



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

PREVALENCE AND ASSOCIATED FACTORS OF GLUE SNIFFING AND SYMPTOMS
OF NEUROTOXICITY AMONG STREET CHILDREN IN ADDIS ABABA, ETHIOPIA

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List of abbreviations

BMI: Body mass index

Bolsa Burro of labour and social affair

CNS Central Nerves System

IRB Institutional Review Board

LOAEL The lowest-observed-adverse-effect level

NIOSH The National Institution for Occupational Safety and Health

PRs Prevalence Ratio

RR Relative Risk

SC Sub city

SPSS Statistical Package for the Social Sciences

TWA Time Weighted Average

USA United State of America

Abstract

Background: Organic solvent like toluene is a neurotoxin chemical known to cause many health effects targeting mainly the central nervous system. Such chemicals are found in glue. These days, street children are abusing this substance by sniffing on the glue which leaves them for risk of neurotoxicity that is a toxicity of central nervous system.. The magnitude of problem is not explored in our context. Therefore, this study aims to assess the prevalence of glue sniffing and neurotoxicity symptoms among street children who have been exposed to organic solvents through sniffing glue. It's also thrives to find out the factors associated with glue sniffing.

Method: A cross sectional study was employed using both qualitative and quantitative approaches. Four hundred twenty participants were recruited in this study with a Probabilistic sampling techniques. A modified Germen version Q18 was used to assess neurotoxic symptoms. Focus group discussion (FGD) was used for the qualitative study. Data were transferred to epi info version 7 and then transferred to SPSS version (20) for analysis. The qualitative data were collected using one male and one female FDG. Key informants' interview was also carried out. Descriptive analysis and Logistic regression analysis was used for the quantitative data whereas Content analyse was done using open code software for the qualitative part.

Result: Of 420 participants 330 (78.6%) were male. The prevalence of glue sniffing among street children was found to be 81.9% at 95%CI, of which 274 (79.6%) were male. Depression 293(69.8%), Headache 287(68.3%) and feeling sick 212(50.5%) were the most prevalent neurotoxicity symptoms among street children. Age (AOR=2.04; 95% CI: 1.06-3.93), Work status (AOR=0.49; 95% CI: 0.26-0.91), time on the street (AOR=3.73; 95% CI: 1.78-7.82), Peer pressure (AOR=3.10; 95% CI: 1.72-5.59), stress and depression (AOR=3.72; 95% CI: 2.07-6.68) and self-esteem (AOR=2.86; 95% CI: 1.51-5.43) were significantly associated with glue sniffing.

Conclusion: The prevalence of glue sniffing among street children is alarmingly high causing health problem on these children with a high prevalence of neurotoxicity symptoms; depression, headache and short memory. The determinant factors were age, time on street, work status, peer pressure, stress & depression and self-esteem,. Prohibiting the use of glue by law and further study is recommended.

Key word: organic solvent, neurotoxicity, glue sniffing, street children.

1. Introduction

1.1 Background

The National Institute for Occupational Safety and Health (NIOSH) defines organic solvent as ‘carbon-based substances capable of dissolving or dispersing one or more other substances’(1). These organic solvents are widely used in industries and are needed in large quantity in the world(2). Some of the organic solvents such as benzene, carbon tetrachloride, and trichloroethylene are known to cause cancer (1). Others such as 2-ethoxyethanol, 2-methoxyethanol, and methyl chloride are considered as reproductive hazards(1). Organic solvent such as n hexane, tetra chloro ethylene and toluene are considered as neurotoxins(1).

Toluene, which is one of the neurotoxin organic solvent, is widely used in the production of paints, adhesives, rubbers, thinner for inks, dyes and perfumes. It is also used in the production of benzene. Many household products are a constituent of toluene. Toluene is now widely used as an inhalant drug for its intoxicating property (3-5).

Neurotoxicity is a form of toxicity in which a biological, chemical, or physical agent produces an adverse effect on the structure or function of the central and/or peripheral nervous system (6). There is evidence that exposure to different chemicals results neurological and behavioural problems among children. Chronic inhalation abuse of solvents containing n-hexane and toluene, have been shown to have neurotoxicity effect (7, 8).

Inhalant abuse which is also called volatile substance abuse, solvent abuse, sniffing, huffing and bagging is one of the major public health problems. It is inhalation of a volatile organic substance deliberately so as to achieve a different mental state. Glue sniffing is therefore kind of inhalant abuse in which the glue is sniffed (9, 10). Till now, Inhalant abuse remains a well-know and identified problem among adolescents in the entire world. Generally, it is possible to classify inhalants in to four major classes namely; aerosols, gases, nitrites and volatile solvents (11, 12).

The occupational exposure limit for toluene as of total weighted average is 20 ppm(13).

1.2 Statement of the problem

Estimation has shown that there are as high as 100 million street children in the world. But this is just estimation because it is hard to have the exact number of street children. And this number is now rising with global population growth, increased migration and rapid urbanization (14, 15). But the problem is mostly shown in the developing country such as Ethiopia (16). It is not unusual to see street children on the road side of Ethiopian cities and towns. It is estimated that 150,000 people live on streets of Ethiopia of which most of them are children. Out of this around 60,000 of them are living in the streets of Addis Ababa (17).

Glue sniffing is a common activity of street children all over the world (18). Individuals who intentionally inhale or sniff glue in order to cope the harsh weathering and their hunger will be exposed to very high concentrations of toluene and also for n-hexane which are one of the neurotoxin organic solvents and a colourless liquids(3). The reason why this street children sniff on glue might be different in nature. It could be family related reason or it could be for reduction of Psychological Stress. That is to cope up with fatigue, sadness, sorrow, and stress (19). Affordability and accessibility of substance, fear of isolation, curiosity and peer pressure are other reason for street children to engage in glue sniffing (20)

Toluene-containing compounds and products such as glues, nail polish removers, lighter fluids, spray paints, deodorant, hair sprays, and cleaning and correcting fluids are the most commonly misused products by street children (1).

Organic solvent like toluene are known to cause many health effects targeting mainly; cardiovascular system as well as the nervous, musculoskeletal, excretory, respiratory and other systems and organs (21). A lower in blood level and Ototoxicity are also another effect of toluene exposure (22). Ocular and respiratory irritation along with a perceived deterioration of air quality, enhanced odour, headache, and dizziness at 100 ppm was experienced among exposed individuals (3). Being a neurotoxic substances, toluene and n-hexane primary targets the central nerves system. A permanent CNS damage was show in glue sniffer and solvent abuser as toluene is a common solvent in glue. Effects like emotional and psychiatric problem was also show in solvent abusers (23, 24).

Particular concern on human exposure to the vapour of volatile organic substance is deliberate self-administration by inhalation in order to achieve intoxication(25).

Efforts have been taken to reduce the number of street children in addis ababa by taking children out of the street in to shelter and by rising funds in supporting this children. But the situation still remains a huge problem (17). In top of that there is a rapid increment of street

children especially young boys and girls. This is due to mainly poverty and family breakdown. So they come to the city to escape this problems (26).

But this problem of intoxication among street children is not well studied in Ethiopia. Furthermore, the magnitude of the practice; the effect; reason why street children are engaged in glue sniffing is not known. Besides, the factors that make street children engage in glue sniffing are not well known too.

1.3 Rational and Significance of the study

1.3.1 Rational of the study

Despite the fact that many studies have been carried out on street children, Glue sniffing among street children and its neurotoxicity effects is understudied worldwide and no evidence is found in Ethiopia setting. The reason behind sniffing glue among this street children and how they feel about it is not studied. Therefore this study thrives to fill the gap by assessing the prevalence of glue sniffing and neurotoxicity symptoms due to organic solvent exposure among street children who are exposed with directly exposed to sniffing on the solvent.

1.3.2 Significance of the study

Street children are an undermined and unrecognized part of the community. This are children who are supposed to take the future Ethiopia, to This study will establish a new base line by determining the prevalence of glue sniffing or inhalant abuse among the street children in Addis Ababa and show the magnitude of the problem. Since this study shows the reason why street children get in to glue sniffing and its magnitude, this study will help those concerned body and the government to identify their focus of intervention towards street children and strategize action plan. It will also be a baseline and a motivation for other researcher to dig more. It can also facilitate rehabilitation program for the neurotoxicity effects.

2. Literature review

2.1 Prevalence of glue sniffing

Descriptive cross-sectional studies carried out in Butwal, municipality of Nepal in 2020 to find Prevalence of glue-sniffing among street children showed that the prevalence of glue sniffing among street children were 51.7%, 72.9% and 78.7 % (18, 27, 28).

A cross-sectional study conducted in Guwahati City Assam, India among street children 5 - 18 years of age, showed that about (80.9%) were substance user(29). In 2013, a literature review that was conducted in India showed that out of 11 million street children, 82.98% of were substance user (16)

A systematic review and meta-analysis conducted in USA in 2013 based on 50 papers published in developing countries, showed a high prevalence of substance use among street children and youth with a significance difference by geography, religion and study methodology. Specially, the result indicated that majority of street children around the world are using volatile solvents. This study reported a prevalence for street children's inhalant use of 47% (95% CI = 36–58%) in developing setting including glue and thinners(30).

A study conducted in Egypt in 2009 showed that, nearly 91% of street children are engaged in misusing products containing volatile substances like glue (31).

In 2002, a literature study in South Africa confirmed that 95% of street children are addicted to glue inhalation and are engaged in glue sniffing activity (32). In western Kenya, across-sectional survey was conducted in 2012 that assess substance use among street children. The study revealed that the most commonly used substance among street children to be glue with the prevalence of 67%(33).

A cross sectional study that was done in Jimma town, Oromiya, South West Ethiopia, showed that the prevalence of glue sniffing among street children was 45.9% (20).

2.2 Neurotoxic symptoms of exposure to organic solvent

.A Scandinavian study in 1985, which examined the evidence for the assertion that organic solvents are neurotoxic, suggested that for neurotoxic organic solvents, the type of neurological effect is related to the structure of the chemical agent while the degree of damage and irreversible effect are related to its dose, duration of exposure and potency (8).

