



## **Arsenic Poisoning and Social Crisis in Bangladesh**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MAR designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors ME, MSA and MBH managed the literature searches and took part in the statistical analysis, authors SMH and MEH prepared the final version of the manuscript. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Arsenic contamination and its prevalence in the environmental component appeared as a social disaster. This study focused on arsenic exposure among the local people and how lead to their daily life despite of severe arsenic poisoning in the community. A number of social factors was considered to be a key indicator to investigate social issues and prospects. This qualitative research was performed to make better understanding on arsenic exposure and social instability through intensively taking interview and focus group discussion. As regards observational findings, a number peoples identified who is carried arsenicosis symptoms, it might be the result of food chain contamination and frequently consumption of arsenic contaminated groundwater. Consequently, its

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long term result is negatively impacted on their existing social life and values. Result showed that, arsenicosis patients were apparently neglected by the group peoples who believe, it might be the result of any previous curse or sin. In the community, superstitious and social ostracism problems turned into a social hazards for an arsenicosis patient which is directly insisted daily life style, social status, access and deny to participate any social meeting. Surprisingly it was considered that almost all the communities openly or ultimately and unconsciously arsenic affected owing to continuous taking contaminated food and gradually leads to worsen health condition. It might be the results of absence situational and social factors. Simultaneously, worsen socioeconomic condition may act as predominant factor to exaggerate social phenomenon. In addition, cause finding and problem identification would be a helpful way to better understanding about arsenic exposure. However, this study tried to find out a thematic outline in environmental contamination and social crisis using some factors like social perception, respondent attitudes, behaviors, economical condition and knowledge to follow a combine approach. Its novelty might be reflected through knowledge shearing and practices.

*Keywords: Arsenic contamination; social perception; social ostracism & superstitious problem; social vulnerability and mental hazards.*

## 1. INTRODUCTION

Arsenic contamination is a concerning problem which is embodied on long term negative consequences as a public health issues. Groundwater contamination is one of the major cause for the devastating approach of arsenic hazard. Now, this contaminated water is extensively used in different agricultural sector for the irrigation purpose. Long term use of contaminated water not only irrigation but also household purpose get expedite to bioaccumulation rate in human body. In addition, food chain contamination is a great threat for the arsenic accumulation and probable exposure among the communities.

A number of develop and developing countries are encountered by arsenic contamination. Develop country has already been taken some measures for the mitigation approach through technological advancement and awareness build up. A number of psychological research has been reported that, newly discovered some drinking water technology always meet some critical barriers in everyday life [1-3]. On the other hand, developing countries are not so good in position to propitiate the curse of arsenic poisoning. A number of south Asian and another countries has been identified as highly arsenic contaminated area like Bangladesh, India, Nepal, Cambodia, Myanmar, Taiwan, Mongolia, Vietnam, China, Afghanistan, Pakistan, Argentina, Mexico, Chile and the United States [4-7]. Meanwhile, Bangladesh is one of the most arsenic contaminated country in the south Asian region. Groundwater contamination is one of the major cause of arsenic poisoning in Bangladesh.

A number of studies [8-10] has been reported that, high level of arsenic concentration was found to be in many cases but sometimes its range exceeding up to 2000  $\mu\text{g/L}^{-1}$ . More than 35 million and 57 million peoples consider to be under risky position who are drinking exceeding level of arsenic contamination 0.05 mg/L and 0.01 mg/L respectively [4]. However, Climate change and its negative significances directly attributed to groundwater depletion through over extraction and extensively use in the irrigation purposes. Most of the people in Bangladesh also frequently using contaminated water for the different household purposes. At this consequences, normally this contamination transfer to human body through food chain contamination and drinking. Approximately 100 million people might be arsenic affected owing to natural occurrence in groundwater [11]. For the long time taking arsenic contaminated groundwater it may affect all organs of the human body [12,13]. Several types of diseases evolve through arsenic contamination like as hepatic, cardiovascular, renal, neurological, gastrointestinal, malignancies and reproductive problems [14]. Regarding with the previous information, 20-70% peoples completely unable to take any treatment due to financial crisis [15]. Long term consideration it might be occur health disaster and social insecurity in the community. Arsenic contamination and social implication is one of the concerning issues for the arsenicosis patients.

