Deanship of Graduate Studies

Al Quds University

Types and Trends Of Pediatric Cancer in Gaza Governorates During The Period 1998 -2010

Submitted by

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Types and Trends Of Pediatric Cancer in Gaza Governorates During The Period 1998 -2010

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Dedication

To Palestinian children

Children of

Suffering

Pain

Deprivation

War

To all whom I love

I dedicate this work

Reem Mahmoud Al Zeer

Declaration

I Certify that this entire thesis submitted for the degree of master is my own work and has not been written to me in Whole or part, by any other person(s), and this thesis (or any part of the same) has not been submitted for higher degree or qualification to any other university or institution.

Signed ………………….

Reem Mahmoud Al Zeer

Date: / /

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Abstract

Background: Cancer is a serious disease and has special and global concern. It is considered one of the largest burdens in the global burden of disease. There is a steep increase in incidence of cancer everywhere.

Aim: Assessing the types and trend of pediatric cancer in Gaza strip during the period 1998 to 2010

Methodology: The design of this study is descriptive, comparative and record based study for the cancer data. The data was collected from Gaza cancer registry and other cancer health services sites. We applied special designed abstract sheet to measure the current frequency and characteristics of the event in the population.

Results: The total of 904 cases of childhood cancer was reported in Gaza strip during the period from 1998 to 2010. The annual average of cases was about 70 pediatric cancer cases per year. Average annual percentage change is (+4.4%). Males are exposed more than females, where 502 cases of the event for males (55.7%) with ASR 110 and 402 for females (44.3%) with ASR 90. Male/female ratio is 1.25:1. The study results showed that the highest event incidence was among age group (0-4) 39.5%, followed by age group (5-9) 33%, (10-15) 27.9%. The Gaza city has the majority of cases (49.7%). The types of cancer showed, one-third of all childhood cancers were leukemia 255 cases (27.9%), lymphomas 17.6%, while brain and spinal tumor representing 15.8%. The incidence was highest in the 0–4 age group 356 cases (ASR 101), followed by 5–9 with 296 case (ASR 104), and 10–15 age group 253case (ASR 90). Leukemia and neuroblastoma and tumors of connective tissue were predominantly among 0–4 age group. H.D and bone tumor incidence in 10–15, in N.H.D. the highest incidence was seen in 5-9 age groups. There was male predominant in lymphomas and leukemia. Over this period the total mortality counted for 336 reported deaths among pediatrics cancer with an annual average 25 deaths per year. The proportional death rate due to cancer among children was 3.12% from total child deaths.

Conclusion: There were no consistent large changes in incidence for the major types of cancer among children aged 0-15 years during 1998 to 2010. The modest increases for childhood were CNS cancers and leukemia. This pattern suggests that the increases likely reflected reporting or diagnostic changes rather than effects of environmental influences. Cancer is still considering a rare disease among children, on average one child can develop cancer per 10.000 each year in Gaza governorates. We recommend further investigation and more deep analysis for pediatric cancer and we think that the policy makers should have developing a strategic plan for monitoring and control the incidence of cancer in Palestine.

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Abbreviations

ALL: Acute Lymph node Leukemia

AML: Acute Myeloid Leukemia

APC: annual percentage change

AAPC: average annual percentage change

ASR: Age Standardized Rate

BNS: Brian and nerve system

CNS: Central Nervous System

CI: Confidence Intervals

GS: Gaza strip

HD: Hodgkin disease

HMIS: Health Management Information System

IRR: Incidence Rate Ratio

ICCC : International Classification of Childhood Cancer.

ICD: International Classification of Disease

ICD-O: International Classification of Disease for Oncology

PCR: Palestinian Cancer Registry

SEER: Surveillance, Epidemiology, and End Results

Chapter 1

1.1 Introduction

Cancer is a serious disease and has special and global concern. It is consider one of the largest burdens in the global burden of disease. It has been steep increasing in incidence of cancer everywhere. It can affect all ages, all people rich or poor, and in any part of the body, it is painful and harmful on both the patient and his family members. It always ends by death.

Worldwide the estimated number of new cases each year is expected to raise from 10 million in 2002 to 15 million by 2025 (MOH,1995-2000). In 2004, 7.4 million people died of cancer - 13% of all deaths from different causes. More than 70% of all cancer deaths occur in low and middle income countries. More than 30% of cancer could be prevented, mainly by not using tobacco, having a healthy diet, being physically active and preventing infections that may cause cancer (WHO, 2006).

Children are our future and should be the core of our interest and care. Cancer in childhood is rare event, but an important when it happened to them.

Time trends in pediatrics tumors are less clear and have been studied in a few populations especially in Arab region. In Gaza strip the total registered number of cancer cases during 1998 to 2008 is 679 cases. The male to female ratio was 1.35:1.The event is reported more in 0-4 years when the age specific rate is 101 for each million children and the rate drops as age increases (Abed et al, 2008).

1.2 Research problem

Pediatric cancer rates increase in some regions and decrease in others around the world. In Gaza strip we do not know the pediatric cancer situation trend. Is it increasing, decreasing or remaining constant?

The area is exposed to different potential risk factors mainly related to the last War on Gaza (2008 – 2009) where suspected illegal weapons were used. The impact of these weapons on health especially the health of our children is unknown.

The availability of information about cancer in general and pediatric in specific is essential and basic for assessing where we are and where we are going. There is a real information gap about our situation regarding national cancer levels compared to international levels. The availability of this information may help to portray the pediatric cancer picture in our country, and to provide a basic tool for research, planning, implementations, prevention and control for this chronic disease.

1.3 Justification

Palestinian population has special concerns and circumstances compared with other populations. We are as others surround of environmental change factors such as pollutions in air, water and food in addition to other hazardous waste (chemical, nuclear, radiations and others). As special population we suffer from Israeli occupation, war, siege, closure, shortage of medication, military and weapons experiments. As a result of these elements the prevalence and trend of cancer is expected to grow up.

Thus we are a vulnerable people to cancer and especially our children because they are the largest group in our population; 41.1% of Palestinian population under age 15 year, and 44.2% in Gaza strip according to PCBS 2010.

Because our children cannot face cancer alone we should give them a hand and especial concern in any task we do.

In the U.S. Cancer is suspended to overtake heart disease as the leading cause of mortality. Where cancer mortality rates are gaining on those of heart disease, recent reports project serious shortages by 2020 of oncology health care providers available to treat and manage the care of those afflicted with cancer (Chang and Candice, 2009).

Cancer disease can be controlled and prevented if the interventions were proper and effective in time and place. Assessing the trend of pediatric cancer will help care provider and policy maker to build up appropriate plans and interventions to reduce the cancer incidence in children.

1.4 Aim of the study

This study aims to explore cancer situation among children in Gaza strip during 1998 to 2010, and assessing the questions in concern does the children cancer change? This will help health policy maker to make the proper decision, also will give the providers and researcher hints about the situation and pattern of the pediatric cancer in Gaza strip.

1.5 General objective

Assessing the types and trend of pediatric cancer in Gaza strip during the period 1998 to 2010

1.6 Specific objectives:

1- To estimate the incidence rate of the different types of pediatric cancer in Gaza governorates in 1998-2010
2- To specify the rank and the type of cancer site among children.
3- To explore the distribution of pediatric cancer cases by socio-demographic distribution in Gaza governorates
4- To estimate the cancer cause specific mortality rate among the Palestinian children in Gaza Strip.

1.7 Study profile:

1.7.1 Geographical context

Palestine constitutes the southwestern part of in the eastern part of the Arab world, which is Belad El-Sham. In addition to Palestine, Belad El-Sham contains Lebanon, Syria and Jordan. It used to have common borders with these countries, in addition to Egypt.

Palestinian region stretches from Ras Al-Nakourain the north to Rafah in the south. The entire area of Palestine is about 27,000 sq. Km, including Tabariya, El-Hoola lakes and half of the area of Dead Sea. Now, Gaza Strip and West Bank comprises two areas separated geographically. The total area is 6,020 sq. Km. with total population living in is 4.1 individuals in 2010 with capita per sq Km 625 (PCBS, 2010).

Gaza strip:

The Gaza Strip is a narrow zone of land lying on the coast of the Mediterranean Sea. Its position on the crossroads from Africa to Asia made it a target for occupiers and conquerors over the centuries. The last of these was Israel who occupied the Gaza strip from Egyptians in 1967. Gaza Strip is very crowded place with area 378 sq Km and constitute 6.1% of total area of Palestinian territory land (JICA report, 2007). In year of 2010 the population number is to be 1.6 mainly concentrated in the cities, small village, and eight refugee camps that contain two thirds of the population of Gaza Strip. Gaza Strip is consider the second highest rate of population after al Khalil governorate (13.2%, 14.9%) respectively (PCBS, 2010).

Refugee estimation is 44% from total population in Gaza strip and West Bank, the estimate number is 1.8 million, 757 thousand in rate 29.7% of the total population of West Bank, and 1.1 million in rate 67.4% of the total population of Gaza strip.

Palestinian society is described as a young population (PCBS, 2010)**.**

1.7.2 Socio-demographic context

Population under 15 years old:

Children under 15 years old is constituted about 41.1% more than third of the total population in Gaza strip and West Bank (44.2% and 39.2%) respectively (PCBS, 2010).

Sex ratio in Palestine:

In 2010 sex ratio in Palestine is 103.1 male per 100 female, the estimate number is 2.1 million male compared with 2.0 million female. In Gaza strip the number of male is 793 thousands compared with 769 thousands female, the sex ratio is 103.1, in West Bank the number of male is 1.29 compared with 1.25 female, the sex ratio is 103.1 (PCBS, 2010).

Crud birth rate:

According to PCBS 2010 data, the crude birth rate in Palestine dropped from 32.8 births per 1000 population in 2010 to 31.9 per 1000 population in 2015. However, there are regional discrepancies where the crude birth rate in West Bank 30.1 compared with 37.1 in Gaza strip (PCBS, 2010).

Crud death rate:

According to PCBS 2010 data, the crude death rate in Palestine suspected to decline from 4.1 deaths per 1000 population in 2010 to 3.6 in 2015 (PCBS, 2010). There is slight difference between West Bank and Gaza Strip. In West Bank, the crude death rate suspected to drop from 4.2 in 2010 to 3.8 in 2015, where it will drop from 4.0 to 3.5 in Gaza Strip for the same period (PCBS, 2010).

These results indicate that there is an improvement in the living standards, health services, and health awareness among people. (MOH-PHIC 2006)

1.7.3 Political context:

Palestine was known an ancient land and has its own special nature of history and different and difficult political periods a long the time. The last one was in 1967; Israel launched a war of aggression against Egypt, Jordan and Syria and occupied the West Bank, Gaza, the Golan Heights and the Sinai Peninsula. Since that time Palestine has suffered a lot from violence, aggression and wars against innocents civilians in any time, way and context (MOH& PHIC, 2008).

The last story began in 2002 when Israeli has imposed a blockade around the Authority president Yaser Arafat in Ramallah, in 2006 to 2007 the blockade became stricter towards all the borders against in and out of Gaza Strip after the abduction of the Israeli soldier and Hamas won the election of the Authority. At the heart of this crisis is the degradation in the living conditions of the population, caused by the erosion of livelihoods and the gradual decline in the state of infrastructure, and the quality of vital services in the areas of health, water and sanitation, and education.

Between 27 December 2008 and 18 January 2009, the area of the Gaza Strip has witnessed endured intensive and continuous bombardment from land, sea and air in the course of Israel’s "Cast Lead" military offensive (MOH& PHIC, 2008). According to Ministry of health and Palestinian health information center reported that around half are women and children. 1380 Palestinian people had been killed since 27 December 2008, of whom 431 were children and 112 women. Approximately 5380 people were reported injured, including 1872 children and 800 women. Injuries were often multiple traumas with head injuries, thorax and abdominal wounds. Among the casualties, 16 health staff was killed and 22 injured while on duty (MOH& PHIC, 2008).

Significant damage to and destruction of key roads, power and water infrastructure and buildings has been reported in the Gaza Strip, including to a large gas storage facility and electricity transformers, posing immediate risk to health. Hospitals are struggling to cope with the current crises, without having enough medical staff, drugs, equipment and space to treat the wounded. The Ministry of Health in Gaza said that even before the air strikes started, 105 items on the essential drug list were nearly depleted during the conflict. (MOH-PHIC 2008)(UNICF 2009) And this shortage of drug and the blockade have a big impact on the patient especially the cancer patients and the patients who in need to of specialized treatment outside Gaza must go through a difficult and uncertain process to obtain the necessary permits required to leave Gaza, adding to this the suffer and stress to patients' lives. Since January 2008, 40 percent of the applications for permits to leave Gaza were rejected or delayed, compared to approximately 10 percent in 2006 (U.N.,OCHA 2009).

1.7.4 Environment context:

We are as others exposed to the hazardous pollution in the essential elements of life (air, water, food and waste)

Air pollution: transportation contribute 40-50% to the air pollution in WB and it is more than 50% in Gaza strip in addition to the high density of traffic and high number of old cars. Industry is another source in pollution especially Israeli industry in the settlement generates high level of the pollution compared to the industrial estate in Israel (MOH, 2002).

Water pollution: the scarcity of water and the bad quality and quantity of water resources in Palestine is the most crucial problem facing our life.

The main source of water in the Gaza strip is the underground water from the coastal aquifer while, in addition to the utilization of the Israeli settlers to Palestinian wells around the borders and the over pumping of the wells within the settlements which accelerated the increase of salinity and depletion of the ground water as a result of seawater intrusion into the coastal aquifer system (MOH, PCR and HMIS 2002).

Waste water: 35.5% of the population in Gaza strip and 34% in West Bank are connected to the sewer network while the cesspits and septic tanks receive the rest (MOH, PCR and HMIS 2002).

Solid waste: disposal of solid waste at open dumpsites is the common disposal method in the West Bank, while in Gaza strip there are many small uncontrolled dumping sites have been closed and there are currently two controlled landfills used (Gaza city and Deir El Balah) (MOH, 2002).

The improper handling of solid waste and infiltration of wastewater is considering the major cause of deterioration of water quality, land degradation and air pollution (MOH, 2002).

Use of pesticide: Agricultural pesticides are commonly used to maintain and increase crop yields, while public health pesticides are applied to prevent vector-borne diseases, where both types are also applied in homes and gardens. Recent review on pesticides indicated that laboratory experimental studies using model compounds suggest that many pesticides currently used in Europe (including organophosphates, carbonates, pyrethroids, ethylenebisdithiocarbamates, and chlorophenoxy herbicides) can cause neuro-developmental toxicity in humans and laboratory animals. Adverse effects on brain development can be severe and irreversible (Bjørling et al, 2008).

In the West Bank and Gaza strip, the excessive uncontrolled use of chemicals (e.g. DDT, lindane, a-benzene hexachloride, organochlorine, and organophosphate) for pest control and plant disease abatement has been a major issue of land based food production. Increased agricultural productivity in the West Bank (WB) and Gaza strip (GS) has been achieved through intensified use of arable land with massive application of a variety of pesticides and fertilizers. The unsustainable pesticides use may lead too many speculations as to increased breast cancer in Gaza strip, contamination of cow's milk, where tractors and backpack sprayers are the current methods still used to apply pesticides to orchards and greenhouses in the PNA territories. However, little documented information on current practices of pesticides application pertaining to quantities and qualities, types and sales and actual application rates (Safi et al, 1997). Total annual tonnage utilized in agricultural purposes in Gaza Strip ranges from 500-700 ton/year, which lead to an annual average of

3.84 kg/donum of pesticide used in the target areas (Safi et al, 1997). The size of the agricultural land in Gaza strip is given by 506 donum, where the total pesticides applied during the agricultural season is about 1942.2 liters (3.84 L per donum). It is recorded that more than 1000 tons of pesticides used in Gaza Strip resulted from the application of 75 different kind of pesticides, 19 of which type of internationally prohibited (Safi et al, 2002).

Zahm and Ward summarized the studies of pesticides and childhood cancer and concluded that the following childhood cancers were linked to pesticide exposure: leukemia, neuroblastoma, Wilms tumor, soft-tissue sarcoma, Ewing's sarcoma, non-Hodgkin's lymphoma, and cancers of the brain, colorectum and testes. They noted, it is noteworthy that many of the reported increased risks are of greater magnitude than those observed in studies of pesticide-exposed adults, suggesting that children may be particularly sensitive to the carcinogenic effects of pesticides (Zahm and Ward 1998)

1.7.5 Child Health context:

Child health can also be influenced by a number of basic conditions or factors including factors related to the mother’s education, age at giving birth, and other background characteristics. It can also be affected by indirect factors such as the socioeconomic status of the family and accessibility of health services.

Child health can be measured by using indicators such as infant mortality rate (or child mortality rate), contagious diseases rate among children under 5 years, and the nutritional status of children (PCBS 2006).

Nutritional status is one of the most important indicators of the child’s well being. The quantity and quality of food the child consumes and the method of preparing such food influences the nutritional status. The frequent catching of diseases among children also influences it. 9.9% of children under five years suffered from stunting and 4.9% of children suffered from underweight (PCBS 2006).