In 1990, a cross sectional study undertaken on 30 female workers exposed to toluene showed that the verbal memory and visual cognitive ability of the workers were affected by exposure

to toluene ranging from 49 to 130 ppm TWA ($p < 0.01$). But it did not indicate whether the effect is reversible or permanent (34). A study conducted in Copenhagen, Denmark, in 1994 showed that n-hexane, one of the organic solvent found in glue, was among the five chemicals that are categorized as definitely neurotoxic to humans with sufficient evidence. Short-term or low-dose exposure to a neurotoxic chemical can result in symptoms such as headache and dizziness, which are considered to be a reversible effect. With increasing dose, neurological changes can appear leading eventually to irreversible morphological changes (35). An article published in 1998, Belgium, which overviewed neurotoxic effects in solvent-exposed workers revealed that Workers exposed to solvents are at risk to develop diseases on central and peripheral nervous system (36).

In 2001 in Saudi, a study which examined a 3 case report explained that exposure to toluene have a neurotoxic effect like Multifocal disorder, dementia, encephalopathy, cognitive dysfunction, brainstem abnormalities, cranial neuropathies, tremor, disequilibrium, whereas exposure solvent like n-hexane could result in Peripheral neuropathy (37). A study was conducted in 2006 in united kingdom which reviewed the neurotoxicity of solvent showed that a long term, high level, solvent exposure might be associated with a syndrome of personality change, memory impairment, and neurological deficits which termed as solvent neurotoxicity. Neurodegenerative diseases like Parkinson's disease might be also associated with solvent exposure (2).

A study that was conducted in Australia 2009 on Neurobehavioral impairment in children occupationally exposed to mixed organic solvents which assessed the neurotoxic effects through a questionnaire and a selection of neurobehavioral tests revealed that children who have a higher solvent exposure showed significantly higher reporting of neurotoxic symptoms ($P=0.02$) (38).

In a study conducted in Indonesia, 2019, that assessed association Between Toluene Inhalation Exposure and Demography Towards Risk of Neurotoxic among workers showed the prevalence of neurotoxicity symptoms to be concentration problem, get easily angry, palpitation, sweating, headache and numbness with prevalence of 47%, 44%, 40%, 37%, 31% and 31% respectively (39).

Among neurotoxicity symptom, headache, dizziness and a sensation of intoxication were more frequently reported among students exposed for toluene (3) A cross sectional survey was

conducted in Palestine in 2001 which studied the prevalence of neuropsychiatric and mucous membrane irritation among worker exposed to organic solvent revealed a high prevalence's of neuropsychiatric and mucus membrane complaints: headache (65%), mental irritability (53%), tingling of limbs (46%), and sore eyes (43%)(40).

2.3 Factors affecting and initiating glue sniffing

2.3.1 Socio demographic factors

A cross sectional study that was done in Jimma town, Oromiya, South West Ethiopia, showed that Age and educational status were found to be significantly associated with substance use (P -value <0.05). The study showed that the odds of substance use was 2 times as the age street children increases (AOR [95% CI] 1.97 [1.001-3.889]). It also showed that respondents who attended school are less likely to use substance than who did not attended school (AOR [95% CI] 0.334 [0.151-0.757])(20).

A study conducted in western Kenya showed that factor affecting glue sniffing to be family contact, education, sex and age. Age was found to be significantly associated with adjusted odds ratio 1.28(1.06–1.54) (95%CI)(33).

In a population based cross-sectional study conducted in Guwahati City, Assam showed the risk factor associated with glue sniffing were level of education, contact with family, duration of street life where duration of street life being the most significant factor with p value <0.001 (29).

In 2013, a literature review that was conducted in India showed family status and working condition of street children were found to be risk factors(16).

2.3.2 Intrapersonal factor

In a population based cross-sectional study conducted in Guwahati City, Assam showed the risk factor associated with glue sniffing to be duration of street life which was the most significant factor among other with p value <0.001 (29).

A cross sectional study that was done in Jimma town, Oromiya, South West Ethiopia, showed that duration on the street was significantly associated with substance use (P -value <0.05). Respondents who stayed more than a year on the street have 3 times (AOR [95% CI] 3.00 [1.511-5.96]) more likely to use substance compared to respondents stayed less than 1 year on the street(20).

A literature review that was conducted in India showed that the most common reason for substance abuse by street children was peer pressure(62.1%) (16).

A study conducted in Bangladesh in 2011, showed that Peer pressure was found to be the most common reason with 70% of participant mentioning it as reason (41).

A cross sectional study that was done in Jimma town, Oromiya, South West Ethiopia, showed that the risk factors for street children to abuse substance or use glue are affordability, accessibility and availability of substance (20)

A study conducted in Gambia, in 2018, Peer influence and group recognition 33(15.63%), was found to be the risk factor among other (42).

2.3.3 Interpersonal factor

A literature review that was conducted in India showed that the most common reason for substance abuse by street children were experimentation (36.3%) or to boost self-confidence (28.7%). This were found to be risk factor among other factors(16)

A review conducted in Singapore on glue sniffing showed that the risk factors for glue sniffing to be a low self-esteem, where as in a study that was conducted in Bangladesh in 2011 showed one of the risk factor for glue sniffing to be tension(41, 43)

A qualitative study conducted in Zimbabwe, 2018, pointed out the reasons for substance abuse for children as availability and accessibility of substances, Confidence boosting in searching for life needs and to reduce their physical and mental pressures, such as fatigue, sadness, sorrow(44).

A study conducted in Gambia, in 2018, curiosity 23(10.90%), to relieve stress and ignorance 19(9.00%), easy accessibility 18(8.53%), for seeking pleasure and relaxation 17(8.05%), and easy affordability 12(5.68%) where found to be the reason why street children engage in substance or drug abuse(42)

1. Conceptual frame work

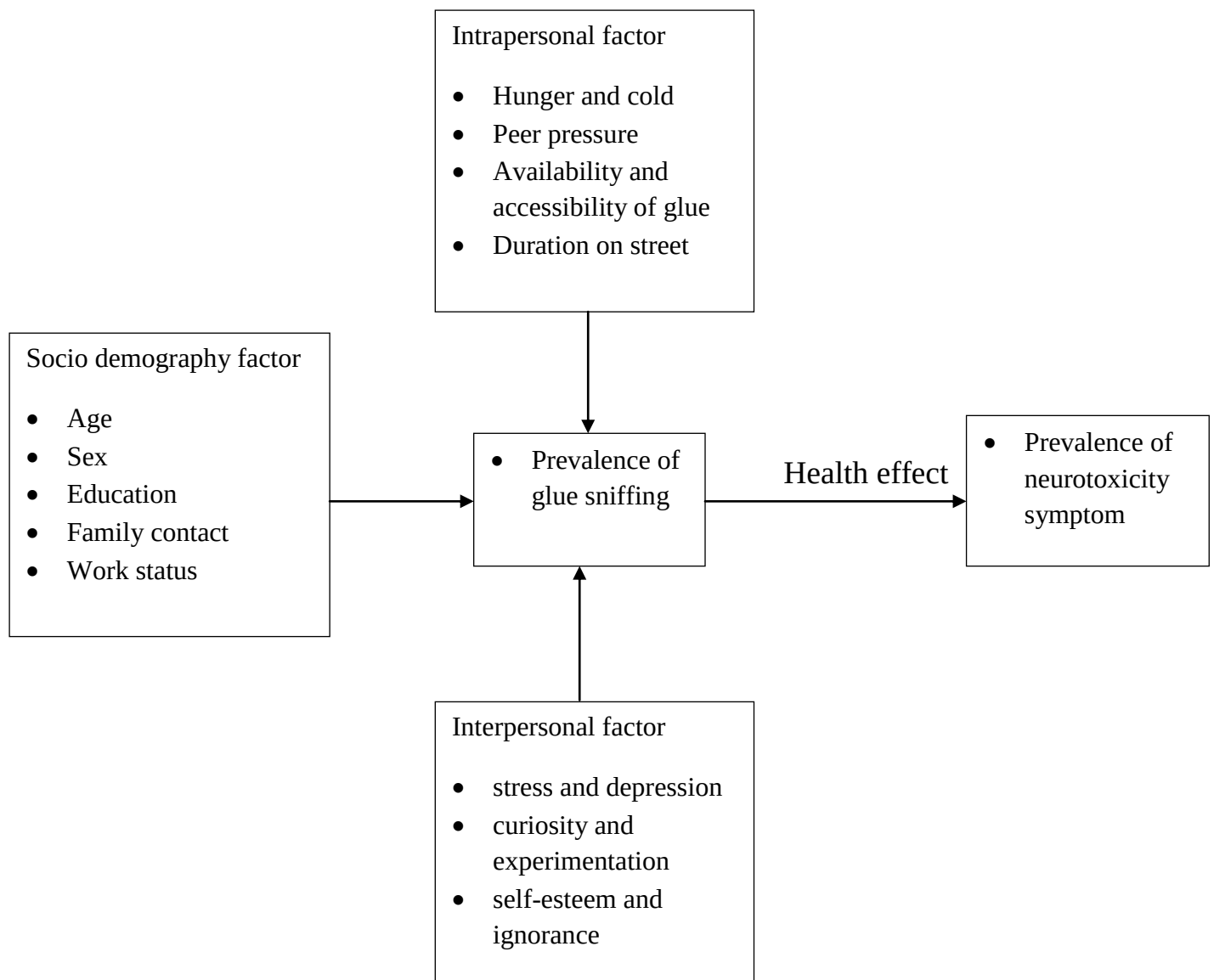


Figure 1 Conceptual framework developed from literature review

The conceptual framework developed from different literatures shows that there are many factors for children to get in to glue sniffing which are can be categorized in to different group. This are interpersonal factors like Self-esteem, Curiosity, relieve stress and ignorance as well as Intrapersonal factors like Peer pressure, hunger and cold, Availability and accessibility of glue and living on a street. The Socio demographic factors are Age, Sex, Education, Family contact and Work status. All the above factors play role in forcing and facilitating glue sniffing among street children which leads to the prevalence of Neurotoxicity symptoms.

4. General objective

To assess the neurotoxic symptoms among street children who have been exposed to organic solvent in Addis Ababa, Ethiopia.

