.66 times high risk than those of who have no girl/boyfriend, (AOR=20.66, CI= (9.39-45.46)) (Table 3).

## DISCUSSION

Pre-marital sex is a penetrative vaginal or anal sexual intercourse performed before formal marriage. This study has tried to assess the premarital sexual practice and associated factors among high school students in Addis Zemen, South Gondar. The current study revealed that the mean age of 15.5 years at first sexual intercourse. Studies conducted at Addis Ababa and Gamogofa show

that the mean age at first sexual intercourse/initiation was 16.03 and 17.07 years respectively. Practicing at the access technology that could increase watching of pornography and sex movies (Dereje et al., 2015; Marelign and Gistane, 2013).

The prevalence of premarital sex among the study participants was 32.6% with the 95% CI (27.5-38.4). This study is in line with the study conducted in Oromia Region, Sebeta Town High School students (28.3%) (Helen, 2014). The current study was higher than a study conducted in Agaro and Nekemte High Schools (25 and 21.4%) (Girma et al., 2004; Dessalegn, 2006), respectively and the possible reason for this difference might be due to advancement and access to technologies in recent years as well as effect of globalization. This study was lower than the study conducted in Kenya (64%) (Mensch et al., 2003) and this might be attributed

**Table 3.** Factors associated with premarital sexual practice among high school adolescent students in Addis Zemen Town, 2017.

Variable	Yes%	No%	COR (95%CI)	AOR (95%CI)
Age(year)				
13-18	45(23.19)	149(76.80)	4.03 (2.33,6.97)*	2.48(1.24, 4.95)
19-25	45(54.88)	37(45.12)		**
Having boy/girlfriend				
Yes	37(17.37)	176(82.63)	25.21(11.75,	20.66(9.39,
No	53(84.13)	10(15.87)	54.07)*	45.46)**
Students' grade				
9th	30(25.42)	88(74.58)	1.80(1.06, 3.03)	
10 <sup>th</sup>	60(37.97)	98(62.02)		
Have ever seen sex film				
Ye	31(49.20)	32(50.79)	2.53(1.42, 4.51)	
No	59(27.69)	154(72.30)		

earlier age in this finding might be explained in relation to differences in cultural and environmental conditions.

In this study the main reason to have sexual practice was fall in love 40 (44.4%). Premarital sexual practice by their desire/ interest accounted 44.4% while peer pressure was 6(6.6%). This finding is similar to the study conducted in Sebeta Town Oromia Region where falling in love registered as 46.8% followed by had desire to have sexual practice (38.9%). But the reason of having premarital sex among Northern Ethiopia High School students was due to peer pressure (35.2%), and use of drugs, which is different from the current study (Salih et al., 2015). The possible reason may be adapting of western culture and style.

In this study majority 76(84.4%) of the students who have experienced premarital sex, had one sexual partner. Similarly, the study conducted among Agaro High School adolescent students showed that larger proportion of the study participants 55.6% had one sexual partner (Girma et al., 2004). Having girl/boy friends were 20.66 times at a higher risk than those who have no girl/boyfriend and the association was significant (AOR=20.66, 95%CI (9.39, 45.46). Students in the lower age groups were 2.48 times high risk than those of higher age groups (AOR=2.48 95%CI, (1.24-4.95) and this finding is more or less in agreement with reports made by Bogale and Seme (2014). The study showed that as grade level and age increases the practice of premarital sex decreases and this indicate that level of awareness increases with increased maturity.

#### Limitation of the study

Although their confidentiality was reassured, since

sexuality is a sensitive issue and the respondents may feel that their privacy is violated. As a result, tendency to hold back or give false information could be a limitation to this study. Relying only on self-administered questionnaire, which compromises the quality of raw data in such sensitive issue, is another drawback to this study.

#### CONCLUSION AND RECOMMENDATION

This study revealed that the prevalence of premarital sex among the study participants is higher than the studies conducted in other parts of Ethiopia. Premarital sexual practice among the study participants was strongly associated with age group and having boy/girlfriends. Furthermore the study showed that students started premarital sexual practice at their lower age group of 13-18 years old. The study showed that as grade level and age increases the practice of premarital sex decreases. Providing school psychosexual services/education to younger populations and establishing club to teach about premarital sexual practice and its risk factor are suggested.

#### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

#### REFERENCES

Adisu SB, Abdulbasit MS (2014). Prevalence of premarital sex and associated factors among out of-school youths (aged 15-24) in Yabello town, Southern Ethiopia: A community based cross-sectional study. *The Pharma Innovation* 3(10):10-15 ISSN: 2277- 7695

- Alemu C, Ewunat G, Fiseha T (2017). Risky Sexual Practices and Associated Factors among Preparatory School Students in Nifas Silk Lafto Sub-City, Addis Ababa, Ethiopia. *Journal of Medical Biomedical and Applied Sciences* 5(7). ISSN: 2349-0748.
- Bogale A, Seme A (2014). Premarital sexual practices and its predictors among in-school youths of Shendi town, west Gojjam zone, North Western Ethiopia. *Reproductive health* 11(1):49.
- Dereje G, Getachew H, Mulatu A, Kassahun K (2015). Factors Early Sexual Initiation among Governmental Preparatory School Students, Addis Ababa, and Community. *Journal of Community Medicine and Health Education* 5(333):2161-0711.
- Dessalegn W (2006). An assessment of premarital sexual practice and factors contributing to premarital sex among high school adolescents in Nekemte town, e/wollega zone, oromia regional state (doctoral dissertation, aau).
- Girma B, Assefa D, Tushunie K (2004). Determinants of condom use among Agaro high school students using behavioral models; *Ethiopian Journal of Health Development* 18(1):25-30.
- Helen B (2014). assessment of the prevalence of premarital sex and unprotected sexual practices among secondary school adolescent students in sebeta town, oromia regional state, Ethiopia, URI: <http://localhost:80/xmlui/handle/123456789/7582>
- Kassa GM, Woldemariam EB, Moges NA (2014) Prevalence of Premarital Sexual Practice and Associated Factors among Alamata High School and Preparatory School Adolescents, Northern Ethiopia. *Global Journal of Medical Research* 14(3).
- Laumann EO (2006) the social organization of sexuality: Sexual practices in the United States. University of Chicago Press.
- Maregn T, Gistane A (2013). Factors associated with age at first sexual initiation among youths in Gamo Gofa, South West Ethiopia: a cross sectional study. *BMC Public Health* 13(1):622. <https://doi.org/10.1186/1471-2458-13-622>
- Mensch BS, Hewett PC, Erulkar AS (2003). The reporting of sensitive behavior by adolescents: a methodological experiment in Kenya. *Demography* 40(2):247-268.
- Salih NA, Metaferia H, Reds AA, Biadgilign S. (2015). Premarital sexual activity among unmarried adolescents in northern Ethiopia: a cross-sectional study. *Sexual & Reproductive Healthcare* 6(1):9-13.
- Stephenson JM, Strange V, Forrest S, Oakley A, Copas A, Allen E, Babiker A, Black S, Ali M, Monteiro H, Johnson AM (2004). Pupil-led sex education in England (RIPPLE study): clusterrandomised intervention trial. *The Lancet* 364(9431):338-346.
- Vos T (2004). Attitudes to sex and sexual behavior in rural Matabeleland, Zimbabwe. *AIDS care* 6(2):193-203

*Full Length Research Paper*

# **Mental health status of students attending tertiary institutions in Bayelsa State, Nigeria**

**Ebenezer Amawulu<sup>1,2\*</sup> and Kurokeyi Eniyekedidei Prosper<sup>2</sup>**

<sup>1</sup>Department of Biological Sciences, Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, Nigeria.

<sup>2</sup>Department of Biology, Isaac Jasper Boro College of Education, Sagbama, Bayelsa State, Nigeria.

Received 19 January, 2018; Accepted 30 July, 2018

**National health policies that take into cognizance the interventions against the menace of students' ill health in Nigeria are limited. This study investigated the health status of students in tertiary institutions in Bayelsa State. A descriptive study design was adopted to randomly select four tertiary institutions out of six. Two hundred students were randomly selected from the four schools; fifty from each school. Structured questionnaires containing symptoms-specific ill health were distributed to the selected students. One hundred and fifty-five questionnaires used for the analyses were retrieved. Thirty six specific health symptoms perceived by the students were classified following WHO standard. Out of 561 students-symptoms, 35.6% were mental health while 34.6% were infectious. More female (66.53%) than male (60.14%) showed mental health symptoms. The differences were not significant ( $P>0.05$ ). Students who had lived in urban location had more mental than those that resided in rural location. The differences were significant ( $P<0.05$ ). The symptoms decreases as age increased. 60.1% of the students developed these health challenges as they got admitted into schools while 39.9% of the students had the problem at home before admitted to the school. The symptoms of the student's mental health increased as parents' income improved. The implication of these results is a cause for prompt public health intervention.**

**Key words:** Mental health, infectious health, students, tertiary institutions, Bayelsa State.

## **INTRODUCTION**

Tertiary institution students represent higher percentages of adolescent, which is the period that marks transition from youthful age to adulthood (World Youth Report (WYR), 2003). Tertiary education represents a transitional period of a new independence life from their parents and a dependent life at school. The period is characterized by

rapid interrelated changes both of body, mind and social relationship (National School Climate Council (NSCC), 2007).

Health, according to World Health Organization is the state of complete physical, mental and social well-being and not merely the absence of diseases and infirmity

\*Corresponding author. E-mail: [ebenezeramawulu@gmail.com](mailto:ebenezeramawulu@gmail.com).

(WHO, 2002). University students are more vulnerable to various kinds of health problems, ranging from increased stresses to unhealthy lifestyle (Adewuya, 2006; Nerdrum et al., 2006; Ovuga et al., 2006; Stewart-Brown et al., 2000). The major health challenges identified among students in the tertiary institution are mental health, psychological problem, infectious diseases and emotional disorder (Tomoda et al., 2000). However, mental health has been more associated with adolescent. It accounted for 11.5% of the global disease burden (World Health Organisation (WHO), 2007). Over 450 million people worldwide are estimated to be suffering from some form of brain or mental disorder. In Nigeria alone, the prevalence of mental illness is reported at 20% (Shekhar, 2006).

Mental health is a major public health challenge, yet suffers institutional neglect. Over 30% of countries lack good mental health policy. Although in Nigeria Mental Health Policy was formulated in 1991 at Lagos, yet the implementation was not readily available (Mental Health Leadership and Advocacy Programme (MHLAP), 2012). The impact of lack of mental health policy implementation has created high rates of neglect, stigmatization, and streets roaming of the sufferers. The mental ill health has also impacted negatively on the educational outcomes among university students (Brackney and Karabenick, 1995). Despite these problems, the National health policies that take into cognizance interventions against the menace of students' mental ill health in Nigeria is lacking. The early identification of the mental related health conditions of students in the tertiary institutions is a pre requisite to providing a long lasting solution to students' ill health. This information is lacking among students in the tertiary institutions in Bayelsa State, Nigeria. The aim of this study was to investigate the health status of students in tertiary institutions in Bayelsa State.

## MATERIALS AND METHODS

### Study area

This study was conducted in four of the six tertiary institutions in Bayelsa State, viz; Niger Delta University, Amassoma in Southern Ijaw Local Government Area (6°15'N and 6°14'E); Isaac Jasper Boro College of Education, Sagbama, Sagbama LGA (5°9'N and 16°14'E); Bayelsa State School of Nursing, Tombia, Yenagoa Local Government Area (4°53'N and 5°17'E) and Bayelsa State School of Health Technology, Otuogidi, Ogbia LGA (4°36'N and 5°45'E). These institutions were selected based on accessibility at the time of the study. Also the institutions were selected on local government basis. Southern Ijaw and Yenagoa LGAs had two tertiary institutions each. The most accessible was purposefully selected.