Infant mortality rate dropped from 25.5 per 1000 births between 1995 and 1999 to 24.2 per 1000 births between 1999 and 2003. Under five mortality rate also dropped from 28.7 per 1000 births between 1995-1999 to 28.3 per 1000 births between 1999-2003. In the West Bank dropped from 24.4 per 1000 births between 1995-1999 to 20.0 per 1000 births between 1999-2003. There was also a marked drop in child mortality from 27.2 per 1000 births between 1995-1999 to 23.7 per 1000 births between1999-2003 (PCBS 2006).

Gaza Strip witnessed an evident rise in such rates mostly among under-5 mortality, where it increased from 31.2 per 1000 births between 1995-1999 to 34.8 per 1000 births between 1999-2003. Infant mortality also increased from 27.3 per 1000 births between 1995-1999 to 30.2 per 1000 births between 1999-2003 (PCBS 2006).

The causes of death among infants and under-5 children Prematurity and low birth weight remained the main leading causes of infant mortality in Gaza Strip. However, there hasbeen a sharp increase in the percentage of deaths caused by respiratory system infections (PCBS 2006).

The MOH is the big provider and responsible for the secondary healthcare delivery system. The MOH hospitals are the only provider for oncology and hematology service. In the year 2005, the MOH have 60 beds assigned to serve this area, out of which 32 beds are in GS based in three different centers. The bed occupancy rate at oncology and hematology sites reached to 168.4%. In the GS, the rate reached to 235.3% while in the WB it was 100%. 260 health clinics in MOH are providing services for children including preventive and curative care (MOH, 2004).

The percentage of children has had the breast feeding was 95.6%, 25.4% of children aged 0-6 month were exclusive breast feeding and 38.1%were mixed fed.

Immunization against infectious disease according to child immunization schedule is given free of charge for all Palestinian (MOH, 2004).

In Gaza strip most of the cancer service are provided in three different MOH hospitals El. Shifa complex, European Gaza Hospital and El Rantisi hospital specialized in pediatric care.

Shifa hospital is the biggest hospital in Gaza strip it provides most of medical services, it is the most important hospital, and it contains many different departments in surgical, medical, maternity and neonatal care unit. It is the main provider for cancer services thorough the oncology department for admission and out patient clinic.

European Gaza hospital also provides the services of cancer patients through oncology department for admission and out patient clinic for daily care it mainly serviced the southern area of Gaza strip.

El Rantisi hospital is a specialized hospital for pediatric care only, one of the main provided services is the oncology and hematology departments for admission and outpatient clinic for daily care for pediatrics.

1.8 Cancer Registry:

Cancer registries have been defined as an organized system for the collection, storage, analysis, and interpretation of data on persons with cancer usually covering a hospital and or groups of hospital. A population-based cancer registry collects the data from many hospitals and non hospitals sources (MOH, 2002).

1.8.1 Palestinian Cancer Registry:

Palestinian Cancer Registry (PCR) is a population-based registry established in 1996 under the umbrella of the Ministry of Health and it started its regular work in 1998. The main purpose of the PCR is to define the size of the cancer problem and pattern of its occurrence in Palestine and also to provide data on the cancer which is an important source for epidemiological and clinical studies. To make cancer incidence and prevalence data available for use by health planners and professionals in order to plan for cancer prevention, control and management in cost effective manner (MOH, 2002).

1.9 Operational definitions

Cancer: Cancer is a term used for diseases in which abnormal cells divide without control and are able to invade other tissues. Cancer cells can spread to other parts of the body through the blood and lymph systems (NCI, 2012)

Child: is the stage between birth and puberty, under the age of 16 years old

Disease burden: is the impact of a health problem in an area measured by financial cost, mortality, morbidity, or other indicators (McGraw-Hill Concise Dictionary 2002)

Distribution: discrete random variables with a finite set of values (wikipedia, 2011)

Incidence: it is the new cases occurs in a certain period of time

Mortality: Refers to the number of deaths due to a disease

Morbidity: is the incidence and prevalence of a disease.

Trend: is to plot the actual observed numbers or rates of interest by years

Chapter 2

Literature review

2.1 Theoretical framework

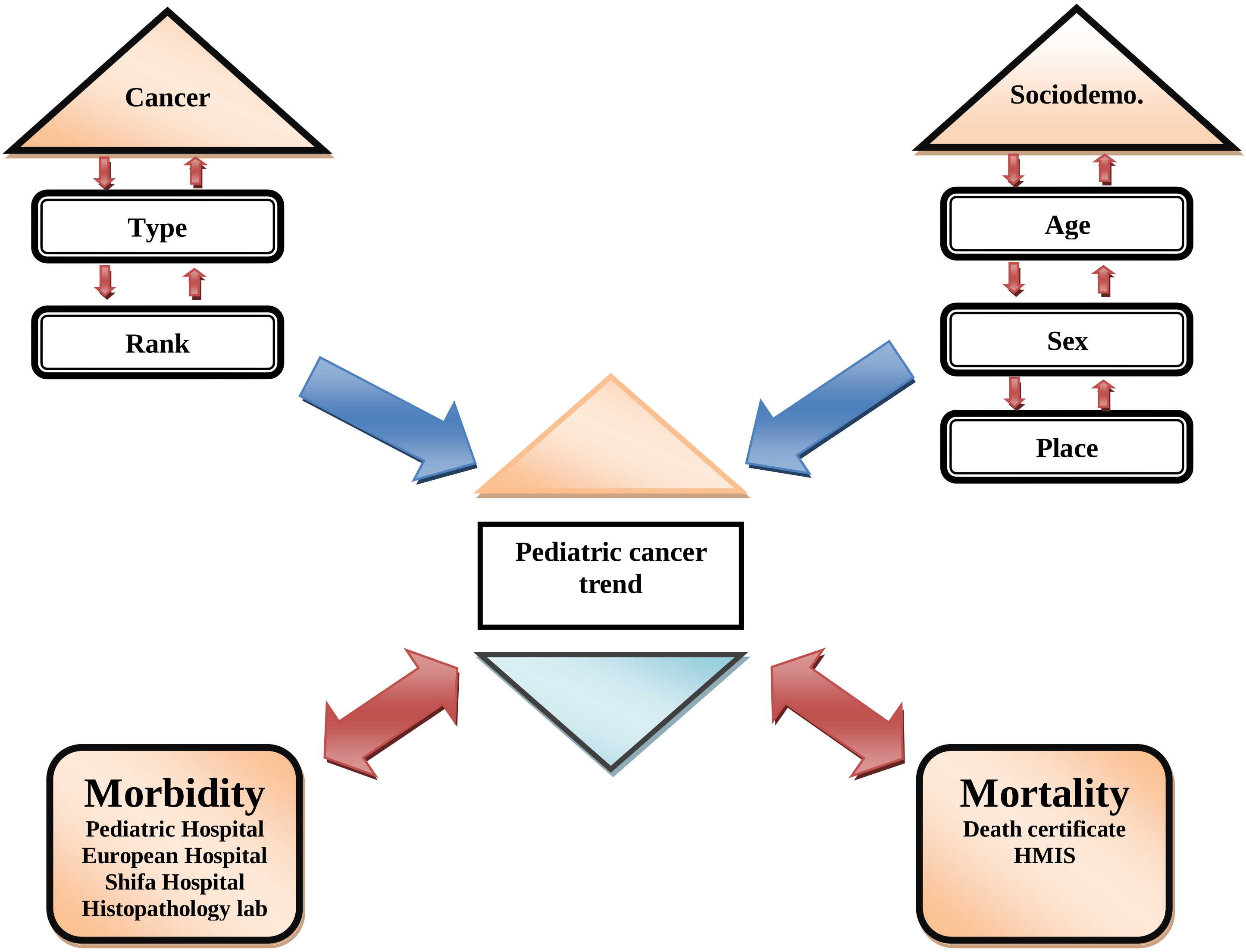


Figure 2.1: Theoretical framework

2.2 Dimensions of time trend study

"Public health agencies have a long tradition of monitoring trends in rates of disease and death and trends in medical, social, and behavioral risk factors that may contribute to these adverse events. Trends in observed rates provide invaluable information for needs assessment, program planning, program evaluation, and policy development activities. Examining data over time also permits making predictions about future frequencies and rates of occurrence (Rosenberg, D 1997).

The big marks of epidemiologic studies is the understanding of health outcomes in a certain population and this can be understood if their frequency and distribution is examined in terms of person, place, and time. Trend analysis is one leg of this analytic triangle, and is used for public health surveillance and monitoring, for forecasting, for program evaluation, for policy analysis, and for etiologic analysis (investigation of potentially causal relationships between risk factors and outcomes).

A study of time trends may focus, therefore, on one or more of the following:

2.2.1 The overall pattern of change in an indicator over time:

The most general goal of trend analysis for public health surveillance is to discern whether the level of a health status, service, or systems indicator has increased or decreased over time, and if it has, how quickly or slowly the increase or decrease has occurred.

2.2.2 Comparing one time period to another time period:

This form of trend analysis is carried out in order to assess the level of an indicator before and after an event. Evaluating the impact of programs, policy shifts, or medical and other technical advances may call for what is sometimes called interrupted time series analysis.

2.2.3 Comparing one geographic area to another:

When comparing the level of an indicator across geographic areas, only looking at one point in time can be misleading. For instance, one area may have a higher value on an indicator in one year, but a lower value in the next--analyzing the trend over several years can give a more precise comparison of the two areas.

2.2.4 Comparing one population to another:

When comparing the level of an indicator across populations, both absolute and relative differences are important. For instance, one population may have consistently higher rates over time compared to another population and the rates in both populations may be decreasing over time, but the disparity between the rates in the two populations at each point in time may be increasing or decreasing. Analyzing the trend over time can provide information about the changing rates and the changing disparity in the rates.

2.2.5 Making future projections:

Projecting rates into the future is a means of monitoring progress toward a national or local objective or simply providing an estimate of the rate of future occurrence. Projecting the potential number of future cases can aid in the planning of needed health and other related services and in defining corresponding resource requirements.

Here the researcher wants to explore the general trend of pediatric cancer in Gaza strip. The study will take about four major components morbidity, cancer types (rank and type), and socioeconomic factor related to the disease (age, sex and place) and mortality rate caused by cancer.

2.3 Morbidity:

Disease, illness or any departure, subjective or objective, from a state of physiological or psychological well-being (McGraw-Hill 2002) It is the incidence and prevalence of a disease.

In statistic morbidity is the frequency of and occurrence of a disease in certain area and population. Morbidity rate is the rate of disease or abnormality occurs, calculating by dividing the diseased people by the number of the same people group (McGraw-Hill 2002).

2.4 Mortality:

Refers to the number of deaths due to a disease, in statistic mortality rat is the number of deaths per 100,000 people. Cancer mortality rate is reflecting the overall risk of dying due to cancer is a specific population (McGraw-Hill 2002).

2.5 Cancer:

There are many definitions of cancer. cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled it can result in death (Young et al, 2005).

Cancer can involve any tissue of the body and have many different forms in each body area. Most cancers are named for the type of cell or organ in which they start. If a cancer spreads (metastasizes), the new tumor bears the same name as the original (primary) tumor (Young et al, 2005).

2.5.1 Risk factor of cancer in children

There are external factors and internal factors that caused cancer. The external factors (tobacco, infectious organisms, chemicals, and radiation), and internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism). And these causal factors may act together or in sequence to initiate or promote carcinogenesis (American Cancer Society; 2010).

Different types of cancer have different risk factor. Risk factors of cancer in children is different form risk factor in adults, for example life style related risks are thought to be the main risk factors for cancers in adults such as diet, smoking, drinking alcohol, inactivity and occupational related risks, but in children life style have little or no effect on childhood cancer (American Cancer Society, 2010).

The causes of childhood cancers are largely unknown. A few conditions, such as Down syndrome, other specific chromosomal and genetic abnormalities, and ionizing radiation exposures, explain a small percentage of cases. Environmental causes of childhood cancer have long been suspected by many scientists but have been difficult to pin down, partly because cancer in children is rare and because it is difficult to identify past exposure levels in children, particularly during potentially important periods such as pregnancy or even prior to conception. In addition, each of the distinctive types of childhood cancers develops differently—with a potentially wide variety of causes and a unique clinical course in terms of age, race, gender, and many other factors. A number of studies are examining suspected or possible risk factors for childhood cancers, including early-life exposures to infectious agents; parental, fetal, or childhood exposures to environmental toxins such as pesticides, solvents, or other household chemicals; parental occupational exposures to radiation or chemicals; parental medical conditions during pregnancy or before conception; maternal diet during pregnancy; early postnatal feeding patterns and diet; and maternal reproductive history. Researchers are also studying the risks associated with maternal exposures to oral contraceptives, fertility drugs, and other medications; familial and genetic susceptibility; and risk associated with exposure to the human immunodeficiency virus (NCI, 2008).

2.5.2 Classification stages of cancer:

Staging describes the extent or spread of the disease at the time of diagnosis. Proper staging is essential in determining the choice of therapy and in assessing prognosis. A cancer's stage is based on the primary tumor's size and whether it has spread to other areas of the body. A number of different staging systems are used to classify tumors. The TNM staging system assesses tumors in three ways: extent of the primary tumor (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Once the T, N, and M are determined, a stage of I, II, III, or IV is assigned, with stage I being early and stage IV being advanced disease. A different system of summary staging (in situ, local, regional, and distant) is used for descriptive and statistical analysis of tumor registry data. If cancer cells are present only in the layer of cells where they developed and have not spread, the stage is in situ. If cancer cells have penetrated the original layer of tissue, the cancer is invasive (American Cancer Society; 2010).

2.5.3 Type of cancer in children:

The most common type of cancer:

Leukemia

Leukemia is a cancer of the bone marrow and tissues which produce the circulating blood cells. Leukemias are the most common childhood cancers. Types of leukemia include:

- **Acute Lymphoblastic Leukemia (ALL):** The most common childhood cancer. Almost 75% of children with leukemia have ALL, a cancer of the lymphoid cells in the bone marrow and the lymphoid organs of the body. They are involved in the body's immune system.
- **Acute Myelogenous Leukemia (AML):** AML (also called acute myeloid leukemia, acute nonlymphatic leukemia or ANLL) is cancer of the myeloid blood cells which are produced in the bone marrow and which help fight bacterial infections (American Cancer Society 2011).

Cancers of the Central Nervous System

- **Brain tumors:** There are many types of brain tumors; the most common are called gliomas.
- **Neuroblastoma:** is a cancer of the sympathetic nervous system which most often originates in the adrenal glands above the kidney (American Cancer Society 2011).

Sarcomas

Sarcomas are cancerous tumors involving the bones and soft tissues.

- **Bone cancers**

Osteosarcoma: the most common type of bone sarcoma. These tumors often are located at the growing end of the long bones of the extremities, close to the joints.

Ewings Sarcoma: a bone cancer that often appears in the middle of the bone. Commonly found in the thighs, hipbones, upper arms and ribs.

- **Soft Tissue Sarcomas:**

Rhabdomyosarcoma: a soft tissue sarcoma that develops in muscles. Most often found in the head, neck, kidneys, bladder, arms and legs (American Cancer Society 2011).

Lymphomas

Lymphoma is a tumor of the lymph tissues, which are part of the immune system. Types of lymphoma include:

- **Hodgkin disease or Hodgkin's lymphoma:** affects lymph nodes nearer to the body's surface, such as in the neck, armpit and groin area.
- **Non-Hodgkin Lymphoma:** affect lymph nodes found deep within the body. There are many types of lymphoma, include Burkitt's, non-Burkitt's, and lymphoblastic lymphoma (American Cancer Society 2011).

Liver Cancers

Liver cancer is an abnormal growth (tumor) in the liver. The most common forms of liver cancer in children are:

- **Hepatoblastoma**
- Hepatocellular carcinoma

Cancers of the Kidney

- **Wilms tumor:** also called nephroblastoma

- **Clear Cell Sarcoma**

Other Types of Cancers

- **Retinoblastoma:** is a malignant tumor of the retina (a thin membrane in the back of the eye).
- **Germ Cell Tumors:** Germ cell tumors appear most commonly in the testes, the ovaries, and the area at the bottom of the spine (sacrococcygeal) and in the middle of the brain, chest or abdomen (American Cancer Society 2011).

2.6 Socio demographic variables:

Demographic variables mean dividing the target population into specific groups according to age, gender, place, family size, income, occupation, religion, education, nationality. This is among the most popular basis for segmenting and understanding group related issues, because it is the easiest, most measurable and most widely used segmentation method (www.wiki/Demographic).

2.7 The burden of cancer disease

2.7.1 The global burden of cancer:

Cancer is a major public health problem and it is increasing mostly every where. Incidence, mortality and survival have obvious differentiations by sex, age, race and regions. It is estimated that there will be more than 12 million new cancer cases in 2007 worldwide, of which 5.4 million will occur in economically developed countries and 6.7 million in economically developing countries (American Cancer Society 2010). The corresponding estimates for total cancer deaths in 2007 are 7.6 million (about 20,000 cancer deaths a day), 2.9 million in economically developed countries and 4.7 million in economically developing countries (American cancer society 2010). By 2050, the global burden is expected to grow to 27 million new cancer cases and 17.5 million cancer deaths simply due to the growth and aging of the population (American cancer society 2010). In economically developed countries, the three most commonly diagnosed cancers are prostate, lung and bronchus, and colorectal among men and breast, colorectal, and lung and bronchus among women. In economically developing countries, the three most commonly diagnosed cancers are lung and bronchus, stomach, and liver in men, and breast, cervix uteri, and stomach in women. In both economically developed and developing countries, the three most common cancer sites are also the three leading causes of cancer death (American cancer society 2010).