Specific objective

1. To determine the prevalence of glue sniffing among street children in Addis Ababa, Ethiopia
2. To calculate the prevalence of neurotoxic symptoms among street children who have been exposed to organic solvent in Addis Ababa, Ethiopia
3. To find out the risk factors associated with glue sniffing among street children
4. to find out the reason why street children sniff glue

5. Methods and material

5.1 Study design

This study employed a cross sectional study. A mixed design of qualitative and quantitative method was used to achieve the objectives.

5.2 Study area

The study was conducted in the selected streets of Addis Ababa, Ethiopia from December 2019 to March 2021. Addis Ababa is the capital city of Ethiopia and a residence for many diplomats as well as a location for Africa union. It is divided in to 10 sub cities and 100 woredas. There is one governmental organization that is responsible for street children in Addis Ababa, called Bureau of Labour and Social Affair (Bolsa). There are 67 non-governmental organizations working directly or indirectly on street children in Addis Ababa. It is estimated that 60,000 street children live on streets of Addis Ababa.

5.3 Source and study population

All street children who are living in the streets of Addis Ababa will be the source population.

5.4 Study population

The study population are all randomly selected street children above the age of 12.

5.5 Inclusion and exclusion criteria

Willingness to take part in the study and spending time on the street for at least 1 year was taken as inclusion criteria. Exclusion is done from eligible individuals. Those less than twelve years old are not eligible. Children who have been taken in to rehabilitation centre in last one year were also been excluded from the study.

5.6 Sample size

Sample size for the first specific objective

The first specific objective of the study aims to discover the prevalence of glue sniffing among street children. The sample size to assess the prevalence of glue sniffing among street children, a single population proportion formula was used, with the following assumption.

P: 45.9% prevalence of glue sniffing among street children(20)

d: margin of error =5%

$Z_{\alpha/2}$: critical value at 95% confidence level = 1.96

A: level of significance (5%)

n: required sample size

$$n = (Z_{\alpha/2})^2 \times p \times (1-p) / d^2$$

$$n = (1.96)^2 \times 0.459 \times (1-0.459) / (0.05)^2$$

$$n = 381$$

By considering 10% non-response rate, the final sample becomes 420

Sample size for specific objective two

In order to calculate the Sample size in determining the prevalence of neurotoxic symptoms same formula as the first objective was used. Using the prevalence of the most prevalent neurotoxic symptom, headache (65%), as p

P: 65% (the most prevalent neurotoxic symptom, headache (65%))

d: margin of error =5%

$Z_{\alpha/2}$: critical value at 95% confidence level = 1.96

A: level of significance (5%)

n: required sample size

$$n = (Z_{\alpha/2})^2 \times p \times (1-p) / d^2$$

$$n = (1.96)^2 \times 0.65 \times (1-0.65) / (0.05)^2$$

$$n = 350$$

By considering 10% non-response rate, the sample becomes 385

There for the final sample size became 385

Sample size determination for specific objective three

Epi info version 7 was used to determine sample size for objective 3 considering the following assumption

$$P = 15.7\% (20)$$

$$\text{Power} = 85\%$$

$$\text{Ratio} = 1$$

$$\text{OR} = 2.59$$

The sample size becomes 252. After adding 10% for non-response rate, it becomes 277

Qualitative sampling

To find out the reason why street children are engaged in glue sniffing, 1 female group and 1 male group was used for Focus group discussion (FDG). Data were collected until no new idea was found or till there is no new theme left to develop. Key informants' interview was carried out from Bolsa.

5.7 Sampling procedures

5.7.1 Quantitative data

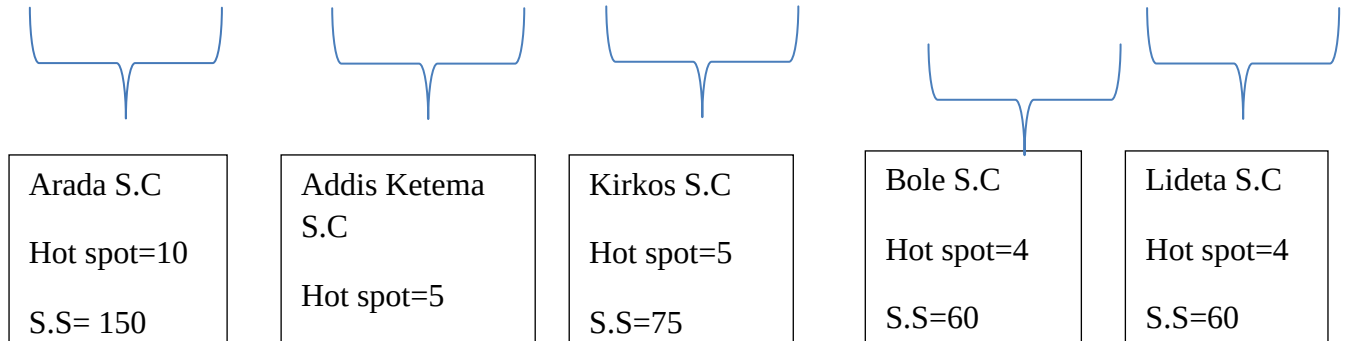
The main challenge for sampling street children was to get the exact locations. The first step was identifying sub cities which contain major hot spots. From the selected sub cities, major places, where these children are located in mass were selected to create a sampling frame of locations (hot-spots) as primary sampling units. Information was gathered from Bolsa about the spot area and site visitation used to identify the convenient spots. The number of respondent was determined according to the number of hotspots in each sub city have. Respondents were then drawn from the selected spots based on their willingness. In each hot spot, street children have their own leader. This person is the one who gives order for the groups "jema" and takes responsibilities what happens in that specific area. Therefore the first action was contacting this person and creating a smooth relation. With the help of this leader, lists of all street children in that specific spot area were registered with specific codes for each person. After registering all children, participants were recruited randomly from the list to collect data.

5.7.2 Qualitative data

A purposive sampling method was used. This is the most common sampling technique in which the researcher actively selects the most productive sample to answer the research question based on the available literature (45). After communicating the group leader, participants were selected for the FGD interview. Five male street children were selected for the first FGD discussion and five female street children were selected for the second FGD discussion.

Addis Ababa city

Aradas.c	N.S.L.S.C	Addis ketema	Gulele	Kirkos S.C	Akakikality	Bole S.c	Yeka	Lideta S.C	Kolfe
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Arada	S.S	Addis ketema	S.S	Kirkos S.C	S.S	Bole S.c	S.S	Lideta S.C	S.S
Churchur	15	Gojamberend	15	Stadium	15	22	15	Mexico	15
Tikuranb	15	Atobustera	15	Estifanos	15	Megenagna	15	Biherawe	15
6 killo	15	Habtegiorgis	15	Commerce	15	Shola	15	Migration	15
5 killo	15	Cinema ras	15	Ambassador	15	Urael	15	Sarbet	15
4 killo	15	abinet	15	Meskelsq	15				
afnchober	15								
Georgis	15								
eribekentu	15								
piyasa	15								
bankodiroma	15								
Total	150		75		75		60		60

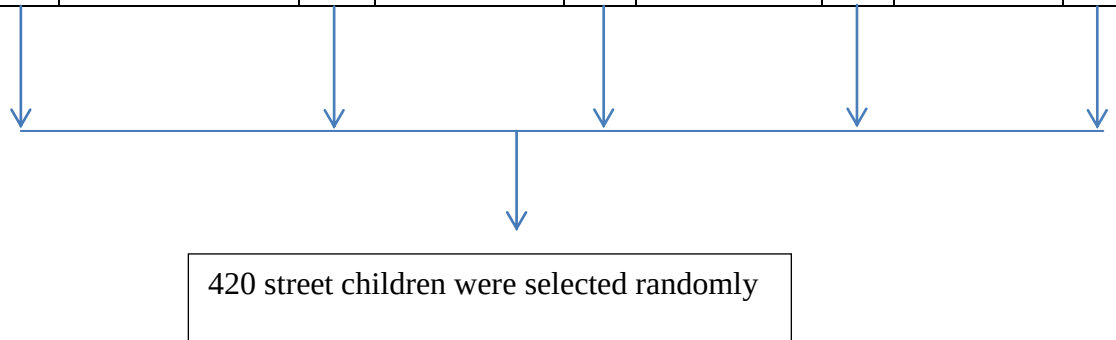


Figure 2 Schematic presentation of sampling procedure

5.8 Data collection procedure

5.8.1 Quantitative data collection

In order to find the socio-demographic characteristics of the participant, factor associated with glue sniffing and the prevalence of glue sniffing among street children, a structured interviewer administered questionnaire was used.

In order to find neurotoxicity effect of organic solvent and to determine the prevalence of neurotoxicity symptom, the modified Germen version of q18 for neurotoxicity symptom which have a 'yes' or 'no' response of 18 questions was used. Some of the symptoms are headache, short memory, concentration, feeling irritated, depression, palpitations and oppression on chest, perspiration and hands tremble. This questionnaire is found to be a sensitive and reliable instrument for the screening of workers exposed to solvents than other tools(39, 46).

The Swedish version of Q16 questionnaire have been used in many studies but mostly in Sweden(47). Two studies in South Africa have used the Swedish version of Q16 questionnaire on neurotoxic symptoms(48, 49). This questionnaire shares 13 similar items with the Q18. Both of them have shown similar sensitivity to identify the effects of solvent exposure of 71% and a consistence result linked with 21 relevant studies. So, the questionnaire (Q18) already has high reliability and validity. The tool can be taken as valid tool to use it in developing country since it has been used in south Africa, (39, 46).

The data collectors were a BSc degree holder with a background of public health. Four data collector and one supervisor were participated on this study. In order to assure data quality, a brief on the objective of the study and the questionnaire were given for the data collectors; translation of question from English to Amharic was done by expertise. A pre-test was held on questionnaire.

Since the qualitative part is to substantiate the quantitative part, interview was carried out for one male FGD which have five male street children and one female FGD consisting 5 female street children. The interview was held in the selected quiet place, near to the place the children live around 'tewodro square' sitting in a circle position on the grass where respondents, group leader (gang), interviewer and one person from Arada sub city woreda 01 labour and social affair officer. The key informants' interview was conducted with Mr X, director of safety net at Bolsa. Given the situation current situation (covid 19), the interview was carried out through telephone recording.

