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**Determinants of Infectious Diseases among Pediatric
Admissions in Palestine Medical Complex: A Case-Control
Study**

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Determinants of Infectious Diseases among Pediatric Admissions in
Palestine Medical Complex: A Case-Control Study

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Thesis Approval

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Declaration

I certify that this thesis submitted to the degree of the master is the result of my own research,

Where otherwise acknowledged, this thesis or any of its parts has not been submitted to any other university or institution for a higher degree.

Signature:

A handwritten signature in black ink, featuring a large, stylized initial 'L' and 'N' that are interconnected. The signature is written on a light-colored, slightly textured background.

Lo'ay Noah Abdul Rahim Fares

Date: 10/1/2023

Dedication

This work is dedicated to my father and my dear mother; I thank you for being there when I needed you most.

To my dear wife for her patience, encouragement, and endless support.

To my beloved children Juman, Obaida, Zain, and Taima'.

It is also dedicated to my brother and sisters for their prayers and support.

List of abbreviations

BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CSF	Cerebrospinal Fluid
E. coli	Escherichia coli
ID	Infectious Diseases
ICU	Intensive Care Unit
MIS-C	Multisystem Inflammatory Syndrome in Children
MRSA	Methicillin-resistant Staphylococcus aureus
MOH	Ministry of Health
SES	Socioeconomic Status
PMC	Palestine Medical Complex
PICU	Pediatric Intensive Care Unit
RCPCH	Royal College of Pediatrics and Child Health
WB	West Bank
WHO	World Health Organization

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Abstract

Background: Pediatric unit is a cornerstone unit at Palestine Medical complex (PMC). It receives and manages ill children with many complains, from diagnosis period to stabilization. However, a certain determinants may have associated with their infectious disease illness.

Study problem: The pediatric department in the Palestine medical complex has become a cornerstone in this facility. It provides an essential service to the population in this province. However, infectious diseases hospitalization could depend on specific factors and determinants. A better understanding of the determinant can play an essential role in the treatment and recovery process. Therefore, we carried out a study to determine the factors associated with pediatric infectious disease (ID) admissions.

Aim & objectives: We aimed to study and examine the determinants for infectious diseases among pediatric admissions in Palestine Medical Complex. The objectives were to explore the risk factors that lead to infectious diseases among pediatric admissions and to examine the sociodemographic features and the environmental factors that may influence infectious disease admission.

Study methodology: We completed a case-control design by selecting cases admitted with infectious diseases to the Pediatric department in PMC, a similar number of matched controls by age and gender from the same hospital admitted due to other diseases (not infectious), Patient files were used to collect information that answers the study questions. SPSS was used for data entry and analysis. Continuous variables were compared between the cases and controls by t-test. Chi-square test or groups (subjects and controls). Al-Quds University's ethical committee approved this study.

Results: analysis of the study data showed that the mean age of participants was 29.2 ± 36 (mean \pm SD) months; age and gender matching were done between subjects and controls. The multivariate analysis revealed that the infancy period of childhood increases the chance of having the infectious disease by seven folds than toddler, preschool, and school age periods (Odds ratio [OR], 7.390; 95% confidence interval [CI], 1.5–36.9). In addition, living in apartments increases the risk of infectious diseases spread by three folds compared to living in detached houses. In addition, frequent exposure to infectious diseases (OR, 4.3; 95% CI, 1.5–12.6) was found to increase the possibility of infections by four folds compared to those with minimal exposure to infectious diseases. In addition, body bathing was found to be a protective factor against infectious

diseases, children who practice a lower frequency of bathing 1-3 times\ a week (OR, 3.3; 95% CI, 1.6–6.8) had a chance to have infections 3 folds than children who practice body bathing more frequent than three times per week.

Conclusion: The study is the first one in Palestine that investigated the determinants associated with infectious diseases among pediatric admissions in Palestine’s medical complex. It identified the possible risk factors associated with infectious diseases, most results were expected and comparable to other international studies' results, while some others were unexpectedly contraindicated in the literature, residence, area of residence, parent’s level of education, family Monthly Income, previous hospitalization, type of housing. Ventilation, and sunlight of houses, having a water-well and drinking from it, handwashing practice, body hygiene, clinical presentation, radiological and laboratory tests appeared to be associated with infectious disease admissions among pediatrics either positively or negatively. Other factors showed no significance in our studies such as the number of child siblings, parents' employment, environmental pollution, animal breeding, some hygiene practices, and illness that affect eating.

المحددات المرتبطة بالأمراض المعدية للأطفال المدخلين الى مجمع فلسطين الطبي

اعداد الباحث: لؤي نوح عبد الرحيم فارس

المشرف: د يحيى عابد

الملخص

الخلفية: وحدة طب الأطفال هي وحدة أساسية في مجمع فلسطين الطبي. تستقبل وتعالج الأطفال المرضى مع العديد من الشكاوى المرضية بكافة اشكالها من امراض معدية وغير معدية، من فترة التشخيص إلى الاستقرار والشفاء. ومع ذلك، قد تترافق بعض المحددات والأسباب مع امراضهم المعدية.

مشكلة الدراسة: أصبح جناح الأطفال (PW) ووحدة العناية المركزة للأطفال (PICU) في مجمع فلسطين الطبي حجر الزاوية في هذا المرفق. يقدم خدمة أساسية للسكان في محافظة رام الله والمدن المجاورة. ومع ذلك، يمكن أن يعتمد دخول المستشفى للأمراض المعدية على عوامل ومحددات محددة. يمكن أن يلعب الفهم الأفضل للمحدد دورًا أساسيًا في عملية العلاج والشفاء. لذلك، نخطط لدراسة المحددات المرتبطة بإدخالات المستشفى من حالات الأمراض المعدية لدى الأطفال.

الهدف والأهداف: نهدف إلى تقييم محدّدات الأمراض المعدية بين الأطفال المدخلين الى مجمع فلسطين الطبي. اما الأهداف الخاصة فهي استكشاف عوامل الخطر التي تؤدي إلى الأمراض المعدية بين الأطفال النزلاء في المستشفى وفحص السمات الاجتماعية والديموغرافية والعوامل البيئية وغيرها التي قد تؤثر وتؤدي الى ادخال الأطفال بأمراض معدية الى المستشفى.

منهجية الدراسة: أكملنا تصميم دراسة الحالات والشواهد من خلال اختيار الحالات التي تم إدخالها للمبيت بأمراض معدية في اقسام الأطفال والعناية المركزة للأطفال في مجمع فلسطين الطبي وعدد مماثل من الضوابط المتطابقة حسب العمر والجنس من نفس المستشفى التي تم قبولها بسبب أمراض أخرى (غير معدية)، وتم استخدام ملفات المرضى لجمع المعلومات التي تجيب على أسئلة الدراسة. تم استخدام برنامج SPSS لإدخال البيانات وتحليلها. أيضاً تمت مقارنة المتغيرات المستمرة بين الحالات والضوابط عن طريق اختبار t-test واختبار Chi-Square أو المجموعات (الموضوعات والضوابط).

الاعتبارات الأخلاقية: تم تقديم هذا الاقتراح إلى لجنة أبحاث جامعة القدس - كلية الصحة العامة ولجنة الدراسات العليا. تم الحصول على الموافقة من وزارة الصحة لجمع ودراسة البيانات من المرضى.

النتائج: أظهر تحليل بيانات الدراسة أن متوسط عمر المشاركين كان 29.2 ± 36 شهرًا (متوسط \pm SD)؛ تم إجراء مطابقة العمر والجنس بين الموضوعات والضوابط. أظهرت النتائج أن فترة الرضاعة في الطفولة تزيد من فرصة الإصابة بالمرض المعدية بمقدار 7 أضعاف مقارنة بفترة الأطفال الصغار ومرحلة ما قبل المدرسة والعمر المدرسي (نسبة الأرجحية [OR]، 7.390؛ فاصل الثقة 95% [CI]، 1.5-36.9). العيش في شقق (نسبة الأرجحية 2.7، مجال الموثوقية 95%، 1.2-6.2) يزيد من انتشار الأمراض المعدية بثلاثة أضعاف، مقارنة بالعيش في منازل منفصلة. وجد أيضاً أن التعرض المتكرر للأمراض المعدية (نسبة الأرجحية، 4.3؛ مجال الموثوقية 95%، 1.5-12.6) يزيد من احتمالية الإصابة بالعدوى بمقدار أربعة أضعاف مقارنة بأولئك الذين تعرضوا لأدنى حد من الأمراض المعدية. كما أن ممارسة الاستحمام عامل وقائي ضد الأمراض المعدية، فالأطفال الذين يمارسون الاستحمام بمعدل أقل من 1-3 مرات في الأسبوع (نسبة الأرجحية 3.3؛ مجال الموثوقية 95%، 1.6-6.8) لديهم فرصة للإصابة بالعدوى 3 أضعاف أكثر من الأطفال الذين يمارسون الاستحمام الجسدي أكثر من 3 مرات في الأسبوع.

الخلاصة: الدراسة هي الأولى في فلسطين التي بحثت في المحددات المرتبطة بالأمراض المعدية بين الأطفال المقبولين في مجمع فلسطين الطبي. حددت عوامل الخطر المحتملة المتعلقة بالأمراض المعدية، وكانت معظم النتائج متوقعة وقابلة للمقارنة بنتائج الدراسات الدولية الأخرى، بينما تم بطلان البعض الآخر بشكل غير متوقع في الأدبيات، والإقامة، ومنطقة الإقامة، ومستوى تعليم الوالدين، ودخل الأسرة الشهري، السابق الاستشفاء، ونوع السكن، والتهوية، وأشعة الشمس للمنزل، ووجود

بئر ماء والشرب منه ، وممارسة غسل اليدين ، ونظافة الجسم ، والعرض السريري ، والفحوصات الإشعاعية والمخبرية يبدو أنها مرتبطة بقبول الأمراض المعدية بين الأطفال سواء إيجاباً أو سلبيًا . لم تظهر عوامل أخرى أي أهمية في دراستنا مثل عدد الأشقاء الأطفال، وتوظيف الوالدين، والتلوث البيئي، وتربية الحيوانات، وبعض ممارسات النظافة، والأمراض التي تؤثر على الأكل.

1 INTRODUCTION

Background

The pediatric department, which include pediatric ward (PW) and pediatric intensive care unit (PICU), are units within a hospital specialized in caring for ill and critically ill infants, children, and teenagers, aged 0-13 years. The pediatric department are directed by pediatric specialists, intensivists and staffed by doctors, nurses, trained and experienced in pediatric and intensive care (MOH 2016).

The first pediatric hospital in the Western world was generally accepted to be the *Hospital des Enfants Malades*, the Hospital for Sick Children in English, which opened in 1802 in Paris. The hospital is famed for the care of patients only up to the age of 15 years (Smith 2020). Today, pediatrics as a specialty is certified and regulated by the American Pediatric Society and American Academy of Pediatrics in the United States, and similar bodies in other countries around the world. (Smith 2019). While G. Haglund established the first pediatric intensive care unit in Europe in 1955 at Children's Hospital of Goteborg in Sweden, ten years before the unit at Children's Hospital of the District of Columbia was developed by Cheston Berlin. John Downes opened the next recorded pediatric ICU at Children's Hospital of Philadelphia in 1967 (Epstein and Brill 2005).

Common reasons for admission to the PW may include sepsis, respiratory infections, urinary tract infections, convulsion disorders, metabolic disorders, cardiology, neurology, and allergic disorders. while PICU admissions may include Respiratory failure needing additional support or mechanical ventilator, acute respiratory distress syndrome(ARDS), Severe asthma exacerbation, Apnea, Sepsis, Shock, Trauma, Altered mental status, Congenital heart defects, complicated Diabetic ketoacidosis, Gastrointestinal perforations, Cancer, post Organ transplants, Prolonged seizures, Poisoning, and many Other life-threatening conditions (Dorofaeff, Mohseni-Bod, and Cox 2012).

Study Justification

The pediatric department considers one of the essential and crucial units in the Palestine medical complex and provides service to a wide variety of populations in the province. Infectious disease

hospitalization could depend on specific factors and determinants. Unfortunately, lack of studies that explore these determinants or risk factors make the picture incomplete. A better understanding of the determinant can play an essential role in the diagnosis, treatment, and recovery process.

Problem statement

The pediatric ward PW and pediatric intensive care unit PICU in the Palestine medical complex has become a cornerstone in this facility; it provides an essential service to the population in this province. However, hospitalization could depend on specific factors and determinants. A better understanding of the determinant can play an essential role in the diagnosis, treatment, and recovery process. Therefore, we plan to study the determinants that associated with pediatric infectious disease admissions.

We expect to have a better understand of the possible risk factors that may associate with the infectious diseases among pediatric admissions.

Context of the study

Palestine medical complex is a governmental hospital established in 1963 as a public hospital called "Ramallah hospital" that provides services to the resident population in Ramallah governance. In 2010, the hospital developed and expanded, and three new buildings were added to the old one and the complex named Palestine medical complex PMC. With 400 beds, PMC now consists of five buildings. Each one is specialized for specific purposes. Al-Bahraini building is the children's hospital consisting of a Pediatric Emergency Room, pediatric outpatient clinics, pediatric ward PW, neonatal intensive care unit NICU, and pediatric intensive care unit PICU(MOH, 2016).

Pediatric ward PW start working in the hospital since establishment of the hospital with 16 beds and neonate intensive care unit NICU. The PW expand their services and its capacity now reaches 45 beds. Pediatric intensive care unit PICU started working and providing services to children since 2010, and it was the first PICU in the west bank. Children can be admitted to the children's hospital from one day to 13 years. Cases admitted to the PICU include all pediatric fields, cardiac, respiratory, neurosurgery, and neurology, which need close monitoring and can be life threatening. The capacity was eight beds (one isolation room). The staff involved are registered nurses, resident physicians, and pediatricians qualified with advanced practice and training in pediatrics.

Study objectives

General objectives

To study and evaluate the determinants that influence infectious diseases ID among pediatric Admissions in Palestine Medical Complex, which increase the knowledge about these determinants and help reevaluate and reorganize the work and medical services inside the units.

Specific Objectives:

- To describe the clinical picture on hospitalization, severity, and its relation with the illness.
- To explore the risk factors that lead to infectious diseases among pediatrics admission.
- To examine the sociodemographic features that may influence on pediatric admissions.
- To examine the environmental factor and their association with infection among hospitalized children in PMC.
- To evaluate the child and family adherence with hygiene practice and its impact on the spread of ID.
- To compare the cases admitted with infectious diseases ID to pediatrics admitted with other complains

Expected outcomes

We expect the study to provide reasonable data about the determinants that influences admitting a pediatrics with ID and the risk factors that could lead to it. Furthermore, it would increase the knowledge about these determinants, which may help us to an appropriate plan of healthcare programs to focus on these risky groups.

2 LITERATURE REVIEW

Literature review

2.1.1 Definition

A children's hospital is a hospital that offers its services exclusively to infants, children, adolescents, it has the added benefit of being staffed by professionals who are trained in treating children(Wikipedia). Children's unit A UK term for a ward or part thereof in which the beds are used exclusively for the care of children. The beds are part of the hospital bed complement.(Medical dictionary).

PW is considered a cornerstone in pediatric hospitals; it aims to save lives and minimize morbidity in ill patients. PICUs treat critically ill children with complex illnesses or life-threatening conditions. Because of the severity of the infectious disease, the patient may need monitoring and care by a qualified medical staff with specific and special skills, which reduces mortality, cost of care, and length of hospitalization.

According to the guidelines, the US Department of Health and the Food and Drug Administration reference approximate age ranges for these phases of life, consist of the following: (1) infancy, between birth and two years of age, (2) childhood, from 2 to 12 years of age, and (3) adolescence, from 12 to 21 yrs. of age(Hackell 2020). New Zealand's national children's hospital guidelines about the age group for admission to PICU as all patients from 34 weeks' gestation until their 15th birthday require intensive care(starship, 2006). At the same time, the National Health Services NHS in England defines a Pediatric patient as "any patient below the age of 18" (Specialized Commissioning Team 2017). The PMC defines the patient admitted to a pediatric hospital as any child below 13 years old.

