Socio-Environmental Determinants and Human Health Exposures in Arid and Semi-Arid Zones of Iran—Narrative Review

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ABSTRACT: Lifestyle is different in arid and semi-arid zones. However, where people are born and live have a lasting influence on their social and environmental exposure. This review focuses on the, various dimensions of environmental health imbalance inequality especially in significant environmental sources such as (ie, air, water, soil) among provinces that creates a big health gap in the center, East and the Southeast of Iran. Thus, the population of the arid and semi-arid zones of Iran is facing respiratory, cardiovascular, cancer and infection diseases linked to environmental problems such as chemical and microbial pollution due to air pollution and unsafe water sources, respectively. The prevalence of certain types of cancer such as skin, stomach, bladder, prostate and colorectal cancer together with some respiratory and cardiovascular diseases in arid and semiarid zones such as Kerman, Yazd, etc., has been reported in comparison with other provinces frequently. These impacts have effects on multiple levels of health security in those zones. Based on these concerns, we propose key questions that should guide research in the context of the socio environmental science to support science-based management actions in Iran and other similar semi-arid areas worldwide.

KEYWORDS: Human health exposures, arid and semi-arid zones, Iran, narrative review, health inequality

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Background

Nowadays, the global water demand is a challenging issue worldwide. Thus, according to UNICEF (2012) reports currently 36 countries are facing extreme water shortage.[1] Arid and semi-arid regions are commonly located in India, in Southeast Asia, sub-Saharan Africa, much of the Southern and Eastern Africa and a few locations in Latin America[2] (Figure 1). However, arid and semi-arid areas are increasing rapidly especially in the developing nations of the world and are common in the whole tropical Mediterranean. Among the Middle East countries, Iran has been highlighted as one as the most vulnerable countries to drought in the last decade.[3] Iran is the second largest country in the Middle East with a population of over 77 million. Iran with 65% of arid and 20% of semi-arid regions is prone to the occurrence of health problems due to hazard substances.[4] One of the largest salt desserts known as "Dasht-e Kavir (Great Salt Desert) Dasht-e Kavir (Central Desert)" is located in the East and Southeast of Iran and is the hottest place on Earth with 70.7°C of temperature in summer that is recorded in 2005.[5] Some provinces in Iran such as Kerman, Razavi Khorasan, Semnan, Yazd, Sistan-Baluchestan, and Markazi are strongly influenced by the presence of this desert.[6] The above-mentioned provinces in that desert are predominantly inhabited by lower social classes of low and middle income with low facility life such as healthcare, access clean environmental sources, potable,water, social or health services and etc. . ..[7] However, the effect of environmental pollution on the human health of mentioned tropical region has not been deniable.[8] Recent published paper reported that more than 40% of the worldwide population suffers from health problems related to the environment which requires special attention.[9] In addition, water, air, and soil are considered as the most important contaminated sources in arid and semi-arid regions that seriously effect on the human health of this regions.[10] Table 1 is summarizing global burden diseases report that is linked to climate factors.[11] Populations in arid region of Iran are more vulnerable than that of other regions due to they are heavily exposed to hazardous substances, shortages of potable water supplies and sanitation systems, lack of protective policies and medical, and public health interventions.[12] The World Health Organization (WHO) reported that nearly 1 billion people are regularly exposed to levels of indoor air pollution on 2021 worldwide. In addition, according to WHO data (2009) more than 60% of the diseases associated with respiratory infections are linked to exposure to outdoor air pollution worldwide.[13] In addition, unsafe drinking water containing

