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Seasonal Variation of Pediatric Diseases Among Children Attending an Outpatient Clinic in Tripoli, Libya

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A B S T R A C T

Background: Pediatric diseases show seasonal patterns influenced by climatic, environmental, and population factors, but outpatient data from Libya are limited. **Objective:** To assess seasonal variation in common pediatric diseases among children attending an outpatient clinic in Tripoli, Libya, and examine differences by season, age group, and gender. **Methods:** This retrospective descriptive study reviewed 290 pediatric records from Qurtoba Polyclinic between March 2025 and February 2026. Age, gender, visit date, and primary diagnosis were extracted. Diagnoses were grouped as respiratory, gastrointestinal, skin, urinary tract infection, or other conditions. Associations with season, age group, and gender were assessed using chi-square testing and Fisher's exact test with Monte Carlo estimation when appropriate. **Results:** The mean age was 7.34 ± 3.73 years and 51.7% were male. Respiratory diseases were most common (73.4%), followed by gastrointestinal diseases (16.9%). Winter accounted for the largest share of visits (32.1%) and summer the smallest (17.9%). Respiratory diseases predominated in winter, whereas gastrointestinal diseases were proportionally more frequent in summer. Disease category was significantly associated with season ($P < 0.001$), but not with gender ($P = 0.246$) or age group ($P = 0.166$). **Conclusion:** Pediatric outpatient diagnoses in Tripoli varied significantly by season. Recognizing these patterns may support seasonal staffing, resource allocation, preventive measures, and outpatient preparedness.

التباين الموسمي للأمراض لدى الأطفال المراجعين لعيادة خارجية في مدينة طرابلس، ليبيا

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الكلمات المفتاحية:
أمراض الجهاز التنفسي
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التباين الموسمي العيادات الخارجية
ليبيا

الملخص

الخلفية :تُظهر أمراض الأطفال أنماطًا موسمية تتأثر بالعوامل المناخية والبيئية وخصائص السكان، بينما ما تزال بيانات العيادات الخارجية في ليبيا محدودة .**الهدف :**تقييم التباين الموسمي للأمراض الشائعة لدى الأطفال المراجعين لعيادة خارجية في طرابلس، ودراسة اختلاف توزيعها بحسب الفصل والفئة العمرية والجنس. **المنهجية :**أُجريت دراسة وصفية استعادية شملت 290 سجلًا طبيًا لأطفال راجعوا عيادة قرطبة متعددة التخصصات بين مارس 2025 وفبراير 2026 .جُمعت بيانات العمر والجنس وتاريخ الزيارة والتشخيص الأساسي، وصُنفت الحالات إلى أمراض تنفسية وهضمية وجلدية والتهابات المسالك البولية وحالات أخرى .واستُخدمت الاختبارات الإحصائية المناسبة لتقييم الارتباطات .**النتائج :**بلغ متوسط العمر 7.34 ±3.73 سنوات، وكان 51.7% (%)من الأطفال ذكورًا .كانت الأمراض التنفسية الأكثر شيوعًا)73.4 (%تلتها الأمراض الهضمية)16.9(% من الأطفال. سجل الشتاء أعلى نسبة من الزيارات)32.1 (%والصيف أدناها)17.9 .(%وارتبطت فئة المرض بالفصل إحصائيًا ($P < 0.001$)، دون ارتباط دال بالجنس أو الفئة العمرية .**الاستنتاج :**تختلف تشخيصات الأطفال في العيادات

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الخارجية بطرابلس باختلاف الموسم، ويمكن الاستفادة من هذه الأنماط في التخطيط الموسمي للكوادر والموارد والإجراءات الوقائية.

Abbreviations and Acronyms

SD: standard deviation; SPSS: Statistical Package for the Social Sciences.

1. Introduction

Seasonal variation is an important feature of pediatric disease epidemiology, particularly in outpatient settings where children present with a wide range of acute and common illnesses. The occurrence of many pediatric diseases is influenced by environmental and climatic conditions, as well as behavioral and social factors. Recognizing these patterns is important for anticipating changes in disease burden, planning healthcare services, allocating resources, and implementing appropriate preventive measures [1], [3].