Infection is an invasion and multiplication of microorganisms in body tissues, as in an infectious disease. The infectious process is similar to a circular chain with each link representing one of the factors involved in the process. An infectious disease occurs only if each link is present and in proper sequence(Medical dictionary). Infections can be caused by a wide range of pathogens, most prominently bacteria and viruses. Hosts can fight infections using their immune system. Mammalian hosts react to infections with an innate response, often involving inflammation,

followed by an adaptive response. Specific medications used to treat infections include antibiotics, antivirals, antifungals, antiprotozoal, and anthelmintic. Infectious diseases resulted in 9.2 million deaths in 2013 (about 17% of all deaths). The branch of medicine that focuses on infections is referred to as infectious disease(Wikipedia).

The signs and symptoms of an infection depends on the type of disease. Some signs of infection affect the whole body generally, such as fevers, fatigue, and weight loss, loss of appetite, sweating, chills, aches and pains.

Infection can be diagnosed by physician depending on signs and symptoms and laboratory test using fluids from patient's body; blood, urine, stool, cerebrospinal fluid, and Mucus from the nose, throat, or genital area. Blood test may include Complete Blood Count CBC, C-reactive protein CRP as indicator of infection presence. Cultures may include blood, urine, stool, and wound culture to determine the pathogen causing the infection.

International Classification of Diseases ICD-10, is a medical coding system designed by the World Health Organization (WHO) to catalog health conditions by categories of similar diseases under which conditions that are more specific are listed, thus mapping nuanced diseases to broader morbidities. According to ICD-10 the infectious diseases listed into subcategories in chapter I between (A00 – B99) blocks.

2.1.2 Related risk factors and determinant

The WHO defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”(Kelley 2008). Determinants of health may be biological, behavioral, sociocultural, economic, and ecological. Broadly, the determinants of health can be divided into four core categories: nutrition, lifestyle, environment, and genetics, which are like four pillars of the foundation. When any one of the pillars of health determinants becomes weak, a support system is needed. This is considered the fifth determinant of health and involves medical care(Patwardhan et al. 2015).

2.1.2.1 Sociodemographic and economic status

The social and demographic characteristics of the parents and child seem to be essential and may have an association with childhood illness and its severity. The patient's age, gender, place of

residence, and other social characteristics like parents' occupation, education level, and their ability to access health care services.

A study was established in Brazil to study the Profile of hospitalizations in Pediatric Intensive Care Units of the Brazilian Unified Health System presents that the highest age group proportion on hospitalization was the 1-4-years old age group, followed by children less than one-year-old, a total of 58.4% of PICU hospitalizations occurred in these two groups. According to the gender in the same study, the male children were 58.1%, and the female was 41.9 of the admission population(de Mendonça et al. 2019). Another study developed in Canada to study the Clinical Profile of Children Requiring Early Unplanned Admission to the PICU presents that the median age at admission for the study group was 14 months, with 46% of calls being for infants aged <1 year. Males were 64% of the total population, while females represented 36% (Krmptotic and Lobos 2013).

A case-control study was conducted on patients with sepsis admitted to the ICU at Aarhus University Hospital, Denmark (2008–2010) found the risk of being admitted to the ICU with sepsis was significantly higher among individuals with a low or medium level of education compared to individuals with a high level of education. Similarly, the risk of being admitted to the ICU with sepsis was significantly higher among the lowest than the highest income(Storm et al., 2018).

Socioeconomic factors include income and wealth. It can significantly affect how well and how long we live. These factors affect our ability to make healthy choices, respond early to critical situations, and afford medical care and housing. Researches have suggested that specific characteristics, such as having divorced parents, lower socioeconomic class, poor adherence to treatment, and pre-existent severe asthma, may enhance the risk of Severe acute asthma(van den Bosch et al. 2012).

Another study in Germany that represents patients with low SES showed a statistically significant increase in risk for more severe disease status at admission as assessed by SOFA score compared with patients with high SES(Bein et al., 2012). In Bangladesh, studies suggest that the health impacts of the high disease burden among South Asian children are further exacerbated by sub-optimal care-seeking behavior, especially among the poorest households. Also, financial stress is strongly correlated with child undernutrition, poor cognitive development, and weakened immune system, increasing vulnerability to infectious diseases(Yaya and Bishwajit 2019).

2.1.2.2 Nutritional status

Nutritional status plays an essential role in children's morbidity; underweight and obese children are highly susceptible to acquired disease and become ill. Childhood and adolescent overweight are related to health risks, medical conditions, and increased risk of adult obesity, with its attendant effects on morbidities and mortality rates. The Prevalence of childhood overweight and overweight has more than doubled in the past 25 years(Whitlock et al., 2005). Underweight children had higher odds of prolonged hospital stay. Being underweight could be a symptom of an underlying disease or reason for admission related to mortality risk. Malnourished children may also have impaired immune function, limiting their defense against infections. Furthermore, critically-ill children are at risk of further nutritional deterioration during their illness course due to disease or barriers to nutrient delivery in the intensive care unit(K. M. et al. 2018).

An Australian study finds that overweight/obese older children and adolescents report a higher prevalence of asthma than children of average weight, And Underweight was associated with substantially more significant morbidity than obesity in preschoolers(Wake et al. 2013).

A tool called Body Mass Index (BMI) can measure nutritional status. The BMI is a continuous, although imperfect, measure of body fatness. Calculated as weight (kg) divided by height (m²), BMI corrects for body size and can be readily and reliably quantified in clinical settings. Average values for BMI vary with age, sex, and pubertal status(Schwarz M, 2020). Furthermore, BMI appears to be an as strong correlation with various metabolic and disease outcomes as are these more direct measures of body fatness(CDC, 2021).

2.1.2.3 Comorbidities and chronic diseases

Congenital anomalies are a critical challenge for the child and his family and are considered one of the leading causes of hospital admission, specifically PICU. In addition, chronic diseases (e.g., asthma, diabetic ketoacidosis, and convulsion disorders) take a significant proportion of cases admitted to PICU. Although respiratory illnesses (predominantly acute respiratory infections) and congenital anomalies were the most common reasons for admission in pediatrics hospitals, respiratory illnesses (especially asthma) and endocrine/metabolic disorders (primarily diabetes) were the most common admitting diagnoses in non-PICU hospitals. Also, Epilepsy was the most common neurological disorder (Ibiebele et al., 2018).

A study was conducted in Brazil to study the admission source and mortality in a pediatric intensive care unit reveals that the Prevalence of comorbidity varied between different admission sources. Over 80% of the children, originating from the OR showed some form of comorbidity. The Prevalence of specific comorbidities varied when patients admitted from wards were compared with those admitted from all other sources. Wards patients had more oncologic/hematologic (22.6% vs. 6.7%), neurologic (15.9 vs. 6.6%), gastroenterological/hepatic(9.2% vs. 5%) and genetic (9.6% vs. 6.3%) comorbidities(Georges et al., 2012).

2.1.2.4 Adherence Hygiene practice

The personal compliance of hand washing and other hygiene practice is a primary preventive method from infectious diseases especially infectious agents found transiently on hands and spread by the fecal-oral route and from the respiratory tract. A study found a significant decrease in diarrheal episodes after implementation of the handwashing program compared with the two control(Black et al. 1981).

Another study conducted in USA to describe the relationship between home hygiene practices and prevalence of infectious disease symptoms among household members, the study identifies the risk areas for disease transmission as (1) toys, (2) floor and laundry, (3) bathroom and (4) kitchen, the study found using the dishwashing detergent in handwashing with positive impact in reducing transmission of infectious diseases(Larson and Duarte 2001).

The major benefits of hand hygiene for the public is for prevention of infectious agents found transiently on hands and spread by the fecal-oral route and from the respiratory tract.

2.1.2.5 Environmental factor

The environmental factors play a fundamental role in pathogen breeding and spreading of infections; sewage system, contaminated water, uncontrolled animals breeding and zoonotic infections are part of the unhealthy environment that leads to infectious diseases.

The home environment, specially the kitchen and bathroom, serves as a reservoir of large numbers of microorganisms, specially Enterobacteriaceae, and infectious disease transmission has been proved to occur in 6-60% of households in which one member is ill (Kagan, Aiello, and Larson 2002)

Contamination of the public water supply in Milwaukee during March and April 1993 resulted in a massive outbreak of cryptosporidium infection (Mac Kenzie et al. 1995). Also Canadian surveillance data suggest that potentially waterborne intestinal infectious diseases account for about 20% of reported communicable disease cases (Teschke et al. 2010). Diarrheal diseases like amoebiasis are endemic to the developing world where a number of environmental aspect including restricted access to clean food and water, and exposure to other Entero-pathogens contribute to increased risk of infection (Verkerke, et al. 2012). While presence of *E. coli* in environmental waters has long been seen as an index of recent fecal pollution (Jang et al. 2017).

In 1997, 18 human cases of avian influenza A (H5N1) illness were documented among citizens living in Hong Kong; all the case patients were hospitalized, and six died. Surveillance in the Hong Kong live bird markets conducted revealed that 20% of chickens tested from poultry markets were infected with H5N1 viruses. This was the first time that an avian influenza A virus of any subtype was documented to cause respiratory infections in humans (Bridges et al. 2002).

2.1.2.6 Infection association with ABO groups

Although there are thousands of publications on the associations of blood groups with disease, many are based totally on statistical analyses. Most of the earlier studies have been controversial, because they were small studies or had inadequate controls or had been analyzed incorrectly. Nevertheless, it is difficult to argue with the general pattern that emerges from the large body of statistical data on malignancy, coagulation, and infection (Garratty 2000).

Many Studies describe association between infectious diseases and ABO groups, some investigators have found an increased incidence of rheumatic fever among AB non-secretors. In one study, the disease was most common among children with type A blood, with increased incidences of rheumatic arthritis and chorea in persons with type B and AB (Berger et al. 1989). Also a case control study was conducted in Iran showed an association between certain ABO groups; O & AB with hepatitis C infection, and found no association between ABO groups and hepatitis B infection (Pourhassan 2014). Another study in India reveals association between malaria infection and group A patient's (Gupta and Chowdhuri 1980). Blood group B was found

highly associated with pediatric *P. aeruginosa* sepsis (Kuo et al. 2013). And also B blood group people are more prone to gastrointestinal *H. pylori* infections (Mahaseth et al. 2021).

2.1.2.7 Clinical presentation and laboratory tests

Symptom is a manifestation of disease apparent to the patient himself, while a sign is a manifestation of disease that the physician perceives. The sign is objective evidence of disease a symptom, subjective. Symptoms represent the complaints of the patient (King 1968).

Many infectious diseases have similar signs and symptoms. Samples of body fluids can sometimes reveal evidence of the particular microbe that's causing the illness (Mayo Clinic 2022). Laboratory tests may identify organisms directly (e.g., visually, using a microscope, growing the organism in culture) or indirectly (e.g., identifying antibodies to the organism). Culture is normally the gold standard for identification of organisms, but results may not be available for days or weeks (MSD Manual 2020).

Neutrophils are a type of white blood cell that help heal damaged tissues and resolve infections, The body produces neutrophils in the bone marrow, and they account for 50–70% of all white blood cells in the bloodstream, levels can increase or decrease in response to infections, injuries, drug treatments, certain genetic conditions, and stress, and some inflammatory conditions can increase neutrophil levels, including rheumatoid arthritis, inflammatory bowel disease, hepatitis, and vasculitis (Medical news today 2022)

Many studies suggest that neutrophil recruitment to the lungs is associated with disease severity during viral infections. For example, in infants with severe RSV-induced bronchiolitis, neutrophils can make up > 90% of the cellular composition of the Broncho alveolar lavage and therefore neutrophils have been implicated as drivers of disease pathogenesis. Also, in both rhinovirus and hMPV-infected children as well as in severe cases of influenza and SARS-CoV-2 infection, lung neutrophils and their markers have been observed to be elevated (Johansson and Kirsebom 2021). A study established in Finland reveals that an elevated CRP was found more often in children with respiratory bacterial infection, either alone or in combination with viral infection, than in those with viral infection alone (Korppi and Kröger 1993).

Other laboratory indicator may influenced by infections, for example Fibrinogen is a major risk factor for cardiovascular disease, and is also an acute-phase protein, which may increase in response to infections and other stressful events (Crawford et al. 2000). During infection, increased ferritin levels represent an important host defense mechanism that deprives bacterial growth of iron and protects immune cell function (Kernan and Carcillo 2017). A systemic review of the Diagnostic Accuracy of C-Reactive Protein to Detect Bacterial Infection in non-hospitalized Infants and Children with Fever indicate that CRP provides moderate but independent information in ruling in and ruling out serious bacterial infection in febrile children at first presentation (Sanders et al. 2008). While low levels of CRP do not rule out the possibility of bacterial infection in children. The initial value of CRP may be negative, even in patients with severe bacterial infection or even after 12 h from onset (Kono et al. 1999)

2.1.2.8 Hospital length of stay

Length of stay (LOS) is a clinical metric that measures the length of time elapsed between a patient's hospital admittance and discharge (Definitive Healthcare 2022), literature study the impact of hospital acquired infections (HAIs) on the length of stay of patients, hospital length of stay is known to be prolonged by the occurrence of HAI. But also many studies on the increased LOS due to HAIs had poor homogeneity and comparability, because most studies were limited to infections caused by a single site or a single organism, and the characteristics of patients in the studies were different (Jia et al. 2019).

Conceptual framework

The conceptual framework is a diagram that explains the content of the study. It could be illustrated in the form of a diagram or narrative. The main goal is to show the different variables recognized during the literature review process self-explanatory and describe simply the relations between other concepts, assumptions, or domains (Miles & Huberman, 1994).

The researcher will study the risk factors attributed to infectious diseases admissions among pediatric in this study. As shown in **Figure 1**, the researcher demonstrates the dependent variable

as ID admission and the independent variable as the risk factors that could lead to ID hospitalization, divided into four main domains: Sociodemographic and economic factors, Nutritional factors, season of the year, comorbidities, and condition severity.

2.1.3 Sociodemographic and economic factors

This domain describes the social and demographic characteristics of the parents and child. These characteristics seem essential to the study to explore their association with childhood illness and its severity. The social features are parents' education level, occupation, and ability to access health care services. On the other hand, the demographic variables of the researcher's interest are age, gender, place, and type of residency. Socioeconomic factors include describing all sources of the family's monthly income as the literature review revealed that the parents' economic status could affect child health from different perspectives.

2.1.4 Nutritional factors

Nutritional status can affect child health, and it is an essential factor in children's morbidity; underweight and obese children are highly susceptible to acquired disease and become ill. Nutritional status can be measured by a tool called Body Mass Index (BMI). BMI can be readily and reliably quantified in clinical settings.

2.1.5 Adherence to hygiene practice

In this section, the researcher is interested in exploring the hygiene practice the subject's compliance with and degree of association between these practices and the infections.

2.1.6 Environmental factor

The surrounding environment of the subject will be studied as a primary factor of infection spreading and its available forms like contaminated water wells, sewage holes, and possible animal breeding as a cause and their association with infections.

2.1.7 Comorbidities and chronic diseases

Chronic diseases and congenital anomalies are considered leading causes of hospitalization(Ibiebele et al., 2018). These disorders seem essential in exploring their association with the children's ID hospitalization.

2.1.8 ABO blood groups

Many studies reveal an association between ABO groups and certain infectious diseases, in our study we plan to study ABO blood groups as a possible factor.

2.1.9 Clinical presentation

Signs and symptoms, laboratory tests, bacterial cultures, and virology panels, are considered an important domain in diagnosing infectious diseases.