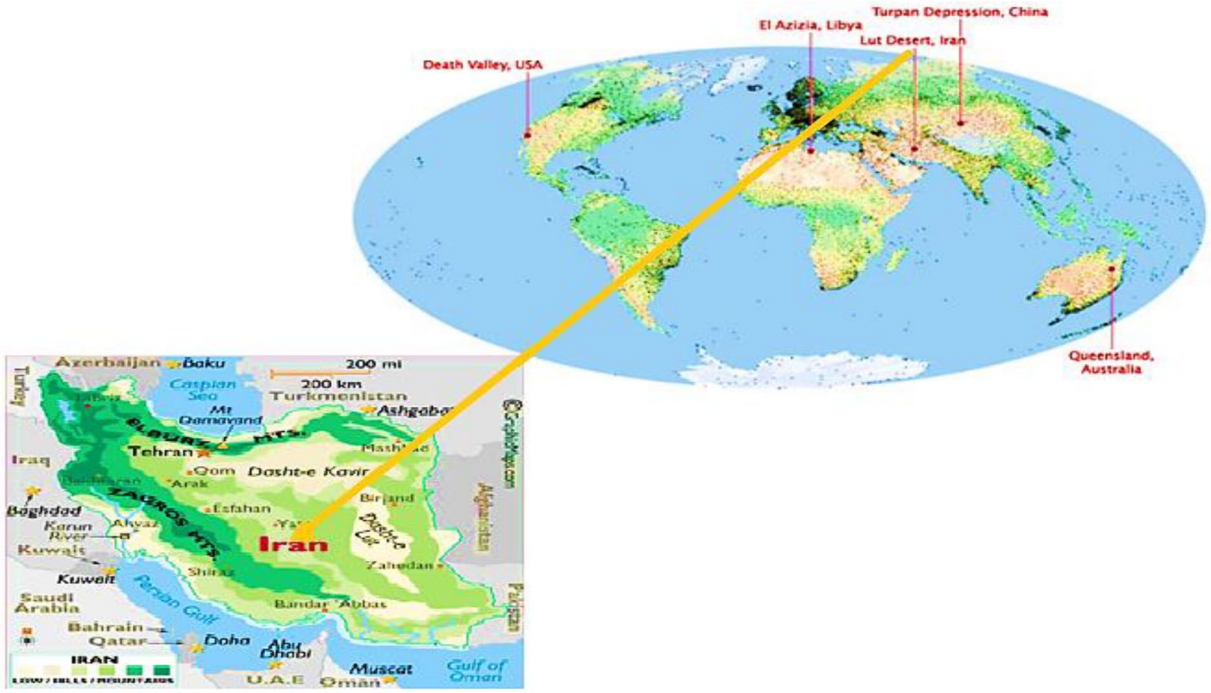

Figure 1. Map and satellite image of arid and semi-arid regions in Iran.[94]

Table 1. Adverse health impacts of climate.[17-19]

CATEGORIES	EXAMPLE	CLIMATIC FACTORS
Non communicable diseases (NCD)	Cardiovascular diseases	Temperature increase
		Increased concentrations of pollutants and allergens
Food-borne diseases	Diseases related to the heat wave of safety (eg, diarrhea, intestinal infections)	Precipitation increase
		Temperature increase
		Change in relative humidity
Water-borne diseases	Diarrhea, cholera, typhoid, intestinal infections	Precipitation increase
		Temperature increase
		Change in relative humidity
Vector-borne diseases	Malaria, leishmaniosis, dengue fever	Changes in maximum and minimum temperatures, climatic and seasonal patterns
		Changes in precipitation pattern
		Changes in relative humidity
Stresses on social processes	Food insecurity (malnutrition, hunger, famine, population displacement, migration, and conflict over limited resources)	Temperature increase
		Reduction of rainfall, increase in precipitation, and impact on agricultural crops

hazardous chemicals, nitrates, arsenic, factors of water hardness and salinity, fluoride in drinking water, and poor sanitation are other important environmental factors that affect directly human health in the arid regions.[14] Contaminated soil with heavy metals, pesticides and other potential toxins that is discharged from industrial activities can be influenced by environmental conditions and effect on the nutrition of the people directly. Overall, potential health impact of polluted

environmental sources leads to biological accumulation in fruit and vegetable consumption that cause to prevalence health problems in population such as different cancer, neurological dieses, respiratory, cardiovascular problem and infection diseases.[15] Therefore, this comprehensive review about the exposure of population to hazardous pollutants in tropical regions is timely and appropriate.[16] To our knowledge, this is the first review assessing the impact of chemical pollutants in the arid and semiarid regions of Iran, particularly in the Lut desert, on human health.

Air

Clean air in and out of the home is essential for healthy life. In recent decades, several scientific documents demonstrated that many cardiovascular and respiratory diseases and different types of cancer such as lung, liver, gastric, and breast cancer are linked to environmental pollution, particularly to air pollution.[17] However, air pollution has been behind the rising burden of NCDs in Iran.[18] In developing countries *as* industrialized societies, the level of ambient air pollutants has increased gradually and even reached a very harmful level in some areas.[8] According to epidemiological studies done in Iran, the frequency of the reported disease cases (carcinogenic and non-carcinogenic), is even higher than the national average level of Iran in the arid and semi-arid regions.[19,20] With respect to the social impact of air pollution and its health risk, this issue should be considered as a classified in 2 separated outdoor and indoor air pollution.