Respiratory tract infections are among the most frequent causes of pediatric outpatient visits and generally increase during colder months. Lower temperatures, changes in humidity, indoor crowding, and increased contact among children may facilitate the transmission of respiratory viruses, including influenza and respiratory syncytial virus [1], [2], [4]. In contrast, gastrointestinal infections commonly increase during warmer periods, when higher temperatures may favor the proliferation and transmission of enteric pathogens through contaminated food and water [3], [5]. Other pediatric conditions, including skin diseases, may also demonstrate seasonal variation in response to environmental conditions [6].

The magnitude and timing of these seasonal patterns may differ between geographical regions because of differences in climate, population characteristics, environmental exposures, and healthcare-seeking behavior [3]. Therefore, findings from studies conducted in other countries may not fully reflect disease patterns in Libya. Evidence from Libya remains limited, particularly regarding the overall seasonal distribution of pediatric diseases in outpatient settings. However, available Libyan evidence indicates that seasonal patterns may influence the presentation of specific pediatric conditions. For example, Alhaddad et al. reported seasonal clustering of Henoch-Schönlein purpura and Henoch-Schönlein nephritis among children in a Libyan outpatient setting [7], highlighting the relevance of seasonal variation to pediatric disease patterns in the local context.

Despite this evidence, there is limited information describing the seasonal distribution of the common pediatric conditions encountered in outpatient clinics in Tripoli. Local epidemiological data are important because Tripoli has a Mediterranean climate with distinct seasonal changes, and local disease patterns may differ from those reported in other climatic and healthcare settings. Characterizing these patterns may help outpatient pediatric services anticipate seasonal changes in patient volume and disease burden and support more effective healthcare planning and preventive strategies.

Therefore, this study aimed to describe the seasonal variation of common pediatric diseases among children attending a general outpatient and emergency pediatric service at Qurtoba Polyclinic in Tripoli, Libya, and to determine whether disease distribution differed according to season, age group, and gender.

2. Methods

2.1. Study design and setting

This retrospective descriptive study was conducted at the pediatric outpatient and emergency service of Qurtoba Polyclinic, a multidisciplinary outpatient facility in Tripoli, Libya. The polyclinic provides healthcare services for both children and adults, including general pediatric outpatient and emergency care, as well as specialized services such as ophthalmology, dermatology, and gynecology. The pediatric service provides care for children presenting with a variety of common and acute conditions, including respiratory illnesses, and functions as a general outpatient service rather than a specialized referral clinic.

2.2. Study population

The study included all pediatric patients who attended the pediatric service between March 2025 and February 2026. A total of 290 patient records were reviewed and included in the analysis. Children with incomplete medical records or missing diagnostic information were excluded from the study.

2.3. Data collection and classification

Data were extracted from routinely maintained outpatient medical records using a standardized data collection form. The variables collected included age, sex, date of visit, and primary clinical diagnosis. Patients were categorized into four age groups: infants (<1 year), toddlers and preschool children (1-4 years), school-age children (5-9 years), and early adolescents (10-14 years). Diagnoses were classified into five major disease categories: respiratory diseases, gastrointestinal diseases, skin diseases, urinary tract infections, and other conditions. For seasonal analysis, the year was divided into winter (December-February), spring (March-May), summer (June-August), and autumn (September-November). Monthly frequencies of outpatient visits were also recorded to evaluate temporal trends throughout the study period.

2.4. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS). Continuous variables were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Associations between disease categories and season, age group, and sex were initially assessed using Pearson's chi-square test. Because several contingency table cells had expected frequencies of less than five, Fisher's exact test with Monte Carlo estimation was used where appropriate. A two-sided P value of less than 0.05 was considered statistically significant.

2.5. Ethical approval

Ethical approval for this study was obtained from the Medical Affairs Administration and the Administration of Qurtoba Polyclinic, Tripoli, Libya, in June 2026. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Patient confidentiality was maintained by anonymizing all collected data, and no personal identifiers were included in the analysis.

3. Results

3.1. Demographic characteristics

A total of 290 pediatric patients were included in the study. The mean age was 7.34 ± 3.73 years (range: 1 month-14 years). Males represented 51.7% of the study population, while females accounted for 48.3%. The largest proportion of patients belonged to the school-age group (5-9 years), representing 42.1% of cases.

Table 1: Demographic characteristics of the study population (n = 290).

