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The Impact of Israeli Industrial Zone on Human Health in Tulkarm District: A Preliminary Study

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Dedication

To my beloved Family Whom

I Owe Much

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Abstract

The present study was conducted on 2471 subjects (250 families) residing in the West of the City of Tulkarm and on 1896 control subject group (200 families) in an urban area within the same district. The main aim was to evaluate the impact of air pollution resulting from the Israeli industrial zone based on the west of Tulkarm district on human health. Among the study group disease related symptoms for respiratory, skin and eye symptoms were represented by 7.6%, 4.2% and 3.5%, respectively. In comparison, disease related symptoms among the control group were represented by 2.4% for respiratory tract, 4% for skin and 3.5% for eye. Differences in the prevalence rates of disease related symptoms were significant between the tow-studied groups especially for respiratory disease related symptoms with a *P* value of 0.002.

With respect to gender differences, on the occurrence of respiratory disease related symptoms, females were represented with a higher frequency in both the study and control groups. Slight differences were observed concerning skin related symptoms in favor of males. On the other hand slight differences were observed concerning eye related disease symptoms in favor of females. The most affected age groups with respiratory disease related symptoms were the age groups 0-10, 11-20 and 41-50 or greater. The young age group constituted around 30% of the affected subjects, however, the elder group represented 67% of the cases. Similar findings were observed regarding skin disease related symptoms. Eye related disease symptoms were more prevalent among middle age groups.

The frequencies for respiratory related symptoms were 50.8%, 46%, 32% and 48% for breathing difficulties, asthma, throat infection, and nasal obstruction, respectively. Around 55% of those

with respiratory related disease symptoms seem to visit clinics and 90% of them seem to require medication. Similar findings were observed among the control group. Skin related disease symptoms including the presence of pimples or rash and itching were represented by 100% and 37%, respectively among the study group. Out of 105 affected subjects, 81(77%) of them visited clinics and 86% of them needed medications. Similar findings were observed among the control group. Eye related disease symptoms including the infections; inflammation and itching were represented by 83% and 71%, respectively among the study group. Out of 84 subjects suffering from eye related disease symptoms, 60(71%) visited clinics and 88% of them required medication.

Association between the presence of smoke and disease related symptoms is clear from the finding of 36.7%, 42% and 66.6% of families suffering from respiratory, skin and eye disease related symptoms, among the study group, respectively. Differences between the study and control groups in this respect were also clear. Findings on smoke intensity were also in support of the association between smoke and the studied disease related symptoms.

Among the study group, families with previous history of respiratory, skin and eye diseases were represented by 13.6%, 8% and 17.1%, respectively. This confirms the association between air pollution and the occurrence of disease.

1.1 General introduction

Air pollution is defined as addition of harmful substances to the atmosphere resulting in damage to the environment, human health, and quality of life. One of many forms of pollution, air pollution occurs inside homes, schools, and offices; in cities; across continents; and even globally. Air pollution makes people sick, it causes breathing problems and promotes cancer, and it also harms plants, animals, and the ecosystems in which they live. Some air pollutants return to earth in the form of acid rain and snow, which corrode statues and buildings, damage crops and forests, and make lakes and streams unsuitable for plant and animal life.

Pollution is changing the earth's atmosphere so that it lets in more harmful radiation from the sun. At the same time, our polluted atmosphere is becoming a better insulator, preventing heat from escaping back into space and leading to a rise in global average temperatures. Scientists predict that the temperature increase, referred to as global warming, will affect world food supply, alter sea level, make weather more extreme, and increase the spread of tropical disease.

1. 2 Major pollutant sources

Most air pollution comes from human activities such as burning fossil fuels including natural gas, coal, and oil, which is used to power industrial processes and motor vehicles. Among the harmful chemical compounds this burning puts into the atmosphere are carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, and tiny solid particles including lead from gasoline additives called

particulates. During the last century motor vehicle use rapidly expanded, and emissions of nitrogen oxides, some of the most damaging pollutants in vehicle exhaust, increased hundreds folds. When fuels are incompletely burned, various chemicals called volatile organic chemicals (VOCs) also enter the air. Pollutants also come from other sources. For instance, decomposing garbage in landfills and solid waste disposal sites emits methane gas, and many household products give off VOCs 1.

Some of these pollutants also come from natural sources. For example, forest fires emit particulates and VOCs into the atmosphere. Ultra-fine dust particles, dislodged by soil erosion when water and weather loosen layers of soil, increase airborne particulate levels. Volcanoes spew out sulfur dioxide and large amounts of pulverized lava rock known as volcanic ash. A big volcanic eruption can darken the sky over a wide region and affect the earth's entire atmosphere. The 1991 eruption of Mount Pinatubo in the Philippines [2], for example, dumped volcanic ash into the upper atmosphere enough to lower global temperatures for the next two years. Unlike pollutants from human activity, however, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric change.

Once in the atmosphere, pollutants often undergo chemical reactions that produce additional harmful compounds. Air pollution is subject to weather patterns that can trap it in valleys or blow it across the globe to damage pristine environments far from the original sources.

1. 2. 1 Major air pollutants and their health effects

International health standards have been set for several major pollutants including: carbon monoxide, lead, Ozone, nitrogen dioxide, particulate matter, volatile organic compounds and biological agents [1].

1. 2. 1. 1 Carbon monoxide

Carbon Monoxide (CO) is an odorless, colorless gas. It is produced by the incomplete burning of carbon-based fuels, including gasoline, oil, and wood. It is also produced from incomplete combustion of natural and synthetic products, such as cigarette smoke. It can build up in high concentrations in enclosed areas such as garages, poorly ventilated tunnels, and even along roadsides in heavy traffic [1].

Carbon Dioxide (CO_2) is the principal greenhouse gas emitted as a result of human activity (e.g., burning of coal, oil, and natural gas). CO_2 can cause burns, frostbite, and blindness if an area is exposed to it in solid or liquid form. If inhaled, it can be toxic in high concentrations, causing an increase in the breathing rate, unconsciousness, and death. After being inhaled, CO molecules can enter the bloodstream, where they inhibit the delivery of oxygen throughout the body. Low concentrations can cause dizziness, headaches, and fatigue; high concentrations can be fatal [1].

Chlorofluorocarbons (CFCs) are chemicals used in great quantities in industry, for refrigeration and air conditioning, and in consumer products. CFCs, when released into the air, rise into the stratosphere (a layer of atmosphere high above the Earth). In the stratosphere, CFCs take part in chemical reactions that result in reduction of the stratospheric ozone layer, which protects the earth's surface from the sun. Reducing the release of CFC emissions and

eliminating the production and use of ozone-destroying chemicals is very important to the earth's stratosphere [1].

1. 2. 1. 2 Lead

Lead is a highly toxic metal that produces a range of adverse health effects particularly in young children. Lead can cause nervous system damage and digestive problems, and some lead-containing chemicals cause cancer. Lead can also harm plant and animal wildlife.

Lead has been phased out of gasoline, which has considerably reduced the contamination of air by lead. However, lead can still be inhaled or ingested from other sources. The sources for lead include paint (for houses and cars), printing houses, manufacture of lead batteries, fishing lures, certain parts of bullets, some ceramic ware, mini blinds, water pipes, and a few hair dye products [1].

1. 2. 1. 3 Ozone (O_3)

Ozone is a gas that is a variety of oxygen. Ozone in the upper atmosphere, where it occurs naturally in what is known as the ozone layer, shields the earth from the sun's dangerous ultraviolet rays. However, at ground level where it is a pollutant with highly toxic effects, ozone damages human health, the environment, crops, and a wide range of natural and artificial materials. Ground-level ozone can irritate the respiratory tract, cause chest pain, persistent cough, an inability to take a deep breath, and an increased susceptibility to lung infection. Ozone can damage trees and plants and reduce visibility. Ground-level ozone comes from the breakdown (oxidation) of volatile organic compounds found in solvents. It is also a product of reactions between chemicals that are produced by

burning coal, gasoline, other fuels, and chemicals found in paints and hair sprays. Oxidation occurs readily during hot weather. Vehicles and industries are major sources of ground-level ozone [3].

