


Risk Perceptions and Experiences of Residents Living Nearby Municipal Solid Waste Open Dumpsite in Ginchi Town, Ethiopia: A Qualitative Study

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Background: Due to improper municipal solid waste management, the use of open dump sites for final disposal of solid waste is common in towns and cities of Ethiopia.

Purpose: This study explored risk perceptions and experiences of Ginchi town residents living near Aba-Semer municipal solid waste open dumpsite in Ethiopia.

Methods: Data on lived experiences were generated using a phenomenological approach. Focus group discussion was used to explore risk perception. Purposive sampling was used to select five in-depth interviewees and 12 participants in two focus group discussions among residents living near Aba-Semer open dumpsite. Amharic language tape recorded data were transcribed verbatim and translated to English. Data were analyzed using OpenCode and a thematic approach was employed.

Results: All the participants perceived municipal solid waste open dumpsite as a risk to the environment and health. Disappointment and anger were experienced due to lack of solutions and ongoing dumping of municipal solid waste at the open dumpsite. Residents were mainly victims of respiratory-related health problems and emotional stresses.

Conclusion and Recommendation: Risk perception was much influenced by lived experiences and observations of physical features. In return, risk perception and lived experiences had affected the level of emotional reactions from living near the open dumpsite. The municipality of the town should provide sustainable solution with provision of properly sited and designed municipal solid waste disposal site for the community in order to alleviate environment and health impacts from open dumpsite.

Keywords: municipal solid waste, open dumpsite, risk perception, lived experience, Ethiopia

Introduction

The quantity and complexity of solid waste generated are increasing in developing countries owing to urbanization, changes in the pattern of life and population growth.¹ However, the current Municipal Solid Waste (MSW) management practices, especially collecting, processing and disposing, are considered to be inefficient. As a result, these countries are facing increasing environmental and health associated problems.² Lack of well-established MSW management systems has been forcing communities to illegally dump wastes on open fields, roadsides and river banks; and practice open burning without air and water pollution control.³⁻⁵

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Open dumps can pose major public health threats and environmental effects in urban areas.^{6–8} It is the most common unscientific, non-engineered municipal waste management method applied in most developing countries including Ethiopia.^{3–5} Uncontrolled and poorly administered dumping results in heaps of wastes onto the dumping sites, which is susceptible to open burning, thus emitting toxic gases causing air pollution.² Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leachate pollutes surrounding soil and waterbodies.⁹ In urban areas, MSW clogs drains, creating stagnant water for insect breeding and floods during rainy seasons.³

Illegal dumping of MSW is proved to cause a number of diseases. Occurrences of malaria, diarrhea and acute respiratory infections have been common with residents living in poorly waste managed area.¹⁰ Using water polluted by MSW for bathing, food irrigation and drinking water can also expose individuals to disease organisms and other contaminants.¹ Moreover, respiratory symptoms, irritation of the skin, nose and eyes, gastrointestinal problems, fatigue, headaches, psychological problems and allergies have been found to be common in people living near waste disposal sites.^{11–13}

Municipal wastes normally contain high concentrations of different organic and inorganic components, which are easily decomposed by various species of microorganisms. Byproducts from municipal wastes like hydrogen sulfide, ammonia, volatile organic compounds, and organic sulfur compounds are generated under anaerobic conditions negatively affect the health of residents.^{1,9,14} Uncontrolled MSW incineration produces a large number of pollutant particles, carbon dioxide, sulphur dioxide, carbon monoxide, particulate matter, dioxins, furans, ash, metals and organic compounds in the environment and exposure to these pollutants may have a significant harmful effect on the mental, physical and emotional health of local residents.^{2,15–18}

Effects appear to be more severe in susceptible groups such as children, the elderly, or those with chronic conditions such as asthma or pre-existing cardiovascular disease.¹⁹ There is evidence that long-term exposure to low concentrations is associated with chronic health effects such as increased rates of bronchitis and reduced lung function, shortened life span, elevated rates of respiratory symptoms and lung cancer.^{20,21} Maternal exposure to ambient air pollution is associated with adverse

birth outcomes, such as low birth weight, preterm birth and small gestational age births and premature deaths.^{22–24}

