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Impacts of Industrial Pollution on Human Health: A Case Study of S.I.T.E Area Karachi

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Abstract: *Industrial pollution has adverse effects on the human health. The prevalence of several toxic and chemical substances emitted from industries affects human health badly. The present research study has mainly focused to analyse the socio-economic conditions, health issues and causal environmental factors associated with prevalent health problems of the respondents residing near the S.I.T.E area in Karachi. In order to analyse the impact of industrial pollution on human health; the researcher has obtained data from 150 study participants through a structured questionnaire based on five points Likert scale. Two different groups, factory workers and people residing near the industrial area are recruited for the collection of data. A sample size of 75 workers and 75 heads of the house residing within a 2 K.M range of industrial area were recruited by using a systematic random sampling technique. The findings of the research study show that there is a significant relationship between air pollution and the prevalence of respiratory diseases. The main pollution sources in the study areas were industries, traffic congestion, and domestic and water pollution. It is suggested that mitigation strategies should be formulated to combat industrial pollution and significant healthcare services should be provided to the people residing near the industrial areas.*

Introduction

Pakistan being a developing country is facing severe environmental challenges that include air, water and land pollution resulting in climate change and ecological imbalance. Adverse conditions of the environment affect the livelihood and health status of the communities. Environmental degradation, ozone layer depletion, air, water and land pollution according to the Pakistan economic survey (2013-14) that deteriorated environmental situation of Pakistan will put adverse effects on the economy that may cost over RS. 365 Billion Every year followed by sanitation and hygiene accounts for RS. 112 Billion, urban air pollution RS.65 Billion, agriculture and soil degradation RS.70 Billion, indoor pollution RS.67 Billion and land pollution RS.6 Billion. The challenge in the environmental sector includes water and air pollution causing widespread health concerned diseases and issues (Adekunle & Kehinde, 2008). Life on earth has become totally dangerous and unfit due to pollution. Pollution has many damaging effects on human health and social welfare (Alton & Ernest, 1990). It is very important to take the necessary measures to control it. A clean environment is very much important for better human health. Many diseases are associated with the pollutant environment and this pollutant environment put a negative impact on human health especially (Boney et al., 2005). According to the findings of WHO, UNCF & UNEP (2002), it

is revealed that about 25% of diseases are associated with environmental issues.

Gjika et al., (2000) stated in their research findings it is very difficult to define whether environmental pollution is caused by industrial smoke, dust waste or the toxic and chemical substances which are emitted from factories and industries. Waste the industries depends upon industrial pollution and industrial material which is being used there in industries. It is also not easy to measure the type, volume, and frequency of the waste discharged from the industries (Andekunel et al., 2008). Findings of many studies have investigated that magnitude of the industrial waste is higher than that of domestic waste. According to the report of WHO, (2000) it is indicated that contaminated water, air and land pollution are the leading factors of several diseases and illnesses concerned with human health. It is also revealed in that report in developing countries pollutant environment is a main cause of shorter life expectancy. That's why it is highlighted that several diseases and disorders are associated with environmental pollution whereas in developed countries several measures have been taken to combat industrial pollution that's why the statistics of the health indicators are satisfactory (WHO, 2000).

Several measures have been adopted by the industrial sector in developed countries to combat the toxic and chemical substances emitted from the industries in the shape of air, land and water pollution (John, 2002). Pollutant environment put several negative impacts on human health these include some common diseases like headache, fever, high blood pressure, deafness and irritation. Findings of one of the studies revealed that air pollution is also a main factor which is causing allergic diseases like skin rashes, skin dryness, eye irritation, cough, nose block, sneezing and hyperacidity (Johnson, 1991).

Sindh Industrial Trading Estate Karachi is the oldest and largest designated industrial area of Pakistan with more than 2000 industrial units on 4500 acres of land. The latitude and longitude of S.I.T.E area Karachi are 24.8547 and 67.0435 respectively. The major industries in S.I.T.E Area Karachi are textile, automotive batteries, food products, chemical, heavy and light engineering workshops, plastic, leather, rubber products, woodworking, glass products, power plants, pharmaceutical, and general Industries. Karachi is now Pakistan's premier industrial and financial hub city of Pakistan. Almost 30% of the industrial output of Pakistan is from Karachi. This present study will examine to find out the impact of industrial pollution on human health residing near the Sindh Industrial Trading Estate area in Karachi. Industrial pollution has an adverse impact on the human health. The negative impact of industrial pollution on human health is very clear and vivid to the people residing near the industrial areas. Issues that are expected to arise out of this research include several diseases like headache, fever, high blood pressure, deafness and irritation, cardiovascular disease, asthma and many other common illnesses diseases the people which are associated with industrial pollution (Reddy and Behra, 2005).

