The proliferation of noise pollution as an urban social problem in Wolaita Sodo city, Wolaita zone, Ethiopia

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Abstract: Noise pollution is an unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings. Urban noise pollution is one of the problems of people who live in an urban area, which causes different health complications and social problems. The primary aim of this study was to explore the proliferation of noise pollution as an urban social problem and the community’s perception on noise pollution. We used a mixed-methods approach. Key informant interviews, indepth interviews, focus group discussion, survey and documentary analysis were data collection methods used in the study. The study findings indicate that noise pollution affects social relations and quality of living environment, disturbs spoken communication and work performance, has a short and long effect on hearing capacity, disturbs mental health, decreases satisfaction on life, etc. The perception of the community on sources and effects of the problem is scrawny, and noise pollution is not considered as a serious problem by both the community members and the government officials in the city, but serious engagement is needed to solve the problems and to minimize their impacts. Mobilizing community representatives, influential persons, elites, activists, Medias and government officials should pay due attention to noise pollution to minimize the effect.

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PUBLIC INTEREST STATEMENT

Noise pollution is an unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings. Urban noise pollution is one of the problems of people who live in an urban area, which causes different health complications and social problems. The primary aim of this study was to explore the proliferation of noise pollution as an urban social problem and the community’s perception of the proliferation of noise pollution in Wolaita Sodo city. Noise pollution affects social relations, quality of the living environment, disturbs spoken communication, affects work performance, has a short and long effect on hearing capacity, disturbs mental health, decreases satisfaction on life, etc. The community’s perception of the sources and results of the problem is scrawny, and it is not considered as a serious problem, but serious engagement is needed to solve the problems and to minimize their impacts.
Subjects: Environmental Issues; Environment & Society; Environment & Health; Environment & the City; Environmental Change & Pollution; Sociology; Sociology & Social Policy; Urban Sociology - UrbanStudies; Health and Safety

Keywords: Noise; pollution; social problem; proliferation; impacts of noise

1. Introduction

Noise is characterized as a transparent environmental hazard that cannot be seen, smelled, touched, removed or purified as waste or water. Noise pollution is an unwanted, unpleasant or displeasing sound that causes discomfort to all living beings and brings environmental stress. Urban noise pollution is one of the problems of people who live in urban areas, and it is a cause for different health complications and social problems. The effects of noise do not pose a stress on the environment per se but accumulate in individual people as noise experiences with effects on hearing and well-being. Literature indicates that noise is conveniently and briefly unwanted sound that generates annoyance and interferes in conversation and disturbs sleep and teaching-learning process. It also reduces work efficiency, causing stress and challenge to public health, and is the silent killer problem growing day-by-day (Gour, 2013; WHO, 2018).

At present, noise pollution is considered as one of the key problems of urban societies, which has abundant harmful effects on the urban environment and may result in a lot of costs on the society. Exposure to noise pollution changes a person's mood, which may vary based on people's mood. People who are exposed to noise are less happy and more depressed. Exposure to noise may provoke aggression in combination with pre-existing anger or hostility. There is a concern that high-level continuous noise exposure contributes to the vulnerability of school children to feelings of helplessness (WHO1999, 2001).

Urban areas are noisier than rural areas because larger numbers of people live in urban areas and different activities are carried out in urban areas. Urban noise levels are a complex mixture of noises from transportation, factories, industries, machines, people, etc. (Morgan, 2015). Gangwar et al (2006) also described that an increasing number of vehicles, musical instruments, small scale industries and human activities in urban areas are the main sources of noise pollution. In addition to an ever-increasing number of vehicles on roads, the sound caused by the cars and exhaust system of autos, trucks, buses and motorcycles is the chief reason for noise pollution in urban areas (as cited in Mesene & Mengistu, 2021).

Noise rate can only be measured by using a range of guidelines for the determination of “noise sound” or “non-noise sound.” Every human receives noise in different ways, which depends on some factors such as age, sex and mood of a person. Men and women are equally at risk of hearing impairments for noise pollution, but adults and children are not equally suffering from noise. Children are more vulnerable to noise-induced hearing impairments than adults, and the effects that noise has on children may be permanent. People with hearing impairment, the elderly and children are more vulnerable to noise interference with speech communication, and adult women are less vulnerable to interference with speech communication (WHO, 1999, 2001 & 2018).

People with particular diseases or medical problems; people in hospitals or rehabilitating at home; people dealing with complex cognitive tasks; the blind; people with hearing impairment; fetuses, babies and young children and the elderly in general are more vulnerable groups to the problem of noise pollution. People with impaired hearing are most adversely affected with respect to speech intelligibility. Even slight hearing impairments in the high-frequency sound range may cause problems with speech perception in a noisy environment. Most of the population belongs to the subgroup vulnerable to speech interference (Van Kamp & Davis, 2013).

WHO has documented seven categories of adverse health effects of noise pollution: hearing impairment, interference with spoken communication, sleep disturbances, cardiovascular
disturbances and disturbances in mental health, impaired task performance, negative social behavior and annoyance reactions. Many surveys have been conducted to assess noise pollution in many cities worldwide, including some African countries (Saadu et al., 1998; Goines & Hagler, 2007).

Actions to control noise effects have been an immediate concern for communities in developed countries, as evidenced by many anti-noise laws, regulations and noise policies. However, such actions remain limited in developing countries, especially in Africa. Ethiopia is among the developing countries whose urban environment has undergone significant changes due to industrialization, rapid urbanization, urban population growth, the expansion of the road network and the increasing number of motor vehicles. Competitions of some religious institutions’ loudspeakers also overly disturb the lives of the society. These changes have probably led to an increase in noise levels that have negative effects on citizens (Dana Doda, 2017; Mesene & Mengistu, 2021).