Risk perception plays a crucial ongoing role in public response to environmental exposure.²⁵ There is mixed finding on people's perception regarding the impact of improper MSW management practices. Some studies have indicated that the public perceived improper solid waste management as a contributor to disease causation and environmental pollution^{7,26} while others reported that the public has not associated municipal waste with harmful health effects.¹²

The current MSW management in Ethiopia is inefficient. The population in major parts of the country has been forced to depend on open dumping, open burning and un-engineered sanitary landfills.^{5,27,28} Ginchi town is no exception. Solid wastes generated from each household are dumped in ditches, road sides and in the river Aba-Semer found in the middle of the town. The MSWs generated are dumped in the river without any segregation. Fire is usually set to the waste for the purpose of volume reduction during summer time. The fact that the river is located in the middle of the town also makes it easily liable for illegal dumping by the community of the town. Uncontrolled open dumping and open incineration have continued to cause environmental degradation by polluting water, soil and air in the surrounding area of Aba-Semer. However, no effort has been made to explore the understanding, experience and reaction of residents living near the open dumpsite. Knowing the perceptions and experiences of the residents is important in order to understand the impact of waste exposure and to design effective interventions. Moreover, the findings from the study could be used as a call for the municipality of the town to consider the residents around open dumpsite in its efforts of assuring better living area for the whole society. It is hoped a thorough understanding of the perspectives of open dumpsite residents would encourage the community of the town and municipality to actively engage in developing, implementing and enforcing an effective MSW management system for the town.

Methods

Study Setting

The study was conducted in Ginchi town, which is located in central Western part of Ethiopia with a total population of 23,118 and 4816 households. Lack of MSWMS is among the sources of pollution for the town. With two kebeles (the smallest administrative unit) in the town, Aba-Semer open dumpsite is found in 02 kebele.²⁹

Study Design, Participants and Sampling Technique

Qualitative study design was employed to explore risk perception and experience. The study participants were people living in the immediate surroundings of the open dumpsite, which lies within a 1 km radius of Aba-Semer River. Only those who lived in the study site for at least the past 5 years were included in the study. A purposive sampling technique was used to recruit the participants. A purposive sampling technique was used to recruit residents who lived proximally to the open dumpsite. As a start point, the researcher approached 2 participants at their homes and explained the purpose of the study. Both agreed to voluntarily participate in the study. The rest of the participants were selected based on the recommendations of the two volunteers.

The researchers approached the participants at their homes and explained the purpose of the study. All of them agreed to voluntarily participate in the study.

Data Collection

First, field observation was carried out around the open dumpsite after preparing observation checklist with the aim of getting a clear picture regarding the situation that exists on the ground and the disposal practices by the community.

Second, two Focus Group Discussions (FGDs) were conducted among 6 participants in each group in order to explore the residents' risk perception. The participants were asked general questions ([Annex I](#)). The FGDs were conducted in a meeting hall of Ginchi Health Center to avoid interruption by nonparticipants. Saturation guided the number and duration of FGDs. On average, the FGDs lasted 45 minutes.

Third, a descriptive phenomenological method was applied for describing and understanding individuals' lived experiences. Hence, in-depth interviews with five participants were conducted based on interview guide questions ([Annex I](#)). They were conducted at the interviewees' homes. The sample size was determined by saturation of the data ie when similar information was repeatedly described about their experiences to the same questions asked. The interviews took an average of 30 minutes.

Conversations from FGD and in-depth interviews were recorded by audio tape recorder. In addition, on-spot handwritten memos were taken during field visit and interviews. Data were collected using Amharic language from

December 16 to 30, 2017 by the first author and one assistant for FGDs.

Data Analysis

All gathered data from different sources were transcribed verbatim and then translated into English language and analyzed together by the researchers. OpenCode qualitative data analysis software version 4.03 was used for analysis purpose. The recorded data and translated transcripts were listened and read thoroughly to gain a broad understanding and become familiar with the narratives of participants. Coding was done based on data and literature. Thematic analysis was used because of its appropriateness in selecting the most recurrent views. Three themes were identified to address risk perception research question and three themes for lived experience research question ([Table 1](#)). Quotations were used to illustrate the participants' direct explanation.