Variable	n (%) / Mean ± SD
Age (years)	7.34 ± 3.73
Age range	1 month-14 years
Gender	
Male	150 (51.7%)
Female	140 (48.3%)
Age groups	
Infants (<1 year)	21 (7.2%)
Toddler and preschool (1-4 years)	61 (21.0%)
School age (5-9 years)	122 (42.1%)
Early adolescents (10-14 years)	86 (29.7%)

3.2. Distribution of diseases

Respiratory diseases were the most common diagnosis (73.4%), followed by gastrointestinal diseases (16.9%), skin diseases (2.1%), urinary tract infections (2.1%), and other conditions (5.5%).

3.3. Disease category according to age group

Respiratory diseases constituted the largest diagnostic category across all age groups (73.4% overall). They accounted for 90.5% of cases among infants, 70.5% among toddlers and preschool children, 75.4% among school-age children, and 68.6% among early adolescents. Gastrointestinal diseases were the second most common category and were relatively more frequent among early adolescents (22.1%) than in the younger age groups. However, there was no statistically significant association between age group and disease category ($\chi^2 = 16.58$, df = 12, P = 0.166).

Table 2: Distribution of disease categories according to age groups (n = 290).

Disease category	Infant (<1 yr) n (%)	Toddler & preschool (1-4 yr) n (%)	School age (5-9 yr) n (%)	Early adolescents (10-14 yr) n (%)	Total
Respiratory diseases	19 (90.5%)	43 (70.5%)	92 (75.4%)	59 (68.6%)	213 (73.4%)
Gastrointestinal diseases	0 (0%)	13 (21.3%)	17 (13.9%)	19 (22.1%)	49 (16.9%)
Skin diseases	1 (4.8%)	0 (0%)	5 (4.1%)	0 (0%)	6 (2.1%)
Urinary tract infections	0 (0%)	2 (3.3%)	3 (2.5%)	1 (1.2%)	6 (2.1%)
Other conditions	1 (4.8%)	3 (4.9%)	5 (4.1%)	7 (8.1%)	16 (5.5%)
Total	21 (100%)	61 (100%)	122 (100%)	86 (100%)	290 (100%)

Note: Percentages within each age group were calculated using the total number of patients in the respective age group as the denominator, whereas percentages in the Total column were calculated using the total study population (n = 290) as the denominator. Pearson's chi-square test showed no statistically significant association between age group and disease category ($\chi^2 = 16.58$, df = 12, P = 0.166).

3.4. Monthly and seasonal distribution

Winter accounted for the highest proportion of pediatric visits (32.1%), followed by autumn (29.3%), spring (20.7%), and summer (17.9%). The highest number of pediatric visits was recorded in September (35, 12.1%), whereas the lowest number was observed in June (12, 4.1%).

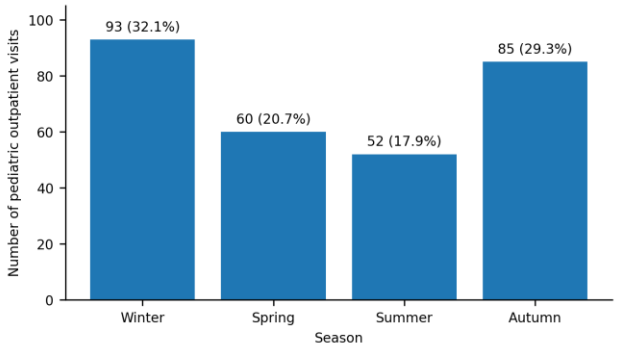

Fig. 1: Seasonal distribution of pediatric outpatient visits in Qurtoba Polyclinic, Tripoli, Libya (March 2025-February 2026).

Table 3: Monthly distribution of pediatric outpatient visits (n = 290).

Month	Frequency, n	Percentage, %
January	32	11.0
February	30	10.3
March	18	6.2
April	22	7.6
May	20	6.9
June	12	4.1
July	21	7.2
August	19	6.6
September	35	12.1
October	21	7.2
November	29	10.0
December	31	10.7
Total	290	100.0

The monthly distribution of pediatric outpatient visits showed that September had the highest number of visits (35, 12.1%), whereas June had the lowest (12, 4.1%). The number of visits in the remaining months ranged from 18 to 32.