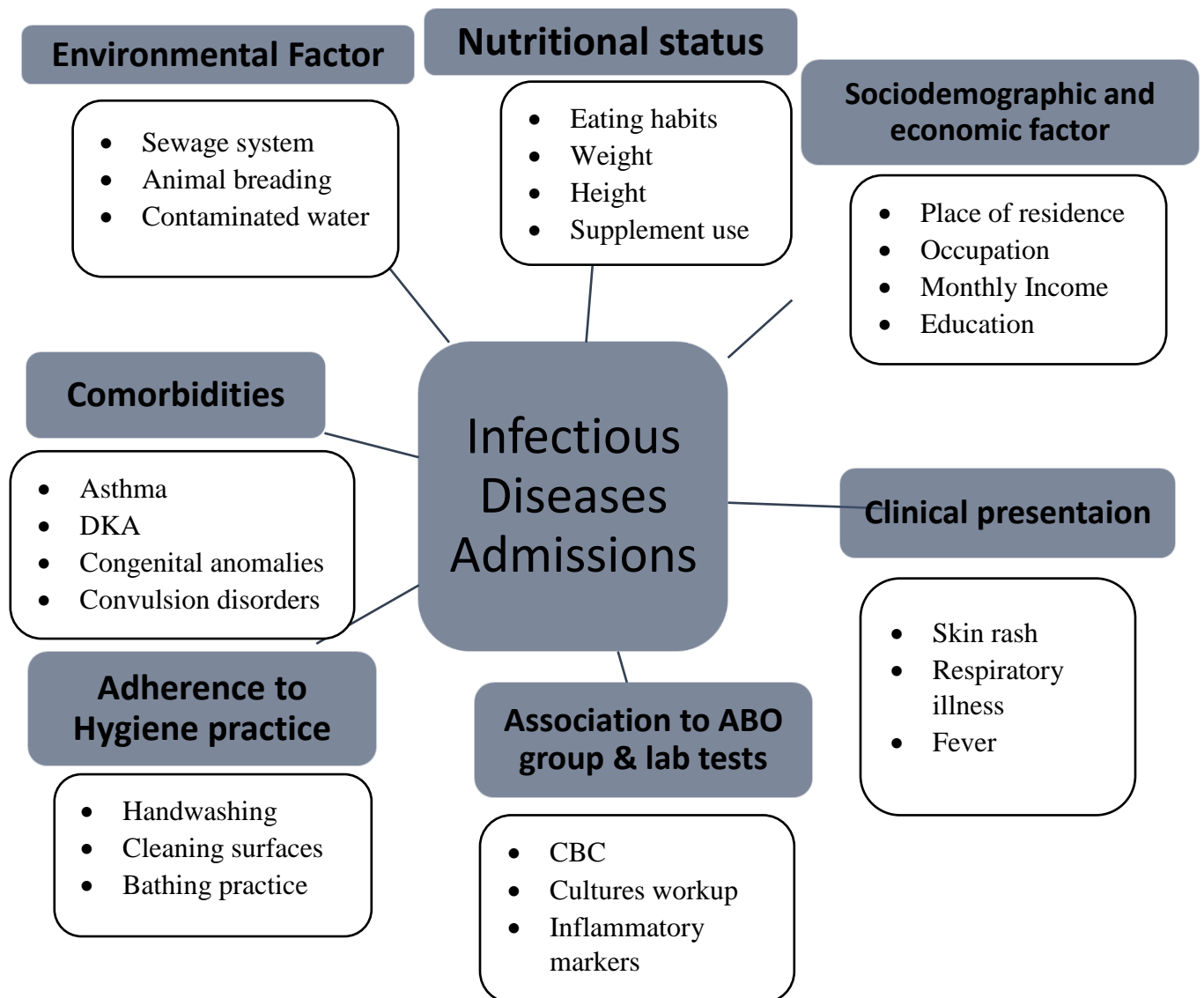


Figure 1: Conceptual Framework for risk factors of infectious diseases among pediatric admission

3 METHODOLOGY

Study design

This study is an analytic case-control study. The analytic property determines the causal relationship between infectious diseases admissions among pediatrics and the different variables included in this study. Exploring differences between cases and controls helps identify possible outcomes' determinants. At this stage, the researcher shall make no intervention.

Study population

The study is composed of two populations, cases, and controls. The population of the cases were selected from all admitted children to the PW and PICU in PMC due to infectious diseases (A00 – B99) over the data collection period. The control study population were selected as controls from children patients admitted to the PW and PICU in Palestine Medical Complex with other complains on the same period.

Study Setting

Our study was conducted at the pediatric ward PW and pediatric intensive care unit PICU at Palestine medical complex (PMC) in Ramallah/west bank, a Governmental Hospital governed by the Palestinian Ministry of Health.

PMC is a general hospital with about 400 beds that provides health care for Palestinian residents at secondary and tertiary levels. Many medical and surgical specializations are found in PMC; patients are hospitalized in the inpatient wards or are examined in the outpatient clinics. The pediatric hospital inside PMC is one of the best necessary pediatrics departments across the West Bank. Pediatric ward consists of 45 beds, provide services to most pediatric fields, while PICU is the only intensive care unit in governmental hospitals across West Bank with eight beds specialized for treating critically ill pediatric patients. Services including diagnosis, treatment, hospitalization,

and follow-up, delivered at the all pediatrics department and through the outpatient clinic for patients from middle regions of the West Bank.

The governmental healthcare facilities used a health information system called Avicenna HIS system. It was developed by the USAID and the project initiated Between 2008 and 2014, in partnership between PMOH and the USAID-funded Palestinian Health Sector Reform and Development Project (Flagship Project) to implement a computerized Health Information System (Avicenna HIS) in selected facilities (hospitals, clinics, and PMOH offices) in the West Bank. Avicenna HIS system is an extended electronic health record (EHR) system and includes functionality for medical charts; registration, scheduling, and financial information of patients; laboratory results; prescription information, including ordering, dispensing, and tracking medications; systems for maintaining, aggregating and reporting data(USAID, 2015)

Eligibility criteria

3.1.1 Eligibility criteria of cases

Inclusion criteria

1. Children admitted to P/W and PICU of age between one day and 13 years old.
2. Children of both gender.
3. Children with infectious diseases according to ICD-10 codes
4. Admitted to hospital within study period

Exclusion criteria

1. Any child has not met the inclusion criteria
2. Patients who acquired infection after 48hrs of admissions

3.1.2 Eligibility criteria of the control group

Inclusion criteria

1. The exact number of cases from children admitted to PW and PICU of the same age between one day and 13 years old.
2. Not admitted with any infection or had any nosocomial infections
3. Children of both gender.

Exclusive criteria

1. Any child has not met the inclusion criteria

Sample size method

The online software tool “Epitool” for case control study size determination calculated sample size. Being a case control study, it is more appropriate to select a confidence level of 95%, a power of 80%, and estimated odds ratio of 4.0. With these three findings, the researcher used Epitool sample size statistical calculator as shown in **Annex (1)** and considered the followings:

- Two-sided confidence level (95%) as we are testing two independent groups.
- Power of the study of 80%.
- Ratio of cases to control to be 1.
- Percentage of exposed controls to be 50% as there is limited information about the exposure risk among the control group.
- Odds ratio to be assumed as 4
- The suggested sample size for cases is 98 and 98 for controls.

However, the researcher increased the number of cases to 102 and accordingly increased the controls to 102 to have a total of 204 sample size for the study.

Matching between the cases and controls will be obtained through choosing controls within the same ratio according to gender and ± 2 years of the age period of the case.

Data collection

The data was collected from the patient units by interviewing the participant’s family and their controls. After selecting, the cases and getting their approvals, their medical file data was extracted, and the researcher himself made an interview with them. The interview time was about 20 minutes. After reviewing their files, controls were selected to ensure they meet the study inclusion-exclusion criteria, interview was made, approval was obtained, and their files was reviewed.

Study instruments

Two instruments were used in our study; the first was a self-constructed questionnaire **Annex (3)**; the self-constructed part was an interview based on a questionnaire that we developed after reviewing the literature on pediatrics hospitalization and other related health issues. It is compulsory also to achieve the objectives of the study and at the same time to be feasible and well comprehended by respondents. The interviewed questionnaire constituted the following conceptual domains:

- 1- Sociodemographic and socioeconomic variables
- 2- Environmental variables
- 3- The clinical conditions
- 4- Nutritional status
- 5- Adherence with hygiene practice
- 6- Comorbidities and chronic diseases

Patient's electronic record entries; data that include the demographic and socioeconomic factors, hospitalization period, telephone number, the date of admission and discharge, the diagnosis, medical history, treatment protocol, patient progress conditions, laboratory levels, and data about the pathology were extracted from the medical file related to every participant in the study.

Scientific rigor

Validity

Content validity: Ten experts were reviewed the instrument of the research. The experts were epidemiologists, pediatricians, researchers, statisticians, and experts working in the field. They were asked to perform content validity to estimate how much the items in each domain can measure what it is intended to measure and ensure its relevancy. All comments and recommendations were considered for instrument modification. Additionally, a pilot study was performed before the data collection process to detect the instrument's appropriateness and ensure that the questions are clear enough for respondents to answer. Finally, medical records were checked to confirm the validity of the medical section of the instrument.

Reliability

The researcher performed the following steps to ensure reliability:

- 1- The data entry was done only by the researcher and served daily to review the data quality, and any invalid feedback was re-filled.
- 2- Upon entering the whole data, 5% of the collected data was re-filling to ensure correct data entry.
- 3- Being a retrospective study, recall biases are particularly expected, especially when investigating events that occurred in the past. The researcher attempted to minimize this type of bias by verifying information given with a reliable third party or with another trustworthy source, e.g., medical records.
- 4- In addition, response bias was expected, some families refused to respond.

Pilot study

A pilot study is a small study conducted on the study field to examine the study design, the constructed instrument, and the data collection techniques. A pilot study was conducted using 10% of the projected sample in this context. It was implemented to detect the appropriateness of the research instrument and to identify problem areas and deficiencies, and so to be amended before the data collection process. It also helps identify the feasibility of the collection techniques and assess the researcher and the data collectors to get familiar with the procedure. During the early stages of the pilot, the researcher is expected to face some problems in guiding and proposing the questions. Additionally, a pilot study provides a preliminary scope about the way data would be processed and analyzed and whether it fulfills the study objectives or not.

Study period

The expected period for all stages to perform the study is 12 months. Started at November 2021 until November 2022. A detailed timeline is shown in **Annex (2)**.

Statistical analysis

All the data was recorded, and the statistical analysis was performed using SPSS version 23. Independent variables were compared between the two groups (cases and controls). The Chi-

square test was used to compare categorical variables between the two groups (cases and controls). Odds Ratio and 95 Confidence interval was used to measure the strength and statistical significance of the association between the dependent and other independent variables. Alternatively, we estimate the effect of different factors on the ID admission determinants and corresponding 95% CI, derived from the conditional logistic regression models, and potential confounders was included as covariates in the model.

Ethical and administrative considerations

Academic approval from the faculty of Public Health at Al Quds University was obtained after submitting the proposal of the study to the research committee for discussion. In the perspective of commitment to research ethics, the participants' acceptance in our research was obtained by consent form shown in **annex (3)**. Additionally, administrative approval was taken from the director of MOH for having access to the institutions' database.

4 RESULTS

In this chapter, the study results will be presented, and study population characteristics will be shown in detailed tables in a descriptive analysis. Univariate and multivariate analyses will be presented in details.

Univariate analysis

4.1.1 Distribution of the study population by sociodemographic variables

In our study, Sociodemographic and economic characteristics were shown an equal distribution of participants according to gender (102 males, and 102 females) as presented in table 4.1, and the mode of age groups was infancy (48.5%). Even though the PMC was in a major province but the majority of the participants are village residents (73.5%). About (70%) had 1-4 siblings. The majority of subjects are village residents (66.7%), and (27.9%) of them are city residents. (46.1%) of mother's finish their secondary education, and (45.1%) finish their universities study, and (85.3%) of them were housewives, while (49.5%) of fathers finish their secondary education and (74.5%) worked in the private sector

Table 4.1 Sociodemographic and economic characteristics

variable		Frequencies	Percentages%
gender	Male	102	50.0
	female	102	50.0
Age group	Infancy	99	48.5
	Toddler & Preschool	82	40.2
	School-age	23	11.3
Number of siblings	no siblings	30	14.7
	1-4 siblings	143	70.1
	more than 5 siblings	31	15.2
Residency	Camp	11	5.4
	City	57	27.9
	Village	136	66.7
Mother's level of education	Primary	18	8.8
	Secondary	94	46.1
	University	92	45.1
father's level of education	Primary	22	10.8
	Secondary	101	49.5
	University	81	39.7
Mother's Employment status	Employed in the private sector	12	5.9
	Employed in the public sector	18	8.8
	Housewife	174	85.3
Father's Employment status	Employed in the private sector	152	74.5
	Employed in the public sector	46	22.5
	unemployed	6	2.9
Monthly income	less than 4000 NIS	71	34.8
	4000 - 6000 NIS	111	54.4
	more than 6000 NIS	22	10.8

4.1.2 Distribution of the study population by Comorbidities & Previous diseases variables

Table 4.2 shows that (34.3%) of the subjects had a history of previous illness, while the majority had no previous diseases (65.7%). Even most of them did not use any medication (82.8%) but (17.2%) of subjects were on regular medications. Of the subjects (63.7%) doesn't experience any previous hospitalization, and (36.3%) had experienced the previous hospitalization, most of them were admitted within 1 year (81.6%), and (77.6%) of them were admitted to PMC

Table 4.2 Comorbidities & Previous diseases characteristics

Variables		Frequencies	Percentages%
History of Previous illness	had disease	70	34.3
	no previous disease	134	65.7
Regular medication use	Yes	35	17.2
	No	169	82.8
Frequent ID exposure	Yes	62	30.4
	No	142	69.6
Previous hospitalization	Yes	74	36.3
	No	130	63.7
If admitted previously, when?	within 1 year	62	81.6
	more than 1 year	14	18.4
If admitted previously, where?	PMC	59	77.6
	private hospital	11	14.5
	governmental hospital	6	7.9

4.1.3 Distribution of the study population by environmental variables

The study shows in table 4.3 that (52%) of the subjects are apartment residents, followed by detached houses (45.6%). majority of subjects' houses had enough ventilation and were exposed to sunlight about (82%). Pollutions like open-house sewage and waste incinerator are present in (19.6%) of all participants. The majority of all subjects had no water well (70.1%) or agricultural land (57.8%), most of the subjects who had a water well did not drink it (82.4%), subjects who had a water well (35.1%) sanitize well with chlorine and (64.9%) did not. A limited number of them breed animals (26.5%), and (73.5%) did not.

Among participants (59.8%) can access the hospital at any time, and (90.1%) can access PHC at all times, (4.4%) of all subjects traveled outside Palestine within the last 12 months, (33.3%) within the Arab countries, and (66.7%) other countries.

Table 4.3 Environmental characteristics

Variables		Frequencies	Percentages%
Type of housing	Apartment	106	52.0
	Brix shed	5	2.5
	detached house	93	45.6
House adequate ventilation	Yes	167	81.9
	No	37	18.1
House adequate sunlight	Yes	162	79.4
	No	42	20.6
Environmental pollutants near the house	Yes	40	19.6
	No	164	80.4
Source of the pollutants near the house	no pollutions	157	80.4
	open house sewage	30	14.7
	waste incinerator	10	4.9
Agricultural land near your house	Yes	86	42.2
	No	118	57.8
	yes	61	29.9

Water well near child house	No	143	70.1
Drink from a well of water	Yes	36	17.6
	No	168	82.4
Chlorine is used to sanitize the well	Yes	33	35.1
	No	61	64.9
Animals in or around the child's house	Yes	54	26.5
	No	150	73.5
Access to the hospital all the time	Yes	122	59.8
	No	82	40.2
Access to PHC all the times	Yes	185	90.7
	No	19	9.3
Travel outside Palestine in the last 12 months	Yes	9	4.4
	No	195	95.6
If you travel, where?	Arabic countries	3	33.3
	other countries	6	66.7
If you travel, when?	within 6 months	6	66.7
	more than 6 months	3	33.3

4.1.4 Distribution of the study population by hygiene practice variables

The study reveals in table 4.4 that (59.7%) of a subject who can wash their hands practice handwashing 7-15 times/day, (72%) of them clean their hands before eating, and (55%) of them practice handwashing after using the bathroom. The majority of the mothers (87.7%) clean the bathroom regularly, and (83.8%) of them use chlorine in disinfecting the food preparation surfaces and dining table.