5.8.2 Qualitative data collection

Comprehensive interview guiding Question was prepared for focal group discussion in order to have effective and well organized interviews and discussions with respondents. The guiding question was prepared in English and then translated in to Amharic. Tape recording was used while interviewing.

5.9 Variables

5.9.1 Dependent variables

- Prevalence of glue sniffing
- Prevalence of neurotoxicity symptoms

5.9.2 Independent variables

- Socio demographic factor (Age, Sex, Religion, Educational status, work status and family status)
- Intrapersonal factor (Hunger and cold, Peer pressure, Availability and accessibility of glue and duration street)
- Interpersonal factor (stress and depression, curiosity and experimentation, self-esteem)

5.9 Operational definition

- Organic solvent: volatile and aromatic solvents specially found in glue, like toluene and n-hexane which are toxic
- Street children: children who spent their entire time on the street, living and working on the street and aged above 18 years of age
- Glue sniffing: an activity of inhaling of adhesive or shoe glue (mastish) for more than 1 year and for at least one time a week
- Neurotoxicity symptoms: are symptoms which rise as a result of inhaling glue and identified with the standard questionnaire (modified Gemen version of q18 questionnaire) such as:9 (headache, short memory, problems with concentrating, irritation, depression, tiresome, palpitations, chest oppression, perspiration, feeling sick, numbness and hands tremble)

5.10 Data management procedures

5.10.1 Data management for quantitative data

The collected data were entered in to Epi info version 7 and transferred to SPSS version (20). Data was backed up in case of data lost happens.

5.10.1 Data management for qualitative data

Familiarization of the data by reading and listening again and again will be the first step. The data were be organized for easy retrieval. File were be created with participant code number and stored in specific location. Data will be backed up and accessible as soon as possible

Participants' personal information were coded or removed from public view keeping the Confidentiality of the data.

5.11 Data Analysis procedures

5.11.1 Quantitative data analysis

Data analysis involved quantitative approach. After coding of all the responses from each questionnaire, cleaned data were analysed using SPSS version 23. Descriptive statistics was used to summarize data. Logistic regression analysis was used to identify whether factors are significantly associated with outcome variables or not. Thus, variables with $p < 0.25$ were included in the multivariable analysis (20). Variables were considered as significant independent factors based on Adjusted Odds Ratio (AOR) with 95% CI and P-value of < 0.05 . The P-value of < 0.05 was considered as statistically significant. The Hosmer–Lemeshow test was used to see goodness-of-fit for the logistic regression models. The effect of multi collinearity of the independent variables were also assessed using VIF value (1-10 value, no multicollinearity) and VIF (<1 or >10 value, there is multicollinearity).

5.11.2 Qualitative data analysis

Qualitative data will be analysed with qualitative tools. The data collected by focul group discussion were undergone in to content analysis. Open code soft were version 4.02 was used

5.12 Data quality management

5.12.1 Quantitative data quality management

To ensure the external validity (generalizability) of the study, appropriate size or a representative sample was taken. In order to ensure the internal validity (accuracy and precision) of the study, maximum effort was taken to minimize bias and errors by training data collector and supervisor; using a valid and standard questionnaire to ascertain outcome; pretesting the questionnaire. Training was given for data collectors. The investigator was supervising data collection proses and checking the completed questionnaire every day.

5.12.2 Qualitative data quality management

Interpretations, conclusions, recommendations were be based on only the data collected and can be confirmed by auditors. Transferability were be ensured if same procedure is taken.

6 Ethical consideration

Ethical clearance for the study was received from Addis Ababa University Faculty of Medicine ethical board. Permission was also taken from concerned body and governmental authority like burro of social and labour affair

During study time, the participants lose some of their time during briefing the objective of the study and during data collection. The participants were given a compensation for their time and meal expense and other expect process accordingly.

The participants were engaged only with the activities which are only needed for the research. No other information was asked or used. All information was according to the consent.

All the participants were treated and contacted properly and in a right way. The identity of the participant stayed anonymous and secret. It's their power concerning personal information. Participants were only included for the study if they were willing to participate and a full right was given to them to participate and to withdraw from the study at any time of the study.

7. Dissemination of results

The final result of this study was presented to concerned bodies, stakeholders and for any interested party. An effort will be done so as to publish on appropriate journals.

8. Result

8.1 Quantitative result

8.1.1 Socio-Demographic Characteristics of the Study Population

A total of 420 participants were included in the study with 100% of response rate. Among the participants, 330 (78.6%) were male and 90 (21.4%) were female [Figure 2]. Their mean age was 17.98, with range age 12 - 23.

Most of the study participants were at the age group of 13-19 years old which accounted 70%. When we see educational status of the participants, 222(52.9%) was school dropped out where the rest of them had never gone to school. Majority of the street children begs for life 316 (75.2%) where the rest of them do some casual works like shoe shine, carrying things 'kuli', parking and washing car. Most of the street children, 369 (87.9%) doesn't have any contact with their family. When we see how long this participants were on the street, the study have found that most of them 274(65.2%) have been living in the street for about more than 2 years. Majority of them, 314 (74.8%) were Christian, whereas 106 (25.2%) of them were Muslim. Table 1 shows the Socio-Demography characteristics of the study participants.

Table 1:- Socio-Demography characteristics of the study participants in Addis Ababa, Ethiopia, 2021

Socio-demographic characteristics	Frequency	Percent
n=420		
Sex		
Male	330	78.6
Female	90	21.4
Age		
12-17	195	46
18-23	225	54
Educational status		
Dropout school	222	52.9
never been to school	198	47.1
Religion		
Christian	314	74.8
Muslim	106	25.2
Work status		
working	104	24.8
begging	316	75.2
Family status		
Yes	51	12.1
No	369	87.9
Time on street		
<2 years	146	34.8
> 2 years	274	65.2

8.1.2 Life style of street children

Even if it is hard to explore life style of street children, the study tried to see their life style with their smoking habit, alcohol use, benzene use and other chemical use. When we see their habit of drinking alcohol, 243 (57.9%) of them said that they drink alcohol. From the total study participants, 355 (84.5%) of them smoke cigarette. The numbers of participants who sniff benzene are very low which is only 65 (15.5%) participants. Only 143 (34%) said that they chew chat. When we see their average sleeping duration, 249 (59.3%) of the participant have a sleeping duration of 6-8 hours, whereas 123 (29.3%) of them sleep for more than 8 hours a day.

Table 2:- Life style of street children in Addis Ababa, Ethiopia, 2021

Life style	variable	Frequency	Percent
Drinking alcohol	Yes	243	57.9
	No	177	42.1
Smoking cigarette	Yes	355	84.5
	No	65	15.5
Sniffing benzene	Ye	92	21.9
	No	328	78.1
Other substance use	Chat	159	37.9
	shisha	24	5.7
Sleeping duration	< 8 hours	297	70.7
	>8 hours	123	29.3

8.1.3 Prevalence of glue sniffing

The prevalence of glue sniffing among street children in Addis Ababa was found to be 344 81.9% (95%CI) (table 3). Among 344 street children who are sniffing glue, 274 (79.6%) were male. Figure 4 shows prevalence of glue sniffing by sex category

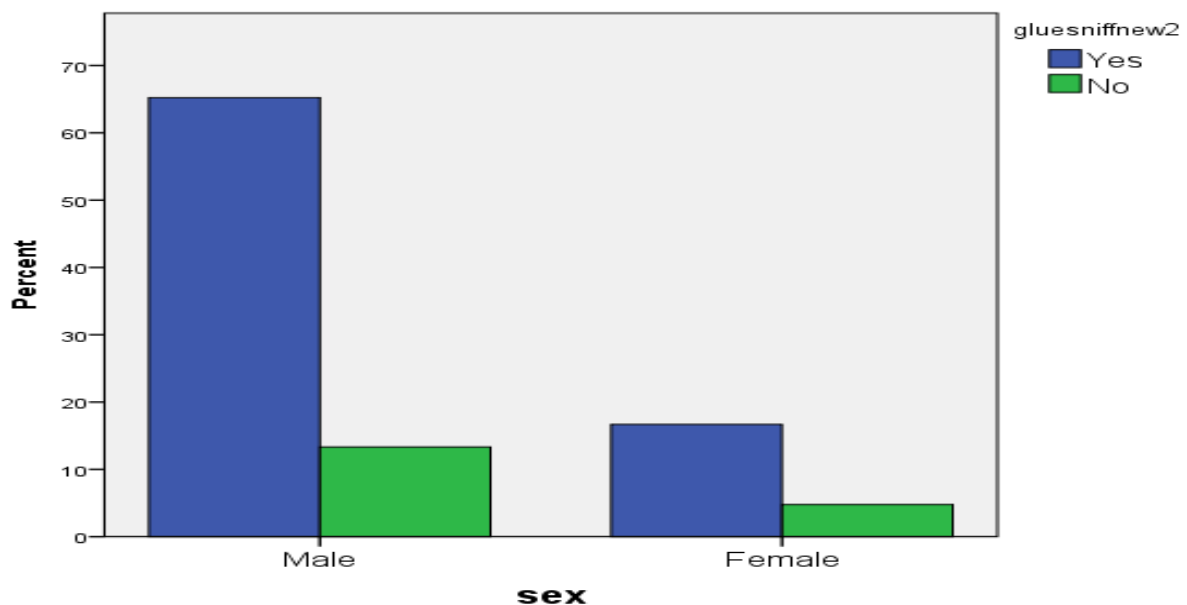


Figure 3 Prevalence of glue sniffing by sex among street children in Addis Ababa, Ethiopia, 2021 (n=420)

Majority of the participants, 143 (41.6%), started sniffing glue more than 2 years ago while 75 (21.8%) of them started 1 years ago. Out of the total glue sniffers, 256 (74.4%) of them sniff daily. when we see the daily sniffing frequency, the study found that 185 (53.8%) of this street children sniffs 2-5 times a day while 131 (38.1%) of them sniff 1 time a day. Daily glue sniffing duration among street children was found to be 1-4 hour for 142 (41.3%) of the participants and 4-8 hours for 142 (41.3%) of them. From the participants, 201 (58.4%) of them use a quantity of < 25 ml of glue while 137 (39.8%) of them use a 25-50ml of glue a day.