Within 64 districts in Bangladesh, around 59 districts groundwater contain high level of arsenic concentration which is exceeding of the Bangladesh (0.05 mg As  $\text{L}^{-1}$ ) standard [16]. Consequently, a number of social problem has

been identified owing to arsenicosis hazards in the community like social injustice, social uncertainty, social isolation and problematic family issues [17,18]. Now, arsenic contamination and social implication is a great challenge for the arsenicosis patients to cope with social ostracism and superstitious problem. A large number of arsenicosis patients in Bangladesh are suffering from long term physical and mental stress [19]. A number of papers has been published in the aspects of arsenic contamination and probable measures. But the problematic outline of a society is a critical aspects to investigate the real point of the arsenicosis hazards. The aims of the study is to investigate the pragmatic cause of social insecurities for the arsenicosis diseases using social perception. This study also dealt with some important point of physical and mental illness owing to long term contamination. It should be taken into consideration to ensure sustainable development against with adverse environmental condition. The thematic outline "arsenic contamination and social implication" would be helpful to figure out the main problem of a society. It would also be guided for policy making and to achieve sustainability in the community approach.

## 2. RESEARCH METHODS

This study was performed at the '*Achintanagar*' Village in the Jhenaidah District, Bangladesh. It is located at the southwestern part of Bangladesh. This area covered by Ganges flood plain area which is composed by more arsenic containing ore. Government and non-government organizations have been made some efforts to monitor arsenic contamination and respective cause of the real fact [20]. But in some cases it was not sufficient to identify arsenicosis patients, social anxieties and probable mitigation strategy. This study was conducted take into consideration of arsenic poisoning and social insecurities to lead normal life style. Most of the people were agro-economy depended. In the total number of respondents, 46% and 54% were male and female respectively. Most of the respondents were found to be Muslim and also a small portion was found to be Hindu. However, qualitative approach were applied to find out the real cause of social insecurities through food chain contamination. Whereas, Questionnaire survey (QS), Focus group discussion (FGD) and informal interviews. Consequently, the structural questionnaire was consisted with several important question to figure out the social

condition like as "demographic information", "arsenic poisoning", "Social views", "Pragmatic Experience", "Social response" and "Social Ostracism and superstition". This study was performed to follow random-route methods, it is meant that interviewers try to connect every fifth household on their way to selected area [21]. They were willingly agreed to share their experience and knowledge. It was very important to get clear concept on arsenic contamination regarding with aims and objectives. On the other hand, for the focus group discussion (FGD), try to capture complex experience and the thinking behind actions attitudes, beliefs and perception through 'interaction discussion' [22]. Nevertheless, FGD was performed to find out the local concept in the integrated approach. The problematic site, cause and its long term impacts has been drawn effectively from the group discussion. A number of critical question was applied to find out the mental disorder and/or speaking anomalies and frustration. It was approved as a better approach to understand the factual consequences among the study group. Most of the respondents were too much courageous for the discussion session. It was tried to cover more opinion using discussion strategy and kept maintain serially individual species. For instances, informal dialogue or interview is to be consider more efficient technique for the qualitative research because it may take into consider some important hidden causes of the problem. A number paper has been tried to make this efforts for the qualitative research. Informal dialogue technique was also applied for the capturing of thematic views and probable thinking on arsenic contamination among the local peoples. It has performed among the local people at the different places like as on the street, road side, local shops and on the way to moving. Most of the respondents were very close residents at the adjacent area or studied people. This information was too much informative and constructive to make out the real feature of arsenic contamination. The problem and cause may could help to dig out the real point of contamination. It may approach to better treatment or probable guideline to control the situation at the local or large scale.

