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ORIGINAL ARTICLE

Seasonal variations and trends of pediatric diseases from 2005-2013 at a tertiary care hospital of Peshawar

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ABSTRACT

Introduction: Seasonal disease variations can assist in identifying potentially preventable determinants of these diseases. The excess number of presentations and admissions in certain seasons establishes the proportion of the burden of disease that might be preventable.

Objective: To determine the seasonal variability of high frequency diseases in children admitted to the Pediatric department of a tertiary care hospital of Peshawar.

Materials & Methods: An observational cross-sectional study was conducted in the Pediatric Department of Rehman Medical Institute (RMI) Peshawar, from January to June 2017 on secondary data of the departmental database (years 2005 – 2013) and analyzed through SPSS v23 for descriptive statistics and trends; trend charts depicting seasonal variation of pediatric diseases were constructed through MS Excel sheets.

Results: Twenty-six thousand eight hundred and ten (26,810) cases were collected for the study period. Acute Gastroenteritis had 3456 (12.9%) cases, Respiratory Tract infections 2441 (9.1%) cases, Enteric fever 1439 (5.4%) cases, Asthma 867 (3.2%) cases, Diarrhea 773 (2.9%) cases and Hepatitis A 678 (2.5%) cases. Morbidity of Acute Gastroenteritis was high in Spring and Summer seasons and another peak was noticed in the Autumn season. Upper respiratory tract infections were high in Spring and early onset of Winter season. Enteric fever was high throughout the Spring and hot Summer seasons, and low in Winter. Asthma was high throughout the Spring season, suddenly flattening in Summer, again rising in Autumn and early Winter. Diarrhea showed a rising trend in Spring and was high in Summer, while in Winter it was low. Hepatitis A was noticed in Summer and persisted till early Autumn.

Conclusion: Obvious seasonal trends of variations were seen for the common childhood diseases, which should help in better prevention and management thereby reducing the likelihood and morbidity of the diseases.

Keywords: Medical Audit; Seasons; Periodicity; Gastroenteritis; Respiratory Tract Infections; Asthma; Typhoid Fever; Diarrhea; Hepatitis; Pediatrics.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

Seasonality is defined as the cyclical variation in the incidence of disease over a period of a year. It can be explained as the periodic occurrence of disease, corresponding to a season, or another predetermined calendar interval.[1] Seasonal variation in mortality and acute hospital usage of regions with temperate atmospheric conditions is particularly prominent in children under the age of two years and in the elderly. This fluctuation in hospital admissions has in the past been seen with influenza, respiratory syncytial virus (RSV), pneumonia and diarrheal diseases.

A disease agent external to the host is reliant on a variety of factors to maintain its infectivity; these include temperature, moisture, and ultraviolet light. Temperature has the most significant affect because the rates of chemical and physical processes are temperature-dependent. It may be assumed that the incidence of infectious illnesses are the result of either seasonal atmospheric changes directly on pathogen number, life-span, or virulence, or due to the cyclical changes with the seasons that are linked to variations in the physical aspects of the environment such as temperature, sunlight, rain, humidity and oxygen saturation. Temperature changes and lack of humidity in the air can affect mucociliary clearance. A recent explanation for the seasonal variation in respiratory tract infections suggests that this difference is related to the effects of air pollution on host mucociliary action.[2]

According to an Australian study, there is increased occurrence of influenza during the Winter, especially in children below five years of age. Childhood Asthma too displays a seasonal variation for Emergency attendances. Seasonal variations can help in pinpointing potentially preventable determinants of these diseases. The abundant amounts of incidence and admissions of some diseases in only certain calendar periods shows the fraction of the burden of disease that could be preventable.[3] About 33% of the seasonal rise in mortality is linked to respiratory diseases related with infection.[4] Seasonal variation of

acute Asthma peaks during Spring and Autumn, coincide with the peak of recurrent diagnoses of rhinovirus infections.