### Study design

The study adopted a cross sectional study to determine the health

status among students attending tertiary institutions in Bayelsa State, from January-March, 2016.

### Sampling technique and data collection

The study population comprised all six tertiary institutions in Bayelsa State. These are; Niger Delta University, Amassoma, Federal University, Otuoke, Federal Polytechnics, Ekewe, Isaac Jasper Boro College of Education, Sagbama, Bayelsa State School of Nursing, Tombia and Bayelsa State School of Health Technology, Otuogidi. Four institutions were purposefully selected based on accessibility at the prevailing time. The samples include all the students in the selected schools. The study included only the new intakes students and those who were in their 3<sup>rd</sup> Year. The 3<sup>rd</sup> Year students were used because apart from Niger Delta University, every other institution runs a three-year program; hence the 3<sup>rd</sup> year is an equivalent of the final year in a four-year program. Although the total population of the schools was not known at the time of study, since the new intake were still undertaking registration process, the proportion of new intakes and third year students was in a ratio of 2:1 across the schools. For these reasons, fifty students from each institution were randomly selected based on willingness to supply data. From each institution, forty new intakes and twenty 3<sup>rd</sup> Year students were engaged after showing their willingness. Thirty-five new intakes and fifteen Year Three students from each institution who satisfy the inclusion conclusion were randomly selected, making up a total sample size of two hundred (200) students.

### Research instrument

200 self-reporting questionnaires tagged: "The health status of students in tertiary institution (HSOSTS) in Bayelsa State" containing 40 items modified by World Health Organization (WHO) were distributed to the randomly selected students in the four institutions (fifty questionnaires for each institution) by a practicing doctor. Each questionnaire comprise two sections; A and B. Section A contained demographic information of students and parents while Section B contains items that elicit the response of the students on their perceived health challenges. The personal information included in the questionnaire was the sex, age, and residential location, year of study and occupation of parents of the students. Other information includes sets of mental and infectious health related symptoms supplied by a practicing doctor.

### Ethical consideration

Prior to the distribution of questionnaires, ethical clearance (in the form of a verbal consent) was obtained during a pre meeting with the institutional heads and participating students to seek their consent. This was granted after the purpose and benefits of the study was properly explained to the institution's head. The self-designed questionnaire was administered to randomly selected students to fill; thereafter, 145 duly filled questionnaires were retrieved from the respondents. The remaining fifty questionnaires were retrieved unfilled; hence, excluded in the data analyses. Only data retrieved were used for all the analyses.

### Method of data analyses

Data were cleaned up and cross-checked for correctness before analysis. These were thereafter entered to Microsoft Office Excel

2007 and then exported to SPSS version 16.0 for analysis. Both descriptive and analytical statistical procedures were utilized. Descriptive statistics like percent mean and standard deviation were used for the presentation of demographic data and classification of health challenges. Significant differences of the mental health, infectious health of students of various sexes, age group and parental background across institutions were determined in ANOVAs at a confident level of 0.05.

## RESULTS AND ANALYSIS

### Demographic information

Out of the one hundred and forty-five (145) questionnaires retrieved, male respondent accounted for 44.8% while female accounted for 55.2%. 46.2% of the total respondents reside in rural area, 51.0% lives in urban area while 2.8% did not indicate residential area. The respondents of the students according to their year of studies are; 100 level (35.2%), 200 level (35.9%), 300 level (23.4%) and 400 level (5.5%).

The parent's characteristics were also described by their occupation and income level. Higher percentage of the student's parents were civil servant (67.9%), followed by business (24.4%). The differences were statistically significant ( $\chi^2 = 26.62$ ;  $df = 5$ ;  $p < 0.05$ ). The income level (naira) in the increasing order are; <5000 (3.7%), > 100,000 (16.4%), 10,000-20,000 (22.4%), 30,000-40,000 (26.1%), 50,000-100,000 (31.3%). Details are shown Table 1.

### Perceived health status of students in tertiary institution in Bayelsa State during January to December, 2016

Thirty-six (36) health specific-symptoms classified by WHO were presented to students in the study institutions. Out of the 36 symptoms presented, 15 symptoms representing 41, 66% were significantly accepted across the institutions ( $F = 426.528$ ;  $df = 1$ ;  $p\text{-value} = 0.000$ ;  $p < 0.05$ ) (Table 2). Twenty-four (24) symptoms representing 66.7% were mental health while 12(33.3%) were infectious health.

Five hundred and sixty one (561) students' symptoms were pooled across the institutions. 65.6% had mental health while 34.6% had infectious health. The differences in students' health status were significant ( $F = 10.558$ ;  $df = 35$ ;  $p < 0.05$ ). The similar trend was recorded across institutions ( $F = 15.364$ ;  $df = 3$ ;  $P < 0.05$ ) (Table 3). Prevalence of the students-symptoms status showed sex differences. Symptoms of mental health were higher in female (66.53%) than in male (60.14%). Male showed more symptoms of infectious health (35.45%) than the female (33.45%). The differences were not statistically significant ( $\chi^2 = 0.77$ ;  $df = 3$ ;  $P > 0.05$ ). The symptoms of

both mental and infectious health decreases as the age of the student increased (Table 4). Variations also exist in the symptoms of the ill health across students' residential locations. Students that reside in the urban areas manifest more symptoms of mental and infectious health (mental- 70.25%; infectious- 20.65%) than those that reside in the rural location (mental- 20.68%; infectious- 14.44%). The differences were significant ( $\chi^2 = 24.46$ ;  $df = 1$ ;  $p < 0.05$ ) (Table 5). The health challenges of students were acquired at different period; some were acquired before gaining admission to the tertiary institution while some develop after gaining admission. From the result, 60.1% of the symptoms were developed after gaining admission while 39.9% were acquired before gaining admission into the school. The trends in the manifestation of the symptoms were similar for both mental and infectious health challenges (Table 6).

### Prevalence of student symptoms health status by parent's socio-economic status

Disparity exist between parents income level and students health challenges. The symptoms of students' mental and infectious health increased as the parents' income level increases. The disparity was not statistically significant. More so, students whose parents were civil servant showed more symptoms of both mental and infectious health while lower symptoms were observed among students whose parents were clergymen. The differences were statistically significant ( $\chi^2 = 2.18$ ,  $df = 3$ ;  $p > 0.05$ ) (Table 7).

## DISCUSSION

The health status of tertiary school students in Bayelsa State was more of mental illness (65.6%) than infectious illness (34.6%). This highlighted the fact that students are more vulnerable to psychological illness than communicable diseases. This observation is consistent with the report of Benton et al. (2003) and Eisenberg et al. (2007). Both acknowledged that students are more vulnerable to mental health problems than the general population. The vulnerability of students to mental health had been attributed to stress of academic pressures, adjustment to meet up with the challenges of adulthood, the demands of practical life and maintaining relationships with others (Rodgers and Tennison, 2009). The prevalence of mental health symptom in this present study was higher than the report elsewhere. Redhwan and Dhekra (2012) reported a prevalence of 48.3% of emotional disorders from among 338 students' in Malaysian university. Berihun et al. (2015) reported 40.9% prevalence of mental distress among undergraduate students of University of Gondar,

**Table 1.** Demographic information of respondents.

<b>Variable</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Sex</b>		
Male	65	44.8
Female	80	55.2
<b>Age (yrs)</b>		
16-21	49	33.8
22-26	63	43.4
27-32	30	20.9
>33	3	2.1
<b>Level of study</b>		
100	51	35.2
200	52	35.9
300	34	23.4
400	08	5.5
<b>Residential location</b>		
Rural	67	46.2
Urban	74	51.0
Un identified	04	2.8
<b>Parent's occupation</b>		
Civil servant	75	67.9
Farmer	08	5.9
Professionals	01	2.7
Business	34	24.4
<b>Parent's income</b>		
<5000	05	3.7
10,000-20,000	30	22.4
30,000-40,000	35	26.1
50,000-100,000	42	31.4
>100,000	22	16.4

Source: Field data (2016).

Northwest Ethiopia. Sadia and Zahid (2013) reported 31% severe mental health and 16% very severe mental health with 1850 students in six public sector universities of Lahore, Pakistan. The observed prevalence of severe and moderate depression (7.0 and 25.2%) among tertiary institution students in western Nigeria, as revealed in this study is a call for urgent public health intervention (Karl et al., 2013).

The prevalence of mental health was sex-specific. Higher prevalence in female than in male has been reported (Adewuya, 2006; Sadia and Zahid, 2013). The differences is an indication that female lack competence in managing their health challenges (Chew-Graham et al., 2003), or

may show more proneness to anxiety (Eisenberg et al., 2007).

Mental health symptoms decreases as the age of the student increased. This observation has also been reported by (Tosevski et al., 2010). Variations of the symptoms by age may be connected with the ability to cope with anxiety and stress. In the present study, higher percentage of mental health symptoms was between 16 to 21 years. These subjects are within teenage age and slightly within adolescent age. The reduced ability to cope with anxiety and stress has been reported among similar age bracket elsewhere (Bostanci et al., 2005). Other reports (Wong et al., 2006; Stallman, 2010) have



**Table 2.** Analysis of variance of the symptoms of students' health challenges in tertiary institutions in Bayelsa State.

<b>Dependent Variable: Predominant</b>						
<b>Source</b>	<b>Type III Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>	
Corrected Model	2122.111 <sup>a</sup>	38	55.845	10.938	0.000	
Intercept	2177.778	1	2177.778	426.528	0.000	
<b>CHALL</b>	<b>1886.722</b>	<b>35</b>	<b>53.906</b>	<b>10.558</b>	<b>0.000*</b>	
<b>SCHOOL</b>	<b>235.389</b>	<b>3</b>	<b>78.463</b>	<b>15.367</b>	<b>0.000*</b>	
Error	536.111	105	5.106			
Total	4836.000	144				
Corrected Total	2658.222	143				

a: R Squared = 0.798; adjusted R Squared = 0.725; \*Significant at 0.05.

**Table 3.** Prevalence of symptoms of health challenges by institutions.

<b>Number of students</b>	<b>Institution's symptoms (n)</b>	<b>Students' symptoms</b>	<b>Health challenge</b>	
			<b>Mental</b>	<b>Infectious</b>
NDU=40	1440	146	96 (65.75)	50 (34.25)
IJBCOE=40	1440	177	122 (68.92)	55 (31.07)
SN=29	936	120	77 (64.17)	43 (35.88)
SHT=36	1292	118	73 (61.86)	45 (38.14)
<b>Total</b>	<b>5112</b>	<b>561</b>	<b>368 (65.60)</b>	<b>193 (34.40)</b>

F=15.367; df= 3; P< 0.05. \*n= Institutions' symptoms was obtained by multiplying 36 perceived symptoms by the number of students; Student symptom = Observed data from the field; \*The number within the parentheses is the percentages of the total number of symptoms recorded; \*NDU= Niger Delta University; \*IJBCOE= Isaac Jasper Boro College of Education; \*SN= School of Nursing; \*SHT= School of Health Technology.

Source: Field data (2016).

**Table 4.** Prevalence of symptoms of health challenges by sex and age.

<b>Variable</b>	<b>Health challenge</b>		<b>Both</b>
	<b>Mental</b>	<b>Infectious</b>	
<b>Sex</b>			
Male	145 (64.16)	81(35.8)	226 (40.29)
Female	223 (66.57)	112 (33.46)	335 (59.71)
<b>Age</b>			
16-21	124 (22.10)	88 (15.69)	212 (73.79)
22-26	103 (18.40)	91(16.22)	194 (34.58)
27-32	63 (11.23)	78 (14.10)	141 (25.13)
33-38	9 (1.60)	4 (0.71)	13 (2.32)

\*The number within the parentheses is the percentages of the total number of symptoms recorded.

Source: Field data (2016).

attributed the high percentage to the inability of students within this age bracket to openly discuss their psychological problems with friends.