1. 2. 1. 4 Nitrogen oxide

Nitrogen Oxide (NO_x) is a major contributor to smog and acid rain. Nitrogen oxides react with volatile organic compounds to form smog. In high doses, smog can harm humans by causing breathing difficulty for asthmatics, coughs in children, and general illness of the respiratory system. Acid rain can harm vegetation and run into lakes and rivers, which changes the chemistry of the water, and makes it potentially uninhabitable for all but acid-tolerant bacteria.

Nitrogen oxides are produced from burning fuels, including gasoline and coal. NO_x acid aerosols can reduce visibility.

Nitrogen Oxide (NO) has been implicated in a number of important biological functions and it was named the molecule of the year in 1992 [4]. At the cellular level, recent studies show that many cell types are capable of producing NO [5]. It is believed that this molecule may play an important role in inflammatory and immune responses [6]. The presence of NO in upper and lower airways of humans is thought to play a role in maintaining the sterility of the para-nasal sinuses and maintaining lower pulmonary vascular tone, respectively. In general its action can be considered beneficial as well as harmful. Elevated levels seem to be important in the respiratory tract as bronchodialaters and vasodialater [7, 8] and appear to play a role in bacterial killing. [9,10]

1. 2. 1. 5 Particulate matter

Particulate Matter is any type of solid in the air in the form of smoke, dust, and vapors, which can remain suspended for extended periods. Aside from reducing visibility and soiling clothing, microscopic particles in the air can be breathed into lung tissue becoming lodged and causing increased respiratory disease and lung damage. Particulates are also the main source of haze, which reduces visibility.

Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, fossil fuels, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining, agricultural burning, and operation of fireplaces and wood stoves. Sulfur Dioxide (SO_2) is an odorless gas at low concentrations, but can have a very strong smell at high concentrations. SO_2 is a gas produced by burning coal, most notably in power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulfur dioxide. Like nitrogen oxides, SO_2 is a major contributor to smog and acid rain. SO_2 is closely related to sulfuric acid, a strong acid. It can harm vegetation and metals and can cause lung problems, including breathing problems and permanent damage to lungs [1].

1. 2. 1. 6 Volatile organic compounds

Volatile Organic Compounds (VOC_s) are organic chemicals. All organic compounds contain carbon, and organic chemicals are the basic chemicals found in all living things and in all products derived from living things. Many organic compounds we use do not occur in nature, but were synthesized by chemists in laboratories.

Volatile chemicals produce vapors easily. At room temperature vapors readily escape from volatile liquid chemicals.

VOC_s include gasoline, industrial chemicals such as benzene, solvents such as toluene and xylene, and perchloroethylene (principal dry cleaning solvent). VOC_s are released from burning fuel, such as gasoline, wood, coal, natural gas and from solvents, paints, glues, and other products used at home or work. Vehicle emissions are an important source of VOC_s. Many VOC_s are hazardous air pollutants; for example, benzene causes cancer [1].

1. 2. 1. 7 Biological agents

Biological agents are present in the air almost everywhere, and are a common factor in office air pollution. They include bacteria, viruses, fungi, pollen, dust mites and other insects, animal dander (tiny scales from hair, feathers, or skin) and molds.

Biological agents can travel through the air and are often invisible. They are usually inhaled, either alone or by attaching themselves to particles of dust and then entering the respiratory system. Offices can be especially vulnerable to microorganisms, because fungi and bacteria find nourishment in inadequately maintained air-circulation systems and in dirty washrooms.

The health effects of such agents usually flourish in poorly maintained ventilation systems, severe health problems can result that can be experienced throughout an entire building.

Various biological agents can cause infectious and noninfectious diseases and they can induce the following symptoms: sneezing, allergic reactions, rashes, watery eyes, coughing, dizziness, lethargy, breathing problems, and digestive problems [1].

Data presented in Table (I) represent a summary of the major air pollutants, their sources, and their health effects based on national health standards.

Table (I). Air pollutants and their health effects*

POLLUTANTS	HEALTH EFFECTS	SOURCES
Carbon Monoxide	Weakens heart contractions and lowers the amount of oxygen carried by the blood. Reduces the ability to exercise and is dangerous for people with chronic heart disease. Causes nausea, dizziness, and headaches. When concentrated, causes death.	Primarily from motor vehicles, but also from incomplete burning of any fuel
Sulphur Dioxide	Aggravates existing lung diseases, especially bronchitis. Constricts breathing passages in asthmatic people and people doing moderate to heavy exercise. Causes wheezing, shortness of breath, and coughing. High levels of particulates appear to worsen the effect of sulphur dioxide. Long-term exposure to both pollutants leads to higher rates of respiratory illness.	Power plants, large industrial facilities, diesel vehicles, and oil-burning home heaters.
Nitrogen Dioxide	Nose and throat irritation, especially in people with asthma. Increases susceptibility to respiratory infections. Combines with volatile organic compounds (VOCs) to form ozone.	Power plants, large industrial facilities, and motor vehicles.
Ozone	Irritates lungs and breathing passages, causing chest pain, sore throats and coughing. Increases susceptibility to respiratory infections and reduces the ability to exercise. Effects are more severe in people with asthma and other respiratory ailments. Long-term exposure leads to scarring of lung tissue and lowered lung efficiency.	Forms in the air from other pollutants, volatile organic compounds and nitrogen oxides. Ozone does not come directly from tailpipes or smokestacks, but forms when sunlight interacts with exhaust hydrocarbons and nitrogen oxides.
Particulates	Aggravates existing heart and lung diseases, changes the body's defenses against inhaled materials, and damages lung tissue. The elderly, children and those with chronic lung or heart disease are most sensitive. Lung impairment can persist for 2-3 weeks after exposure to high levels of particulate matter. Chemicals carried by particulates can also be toxic.	Diesel cars, trucks and buses, power plants, industry and many other sources.
Lead	Destroys the brain and nervous system.	Some industrial facilities and from lead-based paint.

*** (Extracted from reference 11)**

1. 3 Local and regional pollution

Local and regional pollution takes place in the lowest layer of the atmosphere, which extends from the earth's surface to about 16 km. The troposphere is the region in which most weather occurs. If the load of pollutants added to the troposphere were equally distributed, the pollutants would be spread over vast areas and the air pollution might almost escape our notice. Pollution sources tend to be concentrated, however, especially in cities. In the weather phenomenon known as thermal inversion, a layer of cooler air is trapped near the ground by a layer of warmer air above. When this occurs, normal air mixing almost ceases and pollutants are trapped in the lower layer. Local topography, or the shape of the land, can worsen this effect an area ringed by mountains, for example, can become a pollution trap [12].

Smog is intense local pollution usually trapped by a thermal inversion. Before the age of the automobile, most smog came from burning coal and was so severe that in 19th-century. A good example for that was observed in England, where London, streetlights were turned on by noon because soot and smog darkened the midday sky. Burning gasoline in motor vehicles is the main source of smog in most regions today. Powered by sunlight, oxides of nitrogen and volatile organic compounds react in the atmosphere to produce photochemical smog. Smog contains ozone, a form of oxygen gas made up of molecules with three oxygen atoms rather than the normal two. Ozone in the lower atmosphere is a poison; it damages vegetation, kills trees, irritates lung tissues, and attacks rubber. Environmental officials measure ozone to determine the severity of smog. When the ozone level is high, other pollutants,

including carbon monoxide, are usually present at high levels as well.

In the presence of atmospheric moisture, sulfur dioxide and oxides of nitrogen turn into droplets of pure acid floating in smog. These airborne acids are bad for the lungs and attack anything made of limestone, marble, or metal. In cities around the world, smog acids are eroding precious artifacts, including the Parthenon temple in Athens, Greece, and the Taj Mahal in Agra, India. Oxides of nitrogen and sulfur dioxide pollute places far from the points where they are released into the air. Carried by winds in the troposphere, they can reach distant regions where they descend in acid form, usually as rain or snow. Such acid precipitation can burn the leaves of plants and make lakes too acidic to support fish and other living things. Because of acidification, sensitive species such as the popular brook trout can no longer survive in many lakes and streams in the eastern United States.

Smog spoils views and makes outdoor activity unpleasant. For the very young, the very old, and people who suffer from asthma or heart disease, the effects of smog are even worse: It may cause headaches or dizziness and can cause breathing difficulties. In extreme cases, smog can lead to mass illness and death, mainly from carbon monoxide poisoning. In 1952 in London over 3000 people died in one of the notorious smog events known as London Fogs; in 1962 another 700 Londoners died [12].