Statement of the Problem

Industrial pollution is a major environmental concern that poses significant risks to human health, particularly in densely populated urban areas such as the SITE area of Karachi. With the rapid growth of industrialization in the area, air and water pollution have become prevalent, and their impacts on human health have been well documented. The excessive discharge of hazardous chemicals and other toxic substances from industrial areas into the air and water has led to a rise in respiratory diseases, cancers, and other serious health conditions among the local population (Khan, 2022).

Despite the severity of the problem, limited research has been conducted to comprehensively assess the impacts of industrial pollution on human health in the SITE area of Karachi. Existing studies have largely focused on specific

pollutants or individual health outcomes, with little attention given to the broader implications of industrial pollution on public health. Therefore, there is a critical need to conduct a comprehensive study to evaluate the nature and extent of industrial pollution and its impacts on human health in the SITE area of Karachi.

Objective of the Study

The present study aims to explore the impact of industrial pollution on human health in the S.I.T.E area of Karachi. The present research tries to identify the issues of industrial pollution in the S.I.T.E area of Karachi

The study develops the following specific objectives:

- To assess the socio-economic conditions of the study participants in the study area.
- To identify the health issues of the respondents residing near the Sindh Industrial Trading Estate area in Karachi.
- To identify the causal environmental factors associated with those prevalent health problems.

Research Questions

The present research study has focused on the following research questions.

- What are the socio-economic conditions of the respondents in the study area?
- What are the health issues of the respondents residing near the Sindh Industrial Trading Estate area in Karachi?
- What are the causal environmental factors associated with those prevalent health problems?

Hypotheses

The hypotheses of the present research study are as follows.

H1: There is a significant relationship between air pollution and the prevalence of respiratory diseases in industrial areas.

H2: There is a significant relationship between water pollution and the prevalence of serious diseases in industrial areas.

Significance of the Study

The proposed study on the impacts of industrial pollution on human health in the SITE area Karachi is of great significance for several reasons. The study will provide a comprehensive understanding of the nature and extent of industrial pollution in the area, and the specific pollutants that pose risks to human health. This knowledge can inform the development of effective policies and strategies to mitigate the adverse impacts of industrial pollution on human health.

The study can benefit the local population in SITE area Karachi by raising awareness about the health risks associated with industrial pollution. The findings of the study can be used to educate local communities about the dangers of exposure to pollutants and to advocate for measures to reduce pollution levels in the area.

Finally, the study can have broader implications for environmental and public health policy in Pakistan. By highlighting the health impacts of industrial pollution, the study can contribute to the development of more stringent environmental regulations and standards in the country. This can help to improve the overall health and wellbeing of the Pakistani population, particularly those living in areas with high levels of industrial pollution.

Literature Review

The increasing industrialization has led to the pollution of soil through discharge of effluents by the industrial units. According to the findings of WHO reports each year 3 million people die worldwide due to air pollution followed by 800000 premature deaths due to respiratory, cardiovascular and lung cancers. Reports of the world health organization reveal that almost 1.1 billion people do not have access to the clean water followed by 2.4 billion people even doesn't

have the basic facilities of sanitation WHO, . Magnitude of these common health problems in Pakistan also significant. Pollution itself is not merely a problem of world but it has effects the Pakistan as well adversely. The disaster of the pollution can be observed in Pakistan but on the other hand it has far reaching impact on the Pakistan.

Untreated disposal of industrial waste has become a common practice of industries in Pakistan. Solid waste of the industries is mostly disposed off into the open dump area (Henderson, 2002). It is estimated that Sindh Industrial Trading Estate Karachi discharge 615 tonnes biological oxygen demand per day of pollutants into Lyari River. The increase in urbanization due to population pressure presents additional soil erosion problems (Sharma et al., 2013). Industrial pollution is the pollution which can be directly linked with industry. Industrial pollution is categorized as air, water and chemical pollution produced by the industries. Big cities where the mills, factories and heat plants produce the industrial pollution and the chemical substances and smoke emitted from these industries put a negative impact on the human health (Sujatha et Al., 2013).