Risk factor analysis is very important to realize the factual events of a society. It was carried out depending on knowledge, ignorance and socioeconomic condition. Whereas, arsenic contamination get appear as a social catastrophe not only Bangladesh but also in the south Asian country. It is crucial point to emphasis on arsenic

hazards and its magnitude with timeframe. It can be a challenge to find out real scenario and affected people at the large scale but it is very easy to figure out the main cause of environmental crisis like as arsenic pollution. For that reason, this research has been tried out to divide into two groups of the whole communities regarding with the observational status and probable poisoning outcome like as risk group one and risk group two. The principal consideration of grouping was pointed out according to food habit, profession, living standard, livelihood pattern, and total living time at the residence. A few questions was drawn to evaluate the risk group from community like as what is your profession? Are you permanent or temporary at your position? What type of food do you like? Have any variability in your food habit? How much time you spend at your home in a day? Have any regular interval to stay outside of your home? From how many years ago are you staying at your home? This methodological technique would be a better understanding way to assess social consequences against with any environmental crisis.

### 3. RESULTS AND DISCUSSION

#### 3.1 Existing Status of the Arsenic Exposure

Arsenic contamination and its existing impact, negatively attribute to the social people where does it may appear as a social hazard in terms of daily social activities. It is one of the important issue to create any worsen condition in a society like as breakup social harmony and internal relationship [15,23]. A number of people has been reported that *"we are not able to lead normal life due to the arsenicosis diseases. Sometimes we feel scared to short-live death"*. Arsenicosis diseases seemed as chronic mode but its long term measure significantly attributed to worsen health condition. However, observational status showed that, social security has been break down owing to existing curse of arsenic contamination. Socioeconomic status may play a key role to drive the key situational factor of degree of arsenic contamination. In the study area, most of respondents were not belongs to well-structured socioeconomic condition. In some cases, a number of people were observed who were involved in different government and non-governmental organization. In addition, situational case did not deals with their educational qualification because they were

always thinking about their existing place, livelihood pattern and properties. It may binds to stay at the arsenic contaminated area at any cost even until death. However, alternative way is one of the major fact if they able sustain for the same buttress similar to before. On the other hand, a number of people reported that, *"This is our parents' home, we are habituated at this place for food production, income, social understanding, bonding, communication and familiarities but a new place is very tough to match with surroundings for the mentioned causes"*. Groundwater and food chain contamination is consider to be the results of extensive contamination of arsenic. According to the respondent's citation, they are frequently using contaminated groundwater for the irrigation and household purposes. In the study area, the high level of arsenic concentration has been found in groundwater ( $0.89 \pm 0.13 \mu\text{g/g}$ ), human hair ( $3.707 \pm 0.36 \mu\text{g/g}$  for female) and nail ( $2.034 \pm 0.19 \mu\text{g/g}$  for female) [24]. Arsenic concentration variability showed in greater context in female hair and nail. It might be results of body metabolism activities and other external conditioner use in the daily basis for washing. A number of patients has been identified at the study area who were suffering from arsenicosis diseases ranged from 20 to 72 years old. High level of arsenic content in groundwater may help to bio-accumulate in the human body due to regular consuming of contaminated water. Arsenic contaminated food frequently taking in different level of natural ecosystem like primary, secondary or tertiary and gradually is getting deposited into their bodies [25-27]. It poses a serious threats for the long term measures and may impacts to the future generation.

#### 3.2 Socioeconomic Status

A number of causes identified as a key factor to worsen health condition like as socioeconomic condition, educational qualification and ignorance. Whittington [28] reported that, high illiteracy rate has been found in the developing country. Arsenicosis diseases is not an infectious and hereditary, it may aggravate the hazards of arsenic toxicity owing to poor socioeconomic condition and malnutrition, and also it may create social problems [29,30]. In the study area, weaken socioeconomic condition may expedite to make more vulnerable in any case of social hazards like as arsenic hazards. Regarding with the observational feature, most of the peoples were agro-economy depended and recorded as a principal source of income. On the other hand,

major portion of them live below the poverty line. Livelihood pattern and its stability sometimes help to cope with social hazards in the aspects of long and short term measures. Meanwhile, social status is a mirror of educational qualification. On the other hand, most of the peoples were observed not so wellbeing and cautious about arsenic contamination and long term impacts. Just they believe it would be remove automatically after a certain period of time. Whereas, it may enhance to social and personal ignorance. It is very important to sequential monitor and take prospective measure to control the situational case through intensive awareness programme development. In terms of long term way, it may appear as a social disaster through building up mental and physical stress. Arsenic is not only a social phenomenon but also deals with physical [23]. A number peoples (patients) were identified who were suffering from metal and psychological disorder like as behavioral attitude change, impatient, frustration, neurobiological impacts and distraction. It would be rather difficult to control and take measures if it gradually increase.