Table 3:- Prevalence of glue sniffing among street children in Addis Ababa, Ethiopia, 2021

variable	response	Frequency	Percentage
Glue sniffing	Yes	344	81.9
	No	76	18.1
Started glue sniffing	6 month ago	56	16.3
	1 year ago	75	21.8
	2 years ago	70	20.3
	>2 years	143	41.6
Sniff daily	Yes	256	74.4
	No	88	25.6
	1 time	131	38.1
Daily sniffing frequency	2-5 times	185	53.8
	> 5 times	28	8.1
	< 1 hour	14	4.1
Daily sniffing duration	1-4 hours	142	41.3
	4-8 hours	142	41.3
	>8 hours	46	13.4
Weekly sniffing frequency	1-2 times	34	38.6
	3-4 time	42	47.7

8.1.4 Prevalence of neurotoxicity symptoms among street children in Addis Ababa, Ethiopia.

The prevalence of neurotoxicity symptoms among street children in Addis Ababa was shown in table (5). Depression and headache were found to be the most prevalent symptoms among street children 293(69.8%) and 287(68.3%) respectively. The prevalence of often feeling

sick, feeling irritated and numbness are 212(50.5%), 196 (46.7%) and 169 (45.7%) respectively. Short memory and palpitations have an equal prevalence of 170 (40.5%) and 160(38.1%). Concentration and cognition problems have a prevalence of 143 (34%) and 133 (31%). Table 5 shows the prevalence of neurotoxicity symptoms among street children in Addis Ababa, Ethiopia.

Table 4:- Germen version Q18 questionnaire, prevalence of neurotoxicity symptoms among street children in Addis Ababa, Ethiopia, 2021

Symptoms	Frequency	
	Yes	No
Do you have a short memory	170(40.5%)	250(59.5%)
Have your relatives told you that you have a short memory?	117(27.9%)	303(72.1%)
Do you often have to make notes about what you must remember?	30(7.1%)	390(92.9)
Do you generally find it hard to get the meaning from reading newspapers and books?	133(31%)	287(69%)
Do you often have problems with concentrating?	143(34%)	277(66%)
Do you often feel irritated without any particular reason?	196(46.7%)	224(53.3%)
Do you often feel depressed without any particular reason?	293(69.8%)	127(30.2%)
Are you abnormally tired?	137(32%)	32.6(68%)
Do you have palpitations of the heart even when you don't exert yourself?	160(38.1%)	260(61.9%)
Do you sometimes feel oppression in your chest?	120(28.6%)	300(71.4%)
Do you often perspire without any particular reason?	78(18.6%))	342(81.4%)
Do you have a headache at least once a week?	287(68.3%)	133(31.7%)
Do you often feel sick?	212(50.5%)	208(49.5%)
Do you have numb feelings in your hands or feet?	196(45.7%)	228(54.3%)
Is there a weak feeling in your arms or legs	98(23.3%)	322(76.7%)
Do your hands tremble?	162(38.6%)	258(61.4%)
Does alcohol not agree with you?	50(11.9%)	193(88.1%)

8.1.6 Bivariate analysis for socio demography factors, and life style factor affecting and initiating glue sniffing

8.1.6.1 Bivariate analysis for socio demography factors

Bivariate regression analysis was done to identify variables that are candidate for multivariate regression analysis. Variables with p value <0.2 were taken for multivariate regression

analysis. Having these criteria, the variable that were candidate for multivariate regression analysis are age, work status and education status.

But, factors like sex and family contact did not fulfill the criteria for multiple regression analysis.

Table 5 Bivariate logistic regression analysis for socio demography factors and environmental factor associated with glue sniffing among street children, in Addis Ababa, Ethiopia, 2021

variable	categories	glue sniffing		COR(95% CI)
		Yes	No	
Sex	Male	274	56	1.40(0.79-2.48)
	Female	70	20	1
Age	12-17	173	22	2.48(1.45-4.26)*
	17-23	171	54	1
Educational status	Yes	176	46	0.68(0.41-1.13)*
	No	168	30	1
Work status	Yes	75	29	0.45(0.27-0.77)*
	No	269	47	1
Family contact	Yes	40	11	0.78(0.38-1.59)
	No	304	65	1

1.00 = reference value, *P < 0.2 for COR, COR crude odds ratio.

8.1.6.2 Bivariate analysis for intrapersonal factors and interpersonal factors associated with glue sniffing among street children, in Addis Ababa, Ethiopia, 2021

In this part of bivariate analysis, five factors, peer pressure, Stress and depression, Self-esteem and Experimentation and curiosity and time on street, have shown a p value less than 0.2. As result, these five factors were taken for multivariate regression analysis.

Table 6 Bivariate logistic regression analysis for external factors, internal factor and environmental factor associated with glue sniffing among street children, in Addis Ababa, Ethiopia, 2021

variable	categories	glue sniffing		COR(95% CI)
		Yes	No	
peer pressure	Yes	232	27	3.76(2.23-6.33) *
	No	112	49	1
Hunger and cold	Yes	245	49	1.346(0.81-2.30)
	No	99	27	1
Experimentation and curiosity	Yes	156	21	2.17(1.26-3.75)*
	No	188	55	1
Stress and depression	Yes	222	30	2.79(1.67-4.65)*
	No	122	46	1
Glue availability and accessibility	Yes	102	19	1.26(0.72-2.23)
	No	242	57	1
Self esteem	Yes	129	20	1.68(0.96-2.93)*
	No	215	56	1
Time on street	< 2 years	134	12	3.40(1.77-6.54)*
	> 2 years	210	64	1

1.00 = reference value, *P < 0.2 for COR, COR crude odds ratio.

8.1.6 Multivariate analysis for factor associated with glue sniffing

Variables with p value <0.2 were selected as candidate for multivariate analysis. There for, eight variables were entered in multivariate regression of which six of them showed a significant association with the outcome variable. The multivariate analysis was summarized in Table 8.

In the multivariate analysis; age work status, time on street, peer pressure, experimentation and curiosity, Stress and depression and self-esteem were found to have a significant association with the dependent variable.

The odds of glue sniffing among street children whose age are 12-17 is 2 times more than the children over 17 (AOR=2.04; 95% CI: 1.06-3.93). This shows that as their age increases, they tend to stop sniffing.

The odds of glue sniffing among street children who are working is 0.49 times less likely than children who do not work (AOR=0.49; 95% CI: 0.26-0.91).The odds of glue sniffing

among street children who lived in the street for less than 2 years was 3.73 times more than that of who lived for more than 2 year (AOR=3.73; 95% CI: 1.78-7.82). That is the more they live on the street, the more they tend to stop sniffing glue.

The odds of engaging in glue sniffing as a result of peer pressure was 3.10 times more than without peer pressure (AOR=3.10; 95% CI: 1.72-5.59). The odds of glue sniffing among street children who have stress and depression were 3.72 times more than children who don't have stress and depression (AOR=3.72; 95% CI: 2.07-6.68). That is the more they get stressed the more they sniff glue to relief the stress.

The odds of glue sniffing among street children having a self-esteem problem were 2.86 times more than children without self-esteem problem (AOR=2.86; 95% CI: 1.51-5.43).

Table 7 Multivariate regression analysis for glue sniffing and associated risk factors among street children in Addis Ababa, Ethiopia, 2021

variable	categories	glue sniffing		COR(95% CI)	AOR(95% CI)
		Yes	No		
Age	12-17	173	22	2.48(1.45-4.26)*	2.04(1.06-3.93)**
	17-23	171	54	1	1
Educational status	Yes	176	46	0.68(0.41-1.13)*	0.79(0.44-1.40)
	No	168	30	1	1
Work status	Yes	75	29	0.45(0.27-0.77)*	0.49 (0.26-0.91)**
	No	269	47	1	1
Time on street	< 2 years	134	12	3.40(1.77-6.54)*	3.73 (1.78-7.82)**
	> 2 years	210	64	1	1
peer pressure	Yes	232	27	3.76(2.23-6.33) *	3.10(1.72-5.59)**
	No	112	49	1	1
Experimentation and curiosity	Yes	156	21	2.17(1.26-3.75)*	1.38 (0.72-2.65)
	No	188	55	1	1
Stress and depression	Yes	222	30	2.79(1.67-4.65)*	3.72(2.07-6.68)**
	No	122	46	1	1
Self esteem	Yes	129	20	1.68(0.96-2.93)*	2.86 (1.51-5.43)**
	No	210	64	1	1

1.00 = reference value, *P < 0.2 for COR, **P < 0.05 for AOR, COR crude odds ratio, AOR adjusted odds ratio. goodness of fit sig=0.47

8.2 Qualitative result

The study incorporated qualitative method to elicit the factor and reason behind sniffing glue.

Theme 1:- Reason for glue sniffing

Intrapersonal reasons

Peer pressure

Participants were asked to tell why they are engaged in glue sniffing and they mentioned peer pressure as one of the reason for using glue.

When I first came to the street, I saw people using the glue and they gave me to try it. (Male Street Child 5, 15 year old)

Uncomfortable living situation

The other factor behind glue sniffing was the uncomfortable living situation. The way they live their life forced them to use glue. Their life is always on the edge.

“When you use glue, you will escape this uncomfortable situation, everything around you” (Male Street Child 4, 19 year old)

At night, the police men will hit us with their stick. You know they hit me with the stick even an animal doesn't deserve. Therefore I have to use glue to control myself” (Male Street Child 2, 20 year old)

Hunger and cold environment

Most of them mentioned hunger and cold environment as one of the main factor for using glue. They use of glue as a means of escaping hunger and the cold weather in the night.

“I don't eat food if I am sniffing glue even if you give me meat. That is because you will lose your appetite. And here you don't get food. That's why” (Female street child 2, 22 years old)

“The first thing, whatever kind of cloth I ware, I won't feel the cold. I will become desensitize “medenze” (Male Street Child 3, 17 year old)

Community and Rich people influence

Community and Rich people influence were found to be another factor that can affect either positively or negatively. Community can affect positively because the children may have this fear of feeling to use glue around the community. On the other hand rich people may affect negatively by providing some money to the children. The children do not use the money only to buy glue.