2.7.2 The global burden of Pediatric cancer:

Cancer is very rare among children everywhere in the world. With age-standardized annual incidence usually between 70 and 160 per million at age 0–14 years (Stiller Ch. 2004). Whereas most adult cancers are carcinomas, childhood cancers are histologically very diverse. It is therefore more appropriate for childhood tumours to be classified principally according to histology rather than primary site, in which diagnostic groups are defined according to codes for morphology as well as topography in the second edition of the International Classification of Diseases for Oncology (ICD-O) (Stiller Ch. 2004). The 12 major groups are leukaemias, lymphomas, brain and spinal tumours, sympathetic nervous system tumours, retinoblastoma, kidney tumours, liver tumours, bone tumours, soft-tissue sarcomas, gonadal and germ-cell tumours, epithelial tumours, and other and unspecified malignant neoplasmas (Stiller Ch. 2004).

An estimated 10,700 new cases are expected to occur among children aged 0 to 14 years in 2010 (American cancer society 2010). An estimated 1,340 deaths are expected to occur among children aged 0 to 14 years in 2010, about one-third of these from leukemia (American cancer society 2010). Although uncommon, cancer is the second leading cause of death in children, exceeded only by accidents. Mortality rates for childhood cancer have declined by 55% since 1975. The substantial progress in childhood cancer survival rates is largely attributable to improvements in treatment and the high proportion of patients participating in clinical trials (American cancer society 2010).

Childhood cancers include:

Leukemia (31.0% of all childhood cancers), Brain and other nervous system (21.3%), Neuroblastoma (7.1%), Wilms tumor (5.2%), Non-Hodgkin lymphoma (4.3%) and Hodgkin lymphoma (3.8%), Rhabdomyosarcoma (3.3%), Retinoblastoma (2.6%), Osteosarcoma (2.5%), Ewing sarcoma (1.6%) (American cancer society 2010).

2.7.3 Pediatric cancer in United State:

It is estimated that in 2007, approximately 10,400 U.S. children aged birth to 14 years will develop cancer. There have been ongoing public concerns regarding pediatric cancers, underscoring a need to monitor incidence rates (Jemal et al 2010). Cancer is the second most common cause of death among children between the ages of 1 and 14 years in the United States, surpassed only by accidents. Nearly one third of the cancers diagnosed in children ages birth to 14 years are leukemia (particularly acute lymphocytic leukemia), followed by cancer of the brain and other nervous system (21%), soft tissue sarcomas (including neuroblastoma [7%] and rhabdomyosarcoma [3%]), renal (Wilms) tumors (5%), and non-Hodgkin lymphoma (4%) (Jemal et al 2010). Over the past 25 years, there have been significant improvements in the 5-year relative survival rate for all of the major childhood cancers. The 5-year relative survival rate among children for all cancer sites combined improved from 58% for patients diagnosed between 1975 and 1977 to 81% for those diagnosed between 1999 and 2005 (Jemal et al 2010).

There is another study where conducted in U.S. to assess the trend of childhood cancer between 1992 to 2004 and the result was 22,694 incident malignant neoplasm were reported among those patients aged <20 years within the 13 SEER registries examined. The average annual age-adjusted incidence rate was 158 per 1,000,000 person-years and there was a suggestion of a positive trend (APC, 0.4%; 95% CI, 20.1%–0.8%) (Linabery and Ross 2008). Frequencies, incidence rates, and results of the best fit join point regression models for each of the cancer subtypes examined are provided in. None of the rates changed in a strictly monotonic fashion because each of the cancer diagnoses is rare and subject to random fluctuation; trends are best described by join point results. Rates increased substantially over the time period for melanoma (APC, 2.8%; 95% CI, 0.5%–5.1%), hepatoblastoma (APC, 4.3%; 95% CI, 0.2%–8.7%), and other/unspecified central nervous system (CNS) tumors (APC, 5.4%; 95% CI, 0.8%–10.3%). Two join points were found for astrocytoma; the rate decreased initially (1992–1999: APC, 22.9%; 95% CI, 25.2%–20.5%) followed by a rapid increase (1999–2002: APC, 7.8%; 95% CI, 29.1%–27.9%) and a subsequent decline (2002–2004: APC, 28.3%; 95% CI, 223.1%–9.4%). A change in the magnitude and direction of the trend was observed for other unspecified leukemias; a significant decrease was observed between 1992 and 1996 (APC, 218.6%; 95% CI, 231.6%–23.2%) and a significant increase was detected thereafter (APC, 7.0%; 95% CI, 0.1%–14.3%) (Linabery and Ross 2008). The trends for other cancer subgroups were indistinguishable from a slope of 0, although the data indicate a possible increase for leukemia overall (acute lymphoblastic leukemia [ALL] and acute myeloid leukemia [AML]) and non-Hodgkin lymphoma (NHL), and suggest a decrease for Wilms tumor and Ewing sarcoma. Notably, the rate of CNS tumors overall remained steady over the time period examined (APC, 20.1%; 95% CI, 21.1%–1.0%) (Linabery and Ross 2008).

A positive significantly trend (APC, 1.9%; 95% CI, 0.2%–3.7%) for AML was observed among males, whereas no concomitant trend was apparent among females. For other/unspecified leukemias, the rate in males decreased sharply between 1992 and 1997 (APC, 218.4%; 95% CI, 230.5%–24.1%) and then increased between 1997 and 2004 (APC, 14.0%; 95% CI, 2.4%–26.9%). Similarly, rapid changes punctuated by 3 join points were observed with respect to retinoblastoma rates in males; these patterns were not observed in females. Hodgkin disease (HD) declined in females (APC, 22.4%; 95% CI, 24.5%–20.3%), but not in males. Join points resulting in a shift in the direction of the trend also were observed among females for osteosarcoma (1 joinpoint), nonrhabdomyosarcoma soft tissue sarcomas (2 joinpoints), and ependymoma (3 joinpoints); these changes were not detected among males. An increase in thyroid carcinoma was suggested in females only (Linabery and Ross 2008).

The incidence rate of ALL was stable, with the exception of those ages 5 through 9 years, in whom an increase was initially observed (1992–1999: APC, 3.6%; 95% CI, 0.5%–6.8%), followed by a decline similar in magnitude, and in those patients ages 15 to19 years, in whom a substantial increase was detected(APC, 3.3%; 95% CI, 0.4%–6.4%). Rates of HD may also be declining among patients' ages 15 to 19 years. For CNS tumors overall, an initial decline was observed among those ages 1 to 4 years (1992–1996: APC, 24.8%; 95% CI, 210.6%–1.3%), with a subsequent rise and fall in rates; rates appeared stable in other age groups. The early decline observed in the rate of ependymomas in patients ages 10 to 14 years was more rapid later in the period; this pattern was restricted to this age group and was based on few cases (N 5 52). Astrocytoma rates increased in the younger age groups (aged <5 years) and declined in older age groups, although rates were imprecise in all groups. No change was observed in the incidence of primitive neuroectodermal tumor, except in patients' ages 15 to 19 years, in whom 2 joinpoints were identified, resulting in sharp changes in the direction of the trend (Linabery and Ross 2008). A significant increase occurred in the 1990s for rhabdomyosarcoma among those ages 5 to 9 years (APC, 3.5%; 95% CI, 0.3%–6.9%), followed by a sharp decline. For other soft tissue sarcomas, a significant rise was found in infants (APC, 10.4%; 95% CI, 4.9%–16.3%), with little or no change noted in other groups. An increase in patients ages 15 to 19 years was suggested for thyroid carcinoma (Linabery and Ross 2008).

2.7.4 Pediatric cancer in Europe:

Within the framework of the Automated Childhood Cancer Information System (ACCIS), time trend analyses for childhood cancer were performed using data from 33 population-based cancer registries in 15 European countries for the period 1978–1997. The overall incidence rate based on 77,111 cases has increased significantly ($P < 0.0001$), with an average annual percentage change (AAPC) of 1.1% (Kaattsch et al 2006). The rising trend was observed in all five geographical regions and in the majority of the disease groups (in order of AAPC): soft tissue sarcomas (1.8%), brain tumours, tumours of the sympathetic nervous system, germ-cell tumours, carcinomas, lymphomas, renal tumours, and leukaemias (0.6%). No change was seen in incidence of bone tumours, hepatic tumours and retinoblastoma. The increased incidence can only partly be explained by changes in diagnostic methods and by registration artifacts. The patterns and magnitude of these increases suggest that other factors, e.g. changes in lifestyle and in exposure to a variety of agents, have contributed to the increase in childhood cancer in the recent decades (Kaattsch et al 2006).

Another study in Europe, the overall average annual ASR for cancer in children in Europe in the 1990s was 140 per million, based on 48847 cases. The ASR for the age-range 0–19 years was (p<0·0001) (Foucher et al, 2004). In the east, the ASR for leukaemias was 39·3 per million (n=2018), whereas in the west it was 45·7 per million (n=13 763; IRR 0·9 [95% CI 0·8–0·9]). The ASR for carcinomas was 11·8 per million (n=758) in the east and 2·7 per million in the west (n=925; IRR 4·4 [4·0–4·8], p<0·0001). CNS tumors were more common in the east (ASR 32·1, n=1741) than the west (ASR 29·4, n=8874; IRR 1·1 [1·0–1·2], p=0·0005) (Foucher et al, 2004). Lymphomas were more common in the east (ASR

17.4, n=1018) than in the west (ASR 15·2, n=4903; IRR 1·1[1·1–1·2], p=0·0005). Smaller differences were recorded for retinoblastoma (east ASR 3·2, n=139 *vs* west ASR 4·0, n=1052; IRR 0·8 [0·7–1·0], p=0·058), hepatic tumors (east ASR 1·8, n=81 *vs* west ASR 1·4, n=377; IRR 1·3 [1·0–1·6], p=0·04), and germ-cell tumors (east ASR 3·9, n=206 *vs* west ASR 4·7, n=1396; IRR 0·8 [0·7–0·97], p=0·017). The higher incidence of leukemias in the west than in the east was mainly due to the peak in occurrence of lymphoid leukemia at around age 2–3 years, which was more pronounced in the west than in the east. This difference seemed to be diminishing over time although in the 1990s, it was still significant for the age-group 1–4 years (p<0·0001), the proportions of tumor types, defined by the main diagnostic groups of the International Classification of Childhood Cancer, for the five age-groups(Foucher et al, 2004). The most common tumor type in infants was neuroblastoma (1260 [28%]). Leukaemias were most common in the age-group 1–4 years (7150 [41%]), and CNS tumors in the age-group 5–9 years (3748 [28%]). After age 10 years, embryonic tumors, such as retinoblastoma, nephroblastoma (most renal tumors), and hepatoblastoma (most hepatic tumors) almost disappeared, whereas other cancers became more frequent, notably lymphomas, carcinomas, germ-cell tumors, and bone tumors. In the 1990s, the overall incidence rates in children were slightly higher in the east than in the west of Europe, whereas the opposite was true in adolescents (Foucher et al, 2004). This difference is partly due to the age distribution of lymphomas between the two regions: the high incidence in childhood is compensated by low rates in older ages in the east, whereas the low rates in children are followed by high rates in adolescents in the west. This pattern has been described earlier and might be related to a combination of genetic factors, socioeconomic status, infection, and climate.14–18 The 1990s childhood cancer incidence in the east was also affected by high rates of thyroid cancer in Belarus. Discarding the 603 thyroid cancer cases would reduce the overall ASR for the east to 133, significantly lower than the rate for the west (140). Therefore, the excess rate in children in the east can probably be entirely attributed to the Chernobyl accident in 1986. Although the overall incidence rates are higher for boys than for girls in all age-groups, some tumors are more frequent in girls, notably germ-cell tumors in specific age-groups, and thyroid carcinomas (Foucher et al, 2004).

Perhaps the most striking result is the clear evidence of an increase of cancer incidence in childhood and adolescence during past decades, and of the acceleration of this trend. The reduction in the incidence of the unspecified tumor group could indicate an improvement in diagnostic methods and coding of tumors, but it can explain only a small part of the overall increases for specific cancer. The overall incidence rates of cancer have been increasing over time in all ages. The difference in age specific rates between the first and the last decade was significant at all ages, and it was largest at the beginning and end of the age-rang (Foucher et al, 2004).

2.7.5 Pediatric cancer in Australia

During the period 1983–2006, 13 925 childhood cancers were diagnosed in Australia; In the most recent 10-year period, 1997–2006, a total of 6184 children under the age of 15 years were diagnosed with cancer in Australia, equivalent to an annual age-standardised rate of 157 cases per million. Nine in 10 (91%) of these cancers were malignant. The remainder, 568 tumours, or 14 cases per million population were of benign or uncertain behaviour in the brain or central nervous system; the commonest types were leukaemia (34%), CNS (23%) and lymphomas (10%). There was a 1.14:1 male/female ratio for overall childhood cancer incidence, with a marked difference between age groups. The incidence rate of childhood cancer was higher among children aged 0–4 years (223 cases per million population) than at ages 5–9 (117 per million) or 10–14 years (131 per million). Some exceptions to this age-specific pattern were shown by lymphomas, malignant bone tumours and malignant epithelial tumours and melanomas in which incidence was highest at 10–14 years. Childhood cancer incidence increased between 1983 and 1994 for boys (1.6% per year), but has remained stable since then. The overall trend among girls increased by an average of 0.9% per year over the entire period, 1983–2006. Trends varied substantially by cancer type, although the small number of specific cancers often resulted in substantial year-toyear random fluctuations in rates even when the underlying trend was statistically significant. Notably, incidence trends among both boys and girls for leukaemia, hepatic tumours and germ cell tumours showed significant increases, whereas there have been recent, significant decreases among boys in the incidence of neuroblastomas and malignant epithelial tumours and melanomas (Baade et al, 2010).

2.7.6 Pediatric cancer in Shanghai

A study in 2009 in shanghai showed a total of 609 cases of childhood cancer were diagnosed in Shanghai from 2002 to 2005, 311 (51.1%) for males and 298 (48.9%) for females, respectively. The average annual crude incidence was 117.9 per million and the incidence adjusted by the world standard population was 129.0 per million. The types of cancer, according to the 12 diagnostic groups of the ICCC. About one-third of all childhood cancers were leukaemia and had an average annual incidence of 40.7 per million. Lymphoid leukaemia was the most common subtype of leukaemia, comprising 65.7% of all leukaemia. Brain and spinal tumour was the second most common type of cancer, representing 20.2% of the total, and its average annual incidence was 23.8 per million. Astrocytoma and PNET were the two most common subtypes. Lymphomas accounted for 8.4% of the total with mostly Non-Hodgkin lymphomas (NHL) with 80.4%. Hodgkin disease constituted only 7.8% of all lymphomas. Sympathetic nervous system tumour was the fourth and constituted 6.2% of the total, which mainly composed of neuroblastoma. The Ewing sarcoma annual incidence is very low as other Asian population, with only 0.5% of total (Bao et al, 2009).

During 1973–2005, all 3,165 cancer cases had been diagnosed in urban Shanghai among children aged 0–14 years with the average annual crude incidence rate (CR) 107.1 per million. Leukaemia, brain and spinal tumour, and lymphomas were the most common childhood tumour, comprised of 35.0%, 18.5%, and 11.9%, respectively. The CR of all cancers combined was slightly higher in males (112.3 per million) than in females (101.4 per million) with an M/F ratio of 1.1. No significant incidence trend was observed in males and females, with an APC of _0.5% (P=0.57) and _0.3% (P=0.75) in the age-standardized incidence rate, respectively (Bao et al, 2009).

2.7.7 Pediatric cancer in Philippines

The Philippines spread out over 300,000 km2 on an archipelago of 7,107 islands between the Philippine Sea and the South China Sea. The islands are densely populated by 80 million people of various native ethnic groups. Children under 15 form 36% of the population. Child mortality is moderately high and a relatively high proportion of small children are under the recommended weight standards. Cancer incidence data for the Philippines are derived from the two population-based cancer registries in the country: Rizal and Manila (Laudico and Esteban 1998), which combined cover about 14% of the childhood population. Since 1984 the two registries have worked closely together, sharing a common data set and cross-notifying cases from their respective catchment areas. Death certificates are also a source of case identification for the two registries. In fact, the high percentage of cases registered from death certificates only (20%) indicates likely under-reporting. Around 1995 the two registries recorded a crude rate of 103 annual new cases per million children, which allows us to predict a minimum of 3,500 new cases in 2006. Leukaemia accounts for almost 50% of the total incidence. Lymphoma appears unusually low (less than 10%), but in agreement with other registries in South-East Asia (UICC, 2006).

