

Trends in Hospitalization of Children with High-Frequency Diseases; A Nine-Year Retrospective Study

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Abstract

Background

The disease trends help in identifying the importance of the disease. The purpose of this study was to obtain trends of high morbid diseases in children admitted in the pediatric ward of a tertiary care hospital in Peshawar, Pakistan.

Materials and Methods: This is an observational cross-sectional study, conducted in the Pediatric Ward of Rehman Medical Institute (RMI), Peshawar, Pakistan, in 2017. Secondary (historical) data was collected from the Pediatric Ward of Rehman Medical Institute. Data were analyzed using SPSS V.23 and tabulated in excel sheets with percentages and rates to determine the trends. The data was then presented graphically.

Results: A total of 26,810 records were collected from the RMI database to determine the trends of high-frequency diseases in a pediatric ward. Therefore, Acute Gastro-Enteritis (AGE) [12.8%] had the highest number of cases, followed closely by Lower Respiratory Tract Infections (LRTI) [10.7%] and Neonatal Jaundice (NNJ) [10.0%]. Asthma [3.2%] and Hepatitis A [2.5%] were the least prevalent cases. 14% of the cases were excluded. Pneumonia, NNS, AGE, and sepsis showed an increasing trend while URTI and asthma showed a decreasing trend for nine years.

Conclusion

Trends of Pneumonia, Neonatal Sepsis, and Sepsis, in general, show a dramatic rise, AGE, LRTIs, and Enteric Fever show a very gradual increase, a general downward trend is observed in Asthma and Upper Respiratory Tract Infections (URTIs); while NNJ, Hepatitis A, and Urinary Tract Infections (UTIs) show a static trend.

Key Words: Pediatric trends, Neonatal Sepsis, Neonatal Jaundice, Respiratory tract Infections, Urinary tract Infections.

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1- INTRODUCTION

The disease trends help in identifying the importance of the disease. It captures the possible variation in the disease and guides the researchers to decide whether the allocation of funds to research or control disease is necessary. Rotavirus vaccination was introduced in 2006. Before that, Acute Gastroenteritis (AGE) prevalence remained 22.8 million (8.31%) in the USA during 1996-2006. The trend showed a significant decline since (1). The commonest setting reported for outbreaks of AGE, until 2000, were restaurants and events with catered meals. The trend, however, has shifted to hospitals, retirement centers, nursing homes, and other vacation settings (2). Respiratory Syncytial Virus (RSV) is a very common virus that mainly infects children below two years old. However, recent studies have observed it among older adults (3).

The severity of RSV varies with severe cases requiring admission. Studies conducted in temperate countries have reported that 19-54% of Pneumonia and 43-74% of Bronchiolitis cases have been associated with RSV infections (4). In the US, there are 2.1 million out-patient visits and 57,527 in-patient admissions for children under five years old (5). Bronchiolitis is another common cause for hospitalization of children. It is estimated that many children would have experienced at least one episode of Bronchiolitis; accordingly, 2-3% have hospitalized (6, 7). A study conducted during 2000-2009 in the US showed that the incidence in hospital admissions for Bronchiolitis decreased by 3.0 per 1000 people per year among all US-children aged two or less (8). In a study conducted in the UK, it was estimated that the annual average episode-based admissions increased seven times during 1979-2011 (9). One of the leading communicable diseases, which caused numerous mortalities among children with lower than

five years old is Pneumonia (10, 11). According to UNICEF, 802,000 deaths occurred due to Pneumonia in 2000, while it increased by approximately two times in 2018 (12). In a study conducted in 2010 in the USA, a 22% decrease in the admission of Pneumonia in children with lower than one year old was observed, while the minimal change was observed in admissions of children aged between 1-5 years old. However, the rates for admission increased by 22% and 41%, respectively, in children with 6-12 years old and greater than 13 years during the study (13). In both developed and developing countries, community-acquired Pneumonia is the leading cause of hospitalization. Some studies have indicated that the hospitalization rate of children for Pneumonia decreases with age (14). Asthma is an atopic disease that results in hospitalizations missed school days, and emergency room visits. It is a common chronic disease of childhood. An estimated 315,000 children under 18 years old, or 7.4% of New-Yorkers, had asthma, according to the Centers for Disease Control and Prevention (CDC), in a study carried out in 2010 (15). Though asthma symptoms in children are more prevalent in numerous high-income countries, many middle- and low-income countries also have prevalence levels rising, leading to an increased global burden of asthma (16).