3.5. Association between disease category and season

The association between disease category and season was statistically significant (Pearson's $\chi^2 = 47.90$, df = 12, P < 0.001). Because 11 cells (55.0%) had expected counts <5, Fisher's exact test with Monte Carlo estimation was also performed, and the association remained statistically significant (Monte Carlo exact P < 0.001). Respiratory diseases were most frequent during winter, whereas gastrointestinal diseases were proportionally more common during summer, indicating a clear seasonal variation in pediatric outpatient diagnoses.

Table 4: Distribution of disease categories according to season (n = 290).

Disease category	Winter n (%)	Spring n (%)	Summer n (%)	Autumn n (%)	Total n (%)
Respiratory diseases	83 (89.2)	44 (73.3)	22 (42.3)	64 (75.3)	213 (73.4)
Gastrointestinal diseases	4 (4.3)	11 (18.3)	20 (38.5)	14 (16.5)	49 (16.9)
Skin diseases	2 (2.2)	0 (0.0)	4 (7.7)	0 (0.0)	6 (2.1)
Urinary tract infections	1 (1.1)	2 (3.3)	2 (3.8)	1 (1.2)	6 (2.1)
Other conditions	3 (3.2)	3 (5.0)	4 (7.7)	6 (7.1)	16 (5.5)
Total	93 (100)	60 (100)	52 (100)	85 (100)	290 (100)

Note: Percentages within each season were calculated using the total number of visits in that season as the denominator, whereas percentages in the Total column were calculated using the total study population (n = 290) as the denominator. Pearson's chi-square test was used for the initial analysis. Because 11 cells (55.0%) had expected counts <5, Fisher's exact test with Monte Carlo estimation was performed. The association between disease category and season remained statistically significant (Monte Carlo exact P < 0.001).

3.6. Association between gender and diagnosis

No statistically significant association was observed between gender and disease category ($\chi^2 = 5.433$, df = 4, P = 0.246). The distribution of disease categories was comparable between male and female patients.

Overall, respiratory diseases represented the predominant cause of pediatric visits, with a significant seasonal variation characterized by increased respiratory cases during winter and increased gastrointestinal diseases during summer.

4. Discussion

This study demonstrates a clear seasonal pattern in pediatric outpatient presentations in Tripoli, with respiratory diseases predominating during the colder months and gastrointestinal diseases becoming relatively more prominent during the warmer months. These findings are consistent with the well-established influence of climatic and environmental factors on pediatric infectious diseases, although the magnitude and timing of seasonal patterns may vary between geographical settings [2], [3].

The predominance of respiratory diseases in this study is consistent with findings from pediatric outpatient populations in different regions, where respiratory illnesses represent a major proportion of

childhood consultations [1], [3], [4]. The marked increase in respiratory presentations during winter is biologically plausible and may reflect the combined effects of lower temperatures, changes in humidity, increased indoor crowding, and greater contact among school-aged children. Seasonal circulation of respiratory viruses, including influenza and respiratory syncytial virus, also contributes to this pattern [1-3]. Similar winter predominance has been reported in pediatric respiratory surveillance studies, although the timing and intensity of seasonal peaks differ according to climate and local population characteristics [8], [9].

The seasonal pattern observed in Tripoli is particularly relevant to outpatient service planning. The concentration of respiratory presentations during winter suggests that pediatric outpatient facilities should anticipate increased demand during this period. Adequate staffing, availability of essential medications and equipment, infection-prevention measures, and appropriate triage capacity may therefore be particularly important during the winter months. Because Qurtoba Polyclinic provides both general pediatric outpatient and emergency services, recognizing periods of increased respiratory disease burden may help optimize patient flow and service organization.

Gastrointestinal diseases showed a different seasonal pattern, becoming proportionally more frequent during summer. This finding is consistent with the recognized association between warmer temperatures and increased risk of enteric infections, potentially related to food and water contamination, inadequate food storage, and environmental conditions that favor pathogen proliferation [3], [5]. Importantly, local Libyan evidence also supports the relevance of gastrointestinal disease in pediatric outpatient practice. El-Salem et al. reported Cryptosporidium infection among children with diarrhea in Sebha, Libya, providing direct evidence of enteric disease in a Libyan pediatric population [10]. However, that study was not designed to demonstrate seasonality and therefore should not be interpreted as evidence that Cryptosporidium infection is seasonal in Libya.