Indoor air pollution

Life style is different in arid and semi-arid regions due to the existing special climatic and regional conditions. Moreover, that affects significantly the population environmental health exposure.[21] Therefore, indoor air pollution in the tropical cities has different categories than that of other places (Table 2). Since the residents of this region prefer to spend more time in indoor environments, such as home and office work indoors, indoor environment quality (IEQ) is heavily emphasized.[22] In some cases, the Iran population of the arid region does not have access to clean cooking fuels and technologies in their homes which is the main source of household air pollution. Thermal comfort (TC) is a key indoor factor that is linked to human's health, well-being, productivity, and body's respiratory function.[23] Chiefly temperature, humidity and air movement are important factors in the determination of TC.[24] Hot and arid conditions without air movement cause an excess of indoor pollutant concentrations in the desert regions. Notably, escalating climatic conditions including overall heat result in biological materials such as pollen, mold, infectious agents, air pollutants especially ozone and particulate matter in indoor environments.[25]

Outdoor air pollution

Urbanization and industrialization are growing globally leading to air over pollution with a detrimental effect on human health.[34] In the last decade, research about the outdoor air pollution has had a special interest from the health point of view. This is a challenging issue not only in the natural normal state of the atmosphere but also in the arid and semiarid regions that need to be seriously considered.[35] It is important to remark that Dasht Kavir and Lut deserts with complex topography and known as having strong seasonal winds that are directly responsible for atmospheric circulation of air movement the large-scale area.[36] However, complex topography creates ideal conditions for transport of pollutants due to weather conditions and long-range emissions. Particle matter (PM) is one of the most remarkable pollutants that has been emitted from various sources such as volcanos and seismic activities, wild-land fires and etc. in region with arid and semi-arid climate.[37] Especially, PM produced by not only human activities, but also the Earth itself is able to generate atmospheric pollutants in desert regions due to tropical situation.[38] As demonstrated by consequent data which was reported in papers the number of daily dust events has been gradually increased in the East and Southeast of Iran in the last decade.[39-43] However, it is interesting to note that dust events containing high volumes of PM can transport a high diversity of air-borne pathogens.[44] On the other hand, the presence of numerous mines of lead, zinc, iron, and gold in Kavir desert regions and the activities related to them result in a high exposure to those elements by the nearby urban areas surrounded by those desert areas.[45] Therefore, dust from desert regions will include more intense toxic metals such as Ti, Mg, Al, Si, Fe, Mn, Ca, Pb, and Na from mining and industrial activities while that from non-desert regions mainly contains NO_3^- and SO_4^{-2} .[46,47] The source of urban road dust contamination, potentially toxic metals in road dust, industrial-urban and traffic-related activities have been reported by Najmeddin et al[48] in Ahvaz city. Moreover, lack of public awareness and transparency legislation, inappropriate public transport, lack of services such as proper management of transport, paved roads and primitive roads and unplanned distribution of industries contribute to increase the impact air pollution on the incidence of diseases due to raise the chances of exposures.[49,50] Despite this situation, there is not regular data monitoring of those hazardous elements such as air toxics chemicals and also it has lacked a strong communication campaign. There are several reports about long term and short-term health effects of PM around the world[51-53] but there is limited publication has been reported about Iran. Short-term exposure to outdoor air pollution can exacerbate pre-existing diseases such as worsening asthma and lung diseases, chronic bronchitis, heart attacks and arrhythmias, respiratory, and cardiovascular diseases. While, long term exposure increases the rate of progression of emphysema that led to

Table 2. Major health-damaging pollutants generated from indoor sources.[26]