With stronger pollution controls and less reliance on coal for heat, today's chronic smog is rarely so obviously deadly. However, under adverse weather conditions, accidental releases of toxic substances can be equally disastrous. The worst such accident occurred in 1984 in India, when methyl iso-cyanate released from an

American-owned factory during a thermal inversion caused at least 3300 deaths [13].

1. 4 Global scale pollution

Air pollution can expand beyond a regional area to cause global effects. The stratosphere is the layer of the atmosphere between 16 km and 50 km above sea level. It is rich in ozone, the same molecule that acts as a pollutant when found at lower levels of the atmosphere in urban smog. Up at the stratospheric level, however, ozone forms a protective layer that serves a vital function: it absorbs the wavelength of solar radiation known as ultraviolet-B (UV-B). UV-B damages deoxyribonucleic acid (DNA), increasing the risk of such problems as cancer in humans [14]. Because of its protective function, the ozone layer is essential to life on earth.

1. 4. 1 Ozone depletion

Several pollutants attack the ozone layer. Chief among them is the class of chemicals known as chlorofluorocarbons (CFC_s), used as refrigerants (notably in air conditioners), as agents in several manufacturing processes, and formerly as propellants in spray cans. CFC molecules are virtually indestructible until they reach the stratosphere. Here, intense ultraviolet radiation breaks the CFC molecules apart, releasing the chlorine atoms they contain. These chlorine atoms begin reacting with ozone, breaking it down into ordinary oxygen molecules that do not absorb UV-B. The chlorine acts, as a catalyst that takes part in several chemical reactions, yet at the end emerges unchanged and able to react again. A single chlorine atom can destroy up to 100,000 ozone molecules in the stratosphere. Other pollutants, including nitrous oxide from

fertilizers and the pesticide methyl bromide, also attack atmospheric ozone.

Scientists are finding that under this assault the protective ozone layer in the stratosphere is thinning. In the Antarctic region, it vanishes almost entirely for a few weeks every year. Although CFCs use has been greatly reduced in recent years, CFCs molecules already released into the lower atmosphere will be making their way to the stratosphere for decades, and further ozone loss is expected. As a result, experts anticipate an increase in skin cancers, more cataracts (clouding of the lens of the eye), and reduced yields of some food crops [15].

1. 4. 2 Global warming

Humans are bringing about another global-scale change in the atmosphere: the increase in what are called greenhouse gases. Like glass in a greenhouse, these gases admit the sun's light but tend to reflect back downward the heat that is radiated from the ground below, trapping heat in the earth's atmosphere. This process is known as the greenhouse effect. Carbon dioxide is the most significant of these gases. At present, it is estimated that there is 25% more carbon dioxide in the atmosphere today than there was a century ago. This is the result of human burning coal and fuels derived from oil. Methane, nitrous oxide, and CFCs are greenhouse gases as well.

Scientists predict that increases in these gases in the atmosphere will make the earth a warmer place. They expect a global rise in average temperature somewhere between 1and 3.5°C in the next century. Most scientists are reluctant to say that global warming has actually begun because climate naturally varies from

year to year and decade to decade, and it takes many years of records to be sure of a fundamental change. There is little disagreement, though, that global warming is on its way.

Global warming will have different effects in different regions. A warmed world is expected to have more extreme weather, with more rain during wet periods, longer droughts and more powerful storms. Although the effects of future climate change are unknown, some predict that exaggerated weather conditions may translate into better agricultural yields in areas, where temperature and rainfall are expected to increase, while dramatic decreases in rainfall may lead to severe drought and plunging agricultural yields in other parts of the world.

Warmer temperatures are expected to partially melt the polar ice caps, which is expected to lead to project sea levels. A sea level rise would flood coastal cities, force people to abandon low-lying islands, and completely inundate coastal wetlands. Parasitic diseases such as malaria, which at present are primarily found in the tropics, may become more common in the regions between the tropics and the polar regions. For many of the world's plant species, and for animal species that are not easily able to shift their territories, as their habitat grows warmer, climate change may bring extinction [16].

1. 5 Indoor air pollution

Pollution is perhaps most harmful at an often unrecognized site inside the homes and buildings where people spend most of their time. Indoor pollutants include tobacco smoke; radon, an invisible radioactive gas that enters homes from the ground in some regions; and chemicals released from synthetic carpets and furniture,

pesticides, and household cleaners. When disturbed, asbestos, a nonflammable material once commonly used in insulation, sheds airborne fibers that can produce a lung disease called asbestosis.

Pollutants may accumulate to reach much higher levels than they do outside, where natural air currents disperse them. Indoor air levels of many pollutants may reach levels higher than outdoor levels. Such levels of indoor air pollutants are especially harmful because people spend most of their time living, working, and playing indoors. Inefficient or improperly vented heaters are particularly dangerous [1].

1.6 Pollution cleanups and prevention

1.6.1 Legislation acts and laws

In the United States, the serious effort against local and regional air pollution began with the Clean Air Act of 1970, which was amended several times later. This law requires that the air contain no more than specified levels of particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, ozone, and various toxic substances. To avoid the mere shifting of pollution from dirty areas to clean ones, stricter standards apply where the air is comparatively clean. In national parks, for instance, the air is supposed to remain as clean as it was when the law was passed. The act sets deadlines by which standards must be met. At present, environmental protection agencies are in charge of refining and enforcing these standards in many countries [17].

1. 6. 2 Standard methods for measurements of pollution

In an effort to enforce pollution standards, pollution control authorities measure both the amounts of pollutants present in the

atmosphere and the amounts entering it from certain sources. The usual approach is to sample the open, or ambient, air and test it for the presence of specified pollutants. The amount of each pollutant is counted in parts per million or, in some cases, milligrams or micrograms per cubic meter. To learn how much pollution is coming from specific sources, measurements are also taken at industrial smokestacks and automobile tailpipes.

Pollution is controlled in two ways: with end-of-the-pipe devices that capture pollutants already created, and by limiting the quantity of pollutants produced in the first place. End-of-the-pipe devices include catalytic converters in automobiles and various kinds of filters and scrubbers in industrial plants. In a catalytic converter, exhaust gases pass over small beads coated with metals that promote reactions changing harmful substances into less harmful ones. When end-of-the-pipe devices first began to be used, they dramatically reduced pollution at a relatively low cost. As air pollution standards become stricter, it becomes more and more expensive to further clean the air. In order to lower pollution overall, industrial polluters are sometimes allowed to make cooperative deals. For instance, a power company may fulfill its pollution control requirements by investing in pollution control at another plant or factory, where more effective pollution control can be accomplished at a lower cost.

End-of-the-pipe controls, however sophisticated, can only do so much. As pollution efforts evolve, keeping the air clean will depend much more on preventing pollution than on curing it. Gasoline, for instance, has been reformulated several times to achieve cleaner burning. Various manufacturing processes have been redesigned so that less waste is produced. Car manufacturers are experimenting

with automobiles that run on electricity or on cleaner-burning fuels. Buildings are being designed to take advantage of sun in winter and shade and breezes in summer to reduce the need for artificial heating and cooling, which are usually powered by the burning of fossil fuels [1].

1. 6. 3 Role of individuals in cleanup process

The choices people make in their daily lives can have a significant impact on the state of the air. Using public transportation instead of driving, for instance, reduces pollution by limiting the number of pollution-emitting automobiles on the road. During periods of particularly intense smog, pollution control authorities often urge people to avoid trips by car and encourage people to use public transportations such as buses and subways as the situation in England and France.

1. 6. 4 Control of indoor pollution

Indoor pollution control must be 'accomplished building-by-building or even room-by-room. Proper ventilation mimics natural outdoor air currents, reducing levels of indoor air pollutants by continually circulating fresh air. After improving ventilation, the most effective single step is probably banning smoking in public rooms. Where asbestos has been used in insulation, it can be removed or sealed behind sheathes so that it won't be shredded and get into the air. Sealing foundations and installing special pipes and pumps can prevent radon from seeping into buildings [1].

1. 6. 5 Global scale pollution control

On the global scale, pollution control standards are the result of complex negotiations among nations. Typically, developed countries, having already gone through a period of rapid (and dirty) industrialization, are ready to demand cleaner technologies. Less developed nations, hoping for rapid economic growth, are less enthusiastic about pollution controls. They seek lenient deadlines and financial help from developed countries to make the expensive changes necessary to reduce pollutant emissions in their industrial processes.