“When I was in Debrezeyit I only use chat because there are people who may know me. But when I came to nazret no one knows me” (Female street child 1, 20 years old)

Male Street Child 1 who is 27 years old says *“I blame the rich people for giving money for children because that’s how they manage to buy the glue. If you give us money, we don’t buy food or cloth with it, we buy glue and other drug. It would be much better if they gave us the food or cloth”*.

Interpersonal reasons

Depression and stress

The other factor for glue sniffing is depression and stress. Due to the fact that these children are living with depression and stress and have a lot of thing to worry about, they are forced to use glue to relief this depression and stress.

“I use glue to forget about tomorrow, and to get out from stress, to give my self-condolence, not to worry that I don’t have money or anything”. (Male Street Child 2, 20 year old)

Get courage

Since they are spending time begging and mugging, they need to have some courage. And they say sniffing glue will give them the courage they needed to get the job done.

“It gives you courage to ask people money “ለመቀረጽ”. You will get the ability just like the one we see the movie. It gives you a different character”. (Male Street Child 1, 27 year old)

Curiosity

Curiosity is another factor. Wondering about why people use glue and wanting to see what happens when using glue was another drive for street children to start glue sniffing.

“I saw people using glue “አግግ” and I had no clue why they were using it. I was curious about its use and then started” (Female street child 3, 16 years old)

Theme 2:- Feelings of street children after glue sniffing

Hallucination

These children start to hallucinate after sniffing glue. They see things that do not exist. They feel like something horrible is happening to them.

“I feel like the person next to is a demon. I feel like a rat is coming out of my mouth. I touch my mouth with my hand because I thought a mouse is coming out of my mouth. When I am walking on the street I see solders holding a gun at me, and when I was trying to run away people are laughing at me”. (Male Street Child 3, 17 year old)

Loss of sensation (anesthetic feeling) (ጭደንዘዝ)

“You feel just nothing; you become senseless (ጭደንዘዝ). I don’t feel anything even if you hit me”. (Female street children 3, 16 and Female street child 5, 18 years old)

Happiness

The other thing they feel after sniffing glue was happiness. It makes them feel happy and excited. That is because it makes them forget the problem they have.

“You become happy (ረሃ, because you will not be worry about anything like my future, my present, what should I do, what do I eat”. (Female street children 4, 17 years old)

“When I use glue, I feel so happy” (Male Street Child 3, 17 year old)

Theme 3:- Knowledge of street children on the health effect of glue sniffing

Accepting consequence

They do know that get sick because of sniffing glue. They sniff accepting the consequence. For them it is not about heath it is about their current problem.

“I am using glue knowing the consequences, so it doesn’t matter” (Male Street Child 5, 15 year old)

Have been sick

All of them have been very sick. Bleeding nose and mouth, headache, hand shaking, sweating vomiting blood, chest pain and heart beat problem was some of them to mention.

“Someday, little blood was coming of my mouth and nose, very small”. (Male Street Child 5, 15 year old)

“Your brain doesn’t function. Your heart beat is not right”. (Male Street Child 1, 27 year old)

“Sometime when I am vomiting, blood comes out with it. Other than this nothing serious has happened to me”.(Female street child 4, 17 years old)

“I was very sick because of it. I have been bleeding thick blood through my mouth for about a week. My friends were taken by police at that time. I was feeling suffocated inside me (pointing at his chest). And when I cough blood would come out of my mouth to the air. When I am sleeping blood will come out of my mouth and nose”. (Male Street Child 4, 19 year old)

“I feel sweating; your hand becomes shaky to pick up something” (Male Street Child 5, 15 year old)

Theme 4Possible Solution for solving the problem

The bureau of labor and social affair were interviewed to see the challenges, focusing on the solutions for the problems and challenges that can obstacle for solving if not reducing or minimizing the problem.

Prevention

Preventing the problem is the most important direction we have to follow if we want to solve the problem. The prevention can be done at different levels. That is, at family level, regional government level, at street children level, at governmental level and at non-governmental organization level.

At Family level

There are a lot of task that has to be done at family level, as family is the beginning of the problem.

Mr X director of safety net, says “we have to work on family level to if we want to solve the problem at the very core. Strengthening the economy of families by improving their incomes,

family planning, we have to work on solving family conflict, parenting coaching, and child splitting”

According to Mr X, the other focus area should be at regional level. That is Creating work opportunity, Sustainable control of trafficking, creating awareness in schools

“The regional government should work on creating work opportunity for the youth and parents. Around 92% of street children are coming out of Addis Ababa, there are tasks to be done on other city, rural area on controlling children movement in the name of right of movement. Other thing is creating awareness school both higher and lower level school including universities”. (Mr X, director of safety net at Bolsa)

Research

Strong and intense research that can make a difference is very crucial way in solving the problem. Research is the way for making informed intervention.

“You have to really know the factors in the first place, factors that push this children. For instance, prevent cold condition; they have peer pressure; their age also forces them to engage in such practice; they say police are hitting us so we use it not to feel the pain; to have courage for doing things. And the research must be a follow up, start to end seeking change”. (Mr X, director of safety net at Bolsa)

Theme 5:- Challenges on tackling the problem

Lack of coordination and collaboration

There are some challenges that are going to be an obstacle on solving the problem. One of the challenges is lack of coordination and collaboration between governmental bodies.

“For example most of the street children are not from Addis Ababa, and if you try to send them back to where they come from, the other regional government won't accept you. They say it's not my plane, but these children are born there. There is interface to work together but it is not implemented”. (Mr X, director of safety net at Bolsa)

Unsustainable support from organizations

The other challenge is unsustainable support from organizations. That is the support they get is seasonal. There for, when that support stops the problem continuous.

“There are money support, material support from different organization and people, but this is just for some time, it not sustainable”. (Mr X, director of safety net at Bolsa)

False information in the media

Another important challenge is false information in the media by governmental officials.

“False information in the media is very challenging. For example last time the city administers said that 100 million birr is allocated for street children, after that a lot of street children came from different area and started asking to give them the money”(Mr X, director of safety net at Bolsa)

Weak skill of Social affair advisor

Weak skill of Social affair advisor of governmental authorities is also a challenge. Is the advisors have weak skill and lack of awareness what is really in the ground, then decision maker will make some mistake.

“For example last year they said through media that the government will build house for street, this really shows that Social affair advisor of governmental authorities have weak skill”. (Mr X, director of safety net at Bolsa)

9. Discussion

Quantitative part

This study tried to assess the prevalence of glue sniffing and neurotoxic symptoms among street children in Addis Ababa, Ethiopia. In addition to this, the study tried to find the risk factors associated with glue sniffing.

This study founded the prevalence of glue sniffing among street children to be 344 (81.9%) at 95% CI. This finding was different with the result found in Jimma town which was 45.9% (20). This could be due to the focus of substance. This study focused only on glue sniffing where as their study focused in all drugs and substance abuse. Another reason might be age limitation. They only included children with age from 12-18 years old which can under estimate prevalence.

This result is consistent with the study conducted in Guwahati City Assam, India with prevalence of 80.7% (29). A comparable result was found in a very recent study that was carried out in Butwal, municipality of Nepal in 2020 to find Prevalence of glue-sniffing

among street children showed that the prevalence of glue sniffing among street children to be 88.46%(27).

A very little difference was found in the prevalence of glue sniffing between this study and a study conducted in Dharan Municipality, Nepal in 2009. They found out that the prevalence of glue sniffing to be 72.9% a little bit lower prevalence than this study (81.9%)(28). This could be due to the time difference with the study conducted, which is 11 years difference.

A literature review that was conducted in India also showed that 82.98% of street children were addicted to substance which is a comparable result with this study finding. But this finding was little bit lower than a finding in Kathmandu valley, Nepal which was found to be 51.7% prevalence of glue sniffing (16, 18). This could be due to the fact that this study included only boys from the age of 9-16 years old. And also the time of study which was back in 2002.

However the result was somehow higher than the result found in western Kenya which showed a prevalence of 67%(33). This could be due to the time difference where the study conducted, which is 9 years difference.

Depression and headache were found to be the most prevalent symptoms among street children 69.8% and 68.3% respectively. A cross sectional survey was conducted in Palestine in 2001 which studied the prevalence of neuropsychiatric and mucous membrane irritation among worker exposed to organic solvent revealed a high prevalence's of headache (65%) a comparable result with this study finding, which is a 68% of prevalence. The study conducted in Palestine also found the prevalence irritability to be 53% which is a little bit higher result compared to this study which found the prevalence of feeling irritated to be 46.7% (36). This is due to the difference in study subject.

A similar result was found when it comes to some symptom like palpitation (38%) and feeling irritated (46%) with a result found in a study conducted Indonesia which is comparable result with palpitation 38.1% and feeling irritated (46.7%). All symptoms but the above two symptoms have shown a big difference. For instance, headache (68%) and depression (71%) were found in this study where as in the study conducted in Indonesia showed a prevalence of 31% and 15% headache and depression respectively. This is due to the difference in sample size which they only used a 32 sample size. It is also due to difference in type of study subject. They used industrial worker whereas this study used street children. Another explanation is the difference in exposure type and amount(39).

When we come to factor associated, this study founded age to be a significant factor for glue sniffing, (AOR=2.04; 95% CI: 1.06-3.93). which is a similar result from the result obtained in a study done in Jimma, (AOR=1.97; 95% CI: 1.00–3.89) (20) and somehow similar with a study done in west Kenya (AOR=1.28; 95% CI: 1.06–1.54) (33) in which age was a significant factor.

No significant association was found with educational status and glue sniffing which is a similar result obtained in a study conducted in Guwahati City, Assam which did not obtain a significant association with education level (29). This result was also similar with the result obtained in a study conducted in Kenya where education level was not a significant factor (33).

Duration of street life was another factor that showed significance association. A comparable result was obtained in a study done in Guwahati City, Assam. India, when we see its significant association, which found a significant association between duration of street life and substance abuse. As the time on street increases, the odds of sniffing glue increases 1.96 times more. This result is lower than the odd ratio (3.73) found in this study(29). This may be due to the sample size difference that is 420 verses 215. Other reason is difference in classification of the time on street. But this was a comparable result with the study obtained in Jimma. Respondents who stayed more than a year on the street have 3 times (AOR [95% CI] 3.00 [1.511-5.96]) more likely to use substance compared to respondents stayed less than 1 year on the street (20).