POLLUTANT		MAJOR INDOOR SOURCES	HEALTH EFFECTS	REFERENCES
Inorganic contaminants	Fine particles	• Fuel/tobacco combustion, • Cleaning, cooking • Biological origin	• Heart or lung diseases such as coronary artery disease, congestive heart failure, and asthma or chronic obstructive pulmonary disease (COPD) • Premature death in people with heart or lung disease	Marzouni et al[27]
	Co_x	• Cooking stoves • Tobacco smoking • Fireplaces • Generators and other gasoline powered equipment; outdoor air	• Fatigue, chest pain, impaired vision, reduced brain function	Lee et al[28]
	Nitrogen oxides	• Fuel combustion		Lancaster Jr Jr[29]
	Heavy metal	• Pb, Cd, Zn, Cu, Cr, As, Ni, Hg, Mn, Fe Outdoor sources	• Cancers, brain damage • Mutagenic and carcinogenic effects: respiratory illnesses, cardiovascular deaths	Pratush et al[30]
	Sulfur oxides	• Coal combustion	• Impairment of respiratory function • Asthma, chronic obstructive pulmonary disease (COPD) and cardiovascular diseases	Fan et al[31]
	Lead dust	• Lead dust from old lead-based paint • High concentrations of airborne lead particles in homes result from lead dust from outdoor sources	• Seizures, paralysis, anemia, abdominal pain, constipation, vomiting, decreased appetite • Harm cognitive functions • Behavioral problems	Manna et al[32]
	Biological pollutants	• House dust mites • Microorganisms that grow in home heating and cooling systems • Building, construction materials, • Droppings and body parts from cockroaches, rodents and other pests or insects, viruses and bacteria • Accumulate biological contaminants such as draperies, bedding, carpet	• Allergic reactions such as hypersensitivity pneumonitis, asthma • Humidifier fever • Infectious illnesses such as shortness of breath, dizziness, lethargy, fever and digestive problems • Lung diseases especially in children, and elderly people	Tran et al[25]
	O_3	• Outdoor sources	• DNA damage, • Lung damage, asthma • Decreased respiratory functions	Li et al[33]

reduced lung function, development of cardiovascular and respiratory diseases and reduction in life expectancy.[54] Table 3 are summarized several epidemiological studies reporting health burden induced by air pollution in the arid and semi-arid regions of worldwide. Studies conducted in other countries for example Kuwait stated that storms have no significant effect on increasing the risk of cardiovascular deaths (Figure 2)[55] while those performed in Iran showed that dust storms were significantly associated with deaths resulting from heart diseases. This evidence demonstrates that different types of pollutants present in dust storms in desert of Iran in comparison with other country's desert zones.

Water

Water is a necessity for society's life worldwide. In recent decades, millions of the world's population have suffered from water scarcity (Figure 3).[63] Severe cases of water lack zones be observable in arid and semi-arid regions, particularly in developing countries.[64-67] In addition, water shortage challenge in Iran is undeniable. Notably, it is a critical issue in the geographical regions around the central desert of Iran which are undergoing a hard situation of water crisis.[68] Limited water and increasing water demand have encouraged population to use groundwater sources regionally causing hard pressure on water resources.[69] This means an uneven geographic distribution of welfare creating competition between various cities areas over the limited water resources causing an excessive use and exploitation of non-renewable groundwater resources that will result in a deterioration of country's water resources over time.[70] While many high water-consuming industries such as steel, ceramics, aluminum, food, refineries, and petrochemicals have been built in dry and semi-dry regions over the decades that

Table 3. Relationship between epidemiological studies and air pollution in the arid and semi-arid regions of worldwide.

TYPE OF AIR POLLUTION	HEALTH EFFECT	REFERENCE
Dust and particulate matter	Heart diseases	Díaz et al[56]
Dust storms	Heart diseases	Chan and Ng[57]
Dust storms	Heart diseases	Lee et al[58]
MED storms	No significant relationship between and daily mortality Kuwait	Aghababaeian et al[59]
Dust storms	Increased death	Shahsavani et al[60]
Dust storms	There is a statistically significant relationship between dust storms and deaths in the people over 75 year old in Italy	Zauli Sajani et al[61]
NO_2, O_3, PM_{10}, SO_2	Deaths due to cardiovascular and respiratory diseases	Miri et al[62]