Residential locations also affect the manifestation of ill health among students. In this study, students who

resided in urban areas experienced more health challenges than students that had resided in rural areas; an observation that contrasted the report of Redhwan and Dhekra (2012) who reported that emotional disorder was less among urban students than rural students.

**Table 5.** Prevalence of symptoms of health challenges by residential location.

Location	Classification {No. (%)}		Both
	Mental	Infectious	
Rural	127(22.64)	81(14.44)	208 (37.08)
Urban	237(40.25)	116 (20.68)	353 (62.92)

\*The number within the parentheses is the percentages of the total number of symptoms recorded.

Source: Field data (2016).

**Table 6.** Prevalence of symptoms of health challenges by the period of its manifestation.

Period	Classification {No. (%)}		Both
	Mental	Infectious	
Before admission	135 (42.6)	89 (36.5)	224 (39.9)
During School	182 (57.4)	155 (63.5)	337 (60.1)

\*The number within the parentheses is the percentages of the total number of symptoms recorded.

Source: Field data (2016).

**Table 7.** Prevalence of symptoms of health challenges by parent's income level and occupational status.

Variable	Classification		Both
	Mental	Infectious	
<b>Income(#)</b>			
<5000	36 (6.4)	20 (3.7)	56 (10.0)
10,000-20,000	64 (11.4)	45 (7.8)	110 (19.6)
30,000-40,000	101 (18.0)	59 (10.5)	116 (28.5)
≥50,000	150 (26.7)	96 (15.3)	246 (43.9)
<b>Occupation</b>			
Civil servant	174 (56.7)	156 (61.2)	330 (58.8)
Farmer	40 (13.1)	24 (9.4)	64 (11.4)
Business	88 (28.8)	71 (27.8)	159 (28.3)
Clergymen	4 (1.3)	4 (1.6)	8 (1.4)

Source: Field data (2016).

However, similar reports by Muhammad (1993) attributed the differences to the lifestyle and family background of students in these different locations.

The variation in the manifestation of mental and infectious health in students at different stages of their school life agrees with Fisher et al. (2003). Higher percentages of the students manifested the symptoms after they had been admitted to school. Gately (2005) asserted that the onset of mental illness often occurs during early childhood or adolescence, but it became more compounded when such individual struggle to cope

with the stress and anxiety at school.

Parents' income level had shown significant impact on the health conditions of students (Ovuga et al., 2006). Students in this study whose parents earn higher income experienced higher symptoms of both mental and infectious ill health; an observation that contrasted the report of Eisenberg et al. (2007). The occupation of students' parents showed significant relationship.

However, the reasons why students whose parents are civil servants showed higher prevalence of mental symptoms than students whose parents are clergymen

lacks explanation within the scope of this present study.

## CONCLUSION AND RECOMMENDATION

The prevalence of mental and infectious distress among students in tertiary institution in Bayelsa State was found to be high. The prevalence was relatively high among female students than in male and decrease as age increases. Students that live in urban areas showed more vulnerability to ill health than those that live in rural areas. Most students manifest symptoms of ill health at the time they had admission into higher institution. Parents' income level and occupation included factors associated with mental and infectious health challenges of students in the tertiary institution. It is recommended therefore that adequate attention be given to students as regards recognizing their health status as early as possible. Policy makers, college officials, non-governmental organizations, and parents, should show more concern to the health status of students. Programs aimed at preventing mental distress need to be introduced in schools so as to identify factors leading of mental distress at the early stage. Also, Counseling Unit should be established in each institution.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## REFERENCES

- Adewuya AO (2006). Prevalence of major depressive disorder in Nigerian College students with alcohol-related problems, *General Hospital Psychiatry* 28:169-173. <http://dx.doi.org/10.1016/j.genhosppsy.2005.09.002A>
- Benton SA, Robertson JM, Tseng W, Newton FB, Benton SL (2003). Changes in counseling center client problems across 13 years professional psychology, research and practice 34:66-72.
- Brackney BE, Karabenick SA (1995). Psychopathology and academic performance: The role of motivation and learning strategies. *Journal of Counseling Psychology* 42(4):456.
- Bostanci M, Ozdel O, Oguzhanoglu NK, Ozdel L, Ergin A, Ergin N, Atesci F, Karadag F (2005). Depressive symptomatology among university students in Denizli, Turkey: prevalence and socio demographic correlates. *Croatian Medical Journal* 46(1):96-100.
- Chew-Graham CA, Rogers A, Yassin N (2003). 'I wouldn't want it on my CV or their records': medical students' experiences of help-seeking for mental health problems. *Medical Education Journal* 37:873-880.
- Eisenberg D, Gollust SE, Golberstein E, Hefner JL (2007). Prevalence and correlates of depression, anxiety, and suicidality among university students. *American Journal of Orthopsychiatry* 77(4):534-542.
- Fisher WA, Fisher JD, Harman J (2003). The information-motivation-behavioral skills model: a general social psychological approach to understanding and promoting health behavior. In: Suls J, Wallston KA, editors. *Social psychological foundations of health and illness*. Oxford: Wiley-Blackwell pp. 82-106.
- Gately G (2005). Colleges target mental health campus: Groups, courses, online services help reduce the stigma of treatment. Retrieved from [http://www.boston.com/news/education/higher/articles/2005/04/17/colleges\\_target\\_mental](http://www.boston.com/news/education/higher/articles/2005/04/17/colleges_target_mental) the 6th march, 2016.
- Karl P, Limpopo T, Supa P (2013). Depression and Associated Factors among University Students in Western Nigeria. *Journal of Psychology in Africa* 23(3):459-466.
- Mental Health Leadership and Advocacy Programme (MHLAP) (2012). *Mental Health Situation Analysis In Nigeria*. The report of Mental Health Leadership and Advocacy Programme of the department of Psychiatry, University of Ibadan in collaboration with WHO centre for research and training in mental health, Neurosciences and drug and Alcohol abuse. [http://www.mental\\_health\\_situation\\_analysis\\_in\\_nigeria](http://www.mental_health_situation_analysis_in_nigeria)
- Mohammad A (1993). Adolescent girls and their rights: health of adolescent girls, with special emphasis on reproductive and sexual health and nutrition", a paper prepared for the United Nations Expert Group Meeting on Adolescent girls and their Rights, Addis Ababa pp. 13-17.
- National School Climate Council (NSCC) (2007). *The school climate challenge Narrowing the gap between school climate research and climate policy, practice guideline and teacher education policy*.
- Nerdrum P, Rustoen T, Ronnestad M (2006). Student psychological distress: a psychometric study of 1750 Norwegian 1st-year undergraduate students. *Scandinavian Journal of Educational Research* 50:95-109.
- Ovuga E, Boardman J, Wasserman D (2006). Undergraduate student mental Health at Makerere University, Uganda. *World Psychiatry* 5(1):51-52.
- Redhwan AA, Dhekra HA (2012). Prevalence and Associated Factors of Emotional Disorder among Malaysian University Students. *International Journal of Collaborative Research on Internal Medicine and Public Health* 4:1401-1411
- Rodgers LS, Tennison LR (2009). A preliminary assessment of adjustment disorder among First-Year College Students. *Archives of Psychiatric Nursing* 23(3):220-230.
- Sadia S, Zahid M (2013). Mental Health Problems in University Students: A Prevalence Study. *FWU Journal of Social Sciences* 7(2).
- Shekihar S, Gureje O (2006). WHO-AIMS Report on Mental Health System in Nigeria, WHO and Ministry of Health Ibadan, Nigeria P 15.
- Stewart-Brown S, Evans J, Patterson J, Petersen S, Doll H, Balding J, Regis D (2000). The health of students in institutes of higher education: an important and neglected public health problem? *Journal of Public Health Medicine* 22(4):492-499.
- Stallman HM (2010). Psychological distress in university students: a comparison with general population data *Australian Psychologist* 45(45):249-257.
- Tosevski DL, Milovancevic MP, Gajic SD (2010). Personality and psychopathology of university students Current opinion in psychiatry 23(1):48-52.
- Tomoda A, Mori K, Kimura M, Takahashi T, Kitamura T (2000). One-year prevalence and incidence of depression among first-year university students in Japan: a preliminary study. *Psychiatry and Clinical Neurosciences* 54(5):583-588.
- World Youth Report (WYR) (2003). *Youth and Health Issues*, P 102.
- World Health Organisation (WHO) (2002). *Health Environments for Children: Initiating an alliance for Action*. Geneva.
- World Health Organisation (WHO) (2007). *World Health Statistics* (Geneva: WHO, 2007) 68.
- Wong JGWS, Cheung EPT, Chan KKC, Ma KKM, Tang SW (2006). Web-based survey of depression, anxiety and stress in first-year tertiary education students in Hong Kong. *Australian and New Zealand Journal of Psychiatry* 40(9):777-782.

*Full Length Research Paper*

# **Sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia: A community based cross-sectional study**

**Biniyam Sahiledengle<sup>1\*</sup>, Fessahaye Alemseged<sup>2</sup>, Tefera Belachew<sup>3</sup>**

<sup>1</sup>Department of Public Health, School of Health Science, Madda Walabu University Goba Referral Hospital, Bale-Goba, Ethiopia.

<sup>2</sup>Department of Epidemiology, School of Health Science, Jimma University, Jimma, Ethiopia.

<sup>3</sup>School of Graduate Studies Director, Jimma University, Jimma, Ethiopia.

Received 6 August, 2018; Accepted 27 August, 2018

**Attaining sustainable sanitation in urban slum community is still an issue and continues to be a gap. Furthermore, factors associated with sanitation practices among slum dwellers has not been yet well explored in many low income countries, such as Ethiopia. This study was designed to determine the sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia. A community based cross-sectional study was employed. The systematic random sampling technique was used to select households from the slum community in Addis Ababa, Ethiopia. A pre-tested structured interviewer administered questionnaire was used to collect data. Descriptive statistics were computed. Multivariable logistic regression analysis was used to identify associated factors. A total of 335 slum dwellers were involved in the study, of which 64.5% of the households use unimproved sanitation facility and 78.3% of the sanitation facilities were in poor condition. Less than half, 46.9% (95%CI: 41.5, 52.2%) of the slum dwellers had good sanitation practices. Having an improved sanitation facility (AOR= 7.27, 95%CI: 3.09, 17.05), having pour-flush type of sanitation facility (AOR= 4.32, 95%CI: 1.99, 9.39), presence of solid waste collection container inside the house compound (AOR=4.26, 95%CI: 2.02, 8.97), and good hygienic knowledge (AOR=4.37, 95%CI: 1.87, 10.24) were factors associated with good sanitation practice. Poor sanitation practices and unhygienic sanitation facilities were widely reported by slum dwellers and acute in the urban slum of Addis Ababa. Escalating household improved sanitation facilities along with strong health promotion programs on sanitation and hygiene practice is recommended.**

**Key words:** Urban sanitation, sanitation practice, hygiene knowledge, informal settlements, slum, Kirkos sub-city, Addis Ababa, Ethiopia.

## **INTRODUCTION**

Attaining sustainable sanitation is still an issue and continues to be a gap throughout the globe. In addition, the disease burden as a result of inadequate and poor sanitation practice is escalating. Worldwide, poor

sanitation practice is responsible for 4% of deaths and 5.7% of morbidity (WHO and UNICEF, 2012; WHO and UNICEF, 2014). The World Health Organization (WHO) estimates that 1.5 million preventable deaths per year

result from unsafe water, inadequate sanitation or hygiene and these deaths are mostly among children less than five years old (Prüss-Üstün et al., 2008a). In 2010 and 2011 alone, about eight million children died before reaching the age of five, and diarrhoea resulted to 250 million lost school days mainly due to poor sanitation facilities and unhygienic conditions (UNICEF, 2012; Walker et al., 2013). Those who suffer the most of these water-related challenges are the urban poor, often living in slum areas or informal settlements following rapid urban growth, in situations lacking many of life's basic necessities: safe drinking water, adequate sanitation services and access to health services, durable housing and secure tenure (WHO and UNICEF, 2012; UNICEF, 2012; Walker et al, 2013; WHO, 2009; Prüss-Üstün et al., 2008b).