2.7.8 Pediatric cancer in Senegal

Senegal, established 1960, is a mainly low lying country in West Africa, with semi-desert areas in the north and north-east and forests in the south-west. The country is inhabited by 10 million people, 42% of whom are children. A cancer registry is in operation but has not produced any incidence statistics yet. In a retrospective survey carried out in the Royal Albert Children's Hospital of Dakar for the 10- year period 1989-1998, 25 cases of haematopoietic neoplasms were diagnosed among 32,789 children hospitalised, with a sex ratio of 2.57 (18 boys, 7 girls). There were 9 cases of acute lymphoblastic leukaemia, 2 of acute myeloblastic leukaemia, 2 of chronic myeloid leukaemia, 9 of Hodgkin's disease, 2 of Burkitt's lymphoma and 1 of lymphoblastic non-Hodgkin's lymphoma. Among 19 patients whose records were available, 17 received chemotherapy. However, reference protocols were fully applied only in two cases (UICC, 2006).

In another retrospective hospital-based study at the Principal Hospital in Dakar, 130 children with cancer were identified among all admissions in the period 1990-2000. The five most frequent cancer types accounted for 75% of cases, with 28 leukaemias, 21 lymphomas, 21 nephroblastomas, 16 retinoblastomas, and 10 bone sarcomas. In these 130 children, there were 20% more boys than girls. In the neurology department of the University Hospital in Dakar, 10% of children admitted presented with a brain tumour, according to a retrospective survey 1980-1997.

The distribution of cases according to tumour subtype is shown in lymphomas represent 33% of all tumours and, are significantly more common than leukaemias. In contrast, Kaposi sarcoma is very rare (UICC, 2006)

2.7.9 Pediatric cancer in Morocco

Morocco became independent from France in 1956. Of the population of 30.5 million, 31% are children. Child mortality rates are 40 per 1,000 in boys and 38 per 1,000 in girls, and 10% of children under five are underweight. Life expectancy at birth is 71 years(UICC, 2006). There is no population based cancer registry in Morocco. A series of 444 cases of childhood cancer, admitted to the Hospital for Children in Rabat during 1983-85, was reported in the IICC-I international study. This series excluded children requiring neurosurgery, who were not treated in this hospital. The most commonly recorded childhood cancers were lymphomas (33%) - of which 20% were Burkitt’s lymphoma, leukaemia (23%), and Wilm’s tumours (10%) (UICC, 2006). No cases of Kaposi's sarcoma occurred in this series, though the Maghreb is part of the Mediterranean region, an area endemic for classical Kaposi's sarcoma, a form not linked to HIV infection. In North Africa, some childhood carcinomas are more common than elsewhere, notably nasopharyngeal and skin carcinoma. Using the figures published for Algeria, we may expect a minimum of 1,105 new childhood cancer cases per year in Morocco (UICC, 2006).

2.7.10 Pediatric cancer in Egypt

The regional cancer registry of Alexandria, initiated by the Alexandria Faculty of Medicine in 1960, provides cancer incidence data for a childhood population of 1.3 million. The diagnosis of leukaemias is based on peripheral blood analysis and bone marrow findings. The overall estimate of 101 cancers per million children is consistent with the regional averages (UICC, 2006).

However, several observations suggest under-reporting: the high sex ratio of 1.5, and wide fluctuations in the number of recorded cases by year, indicating discontinuity in recording. Definitive evidence that the risk of cancer in children of this country is greater than estimated comes from the population-based registry of Gharbiah, Tanta, established around 2000 under the responsibility of the National Cancer Institute in Cairo. Unpublished preliminary analyses of the incidence data in the period 1999-2001 indicate that incidence is 30% greater (UICC, 2006). In contrast with the general pattern of tumour subtypes, lymphoma cases appear more common than leukaemia. This observation is confirmed by the registry data of Algeria and by the Gharbiah registry (UICC, 2006).

A clear deficit of retinoblastoma in the Alexandria data was noted, since this tumour is five times more common in most North African case series. Based on the age-standardized rate of the Alexandria Cancer Registry (ASR=101 per million), we would expect 2,700 new cases of childhood cancer per year in the whole country. If the higher rates of the Gharbiah registry are confirmed, the incidence would be 3,500 new cases per year (UICC, 2006).

2.7.11 The burden of cancer in Palestine:

In 2005, the reported number of new cancer cases in the occupied Palestinian territory was 1623 and the crude incidence was 43·1 per 100 000 population—49·2 per 100 000 in the West Bank and 32·7 per 100 000 in the Gaza Strip. 45% of all cases were in men and 55% in women. Reported age-adjusted cancer incidence for the occupied Palestinian territory for 1998–2001 was lower than that in Jordan, Lebanon, and in Arabs living in Israel, probably because it was an underestimate since some patients use services outside the territory (Hussini et al, 2009). In 2005, combined cancer mortality rate was 27·8 per 100 000. Lung cancer, the most commonly diagnosed and most deadly cancer worldwide, is the most common type in Palestinian men, those living in Jordan and Lebanon, and Palestinian Arabs living in Israel (Hussini et al, 2009). The estimated incidence is 5·2 per 100 000 men. Lung cancer is the leading cause of death from cancer in men—7·1 deaths per 100 000 in 2005 and 22·8% of all cancer deaths. Prostate cancer is the second most common type in Palestinian men, followed by colorectal cancer. After lung cancer, the four types of cancer resulting in similar mortality rates in men are prostate (9·5%), nervous system (9·5%), colorectal (9·3%), and liver (9·1%).6 Breast cancer is the most common type in Palestinian women (Hussini et al, 2009). The proportion is similar to that in neighboring countries except Lebanon, where breast cancer accounts for nearly half of all cancers in women. This disease causes the highest cancer-related mortality in Palestinian women, 21·1% of all deaths from cancer, and 5·2 deaths per 100 000 women.6 In theory some features of Palestinian society, including a high total fertility rate (4·6%), high rate of breast feeding (95·6%) with a mean duration of 10·9 months, young mean age at first birth (20 years), and low alcohol consumption, should be protective against breast cancer. Other features e.g. obesity and nulliparity—might act against these protective factors. About a third of Palestinian women of reproductive age are single and thus mostly childless. Colorectal cancer is the second most common type in Palestinian women and causes the second highest mortality rate from cancer (Hussini et al, 2009). The traditional Palestinian Mediterranean diet characterized by high intake of fiber and carbohydrate and low intake of fat and protein should provide some protection against colorectal cancer. The nutritional transition that is underway in the occupied Palestinian territory, however, with the economic hardship, is reducing the consumption of a healthy diet in favorite of a western-style diet, and thereby mitigating the protective effect of the traditional Palestinian diet (Hussini et al, 2009).

2.7.12 Pediatric cancer in Palestine:

According to the reviewed data of Gaza cancer registry by Abed et al 2008 shows the number of cases, the proportion of individual diagnostic groups, age-specific rates, and the age-standardized rates during 1997–2008 for all diagnostic groups and subgroups of the International Classification of Childhood Cancer (ICCC). A total of 679 incident cases of childhood cancer were registered during the 11-year period, with an average of 62 cases per year (Abed et al, 2008).

ASR for pediatric cancer is 91.9 and it is higher among males (102.9) than females (80). Number of cases among males is higher than females (387 and 292 respectively). The male to female ratio was 1.35:1. The event is reported more in 0-4 years when the age specific rate is 101 for each million children and the rate drops as age increase (Abed et al, 2008).

The five most common childhood cancers were leukemias (30.3%, ASR = 27.7), lymphomas (19.4%, ASR = 17.7), malignant tumors of the brain and spine cord (13.9%, ASR = 12.7), neuroblastomas (6.8%, ASR=6.2), and malignant bone tumors (6.2%, ASR=5.7) (Abed et al, 2008).

2.8 Cancer mortality

Cancer is the fourth most common cause of death (after unintentional injury, homicide, and suicide) among persons aged 1--19 years in the United States. Because recent childhood cancer mortality has not been well characterized in terms of temporal, demographic, and geographic trends, CDC analyzed cancer death rates among children (defined as aged 0--14 years) and adolescents (defined as aged 15--19 years) for the period 1990--2004 by sex, age group, race, ethnicity.

A total of 34,500 childhood cancer deaths were reported in the United States during 1990--2004. A total of 2,223 cancer deaths occurred in 2004; among these, leukemias were the most common diagnoses (25.5%), followed by brain and other nervous system neoplasms (25.0%). From 1990 to 2004, death rates declined significantly for leukemias by 3.0% per year, for brain and other nervous system neoplasms by 1.0% per year, and for all other cancers combined by 1.3% per year. For all cancers combined during 1990--2004, boys (33.1 per million) had significantly higher death rates than girls (26.1); adolescents (37.9) had significantly higher death rates than children (26.9). Death rates decreased similarly by sex, age group, and race; decreases ranged from 1.5% to 2.0% per year during 1990--2004. Statistical analysis with joinpoint regression revealed that the death rate for whites remained stable during 1990--1992 ($p = 0.77$), declined significantly during 1992--1996 by 4.3% per year ($p = 0.001$), and then stabilized again during 1996--2004 ($p = 0.07$). Death rates for blacks and A/PIs declined significantly, both by 1.6% per year ($p<0.001$ for blacks and $p = 0.003$ for A/PIs). Death rates for AI/ANs were stable during 1990--2004 ($p = 0.18$); this trend might be attributed to the small numbers available for analysis in this population. Regression analysis also revealed that the death rate for Hispanics remained stable during 1990--1992 ($p = 0.53$), declined significantly during 1992--1998 by 4.3% per year ($p = 0.01$), and then stabilized during 1998--2001 ($p = 0.32$) and during 2001--2004 ($p = 0.57$); the death rate for non-Hispanics declined significantly during 1990--1996 by 2.6% per year ($p<0.001$) and 1996--2004 by 0.9% per year ($p = 0.009$). (Pollack LA et al, 2007).

Another study in United State revealed that over the past two decades, childhood cancer mortality in the United States has declined dramatically In the United States today few children die from cancer in comparison to other causes of death Of the nearly 60,000 deaths among children younger than 20 years of age, less than 4% were due to neoplasms (cancer). If infants are excluded, the number one cause of death was accidents followed by homicides, suicides and then cancer (Ries, 2008)

Chapter 3

3. Methodology

This chapter will discuss the methodology and design of the study to asses the current trend of pediatric cancer in Gaza strip during the period 1998-2010. The researcher here is describing the main sources of cancer data in Gaza and the methods used to collate from different sources.

3.1 Study design

The design of this study is descriptive, comparative and record based study. The data were collected from Gaza cancer registry and other cancer services sites. Special designed abstract sheet was used to reveal the current frequency and characteristics of the event in the population.

The researcher collected data from record based-population of Gaza strip cancer registry during the period 1998 to 2008, and collected 2009-2010 data from other cancer services sites is described below. Cancer registry is collecting information about new incidence of cancer in Gaza strip.

The descriptive study will be suitable to achieve the objectives of this study and to assess the current situation of pediatrics cancer among population. Descriptive studies could demonstrate time trend of cancer during the period of the study.

3.2 Study Setting

Since the MOH is the only provider for cancer services. The study was conducted in all the governmental institutions which provide cancer services for children.

1- Hospitals:

There are three main hospitals which provide cancer services to children:

1- Al Rantisi Hospital, the specialized hospital for pediatric this one is consider as the main data source for pediatric cancer 2009-2010, 2- European Gaza Hospital in the south of Gaza that provides cancer services for all patients living in south Gaza.

3- Shifa Hospital as a referral site, since it is considers the primary source of the oncology services and data where Palestinian cancer registry is located.

2- Palestinian Cancer Registry:

Palestinian Cancer Registry (PCR) is a population-based registry established in 1996 under the umbrella of the Ministry of Health and it started its regular work in 1998. The main purpose of the PCR is to define the size of the cancer problem and pattern of its occurrence in Palestine and also to provide data on the cancer which is an important source for epidemiological and clinical studies. To make cancer incidence and prevalence data available for use by health planners and professionals in order to plan for cancer prevention, control and management in cost effective manner (MOH, 2002).

3- Pathology laboratories

The laboratory services in the MOH are offered to the Palestinian people at three levels: Central, Intermediate, and Peripheral (MOH-PHIC, 2006). The histopathology and cytology services are centralized in Shifa Hospital This central laboratory is a referral one specialized for advanced analyses and receives biopsies and samples from other hospitals. The researcher collected the histopathological reports of the patients that were not found and identified in the hospitals within the period 2009- 2010.

4-Health Management Information system (HMIS)

Health management information System is a unit in MOH, incorporates all the data needed by policy makers, clinicians, health service users and researchers to improve and protect population health**.** Resources of data are going towards preventing and controlling high burden diseases such as cancer. The data needed in health management information system ranges from birth, morbidity and mortality data where death certificates collected and interpreted. The researcher used this unit to collect the data of pediatrics cancer deaths during the time of the study.

3.3 Study population

The population of the study includes all the cancer children aged 15 years and below in the Gaza strip and have access to one of the previous sites mentioned in the sitting of the study.

All pediatrics cancer patients aged 15 year and below who diagnosed during the period 1998 to 2010 and confirmed be the histopathological report as a malignant case.

3.4 Eligibility criteria:

3.4.1 Inclusion criteria:

Any patient of cancer aged 15 years and below who have confirmed malignant diagnosis registered in one of the health institutions in Gaza strip during the period 1998 to 2010.

3.4.2 Exclusion criteria

All non confirmed cases by histopathology and lab facilities

Any patient of cancer above the age 15 year at the date of diagnosis

Any patient before and after the period 1998 to 2010

3.5 Data collection and instrument

The data collected through an abstract sheet whish is special design for needed variables to be suitable to assess the objectives of the study, and the data collected by the researcher himself.

3.5.1 Instrument:

Based on the Manual and Standard for Cancer Registry, the researcher designed special abstract sheet including the variables which are necessary to assess the trend and patterns of the pediatrics cancer in Gaza strip.

The abstract sheet contains the following variables:

- socio-demographic data of the child: age, sex and address
- data regarding cancer type: site, morphology, histopathology and cancer behavior
- Treatment procedures and process
- vital status: dead and alive

The researcher collected the data from the different sites by herself, the researcher visited all the mentioned sites and recording data from the medical records during the period 2009-2010

1- The first step was in pediatric hospital; the researcher investigated all the records of pediatrics cancer patients (0-12 years old) included in the criteria, and filled the information into the abstract sheet
2- The second step was in European Gaza hospital; the researcher investigated all the records of pediatrics cancer patients included in the criteria, and filled the information into the abstract sheet.
3- The third step was in Shifa hospital; the researcher investigated all the records of pediatrics cancer patients included in the criteria, shifa hospital had the data source of the patient aged 13 to 15 years, and filled the information into the abstract sheet.
4- The fourth step was in Palestinian Cancer Registry, the researcher collected all the data during the period 1998 to 2008 in one completed package enclosed all the information as in the abstract sheet.
5- The fifth step was in the histopathological laboratory of shifa hospital as it is considered the referral hidtopathologial laboratory in Gaza strip, the researcher collected the data of including criteria during the period 2009 to 2010.
6- The sixth step was the Health Information system, the researcher investigated all the death certificates due to cancer at the age of the including criteria.

7- The seventh step was coding of the disease using the ICD-10 and ICD-O-9. the researcher coded all the diagnosis data of 2009-2010 according to the ICD-10 and ICD-O-9

8- The eighth step was the coding of the residence area of the case; the researcher coded all the residence area of all cases according to the key of the national cancer registry.

9- The ninth step was the data entry into a special designed excel package to remove duplication and to conduct data cleaning.

10- The tenth step was recoding of the diagnosis data and setting into groups.

The groups are according to classification of cancer registry team.

11- Transfer the data to SPSS package for analysis

12- The researcher also used the age-standardized incidence rate (ASR) combines these age-specific rates into one summary measure the 2003 and 2004 mid year population were used to calculate the results.

13- The researcher used the average annual percentage change (AAPC) to estimate the change rate of cases every year. The researcher used the measurement equation to calculate the result:

Annual percentage change: $\frac{\text{Recent year – Previous year}}{\text{Previous year}} \times 100$

14- The researcher used crude incidence rate, the cause specific death rate, case fatality rate and proportional mortality using the following equations :

- Crude rate : $\frac{\text{Specific year incidence x 100.000}}{\text{Specific age population}}$
- Cause specific death rate : $\frac{\text{Deaths to specific disease x 100.000}}{\text{Mid year population}}$
- Cancer case fatality: <u>Deaths specific disease</u>

Number of reported case of same disease

- Proportional mortality : $\frac{\text{Deaths due to specific disease}}{\text{Total deaths during the same period}}$

15- The researcher used GIS to identify the distribution of the cases all over the area of Gaza strip and the distribution of the most common cancer by locality.

3.6 Statistical analysis:

- The collected date was analyzed by using the statistical package of social science (SPSS, version 17).
- Excel sheet for data cleaning and design graphics and charts.
- Geographical Information System (GIS) to allocate the cases in its geographical patterns.

The researcher also use the age-standardized incidence rate (ASR) combines these age-specific rates into one summary measure, providing a method of comparing the incidence rates in different populations while adjusting for differences in the age distributions. In order to calculate the ASR, one needs to define a standard population age distribution to which the other populations are referred. The standard population age distribution chosen for this research is the WHO World Standard population.

The data was processed by the program and passed through out all the steps of the data management and analysis

- data Entry
- Checking and verifying of the collected data from errors, missing and inconsistency
- data cleaning
- data processing
- statistical test.

3.7 Ethical and administrative consideration

Approval from Helsinki committee

Administrative approvals from the Palestinian ministry of health

Consideration to privacy and confidentiality

Honesty in reporting and analysis of data, with respect to confidentiality and results.