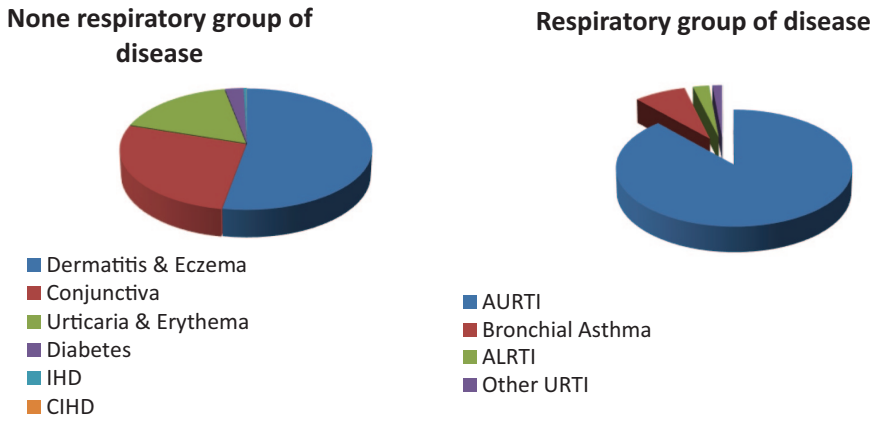

Figure 2. Annual adjusted health visits of air pollution-related respiratory and non-respiratory diseases in Kuwait.[55]

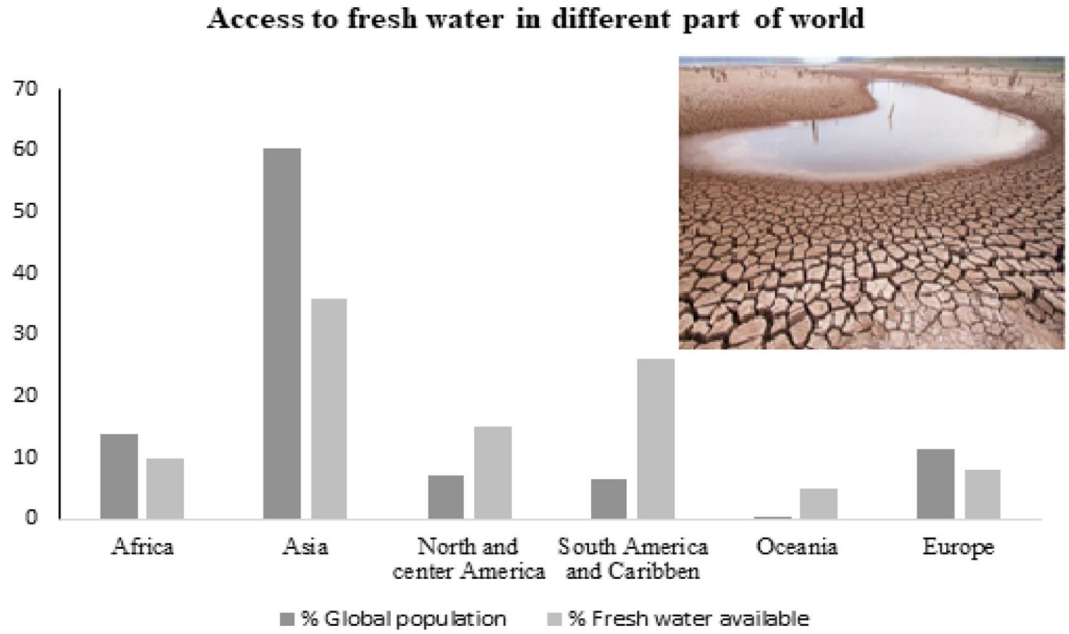

Figure 3. Brief description of population distribution and water availability around the world .[73]

have intensified the water crisis in these areas.[71] However, water challenges are not only limited to scarcity but also to increasing biological and chemical pollution of water sources from agricultural, industrial, medical and domestic effluents and waste. In this regard, in the desert regions in which groundwater is the only water supply source, access to safe and suitable drinking water is a serious problem.[72] In addition, the contaminants in the groundwater sources will lead to adverse health

Table 4. Pooled prevalence of 4 common parasitic diseases (%) in different arid and semi-arid provinces of Iran between 2007 and 2013.[79]

PROVINCE NAME	CUTANEOUS LEISHMANIOSIS PER 100 000		ACUTE TOXOPLASMOSIS PER 100		CHRONIC TOXOPLASMOSIS PER 100		BLASTOCYSTOSIS PER 100		GIARDIASIS PER 100	
	2007-2012	2013 2018	2007-2012	2013 2018	2007-2012	2013 2018	2007-2012	2013-2018	2007-2012	2013 2018
Yazd	60.50	25.032	No data	No data	No data	32	0.73	1.07	0.81	0.93
Sistan and Baluchestan	10.81	13.73	0.55	1.4	10.3	30.8	No data	No data	No data	No data
South Khorasan	4.98	9.75	0	No data	39	No data	0	No data	28.7	No data
Kerman	90.51	46.70	2.7	0	24.1	30.4	No data	13.7	1.2	7.8
Razavi Khorasan	67.86	30.80	6.4	7.1	34.4	31.17	No data	No data	55.9	No data