According to United Nation (UN)-HABITAT, sanitation and hygiene challenges in slums is described in terms of poor basic services, such as access to sanitation facilities as well as safe water sources (WHO, 2009; Dagdeviren and Robertson, 2011). WHO estimates that approximately 2.6 billion people worldwide live with inadequate sanitation and the health risks are severe for the urban poor living in slum conditions (WHO, 2002). The rapid urbanization and the mismatch in the provision and maintenance of basic necessities in these areas even lead to origin and spread of diseases (Shukla et al., 2016). In this regard, urban areas all over Africa, despite local and regional differences have much in common; poor water supply coupled with inadequate waste collection and no facilities for disposal of excreta is a typical condition for most urban settlements in Africa (Erik and Uno, 1994; Kwacha and Egejuru, 2010; Joséphine et al., 2008). Among the world's regions, Sub-Saharan Africa continue to have the lowest levels of sanitation facility coverage; 44% of the population uses either shared or unimproved facilities (WHO and UNICEF, 2012; WHO and UNICEF, 2013; WHO and UNICEF, 2014). This situation was worse among urban slum dwellers, mainly due to poor sanitation facilities and unhygienic conditions (Erik and Uno, 1994; WHO and UNICEF, 2013; Mubarak et al., 2016). Studies reported the slum environment to be high risk for diarrhoea; due to close proximity of sanitation facilities to homes, sharing of sanitation facilities, and poor hygiene of the sanitation facilities and housing compounds (Mubarak et al., 2016). Overcrowding and poor sanitation in these areas also lead to high parasite transmission rates through closer proximity of the infected to larger vulnerable populations and infections thrives in these conditions (Brooker et al.,

2006). Several studies also reported intestinal parasitic infections are common in high risk vulnerable populations such as urban slums (Mbae et al., 2013; Akimbo et al., 2011; Appleton et al., 2009).

People living in slums are not only vulnerable and at high risk of diseases and high mortality in addition unsafe, inadequate, and unhygienic sanitation results in multiple and overlapping health, economic, and social impacts that disproportionately impact women and girls living in urban slums; the impacts on women's health include infectious and chronic illnesses, violence, food contamination and malnutrition, economic and educational attainment, and indignity (Isunju et al., 2011; Corburn and Hildebrand, 2015).

According to the well-known F diagram, disease is transmitted first from feces to fluids, fields, flies, or fingers, and then directly to a new host or indirectly through food (US Agency for International Development, 2004). To discontinue these passageways, sanitation is the vanguard measure to prevent transmissions from faeces regardless of the area, either urban or rural settlements (Mubarak et al., 2016; US Agency for International Development, 2004).

In Ethiopia, access to safe sanitation services is still among the lowest in Sub-Saharan Africa (CSA, 2011; CSA, 2014). In addition, the country suffers a variety of deprivation related to waste management (Van Rooijen and Tadesse, 2009; Bizatu and Negga, 2010; Tewodros et al., 2008; Kassie, 2016; Sahiledengle et al., 2018). Although sanitation has been a long stand problem in urban slums of Ethiopia, there is still a gap in quantifying the sanitation practice of slum dwellers, and identification of factors that affect sanitation practice and strategies to control them is yet to be established (Abdissa and Walelegn, 2016). To attain sustainable sanitation in slum areas and to prevent the dramatic problems linked with sanitation requires reliable data, since, sanitation does not exist in isolation, identifying and understanding the associated factor is equally crucial. Thus, this study aimed to assess the sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia.

## MATERIALS AND METHODS

### Study area, design and population

A community based cross-sectional study design was employed in one of the slum areas in Addis Ababa (Ethiopia), in Kirkos sub-city, District 11. The study was conducted from March 9 to 17, 2015. The

\*Corresponding author. E-mail: biniyam.sahiledengle@gmail.com.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

source population of the study was all households found in District 11 and the study population were randomly selected households. Individuals above 18 years old (household head/spouse) and who lived in the district for six or more months were included. If the randomly selected house is a public or a private organization it was excluded.

### Sample size determination and sampling technique

The sample size was calculated using Epi-Info version 3.5.1 software (Center for Disease Control and Prevention, Atlanta, 2004) using single population proportion formula by considering 50% proportion of sanitation practice, 95% confidence interval (CI) and a 5% margin of error. Accordingly, the sample size was 384. Since the source population ( $n=4,580$ ) is below 10,000, finite population correction was considered and by adding the possible 10% non-response, the final sample size was 392 households. The systematic random sampling technique was used to select households from the district and every 12 household was included. For households which did not fulfil the inclusion criteria, the next household was considered.

### Data collection and quality

A pre-tested structured questionnaire was used to collect data by trained ten data collectors. The data collection tool was developed by reviewing relevant literatures and by adapting the content from related studies (WHO, 2009; WHO and UNICEF, 2013; CSA, 2014). The questionnaire was prepared in English and translated to Amharic (local language) and translated back to check its consistency. The overall data collected process, data completeness and consistently was closely supervised. Sanitation practices of the household were assessed by 11 items with three points Likert-type scale of always, sometimes and never. The Cronbach's alpha reliability coefficient value of the scale was 0.78.

### Measurement and variables

The primary outcome variable of the study, sanitation practices refer to safe disposal of human excreta (faeces and urine) and household waste water disposal, proper segregation, collection and disposal of solid wastes, safe water handling and maintenance of personal and domestic hygiene. To classify sanitation practice, a composite score was constructed and respondents who score more than the mean value of all the sanitation practice questions classified as having a good sanitation practice otherwise poor practice. The independent variables included; socio-demographic characteristics (age, sex, marital status, family size, educational status of the household head/spouse, occupational status of the household head/spouse, monthly income), sanitation facility (type of latrine, location of latrine and latrine ownership), availability of water, housing ownership, presence of on-site solid waste collection containers, and hygiene knowledge.

### Data analysis

Data were entered into Epi data 3.1 (Epi Data Association, Odense Denmark) and exported to SPSS 20.0 version (Armonk, NY: IBM Corp) for further analysis. Descriptive statistics and bivariate analyses were computed. To detect the independent factors of

sanitation practice, multivariable logistic regression analysis was performed. Over all goodness of fit was checked using the Hosmer and Lemeshow chi square test. Adjusted odds ratio (AOR) with corresponding 95% confidence interval (CI) was used to quantify the strength of association and  $p$ -value  $\leq 0.05$  was considered as statistically significant.

### Ethical considerations

The study was approved by Jimma University Ethical review committee and a written consent was obtained from the study participants.

## RESULTS

### Socio-demographic characteristics of the study population

A total of 335 households were interviewed which gives 85.5% response rate. Seven in every ten respondents interviewed were female (245, 73.1%). The mean (standard deviation) age of the respondents were 39.33 ( $\pm 14.53$ ) (Table 1).

### Solid waste and domestic liquid waste management practice

This study showed that 242 (72.2%) of the respondents have access to solid waste storage container in their surroundings. Two-third, 215 (64.2%) of the households reported they use the municipality solid waste disposal container for disposal of solid wastes and the remaining 120 (35.8%) households disposed solid waste by different methods [such as open field dumping (74%), burning in the compound (16%), and burying (10%)]. One hundred and twenty (38.2%) of the households reported they segregate solid wastes. Regarding domestic liquid waste disposal practice, two-third of the households (220, 65.7%) dispose liquid waste into open drainage ditch, 76 (22.7%) in an open field, 22 (6.6%) in septic tank and 17 (5.1%) use soak pit.

### Sanitation and hygiene status of households

Majority (242, 72.3%) of the households had some form of pit latrine. Almost half, 176 (52.5%) of them were found unclean at the time of data collection and 215 (64.5%) of the households use unimproved sanitation facility and 73 (21.7%) of the sanitation facilities were in good condition. It was shown that there was a significant association between type of sanitation facility and educational level [ $X^2 =$  Chi-square test (17.91),  $df =$  degree of freedom (2),  $p < 0.000$ ], monthly income ( $X^2 = 5.45$ ,  $df = 1$ ,  $p = 0.02$ ) and house ownership ( $X^2 = 15.65$ ,  $df = 2$ ,  $p < 0.000$ ) (Table 2).

**Table 1.** Socio-demographic characteristics of slum dwellers in Addis Ababa, Ethiopia (n=335).

Variables	Category	Frequency	Percent
Age	18-25	59	17.6
	26-35	82	24.5
	36-45	93	27.8
	46-55	50	14.9
	56-65	24	7.2
	≥66	27	8.1
Sex	Female	245	73.1
	Male	90	26.9
Marital status	Married	177	52.8
	Single	90	26.9
	Separate	27	8.1
	Widowed	41	12.2
Occupation status	House wife	118	35.2
	Student and unemployed	100	29.9
	Daily laborer and merchant	62	18.5
	Government employee and NGO employee	55	16.4
Education status	No education	36	10.7
	Read and write	65	19.4
	Primary education	50	14.9
	Secondary education	134	40.0
	Diploma and above	50	14.9
Family size	1-4	178	53.1
	5-7	127	37.9
	≥8	30	9
Average monthly income in Ethiopian Birr (ETB)	<500	65	19.4
	500-1000	83	24.8
	1001-2000	97	29.0
	2001-3000	61	18.2
	>3000	29	8.7
House ownership	Owner	94	28
	Rented	97	29
	Government	144	43

Regarding the core preventive methods of diarrhoea, hand washing practice was the most frequently stated prevention methods by 255 (76.1%) households. On the other hand, 315 (94.9%) of the households reported they wash their hands after visiting the toilet and among this 277 (87.9%) wash their hands with soap and water, and

the remaining 38 (12.1%) use water only. Two hundred and sixty five (79.1%) (95%CI: 74.6, 83.3%) of the households had good hygiene knowledge. Based on the cut off point set, 157 (46.9%) (95%CI: 41.5, 52.2%) of the households had good sanitation practice and the remaining, 78 (53.1%) 95%CI: (47.8, 58.5%) of the

**Table 2.** Association between type of sanitation facility and different variables among slum dwellers in Addis Ababa, Ethiopia (n=335).

Variables	Type of sanitation facility		Total (%)	X <sup>2</sup>	P-value
	Pit latrine (%)	Pour-flash type of latrine (%)			
<b>Educational status</b>					
No formal education	32(13.2)	4(4.3)	36 (10.7)	17.91 df= 2	P<0.000*
Read and write + primary education	94(38.8)	21(22.6)	115(34.3)		
Secondary and above	116(47.9)	68(73.1)	184(54.9)		
<b>Income</b>					
<1700 ETB	156(64.5)	47(50.5)	203(60.6)	5.45 df=1	P= 0.02*
≥ 1700 ETB	86 (35.5)	46(49.5)	132(39.4)		
<b>Housing ownership</b>					
Owner	55(22.7)	39(41.9)	94(28.0)	15.65 df=2	P<0.000*
Rent	69(28.5)	28(30.1)	97(29.0)		
Governmental	118(48.8)	26(28.0)	144(43.0)		
<b>Cleanliness of the latrine *</b>					
Unclean	104(43.0)	72(77.4)	176(52.5)	31.96 df=1	P<0.000*
Clean	138(57.0)	21(22.6)	159(47.5)		
<b>Sanitation facility condition **</b>					
Good	53(21.9)	20(21.5)	73(21.8)	0.006 df=1	P=0.937
Poor	189(78.1)	73(78.5)	262(78.2)		
<b>Sanitation facility status ***</b>					
Unimproved	180(74.4)	35(37.6)	215(64.2)	39.46 df=1	P<0.000*
Improved	62(25.6)	58(62.4)	120(35.8)		
<b>No of households served by shared sanitation facility (215)</b>					
≤ 6	115(79.3)	31(44.3)	146(67.9)	26.57 df 1	P<0.000*
>6	30(20.7)	39(55.7)	69(32.1)		
<b>Proximity of sanitation facility (n=325)</b>					
> 6 meters	96(41.0)	7(7.7)	103(31.7)	49.72 df=2	P<0.000*
≤ 6 meters	125(53.4)	60(65.9)	185(56.9)		
Inside the home	13(5.6)	24(26.4)	37(11.4)		
<b>Sanitation facility with hand washing facility</b>					
Yes	79(32.6)	15(16.1)	94(28.1)	9.08 df=1	P=0.003*
No	162(67.4)	78(83.9)	241(71.9)		

df= degree of freedom, \* p-value < 0.05 , X<sup>2</sup>= Chi-square test. \* Presence of flies in and around the latrine, presence of faeces on the floor or around the sanitation facility, filth smells, and filled; \*\* Sanitation facilities in good condition if they were clean, not filled, having properly constructed superstructure, well fitted door, un- broken slab and presences of hand washing facility; \*\*\* Sanitation facility considered improved if they were not shared by two or more households.



households had poor sanitation practice.