Among a serious and most often unnoticed issues about environmental pollution in urban areas in Ethiopia is noise pollution. Unregulated high noises from a variety of sources are sources of public discontent and social conflict in the country. In most of the developing countries, in Ethiopia, poor urban planning also contributes a lot to noise pollution. Congested houses, large families sharing small space, fight over parking, and frequent fights over basic amenities lead to noise pollution, which may disrupt the environment. Noise is seen as a normal phenomenon, people are not conscious about negative effects, action plans and subsequent acoustical planning are not seriously considered in the country and the impact of noise is not well understood (Rinkesh, 2019; Aberra Berhanu, 2011; Assefa, 2014).

An addiction to loud music is also a psychological impact of noise pollution exposure to loud music. Addiction has expanded in its definition over time to include music, food, sex, etc., in addition to physical substances such as illicit and prescription drugs. Listening to loud music may be connected to addictive behavior, possibly leading to damaging effects. The members of non-professional pop/rock bands with regular exposure to loud music are more likely to show an addictive-like behavior for loud music than matched control subjects. As studies show, listening to loud music can be as addictive as smoking and hearing in children is suffering from listening to music in loud devices (Hogue & Anne, 2019).

Noise pollution not only can cause health problems for human beings but also affects the environment for wildlife on land and in the sea. From traffic noise to rock concerts, loud or inescapable sounds can cause hearing loss, stress and high blood pressure. Noise from ships and human activities in the ocean is harmful to whales and dolphins that depend on echolocation to survive.

As noise pollution from human beings in the form of motor vehicle and airplane traffic among other causes increases, wildlife is forced to adapt in ways that are not sustainable. An increasing number of studies indicate that wildlife is stressed by noise pollution, causing a variety of impacts on the environment by disturbing mammal, bird and fish feeding and breeding patterns. According to the National Park Service (NPS), these effects are compounded by other stressors including disease and extreme weather (Froni & Mackay, 2010). In addition, noise can harm animals, the environment and physical property. Livestock and pets are harmed by noise, as are animals in the wild. Noise can also disturb wildlife feeding and breeding. Noise-related property damage includes structural damage from vibrations induced by sound waves and economic harm in the form of lower property values. The true social costs of noise pollution must also include monetary losses from sickness, absenteeism, loss of productivity and earning capacity and much more.

The environment’s quality has become one of the leading sustainable development goals to achieve in the coming years (Ridzuan, Marwan et al., 2020). However, the boom in economic growth (GDP) (Li & Li, 2020), trade (T) (Wu & Ye, 2020) or urbanization (Chen et al., 2020) is one
of the reasons behind the continuous degradation of the environment and is mitigating for the achievement of the long-awaited environmental sustainability. Noise pollution as a result of economic growth, trade and urbanization is the major factor affecting environmental quality and becoming an obstacle for sustainable development goals.

Social problems are concerns about the quality of life for large groups of people, which are either held as a broad consensus among a population or voiced by social, political and economic elites. Noise pollution is among contemporary social issues, it is one of the social problems that affects the quality of life of large groups of people living in urban areas, social scientists including urban sociologists have not given the impression of sufficiency in the study of noise pollution as a social problem and suggesting solutions for the problem by challenging the policy makers. As the existing studies show, noise pollution is considered only as a public health issue and only environmental scientists and public health professionals tried to study it. This article envisioned to study noise pollution as a social problem in that the causes of the problem are social for human activities causing noise pollution, and the consequence is affecting a large number of people in the society (Chambers, 2000). Regardless of the fact that Ethiopia had established different rules and regulations to control environmental pollutions to manage the existing situation, noise pollution issues still continued without end solutions. Urbanization and associated growth in mobility and industrialization have resulted in the intensification of noise in densely populated areas causing an increase in noise exposure. As the population increases in an urban area, industrial activities also increase to meet people’s needs, which in turn results in increased levels in noise (Assefa, 2014; Aberra Berhanu, 2011; Mesfin et al., 2018; Kucha, 2014; Mintesnot, 2018; Mesene & Mengistu, 2021). The community perception towards the proliferation and its effects is very bantam, while the problem is increasing daily.

Therefore, this study is intended to address the proliferation of noise pollution as an urban social problem and the community's perception towards the proliferation of noise pollution in Wolaita Sodo city.

After the Introduction section, the study covers the following sections: Section 2 deals with methods and materials used in the study. Section 3 is all about the results and discussion of the study. Finally, Section 4 presents the conclusions and policy implications.

2. Methods and materials

2.1. Study setting
Wolaita Sodo city is the administrative capital of Wolaita zone and serves as the administrative, commercial and transport center of Zone. The city is located at a distance of 329 km from Addis Ababa. The absolute geographical location of the city is between 06°46’ and 06°59’ North latitude and 36° and between 37°42’ and 37°48’ East longitudes, and the air condition of the city is on average 20°C. The total area of the city is 9,100 hectare, and according to the 4th structural design of the city, the city is structured into seven (07) kebeles, 19 districts, 59 sub-districts and 379 stations and the total population of the city is estimated to be 254,295. The road coverage of the city is 55.5 km asphalt and 82 km cobblestone, and there are seven main routes in the city, which serve as gates for surrounding locations. Regarding the socio-economic profile of the city, there are two hospitals, three health centers and above 54 clinics in the city. There are also above 87 primary and secondary public and private schools, one public university, two Technical and Vocational Education and Training centers and above five private colleges in the city. Regarding the transport system, there are above 3,100 vehicles in the city. There are 120 religious institutions in the City (10 Orthodox, two Catholic, 50 Evangelical, 30 Kale Hiwot, one Mekane Yesus, one Adventist, 25 others, and four Mosques, etc.), and there are several small-scale enterprises and industries and hotels, restaurants, bars, night clubs and Music shops (Mesene & Mengistu, 2021).
This research has focused on Wolaita Sodo city where the factors discussed above are determined. As discussed above, there are seven kebeles in the city and the researcher purposely classified them into two groups: core kebeles and periphery kebeles. Core kebeles are the kebeles found in the central part of the city geographically, including Markato Yushuwa kebele, Mehal kebele, Wadu Amba kebele and Fana womba kebele, and the rest three are categorized as periphery. The researcher purposively selected to focus on core kebeles because of high population density, high rate of urbanization, a presence of many business centers, location of many social institutions, high rate of road network and other related factors in the core kebeles.