Findings sharing with others whom are interested, or who may get benefits of them.

3.8 Limitation of the study

- Poor documentation and recording
- Limited trends studies in Arab region area
- Limited hard copy resources in our libraries
- Poor electricity
- Low speed of net and download

Chapter 4

4. Result and Discussion

4.1Characteristic of the study population

Table 4.1.1: Distribution of incidence number of pediatrics cancer cases and crude rate per year

Year	Frequency	Crude rate	Percent
1998	77	11	8.4
1999	58	8	6.4
2000	65	9	7.1
2001	62	8	6.8
2002	53	7	5.8
2003	60	8	6.6
2004	68	9	7.5
2005	74	10	8.2
2006	62	9	6.9
2007	66	9	7.8
2008	82	11	9.1
2009	90	12	9.8
2010	87	12	9.6
Total	904		100.0

Figure 4.1: Distribution of incidence number of pediatrics cancer cases

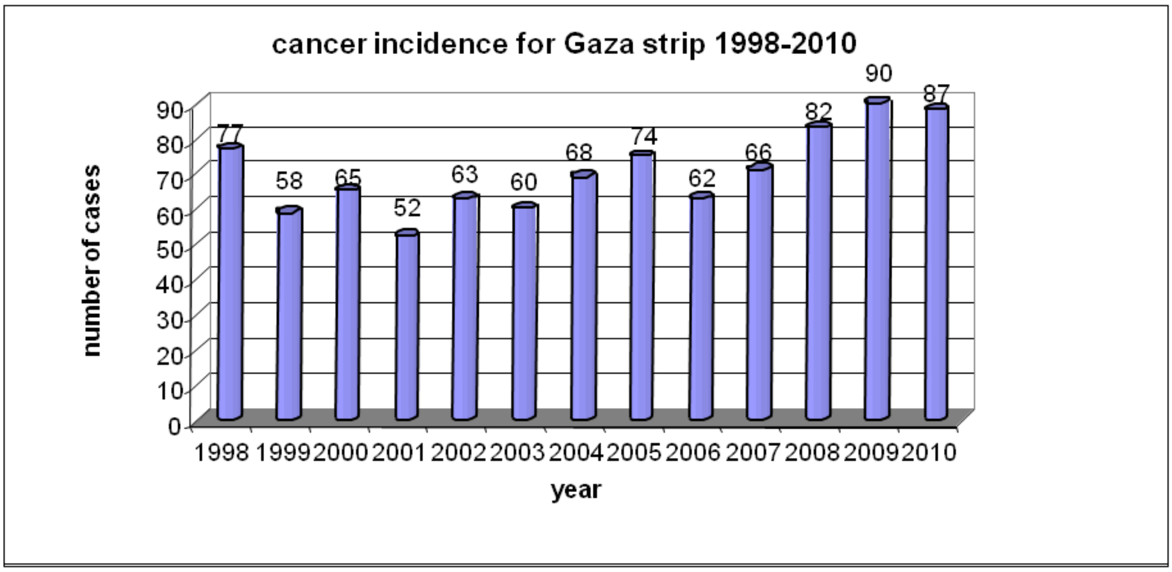
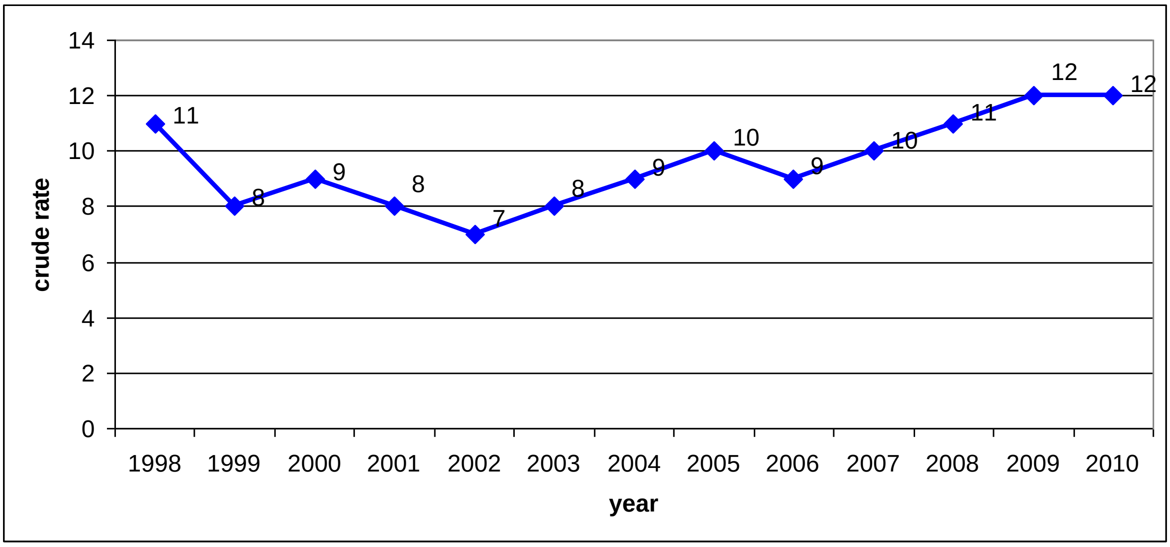


Figure 4.2: Incidence crude rate per year



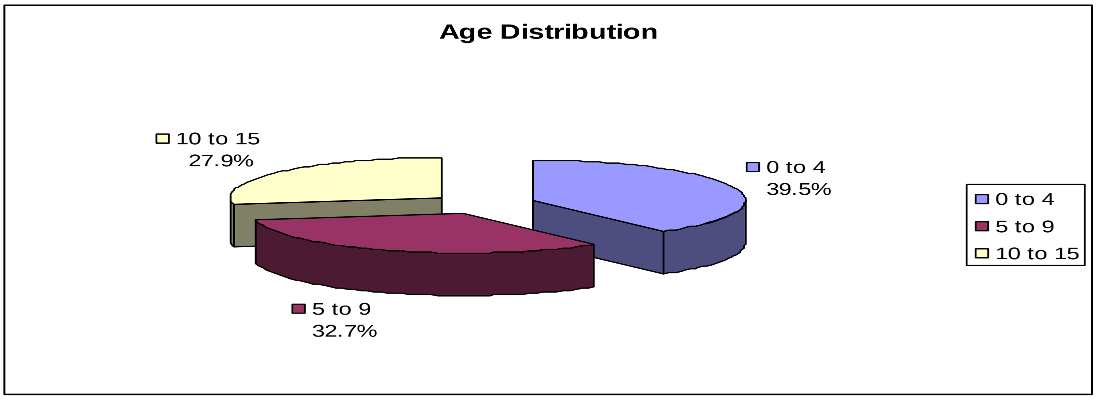
As showed in table (4.1.1), the total of 904 reported cases of childhood cancer were diagnosed in Gaza strip during the period from 1998 to 2010, the incidence was calculated for each year as demonstrated in figure (4.1). The annual average of all cases was 70 cases per year. Crude incidence rates per year were calculated the range of values was 7 to 12 with random fluctuations by years, the lowest value was in 2002 and the highest value were in years 2009 and 2010 respectively as demonstrate in figure (4.2). Trends varied and changed substantially from year to year through random fluctuations in rates, average annual percentage change was (+4.4%), the findings in this study was inconsistent with international studies and reports, the percentage in Gaza strip was considered high comparing to other percentages, in Shanghai no substantial change was found in childhood cancer incidence. But in U.S., between 1975 and 2002, significant increase in the average annual incidence rate (APC, 0.7%) was observed for all pediatric cancer (Ries LAG, et al.2008). Also in UK, from 1962 to 1998, registration rates increased by 0.8% per year on average a total increase of 35% (UK, CCRG.2008), by1.0% in Europe between 1970 and 1999 (Steliarova-Foucher et al, 2004), by 1.0% in Sweden between 1960 and 1998 (Dreifaldt et al, 2004) and by 0.8% per year in Western Germany (1987–2004). The much higher increase in rates in Eastern Germany (2.1% per year in 1991–2004) was probably influenced by incomplete data early in the reporting period (Spix et al, 2008).

Table 4.1.2: Distribution of the study population by sex and age

Age	male		female		Total	percent
0-4	188		168		356	39.5%
5-9	177		119		296	32.7%
10-15	138		115		253	27.9%
Total	502	55.4%	402	44.3%	904	100%

During 13-years period, 1998–2010, a total of 915 children at the aged 15 years and below were reported with cancer disease in Gaza strip. The study results showed that the highest event incidence was among age group (0-4) which presents 39.5%, followed by age group (5-9) 33% and the lowest representing the age group (10-15) with a percentage 27.9%. These results were consistent with other studies. In Australia the incidence rate of childhood cancer was higher among children aged 0–4 years (223 cases per million population) than at ages 5–9 (117 per million) or 10–14 years (131 per million) (PD Bade, et al, 2010). In shanghai annual incidence rate was highest in the 0–4 years age group with 173.3 per million. The annual incidence of 5–9 and 10–14 years age group was 100.1 per million and 102.2 per million, respectively (Bao, et al. 2009). Also the same result seen in Europe, all over time although in the 1990s, it was still significant for the age-group 1–4 years ($p<0\cdot0001$) (Foucher et al, 2004). In Egypt the high incidence of cancer was seen in the same age group 0-4 as reported by ENCI 2002-03. In Gaza strip the event is reported more in 0-4 years when the age specific rate is 101 for each million children (Abed et al, 2008).

Figure (4.3): Distribution the incidence by age



The results also showed 502 reported cases of the event for males with a percentage (55.7%), and 402 for females (44.3%), male/female ratio 1.25:1 for overall pediatric cancer incidence. (ASR for male was 110 and for female 90 per million respectively). Male predominance in this study is consistent with many published studies, in Egypt there were 1,184 (61.1%) male and 753 (38.9%) female, with a ratio of nearly 1.57:1(ENCI 2002-03). In Australia There was a 1.14:1 male/female ratio for overall childhood cancer incidence (PD Bade, et al, 2010). But in shanghai a total of 609 cases of childhood cancer were diagnosed from 2002 to 2005, 311 (51.1%) for males and 298 (48.9%) for females, respectively Overall, the crude annual incidence of childhood caner has no significant difference between males and females and the ratio was 1.0 male/female (128.5 per million and 129.6 per million) (Bao, et al. 2009). In Gaza strip, during the year 1988-2008 numbers of cases among males is higher than females (387 and 292 respectively). The male to female ratio was 1.35:1. (Abed et al, 2008).

Figure (4.4): Distribution of the study population by sex

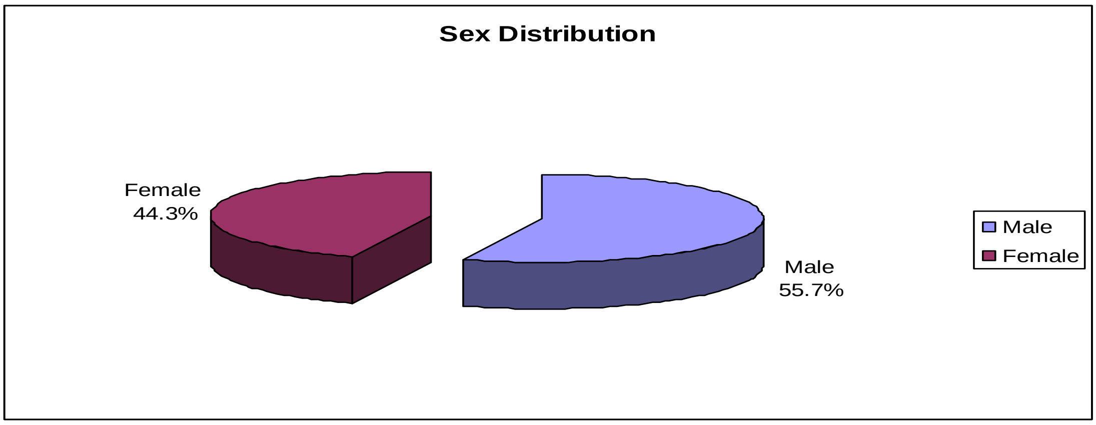
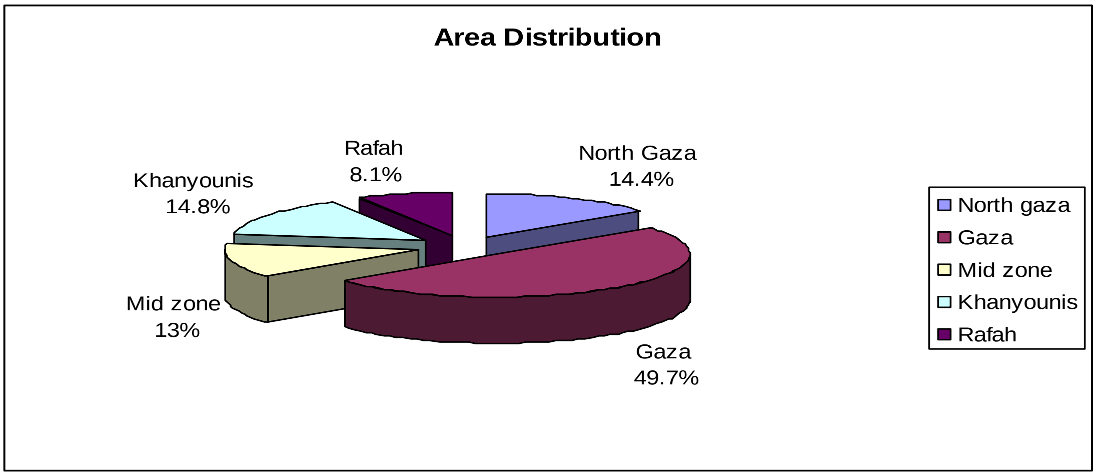


Table 4.1.3: Distribution of the study population by area

	Frequency	Percent
North Gaza	132	14.4
Gaza	444	49.1
mid zone	119	13.0
khanyounis	135	14.8
rafah	74	8.1
Total	904	100.0

The distribution of reported cases by area showed that the majority of cases were allocated in Gaza (49.1%) followed by Kanyounis 14.8%, north Gaza 14.4%, mid zone 13% then Rafah 8.1%.This marked difference between Gaza and other areas maybe due to the marked difference between the populations of the same areas as the population of Gaza is count for 543,195 from 1,561,906 the total population of Gaza strip (PCBS, 2010). The address is not reported correctly further inquiries showed that it is administrative process, the staff of cancer registry report Gaza when the address is not recorded. Similar variation between Governorates was observed in Jordan where Amman city reported the highest cancer rates. The rates in Amman are twice or triple of other governorates in Jordan (Tarawenh M, et al.2010). Cairo and Geiza reported more than 50% of cancer cases in Egypt (ENCI 2002-03).

Figure (4.5): Distribution the incidence by area



4.2 characteristic of Disease

Table 4.2.1: distribution of cases by cancer type

ICD_group	Frequency	Percent	Rank
Leukemia (C91-95)	255	27.9	1
lymphomas (C81-C82-C85)	163	17.6	2
B.N.S. (C70 -71-72)	145	15.8	3
Bone (C40-C41)	49	5.4	6
Kidney (C64-66-68)	49	5.4	6
Connective tissue (C38-C45- C49)	30	3.3	8
Ovary (C56)	14	1.5	9
Or pharyngeal (C00-C14)	11	1.2	10
Liver (C22)	11	1.2	10
Testis (C60- 62- 63)	10	1.1	12
Skin (C43 - C44)	7	0.8	13
Lung (C34)	7	0.8	13
Bladder (C67)	6	0.7	15
Thyroid (C73)	5	0.5	16
Stomach (C16)	2	0.2	17
Oesophagus (C15)	1	0.1	18
Other sites	139	15.1	4
Total	904	100%	

The types of cancer, according to the 27 diagnostic groups of the ICD-10 and ICD-O are listed in annex 3. About one-third of all childhood cancers were leukemia 255 reported case with percentage 27.9%, lymphomas was the second most common type of cancer accounted for 17.6%, among lymphoma cases 9.5% and 8.1%, was Hodgkin disease and Non-Hodgkin lymphomas respectively, Brain and spinal tumor representing 15.8%, of the total pediatric cancer with 145 reported cases. Bone and kidney were at the same level and constituted 5.4% of the total. And the others sites was accounted for connective tissue 3.3%, ovary 1.5%, Oropharyngeal and liver 1.2%, testis 1.1%, and skin, lung, bladder , thyroid and other sites was counted less than 1%. This result concluded that the most common types pediatric cancer were leukemias, lymphomas and brain nerve system.