By comparison, few attacks occur in the Summer, which is the time of the year during which most children are on holiday.[5] Additionally, those viruses which may cause systemic diseases, but enter the body via the upper respiratory tract also show a rise during the Winters, as do lower respiratory tract diseases such as pneumonia, which can be viral or bacterial in origin.

The incidence of disease due to pneumococcus, like multiple other bacterial pathogens, also shows a seasonal pattern that rises in Winter in areas with temperate climates. These periodic epidemics are most likely a consequence of the increased carriage of bacteria, combined with increased vulnerability to contracting disease.[6]

Acute gastroenteritis (AGE) is a major reason for hospitalization in children, particularly in the first few months of life. Hospital- and population-based studies showed that 45% to 75% of children with AGE had an enteric pathogenic organism isolated from their stools.[7] Enhanced survival of rotavirus and norovirus at lower temperatures is the cause for the routinely observed peaks of gastroenteritis in Winter.[8] Raised prevalence of Enteric Virus (EV) and Human Adenovirus (HAdV) was regularly detected in the rainy season from May to September, which could be a probable origin of the spread of gastroenteritis in the community. The majority of enteric diseases are either directly or indirectly associated with contaminated water, particularly in urban areas of Khyber Pakhtunkhwa (KP) province of Pakistan.[9]

Diarrhea, a very common occurrence, accounts for 840,000 deaths among children below 5 years of age. Diarrhea kills 2,195 children every day, more than the combined sum of deaths due to AIDS, Malaria, and Measles. Over 1.3 million cases of diarrhea occur annually in children less than 5 years of age in Asia and Africa.[10] Diarrheal diseases though preventable, still cause 9% of all deaths among this age group of children globally. In 2013, this meant almost 580,000 child deaths, or on average 1,600 deaths per day due to potentially avoidable diarrheal causes. It continues to remain a high burden disease in spite of the presence of easily available and efficient remedies.[11]

Pakistan, a developing country with a high population density, experiences myriad human health effects due to climate change. To our knowledge, there is no published paper of the monthly seasonal variation in different pediatric diseases in Khyber Pakhtunkhwa (KP) province of Pakistan. The present study was undertaken to examine the monthly seasonal variation for six different high frequency diseases based on retrospective data.

OBJECTIVE OF THE STUDY

To determine the seasonal variability of high frequency diseases in patients admitted to the Pediatric department of a tertiary care hospital of Peshawar based on retrospective hospital data from 2005-2013.

MATERIALS & METHODS

A cross-sectional study was conducted in the Pediatric Unit of Rehman Medical Institute Peshawar from January to May 2017 after approval from the Rehman Medical Institute-Research Ethics Committee (RMI-REC). Secondary (historical) data were collected from the RMI computerized database. All children admitted in Pediatric ward from January 2005 to December 2013 including neonates, infants and children below 18 years of age were included. There were no exclusion criteria.

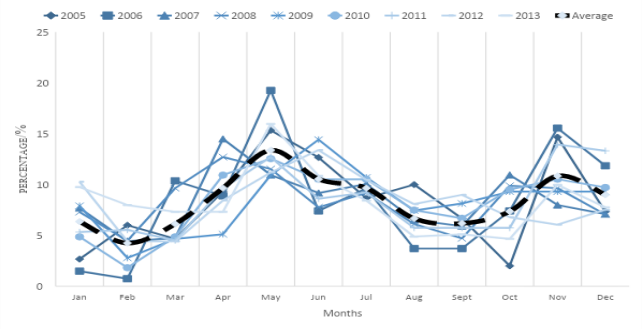
The four seasons were divided as follows: Winter (December to February), Spring (March to May), Summer (June to September) and Autumn (October to November). Microsoft Excel 2013 was used to organize raw data and perform all statistical analyses, tabulations, and graphical distribution of seasonal diversity in line charts. Calculations were done for seasonal disease variation on monthly basis. Statistical relationships between the calendar seasons and different pediatric diseases i.e. acute gastroenteritis, respiratory tract infections, Asthma enteric fever, diarrhea and hepatitis were determined.