2.2. Research design
According to Creswell (2009), mixed methods research is an approach to inquiry that combines both qualitative and quantitative forms, which involves philosophical assumptions, the use of qualitative and quantitative approaches and the mixing of both approaches in a study. To attain the objective of the study, mixed approaches of research were employed to this study. Quantitative data gained from survey are summarized by the quantitative analysis method. The qualitative approach is also used to investigate how noise pollutions affect urban social well-being by assessing situations on the ground.

2.3. Quantitative data collection methods
Survey Design: A survey is a method used to gather information from a sample of population (Earl 1994). To collect data cost-effectively and for time-saving, the researcher chooses a cross-sectional survey design to collect data at one point from the study area. Questionnaires prepared by both open-ended and close-ended questions were distributed to respondents. The questionnaire had self-administered questions that the respondents themselves filled. From seven kebeles of Sodo City, the study focused on four core kebeles found in the center of the city. Random sampling selected two hundred households from these kebeles to answer the questionnaire.

2.4. Qualitative data collection methods
In-depth interviews, key informant interviews, Focus Group Discussions (FGDs) and observations were employed to collect qualitative data in this study. In-depth interviews provide richer materials or pieces of information to the intended studies (Kothari, 2004). An in-depth interview in this study was made with 15 individuals believed to provide rich and in-depth information about their life experiences and have the closest information and knowledge about the sources of noise pollution and its effects. Semi-structured interview questions are prepared to deal with the informants. The informants were selected in purposive sampling from government offices, were selected from areas vulnerable to a high level of noise pollution and were individuals with personal experience in the effect of noise pollution.

Key informant interview was made with five key informants from the city who have the closest knowledge and information in the subject matter. The researcher dealt with unstructured interview questions with key informants from the Environmental protection Office, Town Attorney Office, the Office of Peace and Security, the town’s municipality and the mayor Office. One FGD with eight individuals was made in the study, including representatives from all four kebeles. The observation method is employed in the study to see the information in the investigators’ own way without asking the respondent to eliminate subjective bias, obtain information on current happenings and minimize the effect of past practice (Kothari, 2004). The researcher observed different settings of the city. Congested roads, religious organizations, recreational centers, schools and health centers and related settings were observed by the help of the observation check list.

2.5. Sources of data
Both primary and secondary data were used in this research work. To gather the primary data, various qualitative and quantitative data collection instruments were employed, such as key informant interviews, in-depth interviews, Focus Group Discussion (FGDs), observation and questionnaires. To endorse data from interviews, FGD, Questionnaires and observation, a thorough
document analysis was performed to secondary data on policies, laws and regulations. Internet sources and documents from zonal and city offices were duly collected. Reports of the offices, applications from residents, laws and policies are reviewed in the study.

2.6. Sampling procedures and sample size

According to Yamane (1967), the formula to determine and calculate the sample size is at the 93% confidence level and a precision level of ±7%. The precision level is taken as 0.07 for the range in which the true value of the population is estimated. 15,000 households live in four kebeles selected purposively to this study: from Wadu Amba, Fana Womba, Markato Yushuwa and Mehul Kebeles.

Therefore,\[n = \frac{N}{1+Ne^2}\] (Yamane, 1967),

where \(n\) is the sample size, \(N\) is the population and \(e\) is the level of precision,

\[N = 15,000 \text{ households. } e = 0.07 \quad n = \frac{15,000}{1+15,000(0.07)^2} = 201\]

A total of 201 households were selected to respond to the questionnaire through systematic random sampling procedures. Also, 15 individuals for in-depth interviews and five (05) individuals for key informant interviews were selected. Eight (08) individuals were selected for focus group discussion (FGD) to discuss in a group that represented four kebeles. A total of 229 samples were selected through random sampling by employing both probability and non-probability samplings.

2.7. Sampling procedures

Since the study relies on both quantitative and qualitative approaches, both probability and non-probability sampling procedures were employed in the study.

2.7.1. Probability sampling

Probability sampling uses random sampling techniques to create a sample in which the probability of the sample to be included in the study is known and non-zero. In probability sampling, every population element has the same chance at being included in the study (Cook (2005)).

The probability sampling procedure used in this research is systematic random sampling. In Systematic Sampling, the researcher chooses every “nth” participant from a complete list (Cook (2005)). The collected lists of households from the record of kebele office determined the sample per kebele based on the population size in each kebele using sampling proportional to the size of the population. Accordingly, 50 (25%) from Markato Yushuwa kebele, 49 (24%) from Wadu Amba kebele, 50 (25%) from Fana Womba kebele and 52 (26%) from Mehul kebele, totally 201 households, were included in this study. Then, the unit of analysis (households) was systematically selected from the given lists of households in each kebele.

2.7.2. Non-probability sampling

Non-probability sampling is a sampling technique in which the researcher selects samples based on the subjective judgment of the researcher rather than random selection, it depends heavily on the expertise of the researchers and it helps to collect qualitative data (Cook (2005)).

Among the non-probability sampling techniques, the purposive sampling technique is employed in the study. In the purposive sampling technique, researchers select the samples based purely on the researcher’s knowledge and credibility. Researchers choose only those people who they deem fit to participate in the research study (Cook (2005)). In-depth interview informants, Key-informant interview informants and focus group discussion participants are selected by using a purposive sampling procedure.
2.8. Data collection instruments
Both quantitative data collection instruments and qualitative data collection instruments were employed in the study. The quantitative data collection instrument in this study was a questionnaire. A questionnaire was prepared to collect data from 201 respondents. Questions derived from the study’s specific objectives were prepared to collect quantitative data. To measure the attitude of the respondent, Likert scale questions were included in the questionnaire. This study’s qualitative data collection instruments include key informant interview guide, in-depth interview guide, FGD guide and Observations checklist. Semi-structured interview questions derived from the specific objectives were prepared. The researcher dealt with the informants who were purposely selected for in-depth interview, who are considered to give mature information on the issue. The unstructured interview guide was prepared for key informant interviews to get matured news. Individuals from different offices, from Sodo city Mayor office, Municipality, Sodo city Environmental office, Sodo city Attorney's office, and Sodo city Peace and Security office, were interviewed as key informants in the study. An observation checklist was prepared to observe different situations of noise pollution in the study area.