Humans are the principal host to Hepatitis A Virus (HAV) worldwide. Most adults develop symptoms following the infection, while most children under six years old remain asymptomatic or get a self-limiting disease, which is mild (17). The incidence of acute HAV infection in the US was initially 12 cases per 100,000 in 1995; however, it had a decline to approximately 0.4 cases per 100,000 by 2011 (18, 19). Another global health problem is Typhoid fever. Asia, with 93%, has the highest morbidity rate due to Typhoid fever. The regional incidence rate of 274 cases per

100,000 individuals is highest in the region. The closest region to Asia has a case incidence of five times lower than it. Pakistan is part of Southeast Asia, which has an incidence rate of 110 cases per 100,000 population. This corresponds to the third-highest incidence rate for any region (20). The most common and serious bacterial infections among the children are of the urinary tract. The incidence of urinary tract infections urinary tract infections (UTIs) in American children indicates that up to 180,000 of the annual birth cohort has been diagnosed with UTI by six years aged (3–7% of women and 1–2% of boys). During 2000–2006, UTIs were among the foremost common pediatric admission diagnoses—9th commonest in 2000, 10th commonest in 2003, and 11th commonest in 2006.

From 2000–2006, roughly 50,000 children once a year were admitted to the hospital with the diagnosis of a UTI. Moreover, children with UTIs represented nearly 1.8% of all hospital admissions. Children with one year old represented 40% of all UTI based case admissions. Girls were 2.5 times more likely to be admitted with a case of UTI compared to boys (21). According to a meta-analysis conducted in 2018, UTIs are more common in malnourished children compared to their healthy counterparts, from which it can be inferred that their prevalence would be higher in the middle- and low-income countries (22). Neonatal Sepsis (NNS) is one of the more challenging diseases among neonates and infants. The prevalence rate of NNS stands at 1–10 per 1000 live births worldwide. Bacterial sepsis is the most common cause. The existing data state that about 10% of all maternal, while 26% of all neonatal deaths occur due to sepsis (23). In the US, the Early-Onset Sepsis (EOS) overall cumulative incidence stands at 0.8–1.0 cases per 1,000 live births, and LOS (Late-Onset Sepsis) is 36% in premature

neonates. Between January 1, 2001, and December 31, 2006, 2727 neonates were admitted to the NICU. The incidence of sepsis was 4.00% among all NICU infants or 2.70 per 1000 patients per day (24). Neonatal jaundice is a usually benign condition that occurs within the first two weeks of life. It is estimated to affect approximately 60% of full-term neonates and 80% of preterm ones. Almost 10% of these affected neonates are likely to progress to clinically significant jaundice, needing vigilant monitoring and treatment (25). To the best of our knowledge, there is no published paper on the annual trends in different pediatric diseases in Khyber Pakhtunkhwa. The present study was conducted to retrospectively examine the annual trends of twelve (13) high-frequency diseases presenting to a tertiary care center of Peshawar to determine their trends. Such trends will help in taking prompt measures to tackle such diseases and control their uprising trend.

2- MATERIALS AND METHODS

2-1. Study design and population

The present study is an observational cross-sectional study, conducted in the Pediatric Ward of Rehman Medical Institute (RMI), Peshawar, Pakistan, in 2017. The sample population included all children admitted in the Pediatric Ward from January 2005 to December 2013.

2-2. Method

After approval, secondary (historical) data were retrieved from the Pediatric Ward of RMI archive using a proforma. The proforma included the patients' record number, age, and gender, date of admission, and diagnosis at the time of discharge.

2-3. Ethical consideration

All the data was saved according to their hospital patient record numbers. Names of patients were redacted for confidentiality.

The excel spreadsheet was kept under password protection and was only accessible to participants of the study. Institutional ethical review was obtained under Ref # RMI/RMI-REC/Article Approval/31.

2-4. Inclusion and exclusion criteria

All infants and children below 18 years old were included in the study. Any incomplete records were excluded.