Results

Background Profile

Of the total 17 study participants, 7 were males and 10 were females. The mean age of FGDs participants was 44.2 years, and in-depth interview participants was 42.7 years. Eight of them were government employee, 5 of them were petty business owners and 4 of them were housewives. Except one participant, who had no formal education, all were educated. On average, the participants had lived in the study area for 24.6 years.

Field Observation

There are no organized collection, transfer and disposal of the generated MSW in the town. Solid waste storage containers, dustbins and MSW disposal sites are not available. Solid waste from households, commercials and institutions is illegally dumped on open land, river banks, drains, and roadsides. Aba-Semer River, which is found in the middle of the town, is the main disposal site for majority of MSW generated in the town. All sorts of solid waste are dumped in and on its banks with peak hours of dumping being at night and early in the morning. Food wastes, plastics, festal, plastic bottles, clothes, shoes, sweeping wastes, dead animal corpse, broken glasses, used batteries, ash and hair are the main components of the waste dumped in the river ([Figure 1](#)).

Table 1 Themes and Subthemes of Risk Perceptions and Experiences of Open Dumpsite

Risk Perception	Themes	Subthemes
	Perceived environmental risks	Air pollution from MSW open dumpsite
		Water pollution from MSW open dumpsite
		Soil pollution from MSW open dumpsite
	Perceived health risks	Perceived causation of health problems
		Risk factors for health problems
Perceived solutions	Vulnerability	
Experience	Being victim of health problems	
	Worriedness	Present and future health risks
		Fear of fire accidents
	Anger and disappointment	Lack of solution and ongoing MSW dumping

Risk Perceptions

Perceived Environmental Risks

Air Pollution from MSW Open Dumpsite

All the study participants stressed that MSW in open dumpsite causes air pollution. Smoke and foul smells



Figure 1 Municipal solid waste from Aba-Semer open dumpsite.

were frequently mentioned both in FDGs and in-depth interviews as factors contributing to air pollution. The nature of the pollution was believed to be season dependent. They underlined in winter time the solid waste easily decays and releases bad odor to the environment causing air pollution. However, in summer time, the bad smell is mainly due to the burning of wastes in the open dumpsite. It was pointed out that the process of burning emits very dense smoke to the air environment which not only covers the dumpsite area, but the whole surrounding neighbors of Aba-Semer.

Water Pollution from MSW Open Dumpsite

Without a difference in opinion, all participants pointed out that open dumping of MSW causes water pollution. The water pollution of Aba-Semer River was mentioned as an example. During summer, it was stressed the direct disposal of waste to the water which caused the pollution. However, in winter time, the MSW from the surrounding open dumpsite is washed away by rain and enter into the river. The waste was responsible for interfering with the flow of water in the river thereby causing stagnant water particularly during summer time. As one participant explained, the waste was sucking water into the river and making the river dry. In addition, the burning of waste in open dumpsite was believed to reduce the volume of the river water through evaporation. They also mentioned that the river was eutrophicated. One of the participants pointed out:

... currently the river water is polluted by the solid waste dumped and people are not using it. Moreover, the waste is distracting the flow of the river water and it is clogging the water which is filled with waste. (FGD participant-2)

Soil Pollution from MSW Open Dumpsite

Loss of soil fertility and damage to bridge due to burning of MSW were associated with soil pollution from open dumpsite. The open burning of the MSW was believed to cause the soil lose its contents thereby polluting it. On the other hand, the burning of the soil was feared to damage the foundation of the bridge over the river. They believed soil pollution as one of the contributing factors for the cracking of the bridge. Unaesthetic environment was mentioned as one of the consequences of soil pollution due to dumping of solid wastes in open areas.

Perceived Health Risks

Perceived Causation of Health Problems

Without any disagreement, all the participants stressed that open dumpsites cause diseases in humans, and respiratory system related health problems were frequently mentioned. Diseases such as cold, sinus, asthma, trachoma, allergies, malaria, tuberculosis and cancer were believed to result from MSW open dumpsites. Coughing; sneezing; other respiratory problems; irritation to the eye, nose and throat; burning and watering eyes, chest pains, irregularity of breathing; suffocation; cracking of the mouth; running nose; sleep disturbance; discomfort were linked directly or indirectly with health impacts of MSW open dumpsites. In line with this, a participant elaborated the health problems caused due to open dumping of solid waste as:

Coughing; skin allergic, eye allergic; trachoma; itching and burning of skin; itching, irritation and burning of eyes; sometimes swelling on body parts and others are the health problems the people in this neighborhood faced. It is breeding place for flies. The waste has been a source and cause of many diseases transmission. (FGD participant-4)

Three of the participants indicated the health problems from the waste to affect cattle's health as well. One of the participants explained:

There are some people down the river who use the river water. Even if the people don't use the water, their cattle drink it. Therefore, the people and cattle are exposed to different diseases. At this time tuberculosis disease is

getting worse. It can spread through this way. (FGD participant-3)

Risk Factors for Health Problems

Air pollution from dumpsite was identified as the dominant risk factor for the health problems. Water pollution was mentioned by some as causing health problems, particularly for cattle. Soil pollution was not recognized as a risk factor for health problems.

Bad smell and smoke were identified as the major factors causing health problems from MSW open dumpsites by all participants. In addition to this, one participant from FGD and in-depth interview mentioned flies and mosquitoes from open dumpsite to transmit diseases in humans.

Inhalation of bad smell and smoke from burning and decomposition of waste were believed to affect the respiratory organs and cause respiratory related health problems. The smell and smoke from festal and plastics were believed to be the major ones causing health problems.

I prefer other wastes than plastics and festal. It is these festal and plastics which are very problematic. (In-depth interview no.1)

We believe the smoke and smell can cause respiratory organs related cancers. The air pollution is causing sinus, throat irritation and lung problems. Therefore, through time these diseases can progress to lung cancer, throat cancer, nose cancer. (FGD participant-3)

The other risk pointed out was the reuse of plastic bottles from open dumpsite. Plastic bottles thrown at the dumpsite by hotels, groceries and others were usually collected by street children and sold back to the community at cheap prices. As one of the participants witnessed, she had observed that some of the bottles were filled with pee and other liquid waste. The street children empty the bottles and sell them without washing. People use these bottles for storing oil and other products and for serving homemade drinks to large number of people attending big ceremonies. According to the participants, this was believed to cause and transmit diseases such as diarrhea.

Vulnerability

Health impacts from open dumpsite were believed to affect indiscriminately all age groups and both sexes by all participants.

I am one of the victims. I am not a child or elderly, I am an adult woman (FGD participant-3).

However, two of the participants indicated children and elderly were very susceptible to the health problems owing to their weak resistance to diseases due to their ages.

...children are most susceptible since they have low resistance. Those older people are also more at risk because their body's defense to diseases is low. (FGD participant-5)

Experiences of Living Nearby MSW Open Dumpsite

Being Victim of Health Problems

In both in-depth interviews and FGD, the participants highlighted that they were experiencing health problems, the prevailing being respiratory system related. According to the participants, majority of the health problems listed under Perceived causation of health problems were experienced by residents of Aba-Semer neighborhood. Coughing, sneezing, sinus, chest pain and cold were listed as the main health problems. One of the participants explained her son's and her experiences from being exposed to burning waste smoke as follows:

I start to cough immediately, my eyes start to itch, burn, irritate and cry the moment I smell the bad odor which is emitted from the waste. My little boy and I are mostly affected from my family. My son has developed sinus. The moment the bad odor smells to him, his voice gets blocked; his throat gets blocked. His nose, mouth and throat parts get irritated very much. He could not breath properly. He faces air shortage. His voice and throat open after I make him get an injection. (FGD participant-1)

The smoke and offensive smell were highly blamed. As it was explained:

The smoke is entering into our lungs. It is causing coughing, sinus, allergy. ... If you take my family, we are not sleeping well because of the smoke. I have a coughing problem, my wife has sinus. We don't open doors and windows when it gets dark, but the smoke enters through other openings. (FGD participant-5)

The night time was noted as very disturbing because the frequency of waste dumping increases during night so the intensity of the smoke as well.