2.9. Method of data analysis
Data were presented, interpreted and thoroughly analyzed per the rules of quantitative and qualitative data analyses. Qualitative and quantitative data were analyzed separately to complement and supplement each other. The quantitative way analyzed quantitative data, and results of the questionnaire were analyzed by the use of SPSS, v.20. Qualitative data from observations, FGDs and in-depth interviews are analyzed through manual theme and content analysis.

2.10. Ethics, consent and permission
Research ethics require that the researchers ensure the research participants’ confidentiality and protecting them from any harm (Creswell, 2009). In line with this, the research was carried out according to the ethical guidelines of Wolaita Sodo University. Approval of this study was obtained from the College of Social Sciences and Humanities of Wolaita Sodo University. Before interviews and discussions, verbal informed consent was elicited from research participants to record their voices. Participants have thoroughly explained their rights and the purpose of the research. Care was taken to ensure participants know that their responses would be kept anonymous and confidential.

3. Methodological approach
• Research design—mixed approach method was applied

• Methods of data collection:-
  o Quantitative:- Survey method (cross-sectional) and questionnaire
  o Qualitative:- KI, KII, FGD, observations

• Sources of Data:- Primary and Secondary

• Sampling procedure:-
  o Probability sampling:- systematic random sampling
  o Non-probability sampling:- purposive sampling

• Sample Size = 229
  o Questionnaire—201
  o In-depth interview—15
  o Key informant interview—5
  o FGD—8
• **Data Collection Instruments:** Questionnaire, interview guide, FGD guide, observation checklist

• **Method of Data analysis**
  - Quantitative: Software (SPPS)
  - Qualitative: theme and content analysis

5. Results and discussion

5.1. **Noisy situations, levels, time and days**
Before discussing the impact of noise pollution in the study area, it is necessary to look noisy situations, noise levels, noisy time and noisy days in the study area. Survey study was performed to differentiate noisy situations, noise levels, noisy times and noisy days in the study area by Mesene and Mengistu (2021), and the result is incorporated to this study in Table 1.

As it is shown in Table 1, the majority of people living, working or studying in the study area are facing noisy situations in their daily life and their activities, while the little are not facing a noisy situation or they do not consider it as a problem or they accepted it as a positive situation, which indicates modernity, urbanization, industrialization, etc.

| Table 1. Survey results on noisy situations, noise level, noisy time and noisy days |
|---------------------------------|-----------------|-----------------|
| The noisy situations in the study area | Frequency | Percent |
| No | 58 | 28.9 |
| Yes | 143 | 71.1 |
| Total | 201 | 100.0 |
| Noise level in the study area | | |
| Very low | 4 | 2.0 |
| Low | 29 | 14.4 |
| Medium | 16 | 8.0 |
| High | 85 | 42.3 |
| Very high | 67 | 33.3 |
| Total | 201 | 100.0 |
| Noisy times in the study area | | |
| Morning | 34 | 16.9 |
| Day time | 17 | 8.5 |
| Evening | 25 | 12.4 |
| Mid night | 38 | 18.9 |
| Whole day | 27 | 13.4 |
| Whole night | 60 | 29.9 |
| Total | 201 | 100.0 |
| Noisy days in the study area | | |
| Working days (Monday–Friday) | 59 | 29.4 |
| Weekends (Saturday and Sunday) | 75 | 37.3 |
| All days | 67 | 33.3 |
| Total | 201 | 100.0 |

Source: Mesene and Mengistu (2021).
As shown in survey results in Table 1, most people living, working and studying in the study area face noise pollution the whole night. It is because of the different activities performed at night. Night times lack different movements and activities that balance the environment’s noise level. There are no traffic congestion and limited vehicle movements, no or limited people conversations, no business activities and markets at night and no or little wood and metalwork; garage and welding activities are limited or closed at night time; people go to rest, doors are closed, movements are limited and ecosystems has become silent at night time. Because of these, little noises released in night disturb the whole community and all living nature.

Some movements and activities release noises that disturb the environment in the study area at night time. People relax at different recreational centers such as night clubs, bars and restaurants, while others pray and worship at religious centers or in a group within their neighborhood and different chapels at night time. Both recreational and religious happenings emanate noise at night, polluting the environment. There are a number of prayers and worship in different religions in the evening and in the midnight, and there are also many neighbourhood programs in the evening. The presence of the religious programs or worship by itself does not create a noisy situation, but the practice of using loudspeakers to prayers; small group programs at the neighborhood and using speakers in religious centers at midnight aggravate the noise problem pollution in the study area. Noises from night clubs are making boring their night time to people vulnerable to the problem. An enormous number of residents in the study area face high disturbances from night-clubs adjacent to residences.

Alike noisy time that differs from time to time, day and night, noise also differs from one day to another based on different activities performed on different days and nature of the days within the week. Globally, days of the week are classified into working days and weekends, but activities in these days differ from community to community and differ between different religions. On working days, the community faces noises from work-related sources, and in weekends, people face noises mostly from recreational centers, religious institutions and social events.

Weekends are noisier than working days in the study area. Different factors contributed to this; most religious institutions have regular and special programs at weekends (regular program is a weekly program or fixed programs, while the special program is programs like conference, thanksgiving and other celebrities). The other is that high numbers of social events that use loudspeakers as a wedding, thanksgiving, birthday, and other celebrities, announcements, activations, etc. are taking place at weekends.