Peer pressure was significantly associated with glue sniffing. A lot of papers have showed peer pressure as the most risk factor for glue sniffing among street children (16, 20, 41, 42) but all did not calculated factor association.

Stress & depression and self-esteem & curiosity have shown a significance association. Most paper lists them as the most reason for glue sniffing but did not calculate risk factor association (16, 41-43).

Qualitative part

This study also incorporated qualitative approach in order to elucidate quantitative result. The focal group discussion generally focused on five themes. These are Factors contributing for glue sniffing, Feelings of street children after glue sniffing, Knowledge of street children on the health effect of glue sniffing, Possible Solutions for solving the problem and Challenges on tackling the problem

The first theme was divided into two categories, external factor (Peer pressure, Uncomfortable live situation, Hunger and cold environment and Community and Rich people influence and internal factor) and internal factor (Depression and stress, Get courage and Curiosity). The second theme has three categories which are Hallucination, Loss of sensation (anaesthetic feeling) and Happiness while the third theme contains two categories that is accepting consequence (they know that glue sniffing have health effect but still use it) and have been sick as a result of glue sniffing.

A key informant interview on the other hand focused on two themes. The first one was the key informant idea on Possible Solution for solving the problem and the other one on Challenges on tackling the problem each themes having broad categories. The first theme has a prevention category which focused on prevention at family level, regional government level, at street child level (on the spot), at governmental level and at non-governmental organization level. The second category was research which explained the need of research on identifying the factors and doing start to end follow-up research that can have real impact.

10. Strength and limitation of the study

10.1 Strengths

- Used a mixed approach

10.2 limitations

- Bias arising from admitting the use of glue (under estimate prevalence)
- Mix up of subjects from spot area to spot area may happen since this children are not stationary some times

11. Conclusion and recommendations

11.1 Conclusion

The prevalence of glue sniffing among street children is alarmingly high and is causing a tremendous health problem on these children with a high prevalence of neurotoxicity symptoms; depression, headache and short memory. The harsh living condition of these children makes them vulnerable for glue addiction. The determinant factor for glue sniffing, were age, time on street, work status, peer pressure, stress & depression and self-esteem. Having unhealthy and very depressed generation is unfortunate for a given country which can have a social and economic effect in general. This calls for immediate action and additional research to examine its farther effect and long term impact.

11.2 Recommendations

For Bolsa (Addis Ababa bureau of labour and social affair)

- Collaborate with regional government to reunite children with their family
- Formulate rule and regulation that can prohibit the use of glue
- Educate families on family conflict, parenting coaching, child splitting and family planning with collaborating responsible bodies

For non-governmental organization who work on street children

- Give a continues training for the children that focus on glue sniffing and its health effect
- Collaborate with the government for creating job opportunity for the children

For the government

- Create opportunities that can increase income of the society
- Conduct a Sustainable control of trafficking of children with a coordination of regional government

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15 ANNEXES

Annex 1: Information sheet (English version)

My name is _____ . I am here to collect data to study neurotoxic risk of exposure to organic solvent among street children. The study is being conducted by a post graduate student Tony Girma as partial fulfilment for the requirement of masters' degree in public health at Addis Ababa University.

The objective of this study is to see the risk of neurotoxicity among sniffers and to determine the neurotoxicity symptom prevalence, and find out the reason why street children are sniffing glue. The study will identify the neurotoxic effects that can be arising from the exposure of organic solvent mostly from glue sniffing activity. The result of this study and its recommendations will be disseminated to the concerned body

If you are willing to participate in the study, we will stay together for a short while. The information that you will provide will be kept confidential. Only the principal investigator, co investigators will know the information. Otherwise it will be kept secret and coded. You are free to answer only what you understand, to ask any question, and to terminate participation in the interview.

Are you voluntary to participate in this study? Yes----- no-----

Annex 2: Information sheet (Amharic version)

_____ እባላለሁ ::

እዚህ ላይ ተገኘሁት በከተማችን ውስጥ አገልግሎት የሚሰጡ ልጆች ላይ ጥናት ለማድረግና መረጃ ለመሰብሰብ ነው። ጥናቱ የሚያተኩረው የግልጽ ልጆች ለአረጋጊ ክስ ልሸንጎት በመጋለጣቸው በአይም ሮጤናቸው ላይ ያለውን ተጽዕኖ ማጥናት ሲሆን ምን ያህል የግልጽ ልጆች የጤማ ማጣባቂያ ማስታወሻ (ግሉ) ይስባሉ፤ ለምን ይስባሉ የሚሉትን እና በአይም ሮጤና ላይ ያለውን ተጽዕኖ ማወቅ የጥናቱ ዓላማ ነው። ጥናቱን የሚያካሂዱት ስማቸው አቶ ቶኒ ግርማ የተባሉ በአገልግሎት ሰጪ ተባብረው ተሰብሮ ስራ ላይ ያሉ ፍልጽ ህጋዊ መረቃት ምህንድስና ነው። ጥናቱን ማድረግ የሚገባ ለልጆች የጤና ግርም ለየት የሆኑ ምን ስሜት ለመለየት አስፈላጊውን ግብረመልስ ለሚመለከታቸው አካላት በማቅረብ ፋይዳ ይደረጋል።

በዚህ ጥናት ላይ ለመሳተፍ የእርስዎን ሙሉ ፊርማ እንፈልጋለን። የጥናቱ መረጃ የሚሰበሰበው ከህጻናት ጋር ቃለመጠይቅ በማድረግ ሲሆን ደረጃውን የጠበቀ መጠይቅ ተግባራዊ ይደረጋል። የሚሰጡን መረጃ ሚስጥራዊነቱ የተጠበቀ ሲሆን የእርስዎን ስም በዚህ ጥናት የመረጃውን ባለበት ለመለየት የማንጠቀም መሆኑን ለረጋግጥልዎት እወዳለሁ። በዚህ ጥናት ላይ የመሳተፍ ምክንያት ለመሳተፍ ምክንያት ያለዎት ብትወያይ ተጠብቀው። መረጃውን በመስጠት ሂደት ላይ ከጥናቱ አቋርጠው የመውጣት መብት ያለዎትም ብትወያይ ተጠብቀው። በዚህ መሠረት የእርስዎን በዚህ ጥናት ላይ የመሳተፍ መረጃ የመስጠት ፈቃደኝነትን በትኩረት እጠይቃለሁ።

አመሰግናለሁ!

በዚህ ጥናት ላይ አስፈላጊውን መረጃ ለመስጠት ፍቃደኛ ነዎት? ፍቃደኛ ነኝ _____ ፍቃደኛ አይደለሁም _____

Annex 3: Consent form(English version)

Detail information about the study is explained to me. I have understood that the objective of this study is to assess chronic respiratory symptoms and personal flour dust exposure and associated factors in workers of flour mill factories. I have been told that the study will help in better understanding of the effect of organic solvents on health.

In addition, I have been told about how the data collection is proceeding and the time it takes to complete the data collection. I also understand that the research imposes no risk on me. I am assured that there will be confidentiality of my response and collected data will be used only for the study. It has also been explained to me that I have the right to stop participation at any time.

Also, I understood that participating in this study is important for scientific knowledge and base for further study. Therefore, I have now consented to participate in the study by signing this form.

Signature of participants_____ date _____

Name and signature of data collector_____ date _____

Annex 4: Consent form Amharic version

ስለጥናቱመረጃተሰጥቶኛል።

የጥናቱዓላማየኦረጋጊከሶልሽንትማላትምማስትሽመሳብበጤናላይበተለይምበአይምሮላይየሚያስከትለውንጉዳትለማጥናትመሆኑንተረድቻለሁ።

በተጨማሪምመረጃእንዴትእንደሚሰበሰብናየሚወስደውንግዜአውቂያለሁ።

በኔላይጉዳትእንደሌለውናየምሰጠውመረጃበሚስጥርእንደሚጠበቅተረድቻለሁ።

የምሰጠውመረጃለጥናቱብቻእንደሚውልበማንኛውምግዜከጥናቱአቋርጬመውጣትእንደምችልከረጋግጠውልኛል። ጥናቱለእውቀትናለተለያዩጥቅምችፋይዳእንዳለውምእረዳለሁ።

ስለሆነምበዚህጥናትለመሳተፍበፈርማዬአረጋግጣለሁ።

የተሳታፊፊርማ_____ቀን_____

መረጃውንየሰበሰበውስምናፊርማ_____ቀን_____

Annex 5: Questionnaire (English version)

Data collection date: _____

Section one: Socio demographic information.