This result was consistent with the international rank of pediatric cancer types in other regions. According to American cancer society and based on the International Classification of Childhood Cancer, childhood cancers include: Leukemia (31.0% of all childhood cancers), Brain and other nervous system (21.3%), Neuroblastoma (7.1%), Wilms tumor (5.2%), Non-Hodgkin lymphoma (4.3%) and Hodgkin lymphoma (3.8%) (American cancer society, 2010). In Shanghai about one-third of all childhood cancers were leukemia. Brain and spinal tumor was the second most common type of cancer, representing 20.2% of the total, Lymphomas accounted for 8.4% of the total with mostly Non-Hodgkin lymphomas (NHL) with 80.4%. Hodgkin disease constituted only 7.8% of all lymphomas (Bao, et al. 2009). In Australia the commonest types were leukemia (34%), CNS (23%) and lymphomas (10%) (PD Baade, et al. 2010). In U.S.A. Nearly one third of the cancers diagnosed in children ages birth to 14 years are leukemia followed by cancer of the brain and other nervous system (21%), soft tissue sarcomas (including neuroblastoma [7%] and rhabdomyosarcoma [3%]), renal (Wilms) tumors (5%), and non-Hodgkin lymphoma (4%) (Jemal et al 2010). In Morocco hospital based study of 444 cases of childhood cancer, during 1983-85, was reported in the UICC, 2006; the most commonly recorded childhood cancers were lymphomas (33%), leukemia (23%), and Wilm’s tumours (10%). But the result of study was consistent with other reports, in Egypt the most cancer type was leukemia, 643 (33.2%) new cases. Lymphoma was the next most common (18.1%), followed by brain tumors, accounting for 7.1%, of all childhood cancer. (ENCI 2002-03). In Gaza strip the five most common childhood cancers were leukemias (30.3%) lymphomas (19.4%) malignant tumors of the brain and spine cord (13.9%), and malignant bone tumors (6.2%) (Abed, et al. 2008).

Table 4.2.2: distribution of the most common cancer type by sex and age

Sites group	Age 0-4		Age 5-9		Age 10-15		Total	
	M	F	M	F	M	F	M	F
Oropharyngeal (C00-C14)	1	0	0	1	5	4	6	5
Oesophagus (C15)	0	0	0	0	0	1	0	1
Stomach (C16)	1	1	0	0	0	0	1	1
Liver (C22)	4	2	0	3	1	1	5	6
Lung (C34)	1	1	1	1	2	1	4	3
Connective tissue (C38-C45- C49)	10	10	2	4	3	1	15	15
Bone (C40-C41)	2	5	10	7	13	12	25	24
Skin (C43 - C44)	1	2	0	0	3	1	4	3
Testis (C 60- 62- 63)	5	0	2	0	3	0	10	0
Kidney (C64-66-68)	14	20	10	3	0	2	24	25
Bladder (C67)	5	0	0	0	1	0	6	0
B.N.S. (C70 -71-720	28	27	28	25	21	16	77	68
Thyroid (C73)	0	0	1	0	0	4	1	4
H.D. (C 81)	10	6	27	8	20	16	57	30
N.H.D(C82-85)	19	8	15	17	11	6	45	31
Leukemia (C91-95)	47	48	57	40	35	28	139	116
Ovary (C56)	0	1	0	3	0	10	0	14
Other sites	41	35	25	7	19	12	84	54
Total	188	168	177	119	138	115	502	402

As showed in table (4.2.2) the incidence was highest in the 0–4 years age group with 356 reported cases (ASR 101), followed by 5–9 with 296 reported cases (ASR 104), and 10–15 years age group was accounted for 253 reported cases (ASR 90), respectively. This finding clarifies that the incidence of cancer decreases when the age increases.

Different diagnostic groups have distinctive age distributions. The data shows that BNS and tumors of connective tissue were predominantly among children in the 0–4 years age group, and only a few cases in other age groups. The peak age of 0–4 years was also observed in the leukemia with ASR 27.8, but there was slight decrease when the age increases. In contrast, malignant bone tumor and lymphoma showed a marked increase in incidence with age increase, with the highest H.D and bone tumor incidence in 10–15 years age group followed by 5-9 age group (ASR for HD was 18.8, 23.3 respectively),but in N.H.D. incidence the highest value was accounted for 5-9 age groups.

Overall, the crude annual incidence of childhood caner has differences between males and females (510 and 405 cases, respectively). The annual incidence adjusted for the world standard population among male and females showed sex variation (110 per million and 90 per million respectively).

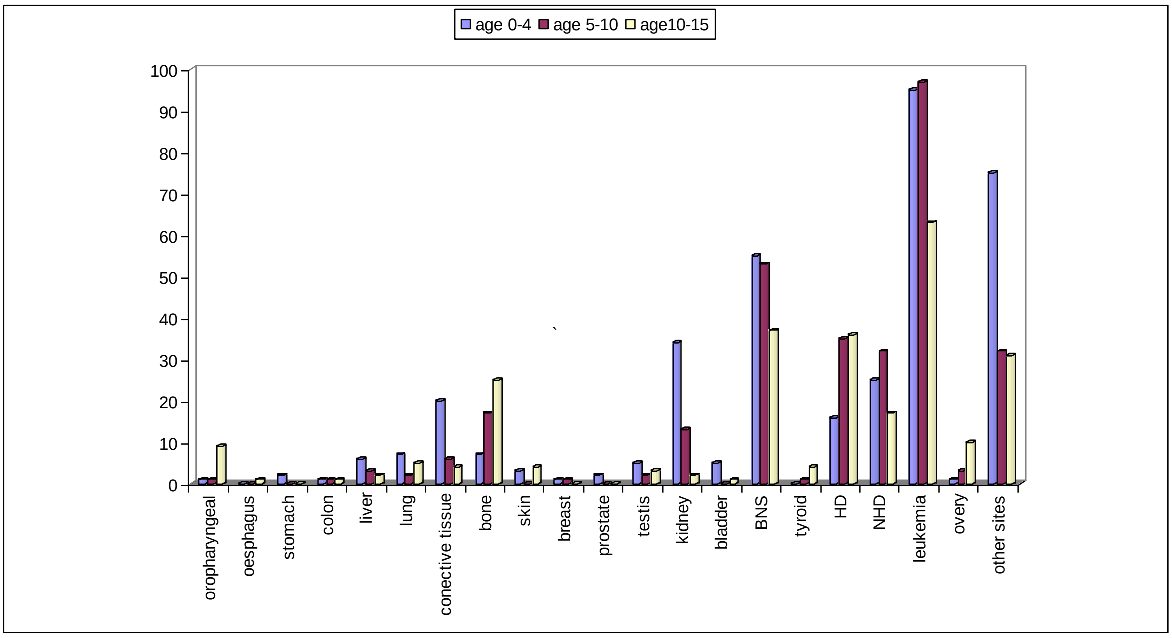


Figure (4.2.2): distribution of cases by age

The incidence of lymphomas and leukemia was considerable higher in males than in females. There was a slight difference of males with brain and spinal tumor, bladder tumors was seen in male but not in female. The most pronounced difference in sex was seen in lymphomas (ASR among male and female was 2.16, 1.36 respectively). Males' incidence rates were three times higher than females in the 5–9 year age group (27 – 8 cases in HD type) respectively. No sex differences were apparent in the remaining cancer sites among these three age groups.

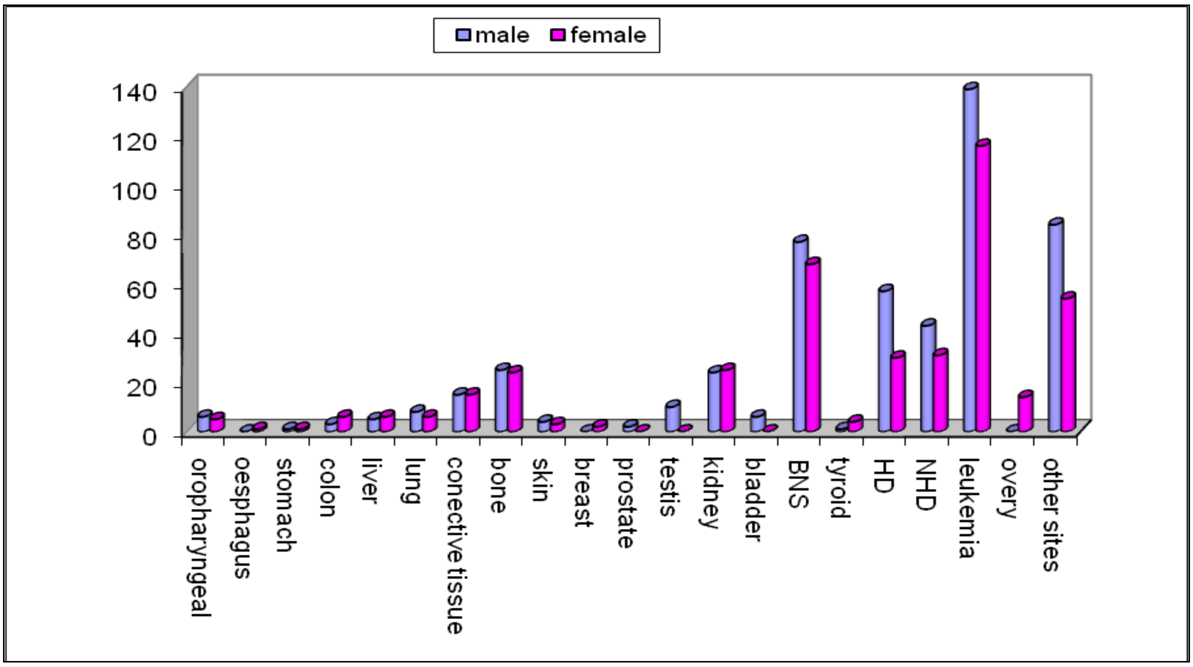


Figure (4.2.3): distribution of cases by sex

Among the other regions of the world the rates and trend were varied in relation between cancer type and sex and age. In Australia incidence trends among both boys and girls for leukaemia, hepatic tumours and germ cell tumours showed significant increases, whereas there have been recent, significant decreases among boys in the incidence of neuroblastomas and malignant epithelial tumours and melanomas.

There was also some variation in incidence rate trends by age group. At 0–4 years, the average increase (0.7% per year) was consistent up to 2006, but at 5–9 years there was evidence of a consistent, small, but not significant increase over time; at 10–14 year

(PD Baade, et al.2010). In Shanghai the data shows that neuroblastoma, retinoblastoma and hepatoblastoma were cancers predominantly diagnosed among children in the 0–4 years age group, and only a few cases in other age groups. The peak age of 0–4 years was also observed in the leukaemia, but the decrease with age increasing was more gradual. In contrast, malignant bone tumour and malignant epithelial tumour showed a marked increase in incidence with age growing, with the highest in 10–14 years age group. Lymphomas had the highest incidence in the 5–9 years age group, and change of rate in different age groups was more obvious in males than in females (Bao, et al. 2009). In U.S.A The incidence rate of ALL was stable, with the exception of those ages 5 through 9 years, in whom an increase was initially observed (1992–1999), followed by a decline similar in magnitude, and in those patients ages 15 to19 years, in whom a substantial increase was detected(APC, 3.3%). Rates of HD may also be declining among patients' ages 15 to 19 years. For CNS tumors overall, an initial decline was observed among those ages 1 to 4 years (1992–1996: APC, 24.8%) with a subsequent rise and fall in rates; rates appeared stable in other age groups (Linabery and Ross 2008).

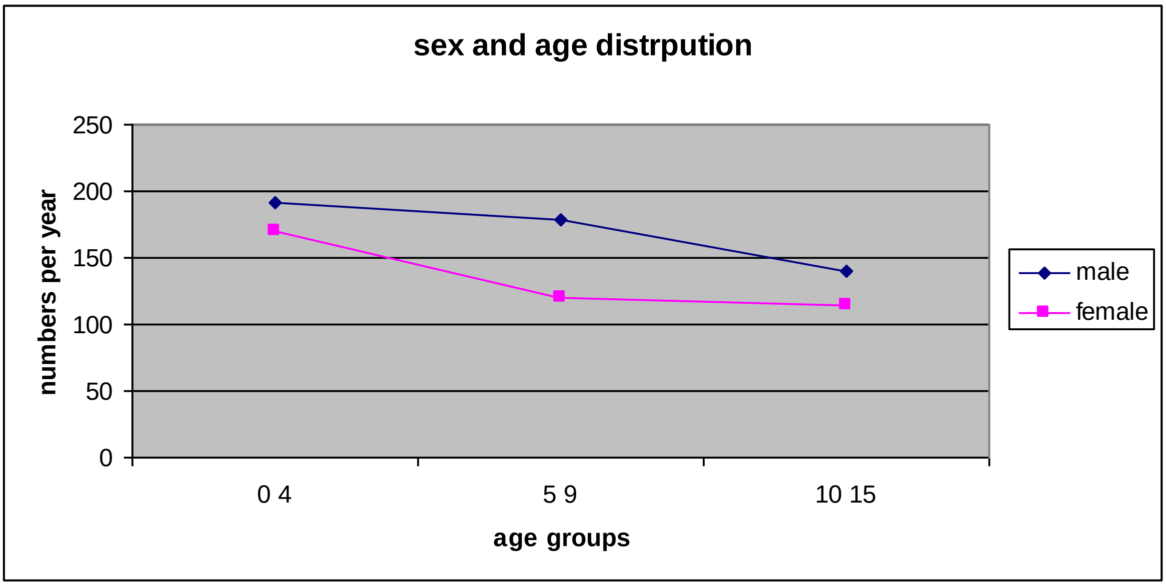
In Egypt leukemia was accounted for 33.2% of all newly diagnosed proven malignant children. There were 394 boys (33.3% of all cancer types) and 249 girls (33.1% of all cancer types), lymphoma was accounted for 18.1% of all newly diagnosed proven malignant children. There were 253 boys (21.4% of all cancer types) and 97 girls (12.9% of all cancer types) (ENCI, 2002-03)

Table 4.2.3: distribution of cases by year, age and sex

	Age 0-4		Age 5-9		Age 10-15		Total		
Year	M	F	M	F	M	F	M	F	Ratio
1998	20	13	25	8	5	6	50	27	1.8
1999	13	6	12	14	8	5	33	25	1.3
2000	9	11	13	9	11	12	33	32	1.0
2001	17	13	6	6	12	8	35	27	1.2
2002	15	16	6	5	4	7	25	28	0.8
2003	10	11	19	8	7	5	36	24	1.5
2004	8	11	9	10	15	15	32	36	0.9
2005	15	17	12	11	11	8	38	36	1.0
2006	20	9	10	9	6	8	36	26	1.4
2007	17	6	15	6	14	8	46	20	2.2
2008	15	16	21	10	15	6	50	32	1.5
2009	10	15	18	12	18	17	46	44	1.0
2010	18	24	11	11	13	10	42	45	0.9
Total	188	168	177	119	138	115	502	402	1.25

The results in table 4.2.3 showed that there was an obvious difference between male and female ratio by years. The peak of differences seen in year 2007 presented in ratio 2.2, the lowest differences seen in year 2002 and 2010 (0.8 - 0.9 respectively) There were considerable year-to-year random fluctuations in sex ratio between years.

Figure (4.2.3): Distribution of sex by year and age



Cross the years the big differences was seen in 5-9 age group, but the differences was almost the same in the other age groups.

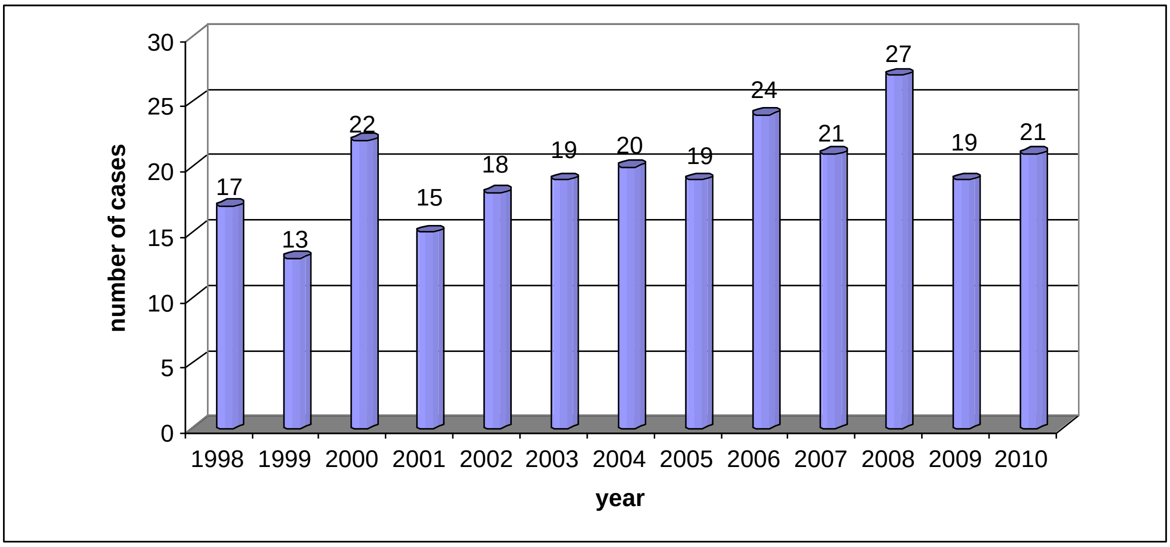
4.2.4 The top site incidence distribution

4.2.4.1 Leukemia

Leukemia was accounted for one third of the total 255 case. The ASR for leukemia was 28.5, with a small high rate among male to female (ASR 30, 25.9 respectively). The age specific rate for the 0-4 age group was lower than the 5-9 age group (ASR 27.8, 33.9 respectively).

Incidence of pediatrics leukemias appeared to rise in 1998, with rates increasing from 2.7 cases per 100,000 in 1998 to 3.3 cases per 100,000 in 2010. Rates in the other years between from 1998 to 2010 have shown inconsistent upward or downward trend and have ranged from 2.0 to 3.8 cases per 100,000.