According to World Health organization guidelines (1999, 2001, 2018), the noise level must not exceed 55 decibel (dB) in residential, 65 decibel (dB) in commercial, 75 decibel (dB) in industrial and 50 decibel (dB) in the silence zone in the day time and 45, 55, 65 and 45 dB, respectively, in night times and the noise level above 70 dB is painful and may cause harm to human health. The extent of noises from every source in Wolaita Sodo city exceeds the recommendations, and to some extent, it doubles the given tolerable level of decibel (Mesene & Mengistu, 2021). EPA adopted the WHO standard and has set 75 decibels (dB) for industrial areas and 65 and 55 dB for commercial zones and residential districts during day time, while 70, 55, and 45 dB for industrial and commercial and residential areas are the limit during the night time. Even if there is no clear demarcation for commercial, residential, industrial and other areas in the city, it is very clear that the noise level in all areas and from all sources in the study area exceeds the standard of both WHO and EPA. It is known that a noise level that exceeds 70 db will result in harm to human health, but there is no trend of sensing such harm in the study area. The minimum dB recorded in the study area during this study is 78 dB from people’s conversations, and the maximum dB is 134.5 dB from different announcements (Mesene & Mengistu, 2021). So we can conclude that the noise level in the study area is at a critical stage and results in different effects.
5.2. Impacts of noise pollution

Depending on the type, duration, place and the moment when it is produced, noise can annoy, irritate and cause convenience in some conditions altering a person’s physical and psychological state. The finding provides evidence that noise is disturbing the peace living of the community and affects sleep and rest of infants, children, adult and aged people, some are facing irritation, the others are annoying, social behaviors are changing, social conflict is increasing, etc. in the study area. The finding is consistent with previous studies by Dana Doda (2017), which describes that urban noise pollution produces direct and cumulative adverse health effects by degrading residential, social, working and learning environments with corresponding real economic and intangible well-being losses. The survey result in the study is given below.

Noise pollution counts among the hideous hazards of modern times because it invades our personal spaces in ways that are difficult to define and it diminishes the quality of our lives to degrees that are hard and even impossible to measure. Depending on the type, duration, place and the moment when it is produced, noise can annoy, irritate and cause convenience, in some luggage’s altering a person’s physical and psychological state (Mesfin et al., 2018). The finding provides evidence that noise is disturbing the peaceful living of the community, affecting the sleep and rest of infants, children, adults and aged people. Some are facing irritation, the others are annoying, social behaviors are changing, social conflict is increasing, etc. in the study area. The finding is consistent with the findings of previous studies by Dana Doda (2017), which describe that urban noise pollution produces direct and cumulative adverse health effects by degrading residential, social, working and learning environments with corresponding real economic and intangible well-being losses.

Through time and extended exposure, people learned to live with the noise, which may counterbalance the psychological damage it may cause (Mintesnot, 2018). The WHO advocates that noise can affect human health and well-being in a number of ways, including annoyance reaction, sleep disturbance, interference with communication, performance effects, effects on social behavior and hearing loss. Activity disturbance is an important indicator of the community impact of noise. Table 2 shows that the majority of respondents, 157 (78.6%), agreed with the effect of noise pollution on social relation and little respondents, 44 (21.3%), disagreed to noise pollution’s effects on social relations.

As it is presented in different studies, social problems affect the quality of the living environment by minimizing people’s preference to live, work or study in a certain environment (Aberra Berhanu, 2011). Based on this, the respondents asked if they agree or disagree with the effect of noise pollution in the study area on the quality of the environment. As shown in Table 2, the majority of respondents, 170 (84.6%), agreed on the effect of noise pollution on quality of living, working and studying environment in the study area.

The existing studies show that noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, social handicaps and behavioral changes. Some of the effects are problems with concentration, fatigue, uncertainty, lack of self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships and stress reactions (Ogunjunde et al., 2019; Stansfield & Matheson, 2003). As it is given in Table 2, the majority of respondents from 201 respondents, 161 (80.1%), agree to the effect of noise pollution on spoken communication in the study area.

The interview with informants in this study also confirmed that people living, working or studying in the study area are experiencing the problem in spoken communication directly or indirectly.

Because of noises emitted from different sources in the study area, residents exposed to it are in a high burden of problem in spoken communication, which results in lack of concentration, fatigue,
Table 2. Survey results on impacts of noise pollution

| s/n | Statements                                                                 | Responses            | Frequency | Percent |
|-----|-----------------------------------------------------------------------------|----------------------|-----------|---------|
| 1   | I agree that from noise pollution, social relations are broken              | Strongly disagree    | 21        | 10.4    |
|     |                                                                             | Disagree             | 22        | 10.9    |
|     |                                                                             | Agree                | 90        | 44.8    |
|     |                                                                             | Strongly agree       | 68        | 33.8    |
|     | **Total**                                                                  |                      | **201**   | **100.0**|
| 2   | I agree that noise pollution affects the Quality of living, working & studying environment | Strongly disagree    | 15        | 7.5     |
|     |                                                                             | Disagree             | 16        | 8.0     |
|     |                                                                             | Agree                | 84        | 41.8    |
|     |                                                                             | Strongly agree       | 86        | 42.8    |
|     | **Total**                                                                  |                      | **201**   | **100.0**|
| 3   | Noise pollution interferes with spoken communication such as problems with concentration, fatigue, irritation, lack of self-confidence, uncertainty, misunderstandings, disturbed interpersonal relationships and stress reactions. | Strongly disagree    | 17        | 8.5     |
|     |                                                                             | Disagree             | 23        | 11.4    |
|     |                                                                             | Agree                | 84        | 41.8    |
|     |                                                                             | Strongly agree       | 77        | 38.3    |
|     | **Total**                                                                  |                      | **201**   | **100.0**|
| 4   | Noise pollution results in sleep disturbances and depressed mood            | Strongly disagree    | 8         | 4.0     |
|     |                                                                             | Disagree             | 13        | 6.5     |
|     |                                                                             | Agree                | 88        | 43.8    |
|     |                                                                             | Strongly agree       | 92        | 45.8    |
|     | **Total**                                                                  |                      | **201**   | **100.0**|
| 5   | Noise pollution has resulted disturbance in mental health such as anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness & sexual impotence, changes in mood, increase in social conflicts, neurosis, hysteria and psychosis | Strongly disagree    | 16        | 8.0     |
|     |                                                                             | Disagree             | 14        | 7.0     |
|     |                                                                             | Agree                | 89        | 44.3    |
|     |                                                                             | Strongly agree       | 82        | 40.8    |
|     | **Total**                                                                  |                      | **201**   | **100.0**|
| 6   | Noise pollution will not result in impaired or decreased task performance, not increase work errors, & do not decrease work motivation | Strongly disagree    | 79        | 39.3    |
|     |                                                                             | Disagree             | 75        | 37.3    |
|     |                                                                             | Agree                | 32        | 15.9    |
|     |                                                                             | Strongly agree       | 15        | 7.5     |
|     | **Total**                                                                  |                      | **201**   | **100.0**|

(Continued)
uncertainty, lack of self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships and stress reactions directly or indirectly.