It has also far reaching impact on the human health. According to the reports of world health organization almost 2% of the all heart and lung diseases, about 5% of all lung cancers and about 1% of the chest diseases are associated with the industrial pollution. The effects of this industrial pollution are different in worldwide. In developed countries the situation of this industrial emission of toxic substances and industrial waste is comparatively better than the developing countries. The situation of industrial pollution in quite different in developed countries. Necessary Mitigation strategies of pollution have been adopted by these developed countries. But the situation of industrial pollution is quite dangerous and complex in the developing countries. The process of industrialization is also quite less developed in these countries. According to the finding of Henderson (2002) domestic, municipal waste and industrial waste are the main sources of environmental pollution. According to the findings of John (2002) industrial pollution has adverse effects on the human health and residential areas of the industrial area. According to the findings of Janseng (1992) Industrial noise also has great effects on the hearing of the workers.

Methodology

The present research study is determined to analyse the impact of industrial pollution on human health residing near Sindh Industrial Trading Estate area in Karachi. Population of the study was people residing near the industrial area and factory workers. The researcher has recruited 150 study participants for the data collection. Two different groups, factories workers and people residing near the industrial area were selected for the data collection. A sample of 75 workers was recruited by using stratified random sampling technique. Every 5th worker was chosen from the 5 industries with at least 15 worker from each industry based on local record of employees data of individual industry. A door to door survey was conducted and a sample of 75 of the house was recruited by using stratified random sampling technique and each 5th house was selected for the study residing within 2 k.m range of industrial area. However, a well-structured questionnaire was administered to obtain the responses of study participants. Moreover, data was analysed by using SPSS version 2022. After data analysis, results are presented in descriptive and inferential statistics.

Results and Discussion

We were interested in the analyzing the impact of industrial pollution on human health residing near Sindh Industrial Trading Estate area in Karachi.

Table 1

Frequency distribution of the respondents regarding gender

Variable	Frequency	Percentage
MALE	120	80.0
FEMALE	30	20.0

According to table 1 demographics of respondents in terms of gender is computed. Statistics of the table highlights that 80% of the respondents were male and remaining 20% of the respondents were female, who participated in the present study.

Table 2

Frequency distribution of the respondents regarding age group

Variable	Frequency	Percentage
20-24 YEARS	6	4.0
25-29 YEARS	19	12.7
30-34 YEARS	70	46.7
35-39 YEARS	52	34.7
40 & ABOVE YEARS	3	2.0
Total	150	100.0

In case of age group 30-34 years respondents are 46.7%, 34.7% of the respondents are 35 to 39 years, 12.7% of the respondents are between 25 to 29 years, 4% of the respondents are between 20 to 24 years and almost 2% are above 40 years. The results shows that majority of the respondents are from age group 30 to 34 years.

Table 3

Frequency distribution of the respondent's level of education

Qualification	Frequency	Percentage
Illiterate	29	19.3
Middle	65	43.3
Matric	35	23.3
Intermediate	13	8.7
Graduate	8	5.3
Total	150	100.0

Table 3 computes the level of education of the respondents. The results shows that fourty three (43.3%) of the respondents education level was middle, twenty three (23.3%) of the respondents were level of metric, more than nineteen (19.3%) of the respondents were level of illiterate, more than eight (8.7%) of the respondents were level of intermediate. Data shows that only five (5.3%) of the respondents were level of graduation.

Table 4

Frequency distribution of the respondents' family members and family structure

Variable	Frequency	Percentage
Family Members		
<3 MEMBERS	1	.7
4-6 MEMBERS	83	55.3
7-9 MEMBERS	62	41.3
10& ABOVE MEMBERS	4	2.7
Total	150	100.0
Family Structure		
NUCLEAR	72	48.0
JOINT	57	38.0
EXTENDED	21	14.0
Total	150	100.0

Table 4 computes respondent's response frequency according to their family members and family structure. Results of the Present study indicate that respondents residing near the industrial areas have a large family size. In present study more than fifty five (55.3%) of the respondents family size was consist on 4-6 members, followed by 7-9 members 41.3%, less than 3 members .7% and 10 & above family members ration was 2.7

Present study also identify that significant 48% of the people residing near the industrial areas they belong from nuclear families followed by joint family structure 38% and extended family structure 14%.

Table 5

Frequency distribution of the respondents regarding their household monthly income

Variable	Frequency	Percentage
House Hold Monthly Income		
0-9 THOUSAND	1	.7
10-19 THOUSAND	20	13.3
20-29 THOUSAND	87	58.0
30-39 THOUSAND	36	24.0
40& ABOVE THOUSAND	6	4.0
Total	150	100.0

Table 5 outlines variable related to the house hold monthly income of the respondents. The data shows that Monthly house hold incomes of these respondents' families were also low. About fifty eight (58%) of the respondents house hold monthly income was 20-29 thousand PKR, followed by 30-39 thousand PKR 24%, 10-19 thousand PKR 13.3%, 40 & above thousand PKR 4% & 0-9 thousand PKR .7 % . Mostly these family lives in houses on rent which is normally consist of only one & two room. So in this very low earning they almost pay 7 to 10 thousand rent of the house. That's why living condition of these respondents was also very miserable. Smoke and smell of the chemical substance was also threatening for the health of the respondents. Noise pollution created by these industries was also a major factor which creates the sleep deprivation for the residents of the industrial area.