Table 4.4 hygiene practice characteristics

Variables		Frequencies	Percentages%
Handwashing frequency per day	1-6 times / day	33	49.3
	7-15 times / day	34	50.7
Handwashing practice before eating	Yes	147	72.1
	sometimes	43	21.1
	No	14	6.9
Handwashing after using the bathroom	Yes	46	55.4
	sometimes	37	44.6
Clean the bathroom regularly	Yes	179	87.7
	No	25	12.3
Clean the toys of the child	Yes	30	14.7
	sometimes	5	2.5
	No	169	82.8
Chlorine to clean dining table surfaces, food preparation	Yes	171	83.8
	sometimes	19	9.3
	No	14	6.9
Body bath times per week	1-3 times/week	101	49.5
	more than 3 / week	103	50.5

4.1.5 Distribution of the study population by Nutritional variables

The study shows in table 4.5 that about (90%) had no disorder that may affect eating, about (50%) of the subjects consume 7-10 meals/day, (66%) did not use nutritional supplements, and (92%) did not feed by special formulas. The mean of the subject's weight in kg was 11.48 kg, while the mean of the subject's height was 79.3 cm.

Table 4.5 Nutritional characteristics

Variables		Frequencies		Percentages%		
The child had a disorder that affect their eating	Yes	21		10.3		
	No	183		89.7		
Child's meals per day	2-3 meals per day	61		29.9		
	4-6 meals per day	42		20.6		
	7-10 meals per day	101		49.5		
Use of nutritional supplement	Yes	69		33.8		
	No	135		66.2		
Use of special formulas	Yes	16		7.8		
	No	188		92.2		
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Child's weight in Kg.	204	47.9	2.1	50.0	11.482	9.1511
Child's height in cm	204	108	42	150	79.34	27.357

4.1.6 Distribution of the study population by Clinical presentation variables

The study results showed in table 4.6 that dehydration was present in (54.4%) of all subjects, fever in (46.6%), abdominal pain in (37.7%), and nausea and vomiting in (25%) of the study population

Table 4.6 Clinical presentation characteristics

Variables		Frequencies	Percentages%
Skin rash	Yes	41	20.1
	No	163	79.9
fever	Yes	95	46.6
	No	109	53.4
hypothermia	Yes	10	4.9
	No	194	95.1
Chills and sweating	Yes	71	34.8
	No	133	65.2
dehydration	Yes	111	54.4
	No	93	45.6
Respiratory distress	Yes	53	26.0
	No	151	74.0
cough	Yes	58	28.4
	No	146	71.6
jaundice	Yes	27	13.2
	No	177	86.8
Cyanosis	Yes	49	24.0
	No	155	76.0
Edema	Yes	17	8.3
	No	187	91.7
Itching	Yes	12	5.9
	No	192	94.1
Abdominal pain	Yes	77	37.7
	No	127	62.3
Constipation	Yes	25	12.3
	No	179	87.7
Nausea & Vomiting	Yes	51	25.0
	No	153	75.0
Confusion	Yes	25	12.3
	No	179	87.7

4.1.7 Distribution of the study population by Radiological and laboratory variables

The radiological results showed in table 4.7 that (26%) of the subjects had abnormal chest X-rays, and (17.6%) had abnormal Ultrasound tests. The laboratories result reveals that (53%) of subjects had abnormal WBC result. (20.2%) of blood cultures taken from patients was positive (48%) of them were due to staphylococcal infections, (23.6%) of urine cultures were taken positive (68%) were due to E. coli, and (4.7%) of CSF cultures taken were positive.

In table 4.8 ABO groups were documented in 130 cases, A group (37.7%), B group (17.7%), O group (40%), and AB group (4.6%).

Table 4.7 Radiological and laboratory characteristics

Variables		Frequencies	Percentages%
CT-scan	normal	11	5.4
	abnormal	13	6.4
	not done	180	88.2
Ultrasound	normal	26	12.7
	abnormal	36	17.6
	not done	142	69.6
Echocardiogram	normal	11	5.4
	abnormal	16	7.8
	not done	177	86.8
Chest X-Ray	normal	97	47.5
	abnormal	53	26.0
	not done	54	26.5
WBC	normal	95	46.6
	abnormal	109	53.4
Neutrophil %	normal	30	14.7
	abnormal	174	85.3
Lymphocyte %	normal	21	10.3
	abnormal	183	89.7
Platelets level	normal	139	68.1
	abnormal	65	31.9
Creatinine level	normal	138	67.6
	abnormal	66	32.4
Sodium level	normal	127	62.3
	abnormal	77	37.7

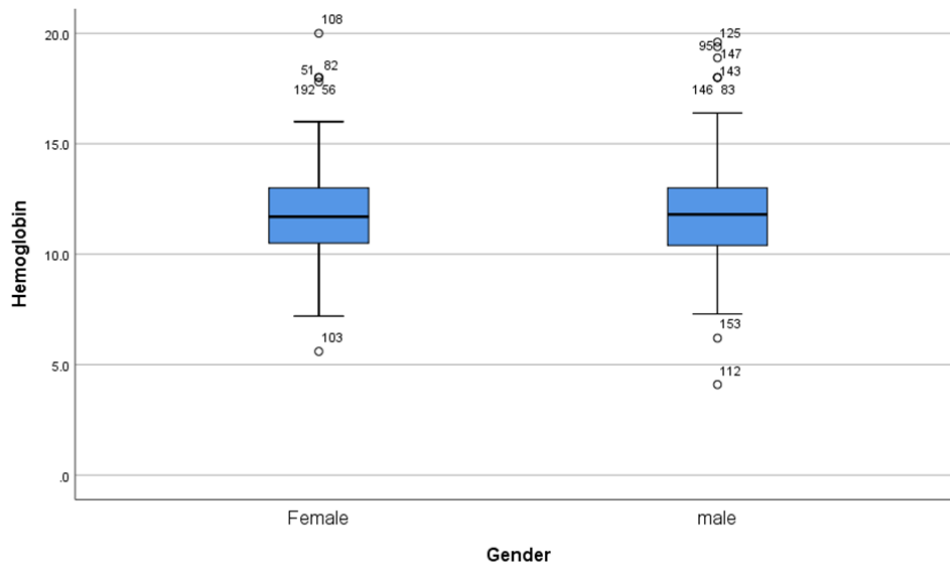
Potassium level	normal	176	86.3
	abnormal	28	13.7
Chloride level	normal	121	59.3
	abnormal	83	40.7
Albumin level	normal	27	13.2
	abnormal	21	10.3
C-reactive protein	normal	46	22.5
	abnormal	66	32.4
Ferritin level	normal	13	6.4
	abnormal	6	2.9
Fibrinogen level	normal	6	2.9
	abnormal	8	3.9
LDH level	normal	17	8.3
	abnormal	17	8.3
Uric acid level	normal	25	12.3
	abnormal	12	5.9
Blood culture	positive	25	20.2
	negative	99	79.8
Urine culture	positive	25	23.6
	negative	81	76.4
CSF culture	positive	3	4.7
	negative	61	95.3
Serology tests	positive	22	10.8
Virology panel	positive	25	12.3

Table 4.8 ABO descriptive characteristics

Variables		Frequencies	Percentages%
ABO groups	A GROUP	49	37.7
	B GROUP	23	17.7
	O GROUP	52	40
	AB GROUP	6	4.6

Table 4.9 Laboratory tests Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
WBC count	204	45.6	3.4	49.0	13.13	6.04
Neutrophils %	204	88.9	6.1	95.0	48.64	20.93
Lymphocytes %	204	85.2	3.8	89.0	42.57	18.83
Hemoglobin	204	15.9	4.1	20.0	11.91	2.45
Platelets	204	778.2	3.8	782.0	359.10	149.49
Creatinine	193	1.21	.09	1.30	0.40	0.19
Sodium	193	48	119	167	137.39	5.56
Potassium	194	3.6	2.8	6.4	4.41	0.61
Chloride	151	117	87	204	102.91	9.46
Albumin	48	3.4	1.5	4.9	3.60	0.73
CRP	112	430.0	.0	430.0	43.65	69.05
Ferritin	19	5804	28	5832	512.16	1308.80
Fibrinogen	15	454	164	618	407.27	122.76
LDH	35	1241	4	1245	374.08	217.32
Uric Acid	37	12.6	1.2	13.8	5.00	2.80



4.1.8 Distribution of infectious diseases in the Cases (102) in the study population

In our study, table 4.10 shows the distribution of infectious diseases among the reported hospital admitted cases as infectious diseases the sepsis (25.5%) was shown as the most infectious disease presented in the study followed by UTI (19.6%), then Amoebiasis (11.8%).

Table 4.10 shows the distribution of the infectious diseases codes according to the international classification of diseases ICD-10, code B96.2 which refers to E. coli infections (16.7%), was shown as the most presented of the codes among infectious diseases, followed by A06.9 which refers to Amoebiasis, then B34.2 which refers to COVID-19.

Table 4.11 shows the hospital length of stay (LOS) which divided into 3 categories, the majority of subjects spent less than 3 days (41.7%), who spent between 4-7 days was (29.9%) of data subjects, and (28.8%) spent more than 8 days in hospital for treatment. The mean of the LOS was 5.9 days, while the maximum was 32 days and the minimum was 1 day.

Table 4.10 Distribution of infectious diseases

	variable	Frequencies	Percentages%
Infectious Disease (ICD-10)	Adenovirus infection (B34. 0)	8	7.8
	Amoebiasis (A06)	12	11.8
	Bacterial meningitis (A87)	1	1.0
	Chickenpox(B01)	4	3.9
	COVID-19 (B34. 2)	9	8.8
	H. pylori gastritis (B96. 81)	1	1.0
	Infectious mononucleosis (B27. 90)	4	3.9
	Respiratory infections	10	9.8
	Sepsis	26	25.5
	Urinary tract infections	20	19.6
	Viral encephalitis (A86)	2	2.0
	Viral meningitis (A87. 9)	5	4.9
	Total	102	100

Table 4.11 hospital length of stay LOS among the study population

Variables		Frequencies		Percentages%		
LOS into 3 groups in days	less than 3 days	85		41.7%		
	4 - 7 days	61		29.9%		
	more than 8 days	58		28.4%		
	Total	204		100.0%		
	N	Range	Minimum	Maximum	Mean	Std. Deviation
LOS in days	204	31	1	32.0	5.89	4.414

Inferential Analysis

4.1.9 Relationship between pediatric infectious disease and Socio-demographic variables

Gender and age: Table 4.12 shows that our study has an equal number of both gender and different age groups in the cases and controls due to matching during the study design. The Mean age of the cases group was lower (27.78), than the control group (30.69) and the differences between the 2 means did not reach a statistically significant difference. No clear differences were found in the number of a sibling,

Residency: Among cases, the residency in camps was higher than the controls (81.8% vs. 12.2%) and by the village (52.2% vs. 47.8%), while controls reported city residency more than in cases (61.4 Vs 38.6%). The difference between cases and controls reached a statistically significant level (P value 0.021).

Parent's level of education: As seen in the same table, there is a marked difference between the cases (children with infectious diseases) and the controls. Controls reported a higher percentage of a university degree for both fathers and mothers (61.7% and 60.9% respectively) compared to the controls (38.3% and 39.1% respectively). The differences between the cases and controls were statistically significant for both mother education (P value 0.019) and father education (P value 0.021).

Parent's Employment: Father's and mother's employment status show no marked differences between cases and controls. It is apparent that employment in the public sector is lower among cases for both the fathers and mothers (41.3% and 38.9%); anyhow, these differences did not reach a statistically significant level.

Family Monthly Income: Our findings show that low income is more prevalent among cases than controls (60.6% vs. 39.4%). The differences between the two groups are statistically significant (P value 0.012), in most of the cases subjects had an income of less than 5000 NIS, and a less group who had an income of more than 6000 NIS per month were workers inside the occupied territories.

Table 4.12 socio-demographic characteristics of the study subjects

Variable		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
Gender	Male	50	49%	52	51%	0.779
	female	52	51%	50	49%	
Age group	Infancy	53	53.5%	46	46.5%	0.582
	Toddler & Preschool	39	47.6%	43	52.4%	
	School-age	10	43.5%	13	56.5%	
Age (months)	Mean (SD)	102	27.78 (34.296)	102	30.69 (37.885)	
Number of siblings	no siblings	16	53.3%	14	46.75	0.892
	1-4 siblings	70	49%	73	51%	
	more than 5 siblings	16	51.6%	15	48.4%	
Residency	Camp	9	81.8%	2	18.2%	0.021*
	City	22	38.6%	35	61.4%	
	Village	71	52.2%	65	47.8%	
Mother's level of education	Primary	11	61.1%	7	38.9%	0.019*
	Secondary	55	58.5%	39	41.5%	
	University	36	39.1%	56	60.9%	
father's level of education	Primary	14	63.6%	8	36.4%	0.021*
	Secondary	57	56.4%	44	43.6%	
	University	31	38.3	50	61.7%	
Mother's Employment status	Employed in the private sector	6	50%	6	50%	0.612
	Employed in the public sector	7	38.9%	11	61.1%	
	Housewife	89	51.1%	85	48.9%	
Father's Employment status	Employed in the private sector	79	52%	73	48%	0.317
	Employed in the public sector	19	41.3%	27	58.7	
	unemployed	4	66.7	2	33.3	
Monthly income	less than 4000 NIS	43	60.6%	28	39.4%	0.012*
	4000 - 6000 NIS	45	40.5%	66	59.5%	
	more than 6000 NIS	14	63.6%	8	36.4%	

*Statistically significant Result

4.1.10 Relationship between pediatric infectious disease and hospital length of stay

Hospital length of stay: Table 4.13 shows that the length of stay LOS among cases who spent less than 3 days in hospital was lower than controls (12.9% vs 87%) respectively. However, the cases who spent between 4-7 days in hospital was higher than controls (67.2% vs 32%). The LOS among cases who spent more than 8 days was higher than controls (86.2% vs 13.8%), and the difference was statistically significant (P value =0.000). t-test was used to compare the means of our two group, the mean of LOS in days was higher among cases than controls (8.15 vs 3.63) days, and the difference was statistically significant (P value = 0.004).

Table 4.13 LOS characteristics of the study subjects

Variable		Study cases		Control group		P value +
		count	N %	count	N %	
LOS into 3 groups in days	less than 3 days	11	12.9%	74	87.1%	<0.001*
	4 - 7 days	41	67.2%	20	32.8%	
	more than 8 days	50	86.2%	8	13.8%	
LOS in days	N	mean	SD	mean	SD	0.004*
	204	8.15	4.379	3.63	3.108	

*Statistically significant Result, + t-test used for continuous variables and Chi2 for categorical variables

4.1.11 Relationship between pediatric infectious disease and Comorbidities & Previous diseases variables

Previous illness: Table 4.14 shows that the previous diseases in both cases and controls subjects were approximate (46% Vs. 54%) and the difference not presenting any correlation (P value 0.449), the use of regular medication percentage was found higher among the cases subject than control (51.4% Vs. 48.6%) but also not statistically significant.

Infection exposure and hospitalization: Frequent exposure to ID was found higher among cases (66.1% Vs. 33.9%) this difference was found statistically significant, also the previous hospitalization among cases was found higher than control (61.6% Vs 38.4%) the difference was significant (P value 0.013). Most of the children who were admitted to the hospital within 1 year were among the cases group than controls (53.2% Vs 46.8%), among cases the children who were admitted to previously to hospital more than 1 year was higher than controls (64.3% Vs

35.7%), cases who previously admitted to Palestine medical complex was more than controls (54.2% Vs 45.8%), in private hospitals (81.8% Vs 18.2%), and governmental hospital (16.7% Vs 83.3%).