No.	question	Possible response	Skipping	code
101	ID number of subject	_____		
102	Sex	1. Male 2. female		
103	Age	_____ years		
104	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others		
105	Ethnicity	1. Amhara 2. Oromo 3. Tigre 4. SNNP 5. Other		
106	Education status	1. Dropped out school 2. Never been to school		
107	Work status	1. Working 2. Not working		
108	Time spent on street	1. 6 month-1 year 2. 1 year-2 years 3. > 2years		
109	Family status	1. Contact with family 2. Non-Contact with family		

Section two: life style

No.	question	Possible response	Skipping	code
201	Do you drink alcohol	1. Never 2. Sometimes 3. regularly		
202	Do you smoke cigarette	1. never 2. sometimes 3. regularly		
203	Do you sniff gasoline	1. never 2. sometimes 3. regularly		
204	daily sleeping duration	1. < 6 hour 2. 6-8 hour 3. > hour		

Section three: prevalence of glue sniffing

No.	question	Possible response	Skipping	code
301	Do you sniff on glue	1. Yes 2. no	If no go to section four	
302	If you use glue when did you begin	1. 6 month ago 2. 1 years ago 3. 2 years ago 4. > 2 years ago		
303	Do you sniff daily	1. Yes 2. No	If yes, skip no. 304	
304	If no, how many a week do you sniff	1. 1-2 times 2. 3-4 3. 5-6		
305	How many times a day do sniff	1. 1 times 2. 2-5 times 3. More than 5 times		
306	For how long do you sniff a day	1. 1 hour 3. 4hrs 4. 8 hour 5. Whole day		
307	What quantity do you use at a time	1. Below 25 ml 2. 25- 50ml 3. 50-100ml 4. _____		

Section four: Assessing neurotoxicity symptom with germen version of Q18

No.	question	Possible response	Skipping	code
401	Do you have a short memory	1. yes 2. No		
402	Have your relatives told you that you have a short memory?	1. yes 2. No		
403	Do you often have to make notes about what you must remember?	1. yes 2. No		
404	Do you generally find it hard to get the meaning from reading newspapers and books?	1. yes 2. No		
405	Do you often have problems with concentrating?	1. yes 2. No		
406	Do you often feel irritated without any particular reason?	1. yes 2. No		
407	Do you often feel depressed without any particular reason?	1. yes 2. No		
408	Are you abnormally tired?	1. yes 2. No		
409	Do you have palpitations of the heart even when you don't exert yourself?	1. yes 2. No		
410	Do you sometimes feel an oppression in your chest?	1. yes 2. No		
411	Do you often perspire without any particular reason?	1. yes 2. No		

412	Do you have a headache at least once a week?	1. yes 2. No		
413	Are you less interested in sex than what you think is normal?	1. yes 2. No		?
414	Do you often feel sick?	1. yes 2. No		
415	Do you have numb feelings in your hands or feet?	1. yes 2. No		
416	Is there a weak feeling in your arms or legs	1. yes 2. No		
417	Do your hands tremble?	1. yes 2. No		
418	Does alcohol not agree with you?	1. yes 2. No		

Section five: reason for sniffing glue

No.	question	Possible response	Skipping	code
501	Tell me about your self			
502	When did you start using glue?			
503	Where do you get the glue?			
504	Where do you get the money to buy the glue?			
505	Why do you sniff glue?			
506	What do you feel after using the glue? Tell me the feeling.			
507	Do you know that sniffing glue have health effect?			
508	Have you ever thought of to stop?			

Section six guiding question for key informant

1. Detail about respondent
2. What are you working concerning street children?
3. What are you doing about them sniffing glue?
4. Do you have any regulation on sniffing glue?
5. Do u have a rehabilitation place for them?
6. What do you think should be done to stop if not reduce glue sniffing among them
7. What are the challenges on tackling the problem?
8. Do you think this area is well researched?
9. How many NGO's are there in Addis Ababa?
10. Are you working with them, how well?

Annex 6: Questionnaire (Amharic version)

ክፍል አንድ፡- ማህበራዊ ሁኔታ መስፈርት

ተ.ቁ	ጥያቄ	መልስ	መለያ
101	የተሳታፊዎቻቸውን ያውቁ?	1. ወንድ 2. ሴት	
102	እድሜዎትስንትነው?	_____ ነው	
103	ሃይማኖትዎምን ያውቁ?	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌላ	
104	ብሔርዎምን ያውቁ?	1. አማራ 2. አሮሞ 3. ትግራይ 4. ደቡብ 5. ሌላ	
105	የትምህርት ሁኔታ?	1. የተማረ 2. ያልተማረ	
106	የሥራ ሁኔታ	1. የሚሰራ 2. የማይሰራ	
107	ምን የህልገህ ሆኑት ግዳና ከወጡ	1. ከ 6 ወር-1 ዓመት 2. ከ 1 ዓመት 2 ዓመት 3. ከ 2 ዓመት በላይ	
108	የቤተሰብ ሁኔታ	1. ከቤተሰብ ጋር የሚገናኝ 2. ከቤተሰብ ጋር የማይገናኝ	

ክፍል ሁለት፡- አኗኗር ሁኔታ

ተ.ቁ	ጥያቄ	መልስ	መለያ
201	አልኮሎል ይጠጣሉ	1. መቼም 2. አልፎ አልፎ 3. ሁሉ	
202	ሲጋራ ያጨሳሉ	1. መቼም 2. አልፎ አልፎ 3. ሁሉ	
203	ቤንዚን ያሸታሉ	1. መቼም 2. አልፎ አልፎ 3. ሁሉ	

204	ለምንያህልጊዜይተኛሉ	1. ከ 6 ሰዐትበታች 2. ከ 6 – 8 ሰዓት 3. ከ 8 ሰዓትበላይ	
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ክፍልሶስት፡- ስለግሉ (ማስትሽ) ማሸተትሁኔታናመጠን

ተ.ቁ	ጥያቄ	መልስ	መዝለያ
301	ግሉ (ማስትሽ) ይስባሉ	1. አዎ 2. አይ	መልሱአይከሆነወደክፍል 4 እለፍ
302	መቼመሳብጀመሩ	1. ከ 6 ወርበፊት 2. ከ 1 ዓመትበፊት 3. ከ 2 ዓመትበፊት 4. ከ 2 ዓመትበላይ	
303	በየቀኑይስባሉ	1. አዎ 2. አይ	መልሱአዎከሆነጥያቄ 305ዝለል
304	ካልሆነበሳምንትለምንያህልቀንይስባሉ	1. 1-2 2. 3-4 3. 5-6	
305	በቀንለምንያህልግዜይስባሉ	1. 1 ግዜ 2. 2-5 ግዜ 3. ከ 5 ግዜበላይ	
306	በቀንምንያህልሰዓትይስባሉ	1. 1 - 4 ሰዐት 2. 4 - 8 ሰዓት 3. 8 - 12 ሰዓት 4. _____	
307	ምንያህልመጠንይስባሉ	1. 25 ሚ.ሊበታች 2. 25 – 50 ሚ.ሊ 3. 50 – 100 ሚ.ሊ 4. _____	

ክፍል 4፡- የነርቭሥርዓተ-ነክሥርዓቶችአቤቱታዎች (ኒውሮቶክሲሲቲምልክቶች)

ተ. ቁ	ጥያቄ	መልስ	መዝለያ
40 1	አጭርማህደረትውስታአለዎት?	1. አዎ 2. አይ	
40 2	ዘመዶችዎአጭርየማስታወስችሎታእንዳሎትነግረውዎትያውቃሉ?	1. አዎ 2. አይ	
40 3	ማስታወስለብዎትንነገርበተመለከተማስታወሻዎችብዙውንጊዜአለዎት?	1. አዎ 2. አይ	
40 4	ጋዜጣዎችንእናመጽሃፎችንበማንበብበአጠቃላይትርጉሙንለማግኘትይችግራሉ?	1. አዎ 2. አይ	
40 5	ብዙውንጊዜበማተኮርላይችግሮችዎጋጥሙዎታል?	1. አዎ 2. አይ	

40 6	ያለምንምልዩምክንያትብዙውንጊዜይናደዳሉ?	1. አዎ 2. አይ	
40 7	ያለምንምልዩምክንያትብዙጊዜጭንቀትይሰማዎታል?	1. አዎ 2. አይ	
40 8	ባልተለመደደክሞሃል?	1. አዎ 2. አይ	
40 9	እራስዎንጭናባታደርጉምእንኳልብዎበፍጥነትይመታል?	1. አዎ 2. አይ	
41 0	አንዳንድጊዜበደረትዎውስጥጭቆናይሰማዎታል?	1. አዎ 2. አይ	
41 1	እርስዎያለምንምልዩምክንያትብዙጊዜያልበወታል?	1. አዎ 2. አይ	
41 2	ቢያንስበሳምንትአንድጊዜየራስዎታትአለብዎት?	1. አዎ 2. አይ	
41 3	Normalታዊነውብለውያሰቡትለsexታግንኙነትብዙምፍላጎትየለዎትም?	1. አዎ 2. አይ	? may be excluded
41 4	ብዙጊዜህመምይሰማዎታል?	1. አዎ 2. አይ	
41 5	በእጆችዎወይምበእግሮችዎውስጥመደንዘዝስሜቶችአሉዎት?	1. አዎ 2. አይ	
41 6	በእጆችዎወይምበእግሮችዎውስጥደካማስሜትአለ?	1. አዎ 2. አይ	
41 7	እጆችዎይንቀጠቀጣሉ?	1. አዎ 2. አይ	
41 8	የአልኮልመጠጥከእርስዎጋርአይስማማም?	1. አዎ 2. አይ	

ክፍል 5:- የጥናቱተሳታፊዎችለምንግሉእንደሚስቡለማወቅየተዘጋጁጥያቂዎች

ተ.ቁ	ጥያቄ	ማብራሪያ (መቅዳት...)
501	ለምንድንነውግሉ (ማስትሽ) የሚስቡት	
502	ምንድንነውየሚሰማዎትከሳቡበኋላ	
503	ከሳቡበኋላምንድንነውየሚደርጉት ከዚህበላይሊነግሩኝይችላሉ	
504	ማስተሽለመሳብተግባርዎየሚሰማዎትምንድንነው; ቢያብራሩልኝ	
505	ከየትነውማትሹንየሚያገኙት	
506	ማስትሹንመግዚከየትነውየሚያገኙት	
507	ጉዳትወይምተጽዕኖአድርስዎበትያውቃል; ምሳሌቢሰጡኝ	
508	ማስትሽመሳብበጤናላይጉዳትአለውብልውያስባሉ; ምሳሌሊሰጡኝይችላል	
508	ለማቆምአስበውያውቃሉ; ማቆምስይፈልጋሉ	

Annex 7: Bio sketch

Name	Tony Girma
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I have B.Sc. Degree in Environmental health science from Jimma University in June 16, 2011. I have taken some short courses, like pedagogy for three month and basic computer skill for three month and earned certificate. I am currently taking my Mph program on Environmental and Occupational health at Addis Ababa University College of health sciences school of public health.

I have been working at Arada Sub City Woreda 01 Administration Food Medicine and Health care Administration and control office for more than eight years from June 2, 2004 E.C as food and drinking establishment inspector.

Declaration

I, the undersigned, declared that this, my original work has never been presented for degree in this or other university and that all sources of materials used for this thesis has been fully Acknowledged.

Name: Tony Girma

Signature _____

Place: Addis Ababa University

Date of submission_____

This thesis has been submitted for examination with my approval as university advisor.

Name: Teferi Abegaz (MPH, MSC, PhD)

Signature _____