RESULTS

From January 2005 to December 2013, a total of 26,810 children aged 1 to 17 were identified in the RMI database. Of these, 17,855 (66.6%) were boys and 8,955 (33.3%) girls; 15,845 (59.1%) aged 1 to 4 years, 7,802 (29.1%) aged 5 to 9 years, 2,761 (10.3%) aged 10 to 14 years and 402 (1.5 %) aged were above the age of 14 years. Regarding the major diseases studied, Acute Gastroenteritis had 3456 (12.9%) cases, Respiratory Tract infections 2441 (9.1%) cases, Enteric fever 1439 (5.4%) cases, Asthma 867 (3.2%) cases, Diarrhea 773 (2.9%) cases and Hepatitis A 678 (2.5%) cases.

A biannual peak in the morbidity of Acute Gastroenteritis (AGE) was noticed in the Spring and mid-season of Winter and Autumn (Figure 1). An average 13% of the children admitted fell prey to AGE in the Spring season while the mid-season trend showed a similar picture with an average of 11%. The prevalence of AGE has decreased as years have passed, starting initially at an average high of 15 to 18% and falling to near 10% on average.

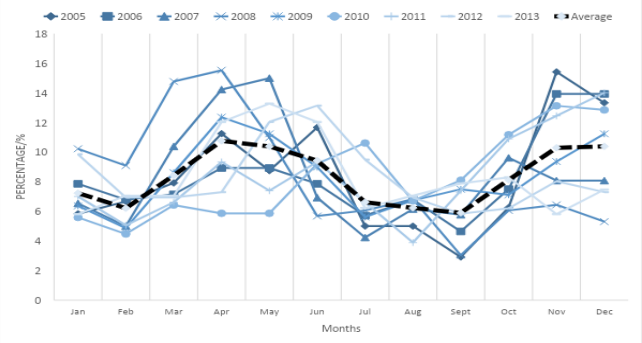
Figure 1: Seasonal Variation in Acute Gastroenteritis (2005-2013).



Like AGE, a biannual peak in the Spring and early Winter seasons can be noticed in the upper respiratory tract infections (URTI)

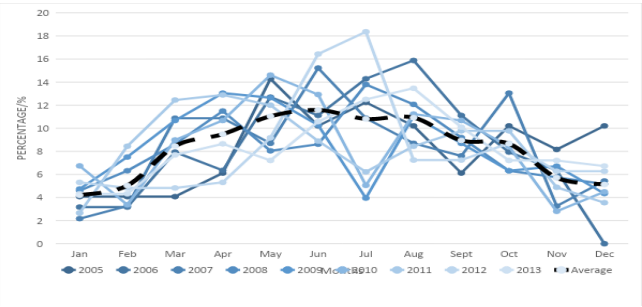
(Figure 2). An average 8% of the admitted patients throughout the study period were diagnosed with URTI. The seasonal variation over the years has stayed the same and so has the prevalence of the disease. Record high morbidity to URTI were seen in the Spring of 2008 (14 - 16%) while the lowest rate of patients was affected in Summer of 2010 (3 - 4%).

Figure 2: Seasonal Variation in Upper Respiratory Tract Infections (2005-2013).



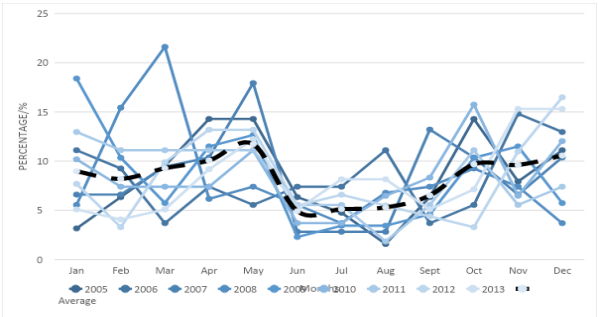
Enteric fever mainly affected children during the Spring and Summer seasons while Winter saw the least number of cases (Figure 3). In July 2013, the highest number (>18%) of cases were diagnosed. The seasonal variation stayed the same throughout the 8-year period.