2-5. Data Analyses

The raw data obtained using the proformas were first organized and sorted in Microsoft Excel 2013. Data were statistically analyzed using SPSS software version 23.0. Microsoft Excel was used to determine percentages and rates to determine the annual trend of high-

frequency diseases. Data was then presented in the form of tables, lines, and pie charts.

3- RESULTS

From January 2005 to December 2013, 26,810 children from 1 to 17 years old were admitted to the pediatric ward were identified in the RMI database. Out of these, 66.6% were boys and 33.3% girls. 59.1% aged 1 to 4 years, 29.1% aged 5 to 9 years, 10.3% aged 10 to 14 years and 1.45 % were above 14 years (**Table.1**). We took the twelve diseases according to its high frequency. The respiratory diseases were categorized into 04 groups, i.e., upper respiratory tract infection (URTI), Lower respiratory infection (LRTI), Pneumonia, and Bronchiolitis.

Table- 1: Baseline Characteristics of Patients.

Gender	(Number) (%)
Boys	17847 (66.6)
Girls	8913 (33.3)
Age Brackets	
1-4 years	15851 (59.1)
5-9 years	7804 (29.1)
10-14 years	2765 (10.3)
>14 years	390 (1.45)

Acute Gastroenteritis had 3456 (12.8%) cases, LRTI had 2887 (10.7%) cases, Neonatal Jaundice (NNJ) had 2701 (10.0%) cases, Pneumonia had 2482 (9.2%) cases, URTI had 2441 (9.1%) cases, Neonatal Sepsis (NNS) had 1773 (6.6%) cases, sepsis had 1744 (6.5%) cases, enteric fever had 1439 (5.3%) cases, Bronchiolitis had 1395 (5.2%) cases, UTI had 1221 (4.5%) cases, asthma had 867 (3.2%) cases and hepatitis A had 678 (2.5%) cases. Around 14% of the cases were excluded due to their peculiar nature (**Figure.1**). To determine the trends, we calculated the annual rate per thousand among the different diseases in children with a highly frequent disease. The trend

for Pneumonia increased during 2005-13; initially, the rate was approximately 40 per thousand but gradually increased over that period and reaches a maximum rate of 175 per thousand **Figure 2(a)**. For AGE, the trend was somewhat stable with a leap upward because the rates have consisted of little variation in them, the initial rate as high as 108 per thousand, and has a sharp decline to 68 per thousand in 2006 **Figure 2(b)**. For URTI, the trend was decreasing sharply over a while; initially, the rate per thousand was 173 in 2005, while in 2013, it decreased to 64 per thousand **Figure 2(c)**. For LRTI, the trend was stable with a little upward trend. Initially, the rate was 46 per thousand in 2005, had a sharp

increase during 2007-08, where the rate was 119 and 149 respectively, while the rate was 81 in 2013, which was the second-lowest rate after 2005 **Figure 2(d)**. For NNJ, the trend was stable, neither increasing nor decreasing; however, was the rate per thousand different over a while with little variation. The maximum rate was 120, noted in 2009, **Figure 2(e)**. For Bronchiolitis, the trend was stable, the same as NNJ. Initially, the rate was 58 per thousand and declined in 2009 and 2012, where the rate was 34 and 36 per thousand. The rate was high in 2011 and 2013, 67 and 60 per thousand, respectively **Figure 2(f)**. For NNS, the trend was in an upward direction and increased sharply over a while. The rate was very low as 3.6 per thousand, and the highest in 2011 noted as 104 per thousand **Figure 2(g)**. For sepsis, the trend was increasing sharply and in an upward trend as NNS. Initially, the rate

was 31 per thousand, but during 2012-13 it had the highest peak rate of 112 and 115 per thousand, respectively **Figure 2(h)**. For enteric fever, the trend was slightly in an upward direction. The highest rate was noted in 2009 as 86 per thousand **Figure 2(i)**. For asthma, the trend was downslope with a sharp decrease over the years. The lowest rate was 22 in 2012, while the highest rate was noted in 2008 as 54 per thousand **Figure 2(j)**. For UTI, the trend is stable due to little variation in disease rate over a while. The highest rate was 56 per thousand in 2007 **Figure 2(k)**. For hepatitis A the trend is stable with a little upward direction. There are many variations during 2009-13 like a pattern of M. The peak was two noted in 2010 and 2012 with 39 and 40 per thousand, respectively. The lowest rate was 14 as per thousand noted in 2013 **Figure 2(l)**. **Figure.2** shows the graphs.