### Water supply

All the households reported that they use pipe water as the main sources of water supply for all domestic purposes. However, the respondents reported that it is not adequate for personal hygiene (199, 59.4%), domestic purpose (179, 53.4%) and drinking (122, 36.4%). Two hundred and fifty six (76.4%) of the households had awareness on how to making water safe for drinking.

### Factors associated with sanitation practice

Multivariable logistic regression analysis was performed, to check the correctness of the final model, Hosmer and Lemeshow test for the overall goodness of fit was used, and the value became 0.381 that is insignificant, which means the final model was correct. The result of this study showed that, married household heads/ spouse were four times more likely to have good sanitation practice as compared to widowed [Adjusted odds ratio (AOR), 95% Confidence Interval (CI)] = (AOR= 4.25, 95%CI: 1.48, 12.47); households having improved latrine facility were seven times more likely to have good sanitation practice than those who use unimproved sanitation facility (AOR= 7.27, 95%CI: 3.09, 17.05). In this study, households with pour-flush type of latrine were four times more likely to have good sanitation practice as compared to those who had pit latrine (AOR= 4.32, 95%CI: 1.99, 9.39); households having solid waste collection container in their compound were four times more likely to have good sanitation practice as compared to their counter parts (AOR= 4.26, 95%CI: 2.02, 8.97). Moreover, households with good hygiene knowledge were four times more likely to have good sanitation practice as compared to their counter parts (AOR= 4.37, 95%CI: 1.87,10.24) (Table 3).

### DISCUSSION

This study was conducted to assess the sanitary practice and associated factors of the urban slums residing in Addis Ababa. In this study, almost all the households had some form of latrine, among this 72.3% of them had a pit latrine. This finding is in agreement with a previous study conducted in Addis Ababa (Ethiopia) (Van Rooijen and Tadesse, 2009) and dissimilar with a report from Kersa District (East Ethiopia) which reported that 91.7% of households had pit latrine (Bizatu and Negga, 2010). In the present study, 35.8% of households had improved

latrine facility. This finding is lower as compared with a study finding from urban slum of Pokhara sub-metropolitan (Nepal) which reported 74.72% households had improved non-shared latrine (Acharya et al., 2015). In this study, it was witnessed that 52.5% of the sanitation facilities had a foul smell, unclean and need repair; that is lower than a study from Kersa, which reported 67.3% of the studied household latrine witnessed the presence of flies in and around the latrine (Bizatu and Negga, 2010). This finding is also higher than a study conducted in North Ethiopia that reported 22.6% of the cases witnessed foul smell and had inconvenience during use (17.8%) (Ashebir et al., 2013); this inconsistency may be due to study area difference; since our study was conducted in urban slum area that is characterized by poor sanitation facility and the presence of faeces on the floor might also be explained due to presence of shortage and interruption of water supplies as it is reported by the majority of households. The other possible explanation might be that users are not devoted to cleaning shared latrines. A similar finding also reported from Bangladesh revealed that 61% of the latrines had observable faeces (Alam et al., 2013). Despite, 76.1% of the respondents know that hand washing practice was the core preventive methods for diarrhoeal diseases; majority of the households (71.9%) had no functional hand washing facility which is a serious concern since having a hand washing facility had a positive implication and advantageous over preventing feco-oral transmission (Rabie and Curtis, 2006).

This study also showed that 74% of the households practice open dumping of solid wastes. This finding was consistent with a study from Kersa (38.5%) (Bizatu and Negga, 2010) and similar solid waste dumping practices was also reported from Northern Ethiopia (Tewodros et al., 2008). The practice of indiscriminate throwing of refuse was reported by Shukla et al. (2016), from Lucknow, capital of Uttar Pradesh.

In this study, 46.9% of the households had good sanitation practice. This finding was closely related to a similar study from Addis Ababa which reported 43.89% of the households practice sanitation (Abdissa and Walelegn, 2016). Related finding from Kabul (Afghanistan) showed poor hygienic activities among urban slums (Mubarak et al., 2016). A study from slum of Lucknow, capital of Uttar Pradesh, also reported households had unsafe practices towards water storage and handling (Shukla et al., 2016).

This study also revealed that households having improved sanitation facilities were more likely to had good sanitation practice than those who use unimproved sanitation facility. This affirmation is also in agreement with a study report from Addis Ababa (Abdissa and Walelegn, 2016), and a systematic review report, that showed households with shared sanitation facilities were

**Table 3.** Factors associated with sanitation practice among slum dwellers in Addis Ababa, Ethiopia (n=335).

Variables	Sanitation practices		Crude OR (95%CI)	Adjusted OR (95% CI)
	Good n=157	Poor n= 178		
<b>Sex</b>				
Male	52	38	1.83( 1.12-2.98)*	2.78(0.91-8.49)
Female	105	140	1	1
<b>Marital status</b>				
Single	44	46	1.85(0.86-3.97)	2.88 (0.85-9.71)
Married	92	85	2.09(1.03-4.24)*	4.25(1.48-12.47)**
Separate	7	20	0.68(0.23-1.98)	2.75(0.63-11.92)
Widowed	14	27	1	1
<b>Responsibility in the home</b>				
Housewife	77	114	1	1
Husband	80	64	2.87(1.19-1.85)*	0.63(0.23-1.72)
<b>Housing ownership</b>				
Owner	68	26	1	1
Rented	43	54	0.30(0.17-0.56)*	0.58(0.22-1.51)
Governmental home	46	98	0.18(0.10-0.32)*	0.73(0.30-1.79)
<b>Educational status</b>				
No formal education	13	23	1	1
Read and Write + primary education	40	75	0.94(0.43-2.06)	0.46(0.15-1.45)
Secondary and above	104	80	2.30(1.09-4.82)*	0.42(0.13-1.36)
<b>Occupational status</b>				
Housewife	55	63	1	1
Governmental and NGO employee	29	26	1.28(0.67-2.43)	1.99(0.76-5.22)
Daily laborer and merchant	19	43	0.51(0.26-0.96)*	0.59(0.22-1.61)
Student and unemployed	54	46	1.35(0.79-2.29)	1.09(0.43-2.82)
<b>Income</b>				
<1700 (ETB)	81	122	1	1
≥ 1700 (ETB)	76	56	2.04 (1.31-3.19)*	1.13(0.58-2.19)
<b>Sanitation facility status</b>				
Unimproved	61	154	1	1
Improved	96	24	10.45(6.09-17.93)*	7.27(3.09-17.05)**
<b>Type of sanitation facility</b>				
Pit latrine	87	155	1	1
Pour-flush latrine	70	23	5.42(3.16-9.29)*	4.32(1.99-9.39)**
<b>Proximity of sanitation facility (n=325)</b>				
>6 meter	29	74	1	1
≤6 meter	97	88	2.81(1.68-4.72)*	1.44(0.71-2.92)
Inside the home	25	12	5.32(2.36-11.96)*	1.23(0.34-4.43)

Table 3. Contd.

<b>Presence of solid waste collection container inside house compound witnessed</b>				
Yes	116	99	2.26(1.42-3.59)*	4.26(2.02-8.97)**
No	41	79	1	1
<b>Hygiene knowledge</b>				
Good	108	157	3.39(1.92-5.97)*	4.37(1.87-10.24)**
Poor	49	21	1	1
<b>Availability of water</b>				
≥ 5 days/week	79	35	4.99(2.67-9.32)*	2.49(0.99-6.32)
3-4 days/week	54	90	1.33(0.74-2.39)	0.69(0.31-1.59)
≤ 2 days/week	24	53	1	1

OR= Odds Ratio, \*Significant association ( $P \leq 0.05$ ) crude, \*\* Significant association ( $p \leq 0.05$ ) adjusted

poorer than those that did not shared (Heijnen et al., 2014). In support of this, the Joint Monitoring Programme (JMP) for water supply and sanitation of WHO and United Nations Children's Fund (UNICEF) reported that shared sanitation facilities tend to be less hygienic and less accessible than private sanitation facilities (WHO and UNICEF, 2012; WHO and UNICEF, 2014). In addition, sharing of a sanitation facility strongly is associated with the presences of acute diarrhoea among slum children (Adane et al., 2017). A case study by Simiyu et al. (2017) from Kisumu (Kenya) examined the quality of shared sanitation facilities and reported they were dirty, and their quality decreased with an increase in the number of households sharing them.

In this study, households using pour-flush sanitation facility were more likely to have good sanitation practice as compared to those who had pit latrine. Similar finding also reported from Northern Ethiopia shows that sanitation practice gets lower in households who own simple pit latrine (Abdissa and Walelegn, 2016). This can be explained by the fact that, pit latrines are low quality as compared to pour-flush type of sanitation facility in terms cleanliness (Nakagiri et al., 2015; Sonogo and Mosler, 2014; Simiyu et al., 2017). As well, they are found at the bottom of sanitation ladder compared to water carriage system.

The other factor which was significantly associated with good sanitation practice is hygiene knowledge of the study participants. In this study, those respondents who had good hygiene knowledge were about four times more likely to have good sanitation practice than those who do not. The result presented here suggests that with improved hygiene knowledge of slum residents, sanitation practice can also be improved. As one described, where adequate improved latrines already exist, changing behaviour may be an effective means of

improving health without significant bricks-and-mortar investment (Buttenheim, 2008). Another factor which was significantly associated with sanitation practice is the presence of solid waste collection container inside the household compound.

### Limitation of the study

The present study has some limitations that must be considered. As this is a cross-sectional study, limitations that come with this type of design need to be taken into account. In addition, the bias attributable to self-reporting practice should be considered while interpreting the findings.

### Conclusions

The study reveals that the household sanitation practice of slum dwellers was very low and unhygienic sanitation facilities are acute in the urban slum of Addis Ababa. Having improved sanitation facility having pour-flush type of latrine, the presence of the solid waste collection container inside the house compound and good hygiene knowledge were factors associated with good sanitation practice. Hence, escalating household improved sanitation facilities along with strong health promotion program on sanitation practice is strongly recommended.

### ACKNOWLEDGEMENTS

The authors would like to thank Kirkos sub-city, District 11 administrators and the studied households.

**CONFLICT OF INTERESTS**

The authors have not declared any conflict of interests.