I get common cold, but that I can resist it. During summer, the smoke from burning waste I cannot resist it. It is making my life very miserable. My respiratory system

has been very much damaged by the smoke. I have sought treatment repeatedly from different health institutions, but I am told the only preferable solution to my problem is to stay away from the smoky area. Where can I go from the place I live and my home?. (In-depth interview no.2)

One of the participants explained the difficulties she was experiencing due to the respiratory problem she got by living many years of her life near an open dumpsite as:

Once you get breathing problem, the whole body gets difficulty to function. I do not sleep the whole night. I ventilate the smoke the whole night. I cannot breath properly. If I cannot breath, I cannot sleep. My nostrils get blocked and I breath only through my mouth. I face shortness of air to breath. Since I breath through my mouth, the inside of my mouth and my tongue are cracked. (In-depth interviewee No.2)

Worriedness

Present and Future Health Risks

Facing health problems by residents was making them worried. Those who already had health problems feared about the progress of the diseases through time. They feared if the diseases could currently lead to unexpected outcomes. The fact that there was ongoing disposal of solid waste had also made them anxious about the future.

I worry too much. I have a little child. My husband is now coughing. I fear they will end up like me if this waste problem continuous. It is very difficult. Particularly, I worry too much for the child. (In-depth interview no.2)

More worries were for what might happen to their children in the future. They were scared of getting more dangerous diseases like cancer. They were afraid of calling the disease "cancer" directly. Instead they preferred to call it "that disease". Worriedness about health problems from the open dumpsite was making some to think of leaving the neighborhood they used to like and moving to a new place. One (and only) participant expressed her worry about newborn babies. The fact she heard from mass media that preterm and underweight babies were common in open dumpsite neighborhood worried her very much. She said she started to associate the health problems in the neighborhood with the waste. She wanted to have a baby in the near future, but she was afraid of what might happen.

Fear of Fire Accidents

The burning of solid waste for long period of summer had

put residents in constant fear of fire accidents. There are theories that fire is set by one of the following: flames in the disposed waste, street children, mentally ill persons. Once the waste catches fire they said it was difficult to extinguish because of dumping of new waste on top of already burning waste. The participants mentioned that they were afraid a fire would break out and cause damage, particularly at night time. Another worry was fear of fire accident if electric cable passing over the dumpsite catches fire from the burning waste. They underlined that such a fire accident could demolish not only their neighborhood, but the whole town.

Anger and Disappointment

Lack of Solution and Ongoing MSW Dumping

No solution was found to the open dumpsite problems even though different efforts were made by the residents.

We took a step to solve the problem by ourselves by erecting a corrugated fence to one side of the bridge. But the community still dumps its waste and the waste is burning. (In-depth interview no.1)

Moreover, the use of Aba-Semer River as open dumpsite has been normalized by the community. Hence, majority of the community considers dumping of waste at this site legal; there is ongoing dumping of MSW. Nonetheless, the lack of intervention by responsible bodies such as the municipality had caused anger and disappointment in open dumpsite residents (Figure 2).

Perceived Solutions to Risk

Provision of properly designed and located MSW disposal site by the municipality was repeatedly raised and emphasized by all participants as the first and very important solution for the problem in relation to open dumpsite. They claimed that the municipality should employ workers who collect, transport and dispose waste in properly sited disposal place. Trucks should be available which could make the MSW management easy for workers. Besides dumping of street sweeping waste, dead animal bodies and others by the municipality itself should be stopped. On the other hand, the administration of the town should work together with the municipality because both have the mandate to create healthy environment for the community.