Table 6

Frequency distribution of the main source of pollution in S.I.T.E area

Variable	Frequency	Percentage
INDUSTRY	89	59.3
TRAFFIC	49	32.7
DOMESTIC	8	5.3
ANY OTHER	4	2.7
Total	150	100.0

Table 6 outlines the various items of the main source of pollution in S.I.T.E area Karachi. Findings of the study shows that more than fifty nine (59.3%) of the respondents stated that industry is the main factor creating industrial pollution in this industrial area. Because there were inadequate patterns of waste discharge adopted by these industries. During the survey it was found that some where waste of these industries found lying around the road and smoke and toxic substances were emitting from these industries. It was also highlighted that another major source of pollution in S.I.T.E area was traffic with the proportion of 32.7% followed by domestic 5.3% and any other sources of pollution were 2.7%.

Table 7

Frequency distribution of the prevalence of air, water and land pollution

Variable	Frequency	Percentage
Prevalence Of Air Pollution		
Very Prevelant	127	84.7
Not Prevelant	16	10.7
Indifferent	7	7.3
Prevalence Of Water Pollution		
Very Prevelant	118	78.7
Not Prevelant	21	14.0
Indifferent	11	11.3
Prevalence Of Land Pollution		
Very Prevelant	106	70.7
Not Prevelant	21	14.0
Indifferent	23	15.3

Table 7 calculates respondent's frequency of response according to their perception of prevalence of air, water and land pollution in the S.I.T.E area Karachi. Majority of the respondents revealed that air pollution was very prevalent 84.7%, followed by water pollution was also very prevalent 78.7% and land pollution was very prevalent 70.7%.

Table 8

Frequency distribution of the prevalence of common health diseases in industrial area

Variable	Frequency	Percentage
Skin Diseases	73	48.7

Cold/Cough	15	10.0
Dysentary	4	2.7
Headache	4	2.7
Diarrhoea	54	36.0

Table 8 identifies the prevalence of common health diseases in industrial area. Industrial pollution had adverse impact on the human health. Results revealed that skin diseases 48.7% were found very prevalent among the respondents followed by diarrhea 36% are the common health problems among the people residing near the industrial area .Rest of the other associated health problems are cold/cough 10%, dysentery 2.7% and headache 2.7% as well.

Table 9

Frequency distribution of the prevalence of respiratory diseases in industrial area

Variable	Frequency	Percentage
Asthma	62	41.3
Chronic Bronchitis	43	28.7
Chronic Pulmonary	24	16.0
Pneumonia	21	14.0

Table 9 shows that prevalence of respiratory diseases in respondents was found significant. Prevalence of respiratory diseases in industrial area is very common. It is indicated that asthma 41.3% is the leading respiratory disease found in the study area where as Chronic Bronchitis 28.7%, Chronic Pulmonary 16% and Pneumonia 14%. Respondents revealed that due to pollutant air these allergic diseases are common in industrial area. Environment of the air is full of toxic and chemical substances which put negative impacts on the human health specially on those people who are working or residing near the industrial area. Sujhata et al,. (2013) also identified the prevalence of these respiratory diseases is due to the industrial pollution.

Table 10

Frequency distribution of the prevalence of other different serious diseases in industrial area

Variable	Frequency	Percentage
DEAFNESS	9	6.0
CARDIOVESCULAR DISEASE	35	23.3
HIGH BLOOD PRESSURE	50	33.3
CANCEROUS DISEASE	5	3.3
DIARRHEA	27	18.0
DIGESTIVE PROBLEM	24	16.0

Life of the human being is at great risk in this modern era of industrialization. Rapid growth of industries production where it contributes for the better economic development but on the other hands if this industrial waste is not being discharged properly than ultimately the health indicators of the counties will be very adverse. Industries waste is causing serious diseases for the human health. Results of the table 10 computes the variable related to the different serious diseases. In present study data revealed that high blood pressure 33.3% is the leading serious disease found in the study area followed by diarrhea 18%, cardiovascular disease 23.3%, digestive problem 16.0%, deafness 6% and cancerous disease 3.3%. Reddy and Behera (2005) also explored the similar kind of results in his study.