In 1992 the United Nations Framework Convention on Climate Change negotiated a treaty outlining cooperative efforts to curb global warming. The treaty has been legally accepted by 160 of the 165 participating countries [18]. This was also followed by several international accords by the USA and 24 other nations in 1968, in which they agreed on a Long-Range Trans-boundary Air Pollution Agreement to hold their production of nitrogen oxides [19]. Another protocol, Montreal Protocol, was adopted in 1987 and strengthened in 1990 and 1992 where most nations agreed to stop or reduce the manufacture of CFCs.

In December 1997 at the Third Conference of the United Nations Framework Convention on Climate Change in Japan, more than 160 nations formally adopted the Kyoto Protocol. This agreement calls for industrialized nations to reduce their emissions of greenhouse gases. The United States, which releases more greenhouse gases than any other nation, has traditionally been slow to support such strong measures.

All these anti-pollution measures have helped in decreasing of global pollution emission levels as reported by several countries. At

present, air pollution control is a race between the reduction of pollution from each source, such as a factory or a car, and the rapid multiplication of sources.

1. 7 Air pollution and its effect on upper and lower respiratory symptoms and asthma

Over the past decade there has been a renaissance in studies of air pollution. This renewed interest has been driven partly by the development of more sensitive techniques to analyze time-series data, which have shown that there are still clear adverse effects on mortality rates from current levels of air pollution. These effects are seen largely in elderly people and are related to cardiovascular and respiratory causes of death.

Several epidemiological studies have described the adverse effects of ambient air pollution on respiratory health in children [20-24]. Most of these studies have focused on children with chronic respiratory symptoms. These children are judged to be the most vulnerable to the effects of air pollution. However, respiratory symptoms are an outcome of underlying processes. There is evidence that allergy plays an important part in the onset of respiratory symptoms in children. Therefore, allergy may be an important factor in assessment of whether a child will be susceptible to air pollution.

Bronchial hyper-responsiveness (BHR) is also associated with the development of respiratory symptoms in children. Population studies have shown a strong relation between raised serum concentrations of total IgE and the presence of BHR [25-27]. Children with BHR and raised serum concentration of total IgE may be vulnerable to the effects of air pollution, but they are not necessarily

identified as such because they do not present themselves (yet) with chronic respiratory symptoms.

In a study conducted on children it was found that children with BHR and relatively high concentrations of serum total IgE are susceptible to air pollution [25]. This susceptibility is expressed as an acute and sub-acute effect of increased amounts of air pollution on the prevalence of lower respiratory symptoms. It was also found that trends towards an acute and sub-acute effect of air pollution on the prevalence of evening decrease in peak expiratory flow of 10% or more, and acute effects of air pollution on the prevalence of upper respiratory symptoms.

Dockery and Popel[20] analyzed the combined data of several epidemiological studies of children in the USA and Netherlands. They estimated a mean increase of 3% in the prevalence of lower respiratory symptoms with each 10 mg/m3 increase in daily mean concentrations of airborne particulate matter, and a 0.7% increase in the prevalence of upper respiratory symptoms for each 10 mg/m3 increase in airborne particulate matter smaller than 10mm.

The effect of several types of single air pollutants on respiratory health usually does not take into account that air pollution is in fact a mixture of air pollutants, which may interact and modify each other effects on respiratory health. Therefore, investigation of the effect of single air pollutants on respiratory health should be carefully planed.

Another study conducted by John Hart [28] using single pollutant comparing the effects of air pollution in children with BHR and relatively high serum concentrations of total IgE with the effects of air pollution in a control group showed that the effects of air pollution on the group of children with BHR and relatively high

serum total IgE were comparable with those previously described in children with chronic respiratory symptoms [20, 21]. Thus, it is recommended to include BHR and high serum concentrations of total IgE by public health-improvement strategies. Medical characterization of subgroups of study populations seems worthwhile in future research into air pollution.

1. 8 Israeli industry and environmental pollution in the West Bank of Palestine

The Palestinian environment and its natural resources have been under human pressure since the Israeli occupation of 1967. The division of the West Bank into areas A (complete Palestinian authority), B (joint Palestinian and Israeli authority) and C (complete Israeli authority) is making environmental conditions more severe as the potential for environmental protection is diminished. Along with the continued land confiscation, settlement expansion and movement restrictions of Palestinians, Israel is also polluting the West Bank and its natural resources through dumping the liquid and solid waste generated from Israeli settlements and its industrial zones built adjacent to the land of the West Bank. Moreover, illegal transfer of toxic waste generated inside Israel into the West Bank is further complication to this issue, evidence for this came from the findings of two dumping sites. The first location is near the south eastern border of the Tulkarm Municipality, an area classified as C and is planted with citrus trees, various irrigated vegetable crops and includes two groundwater wells. The second dumping site is located in close proximity to the residential area of A'zoun Municipality and 50 meters from the drinking groundwater well of the town.

Analysis of collected samples from the dumping sites revealed the following contents:

Liquid organic peroxide, Asbestos fibers, Various antibiotics, Organo Phosphorous materials, Hydrophic (lenses washing material), Organic Peroxide, Polyethylene and Polypropylene resins, Sabion (a trade name of pesticide that is classified within the Carbamate Family), Victin (under trade name of Cartomer) organo phosphate group, Activated Carbon (it is estimated from the size of the particles that the activated carbon particles are used to adsorb high toxic materials, Fused Aluminum Silicate, Methomyl (Crushed Crystalline material), Butyl-Butyl-Lurel-Lactice (Saponification and preservative Agent), Potassium Complex (Green Dye), Phthalic Anhydride Solid-Fired resin: A very complex polymer, Asphalt, and other Pigmented materials.

The illegal transfer and dumping of such toxic and hazardous waste to the Palestinian areas was and still the practice of the Israeli's and is considered as an environmental and health crime against the Palestinian community and its natural resources[29]. One should add in this respect that such practice will be reflected on the Israeli's themselves as they share with the Palestinians the main major groundwater sources (the Western Basin Aquifer with an estimated annual safe yield of 380 MCM).

1. 9 Tulkarm district and pollution

In almost all-Palestinian districts, urban air pollution is worsening. Rapidly growing cities, more traffic on roads, use of dirty fuels, reliance on outdated industrial processes, growing energy consumption, increasing the number of quarries and stone-cutting factories and lack of industrial zoning and environmental regulations

next to residential areas west of Tulkarem city. The creation of this zone worsens the situation in the area and the current study aimed to evaluate its impact on human health (see Appendix II).

1.10 Study Objectives:

The aim of the present study is:

1- To asses the possible hazardous of Israeli industrial zone on human health in target area

2- To shed light on major causes of disease borne due to air pollution on the target zone in comparison to control area zone.

The approach to assess the situation was through the study of the most exposed population versus the control population. To do so a specially designed questionnaire was prepared (see appendix I).

2. 1 Study population

The study included 250 families residing in a heavily affected area in the west of Tulkarm and 200 families residing within Tulkarem district (Shweekeh, around 3km away from pollution site and dose not host any polluted industry,see Appendix III). Data regarding personnel heath were collected, by the employees of the Ministry of Environmental Affairs (Tulkarem District), using a specially designed questionnair.

2. 2 Statistical analysis

Collected data were analyzed using the SPSS (Statistical Package for Social Studies). Frequencies, k^2 and Peareid's samples (T test) were calculated and a comparison was made between study population and the control group. Data were represented in tables and illustrated when necessary in diagrammatic form.

Data presented in Table 1 shows sample distribution according to family size in both study and control groups. This distribution pattern is in agreement with published data by the Palestinian Bureau of Statistics in 1996 were more than 70% of the population with 9 individuals or more.