effects depending on their type and concentration however, exposure to high and low chemical doses of contaminants can lead to a variety of short- and long-term health effects. Contaminants in groundwater are complex and difficult to monitor and has long-term health effect such as biological accumulation and cause to certain types of cancer. It is noteworthy that in the most arid region of Iran, especially in the rural area, the quality of groundwater source "'which has been used as a drinking water source'" is low and often untreated even by any primary water treatment or disinfection process.[69]

Microbial-based disease

In Iran, intestinal parasites prevalence between 4.7% and 56% have been reported.[74] This issue has been significantly observed in the East and Southeast of Iran (arid and semi-arid regions) due to low socioeconomic status, limited sanitation and geographic factors such as location, physical features, distribution of natural, and etc.[74] According to recent studies *Blastocystis* sp., *Escherichia coli*, and *Giardia lamblia* are the most common water-borne intestinal parasites In Iran.[75,76] However, the outcomes of an epidemiological study performed in the Kerman province of Iran showed that 7.5%, 28.4%, 18.9% of the recorded water-borne diseases were associated with *Blastocystis* and *E. coli* infections, respectively.[74] The reviewed evidence leaves no room for doubt about the association between intestinal parasitic infections and the source of drinking water. It is demonstrated that 38.4% of the infected with prevalent species parasites were using unsafe sources of water as drinking water.[77] Generally, the low socioeconomic status of the rural areas is one of the main causes of Iran's water-borne diseases. Other factors and drivers that have turned into the most pressing issue is the lacking of an appropriate sewage collection system in most rural and urban areas in the arid region leading to a gradual discharge of domestic wastewater in groundwater sources. So, alarming levels of nitrate and water-borne organisms can be found in many areas with regular monitoring in most of the drinking water sources.[78] Indeed, it is imperative to monitor groundwater sources regularly due to their health effects on residents and this is one of the most important social health-based index that originated from social injustices. Table 4 shows the prevalence changes of the 4 most common protozoan parasitic infections in the arid region of Iran. As it can be clearly, observed toxoplasmosis in Yazd, Razavi and Khorasan is in high level.

Chemical based diseases

Hydro quality of groundwater sources is quite important to evaluate society's development, particularly in regions suffering from surface water shortage. Soil layers in various regions are different from one another in physicochemical properties based on single features of the soil such as texture, pH, color, potassium, or phosphorus content, etc.[80] There is close relationship between soil and its parent material (such as mineral rock and organic matter) that directly effect on the physicochemical properties of the aquifer and groundwater sources. In this sense, a wide range of physicochemical parameters' variability in groundwater sources is expected. However, groundwater with very low flow rate and high residence time has enough time to interact with the surrounding aquifers and effect directly on the water sources quality. Arid and semi-arid soils contain a high level of salinity as a result of the geological conditions and climatic factors, so the intrusion of saline bodies of water into the coastal aquifers leads to salinity aquifer and groundwater sources.[81] Salinity is the most dissatisfaction of water consumer. However, in arid and semi-arid provinces of Iran hardness is an important problematic issue Kalankesh et al[82]. Hardness in water consists of inorganic salts including calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates and in most of the drinking water of arid and semi-arid provinces have excessed level of WHO quid line suggestion[83] (Table 5). Nitrate is one of the critical pollutants in groundwater that in high concentrations could potentially cause adverse cancers and non-carcinogenic health effects such as met hemoglobin, blue baby's syndrome, infant mortality, cancer in mammals and abnormal thyroid function. Previous studies showed alarming levels of

Table 5. Health-based physicochemical values of groundwater according to WHO guidelines.[85]

PARAMETER	WHO 2011 GUIDELINES	PRIMARY EFFECTS ON HUMAN HEALTH
pH	6.5-8.5	Irritation to the eyes, skin, and mucous membranes
Cl (mg/L)	⩽250	Undesirable tastes, bladder, colon, and rectal cancer
Na (mg/L)	⩽200	Provide electrolyte imbalance and valuable information regarding an individual's physical and mental situation
K (mg/L)	⩽12	Cardiac arrhythmia, muscle weakness, nausea, and vomiting
SO_4 (mg/L)	⩽250	Diarrhea and dehydration
NO_3 (mg/L)	⩽50	Cancer, birth defects, colon, and rectal cancer
Ca (mg/L)	⩽200	Hypercalcemia, stomach upset, nausea, vomiting and constipation, kidneys harmless,
TDS (mg/L)	<500	cancer, coronary heart disease, arteriosclerotic heart disease, and cardiovascular disease