Table 11

Frequency distribution of the cause of diseases due to living in industrial area

Variable	Frequency	Percentage
YES	112	74.7
NO	38	25.3

In present study respondents were asked about the cause of disease due to living in industrial area. Results of the table 11 identifies that 74% of the respondents revealed that living in industrial

area is the main cause of disease where as 25.3% of the respondents denied from the statement.

Table 12

Frequency distribution of the adequate pattern of waste discharge adopted by the industries?

Variable	Frequency	Percentage
ADEQUATE	16	10.7
INADEQUATE	85	56.7
INDIFFERENT	49	32.7

In table 12 respondents were asked about the proper discharge of the waste of the industrial pollution. Results of the table reveals that 56% of the respondents highlight that inadequate patterns and methods are being adopted by the industries for the discharge of the waste of industries followed by 32% indifferent and rest of the 10% respondents said adequate patterns of wastes discharge adopted by the industries.

Hypothesis 1: *There is a significant relationship between air pollution and prevalence of respiratory diseases*

Table 13

Correlation between air pollution and prevalence of respiratory diseases

Prevalence of air pollution	Prevalence of respiratory diseases in industrial area					Total
	Asthma	Chronic bronchitis	Chronic pulmonary	Pneumonia	Any other	
Very prevalent	58	39	16	14	0	127
Not prevalent	2	2	6	6	0	16
Indifferent	2	2	2	1	0	7
Total	62	43	24	21	0	150

Chi square: 19.063[a]; Degree of Freedom: 6; Sig Level: 0.004; Gamma; 0.522; Sig Level; .001
Co-efficient of Correlation: .336

Data in the table 13 shows relationship between air pollution and prevalence of respiratory diseases in the study area, Chi-Square (19.063[a]) value statistically shows highly significant (probability=.336) association between these two variables. Chi-Square statistic of 19.063[a], with 6 degrees of freedom which is associated with probability of .336 which is highly significant at the 0.01 level of significance. On the other hand Gamma value 0.522 also shows a significant relationship between these two variables. This is highly significant at 0.01 levels. So, the existing hypothesis entitled "there is a significant relationship between air pollution and prevalence of respiratory diseases" is highly statistically accepted. Therefore, value of co-efficient of correlation .336 shows a moderate relationship between these two variables.

Hypothesis 2: *There is a significant relationship between water pollution and prevalence of other serious diseases*

Table 14

Correlation between water pollution and prevalence of serious diseases

Prevalence of air pollution	Prevalence of other serious diseases in industrial area							Total
	Deafness	Cardiovascular	High Blood Pressure	Cancerous Diseases	Diarrhea	Typhoid	Digestive Diseases	
Very prevalent	8	18	33	5	20	4	28	116

Not prevalent	1	3	8	0	6	5	0	23
Indifferent	0	0	9	0	1	1	0	11
Total	9	21	50	5	27	10	28	150

Chi square: 32.035[a] ; Degree of Freedom: 12; Sig Level: 0.001; Co-efficient of Correlation : .420

Data in the table 4.14 shows relationship between water pollution and prevalence of serious disease in the study area, Chi-Square test is applied to test the independence of two variables. The value of chi square 19.063[a] is greater than its value of 12 DF and calculated P value is statistically shows highly significance at 0.001 values. Therefore, the alternate existing hypothesis entitled "there is a significant relationship between water pollution and prevalence of serious diseases" is highly statistically accepted. Therefore, value of co-efficient of correlation .420 shows a moderate relationship between these two variables.

Conclusion & Recommendations

Findings of the present study concluded that resident of industrial areas are facing different health and environmental problems. Chemical substances emitted from the industries had an adverse effect on the human health. In present study air and land pollution was found very prevalent in the industrial areas. Industry and traffic congestion were identified as leading causal factor responsible for pollution in the study area. Headache and fever/malaria were identified the major common health problems faced by the respondents. In aspect of prevalence of some other associated diseases high blood pressure, asthma, cardiovascular and respiratory diseases were reported in majority among the respondents. The results of the study reveal that industrial pollution has a far reaching impact on the human health specially on the neighborhood inhabitant's health and workers of the industries.

In order to combat the industrial pollution government should take some necessary measures. For the better health and lives of the people government should enforce national pollution control program through legislation at federal and provincial level. It is also the dire need of the time to set up an Inter ministerial commission to formulate a Pakistan's pollution management program. A consolidated regulatory frame work for pollution control should reach out to millions of Pakistanis.

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