### 3.3 Social Ostracism

Arsenic contamination negatively attributed to social peoples and suffering from social ostracism. Degree of contamination and severity exposed as a local hazard in the community [20]. According to the observational status, it is one kind of curse for the arsenicosis patients. Regarding with the respondents citation, "*it is a natural hazard and not so essay to control the worsen condition, we are very poor and could not to do anything to remove arsenic contamination*" In the situational case, sometimes social factor is directly coincided with the existing social condition. Most of people of the study area reported that, "*Nothing to say about this arsenic contamination hazards, it is our fate that's why we are just encountered by arsenic poisoning compare with other places and peoples*". For instance, it is now gradually develop a social insecurities through creating panic and frustration. A female respondents reported that, "*I am very scared about my husband due to his long time poisoning, I have a children what will be happen in the near future? I am not sure, sometimes I cannot thinking.....*" Social insecurities and instability impede to normal marital status of the local people. Observational results indicated to, arsenic contaminated people treated as a social burden because of they are facing some marital problem ranged from 18-30

years old. It is very difficult to get marry for an arsenicosis patients, general commons of the society are reluctant for this relationship. They advise to both young men and women remain unmarried [15]. Arsenicosis wives are frequently divorced and force to send back of their parents' house [15,31]. People do not take so easily decide to marry with arsenicosis patients like as girls and boys. One of the arsenicosis patients replied that "*I am an arsenicosis patient, I am deprived from social responsibility, nobody agree marry with me, some of them (in society) always try to avoid from any activities, actually it's my luck.....*" Always arsenic unaffected people try to avoid arsenicosis patients [15,23,32,33]. Arsenic contamination act as key problematic factor to produce social discrimination and stigmatization [15]. A number of authors [23,31] has been reported that, children of arsenicosis patients are not allowed to join any cultural and religious function. It should be very important to take some initiatives for the future mitigation approach along with policy make and practice.

### 3.4 Social Believe and Superstition

Arsenicosis diseases and social believe does not place same as to parallel in between awareness and educational qualification. Maximum number of people of rural areas in Bangladesh are not well informed about arsenic toxicity and arsenicosis illness [14,17,23,34,35]. Social awareness may positively attributed to future development with taking some crucial steps. Literacy rate is a common factor to build up social capacity against with any adverse social condition. In the study area, socioeconomic condition was not well-structured in the aspects of fighting against with the arsenic contamination. However, food chain contamination appeared as a devastating approach to make social disaster. For this situation, peoples may try to alleviate adverse condition as usually like as through natural process. A number of people reported that, "*we know, arsenic contamination is very harmful for health but we believe that it is a normal process of nature.....it actually comes from "creatures" we are blessed of God, after a certain period of time it would be remove automatically*". It might be true in some cases but sometimes it may not to be an effective manner to alleviate social crisis. However, Local believe and life style is one of the responsible factor to expedite the degree of contamination. Arsenic contamination and mental disaster is one of the concerning issue in Bangladesh. Consequently, continuous hazards my turn into psychiatric

problem in the community. In the study area, a number of patients were identified, their attitudinal problem indicate to mental incongruent among the local communities. In addition, mental disaster may significantly attributed to social disaster in the way to achieve sustainable development.