Table 1. Distribution of study and control groups according to family size

Family Size	No. and Frequency Study sample	No. and Frequency Control group
3.00	96 (12.8%)	36 (1.80%)
4.00	24 (2.40%)	48 (2.50%)
5.00	10 (0.80%)	80 (4.20%)
6.00	30 (2.00%)	48 (2.50%)
7.00	42 (2.40%)	28 (1.50%)
8.00	88 (4.40%)	80 (4.20%)
9.00	234 (10.4%)	144 (7.6%)
10.0	630 (25.2%)	560 (29.6%)
11.0	165 (6.00%)	132 (7.00%)
13.0	312 (9.60%)	208 (11.0%)
14.0	840 (24.0%)	532 (28.1%)
Total	2471(100%)	1896(100%)

Data presented in table 2 shows the percentages and frequencies of various disease symptoms among males and females of both study and control groups. Out of 2471 studied cases, 188 (7.6%), 105 (4.2%) and 84 (3.5%) were represented with respiratory, skin and eye disease related symptoms, respectively. In comparison out of 1896 cases of controle group, 46 (2.4%), 78 (4%) and 66 (3.5%) were represented with respiratory, skin and eye disease related symptoms, respectively. Data presented in the same table showes that females were represented with a highe frequency regarding respiratoty related disease symptoms (63.8%) compared to males (36.2%) among the study group, on the other hand females were also represented with a much higher ferequency (83%) compared to

males (17%) among the control group. With respect to skin related disease symptoms, among the study group, males showed a highier frequency (62%) compred to females (38%). Similar frequencies were also observed among the control group (64% males to 36% in females). Eye related disease symptoms were represented by (44% and 56%) and (39% and 61%) for males and females among the study and control groups, respectively.

Table 2. Number and percentage of individuals suffering from respiratory disease related symptoms according to sex among the study and control groups.

Group		Respiratory Related No. (%)	Skin Related No. (%)	Eyes Related No. (%)
Study Sample	Males	68(36.2%)	65 (62%)	37 (44%)
	Females	120(63.8%)	40 (38%)	47 (56%)
	Total	188 (100%)	105 (100%)	84 (100%)
	% of total (2471)	7.6 %	4.2%	3.5%
Control Sample	Males	08 (17%)	50 (64%)	26 (39%)
	Females	38 (83%)	28(36%)	40 (61%)
	Total	46 (100%)	78 (100%)	66 (100%)
	% of total (1894)	2.4%	4.0%	3.5%

Data presented in tables 3, 4 and 5 clearly shows that variations in respiratory related symptoms between study and control groups were statistically significant (P= 0.002). On the other hand, variations with respect to skin related disease symptoms between the two groups were also significant (P= 0.04), however, eye related disease symptoms were of no significant values (P = 0.15).

Table 3. Paired's T test for respiratory related disease symptoms among study and control groups

Study Group		Control Group		T value	Sig.
Means	St.Deviation	Means	St.Deviation		
0.725	0.447	0.230	0.421	13.96	.002

Table 4. Paired's T test for skin related disease symptoms among study and control groups

Study Group		Control Group		T value	Sig.
Means	St.Deviation	Means	St.Deviation		
0.410	0.493	0.390	0.489	- 2.015	.045

Table 5. Paired's T test for eye related disease symptoms among study and control groups

Study Group		Control Group		T value	Sig.
Means	St.Deviation	Means	St.Deviation		
0.340	0.474	0.330	0.471	1.418	.158

Data presented in table 6 represent the association between disease related symptoms and age groups in both studied groups. Respiratory related disease symptoms, among study group, were most prevalent among the elder age groups < 41(67%), and followed by the age group 0-10 which was represented by 22.9%. This finding corrolates well with the findings regarding the prevalence of respiratory disease related symptos among the control group.

Both skin and eye related disease symptoms were prevalent among the middle age groups and corrolates well in both the study and control groups.

Table 6. Association between disease related symptoms and age groups among the study and control groups.

Age Group	Disease Related Symptoms					
	Study Group			Control Group		
	Respiratory No.(%)	Skin No.(%)	Eyes No.(%)	Respiratory No.(%)	Skin No.(%)	Eyes No.(%)
0 –10	43(22.9%)	11(10.5%)	6(7.00%)	8(17.4%)	8 (10.2%)	2(3.00%)
11-20	13(6.92%)	9(8.60%)	2(2.40%)	4(8.70%)	6 (7.70%)	2(3.00%)
21-30	06(3.20%)	32(30.5%)	9(10.7%)	5(11.0%)	24(30.8%)	8(12.0%)
31-40	00(0.00%)	21(20.0%)	38(45.3%)	3(6.50%)	14(18.0%)	30(45.7%)
41-50	72(38.3%)	22(21.0%)	26(31.0%)	18(39.0%)	16(20.5%)	22(33.3%)
< 51	54(28.7%)	10(9.40%)	3(3.60%)	8(17.4%)	10(12.8%)	2(3.00%)
Total	188(100%)	105(100)%	84(100%)	46(100%)	78(100)%	66(100%)

Data presnted in table 7 shows frequencies and percentages regarding the place of residence specifications for both study and control groups. Based on the answers of the questionear, it was clear that the control group is living in a much better environmental conditions with respect to ventilation, size and garden facilities.

Table 7. Specifications of the place of residence in both studied groups

Group	Smell			Smoke			Smoke intensity			Use of Roof			Usage purposes		Spots on Cloths			Spot Color		
	Yes	No	Some times	Yes	No	Some times	Heavy	Intermediate	Light	Yes	No	Some times	Sleep	Cloth drying	Yes	No	Some times	Yellow	Brown	Other
Study	197 78.7%	50 20%	3 1.2%	101 40.4%	143 50.2%	6 2.4%	36 33.6%	47 44%	24 22.4%	13.2 52.8 %	112 44.8%	6 2.4%	21 15.9%	111 84.1%	116 46.4 %	110 44%	24 9.6%	41 29.2%	99 70.8%	- -
Control	38 19%	162 81%	- -	28 14%	172 86%	- -	8 28.5%	4 14%	16 57.5%	156 78%	42 21%	2 1%	28 18%	128 82%	18 9%	162 81%	20 10%	4 10.5%	34 89.5%	-

Based on collected data in the same table, the frequencies of 79.9%, 42.8% and 56% were reported for smell, smoke and the presence of colored spots on cloths, respectively, by families within the affected areas. This is much highier than what was reported by the families of the control group as the frequencies were 19%, 14% and 19% for smell, smoke and presence of spots, respectively. With respect to the color of the spots, the most prominent color was reported to be yellowish and the frequencies of 39.6% and 17% were reported by the study and control groups, respectively. The use of house roof was reported by 55.2% and 79% of the study and control groups, respectively. The use of the roof for the purpose of cloth drying was common in both groups and was represented by 84.1% and 82% for the study and control groups, respectively. The use of the roof for sleeping purposes was reported by 15.9% and 18% by the study and control groups, respectively.

Table 8 shows the frequencies and percentages of symptoms related to respiratory tract in both groups. Difficulties in breathing, asthema, throught infections and nasal obstriction, were represented by 67.5%, 61%, 42.5% and 63.8%, respectively. Out of 188 subjects suffering from respiratory related disease symptoms, (104) 55.3% were reported to visit their physicians and medications were perscribed for 90% of them. In comparison, the percentages of 54%, 34.7%, 58.6% and 56.5%, were reported by the control group for difficulties in breathing, asthema, throught infections and nasal obstriction, respectively. Out of 46 subjects reported to suffer from respiratory disease related symptoms, (15) 32% were reported to visit their physicians and medications were perscribed for 80% of them.

Table 8. Percentages and frequencies of respiratory disease related symptoms among the studied groups

Respiratory Symptoms	Study Group		Control Group	
	Yes (No. &%)	No (No. &%)	Yes (No. &%)	No (No. &%)
Difficulty in Breathing	127 67.5%	61 33.5%	25 54%	21 46%
Asthmas	115 61%	65 39%	16 34.7%	30 65.3%
Throat Infection	80 42.5%	108 67.5%	27 58.6%	19 41.4%
Nasal & Sinuses Infection	120 63.8%	68 36.2%	26 56.5%	20 43.5%
Clinic Visit	104 55.3%	84 44.7%	15 32%	31 68%
Drug Prescription	94 90%	10 10%	12 80%	3 20%

Data presented in table 9 shows the frequencies and percentages of symptoms related to skin disease in both groups. Presence of pimples or rash and itching were represented by 100% and 37%, respectively. Out of 105 subjects suffering from skin related disease symptoms, (81) 77% were reported to visit their physicians and medications were perscribed for 86% of them. In comparison, the percentages of 46% and 27% were reported by the control group for the presence of pimples or rash and itching, respectively. Out of 78 subjects reported to suffer from skin disease related symptoms, (53) 67.9% were reported to visit their physicians and medications were perscribed for 73% of them.