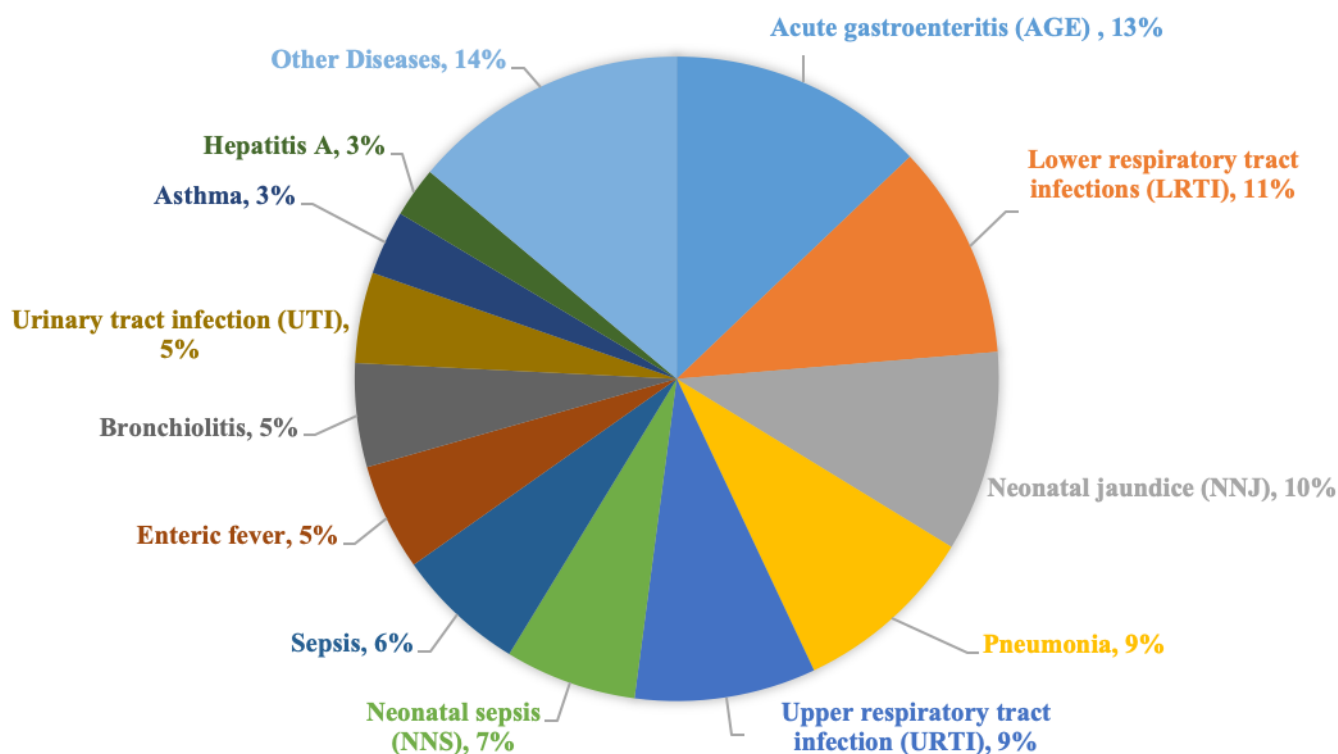


Figure.1: Frequency of Pediatric Diseases from 2005 – 2013.