Figure 3: Seasonal Variation in Enteric Fever (2005-2013).



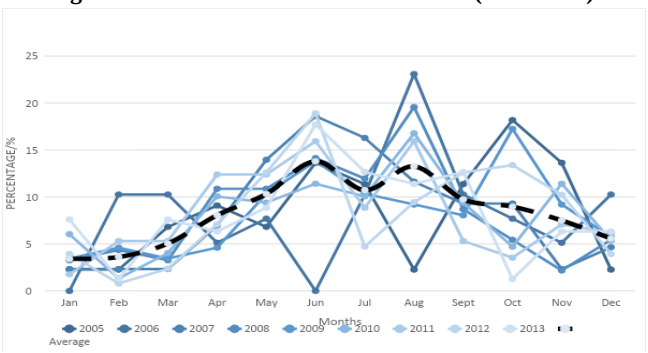
The morbidity with Asthma peaked by the end of Spring and continued to peak during the early Summers (11%) after which a dip was seen in the late Summers to less than 5% prevalence. It stayed at an average 5% incidence till end of Autumn and rose again to peak at around 11% in Winters. The highest recorded incidence of Asthma (22%) was in the Spring of 2008 (Figure 4).

Figure 4: Seasonal Variation in Asthma (2005-2013).



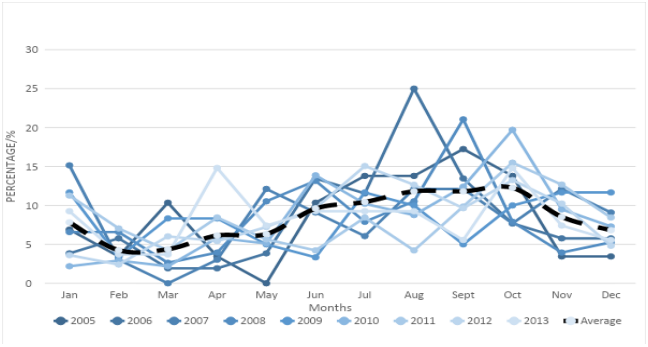
Diarrhea presented in a very bizarre mode with peaks and troughs without a significant pattern. Although two peaks were identified, these were in the same season of Summer (Fig 5). A general rising trend in the incidence of diarrhea when the average is looked at can be noticed starting from an average 3% cases to peaking at 12.5% cases per year. A significant dip in the incidence in the following month (July) can be seen followed by another peak in August (12%). A fall in the incidence is then noticed in Autumn and Winters (around 6%).

Figure 5: Seasonal Variation in Diarrhea (2005-2013).



Seasonal variation is evident in five of the six diseases that have been reported. Hepatitis A did not show any seasonal variation however, the incidence of Hepatitis A decreased gradually over the years nearing an average of 7 – 8% Hepatitis A diagnosis per month per season of the total Hepatitis A diagnosed per year in 2013. This was initially, in 2005, at an average 11 – 12% cases per year (Fig 6).

Figure 6: Seasonal Variation in Hepatitis-A (2005-2013).



DISCUSSION

This study has revealed several findings regarding seasonal patterns for different childhood diseases. Seasonal changes in temperature, rain, and resource availability can exhibit strong forces on the dynamics of a population.[11] Pakistan is a developing country with a high population density which experiences myriad human health effects because of climate change.

A local study in Peshawar showed that high prevalence of Enterovirus and Hepatitis A was detected often in the wet season from May to September, which could be a probable cause of the spread of gastroenteritis in the community.[9] In the present study the

high peak of hepatitis A virus was detected in Summer season (June to September).