Table 9. Percentages and frequencies of skin disease related symptoms among the studied groups

Skin Related Symptoms	Study Group		Control Group	
	Yes (No. & %)	No (No. & %)	Yes (No. & %)	No (No. & %)
Pimples	105 100%	---	36 46%	42 54%
Itching	39 37%	66 63%	21 27%	57 73%
Clinic Visit	81 77%	24 23%	53 67.9%	35 34.1%
Drug Prescription	70 86%	11 14%	38 71.7%	15 28.35%

Data presented in table 10 shows the frequencies and percentages of symptoms related to eye disease in both groups. Infections, inflamation and itching were represented by 83% and 71%, respectively. Out of 84 subjects suffering from eye related disease symptoms, (60) 71% were reported to visit their physicians and medications were perscribed for 88% of them. In comparison, the percentages of 75% and 60.6% were reported by the control group for eye infection and eye inflamation and itching, respectively. Out of 66 subjects reported to suffer from eye disease related symptoms, (58) 87.8% were reported to visit their physicians and medications were perscribed for 87.9% of them.

Table 10. Percentages and frequencies of eye disease related symptoms among the studied groups

Eye related Symptoms	Study Group		Control Group	
	Yes	No	Yes	No
Infection	70 %83	14 %17	50 %75	16 %25
Inflamation and Itching	60 %71	24 %29	40 %60.6	26 %39.4
Clinic Visit	60 %71	24 %29	58 %87.8	8 %12.2
Drug Prescription	53 %88	7 %12	51 %87.9	7 %12.1

Data presented in table 11 shows the association between the presence smoke in affected families and disease related symptoms. Out of 188 affected families, of the study group, suffereing from respiratory disease symptoms, 69 (36.7%) were reported to observe smoke, while out of 46 affected families of the control group 10 (21.7%) were reported to observe the somke in their residential areas. With respect to skin related symptoms, out of 105 affected families, of the study group, 44(42%) were reported to observe smoke, while out of 78 affected families of the control group 10 (12.8%) were reported to observe the somke in their residential areas. On the other hand, out of 84 families with eye related disease symptoms, 56(66.6%) were reported to observe the smoke compared to 12(18%) out of 66 families of affected individuals of the control group.

Table 11. Cross tabulation between disease related symptoms and the presence of smoke in the residential areas of the studied groups

Disease Symptoms	Group	Presence of Smoke		K^2	*P* value
		Yes	No		
Respiratory	Study	69 36.7%	119 63.3%	25.6	0.000
	Control	10 21.7%	36 78.3%	17.59	0.000
Skin	Study	44 42%	61 58%	4.47	0.107
	Control	10 12.8%	68 87.2%	28.5	0.000
Eye	Study	56 66.6%	28 33.4%	37.23	0.000
	Control	12 18%	54 82%	24.04	0.000

Variations between those who observed the smoke in their residential areas and those who did not were significant (P= 0.000) and were in favor of those who did not. This was also the situation among the control group. Variations with respect to eye related disease symptoms were also statistically significant and were in favor those who did not observe the smoke in their residential areas

in both the study and control groups. However, such variations were of no significance with respect of skin related disease symptoms.

Data regarding previous history of disease (respiratory, skin and eye) strongly indicates that most of the study group families have no previous history and the percentages of 13.6, 8 and 17.1% were reported for those with previous history regarding respiratory, skin and eye, respectively (data not shown).

Data presented in table 12 shows the association between smoke intensity and disease related symptoms, among those who observe the smoke of the affected families. Out of 69 affected families, of the study group, suffereing from respiratory disease symptoms, 18 (26%), 27(39.5%) and 24 (34.5%) were reported to observe heavy smoke, intermediate and smoke of light intensity, respectively. while out of 10 affected families of the control group 2(25%), 2(25%) and 6(50%) were reported to observe heavy smoke, intermediate and smoke of light intensity, respectively.

With respect to skin related symptoms, out of 44 affected families who observe smoke, of the study group, 18(41%) and 26(59%) were reported to observe heavy smoke and smoke of intermediate intensity, respectively. On the other hand, out of 10 affected families of the control group 2(25%), 2(25%) and 6(50%) were reported to observe heavy smoke, intermediate smoke and somke of light intensity in their residential areas.

Furthermore, out of 56 families with eye related disease symptoms, 28(50%) and 28(50%) were reported to observe heavy smoke and smoke with intermediate intensity, respectively. The control group (12 families), were represented by 4(33.4%),

2(16.6%) and 6(50%) for those who observe heavy smoke, intermediate smoke and smoke of light intensity, respectively.

Variations between those who observe heavy smoke, intermediate and smoke of light intensity in their residential areas and the occurrence of disease symptoms were significant (P= 0.000) for all studied disease symptoms. These differences were in favor of those who observed smoke with intermediate intensity. There were no significant variations among the control group.

Table 12. Cross tabulation between disease related symptoms and smoke intensity in residential areas of the studied groups

Disease related symptoms	Group	Dense	Intermediate	Light	K^2	P value
Respiratory	Study	18 26%	27 39.5%	24 34.5%	33.04	0.000
	Control	2 25%	2 25%	6 50%	7.48	0.058
Skin	Study	18 41%	26 59%	-	21.7	000
	Control	2 25%	2 25%	6 50%	1.13	0.77
Eye	Study	28 50%	28 50%	-	70.4	0.000
	Control	4 33.4%	2 16.6%	6 50%	4.94	0.000

For the past fifty years, air quality has been studied at work, in the ambient air of urban and industrial areas, and in various indoor environments without occupational exposure. Methods for sampling and measuring air pollutants have been introduced or developed and verified. The behavior and the fate of air pollutants in the environment have also been investigated. Since the primary goal of the studies was to assess the extent of human exposure to air pollutants, the data were used to calculate the risk for various population groups. Residence location has long been used to indicate environmental exposure in many epidemiological studies. This indicator is easy to establish, requires little exposure or monitoring data, and is potentially applicable to many types of investigations. The validity, accuracy and utility of residence location as an exposure indicator, however, is challenged by current concerns regarding multiple exposure pathways, persistent and toxic contaminants, and cumulative exposures from non-point, mobile and point sources.

Looking at the data presented in table 1 one can easily figure out that over 80% of the Palestinian families are considered as large families. Such situation is expected to influence the hygienic conditions in general and thus, indirectly affects human health.

The finding of 188 (7.6%), 105(4.2%) and 84(3.5%) out of 2471 studied cases suffering from respiratory, skin and eye disease related symptoms, respectively, is an alarming number compared to what was found among the control group (2.4% respiratory, 4% skin and 3.5% eye) specially for respiratory related disease symptoms. Variations between the study and control groups with respect to respiratory related symptoms were statistically significant and in favor of the study group (see table 4). We also find that females, in both the control and study

groups, were represented with a much higher frequency for respiratory disease related symptoms compared to males (see table 2). This may be explained by the fact that females spent more time indoor compared to males, who usually spend more time out of their residentially contaminated environment at work, and thus are less exposed to air pollution. Another fact that may be in favor of males is their physiological nature, as they seem to be less susceptible to disease [30].

Our data with respect to the association between respiratory disease and air pollution is in agreement with several reports that provided evidence on people living in areas with high levels of pollution. Such people seem to have more respiratory disease related symptoms and worse lung function than those living in areas with clean air [31-34].

With respect to skin related symptoms, slight differences were observed between males and females. These differences were in favor of females. Outdoor exposure to sunlight and social and traditional behavior concerning the way men and women dress may account for such variations.

Males were also represented by a higher frequency regarding eye-related symptoms in both groups. This again might be due to the fact men are more exposed to outdoor pollution and particulate matter pollutants, which in general play an important role in eye disease.

Data presented in table 6 shows that age groups 0-10, 41-50 and <50 were the most affected groups with respiratory disease related symptoms and constitute around 90% of the affected individuals. This is an expected observation as children are especially vulnerable to the effects of ozone and other pollutants. Except for the very young, they typically spend more time outdoors than do adults, especially during

the summer when ozone levels are the highest. Children also spend more time in vigorous activity, which results in more outside air being taken into their lungs. Their activity, combined with the higher breathing rate of children relative to their body weight and lung surface area, results in a greater dose of pollutant delivered to their lungs. Children are also sensitive to particulate matter, which may cause respiratory disease and complicate asthma. Particulate matter is inhaled and the particles accumulate in the respiratory system. Exposure to coarse particles is primarily associated with the complication of respiratory conditions, such as asthma [32, 35, 36].