Table 4.14 Comorbidities & Previous diseases characteristics of the study subjects

Variable		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
History of Previous illness	had disease	29	46%	34	54%	0.449
	no disease	73	51.8%	68	48.2%	
Regular medication use	Yes	18	51.4%	17	48.6%	0.853
	No	84	49.7%	85	50.3%	
Frequent ID exposure	Yes	41	66.1%	21	33.9%	0.002*
	No	61	43%	81	57%	
Previous hospitalization	Yes	45	61.6%	28	38.4%	0.013*
	No	57	43.5%	74	56.5%	
If admitted previously, when?	within 1 year	33	53.2%	29	46.8%	0.452
	more than 1 year	9	64.3%	5	35.7%	
If admitted previously, where	PMC	32	54.2%	27	45.8%	0.034*
	private hospital	9	81.8%	2	18.2%	
	governmental hospital	1	16.7%	5	83.3%	

*Statistically significant Result

4.1.12 Relationship between pediatric infectious disease and Environmental Characteristics

Housing: Table 4.15 shows that cases live in apartments more than controls (55.4% vs 44.6%), also in Brix shed (100% vs 0%), and lower in a detached house (43% vs 57%), the difference found statistically significant, house ventilation among cases was lower than controls (46.7% vs 53.3%), also houses sunlight was lower among case (45.7% vs 54.3%), the differences found significant for adequate sunlight and ventilation.

Environmental pollutants: among cases, pollution near their houses was higher than controls (55% vs 45%) with no significant difference. The open house swage was higher among cases than controls (54.1% vs 45.9%) and the water incinerator was lower among cases than controls (40 vs 60), and the difference was statistically significant. In addition, the cases that live beside agricultural land are higher among cases than controls (55.8% vs 44.2%) with no marked difference.

Water sanitization Having a water well near a house among cases group was higher than controls (63.9% vs 36.1%) and considered a significant factor, among cases who had water well and drinking from it, cases were higher than controls (72.2% vs 27.8%) with marked correlation. Chlorine use to sanitize the well is higher among cases (60.6% vs 39.4%) but not considerable, also breeding animal found higher among cases than controls (55.6% vs 44.4%) but also not considerable correlation.

Traveling: The result showed that the cases group's ability to access hospitals at all times was higher than controls (53.3% vs 46.7%) and primary healthcare centers PHC (50.8% vs 49.2%), with no significant difference. Traveling outside Palestine was higher among cases than controls (53.3 vs 46.7%) with no clear difference, among cases who travel to Arabic countries was higher than controls (66.7% vs 33.3%), and to other countries was the same (50% vs 50%) respectively. Among cases who travel within 6 months was higher than controls (66.7% vs 33.3%) and lower for who travel more than 6 months ago (33.3% vs 66.7%).

Table 4.15 Environmental characteristics of the study subjects

Variables		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
Type of housing	Apartment	56	55.4%	45	44.6%	0.046*
	Brix shed	3	100%	0	0%	
	detached house	43	43%	57	57%	
House adequate ventilation	Yes	78	46.7%	89	53.3%	0.046*
	No	24	64.9%	13	35.1%	
House adequate sunlight	Yes	74	45.7%	88	54.3%	0.015*
	No	28	66.6%	14	33.3%	
Environmental pollutants near the house	Yes	22	55%	18	45%	0.481
	No	80	48.8%	84	51.2%	
Source of the pollutants near the house	open house sewage	20	54.1%	17	45.9%	0.430
	waste incinerator	4	40%	6	60%	
Agricultural land near the house	Yes	48	55.8%	38	44.2%	0.156
	No	54	45.8%	64	54.2%	
Water well near the house	yes	39	63.9%	22	36.1%	0.009*
	No	63	44.1%	80	55.9%	
Drink from a well of water	Yes	26	72.2%	10	27.8%	0.003*
	No	76	45.2%	92	54.8%	
Chlorine is used to sanitize the well	Yes	20	60.6%	13	39.4%	0.363
	No	31	50.8%	30	49.2%	
Animals in or around the child's house	Yes	30	55.6%	24	44.4%	0.341
	No	72	48%	78	52%	
Access to the hospital all the time	Yes	65	53.3%	57	46.7%	0.253
	No	37	45.1	45	454.9%	
Access to PHC all the times	Yes	94	50.8%	91	49.2%	0.470
	No	8	421%	11	57.9%	
Travel outside Palestine in the last 12 months	Yes	8	53.3%	7	46.7%	0.789
	No	94	49.7%	95	50.3%	
If you travel, where?	Arabic countries	2	66.7%	1	33.3%	0.635
	other countries	3	50%	3	50%	
If you travel, when?	within 6 months	4	66.7%	2	33.3	0.343
	more than 6 months	1	33.3	2	66.7%	

*Statistically significant Result

4.1.13 Relationship between pediatric infectious disease and hygiene practice variables

Handwashing practice: Table 4.16 shows the handwashing practice among cases with low frequency of practice (1-6 times/ day) higher than controls (63.6% vs 36.4%), and in better frequency (7-15 times/ day) (38.2 vs 61.8), which reflects significant correlation (P value 0.038) the result influenced by the age of the subjects because about (67%) below the age of 2 years which excluded from the question. The practice of hand washing was found lower among cases than controls (42.9% vs 57.1%). Also, the cases who did the practice sometimes was higher (72.1% vs 27.9%), and those who didn't wash their hand was higher among cases (57.1% vs 42.9%) which reflects significant correlation (P value 0.003), also the question of practicing handwashing after using bathroom indicates that cases wash their hands lower than controls (43.5% vs 56.5%) but the difference not considerable.

House facilities: The same table shows that Regular cleaning of the bathroom among cases was lower than controls (48% vs 52%), also cleaning of child toys was lower among cases than controls (40% vs 60%), and using chlorine to clean dining. Also, on food preparing surfaces was lower among cases than controls (48.5% vs 51.5%) all these variables differences found not statistically significant.

Child body bath: Among cases of children who practice body baths at a lower frequency (1-3 times/week) was higher than controls (66.3% vs 33.7%) and who practice at a frequency (more than 3 times/ week) found higher among controls (34% vs 66%) which reflect considerable significance correlation (P value 0.000).

Table 4.16 hygiene practice characteristics of the study subjects

Variables		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
Handwashing(HW) frequency per day	1-6 times / day	21	63.6%	12	36.4%	0.038*
	7-15 times / day	13	38.2%	21	61.8%	
HW before eating	Yes	63	42.9%	84	57.1%	0.003*
	sometimes	31	72.1%	12	27.9%	
	No	8	57.1%	6	42.9%	
HW after using bathroom	Yes	20	43.5%	26	56.5%	0.119
	sometimes	24	64.9%	13	35.1%	
Clean the bath regularly	Yes	86	48%	93	52%	0.135
	No	16	64%	9	36%	
Clean the toys of the child	Yes	14	46.7%	16	53.3%	0.824
	sometimes	2	40%	3	60%	
	No	86	50.9%	83	49.1%	
Chlorine to clean dining, and food surfaces	Yes	83	48.5%	88	51.5%	0.636
	sometimes	11	57.9%	8	42.1%	
	No	8	57.1%	6	42.9%	
Body bath times per week	1-3 times/week	67	66.3%	34	33.7%	<0.001*
	more than 3/week	35	34%	68	66%	

*Statistically significant Result

4.1.14 Relationship between pediatric infectious disease and Nutritional variables

Nutritional health: Table 4.17 shows that disorders that may affect the child's eating are lower among cases than controls (47.6% vs 52.4%) but the difference is statistically significant. Meals per day were divided into 3 categories; 2-3 meals were higher among cases than controls (52.5% vs 47.5%), 4-6 meals/ day was lower among cases than controls (40.5% vs 59.5%), 7-10 meals/ day was higher among cases than controls (52.5% vs 47.5%), but differences were not statistically significant due to the variances in age group and its inverse relationship with the frequency of meals. Using nutritional supplements among cases was lower than controls (49.3% vs 50.7%), but the difference did not reach statistical significance. The use of special formula was higher among cases than controls (56.3% vs 43.8%) but also not significant

The mean height among cases was found to be lower than the control (78.36 vs 80.31), also the mean weight among cases found to be lower than controls. (11.12 vs 11.85)

An Emergency Nutrition Assessment (ENA) anthropometry software was used to compare means of weight and height for both cases and controls, the data was filled into the program, which measure the means of our data's height and weight according to world health organization (WHO) standards 2006, these standards are based on a high-quality study designed explicitly for creating children growth charts.

The z-score of height for age was negatively lower among cases than controls (-1.19 vs -1.39), and the z-score of weight for age was lower negatively among cases than controls (-1.04 vs -0.88).

z-score of height of children was categorized into two groups and crosstab developed, results showed that z-score of -1 to 1 was higher among cases than controls (52.4% vs 47.6%), and z-score Higher than 1 and less than -1 was lower among cases than controls (48.9% vs 51.1%) with no statistical significant difference.

Table 4.17 Nutritional characteristics of the study subjects

Variables		Study cases		Control		P value of Chi-Square
		count	N %	count	N %	
						0.818
The child had a disorder that affect their eating	Yes	10	47.6%	11	52.4%	
	No	92	50.3%	91	49.7%	
Child's meals per day	2-3 meals per day	32	52.5%	29	47.5%	0.383
	4-6 meals per day	17	40.5%	25	59.5%	
	7-10 meals per day	53	52.5%	48	47.5%	
Use of nutritional supplement	Yes	34	49.3%	35	50.7%	0.882
	No	68	50.4%	67	49.6%	
Use of special formulas	Yes	9	56.3%	7	43.8%	0.602
	No	93	49.5%	95	50.5%	

Stunting seems to be higher among cases (children with infection diseases) while underweight is higher among controls (hospitalized children due to other diseases). Anyhow, the differences between cases and controls did not reach statistically significant differences.

For the weight the z-score was also categorized into two groups and crosstab developed, the results showed that z-score of -1 to 1 was lower among cases than controls (41.9% vs 58.1%), and z-score Higher than 1 and less than -1 was higher among cases than controls (56.8% vs 43.2%) with no statistical significant difference.

Table 4.18 Growth pattern among cases and controls

Variable		Study cases		Control group		P value
		count	N %	count	N %	
Height	Stunted (z-score -1 to 1)	33	52.4	30	47.6	0.65
	Normal height	69	48.9	72	51.1	
Weight	Under weight (z-score -1 to 1)	26	41.9	36	58.1	0.06
	Normal weight	89	56.8	84	43.2	

4.1.15 Relationship between pediatric infectious disease and clinical presentation variables

Table 4.19 shows **skin rash** among cases higher than controls (70.7% vs 29.3%) and the difference statistically was significant. **Fever** among cases was higher than controls (92.6% vs 7.4%) and the difference statistically was significant. **Hypothermia** among cases was lower than controls (20% vs 80%) and the difference statistically was not significant. **Chills and sweating** among cases were higher than controls (81.7% vs 18.3%) and the difference was statistically significant

Dehydration among cases was higher than in controls (64% vs 36%) and the difference statistically was significant. **Respiratory distress** among cases was higher than among controls (71.7% vs 28.3%) and the difference statistically was significant. **Cough** among cases was higher than controls (72.4% vs 27.6%) and the difference statistically was significant. **Jaundice** among cases was lower than among controls (11.1% vs 88.9%) and the difference statistically was significant. **Nausea and vomiting** among cases were higher than in controls (66.1% vs 33.9%) and the difference statistically was significant.

The same table shows **Cyanosis** among cases higher than controls (61.2% vs 38.8%), **itching** (66.7% vs 33.3%), **abdominal pain** (53.2% vs 46.8%), **confusion** (56.9% vs 43.1%), **constipation** and **edema** was lower among cases than controls (48% vs 52%) (47.1% vs 52.9%) respectively, the difference between cases and controls did not reach the statistical significance.

Table 4.19 Clinical presentation variables of the study subjects

Variables		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
Skin rash	Yes	29	70.7%	12	29.3%	0.003*
	No	73	44.8%	90	55.2%	
fever	Yes	88	92.6%	7	7.4%	<0.001*
	No	14	12.8%	95	87.2%	
hypothermia	Yes	2	20%	8	80%	0.052
	No	100	51.5%	94	48.5%	
Chills and sweating	Yes	58	81.7%	13	18.3%	<0.001*
	No	44	33.1%	89	66.9%	
dehydration	Yes	71	64%	40	36%	<0.001*
	No	31	33.3%	62	66.7%	
Respiratory distress	Yes	38	71.7%	15	28.3%	<0.001*
	No	64	42.4%	87	57.6%	
cough	Yes	42	72.4%	16	27.6%	<0.001*
	No	60	41.1%	86	58.9%	
jaundice	Yes	3	11.1%	24	88.9%	<0.001*
	No	99	55.9%	78	44.1%	
Cyanosis	Yes	30	61.2%	19	38.8%	0.071
	No	72	46.5%	83	53.5%	
Edema	Yes	8	47.1%	9	52.9%	0.800
	No	94	50.3%	93	49.7%	
Itching	Yes	8	66.7%	4	33.3%	0.234
	No	94	49%	98	51%	
Abdominal pain	Yes	41	53.2%	36	46.8%	0.470
	No	61	48%	66	52%	
Constipation	Yes	12	48%	13	52%	0.831
	No	90	50.3%	89	49.7%	
Nausea and Vomiting	Yes	39	66.1%	20	33.9%	0.003*
	No	63	43.4%	82	56.6%	
Confusion	Yes	29	56.9%	22	43.1%	0.258
	No	73	47.7%	80	52.3%	

*Statistically significant Result

4.1.16 Relationship between pediatric infectious disease and Radiological and laboratory variables

Radiologic workup: Table 4.20 shows that abnormal **CT** results among cases were higher than controls (53.8% vs 46.2%), the **Ultrasound** abnormal results among cases were higher than controls (52.8% vs 47.2%), the **Echocardiogram** abnormal results was higher among cases than controls (75% vs 25%) but all difference between variables didn't reach statistical significance. The **Chest X-ray** abnormal results were higher among cases than controls (71.7% vs 28.3%) and the difference reach statistical significance (P value 0.000).

Laboratory workup: the same table shows abnormal results of **WBCs** and **neutrophils** among cases were higher than controls (61.5% vs 38.5), (53.4% vs 46.6%) respectively, and the difference was statistically significant. The **lymphocyte** and **platelets** abnormal results among cases were higher than controls (51.9% vs 48.1%), (55.4% vs 4.6%) respectively with no significant difference.

Creatinine abnormal level among cases was higher than controls (53% vs 47%), **sodium** among cases was higher than controls (55.8% vs 44.2%), **and potassium** was lower among cases than controls (46.4% vs 53.6%) but none of these variables' difference reaches statistical significance. While **chloride** among cases was lower than controls (41% vs 59%) and the difference reach statistical significance (P value 0.033).

In inflammatory markers, **ferritin** among cases was higher than controls (100% vs 0%), **fibrinogen** among cases was higher than controls (100 vs 0), **LDH** among cases was higher than controls (58.8% vs 41.2%), **uric acid** among cases was higher than controls (66.7% vs 33.3%), but none of them reach statistical significance, **CRP** among cases was higher than controls (81.8 vs 18.2) and difference reach statistical significance (P value 0.000).

Positive Blood culture results among cases were higher than controls (66.7% vs 33.3%), the difference was significant (P value 0.001), **positive urine culture** results among cases was higher than controls (72.8% vs 27.8%), and the difference was significant (P value 0.003). **Positive CSF culture** results among cases were higher than controls (72.1% vs 27.9%) but the difference did not reach statistical significance.