Figure (4.2.4.1): Distribution of leukemia incidence by years



4.2.4.2. Lymphoma

Lymphoma was accounted the second high site of malignant tumor among pediatric 161 cases. The ASR for lymphoma was 17.7, with a considerable difference among male to female (ASR 21.6, 13.6 respectively). The age specific rate for the 5-9 age group was the highest ASR 23.3, followed by 10-15 age group ASR 18.8, and the lowest was for age group 0-4 ASR 12.6. Hodgkin lymphoma type was the highest between other types of lymphomas

For pediatrics Hodgkin lymphoma and Non-Hodgkin lymphoma, the overall incidence declined from 1998 through 2010, from 3.3 to 1.4 cases per 100,000, with the greatest downward occurring from 2003 through 2010.

Figure (4.2.4.2): distribution of Hodgkin lymphoma incidence by years

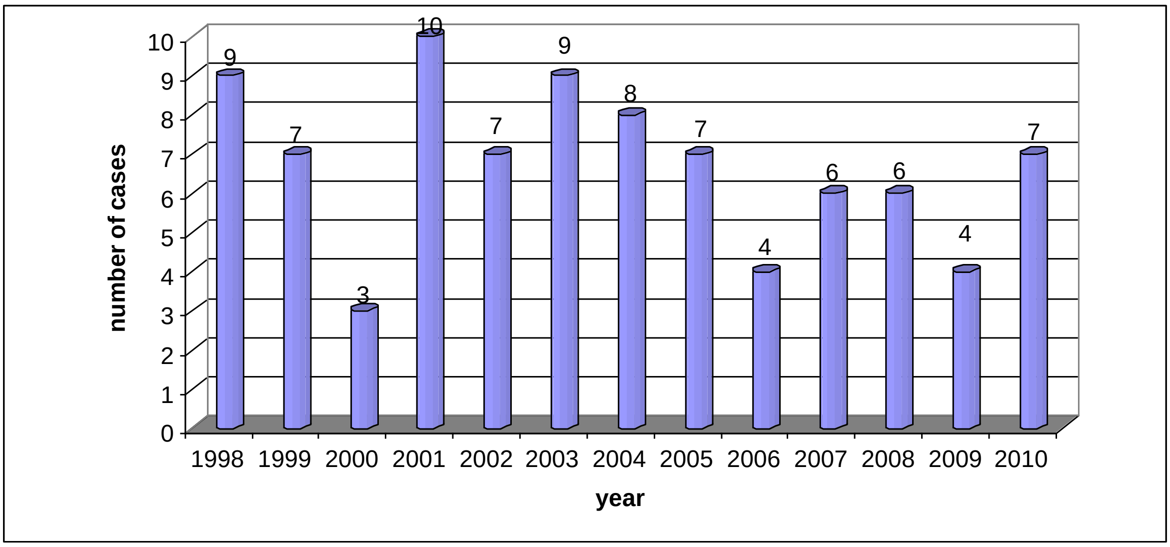
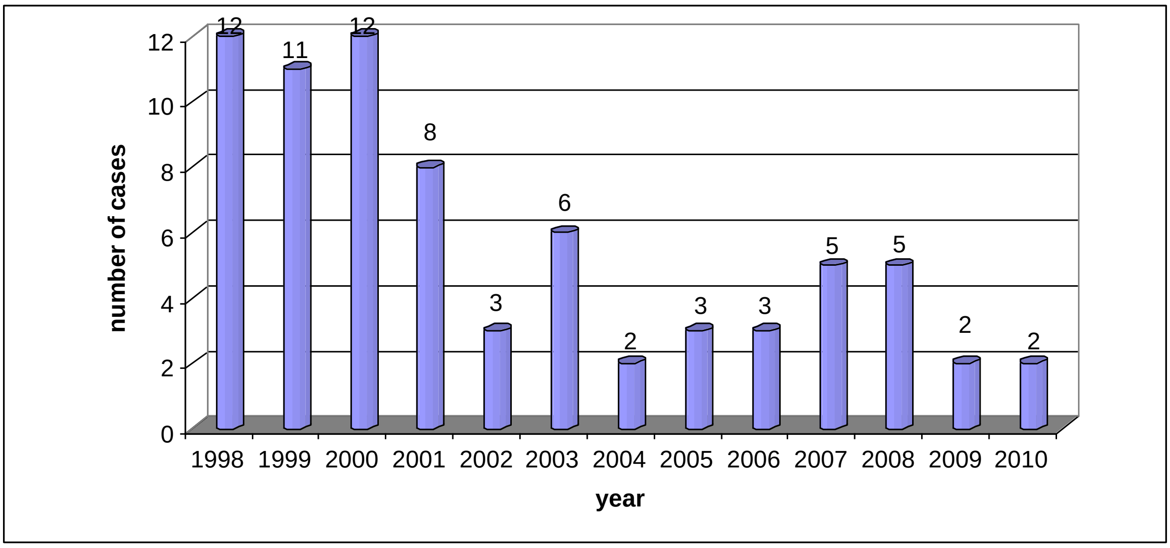


Figure (4.2.4.3): distribution of Non-Hodgkin lymphoma incidence by years



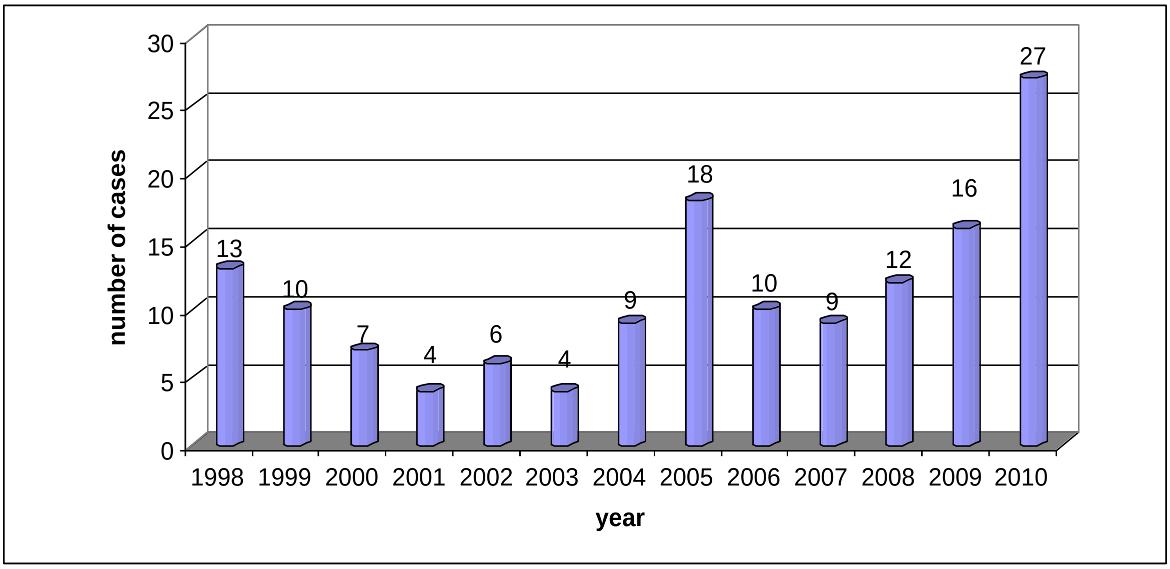
4.2.4.3. Brain and nerve system.

BNS was the third high site after leukemia and lymphoma, it was accounted 145 cases. The ASR for BNS was 15.9, with slight difference among male and female (ASR 16.6, 15.2 respectively). The age specific rate for the 5-9 age groups was the highest value ASR 18.5, followed by 10-15 age groups ASR 13.2, and the lowest was for age group 0-4 ASR 10.1.

The overall incidence of pediatrics BNS, there was a great jump from 1998 through 2010, from 2.0 to 4.3 cases per 100,000, with the greatest increase occurring from 2005 through

2010, An article of the Journal of the National Cancer Institute suggests that the rise in incidence of brain and nerve system tumor may not have represented a true increase in the number of cases, but may have reflected new forms of imaging equipment (MRI) that enabled visualization of brain tumors that could not be easily visualized with older equipment. Other important developments included the changing classification of brain tumors, which resulted in tumors previously classified as “benign” being reclassified as “malignant,” and improvements in neurosurgical techniques for biopsy brain tumors (Smith et al, 1998).

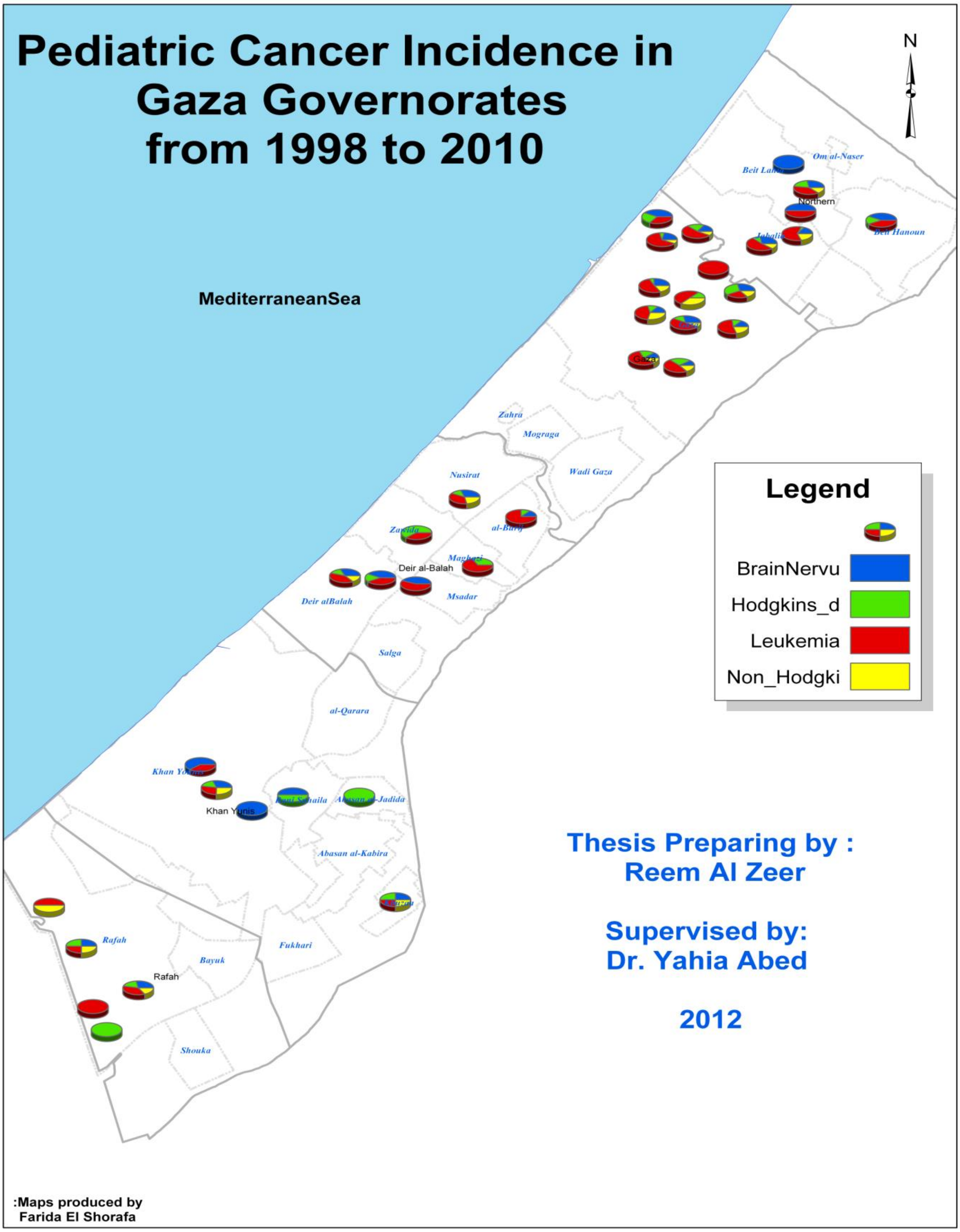
Figure (4.3.4.4): distribution of brain nerve system incidence by years



GIS and top cancer sites:

By using GIS to identify the distribution of the most common caner by locality it is seen in figure (4.3.4.5) that Gaza and Rafah had most cases of leukemia while khanyounis was most pronounced of Hodgkins lymphoma and the north of Gaza reported more of brain and nerve system neoplasm.

Figure (4.3.4.5): GIS Distribution of the top cancer sites.



4.3 Mortality

During the period from1998 to 2010 the reported mortality counted for 336 deaths with an annual average 25 deaths per year. The proportional death rate due to cancer among children was 3.12% from total reported child deaths.

The case fatality rate and cause specific death rate were counted for cancer disease among pediatrics during the period from 1998 to 2010, the result was for case fatality rate 37% all over the reported incidence and mortality totals, and for cause specific death rate was 26% per 100.000 using the estimation of midyear population.

Around the world there is declining of death rate and this refers to advance treatment and technology, however this inconsistent in Gaza since the pediatric cancer patients suffer a lot and always from the shortage of essential drugs for oncology, because of a political unrest situation in Gaza. Certain chemotherapy drugs have been unavailable for some time already. When chemotherapy is discontinued, the chances of success drop dramatically and the patients must start their painful treatment all over again (www.icrc.org). The second cause is the referral system to hospitals outside Gaza provide an indication of the type of care that is not available in Gaza. Many patients are referred for radiology therapy and scanning. The important thing is the high number of pending referral requests for patients needing authorization from Israel to travel outside Gaza. They make up about 30 to 40 per cent of referral requests (Dally E, 2010).

Before the closure was imposed, patients requiring specialized care also used to go to Egypt through the Rafah crossing. However, since Rafah cannot be open in any time, there are many problems face both the patients and hospitals (Dally E, 2010).

Chapter 5

5.1 Conclusion

Pediatrics cancer trends have several and variety of conclusions depending on the type of cancer, the age, the sex of the child, time period and the geographical area.

During the last 13 years there were 904 new cases of cancer occurring among children 0-15 years of age in Gaza governorates, and about 336 children die from the same disease during the same period. Among the 12 major types of childhood cancers, leukemias (blood cell cancers), lymphomas and cancers of the brain and central nervous system account for more than half of the incidence. About one-third of pediatric cancers are leukemias. The most common type of leukemia in children is acute lymphoblastic leukemia. The most common types of lymphomas are Hodgkin and Non-Hodgkin. The most common tumors are brain tumors (e.g., gliomas and medulloblastomas), with other tumors (e.g., neuroblastomas, Wilms tumors, and sarcomas such as rhabdomyosarcoma and osteosarcoma) being less common.

Cancer is still considering a rare disease among children, on average one child can develop cancer per 10.000 each year in Gaza governorates.

Over the last 13 years there was some increase in the incidence of pediatric caner in all types of cancer, from 9.9 cases per 100.000 in 1998 to 11.2 cases per 100.000 in 2010.

Trends in incidence of 13 years for leukemias, lymphomas and brain tumors, the most common pediatrics cancers, show patterns that are somewhat different from the others. Incidence of pediatrics leukemias appeared to rise in 1998, with rates increasing from 2.7 cases per 100,000 in 1998 to 3.3 cases per 100,000 in 2010. Rates in the other years between from 1998 to 2010 have shown inconsistent upward or downward trend and have ranged from 2.0 to 3.8 cases per 100,000.

For pediatrics lymphoma, the overall incidence declined from 1998 through 2010, from 3.3 to 1.4 cases per 100,000, with the greatest downward occurring from 1998 through 2003.

For pediatrics BNS, the overall incidence rose from 1998 through 2010, from 2.0 to 4.3 cases per 100,000, with the greatest increase occurring from 2005 through 2010

About sex there was male predominance, 502 cases of the event for males with a percentage (55.7%), and 402 for females (44.3%), with male/female ratio 1.25:1 for overall pediatric cancer incidence. (ASR for male was 110 and for female 90 per million respectively).

Trend of cancer types have a variety of distributions depending on the age of the child, BNS and tumors of connective tissue were predominantly among children in the 0–4 years age group, and only a few cases in other age groups. The peak age of 0–4 years was also observed in the leukemia with ASR 27.8, but there was slight decrease when the age increases. In contrast, malignant bone tumor and lymphoma showed a marked increase in incidence with age increase, with the highest H.D and bone tumor incidence in 10–15 years age group followed by 5-9 age group (ASR for HD was 18.8, 23.3 respectively), but in N.H.D. incidence the highest value was accounted for 5-9 age groups.

The distribution of cases by area showed that the majority of cases were allocated in Gaza (49.7%) followed by Khanyounis 14.8%, north Gaza 14.4%, mid zone 13% then Rafah 8.1%.

In summary, there were no consistent large changes in incidence for the major types of cancer among children aged 0-15 years during 1998 to 2010. The modest increases for childhood CNS cancers and leukemias, this pattern suggests that the increases likely reflected reporting or diagnostic changes rather than effects of environmental influences. The jump in BNS has been ascribed to preceding developments in diagnostic technology, new neurosurgical procedures, and classification changes. However, and the declines in

Non-Hodgkin's disease during the interval 1998 through 2010 are also not entirely clear. However, the dramatic increase in mortality for many childhood cancers represent the bad conditions that the patients lives in Gaza strip . Childhood cancer trends in Gaza strip should continue to be monitored, and postulated risk factors (including environmental exposures) should be evaluated to identify the causes of cancers in children.