Neuralgic dysfunctions resulting from carbon monoxide poisoning such as visual impairment, poor learning ability, reduced work capacity, and difficulty in performing complex tasks were reported in association with exposure to high CO levels among children [37]. A study conducted between 1980 and 1989 by Goren and Hellmann [38] showed that school children, exposed to air pollution, have a significant increase in the prevalence of asthma. At the same time a significant rise in the prevalence of wheezing accompanied by shortness of breath were reported.

Lead and other heavy metal contaminants are also considered as a serious health problem among children even at very low doses, as it is associated with IQ deficiencies, reading and learning disabilities, impaired hearing, reduced attention spans, hyperactivity, and antisocial behavior. In metal-contaminated areas, the transport of heavy metals into the home from external sources and their subsequent re-suspension into the air due to normal household activities are significant factors in the exposure to heavy metals, whereas in unpolluted areas indoor sources play the major role [39]. Lead is usually stored in blood, bones,

and soft tissues, and can hurt kidneys, liver and the nervous system. Excessive exposure can cause seizures, mental retardation, and behavioral problems and thus is considered to be very dangerous.

We do believe that lead is a major air pollutant in the study area as the Israeli industrial zone is involved paint production in addition to melting of painted materials used for filtration in agriculture. Thus, lead may account for the finding of high prevalence of respiratory related disease symptoms among younger age groups. Previous studies on the effect of various pollutants emphasize the need of further investigation to measure the effect of air pollution on the nervous system as well as other systems [33].

With respect to the elder age groups, our data is also in agreement with previous studies. The finding of high prevalence rates of respiratory related disorders in our study could be attributed to longer exposure time to pollutants and advanced aging is considered as a period of enhanced vulnerability to the toxic effects [33]. In adults, accumulation of pollutants such as lead seems to exhibit similar deficits in learning and memory as the case in children. In Germany, a large study documented an age-related decline in bone lead concentrations with advancing age. This effect was more pronounced in women than in men, reflecting post-menopausal processes in women, which contribute to bone re-sorption and the release of lead back into the bloodstream. These results mean that lead exposure is actually increased during a period of already heightened susceptibility due to concurrent degeneration of other physiological functions, including both CNS and renal functions [33].

It is also suggested that mortality among adults, is particularly high in lower socioeconomic groups who are exposed to higher levels of air

pollution and have poorer access to early and effective medical care. Air-borne particulates seem to be major factor in the increasing morbidity from asthma [33].

With respect to place of residence specifications, one can easily deduce that the control group, a rural residential area, are living in a better hygienic conditions which could explain the observed variations in prevalence rates of disease related symptoms, in general, compared to the study group. Our findings with respect to house specifications were expected as city living conditions are usually worse than that of the rural areas as cities are more crowded and air pollutants are more abundant and this can be reflected from the larger number of vehicles and small industries within cities boundaries [33].

The smell of the air, intensity of smoke and the appearance of colored brownish spots are distinguishing features of air contamination in the residential area of the study group. Based on data presented in the questionnaire, one can deduce that episodes of a high level of air contamination occur in that area adjacent to the Israeli industrial zone. It was also difficult to judge the situation on the basis of human judgment and not on scientifically designed experimental work. To be specific, measurements of several expected contaminants are required. To do this monitoring stations are needed and this requires the collaborative work of both governmental and research institutes. However, one might suggest that nitrogen dioxides (NO_x), like nitrogen dioxide (NO_2) and nitric oxide (NO) were major contaminants as reflected by the presence of a reddish brown spots on clothing. Such oxides were reported to produce changes in airway responsiveness; aggravation of existing cardiovascular disease, temporary breathing problems, increased susceptibility to respiratory infection and may

cause alteration in the lungs [33, 40].

Statistical analysis shows a strong association between the presence and intensity of smoke and the appearance of respiratory disease related symptoms as shown in tables 9 and 10. Such finding is in support with previous findings on the variations in the prevalence rates of respiratory related disease symptoms in both the study group and the control and emphasizes the hazardious role played by the Israeli industrial zones adjacent to Palestinian resedential areas.

The findings on disease symptoms (see table 11) strongly reflect the association of these factors with air pollution (study versus control). Our finding on asthema cases (61% of respiratory diseased related symptoms) strongly indicates the association with air pollution with this disease and is inconsistant with previous reports in this respect [34, 38, 41, 42] and we would like to add that all asthema cases were confirmed by the medical reports of the concerned cases. Such observation need more detailed attention intrest in future studies.

The need of medical intervention through drug prescribtion for 90% of the cases (study group) who visted either private or public clinics is another evidence in support of the seriousness of the effect of air pollution on human health. Differences in the prevalence rates of the other symptoms between the study and the control groups were also in support of this assumption.

Our findings on the prevalence rates of skin and eye disease related symptoms (tables 12 and 13), between the study and control groups, indicate a week association between the skin and eye disease related symptoms and air pollution. Such finding in consistant with the physiological fuctions played by these organs compared to the lung.

In general, comprehensive and systematic approaches to identify

and estimate population exposures were not used, and the exposure estimates were therefore deemed likely to have great uncertainty. Unless exposure levels among groups are verified, it cannot be determined whether nonsignificant associations between exposures and health endpoints indicate a lack of measurable health effects, or are merely a result of exposure misclassification. Site-specific and quantitative exposure assessments are needed to better quantify and confirm exposures within such studies, as well as to permit interpretations and comparisons across studies.

Recommendations and concluding remarks

1. It is essential that the Palestinian as well as the international community should force the Israeli government to comply to the international laws concerning both regional and global pollution.
2. Further investigation and follow up studies on affected population seems to be essential at this stage
3. The need of medical intervention, diagnosis, treatment is deemed necessarily to the affected area.
4. Air quality modeling, assessment and planning; development of standards, economic measures and regulations; public education, health promotion and information should be a priority for the Palestinian Ministry of Environment.
5. Encourage industries ready to grasp the challenge and willing to make the changes needed to improve the quality of the environment
6. In the absence of a national air quality objective for fine particulates and other pollutants in Palestine, it seems essential at this stage to plan and follow up strategies based on international recommendations in this field.

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بسم الله الرحمن الرحيم

أخي المواطن :-

يقوم الباحث بإجراء دراسة حول اثر المنطقة الصناعية الإسرائيلية والمقامة على الشريط الحـــدودي المحـــاذي لمدينـــة طولكرم غربا على صحة الإنسان وبيئته ، ولتحقيق هدف الدراسة يرجى المساعدة في تعبئة الاستبانة وذلك من اجـــل الحصول على درجة الماجستير في العلوم البيئية ، علما بأن المعلومات الواردة في الاستبانة لن تســـتخدم إلا لأغـــراض البحث العلمي فقط .

الباحث :

كلية الدراسات العليا

جامعة النجاح الوطنية

رقم العائلة :_____

المكانة	العمر	طبيعة العمل	مكان العمل
الأب			
الأم			
الذكور			
الإناث			

- طبيعة المسكن :-

طبيعة المسكن	الحجم	التهوية	الارتفاع	وجود حديقة
شقة				
بيت مستقل				

- ملاحظات حول بيئة المسكن :-

> هل يوجد رائحة ؟

نعم ؟ لا ؟ أحيانا ؟

> هل يوجد دخان ؟

نعم ؟ لا ؟ أحيانا ؟

> إذا كانت نعم ؟

كثيف ؟ متوسط ؟ خفيف ؟

> هل تستعمل سطح المنزل ؟

نعم ؟ لا ؟ أحيانا ؟

> إذا كان نعم ؟

للنوم ؟ لتجفيف الملابس ؟

> هل يوجد بقع على الملابس ؟

نعم ؟ لا ؟ أحيانا ؟

> ألوان البقع إن وجدت ؟

اسود ؟ اصفر ؟ غير ذلك ؟

- الأشخاص الذين يعانون من آثار التلوث

نوع المرض	الجنس	العمر	الاعراض	نعم	لا
أمراض صدرية	ذكر		هل يوجد صعوبة في التنفس ؟		
	أنثى		هل يود ازمة ؟		
			هل عانيت من تقرحات ؟		
			هل عانيت من التهابات الجيوب الانفية ؟		
			هل استدعى الامر زيارة الطبيب؟		
			هل استدعى الامر زيارة الطبيب ؟		
			هل وصف الدواء ؟		
أمراض جلدية	ذكر		هل يوجد بثرات او حبوب ؟		
	أنثى		هل يوجد حكة او احمرار في الجلد ؟		
			هل استدعى الامر زيارة الطبيب ؟		
			هل وصف الدواء ؟		
			غير ذلك ؟		