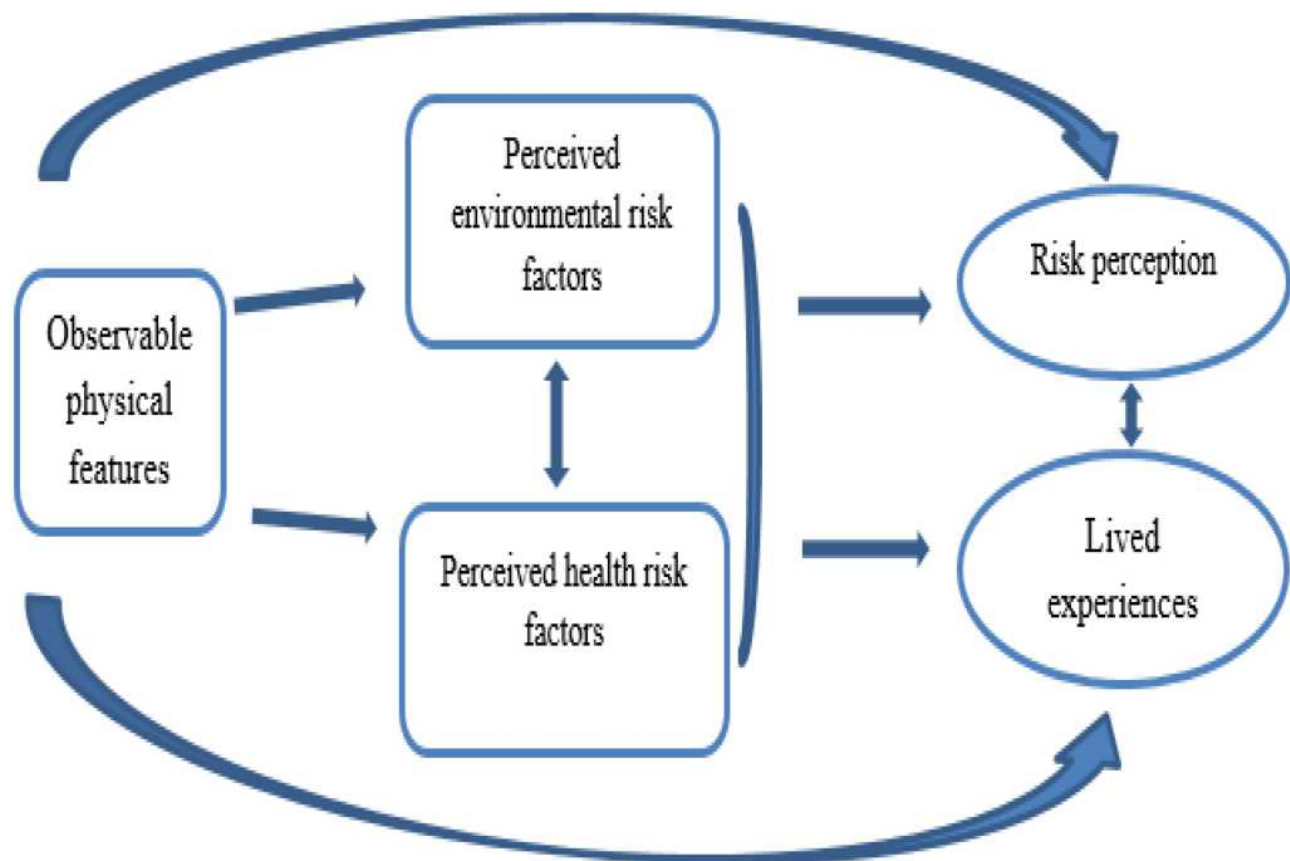


Figure 2 Relationships of risk perceptions and lived experiences.

Moreover, the community should be encouraged and educated to manage its solid waste in the space of its backyard.

Planting vegetation, fencing of the bridge and its surroundings were raised as temporary solutions that should be applied by the residents living near the open dumpsite. However, one participant opposed the idea of fencing as solution. She stated:

... when the community doesn't get disposal area, it will start to dispose it on streets at night time. It will not be a solution for the town. This will make the whole town dirty and creates the opportunity for wastes to be dumped everywhere. The only solution as to me is the municipality should prepare disposal site, employ workers, and buy a truck for facilitating collection and disposal. Otherwise, fencing the bridge doesn't provide solution to the problem. (FGD participant-3)

Discussion

This study aimed to explore the perception of residents who lived near Aba-Semer MSW open dumpsite about environmental and health risks from open dumpsite. It also explored the experiences of residents from living near the open dumpsite. Risk perception was assessed to gain an understanding on the level of awareness among the residents while individuals' experiences were explored in order to reveal how their experiences were influencing their lives.

The study found that participants in all perceived open dumpsite could cause air, water and soil pollution; and living around open dumpsite could be a risk factor for negative health impacts. Moreover, by living close to the open dump site, they had been victims of health problems; they were worried about the immediate and long term impacts of those health problems on themselves and their families as well as the probability of getting health problems in the future due to ongoing illegal dumping; and they were disappointed and angered due to lack of solutions and ongoing dumping of MSW.