5.2 Recommendations

1. Farther investigation and more deep analysis for pediatric cancer and mortality
2. The policy makers should have developing a strategic plan for monitoring and control the incidence of cancer
3. Recommendation for further research.
4. Enhance the efforts for accurate documentation and registration among professionals
5. Increase the awareness of important use of information and data among professional and policy makers in health centers

Chapter 6

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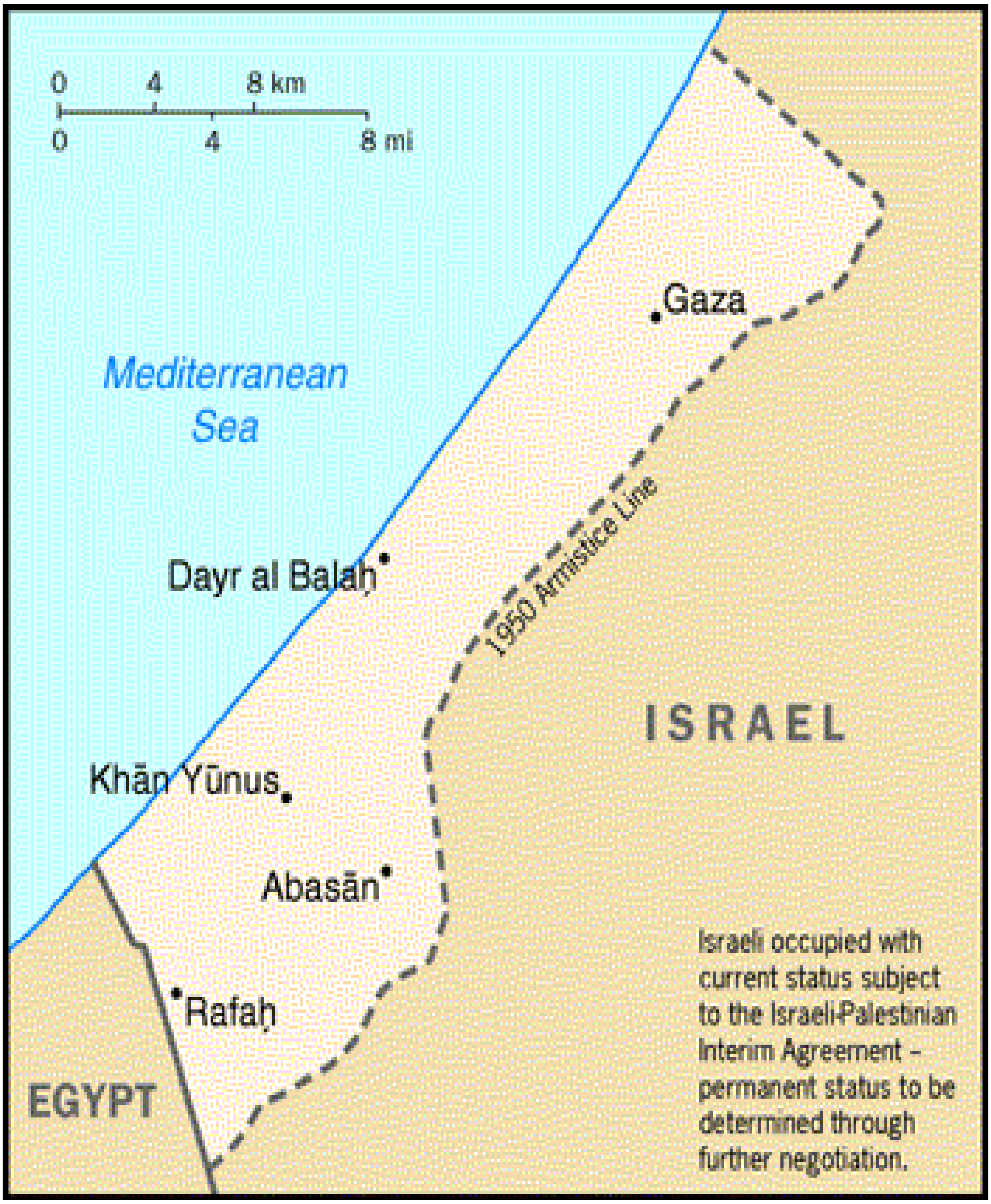
Annexes
Annex 1

Map of Gaza



Annex 2

Abstract Sheet

Primary information

- Case No.:----------------- sequence No.:-------------------
- Age at diagnosis:_ _ _ DOB:_ _/ _ _/ _ _ _ _ Sex: ☐ Male ☐ female
  Address:___________ Residential status:____________
- Place of birth: _________________ Date of diagnosis: _ _/ _ _/ _ _ _ _

Medical information

- Basis of diagnosis ☐ non-microscopic ☐ microscopic
- Primary site text:_____________ Primary site code:____________ Morphology text:_____________ Morphology code:_____________
- Histological type:_____________ Behavior:_____________ Grade:_______________ stage: ________________ ICD-O3:__________
- Clinical : T_______N_________M____________
  pathologicalT_____________N___________M____________

Treatment information

- Surgery: ☐ non given ☐ given ☐ patient refused ☐ Recomd. Unkrecd ☐ unknown
- Radiotherapy: ☐ non given ☐ given ☐ patient refused ☐ Recomd. Unkrecd ☐ unknown
- Chemotherapy: ☐ non given ☐ given ☐ patient refused ☐ Recomd. Unkrecd ☐ unknown
- Immunotherapy: ☐ non given ☐ given ☐ patient refused ☐ Recomd. Unkrecd ☐ unknown
- Hormonal therapy: ☐ non given ☐ given ☐ patient refused ☐ Recomd. Unkrecd ☐ unknown

Follow up information

- Date of last contact: _ _/ _ _/ _ _ _ _ Date of death: _ _/ _ _/ _ _ _ _
- Vital status: ☐ Alive ☐ Dead
- Cause of death:______________________

Annex 3

ICD groups

Organ	ICD cods	Group code
Oropharyngeal	C00-C14	1
Oesophagus	C15	2
Stomach	C16	3
Colon	C18	4
Rectum	C19-C20	5
Liver	C22	6
Goll Bladder	C23	7
Pancreas	C25	8
Larynx	C32	9
Lung	C34	10
Connective tissue	C38 - C45 – C49	11
Bone	C40 – C41	12
Skin	C43 – C44	13
Breast	C50	14
Kidney	C64 –C66 -C68	17
Bladder	C67	18
Brian nerve system	C70- C71- C72	19
Thyroid	C73	20
H.D	C81	21
NHD	C82-C81	22
Leukemia	C91-C92-C42.1	23
Other sites	C→	27
Female organ		
Cervix	C53	24
Uterus	C54 – C55	25
Overy	C56	26
Male organ		
Prostate	C61	15
Testis	C60-C62-C63	16

Annex 4

Address group codes

address group													
north	1100	1101	1102	1103	1104	1105							
	North Gaza	Bitlahia	Bit Hanoun	Jabalia	Mashrou' bit lahia	Jabalia camp							
gaza	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212
	Gaza	Shate' Camp	Al Nasser	Al Zitoun	Shikh Redwan	Mashrou' A'amer	Remal	Shikh E'jleen	Sabra	Al Daraj	Al Tofah	Shija'ia Torukman	Shija'ia Jdida
middle Zone	1300	1301	1302	1303	1304	1305	1306						
	Mid Area	Nussirat camp	Burig camp	Zawaida	Deir Al Balah	Al Maghazi	Deir Balah City						
khan younis	1400	1401	1402	1403	1404	1405	1406	1407	1408				
	KhanYounis	Al Qarara	Al Malaha	Khanyounis Camp	Bani Souhila	kahnyounis city	Abassan Small	Abassan big	Khoza'a				
rafah	1500	1501	1502	1503	1504	1505	1506	1507	1508				
	Rahah	Tal Soultan	Rafah City	Rafah camp	Soufa	Barazil	Jenina	Kherbi El Addas	Arabia				

Annex 5

Administrative approval

Al-Quds University

Jerusalem

School of Public Health

جـامـعـة الـقـدس

القدس

كلية الصحة العامة

التاريخ:2011/7/10

حضرة الدكتور ناصر أبو شعبان المحترم

مدير عام تنمية القوى البشرية —وزارة الصحة

تحية طيبة وبعد،،،

الموضوع: مساعدة الطالبة ريم الزير

تقوم الطالبة المذكور ةأعلاه بإجراء بحث بعنوان:

"Types and Trends of Pediatric Cancer in Gaza Governorates During the Period From 1998 To 2010"

كمتطلب للحصول على درجة الماجستير في الصحة العامة–مسار وبائيات. و عليه نرجو التكرم للإيعاز لمن ترونه مناسب لتسهيل مهمة الطالبة في جمع البيانات اللازمة من مستشفياكم الموقرة والتي تقدم الخدمات العلاجية لأطفال مرضى السرطان في وزارة الصحة بقطاع غزة وهي م. مجمع الشفاء الطبي وم.غزة الأوروبي وم.عبد العزيز الرنتيسي .

علماً بأن المعلومات ستكون متوفرة لدى الباحث و الجامعة فقط.

و اقبلوا فائق التحية و الاحترام،،،

كلية الصحة العامة

College of Public Health

AL-QUDS UNIVERSITY

د. بسام أبو حمد

منسق عام برامج الصحة العامة

نسخة:

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فرع غزة/تلفاكس 08-2884422-2884411

ص.ب/51000-القدس

Annex 6

Administrative approval

The Palestinian National Authority
Ministry of Health
Directorate General of Human Resources Development

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة لتنمية القوى البشرية

الرقم: 1172/11

التاريخ: 2011/07/19م

الأخ / د. مدحت محيسن المحترم،،،
مدير عام المستشفيات

تحية طيبة وبعد،،،

الموضوع/ تسهيل مهمة باحث

بخصوص الموضوع أعلاه، يرجى تسهيل مهمة الباحثة / ريم محمود الزير والملتحقة ببرنامج الماجستير مسار علم الأوبئة _ كلية الصحة العامة – جامعة القدس في إجراء بحث بعنوان :-

"Types and Trends of Pediatric Cancer in Gaza Governorates During the Period from 1998 To 2010"

حيث ستقوم الباحثة بالإطلاع و أخذ بيانات من ملفات مرضى السرطان من الأطفال دون سن 15 سنة من مستشفى الرنتيسي ومجمع الشفاء الطبي ومستشفى غزة الأوربي ، وذلك بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، و دون تحمل الوزارة أي أعباء.

وتفضلوا بقبول التحية والتقدير،،،

- مرفق طيه/
1. نموذج طلب تسهيل مهمة باحث

د. ناصر رأفت أبو شعبان
مدير عام تنمية القوى البشرية

11 / 1172
التاريخ: 2011/7/27

صورة/
- صاحب/ـة العلاقة

Annex 7

Hesinki approval

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

التاريخ : 07/03/2011

Name: **Reem El Zeer**

الاسم: ريم الزير

I would like to inform you that the committee has discussed your application about:

" Types and trends of Pediatric Cancer in Gaza governorates during the period from 1998 to 2010."

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

In its meeting on March 2011
and decided the Following:-
To approve the above mention research study.

و ذلك في جلستها المنعقدة لشهر 3 2011
و قد قررت ما يلي:-
الموافقة على البحث المذكور عاليه.

Ministry of Health Helsinki Committee

Signature
توقيع

Member
عضو

Member
عضو

Chairperson

Conditions:-
- Valid for 2 years from the date of approval to start.
- It is necessary to notify the committee in any change in the admitted study protocol.
- The committee appreciate receiving one copy of your final research when it is completed.

31

عنوان الدراسة:أنواع و اتجاهات سرطان الأطفال في قطاع غزة في الفترة الزمنية ما بين 1998-2010

الباحثة:ريم محمود الزير

المشرف:د. يحيى عابد

ملخص الدراسة

الخلفية:يعتبر مرض السرطان من الأمراض الجادة و الذي له اهتمام خاص و عالمي لكونه واحد من احدى الامراض التى تمثل عبئا كبيرا على الدول.

الهدف:تقييم أنواع و اتجاهات سرطان الأطفال في قطاع غزة خلال فترة ما بين 1998 إلى 2010

منهجية البحث:دراسة وصفية مقارنة تعتمد على بيانات السجلات الطبية لمرضى السرطان. جمعت البيانات من المركز القومي في غزة لتسجيل حالات السرطان بالإضافة إلى البيانات الموجودة في المراكز الصحية الأخرى التى تقدم خدمات صحية لمرضى السرطان. تم استخدام نموذج صمم خصيصاً لقياس حالات حدوث المرض و خصائصه داخل مجتمع الدراسة. تم استخدام برنامج SPSS لتحليل البيانات و استخراج النتائج.

النتائج:لقد تم تسجيل 904 حالة سرطان أطفال في قطاع غزة خلال الفترة ما بين 1998 إلى 2010. متوسط حالات حدوث سرطان الأطفال السنوية 70 حالة سنويا. المتوسط السنوي لنسبة التغير هي +4.4%. كانت حالات الحدوث أكثر بين الذكور عنها من الاناث حيث تم تسجيل 502 حالة بين الذكور بنسبة 55.7% مع معدل توحيد العمر 110. و كانت الحالات المسجلة بين الإناث هي 402 حالى بنسبة 44.3% مع معدل توحيد العمر 90. و كانت نسبة حدوث الذكور إلى الإناث 1.25:1 . و كانت زيادة المعدل الخام خلال الفترة ما بين 1998-2010 في حدوث حالات سرطان جديدة بين الاطفال من 9.9 حالة من كل 100.000 في عام 1998 إلى 11.2 حالة من كل 100.000 في عام 2010.

كما أظهرت نتائج الدراسة بأن أعلى ظهور للمرض كان بين الفئة العمرية (0-4) بنسبة 39.5%، تبعتها الفئة العمرية (5-9) بنسبة 33%، ثم تبعتهم الفئة العمرية (10-15) بنسبة 27.9% . كما و أظهرت النتائج أن معظم الحالات المسجلة كان من مدية غزة و شكلت نسبة 49.7% من الحالات. أما نتائج أنواع سرطان الأطفال فكانت ثلث الحالات المسجلة بين الأطفال المصابين هي اللوكيميا 225 حالة بنسبة 27.9%، تليها الليمفوما 17.6%، بينما شكلت حالات ورم الدماغ 15.8%. أعلى نسبة حدوث كانت بين الفئة العمرية 0-4 (356) حالة مع معدل توحيد العمر 101 تليها الفئة العمرية 5-9 (296)حالة مع معدل توحيد العمر 104 ثم تليها الفئة العمرية 10-15 (253)حالة مع معدل توحيد العمر لهذه الفئة 90. كما اظهرت النتائج أن اللوكيميا و أورام الدماغ و الأنسجة الضامة كان ظهورها في الغالب بين الفئة العمرية 0-4 . أما HD و أورام العظام ظهرت في الفئة العمرية 10-15. وكان أعلى ظهور لحالات NHD في الفئة العمرية 5-9 . و أوضحت نتائج الدراسة أن أغلب حالات ظهور اللوكيميا و الليمفوما في الذكور عنه من الإناث. و أظهرت النتائج زيادة في حالات اللوكيميا حيث ارتفعت من 2.7 حالة من كل 100.000 في عام 1998 إلى 3.3 حالة من كل 100.000 في عام 2010. أما الليمفوما كان انحدار واضح في حالات حدوث المرض خلال فترة ما بين 1998 إلى 2010 حيث سجلت النتائج 33.3 حالة في 1998 إلي 1.4 حالة في 2010. أما أورام

الدماغ فقد ارتفعت معدل حدوث حالات المرض خلال نفس الفترة حيث سجلت النتائج 2.0 في عام 1998 إلى 4.3 في عام 2010 و كانت أكبر زيادة سجلت من العام 2005 حتى عام 2010.

خلال نفس فترة الدراسة سجلت 336 حالة وفاه بين الأطفال المصابين بالسرطان و كان متوسط 25 حالة وفاه سنويا. و كان معدل الوفيات النسبي لحالات الوفيات بين الأطفال 3.21% من إجمالي وفيات الأطفال.

الخاتمة: لا توجد تغيرات كبيرة في حدوث الحالات للأنواع الرئيسية لمرض السرطان بين أطفال الفئة العمرية 1-15 سنة خلال الفترة ما بين 1998-2010. كانت الزيادة الواضحة في حالات الاصابة بالأورام الدماغ و االلوكيميا و هذه الزيادة تشير إلى التغير في نمط التشخيص اكثر من التأثيرات البيئية. ما زال يعتبر مرض السرطان نادر الحصول في الأطفال في المتوسط حوالي طفل واحد يمكن إصابته بالمرض من كل 10000 سنويا من الإجمال العام من السكان. بعد البحث و النتائج نوصي بمزيد من البحوث و التحليلات العميقة لمرض سرطان الأطفال بالإضافة إلى صاحبين القرار للتطوير الخطط الاستراتيجية في المراقبة و التحكم في حالات حدوث مرض السرطان في فلسطين.