أمراض في العيون	ذكر		هل يوجد التهابات في العين وتقرحات ؟		
	انثى		هل يوجد احمرار في العين او حكة ؟		
			هل استدعى الامر زيارة الطبيب ؟		
			هل وصف الدواء ؟		
			غير ذلك ؟		

- هل يوجد تاريخ إصابة سابق لدى أفراد العائلة

المرض	نعم	لا
أمراض صدرية		
أمراض جلدية		
امراض العيون		

الملخص

لقد شملت هذه الدراسة على 2471 شخص (251 عائلة) من المقيمين في الجهة الغربية من مدينة طولكرم وشملت كذلك 1896 شخص وينتمون الى (200 عائلة) ومن المقيمين في ضواحي مدينة طولكرم بهدف تقييم مدى تأثير التلوث الهوائي والناتج عن الصناعات الإسرائيلية في المنطقة الصناعية المحاذية لحدود مدينة طولكرم الغربية على صحة الإنسان .

في استبانه تناولت الأعراض المرضية المزامنة لكل من الجهاز التنفسي والجلد والعيون لدى العينة الدراسية تبين أن (7.6 %) من الأشخاص يعانون من أعراض مرضية مرتبطة بالجهاز التنفسي في حين كانت نسبة الإصابات بأعراض مرضية مرتبطة بكل من الجلد والعيون هي (4.2%)،و(3.5%) على التوالي. وبالمقارنة كانت نسبة الأعراض المرضية المرتبطة بالجهاز التنفسي والجلد والعيون لدى الفئة الضابطة هي (2.4%)، و(4%)، و (3.5%) على التوالي.

إن الفروق في النسب المتعلقة بالأعراض المرضية السابقة الذكر هي فروق ذات قيم دالة إحصائية وخاصة فيما يتعلق في أعراض الجهاز التنفسي حيث كانت نسبة P=0.002.

أما فيما يتعلق بالفروقات المرتبطة بالجنس والمرتبطة بالأعراض المتزامنة بالجهاز التنفسي فكانت نسبة الإصابة لدى الإناث أعلى منها عند الذكور لدى كل من عينة الدراسة والعينة الضابطة، في حين كانت الفروق لصالح الذكور فيما يتعلق بالأعراض المتزامنة مع الجلد، وقد لوحظت كذلك فروقات لصالح الإناث فيما يتعلق بالأعراض المرضية المرتبطة بالعيون، وكانت الفئة العمرية (0–10)، و (11–20) وكذلك الفئة العمرية (41–50) وأكثر من 50 هي اكثر الفئات التي أبدت أعراض مرضية بالجهاز التنفسي حيث شكلت الفئات العمرية الصغيرة(30%) من حالات الإصابة وتمثلت الفئات العمرية الكبرى (67%) من حالات الإصابة .

وفيما يتعلق بالأعراض المرضية المرتبطة بالجلد فكانت النتائج مشابهة لما هو الحال بالنسبة للأعراض التنفسية في حين كانت الأعراض المتعلقة بالعيون اكثر تكرارا لدى فئات العمرية المتوسطة (201 فأعلى) وكانت التكرارات لبعض الأعراض التنفسية على النحو التالي :-

(50.8%) صعوبات بالتنفس، و (46%)أعراض أزمة، و (32%) التهابات بالحلق، و(48%) انسدادات في الجهاز التنفسي.

وتشير الدراسة كذلك الى أن(55%) من الحالات التي كانت تعاني من أعراض مرضية متعلقة بالجهاز التنفسي قد اضطروا الى زيارة العيادات الطبية وان (90%) منهم وصفت لهم أدوية وعقاقير طبية ولوحظ كذلك وجود نسب مشابهة لدى أفراد العينة الضابطة ، أما فيما يتعلق بالأعراض الجلدية والتي شملت وجود البثرات، والحكة فكانت تكراراتها (100%)، و (37%) على التوالي في عينة الدراسة وتبين كذلك أن (77%) من اصل (105) أشخاص مصابين بمثل هذه الأعراض قد زاروا عيادات طبية وان (86%) منهم وصفت لهم أدوية وعقاقير لمعالجة هذه الأعراض وكانت نتائج العينة الضابطة شبيهة لما هو عليه الوضع في عينة الدراسة، أما الأعراض المرتبطة بالعيون فشملت الالتهابات والاحمرار والحكة فتمثلت بـ(83%)، و(71%) على التوالي في عينة الدراسة ومن بين (84) شخص ممن يعانون بأعراض مرتبطة بأمراض العيون فإن (71%) منهم اضطروا لزيارة العيادات الطبية ووصف العلاج لـ(88%) منهم.

إن العلاقة ما بين وجود الدخان وكثافته وظهور الأعراض المرضية كانت واضحة من خلال وجود حوالي (37%)، و (42%)، و(67%) من العائلات التي تعاني من أعراض مرتبطة بالجهاز التنفسي والجلد والعيون على التوالي لدى عينة الدراسة هم من الأشخاص الذين لاحظوا الدخان في مناطق إقامتهم وكانت الفروقات ما بين عينة الدراسة والعينة الضابطة في هذا المجال واضحة وجلية. كما أكدت كذلك نتائج كثافة الدخان مثل هذه النتائج وهي ارتباط ظهور الأعراض المرضية وكثافة الدخان ووجوده.

أما فيما يتعلق بتاريخ الإصابة السابقة بالأعراض لدى الفئات المصابة من عينة الدراسة فكانت (13.6%)، و(8%)، و(17.1%) لأعراض أمراض التنفس والجلد والعيون على التوالي مما يؤكد ارتباط ارتفاع نسبه الإصابة بالأعراض لدى فئة الدراسة وتعرضهم للهواء الملوث الناتج عن الصناعات المجاورة.

Dear Citizen

The researcher aim to evaluate the impact of the Israeli industrial zone on human health (Tulkarm city, western side)

We would like to ask for your help in answering the following questionnaire having in mind that such data is fort research purposes

The Researcher

An-Najah National University
Faculty of Graduate studies

Case No.:-

	Age
Father	
Mother	
Males	
Females	

Residency Specifications.

Type of residency	Size	Ventilation	Height	Garden
Flat				
House				

Observations within residency areas: -

- Is there a smell?

Yes☐ no ☐ sometimes☐

- Is there a smoke?

yes☐ no☐ sometimes☐

- If yes?

Intensive☐ moderate☐ light☐

- Do you use roof ?

Yes☐ no ☐ sometimes☐

- If yes ?

For sleeping☐ to dry clothes☐

- Other observations :-
- Is there spots on the clothes ?

Yes☐ no☐ sometimes☐

- The color of this spots if it is present?

Black☐ yellow☐ others☐

Affected Subjects

Disease	Gender	Age	Symptoms and relate question	Yes	No
Respiratory related	Male		Difficult breathing		
	Female		Asthma		
			ulceration		
			nose obstruction infection		
			others		
			have you visit the doctor		
			medication prescription		
Skin related	Male		Presence of pimpers		
	Female		Occurrence of itching or inflammation		
			have you visit the doctor		
			medication prescription		
			others		
Optic disease	Male		Is there infection in eye or ulcers		
	Female		Is there itching or redness in eye		
			Others		

Previous family history of disease.

Type of disease	Sex	Age	Symptoms	Yes	No
	Male		Difficult breathing		
	Female		Asthma		
			Do you suffer from ulcer		
			Do you suffer from nose sinusitis		
			others		
			Do you visit the doctor		
			Is the medicine perception		
	Male		Do you have patches		
	Female		Is there an itching or redness		
			others		
Optic disease	Male		Is there infection in eye or ulcers		
	Female		Is there itching or redness in eye