There was good perception about the risks on the environment and health from open dumpsite among the residents. Even if general questions were asked on perceptions of risk on environment and health, the participants answered based on their neighborhood experiences. The fact that there were victims of health problems in the area from the waste, while seeking treatment for their sickness they had been informed the cause of their health problem;

close relationship among residents which made information flow easy; presence of tangible and observable features; exposure to mass media had contributed for the residents to have good understanding of the risks on the environment and health from open dumpsite waste. More concern was reflected on air pollution than water and soil pollution, hence many of the victims were suffering from respiratory related health problems. Moreover, it was easy to see the smoke created from combustion of waste and link to air pollution. Hence, exposure to smoke or bad smell was believed to cause the health problems, it was easy for them to recognize the impact on air rather than soil and water. However, there was a gap in linking the consequences of wastes from open dumpsite on the environment and health outside of what they experienced by the majority of respondents. For instance, combustion of the waste with greenhouse gas emission and the impact of particulate matter on heart were not mentioned by the participants. Another issue was there was gap of knowledge about the chemical and biological contents of waste. For instance, smoke is believed to cause respiratory problem but what is inside the smoke which causes health risk or the contents in polluted water which cause diseases were not mentioned during discussions except they were aware pollution of water and air generally cause health problems. Nevertheless, it is well understood that they are not expected to know to such details at their level and should be appreciated for having good understandings about the relations of open dumpsite waste with health and environment which the science approves of.

Even though all in all agreed there were risks from MSW open dumpsite; from observations, tones of speaking and gesture during discussions with participants; it was noticeable that risk perception was magnified among those who were victims of health problems by themselves.

Some studies found out that people tend to be less aware of environmental pollution level if they are satisfied with their neighborhood.³⁰ Contrary to this finding, the respondents claimed they liked their neighborhood but they believed it was very polluted and risky to their health.

The diseases believed to be caused from open dumpsite wastes were similar with the findings in other parts of Africa. This could be due to similarity in the nature/type of waste, weather condition and combustion activity. This study's finding of people's positive association of open dumpsites with poor environmental and health conditions is also supported by these studies.^{6,8}

High level of worry was expressed by the study's participants owing to lack of solution and harmful effects of health on self and family particularly children. The existing perception had influenced the level of worriedness. There was high perception that open dumpsites could cause environmental pollution; environmental pollution was believed to be a risk factor and health problems had contributed to high levels of worry among residents. Visible environmental pollutions were also one factor for high level of concern.

Similarly, the existing perception could be a factor in the emotional reactions observed by the participants. Moreover, the manifestations of emotional reactions were response outlets to the reluctance of the municipality and Ginchi town's population for acknowledging the problems in their neighborhood, for sharing their worries, for addressing the problems in their neighborhood.

During discussions, the participants were more interested in talking about the impact on the environment and health from open dumpsite air pollution. Hence, air pollution impact was magnified over water and soil pollution due to the reasons expressed in the discussion part. This may cause exaggeration on part and fading the results of the others. Moreover, incorporating the views of the municipality and other concerned bodies would have given a complete story of the issue.

Conclusions

There was a good perception that opens dumpsite was a risk to the environment and health. Risk perceptions were much influenced by lived experiences and observations of physical features. In return, risk perceptions and lived experiences had affected the level of emotional reactions from living nearby to the open dumpsite. The residents were mainly victims of respiratory-related health problems associated with Aba-Semer open dumpsite. Sinus, cold, chest pain, coughing, sneezing, and irritation of the nose, throat and eyes were affecting majority of the residents. They are also exposed to emotional stresses. Offensive odors during winter; smoke and bad smell from burning of MSW in summer were believed to cause health problems by the participants. Therefore, harmonized MSWMS should be deployed by the municipality of the town. It should offer sustainable solution through provision of properly sited and designed MSW disposal site for the community in order to alleviate environment and health impacts from open dumpsite. Along these, the

community should get education and courage to properly manage solid waste in the spaces available in backyards.

Abbreviations

FGD, focus group discussion; MSW, municipal solid waste; MSWMS, municipal solid waste management system.

Data Sharing Statement

The data that support the findings of this study are available on request from the corresponding author.

Ethics Approval and Consent to Participate

The study was conducted after obtaining, first, approval from the ethical review committee of the School of Public Health, College of Health Sciences of Addis Ababa University, and then written informed consent from each study participant. The objective and importance of the research were explained to each of the study participants and a full informed written consent was obtained to collect the data and communicate the findings through publication. The consent included publication of anonymized responses. The study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval for the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no competing interests in this work.

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