Various studies show that uninterrupted sleep is known to be a prerequisite for good physiological and mental functioning in healthy persons. Noise pollution is a major cause of sleep disturbances. Besides various effects on sleep, noise pollution during sleep causes increased blood pressure, heart rate, pulse amplitude, vasoconstriction, cardiac arrhythmias and body movement. These effects do not decrease over time, and some secondary effects of noise pollution on sleep disturbance include fatigue, depressed mood and well-being and decreased performance.
Combinations of noise and vibration significantly affect health, even at low sound pressure levels (Fry & Vyas, 2022; Oguntunde et al., 2019; SUTER, 1991).

Noise can deter sleep because of its psychological effect. Having noise around can distort peaceful sleep as it causes stress. Moreover, being in a noisy place means that there is almost no chance of having any sleep. Inadequacy of sleep, in turn, interrupts the normal functioning of the body, leading to discomfort, fatigue and general moodiness.

A person exposed to noise pollution may experience difficulty in falling asleep, inability to stay asleep and waking too early. Sounds can also reduce the depth and quality of sleep, altering the amount of rapid eye movement sleep. This can impact a person's mood and ability to concentrate (Rinkesh, 2019, Fry & Vyas, 2022). In this study, as it is given in Table 2, the majority of respondents, i.e. 180 (89.6%) of 201 total samples, agreed on noise effect in sleep disturbances in the study area and people exposed to the problem are facing the problem of difficulty to falling asleep, inability to stay asleep and waking too early. Data from in-depth interviews and FGD show that most children living around noisy areas where churches and mosques are located, near music shops and other sources face difficulty in falling asleep and staying asleep. Waking up too early without having enough sleep is a common experience of people living in the study area, specifically near different noise sources.

The effect of noise pollution on sleep and rest is the problem most people in the study area are experiencing. I have seen in my observation that some people are taking their infants to other areas when they sleep at daytime to handle the effect of noise at daytime. It is mostly experienced that sick adults are getting difficult when loud speakers opened in some religious institutions. The areas with noise pollution are not comfortable to infants, sick people, children and aged people, most areas in Sodo failed under the question of suitability to living because residential areas are surrounded by institutions and objects that release noisy sound and also hospitals and clinics are near these institutions.

Noise pollution is not believed to be a direct cause of mental illness, but it is assumed to accelerate and intensify the development of latent mental disorders. Noise pollution may cause or contribute to the following adverse effects: anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness, sexual impotence, mood changes, increase in social conflicts, neurosis, hysteria and psychosis. Children, the elderly and those with underlying depression are particularly susceptible to these effects (Stansfield & Matheson, 2013, Jongseok Lim et al., 2018). Table 2 shows that most respondents agreed to noise pollution's effect on mental health. Based on the result from 201 respondents, 171 (85.6%) agreed with the impact of noise pollution on mental health in the study area.

The existing studies show that noise pollution impairs task performance, increases errors and decreases motivation. Reading attention, problem-solving and memory are most strongly affected by noise. Noise produces negative after-effects on performance, particularly in children; it appears that the longer the exposure, the greater the damage. This study also approves the effect of noise pollution on work performance. As shown in Table 2, most respondents agree on the effect of noise pollution on work performance. Based on the table, of 201 respondents, 154 (76.6%) agree to the effect of noise pollution on work performance of people exposed to it.

Annoyance increases significantly when noise is accompanied by vibration or by low-frequency components. The term annoyance does not begin to cover the wide range of negative reactions associated with noise pollution; these include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion. Social and behavioral effects are complex, subtle and indirect (Leventhall, 2004; Karina et al. 2015).

The effects of noise pollution on social behavior and annoyance include changes in everyday behavior (closing windows and doors to eliminate outside noises), changes in social behavior
(aggressiveness or disengagement), changes in social indicators (residential mobility, hospital admissions, drug consumption and accident rates) and changes in mood (increased reports of depression). Noise above 80 dB is consistently associated with decreased helping behavior and increased aggressiveness (Alimohammadi et al., 2018). The survey results of the current study also support the above statement. The results in Table 2 show that from the total of 201 respondents, the majority of respondents, 154 (76.6%), agreed to the effects of noise pollution on social behavior in the study area. The result clearly shows that noise pollution results in negative social behaviors and annoyance in the study area.

The sound coming from loudspeakers differs from other environmental noise in that it is directed, addressed and intentional. Loudspeakers are not neutral like the unintentional manifold sounds created in the bustle of everyday life. On the contrary, the sounds they emit are usually partisan, purposeful and deliberate. They carry meaning and what is called “rhetorical energy,” which aims at persuasion and affects both people’s mental and emotional sensitivity and therefore can be far more menacing than any kind of unintended noise (Mesfin et al., 2018).

People suffer silently while being subjected to extreme stress due to persistent loudspeaker noises. The results from the interview with informants and discussion in FGD on noises from religious loudspeakers are summarized as follows.

Noises from religious loudspeakers are disturbing the peace of the whole community, old and infirm persons are not entitled to enjoy reasonable quietness in their residence, students preparing for examinations and working their homeworks and assignments are suffering, children having their sleep in their early hours or during day time and babies in the neighborhood are not entitled to enjoy their natural rights of sleeping in a peaceful atmosphere, etc.