ABO groups: A group results among cases were higher than controls (51% vs 49%), B group results among cases were lower than controls (34.8% vs 65.2%), O group among cases was higher

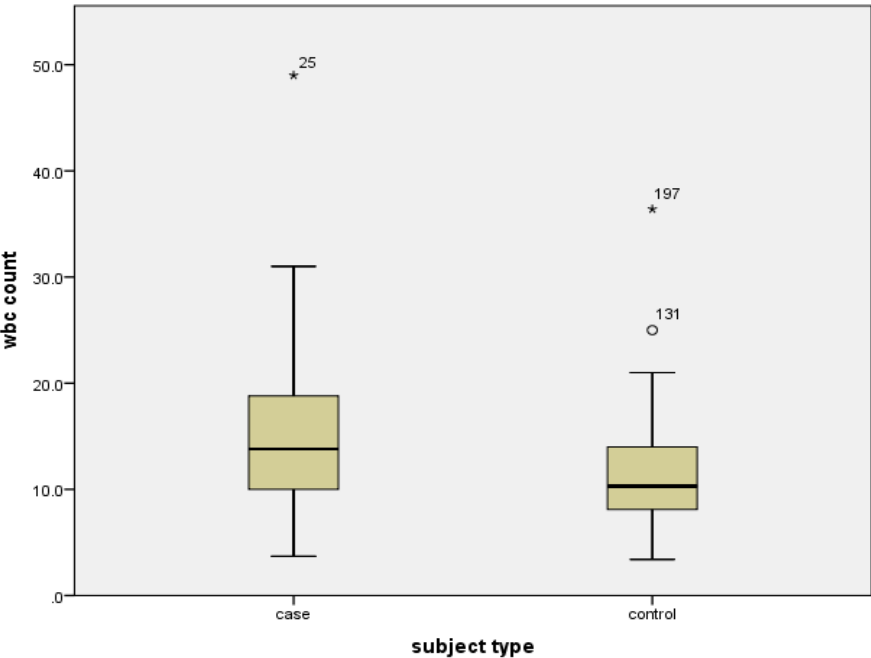
than controls (55.2% vs 44.8%), while AB group was lower among cases than controls (16.7% vs 83.3%) with no significant difference.

Table 4.20 Radiological and laboratory variables of the study subjects

Variables		Study cases		Control group		P value of Chi-Square
		count	N %	count	N %	
CT-scan	normal	2	18.2%	9	81.8%	0.094
	abnormal	7	53.8%	6	46.2%	
	not done	93	51.7%	87	48.3%	
Ultrasound	normal	17	65.4%	9	34.6%	0.194
	abnormal	19	52.8%	17	47.2%	
	not done	66	46.5%	76	53.5%	
Echocardiogram	normal	6	54.5%	5	45.5%	0.103
	abnormal	12	75%	4	25%	
	not done	84	47.5%	93	52.5%	
Chest X-Ray	normal	47	48.5%	50	51.2%	<0.001*
	abnormal	38	71.7%	15	28.3%	
	not done	17	31.5%	37	68.5%	
WBC	normal	35	36.8%	60	63.2%	<0.001*
	abnormal	67	61.5%	42	38.5%	
Neutrophil %	normal	9	30%	21	70%	0.018*
	abnormal	93	53.4%	81	46.6%	
Lymphocyte %	normal	7	33.3%	14	66.7%	0.107
	abnormal	95	51.9%	88	48.1%	
Platelets level	normal	66	47.5%	73	52.5%	0.293
	abnormal	36	55.4%	29	44.6%	
Creatinine level	normal	67	48.6%	71	51.4%	0.549
	abnormal	35	53%	31	47%	
Sodium level	normal	59	46.5%	68	53.5%	0.194
	abnormal	43	55.8%	34	44.2%	
Potassium level	normal	89	50.6%	87	49.4%	0.684
	abnormal	13	46.4%	15	53.6%	
Chloride level	normal	68	56.2%	53	43.8%	0.033*
	abnormal	34	41%	49	59%	
Albumin level	normal	15	55.6%	12	44.4%	0.260
	abnormal	15	71.4%	6	28.6%	

CRP	normal	22	47.8%	24	52.2%	<0.001*
	abnormal	54	81.8%	12	18.2%	
Ferritin level	normal	8	61.5%	5	38.5%	0.077
	abnormal	6	100%	0	0%	
Fibrinogen level	normal	4	66.7%	2	33.3%	0.078
	abnormal	8	100%	0	0%	
LDH level	normal	10	58.8%	7	41.2%	1.000
	abnormal	10	58.8%	7	41.2%	
Uric acid level	normal	14	56%	11	44%	0.536
	abnormal	8	66.7%	4	33.3%	
Blood culture	positive	25	100%	0	0%	<0.001*
	negative	66	66.7%	33	33.3%	
Urine culture	positive	25	100%	0	0%	0.003*
	negative	59	72.8%	22	27.2%	
CSF culture	positive	3	100%	0	0%	0.286
	negative	44	72.1%	17	27.9%	
ABO groups	A Group	25	51%	24	49%	0.145
	B Group	8	34.8%	15	65.2%	
	O Group	29	55.8%	23	44.2%	
	AB Group	1	16.7%	5	83.3%	

*Statistically significant Result



Multivariate analysis

The multivariate analysis included all the significant variables at ($P < 0.05$) in the univariate analysis. The results in table 4.21 revealed that the infancy period of childhood increases the chance of having the infectious disease by seven folds than toddler, preschool, and school age periods (odds ratio [OR], 7.390; 95% confidence interval [CI], 1.5–36.9). Living in apartments increases the risk of infectious diseases spread by 3 folds (OR, 2.7; 95% CI, 1.2–6.2), compared to living in detached houses. In addition, frequent exposure to infectious diseases was found to increase the possibility of infections by four folds (OR, 4.3; 95% CI, 1.5–12.6) compared to those with minimal exposure to infectious diseases. Also, body bathing was found to be inversely associated with the risk for infectious diseases, children who practice a lower frequency of bathing 1-3 times\ a week (OR, 3.3; 95% CI, 1.6–6.8) had a chance to had infections 3 folds than children who practice body bathing more frequent than 3 times per week.

Table 4.21 Multivariate Analysis of study subjects

Variables		Sig.	AOR	95% C.I.	
				Lower	Upper
Age group	Infancy	.015	7.390	1.477	36.974
	Toddler & preschool	.440	1.619	0.477	5.501
	School age		1.00		
Type of housing	Apartment	.017	2.725	1.192	6.228
	Detached house		1.00		
Mother's level of education	University	.102	.308	.075	1.262
	Secondary	.357	.540	.145	2.007
	Primary		1.00		
Father's level of education	University	.649	1.366	.357	5.228
	Secondary	.589	1.399	.414	4.724
	Primary		1.00		
Monthly income	less than 4000 NIS	.307	.513	.142	1.846
	4000 - 6000 NIS	.079	.333	.098	1.134
	more than 6000 NIS		1.00		
Residency	Village	.790	.749	.090	6.264
	City	.241	.284	.035	2.323
	Camp		1.00		
House exposure to sunlight	Yes	.151	.446	.148	1.343
	No		1.00		
House exposure to ventilation	Yes	.797	1.173	.347	3.963
	No		1.00		
Drinking from water well	Yes	.119	2.951	.757	11.504
	No		1.00		
Having a water well	Yes	.490	1.462	.497	4.302
	No		1.00		
Frequent exposure to ID	Yes	.007	4.343	1.497	12.604
	No		1.00		
Previous hospitalization	Yes	.282	1.646	.664	4.083
	No		1.00		
Handwashing frequency	1-6 times	.061	3.496	.946	12.925
	7-15 times	.825	.849	.198	3.632
	does not apply		1.00		
Body bath frequency	1-3 times per week	.002	3.263	1.562	6.816
	More than 3 per week		1.00		

*All the significant variables at (P < 0.05) in the univariate analysis were included in the multivariate analysis i.e. Residency, type of housing, house ventilation, and sunlight exposure, monthly income, parent's education, previous hospitalization, frequent exposure to infectious diseases, handwashing, and bathing frequency, having water well and use it.

5 DISCUSSION

5.1 Introduction

In this chapter, the findings of the study are summarized, discussed, compared with those of other studies around the world, interpreted, and discussed as well, and conclusions and recommendations are presented at the end of the chapter.

5.1.1 Sociodemographic variables and infectious disease among pediatric admissions

Gender: Our study consisted of (204) subjects, matching was made between case and control groups according to age and gender, to eliminate any confounding effect that might cause by gender on the study results, despite that, the increased risk of infection, as well as the delicate balance between immune-tolerance and immune-reactivity, is a delicate state of the immune system that may be even more susceptible to minor differences between sexes than later in life. Males are more susceptible to many pathogens, which can be explained in part by females having stronger immune responses, but higher levels of pro-inflammatory immunity also predispose females to increased immunopathology in some infections (Muenchhoff and Goulder 2014).

Age group: The study shows no statistical significance in the age group due to the matching criteria, but even that, the result reveals higher incidence among the cases group and a respectable difference in the infancy group (53.5% vs 46.5%), which related to the immaturity of the immune system that increases susceptibility to infectious agents (Sellon and Johnson 2006).

Residency: Our study found a statistically significant correlation between infectious diseases among pediatrics and place of residence; higher incidence among cases group villages (52.2% vs 47.8%), camp residents (81.8% vs 18.2%), while city residents found higher among the control group (61.4% vs 38.6%), despite that research's studying the relationship between place of residence and infectious diseases are limited, a study try to discover the effect of urban areas on spreading of infections, it finds that mobility restrictions in the cities help to control the infections spread (Aguilar et al. 2022), and that could be explained by the nature of village residents and their strong social relationships that increase social communications and visits, also their children spent

more time of playing outside house, while city resident's children spent more time inside their house.

Factors also in camps such as overcrowding, poor water, and sanitation conditions, lack of vaccination, delayed diagnosis, and reduced access to treatment can lead to the increased occurrence, severity, and case fatality of infectious diseases (Altare et al. 2019).

Parent's level of education: Our study shows that mothers between cases subjects study the primary and secondary level in school, while most of the control mothers reach university (60.9%), which is considered a significant relationship, also most cases father studies up to primary and secondary level, while the most of the controls fathers reach universities. Which is considered statistically significant. The relationship is bi-directional: higher education leads to better health, while better health leads to higher education (ECDC 2013), according to Monheit and Grafova; higher parental education was associated with increased total health care spending on both children and parents and therefore decreases in specific health conditions and poor health status (Monheit and Grafova 2018). The education level of an individual can impact his or her occupation, which determines economic stability and income level, which can impact the type of healthcare the individual is eligible for and what neighborhood the individual lives in (Singu et al. 2020)

Parent's employment status: our study shows no significant relationship between parent's employment and infectious disease exposure, although the results reveal that mothers of cases and control groups work more in the private sector equally, mostly they are housewives (51.1%), and most of control group mothers work in private sectors. While some cases group fathers work mostly in the private sector (52%), and fathers in the control group (58.7%). Studies state that parents who work in low-income or low-quality jobs are more to have low child care or be unsupervised(Heinrich 2014)

Monthly Income: Our research shows that the monthly income of cases subjects was higher between categories; those who earn less than 4000 NIS (60.6%), and who earn more than 6000 NIS (63.6%), and the middle category 4000-6000 NIS was higher into control group (59.5%). The result is congruent with studies that describe poverty and illness are nearly correlative: the combination of both low economic and social capital leads to poor health (ECDC 2013), The child's parents have low-income jobs, which forces them to live in poor areas that may not have a great school system (Singu et al. 2020).

5.1.2 Hospital length of stay in hospital and infectious disease among pediatric admissions

Hospital length of stay: Our study results showed that the less LOS (less than 3 days) was higher among controls (87%), while the higher LOS spent in hospital (more than 3 days) was higher among cases. With statistical significance, the mean of LOS was compared between cases and controls using t-test calculation and found a statistically significant difference indicated that the ID is a significant predictor of prolonged LOS. Results are coherent to Literature study the impact of hospital-acquired infections on LOS which is well documented, also data from 13 tertiary care centers from different European countries showed that LOS attributable to *S. aureus* BSIs are significant (De Kraker et al. 2011). Hassan's et al. study found that infections could increase the average of LOS by 9.32 days from the onset of infection (Hassan et al. 2010).

5.1.3 Comorbidities and previous diseases and infectious disease among pediatric admissions

Previous illness: Our study founds the previous diseases in both cases and controls subjects were approximate and not presenting any significant correlation, the ill children who had the previous disease presented higher in the control subject but not statistically significant, some of the literature binds between comorbidities and severity of illness caused by infection (Yang et al. 2020), Patients with chronic pulmonary disease from low-income populations were hospitalized at a rate of 398.6 per 10,000, almost 8 times higher than the rate for patients from middle-income groups (Greenberg et al. 2000). Random selection of subjects between each case and control groups and the comparison nature of the study, does not focus on the severity caused by infection, which explains the results.

Recurrent ID exposure: In our study, the results of recurrent exposure to infectious diseases among cases were higher than controls (66.1% vs 33.9%), also the previous hospitalization among cases was found higher than controls (61.6% vs 39.4%), with significant differences, according to Grüber the average child has four to eight respiratory infections per year (Grüber et al. 2008), also this result may be explained by the growing and acquired immunity of children especially the majority of our population are within infancy period because the not-fully educated immune system may be causes for children being a major risk group for common colds (Grüber et al. 2008).

The result also gave us a picture of the percentage of cases group children who had previous hospitalization within the last year of study the majority of them (53%) were admitted to PMC.

5.1.4 Environmental variables and infectious disease among pediatric admissions

Type of housing: In our study results, housing presented as a significant variable, in which cases group had (55.4%) live in apartments, and (100%) live in Brix shed in comparison with the control group, in which the majority of detached house residents are within control group (57%), this result could be explained by the nature of housing and the overcrowding within the camps and some residential complexes, studies indicate with greater contact between infected and uninfected individuals, the opportunity for infections to spread increases (Reyes et al. 2013).

Adequate house ventilation and sunlight: the result of this study indicates that the houses of cases group had poor ventilation (64.9% vs 35.1%), and poor sunlight (66.6% vs 33.3%), while the control had better ventilation and sunlight among their houses, this result is similar to CDC recommendation that ventilation can help reduce virus particles in homes and keep away from spreading (CDC2021). A study published in 2018 founds that rooms exposed to daylight have fewer germs, and compared to dark rooms, sunlit rooms have about half the amount of bacteria that can grow (Kline et al. 2018).

Environmental pollutants: results of our study indicate that pollution near cases houses was higher than controls (55% vs 45%), open house swage was higher among cases than controls (54.1% vs 45.9%), which is compatible with study linked children living in communities with the lowest levels of modern water service had LRI incidence rates 3- to 4-fold higher than those found in communities with the highest levels of modern water services (Gessner 2008). Swallowing water contaminated with sewage that contains bacteria or viruses can cause serious infections (Baglow 2022). In a 5-year study (1998–2002) in Finland, small waterborne outbreaks were recorded with Norovirus infection and linked with poor sewage disposal in private homes or rental cottages (Maunula, Miettinen, and Von Bonsdorff 2005). The waste incinerator was lower among cases than controls (40% vs 60%). Also, The cases who live beside agricultural land are higher among cases than controls (55.8% vs 44.2%), that are congruent with an article mentioning foodborne illness caused by contaminated, or naturally harmful, food or beverages which result

from animal breeding or using chemical or mycotoxin in agriculture as a critical health issue (Grace 2020).

Water sanitization: the study reveals that having a water well near a house among the cases group was higher than controls (63.9% vs 36.1%) and considered a significant factor, among cases who had a water well and drinking from it, cases were higher than controls (72.2% vs 27.8%) with marked correlation, chlorine used to sanitize the well is higher among cases (60.6% vs 39.4%) but not considerable, in 1974 about 1200 person infected with shigella infection investigation indicate a well water supply contamination with untreated sewage system (Weissman et al. 1976). Breeding animal found higher among cases than controls (55.6% vs 44.4%) but also not considerable correlation.

Traveling: The result has shown that the cases group's ability to access hospitals at all times was higher than controls (53.3% vs 46.7%) and primary healthcare centers PHC (50.8% vs 49.2%), with no significant difference. Traveling outside Palestine was higher among cases than controls (53.3% vs 46.7%) with no clear difference, among cases who travel to Arabic countries was higher than controls (66.7% vs 33.3%), and to other countries was the same (50% vs 50%) respectively, among cases who travel within 6 months was higher than controls (66.7 vs 33.3) and lower for who travel more than 6 months ago (33.3% vs 66.7%). According to the literature, travel is a potent force in the emergence of disease. The migration of humans has been the pathway for disseminating infectious diseases throughout recorded history and will continue to shape the emergence, frequency, and spread of infections in geographic areas and populations (Wilson 2005). Traveling in our study is not considered a significant factor due to the limited number of a subject who travel which may be explained by the economic factor of increased traveling costs due to the global rise in prices, and the restriction on traveling last year due to COVID-19 complicated travel procedures.