Trend in Hospitalization of Children with High-Frequency Diseases

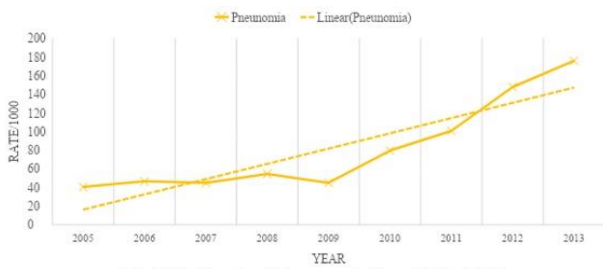


Fig 2(a): Trends of Pneumonia from 2005 - 2013

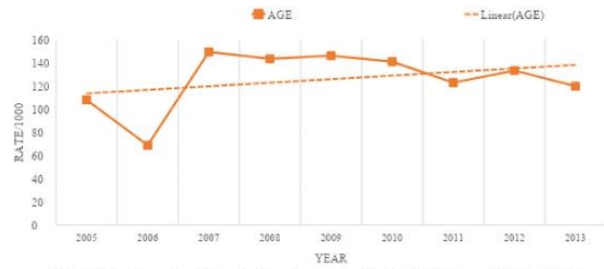


Fig 2(b): Trends of Acute Gastroenteritis (AGE) from 2005 - 2013

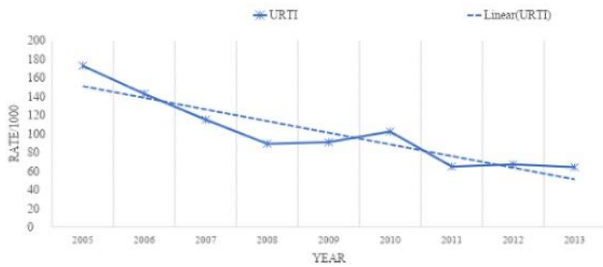


Fig 2(c): Trends of Upper Respiratory Tract Infections (URTI) from 2005 - 2013

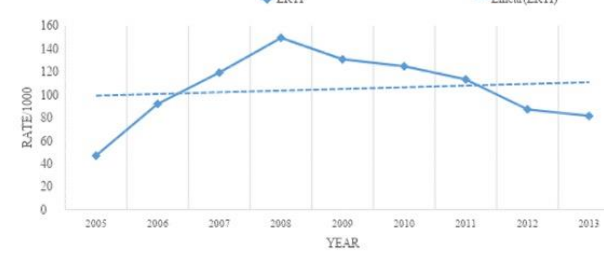


Fig 2(d): Trends of Lower Respiratory Tract Infections (LRTI) from 2005 - 2013

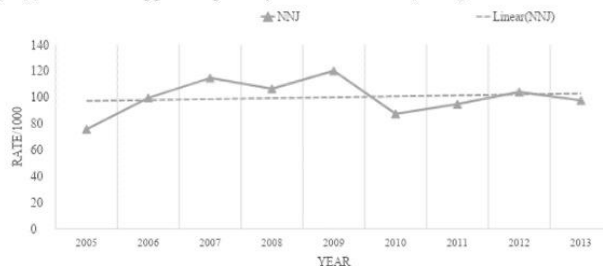


Fig 2(e): Trends of Neonatal Jaundice (NNJ) from 2005 - 2013

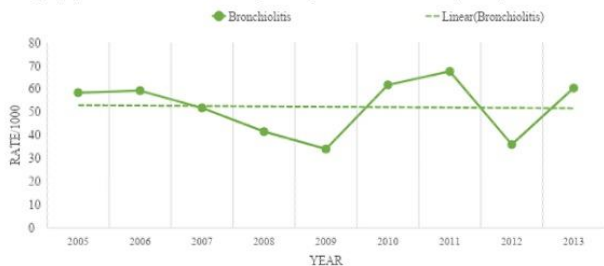


Fig 2(f): Trends of Bronchiolitis from 2005 - 2013

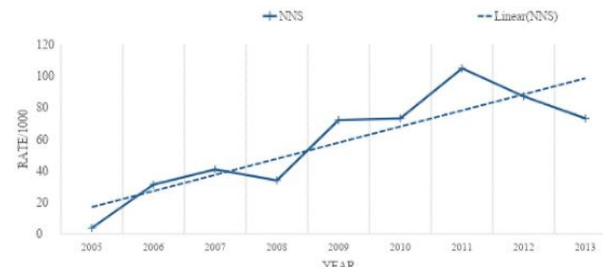


Fig 2(g): Trends of Neonatal Sepsis (NNS) from 2005 - 2013

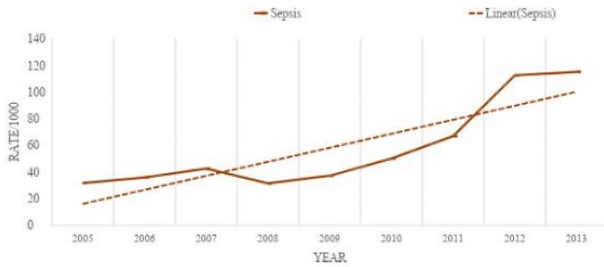


Fig 2(h): Trends of Sepsis from 2005 - 2013

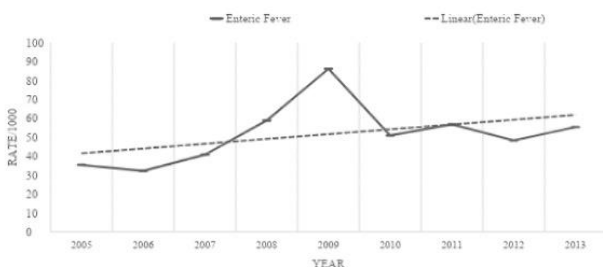


Fig 2(i): Trends of Enteric Fever from 2005 - 2013

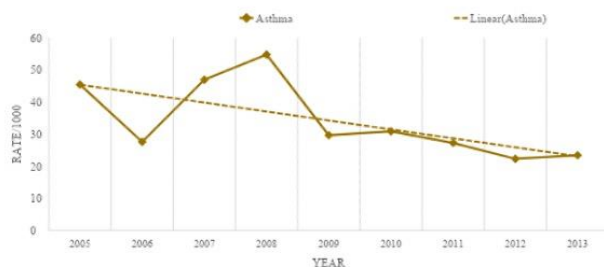


Fig 2(j): Trends of Asthma from 2005 - 2013

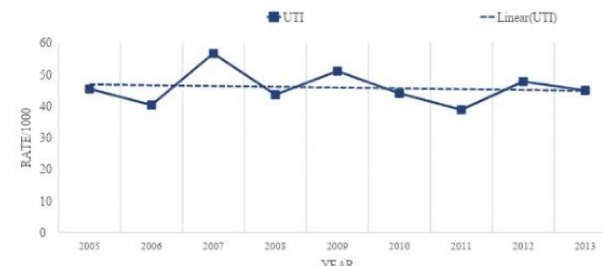


Fig 2(k): Trends of Urinary Tract Infection (UTI) from 2005 - 2013

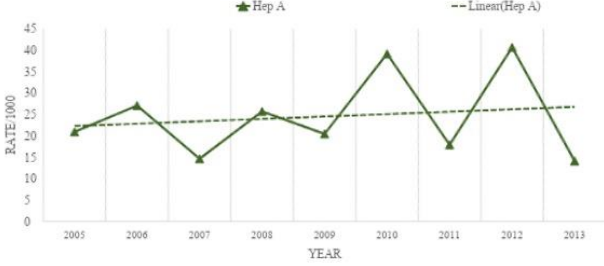


Fig 2(l): Trends of Hepatitis A from 2005 - 2013

Figure 2: Trends of most commonly occurring diseases in Pediatrics Ward 2005 - 2013

4- DISCUSSION