**REFERENCES**

- Abdissa A, Walelegn W (2016). Sanitation practice of slum communities in Addis Ababa, Ethiopia. *Science Journal of Public Health* 4(4):297-304.
- Acharya P, Kaphle HP, Thapa SB (2015). Hygiene and sanitation practices among slum dwellers residing in urban slums of Pokhara sub-metropolitan, Nepal. *International Journal of Health Sciences and Research* 5(5):298-303.
- Adane M, Mengistie B, Kloos H, Medhin G, Mulat W (2017). Sanitation facilities, hygienic conditions, and prevalence of acute diarrhea among under-five children in slums of Addis Ababa, Ethiopia: Baseline survey of a longitudinal study. *PLoS ONE* 2(8). Available at: <https://doi.org/10.1371/journal.pone.0182783>
- Akinbo F, Okaka C, Omoregie R (2011). Seasonal variation of intestinal parasitic infections among hiv-positive patients in Benin city, Nigeria. *Ethiopian Journal of Health Sciences* 21(3):191-194.
- Alam M, Rahman M, Al-Firoz M (2013). Water supply and sanitation facilities in urban slums: A case study of Rajshahi City corporation slums. *American Journal of Civil Engineering and Architecture* 1(1):1-6.
- Appleton C, Mosala T, Levin J, Olsen A (2009). Geohelminth infection and reinfection after chemotherapy among slum-dwelling children in Durban. *Annals of Tropical Medicine and Parasitology* 103(3):249-261.
- Ashebir Y, Rai-Sharma H, Alemu K, Kebede G (2013). Latrine use among rural households in northern Ethiopia: a case study in Hawzien district, Tigray. *International Journal of Environmental Studies* 70(3):629-636.
- Bizatu M, Negga B (2010). Community based assessment on household management of waste and hygiene practices in Kersa district, Eastern Ethiopia. *Ethiopian Journal of Health Development* 24(2):103-109.
- Brooker S, Clements A, Bundy D (2006). Global epidemiology, ecology and control of soil-transmitted helminth infections. *Advances in Parasitology* 62:221-261.
- Buttenheim A (2008). The sanitation environment in urban slums: implications for child health. *Population and Environment* 30(1-2):26-47.
- Central Statistical Agency (CSA) (2011). Central Statistical Agency (CSA) Ethiopia and ICF Macro. Ethiopia Demographic and Health Survey 2011. Addis Ababa, Ethiopia, and Calverton, Maryland, USA: Central Statistical Agency and ICF Macro.
- Central Statistical Agency (CSA) (2014). Central Statistical Agency (CSA) Ethiopia. Ethiopia Mini Demographic and Health Survey. Addis Ababa, Ethiopia.
- Corburn J, Hildebrand C (2015). Slum Sanitation and the Social Determinants of Women's Health in Nairobi, Kenya. *Journal of Environmental and Public Health*. Volume 2015, Article ID 209505, 6 pages. <http://dx.doi.org/10.1155/2015/209505>
- Dageviren H, Robertson S (2011). Access to Water in the Slums of Sub Saharan Africa. *Development Policy Review* 29(4):485-505.
- Erik N, Uno W (1994). Urban environmental and hygiene in sub-saharan Africa. Nordiska Africa Institute. *Current African issues* 18. Available at: <http://www.diva-portal.org/smash/get/diva2:273469/FULLTEXT01.pdf>.
- Heijnen M, Cumming O, Peletz R, Chan GK, Brown J, Baker K et al (2014). Shared sanitation versus individual household latrines: A systematic review of health outcomes. *PLoS ONE* 9(4).
- Isonju J, Schwartz K, Schouten M, Johnson W, Van Dijk M (2011). Socio-economic aspects of improved sanitation in slums: A review. *Public Health* 125(6):368-376. <http://dx.doi.org/10.1016/j.puhe.2011.03.008>
- Joséphine N, Beyala Véronique K, Nkamdjou S, Georges E, Awah T (2008). Water supply, sanitation and health risks in Douala, Cameroon. *African Journal of Environmental Science and Technology* 2(12):422-429.
- Kassie K (2016). The problem of solid waste management and people awareness on appropriate solid waste disposal in Bahir Dar City: Amhara region, Ethiopia. *ISABB Journal of Health and Environmental* 3(1):1-8.
- Mbae C, Nokes D, Mulinge E, Nyambura J, Waruru A, Kariuki S (2013). Intestinal parasitic infections in children presenting with diarrhoea in outpatient and inpatient settings in an informal settlement of Nairobi, Kenya. *BMC Infectious Diseases* 13:243.
- Mubarak M, Abram L, Mari A, Bradley F, Matthew L (2016). Hygienic practices and diarrheal illness among persons living in at-risk settings in Kabul, Afghanistan: a cross-sectional study. *BMC Infectious Diseases* 16:459.
- Nakagiri A, Kulabako R, Nyenje P, Tumuhairwe J, Niwagaba C, Kansime F (2015). Performance of pit latrines in urban poor areas: A case of Kampala, Uganda. *Habitat International* 49:529-537.
- Nkwocha E, Egejuru R (2010). The European union micro-projects program in water and sanitation and reduction in the incidence of some diseases in the rural communities of Imo State Edmund. *Journal of Public Health and Epidemiology* 1(1):001-006.
- Prüss-Üstün A, Bonjour S, Corvalán C (2008b). The impact of the environment on health by country: a meta-synthesis. *Environmental Health* 7:7.
- Prüss-Üstün A, Bos R, Gore F, Bartram J (2008a). Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health. World Health Organization, Geneva. Available at: [http://www.who.int/quantifying\\_ehimpacts/publications/safewater/en/index.htm](http://www.who.int/quantifying_ehimpacts/publications/safewater/en/index.htm).
- Rabie T, Curtis V (2006). Hand washing and risk of respiratory infections: a quantitative systematic review. *Tropical Medicine and International Health* 11(3):258-267.
- Sahiledengle B, Gebesilassie A, Hiko D, Getahun T (2018). Healthcare waste segregation, treatment and disposal practice in governmental healthcare facilities in Addis Ababa, Ethiopia. *Ethiopian Journal of Environmental Studies and Management* 11(1):73-85.
- Shukla M, Agarwal M, Rehman HM, Yadav K, Imchen T (2016). Housing and sanitary conditions in slums of Lucknow, capital of Uttar Pradesh. *International Journal of Medical Science and Public Health* 5:1153-1157.
- Simiyu S, Swilling M, Cairncross S, Rheingans R (2017). Determinants of quality of shared sanitation facilities in informal settlements: case study of Kisumu, Kenya. *BMC Public Health* 17:68.
- Sonego I, Mosler H (2014). Why are some latrines cleaner than others? Determining the factors of habitual cleaning behaviour and latrine cleanliness in rural Burundi. *Journal of Water Sanitation and Hygiene for Development* 4:257-267.
- Tewodros T, Arjan R, Fitsum H (2008). Household waste disposal in Mekelle city, Northern Ethiopia. *Waste Management* 28(10):2003-2012.
- United Nations Children's Fund (UNICEF) (2012). The state of the world's children 2012. Children in an urban world. United Nations Children's Fund. United Nations, New York.
- US Agency for International Development (2004). Assessing Hygiene Improvement: Guidelines for Household and Community Levels. Washington: US Agency for International Development.
- Van-Rooijen D, Taddesse G (2009). Urban sanitation and wastewater treatment in Addis Ababa in the Awash Basin, Ethiopia. Available at: [https://wedc-knowledge.lboro.ac.uk/resources/conference/34/Van\\_Rooijen\\_D\\_-\\_95.pdf](https://wedc-knowledge.lboro.ac.uk/resources/conference/34/Van_Rooijen_D_-_95.pdf).
- Walker C, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta Z et al (2013). Global burden of childhood pneumonia and diarrhea. *Lancet* 381(9875):1405-1416.
- World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2012). World Health Organization (WHO) and United Nations United Nations International Children's Emergency Fund.

- Progress on Drinking Water and Sanitation-2012 Update. Geneva: WHO and UNICEF. Available: <https://www.unicef.org/media/files/JMPReport2012.pdf>. Accessed on 19 February 2015.
- World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2013). World Health Organization (WHO) and United Nations United Nations International Children's Emergency Fund (UNICEF). Progress on drinking water and sanitation-2013 update. Geneva: WHO and UNICEF.
- World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2014). World Health Organization (WHO) and United Nations United Nations International Children's Emergency Fund (UNICEF). Progress on Drinking Water and Sanitation-2014 Update. Geneva. Available: [http://www.searo.who.int/indonesia/documents/progress-on-drinking-water-2014%289789241507240\\_eng%29.pdf?ua=1](http://www.searo.who.int/indonesia/documents/progress-on-drinking-water-2014%289789241507240_eng%29.pdf?ua=1).
- World Health Organization (WHO) (2002). The World Health report 2002, reducing risks, promoting healthy life. World Health Organization Report, World Health Organization, Geneva, Switzerland. Available at: <http://www.who.int/whr/2002/en/whr02en.pdf>
- World Health Organization (WHO) (2009). Water Supply and Sanitation Collaborative Council, World Health Organization. Vision 21: A shared vision for hygiene, sanitation and water supply and a framework for mobilization of action. Geneva, Switzerland: WSSCC, WHO.

*Full Length Research Paper*

# Investigating risk factors associated with the persistence of malaria in the Obang valley, North West Region, Cameroon

Tiburce Gangue<sup>1</sup>, Laurentine Sumo<sup>1\*</sup>, Ngum Helen Ntonifor<sup>1</sup>, Etso I. Che<sup>1</sup> and Hugues C. Nana-Djeunga<sup>2,3</sup>

<sup>1</sup>Department of Biological Sciences, Faculty of Science, University of Bamenda, P. O. Box 39, Bamili, Cameroon.

<sup>2</sup>Centre for Research on Filariasis and other Tropical Diseases (CRFiMT), P. O. Box 5797, Yaoundé, Cameroon.

<sup>3</sup>Parasitology and Ecology Laboratory, Department of Animal Biology and Physiology, Faculty of Science, P. O. Box 812, University of Yaoundé 1, Yaoundé, Cameroon.

Received 24 August, 2018; Accepted 3 October, 2018

**Malaria interventions - vector control using long-lasting insecticidal nets (LLINs) or indoor residual spraying, chemoprevention and case management including diagnosis and treatment of infections - are highly effective and affordable. These interventions have led to a significant reduction in malaria prevalence, and a marked decline in morbidity and mortality associated. Despite these increasing control efforts, this parasitic disease is still persisting in most African countries. The aim of this study was to investigate the risk factors associated with malaria infection in the Obang Valley (North Western Cameroon) in order to identify potential bottlenecks in the malaria elimination procedure. A structured questionnaire was administered to a random sample of 100 individuals visiting the Mbakong Health Centre or attending the Obang Government High School. Association between malaria infection and individual household or environmental risk factors was investigated using logistic regression models. Malaria infection was not significantly associated with LLIN possession ( $p = 0.999$ ) since 97% of interviewees received them free of charge. The age and habits (having each bed cover by a LLIN, time when doors and windows are closed or antimalarial medicine used) of study participants were however significantly associated with malaria infection ( $p < 0.033$ ). These findings suggest that although the interventions recommended by the World Health Organization may help in reducing malaria prevalence and burden, it is of prime importance to also tackle associated risk factors which are mostly related to individual habits.**

**Key words:** Malaria, risk factors, Obang Valley, Cameroon.

## INTRODUCTION

Malaria remains a primer life-threatening disease and therefore a serious public health concern worldwide. In

2016, an estimated 3.2 billion people in 91 countries and territories were at risk of infection with *Plasmodium*.

\*Corresponding author. E-mail: [sumolaure@yahoo.fr](mailto:sumolaure@yahoo.fr), [nanadjeunga@crfilmt.org](mailto:nanadjeunga@crfilmt.org). Tel: 00237 699 076 499

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

216 million cases of malaria occurred worldwide, with an estimated 445,000 deaths, the World Health Organization (WHO) African Region accounting for 91% of all malaria deaths (WHO, 2017a, 2018).