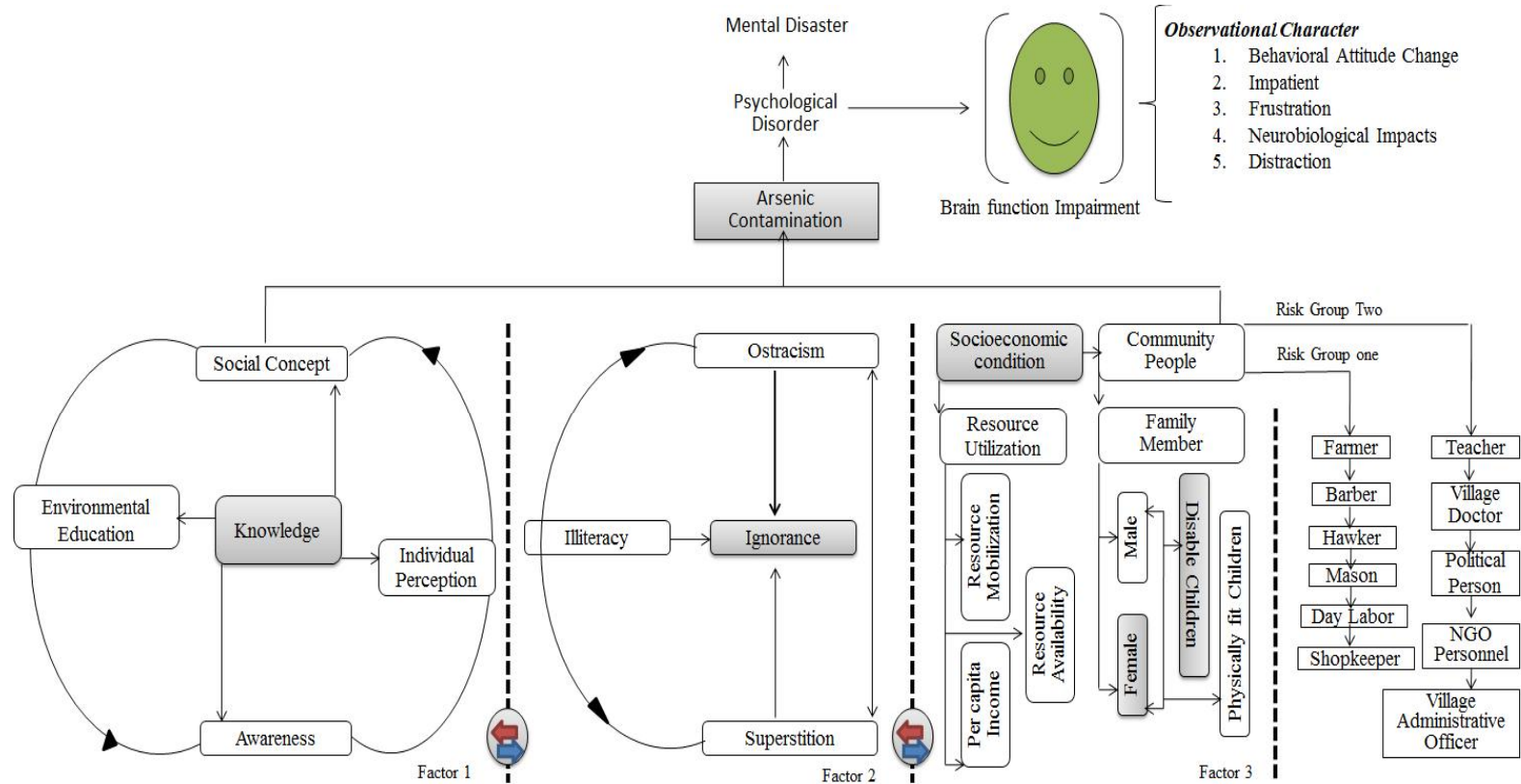
### **3.5 Arsenic Toxicity and Social Vulnerability**

Vulnerability shows the existing condition perspective to environmental hazards along with severity of the impacts and tolerance level. Lack of technological advancement at the rural area of Bangladesh is to be consider a curse of nature [36]. In the study area, severe poisoning and its magnitude emphasis on their health condition, livelihood pattern and worsen financial status. For instance, it may fallen them to adverse situational case and fate. In the holistic approach, almost total residents of the studied population consider to be more or less vulnerable depending upon their living style. Whereas, comparatively female and children is to be considered more vulnerable due to their food habit, residents time and body physiological condition. A number of female respondents were found to be more disappointed who carrying arsenicosis symptoms. They always thinking about their health but no way to escape from unwanted events. It is noted that, might be main fact of family condition. On the other hand, children's are not to be conscious about arsenic contamination owing to immaturity and lack of knowledge. Mothers are frequently using breast food to feed their children. Parents are also encouraged to take available foods which have made by the family members. But, mother does not know, her breast food is one of the more contagious which contain arsenic compounds. Local foods are cause to be a fact of long term health hazards owing to arsenic contamination. Exposures of arsenic contamination and transfer to human body directly attributed to worsen social and situation factors. Its strong abundance may not ensure to sustainable development.