5.1.5 Hygiene practice variables and infectious disease among pediatric admissions

Handwashing practice: our study shows that handwashing practice among cases with low frequency of practice (1-6 times/ day) was higher than controls (63.6% vs 36.4%), and in better frequency (7-15 times/ day) (38.2% vs 61.8%), which reflects significant correlation, the result may have influenced by the age of the subjects because about (67%) below the age of 2 years

which –age group- excluded from the question. The practice of hand washing was found lower among cases than controls (42.9% vs 57.1%), the cases who did the practice sometimes was higher (72.1% vs 27.9%), and those who didn't wash their hand was higher among cases (57.1% vs 42.9%) which reflects significant correlation (P value 0.003), also the question of practicing handwashing after using bathroom indicates that cases wash their hands lower than controls (43.5% vs 56.5%) but the difference not considerable. According to the CDC handwashing can reduce diarrheal illness in people with weakened immune systems by 58%, and absenteeism due to gastrointestinal illness in schoolchildren by 29–57% (CDC 2015) which complies with our results.

House hygiene practice: our study results show that Regular cleaning of the bathroom among cases was lower than controls (48% vs 52%), also cleaning of child toys was lower among cases than controls (40% vs 60%), and using chlorine to clean dining, and food preparing surfaces was lower among cases than controls (48.5% vs 51.5%) all these variables' differences found not statistically significant. The results are complying with studies that assure that floors, sinks, showers, faucets, toys, and fabrics which frequently handled found with a high microbial population and are associated with disease transmission(Larson and Duarte 2001).

Child body hygiene: among cases, children who practice body bath frequency of (1-3 times/week) was higher than controls (66.3% vs 33.7%), and who practice at a frequency of (more than 3 times/week) were found to higher among controls (34 vs 66) which reflect considerable significance correlation, the results are complying with CDC studies that 50% of healthy people have Staphylococcus aureus living in or on their nasal passages, throats, hair, or skin recommendation that showering prevents the spread of germs by reducing the microbial load (CDC 2015). the role of personal cleanliness in the control of infectious diseases over the past century is difficult to measure since other factors have changed at the same time (Larson 2001), the frequency of bathing practices could be affected by factors of the age of the child, activities or exercises, and weather.

5.1.6 Nutritional variables and infectious disease among pediatric admissions

Nutritional health: our study shows that disorders that may affect the child's eating are lower among cases than controls (47.6% vs 52.4%) but the difference is statistically significant. Meals per day were divided into 3 categories; 2-3 meals were higher among cases than controls (52.5% vs 47.5%), 4-6 meals/ day were lower among cases than controls (40.5% vs 59.5%), 7-10 meals/

day were higher among cases than controls (52.5% vs 47.5%), but differences were not statistically significant due to the variances in age group and its inverse relationship with the frequency of meals.

Using nutritional supplements among cases was lower than controls (49.3% vs 50.7. and the use of special formula was higher among cases than controls (56.3% vs 43.8%) for both, the difference did not reach statistical significance level.

An Emergency Nutrition Assessment (ENA) anthropometry software was used to compare means of weight and height for both cases and controls, the data was filled into the program, which measure the means of our data's height and weight according to world health organization (WHO) standards 2006, these standards are based on a high-quality study designed explicitly for creating children growth charts. Z-score of both height and weight of our study subjects was categorized into two groups and crosstab developed, no statistical significance was found between both height and weight and infectious disease among pediatric admissions, despite several studies suggest association between underweight and obesity among children and susceptibility to acquire infections (Dobner and Kaser 2018).

5.1.7 Radiological and laboratory variables and infectious disease among pediatric admissions

Radiologic workup:

In our study, abnormal **CT** results among cases were higher than controls (53.8% vs 46.2%), which complies with Ady's study that found computed tomography has proved to be accurate for the identification and treatment of intra-abdominal fluid collections and abscesses (Ady and Fong 2014). Also chest CT is proven to show higher sensitivity and specificity compared to the RT-PCR testing method, several works in the literature use it (Hassantabar et al. 2020).

The **Ultrasound** abnormal results among cases were higher than controls (52.8% vs 47.2%), in pieces of literature ultrasound is preferred for the identification of biliary or hepatic sepsis(Ady and Fong 2014), also Ultrasound is a valuable tool in the evaluation of skin and soft tissue infections, enhancing our ability to diagnose an abscess cavity or deeper infection and is more reliable than clinical exam alone (O'Rourke et al. 2015).

The **Echocardiogram** abnormal results were higher among cases than controls (75% vs 25%) but all differences between variables didn't reach statistical significance, as in pieces of literature echocardiography has assumed a crucial role in the diagnosis of infective endocarditis, particularly when blood cultures are negative (Evangelista and González-Alujas 2004).

The **X-ray imaging** abnormal results were higher among cases than controls (71.7% vs 28.3%) and the difference reached statistical significance, pooled results showed that chest X-ray (17 studies) correctly diagnosed COVID-19 in 73 % of people who had COVID-19 (Salameh et al 2022).

The results of the radiologic workup were affected by the criteria for taking the exams; CT, ultrasound, and echocardiogram were not routinely ordered for all children admitted to hospitals, but certain criteria were carried out for each test.

Laboratory workup:

our study results show abnormal results of **WBCs** and **Neutrophil** among cases was higher than controls (61.5% vs 38.5%), (53.4% vs 46.6%) respectively, and the difference was statistically significant, WBC count was known to increase or decrease out of the normal range due to infection exposure (MedlinePlus 2022). Our neutrophil results are coherent with data that consider neutrophils as important effector cells in our immune system. They constantly patrol the organism for signs of microbial infections, and when found, these cells quickly respond to trap and kill the invading pathogens (Li Volti et al. 2018).

The **lymphocyte** and **platelets** abnormal results among cases were higher than controls (51.9% vs 48.1%), (55.4% vs 44.6%) respectively with no significant difference, the results are matching with the literature that matches the increase of lymphocyte level "lymphocytosis" or the decrease in the lymphocytes level "lymphocytopenia" with infection (Cleveland clinic 2022), also thrombocytopenia, or low platelet counts, is common in acute infections and can correlate with disease severity (Portier and Campbell 2021), as well infections are the most common cause of a high platelet count in both children and adults(Rose et al. 2012). The results we analyzed are coherent with the literature even if differences do not reach statistical significance.

Creatinine abnormal level among cases was higher than controls (53% vs 47%), results are complying with reviewed literature that assures the higher or lower level of serum creatinine could

be caused by involvement of the kidneys in a wide range of bacterial, and viral, fungal, and parasitic diseases or systemic infection such as sepsis (Herberg et al. 2009).

Sodium among cases was higher than controls (55.8% vs 44.2%), which complies with studies that indicate increased serum sodium level hypernatremia among admitted patients are significantly more likely to have sepsis (Freitas et al. 2019), as well hyponatremia may be associated with infectious diseases (Krajewska et al. 2020).

Potassium was lower among cases than controls (46.4% vs 53.6%), which may be coherent with our results, whereas no study found a match between the serum potassium abnormal level and the infection process.

Chloride among cases was lower than controls (41% vs 59%) and the difference reach statistical significance, results are congruent with studies that match between abnormal levels of chloride and noninfectious disorder such as dehydration, congestive heart failure, prolonged diarrhea or vomiting chronic lung disease, such as emphysema, and metabolic alkalosis (Seladi-Schulman 2018).

Inflammatory markers:

Ferritin among cases was higher than in controls (100% vs 0%), according to Kernan, during infection increased ferritin levels represent an important host defense mechanism that deprives bacterial growth of iron and protects immune cell function (Kernan and Carcillo 2017).

Fibrinogen among cases was higher than controls (100% vs 0%), which complies with Crawford who describes Fibrinogen as a major risk factor for cardiovascular disease and is also an acute-phase protein that may increase in response to infections and other stressful events (Crawford et al. 2000).

LDH among cases was higher than controls (58.8% vs 41.2%), results match with Butt's study which concludes that serum LDH levels could be used as an adjunctive marker in certain opportunistic infections (Butt et al. 2002), LDH is a reliable biomarker of acute inflammatory injury associated with upper respiratory infections (Gharote 2020).

Uric acid among cases was higher than controls (66.7% vs 33.3%), with no statistical significance found, in literature, no clear matches are proved between uric acid and infections, according to

studies it's known that uric acid is an indicator of prognosis of many diseases including cardiovascular disorders, renal insufficiency, metabolic syndrome and diabetes mellitus (Zhu and Cao 2012).

CRP among cases was higher than controls (81.8% vs 18.2%) and the difference reached statistical significance, results are coherent with literature that describe C-reactive protein as a marker for inflammation, and its levels increase during bacterial infection (Sproston and Ashworth 2018), Kingsley and Jones stated that CRP increases during infection in response to monocytic mediators such as IL-1 and IL-6 and that it has a stable decay rate (Kingsley 2008).

Results of inflammatory markers may have been influenced by criteria carried out in PMC in which the doctors request inflammatory markers according to the signs and symptoms the child came with, so inflammatory markers are requested generally with prolonged fever, suspected autoimmune cases, etc.

Positive Blood culture results among cases were higher than controls (100% vs 0.0%), the difference was significant, and the results are similar to San Juan's conclusion; blood culture is an accurate test for the diagnosis of infections, with a high level of certainty (San Juan et al. 2005).

Positive urine culture results among cases were higher than controls (100% vs 0.0%), and the difference was significant, The incidence of UTI without fever in preverbal children is not known but positive urine cultures in afebrile young children are much more commonly due to contamination than to UTI (Robinson et al. 2014).

Positive CSF culture results among cases were higher than controls (100% vs 0.0%), but the difference did not reach statistical significance. CSF culture is the gold standard in diagnosis and is positive in 80% to 90% of patients with community-acquired bacterial meningitis if CSF is obtained before the start of antimicrobial therapy (Mandell 2020).

ABO groups:

A blood group results among cases were higher than controls (51% vs 49%), result coherent to the study on COVID-19 found A blood group is more susceptible to COVID-19 infections (Rana et al. 2021), also Elnady found Blood group A is highly associated with pediatric rotavirus infections (Elnady et al. 2017), but in another study, A blood group found not affecting susceptibility to norovirus infection (Liao et al. 2020).

B blood group results among cases were lower than controls (34.8% vs 65.2%), in literature blood group B was found to be more susceptible to COVID-19 infection (Rana et al. 2021), also Blood group B was associated with a higher risk of severe RDS (Shokri et al. 2022), and found to be more often in chronic upper tract infections (Ratner et al. 1986)

O blood group among cases was higher than controls (55.2% vs 44.8%), results comply with Liao's study that found a significant association between the O blood group and norovirus gastroenteritis (Liao et al. 2020), but it contradicts the literature that considers O blood group protected from viral infection (Ray et al. 2021), and a protective factor from COVID-19 (Pourali et al. 2020), also Rana found in his study that O blood group is at a lower risk of COVID-19 infection (Rana et al. 2021).

AB blood group was lower among cases than controls (16.7% vs 83.3%), results comply with Rana's study that found AB had a lower risk of COVID-19 infection (Rana et al. 2021).

Results of ABO groups found it as a weak predictor of infectious diseases, literature contradicts ABO association with ID in general, and correlation with specific infection may be helpful, clear, and informative.

Limitations and obstacles

The findings of this study have to be seen in the light of some limitations, collecting data from the hospital was an obstacle, the computerized system used in the hospital had an option to use the ICD-10 but unfortunately the coding system is not used properly, which impedes easily access to patient's information.

The lab tests of the patient's PCR, and viral panel were sent to the central governmental lab and the results take days to reach the hospital laboratory which was not connected to the hospital HIS, the lab test was requested from physicians to patients according to each case criteria, therefore the comparison process between cases and controls among some lab test was insufficient.

In addition to some biases that might affect the result like information bias especially in the variables families deal with it conservatively like monthly income, hygiene practice, and recall bias, especially in the variables that require memorizing such as food frequency, and handwashing frequency.

Lack of previous research studies on the topic such as previous exposure to infectious disease and its association with re-hospitalization, a focus on this topic may need further study.

Summary and Conclusion

The study is the first one in Palestine that investigated the determinants associated with infectious diseases among pediatric admissions in Palestine medical complex. A case-control study design was used to answer the study questions. The study was identified the possible risk factors associated with infectious diseases in patients who admitted to pediatric or PICU units in Palestine medical complex.

Most results in our study were expected and comparable to other international studies' results, while some others were unexpectedly contraindicated in the literature, residence, area of residence, parent's level of education, family Monthly Income, previous hospitalization, type of housing, ventilation, and sunlight of houses, having a water-well and drinking from it, handwashing practice, body hygiene, clinical presentation, radiological and laboratory tests appeared to be associated with infectious disease admissions among pediatrics either positively or negatively. Other factors showed no significance in our studies such as the number of child siblings, parents' employment, environmental pollution, animal breeding, some hygiene practices, and illness that affect eating.

Conclusion

The study consists of 204 participants divided to cases and controls, equal number of male and female, matching done according to gender and age, the infancy age group found to be significant risk factor to have ID, living in cities found to be preventive factor from

Children living in cities found to be lower risk of having infections (61.4%), while living in camps associated with higher risk of infections (81.8%), university educated parents had healthier children, parent's job had no significant factor on their children's risk of infection.

Regarding to our study more than 3 days of hospitalization (length of stay) are predicted to be higher among children who had ID comparing them to those with other illness causes, also children who experience more hospitalization and frequent exposure to ID had two folds' chance of having infections. Living in apartments with lower level of ventilation and sunlight exposure consider a

significant predictor of ID among children, water wells and drinking from it found significant risk for ID among children.

Hygiene practice including handwashing in frequency of (7-15) times/day and after using the bathroom were significant preventive factors form ID, no significant correlation found between children's weight-height and ID.

Hospitalized children with ID are found with significant symptoms like skin rash, fever, Chills & sweating, dehydration, Nausea & vomiting, respiratory distress, cough, and jaundice. The result found chest X-ray as a significant diagnostic technique, WBC's, neutrophil percentage, chloride level, CRP, blood and urine cultures were significant in diagnosing infections.

Recommendations

Recommendations for policymakers and healthcare teams

- Increasing the awareness of the medical staff about the importance of considering the social factor in predicting infectious disease
- Providing more attention to patient hygiene practice and its association with infections
- Awareness campaigns should be carried out to remind society about the importance of hygiene practices in preventing infectious diseases.
- Develop employee skills in dealing with the computerized health system.
- Conduct training courses for the correct and proper documentation of international classification of diseases 10.
- Maintenance of the healthcare computerized system HIS that is used in the governmental hospital to facilitate providing organized and categorized data.

Recommendation for public health researchers

- Conducting more advanced and detailed research in different hospitals and geographic areas in Palestine to compare results and provide recommendations.
- Researching specific infectious diseases and the possible determinants that correlated with them.
- Study the association between the ABO group and specific infectious diseases.

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7 ANNEXES

7.1 Annex (1) sample size calculation

Expected proportion in controls	0.05
Assumed odds ratio	4
Confidence level	0.95
Power	0.8
Study type	Case-control study
Sample size per group	98
Total sample size (both groups):	196

Table 1 Sample size for specified values

	P = 0.005	P = 0.01	P = 0.02	P = 0.03	P = 0.04	P = 0.05	P = 0.1
OR = 2	4749	2395	1218	826	630	513	280
OR = 3	1586	801	409	279	213	174	97
OR = 4	882	446	228	156	120	98	56
OR = 5	596	302	155	106	82	67	38
OR = 10	217	110	57	39	30	25	15

Table 2 Sample size (per group) for range of proportions exposed and odds ratios

7.2 Annex (2) Time frame

Activities	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	SEP	OCT	NOV
Writing proposal	■	■											
Defense and approval			■										
Expert validation of the instrument				■									
Pilot study					■	■							
Data collection					■	■	■	■					
Data entry					■	■	■	■					
Data analysis									■	■	■		
Writing thesis												■	■

7.3 Annex (3) proposed questionnaire

English copy

Determinants of Infectious Diseases among Pediatric Admissions in Palestine Medical Complex: A Case-Control Study



Dear participant:

We would like to invite you to participate in the research study that aims to study the factors affecting the infectious diseases of children admitted to the Palestine Medical Complex, which is one of the requirements for obtaining a master's degree in infectious diseases at Al-Quds University.