It is becoming hard for many residents to wake up at morning to the chirping of birds after refreshed good night sleep. Noises from religious institutions' loudspeakers at mid-night prayers and worship disturb and shock many residents in the study area.

The effect of noise pollution from religious institutions' loudspeakers in Sodo city is not only affecting the residents but is also becoming the most challenging issue for the administrative body of the city. The peace and security office report (2019) shows that from religious-related complaints reported to the office in the year, probably around 50% is noise pollution-related problem application.

As the above phrase shows, loudspeakers usage and opening religious institutions in residential areas are becoming the most problematic good governance issue for the administration of sodo city. As it is seen from the above phrase, noise pollution from loudspeakers is also disturbing the operation of the religious institutions themselves. When sound is opened in high volume with loudspeakers in one religious institution in a certain region, the other religious institutions located in the same region that are undergoing their program at the same time will unable to undergo their program because of high noise from the other religious institutions. In Sodo city, where many religious institutions are located and where perfect zoning has not been made and no rule is present to protect loudspeakers, there is a high disturbance of religious institutions with each other.

Hearing damage is related to the duration and intensity of noise exposure at 80 dB or greater levels, equivalent to the noise of heavy truck traffic. Children seem to be more vulnerable than adults. Noise exposure is also associated with a range of possible physical effects, including colds, changes in blood pressure, other cardiovascular changes, increased general medical practice attendance and problems with the digestive system and general fatigue. There is fairly consistent evidence that prolonged exposure to noise levels at or above 80 dB can cause deafness. The amount of deafness depends upon the degree of exposure (Alimohammadi et al., 2018; Kumar et al., 2004).
Hearing is one of the five senses that human beings have. As such, it is an essential part of any person's life. But as much as the ear serves the purpose of receiving sound waves, it can also do so to a certain limit. When it gets to the point termed as noise, it means that it is undesirable because it interferes with one's hearing capacity. This is why people cover their ears when there is a loud noise. Such loud noise can cause hearing impairment, which can even result in permanent hearing loss. Hearing loss due to noise pollution is attributed to prolonged exposure of noise levels above 85 decibels (Rinkesh, 2019).

As given in Table 2, most respondents agree on the effect of noise pollution on hearing impairment and tinnitus. Accordingly, of 201 total respondents, 155 (77.1%) agree to the effect of noise pollution in hearing impairment and tinnitus. Suppose the current exposure to noise pollution in Sodo city will continue. In that case, it is clear that loudspeakers are needed in each classroom in every school and we are enforced to use them in every communication, because our hearing capacity is vanished by continuing noise pollution from different sources. As the study performed by Mesene and Mengistu (2021), the extent of noise from many sources of noise pollution is above 80 dB. The probability of falling in permanent hearing loss to people constantly exposed to the problem is high.

Noise “excites” the heart. Heart is disturbed and ends up beating faster in too much noise, increasing blood pressure. In loud noise, stress hormones such as adrenaline and cortisol are released. Therefore, blood pressure will definitely increase in noisy environments, thus prompting faster flow of blood, which, in turn, leads to the secretion of catecholamine, a hormone that further magnifies the number of times the heart pumps blood. As long as there is no harm in this, regular exposure will keep the body getting higher impulses, leading to increased blood pressure. If blood pressure keeps rising, it may open up chances for heart-related diseases such as high blood pressure and stroke. Other cardiovascular diseases include hypertension and arteriosclerosis, which are caused by the dilation of the pupil and constriction of blood vessels (Thomas Münzel et al., 2014, Rinkesh, 2019, T. Münzel et al., 2021). Table 2 also shows that 129 (64.2%) respondents strongly agree to the effect of noise pollution on the cardiovascular system as blood pressure, heart disease and others in the study area.

Table 2 shows that 73.1 % of respondents agree that noise pollution will result in dissatisfaction and hopelessness and the remaining 26.9% disagree with its effect on satisfaction and hope. People exposed to noise pollution are in constant dissatisfaction by their life, and they feel that they have no hope.

In general, according to a World Health Organization (WHO) finding, noise is the second largest environmental cause of health problems, just after the impact of air pollution. As per the current data, it is estimated that environmental noise contributes to 48,000 new cases of ischemic heart disease a year and 12,000 premature deaths. In addition, it is estimated that 22 million people suffer chronic high annoyance and 6.5 million people suffer chronic high sleep disturbance (WHO, 2018& 2018). As it is discussed in this study, the problem of noise pollution is becoming serious in the study area.

5.3. Perception of the community on the proliferation of noise pollution
People’s perception of noise pollution does not depend on the intensity level of sound, but merely on the people’s interest in that sound. For instance, the noise source from the religious institution is not considered as a noise for the follower of that religion, but it is considered as a noise pollution for others. Moreover, the noise source from recreational centers is not considered as noise pollution for users in the center, but it is a serious problem for others. Another important issue is the sensory adaptation of people to noise. For people who have lived around one type of noise source for a long time, that noise is not considered noise pollution, but it is considered as noise pollution for the newcomers (Zerihun et al, 2017, Omoogbiya et al, 2020).

Table 3 above shows that the awareness of the community on the effect of noise pollution is low. From 201 sample individuals asked to give their response on the issue, only 26 (12.9%) have awareness while 63 (31.3%) have low awareness and the majority that are 112 (55.7%) have very low awareness on the issue. Based on data gained from survey, FGD and IIs, the practice of discussing the problem of noise pollution with polluting body or administrates or owners of such organizations in the study area is weak.
As it is discussed above, the perception of noises from different organization to the community in a given region is various based on their belongingness to institutions such as religious institutions; the need for entertaining in loud music and other related factors limits the effort of justifying and struggling to the problem of noise pollution.

The knowledge of legal framework regarding noise pollution at local, regional and national levels is important to the community. As studies show, there is weak coverage of the legal framework in Ethiopia in general and the study area in particular that particularly addresses noise pollution. The knowledge of existing general rules and policies regarding environmental protection is weak in the study area. As the data gained from FGD show, because of lack of legal knowledge regarding environmental protection and punishments to the offenders, people are not reporting the problem they are facing from noise pollution to the governmental body in the study area.