This study was performed to determine the trends of the highest frequent diseases occurring at a tertiary care center of Peshawar. To the best of our knowledge, this is the most comprehensive assessment of trends in pediatric admissions to Rehman Medical Institute. Over the 09 years, a total of 26,810 children were documented in RMI's database. The top three most commonly occurring diseases out of the twelve observed were AGE, LRTI, and NNS. This study indicated that five of the most common diseases occurring in our hospital had a rising trend; two diseases had a downward trend, while five diseases had a relatively static trend. AGE was the most common of the diseases with 3,456 cases (12.9%), and its morbidity showed peaks with seasonal variation in spring, hot summer, and autumn. Our results are consistent with the study in England, which showed AGE as the most commonly occurring disease as a proportion of all emergency admissions, a total of 56,866 (8.8%)(26). While our study showed a mostly stable trend with a slightly upward trend, other studies have shown a decreased incidence of AGE in children since introducing the rotavirus vaccine (27, 28). This could indicate low vaccination rates and a need for more awareness about it in the population. Children with LRTI were 2887 (10.7%) in our study and showed peaks in the spring and early winter. In a study conducted in the US, there were 120 516 (5.5%) LRTI hospitalizations out of a total of 2.2 million hospitalizations due to all causes for children with 0-18 years old. It also showed no change in the trends for the period of study, which was similar to our findings that displayed a mostly stable trend with little upward direction (29). A systemic analysis conducted in 2015 showed that during 2005-2015, the mortality due to LRTIs in 195 countries decreased by 36.9% in children less than