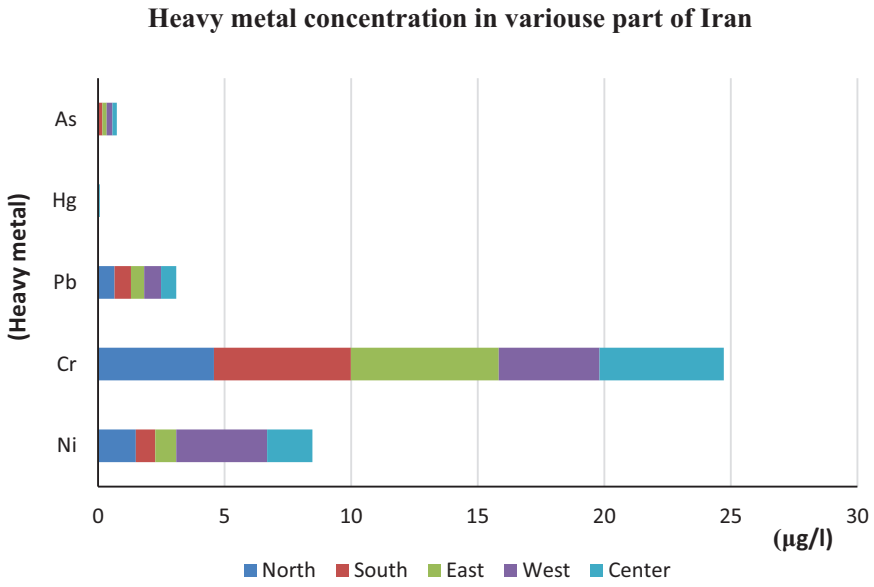

Figure 4. Contribution in heavy metal of input variables on drinking water for 2 age groups.[86]

nitrate concentrations in groundwater in different parts of the country, especially in the Northeast (Khorasan province). In addition, the highest nitrate concentrations were reported in the central region of the country (Yazd province). Both the above-mentioned provinces are the largest and most populated provinces located in the desert region.[84]

In addition, in some parts of the arid region contamination by potentially toxic metals (PTMs) such as As, Pb, Fe, Mn, Cd, Cu, and Cr (PTMs) in groundwater sources poses a significant environmental risk due to their easy bioaccumulation properties. Generally, an excessive use of drinking water containing PTMs creates human health issues. There is no doubt that several diseases such as tooth decay, heart disease, kidney and nerve disorders and various forms of cancer are linked to the presence of heavy metals in drinking water sources.[86] Limited documents were found that carried out an investigation on the association of environmental factors and diseases in the arid region of Iran. There is only one study conducted in Mashhad about the health impact of heavy metals in drinking water and the results can be seen in Figure 4 that are illustrated using the hazard quotient (HQ) in various parts of Iran. As it can be clearly observed the major part of Iran present of Cr^{+2} ion already brings significant challenges as a hazardous element in drinking water sources particularly, in the case of non-carcinogen risk but focusing on carcinogen risk of heavy metals in the center part of Iran. Hg^{+} presented the highest concentration followed by As^{5+}, Pb^{2+}, and Ni^{2+}. Moreover, in the East part As^{5+} showed the highest level followed by Pb^{2+} and Ni^{2+}.[87]

According to the recorded data, serious negative carcinogenic and non-carcinogen impacts of chemical contaminants in drinking water on the society's health are undeniable. The most common type of cancer in different desert parts of Iran are summarized in Table 6 according to a review article by Danaei.[88]

Table 6. The most common types of cancer in different desert parts of Iran.[88]

POPULATION	YAZD	KERMAN	QOM
The most common cancer in men	Skin	Skin	Skin
	Bladder	Bladder	Stomach
	Colorectal	Stomach	Colorectal
	Stomach	Leukemia	Bladder
	Prostate	Lung and Bronchus	Prostate
The most common cancer in women	Breast	Breast	Breast
	Skin	Skin	Skin
	Colorectal	Colorectal	Colorectal
	Leukemia	Leukemia	Stomach
	Stomach	Thyroid Gland	Esophagus