Malaria is an entirely preventable and curable mosquito-borne disease. Indeed, it is accepted that implementation of proven malaria control and prevention measures can reduce transmission within short to moderate timeframes nearly everywhere malaria occurs (WHO, 2014). In the framework of the 68<sup>th</sup> World Health Assembly held in 2015 (WHA68/2015/REC/1), the WHO developed the 2016–2030 Global Technical Strategy (GTS) to preserve progress achieved against malaria and reach global elimination of this deadly disease (WHO, 2017b). The GTS lays on three pillars: (i) ensure universal access to malaria prevention, diagnosis and treatment, (ii) accelerate efforts towards elimination and attainment of malaria-free status, and (iii) transform malaria surveillance into a core intervention (WHO, 2015a). As for pillar #1, the recommended interventions against malaria (vector control using insecticide-treated mosquito nets or indoor residual spraying, chemoprevention and case management including diagnosis and treatment of infections) are highly effective and affordable, and their wide-scale implementation has led to a significant reduction in malaria prevalence and a consequent decline in morbidity and mortality associated. Indeed, between 2000 and 2015, the rate of new malaria cases declined globally by an estimated 37%, and the global malaria death rate fell by 60%, with 6.2 million lives saved (WHO, 2015b).

Despite these increasing control efforts, the disease is still persisting in most African countries. Indeed, the overall rate of new cases of malaria has decreased over years, though the trends since 2014 have levelled off and even reversed in some regions. Malaria mortality rate is therefore following a similar pattern over years, with a stability observed in number of deaths (445,000 in 2016 vs 446,000 in 2015) (WHO, 2018). Thought these figures can result from improved diagnostic methods and close sensitization of populations, it is likely that the decrease in the morbidity and mortality associated with malaria is largely disproportional as regards to the efforts deployed to fight against this deadly disease. It was indeed reported that progress stalled and the critical 2020 milestones will not be reached (WHO, 2017a). It therefore appears of prime importance to investigate the potential specific reasons associated with the persistence of the disease and the stagnation in the number of deaths despite control efforts.

The aim of the present study was therefore to investigate the risk factors associated with malaria infection in the Obang Valley (North West Region, Cameroon) where the trends in the prevalence of malaria were reported to level off or reverse over seven years of follow-up (Ndong et al., 2014; Gangue et al., personal

communication), in order to identify potential bottlenecks in the malaria elimination procedure.

## MATERIALS AND METHODS

### Study design and data collection

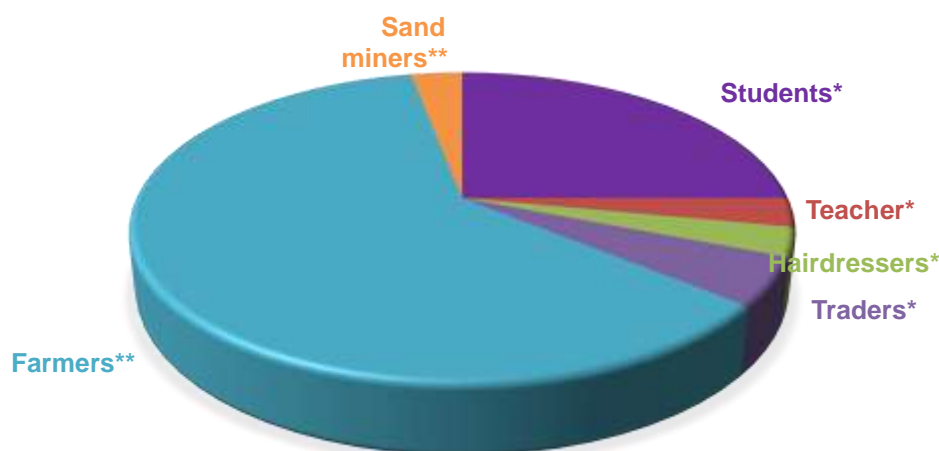
This study aimed at investigating the risk factors associated with the persistence of malaria in the Obang valley (North West Region, Cameroon). Individuals eligible to this survey were those visiting the Mbakong Health Centre or attending the Obang Government High School. This health facility and this school were chosen for representativeness purpose, since they are the most visited/attended by the vast majority of the population of the valley. Data were collected using a structured questionnaire, self-administered and returned back to investigators. A face-to-face interview was used for illiterate study participants. In addition to the self-reporting of malaria episodes (frequency, latest episode), questions included participants' socio-demographic data (gender, age, profession), knowledge, attitudes and practices with regards to malaria clinical manifestations and the strategies used to prevent or treat this parasitic disease, including possession, use and re-impregnation of long-lasting insecticidal nets (LLINs), as well as the habits of study participants with regards to farming near their houses, and the time at which they usually close doors and windows.

### Description of the study area and population

This study was carried out in the Obang valley, located in the Mezam Division (North West Region, Cameroon). Similarly to the entire North West Region, the Obang valley is characterized by accidental relief made up of massifs and mountains. The valley is irrigated by the Mezam River and its tributaries, and it features seven small lakes and dormant volcanoes such as the Mount Oku. In the Obang valley, prevails the equatorial type climate organized into two seasons: (i) a short dry season running from November to March, and (ii) a long rainy season extending from March to November. The average annual rainfall is 2,400 mm, and the average annual temperature is 23°C (NIC-MINEPAT, 2013; Ndoh Mbue et al., 2016). This area was previously covered by a forested vegetation but the forests were progressively cleared for farmland and grazing, so that nowadays, only patches remain (Ndoh Mbue et al., 2016). Indeed, the soil of the Obang valley is very fertile thanks to the past volcanic activity in this area; as such, the main activity of the people of Obang valley is farming (rice farming, maize farming, cocoyam, cassava, beans), though fishing and sand extraction are also practiced. The population of the valley is made up of about 15,000 inhabitants belonging to seven ethnic groups (Obang, Mbakong, Buwi, Otang, Butang, Manta'a, Titashi) (Fon Nanoh II, personal communication).

### Data analyses

A purpose-built Microsoft Office Excel datasheet was used for data entry of each questionnaire beforehand checked for completeness. Categorical variables (gender, occupation, possession, use of LLIN) were summarized using frequencies with 95 % confidence interval (CI) and compared using the Chi-square test. Continuous variables (age) were described using mean (standard deviation, SD) and/or median (interquartile range, IQR).



**Figure 1.** Occupation of study participant. \* category #1; \*\* category #2.

Odds ratio (OR) with 95% CI generated using logistic regression models were used to describe the strength of association between the response variable or outcome (malaria frequency and latest episode) and independent variables (LLIN ownership, use, status as well as habits of the interviewees such as having farm around houses, time to close doors and windows, medicine taken against a suspected malaria case) before and after controlling for possible confounding variables. All statistical analyses was performed using *PASW Statistics* version 18 (SPSS Inc., Chicago, IL, USA); 95% CI was performed online using VassarStats computational website. Non-overlapping 95% CI or p-values  $\leq 5\%$  were considered as statistically significant.

#### Ethical consideration

The present study received approval of the Faculty of Science of the University of Bamenda. Administrative authorization was granted by the Mbakong District Medical Officer. Prior to the commencement of interviews, the objectives of the study were explained to all eligible individuals and informed verbal consents were obtained from those who agreed to participate. Each volunteer was then attributed an individual code to ensure the privacy and confidentiality of personal information as well as anonymous data analysis.

## RESULTS

### Socio-demographic characteristics

A total of 100 individuals, among whom 35.0% males, were interviewed in the framework of this study. Interviewees were aged 16 to 70 years old (Median = 27.0; IQR = 20.0-39.2). Most of these study participants were farmers (61.0%) and students (25.0%) (Figure 1).

### Malaria experience and control approaches

Overall, 28.4% of the interviewees declared having suffered from malaria at least once within the year,

whereas 71.6% presented with their last malaria episode more than one year ago. Table 1 summarizes the characteristics and habits of study participants with regards to malaria infection. As regards to the means of prevention of malaria, 97.0% of the study participants owned a LLIN, though a small proportion (5.2%) declared not using their LLINs. A significant difference (Chi-Square = 30.375; df = 1;  $p < 0.0001$ ) was found between those regularly using their LLIN (77.9%) as compared to those using it from time to time (22.1%), the latter believing that it is uncomfortable to sleep under the net. A total of 82.5% of the participants declared that each bed in their house was cover by a net, though 20.6% of them acknowledged that their net was in a bad status, with holes. Also, 95.9% of bed net owners declared that they had never treated their mosquito nets, mainly because they had never heard about bed net reimpregnation with insecticides. Regarding the drug taken when there was a suspicion of malaria, the difference was not significant (Chi-Square = 0.471; df = 1;  $p = 0.493$ ) between those declaring treating themselves with approved antimalarial drugs (55.9%) as compared to those taking decoctions (fever grass, pawpaw and guava leaves) or just antipyretics.

### Interviewees' habits and potential risk factors associated with malaria

Regarding the habits of individuals interviewed, 81.0% of participants declared that their houses are surrounded by a farm or garden, and 69.0% of them declared closing their doors and windows before 6 pm. Univariate binary logistic regression showed that no significant association was found between malaria last episode and gender, occupation, LLIN possession, LLIN use (either regularly or not), or having a farm/garden around house ( $p >$



**Table 1.** Characteristics and habits of study participants with regards to malaria infection

Characteristics	Number of respondents	Percentage (95% CI)
<b>Farm/garden around house</b>		
No	19	19 (12.5 – 27.8)
Yes	81	81 (72.2 – 87.5)
<b>Time to close doors and windows</b>		
Before 6 pm	31	31 (22.8 – 40.6)
After 6 pm	69	69 (59.4 – 77.2)
<b>LLIN Ownership</b>		
No	3	3 (1.0 – 8.5)
Yes	97	97 (91.5 – 99.0)
<b>Number of year of LLIN possession*</b>		
Less than 3 years	92	94.8 (88.5 – 97.8)
More than 3 years	5	5.2 (2.2 – 11.5)
<b>Status of LLIN*</b>		
Good	77	79.4 (70.3 – 86.2)
Bad with holes	20	20.6 (13.8 – 29.7)
<b>Each bed covered by a LLIN*</b>		
No	17	17.5 (11.2 – 26.3)
Yes	80	82.5 (73.7 – 88.8)
<b>Bed net treatment*</b>		
No	93	95.9 (89.9 – 98.4)
Yes	4	4.1 (1.6 – 10.1)
<b>Use of LLIN*</b>		
No	2	5.2 (2.2 – 11.5)
Yes	95	94.8 (88.5 – 97.8)
<b>Regular use of LLIN**</b>		
No	21	22.1 (14.9 – 31.4)
Yes	74	77.9 (68.6 – 85.1)

95% CI: 95% Confidence interval; LLIN: Long lasting insecticidal net; \* only among those owning a LLIN; \*\* only among those using a LLIN

0.610). Malaria last episode was however significantly associated with the age of interviewees (OR = 1.045; 95% CI: 1.007-1.084;  $p = 0.020$ ) (Figure 2), the time at which they usually close doors and windows (OR = 0.237; 95% CI: 0.076-0.739;  $p = 0.013$ ), the fact to have each bed in the house cover by a LLIN (OR = 0.096; 95% CI: 0.022-0.423;  $p = 0.002$ ) and the intervention (conventional antimalarial drugs vs decoctions) used when malaria was suspected (OR = 0.143; 95% CI: 0.024-0.852;  $p = 0.033$ ). Also, the age of interviewees

was negatively associated with regular used of LLINs (OR = 0.955; 95% CI: 0.925-0.986;  $p = 0.005$ ).