### **3.6 Mental Hazards**

Regarding with the world health organization, health is defined as "state of complete physical, mental and social wellbeing" [37]. Individually mental health is a concerning issue for the arsenicosis patients, it was recorded that cognitive impairment of two workers in the USA and mentally (e.g. function) they were returned to

normal stage after withdrawal from arsenic [38]. Long term exposure of arsenic contamination in different food chain leads to contagious impacts on human health. Different types of neurotoxicological impairments has been found in human body including disturbance of visual perception, poor cognitive performance, psychomotor speed, speech, memory and attention [39]. Arsenic toxicity may affect to the locomotors, oxidative stress and central nervous system [40]. Continuous intake of contaminated food may associate with health risk in the aspects of contamination types and pathway. Level of risk exposure mainly depends on two factors: one is exogenous and another endogenous element [41]. In the developing countries peoples suffer from several types of pollution it may evolve from almost anthropogenic and rest of the natural activities. Meanwhile, these degree of contamination sometimes turn into several folds owing to unwanted change of climatic variables. Consequently, arsenic contamination now it is appeared as a disaster in Bangladesh. Groundwater and food chain contamination consider to be a vital source of extended hazards at the local scale. Almost every aspect of social factors is being affected by significant level of contamination. Regarding with the observational status, two groups of people was found to be under highly risky condition. This situational condition differ from socioeconomic condition, social status, education, food habit and knowledge variability (Fig. 1). Consequently, farmers, barber, hawker, mason, day labor and local shopkeeper was found to be highly risky in position in the community. Most of the people lives below the poverty line due to their daily livelihood and food crisis. Total living time at the residents and food habit can play a vital role for the bioaccumulation of arsenic elements. It would be differed from different social people in the same country. Whereas, total living time at the residence area may indicate to intake same food and probable effects of that prospective food system. On the other hand, a number of people in the same community like as teacher, village doctor, political person, NGO personnel and village administrative officer was found to be less risky than the risk group one. It also being treated as a better output using precaution measure. A number of respondents reported that, they always try to escape arsenic contamination through applying different indigenous technique and also try to avoid contaminated food as a replacement of better one. The government and non-government



**Fig. 1. Showing the factor depending social implications of Arsenic poisoning (shows some important factor like as factor 1: “knowledge” contained social concept, individual perception, awareness and environmental education; factor 2: “Ignorance” consist of superstition, illiteracy and ostracism; factor 3: “socioeconomic condition” indicate to different factors which may help to divide into two risk group e.g. “risk group one” and “risk group two”. Regarding with the risk group, female and children is more vulnerable than others. However, it may implies to psychological and mental disorder in the aspects of long term contamination)**

organizations have been made some efforts to find out a new pathway to reduce contamination level from drinking water [42]. However, socioeconomic condition may change life style by the ensuring financial sustainability and educational qualification to build up knowledge along with awareness development among the communities.

#### 4. CONCLUSION

As a poisoning hazards, it has been pervasively extended across the country. Food chain contamination is spread as out broken among the communities. Regarding with the observational status, a number of peoples identified who was bearing arsenicosis symptoms and also rest of the people unconsciously taken arsenic contaminated food like groundwater, locally produced vegetables and rice which is cultivated using contaminated groundwater in the irrigation field. Whereas degree of toxicity level and number of patients increasing rate depends on food habit, life style and living time at their own residence. On the other hand, socioeconomic condition and livelihood pattern can be considered as a potential cause of contamination rate. In the study area, maximum number of residents were living below the poverty line and they are engaged agricultural activities. However, environmental education and knowledge empowerment may help to change traditional culture, ostracism and superstitious problems to achieve sustainability. But educational status of the study area were not so good enough to cope social crisis through knowledge shearing and awareness development. In some cases, social ostracism and superstitious problem is found to be catastrophically insisting among the communities. While it is one of the main cause that is directly inhibit their normal life style and daily working activities. However, long term social impacts and adverse situational behavior make them to mental disable. In the long term way to life leading, it may appear as a social disaster for the greater context of arsenic hazards.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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