The findings also have similarities with pediatric disease patterns reported from other settings with warm or Mediterranean-type climates, where seasonal environmental conditions influence the distribution of respiratory and gastrointestinal illnesses. Nevertheless, direct comparisons should be interpreted cautiously because differences in diagnostic practices, healthcare-seeking behavior, population characteristics, climatic conditions, and surveillance methods can substantially affect observed disease patterns [3]. The available evidence from Libya remains relatively limited, making local outpatient data particularly valuable for understanding disease burden and planning services.

Although respiratory diseases were the predominant diagnostic category across all age groups, the absence of a statistically significant association between age group and disease category suggests that the broad seasonal pattern observed in this study was not restricted to a particular age group. Similarly, no significant difference was observed according to gender. These findings indicate that seasonal environmental factors may have a stronger influence on the overall distribution of pediatric outpatient diseases than demographic characteristics in this population. However, the relatively small number of patients in some diagnostic categories limits the ability to draw firm conclusions about age- or sex-specific patterns.

The monthly distribution also showed variation in outpatient attendance, with September recording the highest number of visits. This increase may coincide with the reopening of schools and increased contact among children; however, this explanation remains speculative because school attendance, individual exposure, and specific respiratory pathogens were not directly assessed. Therefore, the observed monthly pattern should be interpreted as a descriptive finding rather than evidence of a causal relationship.

From a clinical and public health perspective, these findings support the value of seasonal preparedness in pediatric outpatient services. Winter preparedness should focus particularly on respiratory disease management, infection prevention, appropriate triage, and maintaining adequate staffing and supplies. During warmer months, greater emphasis on food and water safety, hygiene education, early recognition of dehydration, and appropriate management of gastrointestinal illness may be beneficial. Such measures can be adapted to the local disease pattern and healthcare resources of Tripoli.

This study has several limitations. Its retrospective, single-center design limits the generalizability of the findings to other regions of Libya. Diagnoses were based on routine clinical records without systematic laboratory confirmation, and therefore the specific pathogens responsible for seasonal peaks could not be determined. In addition, the study covered only one year, which may not capture year-to-year variation in seasonal disease patterns. Finally, information on environmental exposures, vaccination status, school attendance, and healthcare-seeking behavior was not available. Longer-term multicenter surveillance incorporating laboratory confirmation and relevant environmental and behavioral variables would provide a more comprehensive assessment of seasonal pediatric disease patterns in Libya.

Overall, the findings indicate that pediatric outpatient disease patterns in Tripoli vary by season, with respiratory illnesses more prominent during winter and gastrointestinal illnesses relatively more frequent during summer. The combination of local Libyan evidence and findings from other settings suggests that seasonal preparedness should be incorporated into pediatric outpatient planning [3], [7]. Further multicenter studies across different Libyan regions are needed to determine whether these patterns are consistent nationally and to identify the climatic, environmental, and social factors underlying seasonal variation.

5. Conclusion

Respiratory diseases were the leading cause of pediatric outpatient visits and demonstrated a marked winter peak, whereas gastrointestinal diseases were more common during summer. A key strength of this study is that it provides locally relevant, year-round outpatient data that can inform seasonal pediatric service planning in Tripoli. However, the retrospective single-center design, one-year observation period, and lack of systematic laboratory confirmation limit generalizability and pathogen-specific interpretation. In practice, the observed seasonal pattern can guide staffing, supplies, triage capacity, infection-prevention measures, and targeted health education. Multicenter, multi-year surveillance with laboratory confirmation is warranted to determine whether these patterns are consistent across Libya.

6. Declarations

6.1. Conflict of Interest

The authors declare that they have no competing interests.

6.2. Funding

This research received no external funding.

6.3. Author Contributions

Asma Noureddin Frewan: Conceptualization, study design, data analysis, interpretation of data, manuscript drafting, critical revision of the manuscript, and final approval of the manuscript.

Faisal Mohamed Elmhabresh: Study supervision, data collection, methodology, statistical review, critical revision of the manuscript, and final approval of the manuscript.

Both authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

6.4. Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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