## DISCUSSION

This study was carried out in the Obang valley (North West Region, Cameroon) where the trends in malaria prevalence have decreased after LLIN distribution campaigns, but subsequently reversed two years later

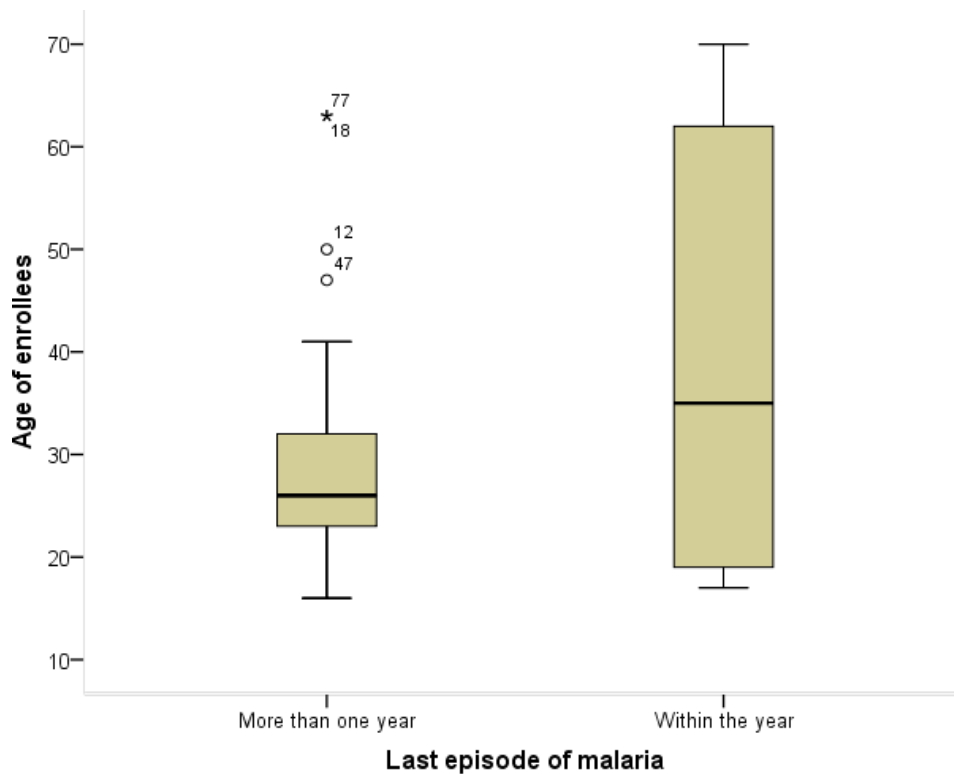


Figure 2. Age shift among individuals experiencing malaria.

(Ndong et al., 2014; Gangué et al., personal communication), in order to investigate the risk factors associated with malaria infection, and identify potential bottlenecks slowing the momentum towards malaria elimination.

The proportion of those who declared having experienced an episode of malaria within the year was 28.4%, similar to the prevalence over a period of seven years in this area (Ndong et al., 2014; Gangué et al., personal communication). This figure indicates that malaria is still highly endemic in the study area, and control measures might not be really effective since the prevalence of malaria has levelled off and even reversed in the study area as previously observed elsewhere (WHO, 2018).

Long-lasting insecticidal net (LLIN) is a core prevention tool widely used to fight against malaria, and it was shown that the universal coverage with LLINs has helped in reducing the global malaria burden since 2000. Moreover, in a recent WHO-coordinated prospective international observational cohort study, it was demonstrated that LLINs still provide a significant level of protection against malaria, even where mosquitoes are resistant to pyrethroids, thus supporting the continuation of their use (Kleinschmidt et al., 2018). Indeed, almost all our study participants owned a mosquito net, and no significant

association was obviously found between malaria infection and LLIN possession ( $p = 0.999$ ). It was not surprising to find that almost all bed net users had never treated their mosquito nets since LLINs - insecticide-treated nets designed to remain effective for multiple years without retreatment - were massively distributed in Cameroon since 2011, with 88% total coverage (FIS, 2016), to comply with WHO recommendation in order to achieve and maintain universal coverage with LLINs. Importantly, LLIN covering each bed in a house appeared as a protective indicator against malaria infection. The question then remained as to whether those individuals receiving LLINs free of charge are using them, lest to jeopardize the efforts of the control programmes and stakeholders. In the framework of this study, only a small proportion of individuals interviewed (4.0%) indicated that they didn't use their bed nets for comfort reasons. Previous studies have reported the factors influencing the bed net use (Xu et al., 2014; Russell et al., 2015), the fact to think that bed nets present any disadvantage being significantly associated with decreased odds of net use.

A negative association was observed between the last episode of malaria and the time when doors and windows are closed, those experiencing malaria more frequently during the year surprisingly declared to close their doors and windows before 6 pm. Though this habit is not

enough as a preventive action against malaria, this observation might be explained by the fact that mosquitoes are able to bite when people are still outdoor. Indeed, a shift in mosquito biting to earlier hours of the evening - before individuals are indoors and protected by bed nets - was previously observed, and shown to compromise the efficacy of vector control in reducing malaria transmission (Thomsen et al., 2017). This behavioural resilience in mosquitoes highlight the necessity to target outdoor exposure to their bites, and thus more efficiently control and potentially eliminate malaria. The last episode of malaria was found to be positively associated with age of interviewees (OR = 1.045; 95% CI: 1.007-1.084;  $p = 0.020$ ), indicating that older individuals experienced malaria more frequently than their younger counterparts. This might be explained by the fact an age-related increasing trends was observed among those declaring not regularly using their bed nets, suggesting that these older individuals might therefore be more exposed to mosquito bites and subsequently to malaria infection than younger ones, especially in a context where none of the interviewees was known to belong to a high risk group.

This study also revealed that the measures used to tackle malaria (or suspicion of infection) was significantly associated with the latest episode of the disease. Indeed, individuals using decoctions (fever grass, pawpaw and guava leaves) or not recommended antimalarial drugs exhibited high frequency of malaria within the year. The use of not recommended antimalarial drugs, despite their potential efficacy (Chukwuocha et al., 2016), might explain the recurrence in malaria infection as a consequence of poor efficacy or resistance to antimalarial medicines (WHO, 2018).

## LIMITATIONS AND POTENTIAL BIAS

The definition and categorization of the different variables used in this study were based on declarations of interviewees, and may be prone to flaw, especially to potential memory bias. Also, the sample size was low, not allowing more accurate estimations of the knowledge, perceptions, habits and practices of the Obang Valley residents with regards to malaria and its control, and consequently the factors that could potentially explain the persistence and even the increase in prevalence of malaria in the study area despite the interventions implemented till now.

## IMPACT ON POLICIES AND DECISIONS MAKING

Although preventable and treatable, malaria is still persisting in many settings, killing one child every two minutes worldwide (WHO, 2018). This inconvenient truth

indicates that measures developed so far to tackle this deadly disease seems not enough or not fully implemented. Whatever the case, the populations suffering from malaria seems not implicated in the development of interventions or policies, and may not necessarily understand (i) the rationale behind each intervention, and (ii) the key role they need to play in the success of the strategy. Indeed, it has been demonstrated that appropriate health education of populations significantly improved the implementation of control measures, notably the uptake of LLIN (Amaran et al., 2012). Education of populations about malaria clinical signs, burden and appropriate prevention and treatment measures appears of high interest to dispel wrong beliefs of populations and therefore avoid/limit inappropriate habits in controlling the disease. This observation needs to be translated into policy to preserve the achievements reached so far in the fight against malaria, and enter the endgame phase towards elimination.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## ACKNOWLEDGEMENTS

The authors are grateful to the populations of the Obang valley, especially those visiting the Mbakong district hospital or attending the Obang Government High School, who agreed to participate in this study. The authors are also thankful to the health personnel for their collaboration.

## ABBREVIATIONS

**CI**, confidence interval; **GTS**, Global Technical Strategy; **IQR**, interquartile range; **ITN**, insecticide-treated net; **LLIN**, Long Lasting Insecticidal Net; **MDG**, Millennium Development Goals; **SD**, standard deviation; **WHO**, World Health Organization.

## REFERENCES

- Amaran OE, Fatugase KO, Fatugase OM, Alausa KO (2012). Impact of health education intervention on insecticide treated nets uptake among nursing mothers in rural communities in Nigeria. *BMC Research Notes* 5:444.
- Chukwuocha UM, Fernández-Rivera O, Legorreta-Herrera M (2016). Exploring the antimalarial potential of whole *Cymbopogon citratus* plant therapy. *Journal of Ethnopharmacology* 193:517-523.
- FIS (2016). Shadow report: independant monitoring of the Global Fund Grants in Cameroon (CMR-M-MoH). For Impacts in Social Health (FIS), Yaoundé, Cameroon. [http://www.fiscameroon.org/sites/default/files/Rapports\\_E/Shadow%20anglais%20version%20finale.pdf](http://www.fiscameroon.org/sites/default/files/Rapports_E/Shadow%20anglais%20version%20finale.pdf). Accessed May 16, 2018.

- Kleinschmidt I, Bradley J, Knox TB, Nnzava AP, Kafy HT, Mbogo C (2018). Implications of insecticide resistance for malaria vector control with long-lasting insecticidal nets: a WHO-coordinated, prospective, international, observational cohort study. *Lancet Infectious Diseases* 3099 (18):30172-30175. [http://dx.doi.org/10.1016/S1473-3099\(18\)30172-5](http://dx.doi.org/10.1016/S1473-3099(18)30172-5).
- National Institute of Cartography (NIC) and Ministry of Economy Planning and Regional Development Cameroon (MINEPAT) (2013). National Atlas of Physical Development of Cameroon. <https://fr.slideshare.net/ninonjopkou/positionnement-gographique-des-activites-conomiques-du-cameroun>. Accessed May 16, 2018.
- Ndoh Nbue I, Bitondo D, Balgah RA (2016). Climate variability and change in the Bamenda highlands of North Western Cameroon: perceptions, impacts and coping Mechanisms. *British Journal of Applied Science and Technology* 12(5):1-18.
- Ndong IC, Van Reenen M, Boakye DA, Mbacham WF, Grobler AF (2014). Trends in malaria admissions at the Mbakong Health Centre of the North West Region of Cameroon: a retrospective study. *Malaria Journal* 13:328.
- Russell CL, Sallau A, Emukah E, Graves PM, Noland GS, Ngondi JM, Ozaki M, Nwankwo L, Miri E, McFarland DA, Richards FO, Patterson AE (2015). Determinants of bed net use in Southeast Nigeria following mass distribution of LLINs: Implications for social behavior change interventions. *PLoS ONE* 10(10):e0139447.
- Thomsen EK, Koimbu G, Pulford J, Jamea-Maiasa S, Ura Y, Keven JB, Siba PM, Mueller I, Hetzel MW, Reimer LJ (2017). Mosquito behavior change after distribution of bednets results in decreased protection against malaria exposure. *Journal of Infectious Diseases* 215(5):790-797.
- World Health Organization (WHO) (2014). From malaria control to malaria elimination: a manual for elimination scenario planning. World Health Organization, Geneva. ISBN 978 92 4 150702 8.
- World Health Organization (WHO) (2015a). Global technical strategy for malaria 2016-2030. World Health Organization, Geneva. ISBN 978 92 4 156499 1.
- World Health Organization (WHO) (2015b). Achieving the malaria MDG target: reversing the incidence of malaria 2000-2015. World Health Organization, Geneva. ISBN 978 92 4 150944 2.
- World Health Organization (WHO) (2017a). World Malaria Report 2017. World Health Organization, Geneva. ISBN 978-92-4-156552-3.
- World Health Organization (WHO) (2017b). A framework for malaria elimination. World Health Organization, Geneva. ISBN 978-92-4-151198-8.
- World Health Organization (WHO) (2018). Malaria. World Health Organization Fact Sheet. Updated 11 June 2018. <http://www.who.int/news-room/fact-sheets/detail/malaria>. Accessed July 20, 2018.
- Xu JW, Liao YM, Liu H, Nie RH, Havumaki J (2014). Use of bed nets and factors that influence bed net use among Jinuo ethnic minority in Southern China. *PLoS ONE* 9(7):e103780.

**Related Journals:**