In that review, in 3 arid cities of Iran the prevalence of some cancer in men and women was reported separately as well as the highest incidence rate (Table 6). Unhealthy lifestyle is a major changeable risk factor in all cancer types but some factors such as opium consumption, chemical environmental exposures, salty food, exposure to X-ray radiation and iodine intake play important environmental role in human health. In Kerman and Yazd, as cities located in the desert region, there is a significant difference in cancer incidence rate associated with socioeconomic factors and lifestyle behaviors.

Social Consequences

Population in arid and semi-arid regions shares limited natural resources due to its food and water demand. As a result, economic activities increase the pressure on the natural environment. Unfortunately, the impact of structural inequities follows individuals "from womb to tomb." Nobody denies the fact that development of science and education can have a positive effect on social population.[89] Training in environmental issues is extremely important to change people perspective about correct environmental behavior. Understanding socio-cultural problems increases the speed prevention of human health risk prevalence and tropical diseases.[90] Open national to the world can help to culture and technology transfer to society.[91] Unfortunately, the geographical situation of the desert region in the East of Iran bordering Pakistan and Afghanistan has left its social and cultural effects. Lack of technology, lack of access to adequate life facilities, unemployment and a high crime rate decrease the quality of life.[92] The main regional inequalities in the East of Iran, including cultural, nutrition, natural sources, education and health inequality. However, social education is one of the important issues that should be taken into account. Moreover, effect of health inequality is not deniable that highlight disease with association environmental exposure. Imbalance inequality in provinces of the country creates a big health gap in the East of Iran. Structural inequities between various regions and provinces of Iran create differences in social participate that lead to inequality in access to a healthy living, including air, food, water source and societal attention. However, this is arguably most fundamental aspect in the environmental social determinants that affecting directly on the human health of this region. Some studies have been carried out to account for social determining health worldwide but there is not any study that considers the effect of socio-environmental determining health in arid and semi-arid regions of Iran. Damari et al (2020) is the only study that has investigated the effect of provincial health performance on food as a social determinant of health and national burden of diseases. Their results showed that the control of non-communicable diseases risk factors was not paid careful consideration.[93] Nevertheless, in some urban and rural areas of Iran, low-income people health care sector is inadequate and even insurance inequality and uninsured people are abundantly visible. Subsequently access health services and the use of free medicine is overshadowed which increases the disease association with hazardous environmental factors in these regions.

Conclusions

Desert land residents face with serious socio-environmental exposure around the world. In this regard, Iran as region with contain large desert regions and inhabitants in it have a big health challenging in socio environmentally aspects. In this study, it was raised 3 main environmental sources issues such as air, soil water that is concerning in the arid and semi-arid region of Iran. Carcinogenic and non-carcinogenic effects of environmental pollution sources in arid and semi-arid provinces was investigated and the result shows that the presence of *numerous* mines of lead, zinc, iron, and gold in Kavir desert regions directly effect on the air quality and lead to high lung and cardiovascular disease in this region. Moreover, Specific microbial and chemical contaminants in ground water sources has led to *Blastocystis* and *E. coli* and toxoplasmosis infections more reports of Kerman,Yazd, Razavi Khorasan respectively.

In addition, in the east and center of the country as a dessert region of Iran heavy metal such as $Hg^{2}+$ and As reported in high value that is directly related to the high rate of various cancer such as breast bladder and etc. in Kerman and Yazd city. Imbalance inequality in east and center provinces of the country intensifies the health effect of the contaminant in arid and semi-arid region. In this regard, governments must put more emphasis on adopting the latest techniques in air water and soil cleaning process and reducing pollutions in arid and semi-arid region of Iran However, considering more research in this area can help to prevent population vulnerabilities. This review study heavy emphasizes on the resolve environmental social problems in the arid and semi-arid zone. Moreover, it is concluded that chemical and microbial polluted air, water, and soil sources in arid regions of Iran lead to serious health problem such as coronary artery disease, congestive, various cancer, respiratory function, asthma, chronic obstructive and cardiovascular diseases that will be intensified in the future unless serious policy reforms are implemented, and immediate actions are taken.

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Authors' Contributions

All authors read and approved the final manuscript.

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