The search requires to ask you about some medical information related to your child during his illness, which may correlate with his admission to the Pediatric Department at Palestine Medical Complex. Medical information will also be obtained from your child's medical file in the hospital.

This information will be used for a better understanding of the factors associated with the infection, which may help improve the performance of medical, diagnostic and therapeutic work in the future. Therefore, we ask you to agree to participate in the research by completing the interview, accurately answering the questions posed by the researcher or one of his assistants, and allowing access to your child's medical information and using the data recorded in it.

We guarantee you complete confidentiality in dealing and keeping the information that you will provide for research, and you are completely free not to mention your name or answer any question asked to you, or withdraw whenever you want from the study and end the interview whenever you want without any obligation.

Accordingly, I agree to participate in this study

Participant name: _____ Date: _____

Thank you very much for your kind participation

Researcher: Lo'ay Fares

For any questions, please contact the phone number: 056966697

	<input type="checkbox"/> retired	
7. Family Monthly salary:	<input type="checkbox"/> Less than 2000 NIS <input type="checkbox"/> 2000-3000 NIS <input type="checkbox"/> 3000-4000 NIS <input type="checkbox"/> 4000-5000 NIS <input type="checkbox"/> 5000-6000 NIS <input type="checkbox"/> More than 6000 NIS	
8. Is access to the hospital available to you at all times? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Maybe		
9. Is access to the PHC available to you at all times? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> sometimes		
10. Do you travel outside Palestine in the last 12 months? <input type="checkbox"/> Yes <input type="checkbox"/> No		
11. If yes, where		
12. If yes, When		
Health status and morbidity:		
1. Does your child have any previous diseases? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know		
2. If he carries previous diseases, specify the type of diseases:	<input type="checkbox"/> respiratory diseases <input type="checkbox"/> heart diseases <input type="checkbox"/> convulsion disorders <input type="checkbox"/> congenital malformations <input type="checkbox"/> diabetes mellitus type 1	<input type="checkbox"/> metabolic disorders <input type="checkbox"/> immune diseases <input type="checkbox"/> neurological diseases <input type="checkbox"/> hematological diseases <input type="checkbox"/> does not carry any disease
3. Do these diseases usually lead to hospitalization of your child? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know <input type="checkbox"/> He has no diseases		
8. Do these diseases affect your child's ability to take treatment regularly? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know		
9. If yes explain how		
5. Does your child take medication regularly? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know		
6. If yes, what medications does he take?		
7. Does your child get infectious diseases frequently? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know		
8. If the answer is yes, what are the diseases?		

9. Did your child admitted to hospital previously? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Environmental factor:		
1. What kind of housing you live in:	<input type="checkbox"/> detached house <input type="checkbox"/> apartment <input type="checkbox"/> tent	<input type="checkbox"/> Brix shed <input type="checkbox"/> other
2. Is your home exposed to adequate ventilation? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
3. Is your home exposed to adequate sunlight? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
4. Are there any environmental pollutants near the house? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> I don't know		
5. If your answer is yes, what is the source of the pollutants near the house?	<input type="checkbox"/> landfill <input type="checkbox"/> open house sewage <input type="checkbox"/> waste incinerator	<input type="checkbox"/> chemical plant <input type="checkbox"/> other
6. Is there agricultural land near your house? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
10. Is there water well near your house? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
11. Source of drinking water?		
8. Do you drink from a well of water? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
9. Do you use chlorine to sanitize the well? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
10. Are there animals in or around your house? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
11. If your answer is yes, what are the animals?	<input type="checkbox"/> cat <input type="checkbox"/> dog <input type="checkbox"/> chicken	<input type="checkbox"/> birds <input type="checkbox"/> sheep cattle <input type="checkbox"/> other
12. Do you dispose animal feces well? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe		
Adhering to hygiene practices		
1. How often does your child wash his hand times/day? ⁶		
2. Do you practice washing hands before eating? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes		
3. Does your child practice handwashing after using the bathroom? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> I'm not sure		
4. Do you clean the bathroom regularly? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes		
5. Do you clean the toys of your child regularly? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes		

6. Do you use chlorine to clean dining table surfaces, food preparation? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes			
7. How many times a week does your child bath.			
Child's nutritional status:			
1. Child weight in kilograms?			
2. Child height in cm?			
3. Does your child have any nutritional disorders that affect your child's eating? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> I don't know			
4. If the answer is yes, kindly specify?			
5. How many meals does your child eat per day?			
6. Do you use any nutritional supplements for your child? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes			
7. Do you use certain special food formulas for your child? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> sometimes			
The clinical presentation on admission			
<input type="checkbox"/> Skin rash	<input type="checkbox"/> Chills or sweating	<input type="checkbox"/> Abdomen Distention	
<input type="checkbox"/> Fever	<input type="checkbox"/> Jaundice	<input type="checkbox"/> Constipation	
<input type="checkbox"/> Dehydration	<input type="checkbox"/> Cyanosis	<input type="checkbox"/> Diarrhea	
<input type="checkbox"/> Respiratory distress	<input type="checkbox"/> Edema	<input type="checkbox"/> Nausea & vomiting	
<input type="checkbox"/> Cough	<input type="checkbox"/> Itching	<input type="checkbox"/> Confusion	
Radiological investigation			
CXR	Ultrasound	Echo	CT- scan
The Laboratory tests that were done			
Test	Result	Comment	
ABO blood group			
WBC			
Neutrophil %			
Lymphocyte %			
HGB			
PLT			
CREAT			

NA+		
K+		
CL+		
Albumin		
Blood culture		
Urine culture		
CSF culture		
ESR		
CRP		
Ferritin		
Fibrinogen		
LDH		
Uric acid		
Vitamin-D level		
Serology test (Widal test, brucella..etc.)		
Viral panel		

Arabic copy

نموذج الموافقة للاشتراك ببحث

"المحددات المرتبطة بالأمراض المعدية للأطفال المدخلين الى مجمع فلسطين الطبي"

عزيزي المشارك/ة:

نود دعوتك للمشاركة في الدراسة البحثية التي تهدف لدراسة العوامل المؤثرة في الامراض المعدية للأطفال المدخلين لمجمع فلسطين الطبي خلال عام 2021 وهو من متطلبات الحصول على درجة الماجستير في الامراض المعدية في جامعة القدس.

يتطلب البحث سؤالك عن بعض المعلومات الطبية المتعلقة بطفلك/ طفلتك اثناء اصابته التي استدعت إدخاله لقسم الأطفال في مجمع فلسطين الطبي، كما سيتم الحصول على معلومات طبية من ملفك طفلك الطبي الموجود في المستشفى.

سيتم استخدام هذه المعلومات في فهم أفضل للعوامل المرتبطة بالإصابة بالعدوى، مما قد يساعد في تحسين أداء العمل الطبي والتشخيصي والعلاجي في المستقبل. لذلك نرجو من حضرتك الموافقة على المشاركة بالبحث من خلال إتمام المقابلة والإجابة الدقيقة على الأسئلة المطروحة من قبل الباحث او أحد مساعديه والسماح بالاطلاع على معلومات طفلك الطبية واستخدام البيانات المسجلة بداخله.

نضمن لحضرتكم السرية التامة في التعامل مع المعلومات التي ستقدمها للبحث ولك الحرية التامة في عدم ذكر اسمك او الإجابة عن أي سؤال يطرح عليك او الانسحاب متى شئت من الدراسة وانهاء المقابلة متى شئت دون أي التزام.

وبناء عليه أوافق على المشاركة في هذه الدراسة

الاسم الرباعي:

تاريخ الموافقة:

شكرا جزيلا على مشاركتك الكريمة

الباحث: لؤي فارس

لأي استفسار يرجى التواصل مع رقم الهاتف: 0569666976

1. الرقم التسلسلي:
2. الوصف: <input type="checkbox"/> control <input type="checkbox"/> case
3. التاريخ:
4. تاريخ الادخال:
5. التاريخ الخروج/ المتوقع للخروج:
6. التشخيص:
7. رمز التشخيص اعتمادا على نظام التصنيف العالمي العاشر للأمراض (ICD-10):
المعلومات الديموغرافية:
1. عمر الطفل بالأشهر:
2. الجنس: <input type="checkbox"/> ذكر <input type="checkbox"/> انثى
3. عدد الاخوة؟
4. مكان الإقامة: <input type="checkbox"/> مدينة <input type="checkbox"/> قرية <input type="checkbox"/> مخيم <input type="checkbox"/> غير ذلك
5. المستوى العلمي للاب: <input type="checkbox"/> غير متعلم <input type="checkbox"/> اساسي <input type="checkbox"/> ثانوي <input type="checkbox"/> جامعي <input type="checkbox"/> دراسات عليا
6. المستوى العلمي للام: <input type="checkbox"/> غير متعلم <input type="checkbox"/> اساسي <input type="checkbox"/> ثانوي <input type="checkbox"/> جامعي <input type="checkbox"/> دراسات عليا
7. عمل الاب: <input type="checkbox"/> لا يعمل <input type="checkbox"/> وظيفة حكومية <input type="checkbox"/> وظيفة خاصة <input type="checkbox"/> اعمال حرة <input type="checkbox"/> متقاعد
8. عمل الام: <input type="checkbox"/> ربة منزل <input type="checkbox"/> وظيفة حكومية <input type="checkbox"/> وظيفة خاصة <input type="checkbox"/> اعمال حرة <input type="checkbox"/> متقاعد
9. دخل العائلة: <input type="checkbox"/> اقل من 2000 شيكل <input type="checkbox"/> 2000-3000 شيكل <input type="checkbox"/> 3000-4000 شيكل <input type="checkbox"/> 4000-5000 شيكل <input type="checkbox"/> 5000-6000 شيكل <input type="checkbox"/> اكثر من 6000 شيكل
10. هل إمكانية الوصول الى المستشفى لكم متاحة في كل الاوقات؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما
11. هل إمكانية الوصول لمراكز الرعاية الصحية لكم متاحة؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما
12. هل سافرت خارج البلاد خلال السنة الماضية؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا
13. إذا كانت الإجابة نعم، الى اين سافرت؟
14. إذا كانت الإجابة نعم، متى سافرت؟

الحالة الصحية والامراض المصاحبة:

1. هل يحمل ابنك اي امراض سابقة: نعم لا لا اعلم
2. في حال كان يحمل امراض سابقة حدد اطار الامراض: امراض تنفسية امراض قلبية امراض تشنجية تشوهات خلقية سكري من النوع الأول امراض ابيضية امراض مناعية امراض عصبية امراض الدم لا يحمل أي مرض
3. هل تؤدي هذه الامراض عادة الى دخول طفلك المستشفى؟: نعم لا لا اعلم غير مصاب بأمراض
4. هل تؤثر هذه الامراض على قدرة طفلك على تناول العلاج؟ نعم لا لا اعلم
5. هل يتناول إذا كانت الإجابة نعم يرجى توضيح السبب ...
6. طفلك ادوية علاجية بشكل مستمر؟ نعم لا لا اعلم
7. إذا كانت الإجابة نعم ما هي الادوية التي يتناولها؟
8. هل يصاب طفلك بأمراض معدية بشكل متكرر؟ نعم لا لا اعلم
9. إذا كانت الإجابة نعم ما هي هذه الامراض التي يصاب بها؟
10. هل دخل طفلك المستشفى من قبل؟ نعم لا لا اعلم
11. إذا كانت الإجابة نعم لماذا؟
12. إذا كانت الإجابة نعم متى؟
13. إذا كانت الإجابة نعم اين؟

العامل البيئي:

1. ما هي طبيعة السكن: منزل مستقل شقة خيمة سقيفة بركس غير ذلك
2. هل منزلك يتعرض لتهوية بشكل كافي؟ نعم لا ربما
3. هل منزلك يتعرض لأشعة الشمس بشكل كافي؟ نعم لا ربما
4. هل يوجد اي ملوثات للبيئة بجانب المنزل؟ نعم لا لا اعلم
5. إذا كانت اجابتك نعم ما شكل الملوثات الموجودة بجانب المنزل؟ مكب نفايات مجاري بيئية مكشوفة محرقة نفايات مصنع مواد كيميائية غير ذلك
6. هل يوجد بجانب منزلك ارض مزروعة؟ نعم لا ربما
7. هل يوجد بجانب منزلك بئر ماء؟ نعم لا ربما

8. هل تشربون باستمرار من بئر الماء؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا		
9. هل تستخدمون المواد المعقمة مثل الكلور لتعقيم البئر؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا		
10. هل يوجد في منزلك او في محيطها حيوانات؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
11. إذا كانت اجابتك نعم ما هي الحيوانات؟ <input type="checkbox"/> قط <input type="checkbox"/> كلب <input type="checkbox"/> دجاج <input type="checkbox"/> عصافير <input type="checkbox"/> ماشية <input type="checkbox"/> غير ذلك		
12. هل تتخلص من براز الحيوانات بشكل جيد؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
الالتزام بممارسات النظافة		
1. كم مرة يقوم طفلك بغسل يديه باليوم؟		
2. هل تمارسون غسل الايدي قبل تناول الطعام؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> احيانا		
3. هل يمارس طفلك غسل الايدي بعد استخدام الحمام؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> غير متأكد		
4. هل تقومين بتنظيف الحمام بالكلور بشكل منتظم؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
5. هل تقومين بتنظيف العاب طفلك بشكل منتظم؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
6. هل تقومين بتعقيم أسطح طاوولات الطعام، تحضير الطعام بالكلور؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
7. كم مرة اسبوعيا يستحم طفلك؟ <input type="checkbox"/> مرة <input type="checkbox"/> مرتين <input type="checkbox"/> 3 مرات <input type="checkbox"/> يوميا <input type="checkbox"/> غير ذلك		
الوضع الغذائي للطفل		
1. وزن الطفل بالكيلو غرام؟		
2. طول الطفل بال سم؟		
3. هل لدى الطفل اي معيقات غذائية تؤثر على تناول طفلك للوجبات؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
4. إذا كانت الإجابة نعم ما هي هذه المعيقات؟		
5. كم وجبة يتناول طفلك باليوم؟		
6. هل تستخدم مدعمات غذائية معينة او اغذية خاصة معينة لطفلك؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
7. هل تستخدم مدعمات غذائية معينة او اغذية خاصة معينة لطفلك؟ <input type="checkbox"/> نعم <input type="checkbox"/> لا <input type="checkbox"/> ربما		
الفحص السريري عند دخول المستشفى		
<input type="checkbox"/> تورم بالأطراف	<input type="checkbox"/> سعال	<input type="checkbox"/> طفح جلدي
<input type="checkbox"/> حكة جلدية	<input type="checkbox"/> قشعريرة وتعرق	<input type="checkbox"/> حرارة مرتفعة
<input type="checkbox"/> انتفاخ بالبطن	<input type="checkbox"/> يرقان	<input type="checkbox"/> جفاف

امساك <input type="checkbox"/>	ازرقاق بلون الجلد <input type="checkbox"/>	تنفس مجهد <input type="checkbox"/>
اسهال <input type="checkbox"/>	ارتباك <input type="checkbox"/>	غثيان و قيء <input type="checkbox"/>
الفحوصات الاشعاعية		
CXR:	Echo:	CT- scan:
النتائج المخبرية		
Test	Result	Comment
ABO blood group		
WBC		
Neutrophil		
Lymphocyte		
HGB		
PLT		
CREAT		
NA+		
K+		
CL+		
Albumin		
Bacterial Cultures (blood, urine, CSF)		
ESR		
CRP		
Ferritin		
Fibrinogen		
LDH		
Uric acid		
Vitamin D level		
Serology test (Widal test, brucella..Etc.)		
Viral panel		