five years old and by 3.2% in all age groups. This shows that while the prevalence trend may be mostly stable, improved health services have reduced the mortality rates due to LRTIs in recent years (30). Upper Respiratory Tract Infections accounted for 2441 (9.1%) of the cases. Our study exhibited a sharp decline in the number of patients over the years, with a steady decrease almost every year. This is similar to the results of a study in Canada, which showed a decline in all URTIs in most countries (31).

A Dutch study that documented cases from 2002-2008 showed a stable trend for most URTIs in children, decreased the trends of sinusitis and tonsillitis in some age groups, and an increase only in serous otitis media (32). The trend for NNJ was neither increasing nor decreasing in our study. In contrast, an American study showed that hospitalizations of NNJ and kernicterus were declining during their study period (15). The percentages of enteric fever were high throughout the spring and hot summer and low in the winter with 1439 cases (5.3%), with the most recent figure being about 50 cases per thousand. A study conducted in Karachi was consistent with our result, and they reported 1248 to the community clinic, 341 were clinically suspected to be cases of typhoid. Based on person-years of observation, the incidence of clinical typhoid was calculated to be 11.69/1000 (20). Morbidity of asthma was high throughout the spring season, suddenly falls and flattens out in the hot summer and again rises in autumn and early winter, and the diagnosed cases of asthma were 867 (3.2%). A study conducted in China among the 13,877 children showed that 665 (4.8%) children were diagnosed with asthma, which is a similar incidence to ours (33). Our study showed a sharp decrease in asthmatic cases over the years, going from 46/1000 in 2005 to 25/1000 in 2013. Another study also showed that while prevalence

increased during 2001-2008, it then significantly decreased during 2009-2013 (34); while more research is required to confirm the trend, asthma rates seem to be stabilizing, particularly in developed countries. However, results are generally conflicting (35). UTIs accounted for 5% of our cases and showed a stable trend throughout the years. A study conducted in the US showed a significant decrease in children's hospitalizations in 2012 compared to those during 1997-2009 (36). Since data for comparison was low, more research needs to be conducted to observe trends for UTIs. In our study, the neonatal sepsis was shown to be significantly up trending, from 3.6 per thousand in 2005 to its highest peak in 2011 at 104 per thousand. However, a 10-year Australian study on EOS showed the opposite results, with 0.19 cases per thousand births in 2016, a downtrend, albeit no significant, from 0.5 per 1000 thousand live births in 2006 (37). A study in the US that documented EOS cases showed a relatively linear occurrence of the disease with 0.79/1000 live births in 2005 and 0.77/1000 live births in 2014 (38). This shows that further studies have to be conducted to observe the trend for this disease. Recognizing these trends in different pediatric diseases makes it easier to take prompt measures to reduce the likelihood of diseases like neonatal sepsis, Pneumonia, AGE, and sepsis. In the future, its graphs should be down trending like asthma and upper respiratory infection.

4-1. Study Limitations and Strengths

Our data represents only one institution in Peshawar, and thus may not be generalizable to populations with different demographic and regional characteristics. There could have been ascertainment errors to measure certain variables. Recognizing these trends in different pediatric diseases had made it easier to take prompt measures to reduce the likelihood of diseases like neonatal sepsis,

Pneumonia, acute gastroenteritis, and sepsis. In the future, its graphs should be down trending like asthma and upper respiratory infection. One strength of our study is that we assessed approximately 09 years of PEDIATRIC admission data, summing a total of 26810 cases.

5- CONCLUSION

Trends in Pneumonia, NNS, and Sepsis, in general, show a dramatic rise, AGE, LRTIs, and Enteric Fever show a very gradual increase, and a general downward trend is seen in Asthma and URTIs. In contrast, NNJ, Hepatitis A, and UTIs show a static trend.

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7- CONFLICT OF INTEREST: None.

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