The other problem related to this is lack of awareness in the procedures of reporting the problem to the government and the trend of living by ignoring the problem for limited awareness on its multi-faceted impacts. Another factor that affects community perception is the fear of breaking existing social relation in their surroundings and the fear of challenges and revenges that will come from the polluters or owners of the polluting organizations and their supporters. Lack of cooperation in the community and challenge of individuals who support polluters unreasonably are the other reasons contributing to the problem.

Awareness of the residents on the causes and consequences of the problem is based on the other actions to mitigate or prevent the problem. The community can work to prevent or to solve the problem when there is adequate awareness of the causes and consequences of social problems. This is also true for noise pollution; the community must understand the causes and consequences of it to be able to take proper corrective actions.
consequences of noise pollution to mitigate and prevent the problem. Unfairly, the populations have limited or no awareness on causes and consequences of noise pollution and the effects of noise pollution are underestimated in most communities. The survey results in this study have approved the awareness gap in the community of the study area.

As the existing works of the literature suggest, noise pollution as one of the biggest environmental problems of our society is not taken seriously. In other words, it is even seen as something positive and synonymous with modernity and dynamism. For most, noise is part of everyday social life and economic activity (S. Zerihun, 2017, Omogbiya et al, 2020).

At some point, the community’s awareness plays a critical role in responsible usage of the object and the protection of problems resulting from misusage. As it is seen from the survey result of this study, the central point in the proliferation of noise pollution in the study area is lack of awareness. Many polluters do not think they are polluting the environment; they just see their entertainment, the success of their program, their prayer or their announcement, etc. Many people ignored to look at the burden they create on others because of their activity. The government officials are not following the situations in the city seriously because of lack of awareness or ignorance of the burden it creates in public. Figure 1

6. Conclusion
This study examines the proliferation of noise pollution as an urban social problem and the community’s perception of the problem in Wolaita Sodo city. The impacts followed by noise pollution in the study area investigated in this study are as follows: it has a strong effect on social relationships; it decreases quality of living, working and studying environments; it disturbs spoken communication; it results in sleep and rest disturbances; it has resulted in mental disturbances and it has cardiovascular effects, dissatisfaction and hopelessness. According to survey that was taken from 201 sample respondents in this study,

- 78.6% of respondents said noise pollution in the study area is affecting social relations.
- 84.6% respondents said noise pollution in the city is decreasing the quality of living, working and studying environments.
- 80.1% respondents agree to noise pollution interferences with spoken communication such as problems with concentration, fatigue, irritation, lack of self-confidence, uncertainty, misunderstandings, disturbed interpersonal relationships and stress reactions.
- 89.6% respondents said that noise pollution in the study area results in sleep disturbances and depressed mood.
- 85.1% of respondents said that noise pollution in the study area results in disturbances in mental health such as anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness and sexual impotence, changes in mood, increase in social conflicts, neurosis, hysteria and psychosis.
- 76.6% of respondents said that noise pollution in the city results in impaired or decreased task performance, increased work errors and decreased work motivation.
- 76.6% of respondents said that noise pollution in the city results in negative social behaviors and annoyance reactions such as anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion.
- 77.1% of respondents agree to noise pollution effects in hearing impairment and tinnitus.
- 64.2% of respondents agree that noise pollution results in cardiovascular effects such as heart diseases.
- 73.1% respondents agree that noise pollution results in dissatisfaction and hopelessness.

The significant gaps that contributed to the problem of noise pollution and increased vulnerability to its impacts in the study area are lack of awareness in the community about sources and effects of noise pollution, misunderstanding in the way of exercising one’s own right and freedom, careless way of performing different activities, carelessness of community members for not struggling noise polluters, negligence of governmental officials for taking measures on offenders, considering the problem as the problem of little individuals, lack of integration and cooperation among different stakeholders, lack of
policy that specifically addresses the problem of noise pollution, weak engagement of scholars and scientific community to take studies on the problem and to propose possible ways of mitigation, etc.

In general, the problem of noise pollution in the study area is at a critical stage and needs the immediate intervention of community representatives, government, media, policymakers and other stakeholders.

A number of policies and related implications have come from studies of social problems as noise pollution. They differ with respect to the context and the scope they address. Some of them are addressing national, and others are typical to the study setting only. While some recommendations can be implemented in a short term, others need mid-term and long-term implementation plans. Besides, the recommendations sometimes overlap each other and need integrated designing for interventions.

Regarding noise pollution, as it is shown throughout this study, research studies related to the problem in Ethiopia specifically in the study area are limited. Recommendations presented are as follows: creating, collecting and distributing information and resources regarding noise pollution; providing awareness creation methods to public through training, media and other methods; revising and strengthening rule of law and providing specific rules that govern the problem of noise pollution at local and national levels, which is very crucial; relocating some institutions from residential and school areas and other sensitive institutions and allocating them by using proper zoning; enforcing some institutions to build their institutions with high standard materials that can hold noises in home or enforce them to use noise detector or enforcing them to perform their activity in sound proofing buildings; putting signs of not making noise around some sensitive areas and institutions; strengthening laws and governmental efforts to control noise pollution in the city and establishing networks among environmental, professional, medical, governmental and activist groups working on noise pollution issues.

**Acronyms**

- AA - Addis Ababa
- EPA - Environmental Protection Authority
- FGD - Focus Group Discussion
- NPS - National Park Service
- NSR - Noise Sensitive Receiver
- SLM - Sound Level Meter
- WHO - World Health Organization

**Acknowledgements**

We would like to thank the editors and reviewers for the constructive comments and suggestions to improve the quality of the work.

**Funding**

The authors received no direct funding for the research.

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**Availability of data and materials**

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

**Disclosure statement**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Citation information**

Cite this article as: The proliferation of noise pollution as an urban social problem in Wolaita Sodo city, Wolaita zone, Ethiopia, Melese Mesene, Mengistu Meskel & Tamirat Mengistu, Cogent Social Sciences (2022), 8: 2103280.

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