About acute gastroenteritis among children, a study in the USA showed a characteristic Winter seasonality, with rotavirus disease activity peaking initially in the Southwest in December and January, and then in the Northeast 2 to 3 months later.[12] However, the present study showed acute gastroenteritis peaked in Spring (March to May) followed by Summer season (June to September).

Another study in Iran showed that the relative frequency of rotavirus gastroenteritis was higher in Winter (41.4%) than other seasons,[13] while in our study the average frequency was higher in Spring (30.89%) compared to other seasons.

Acute upper respiratory viral infections such as the common cold have generally been associated with the cold weather which could be the origin of the term ''common cold'', which suggests exposure to cold.[4] A study in Lahore on the prevalence of respiratory tract infections in early childhood showed that respiratory tract infections were more frequent in the 'temperate–cold' period compared to the 'warm' weather.[14] However, in our study respiratory tract infections were more widespread in Spring (32%) (March to May) and almost the same in Winter (25.33%) and Summer (25.32%) seasons.

Another study in the USA on the epidemiology of Upper Respiratory Infections at a Tertiary Care Center showed that Influenza A started early in October, ended in March, and peaked early in December, compared to the overall peak for the US in late December.[15] In our study the percentage was high in Spring and early onset of Winter season i.e. December.

A study from Lahore showed the highest number of Asthma visits in September through December (10.46-11.68%) (Winter) and lowest number was noted in May (5.92%),[16] while in our study the highest number was mostly related to Winter and Spring seasons where the average percentages were very high i.e. 31.88% and 31.22% respectively; the lowest were in Autumn (17.12%), followed by Summer (19.76%).

Findings of this present study are similar to the pattern observed in a study from Dera Ismail Khan which showed a clear seasonal variation in Asthmatic patients, i.e. in Spring (36%), Winter (23%), Autumn (10%), and in Summer (1%).[17] In our study however, peak of Spring Asthma was observed in May and the average percentages of Asthma were high throughout the Spring and Winter seasons (31.88% and 31.22%), and the number of cases decreased as the temperature increased i.e. in Summer (19.76%) and Autumn (17.12%).

A study in Karachi on seasonal variation and recent status of typhoid fever in a tertiary care hospital noted that the high frequency of positive cases was seen during the month of October.[18] In our study the highest frequency of typhoid fever was seen during the Summer (38.29%) (June to September) especially in June, followed by Spring season (31%).

Another study in Al-Musaib District, Iraq showed the monthly incidence of typhoid fever among patients as highest in May (17%) followed by July (13.2%),[19] while in our study it was highest in Summer season (June 11.12%) followed by Spring season (May 11.6%).

As regards diarrhea, the results in our study are similar to a study in Karachi which noted a marked seasonal pattern for diarrhea, and the overall diarrhea prevalence was lowest from December through March, and peaked in July to October.[20] In our study, diarrhea prevalence was lowest in Winter season (13.89%) and peaked in Summer season (41.46%). Similar results were seen in another study, that is (27.26%) and (17.37%) in Spring and Autumn seasons respectively,[21] which support the previous study in that the diarrheal prevalence was highest during Summer months (42.6%) and lowest during the Winter months (13.5%), whereas for Spring and Autumn seasons it was 24.4% and 19.7% respectively.

Seasonality of hepatitis A in Pakistan has never been determined although persistent cases have been detected round the year. In the present study the prevalence of hepatitis A showed the highest percentage in the hot Summer months (39.36%) persisting throughout Summer, while in Autumn, Winter and Spring seasons the percentages were 20.28%, 20.26%, 20.23% respectively; this supports the previous findings that hepatitis A was more prevalent in late Summer and Winter seasons.[22]

STRENGTH

A strength of our study is that we evaluated approximately 09 years of pediatric admission data, totaling 26810 cases.

LIMITATION

The 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.

CONCLUSION

Obvious differences and trends exist in the seasonal patterns of different diseases in children, recognition of which will make it easier to establish the cause and reduce associated morbidity, as well as allow prompt control measures, especially during the hot Summer season by vaccination, improved sanitation and education.

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