

Prevalence of skin diseases in Cameroonian children and adolescents: Insights into outpatient units at Laquintinie, Cameroon

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ABSTRACT

Background: The epidemiology of skin diseases is difficult to map out because patients rarely seek care, and this is especially true for children and adolescents in resource-limited settings. The availability of only a few trained dermatologists in the workforce in Cameroon widens this knowledge gap. Understanding the pattern of common skin diseases in pediatric patients is crucial for accurate development of public health interventions and research. **Methods:** We conducted a hospital-based, cross-sectional study at the pediatrics and dermatology outpatient units at Douala Laquintinie Hospital (DLH) from January 2019 to December 31, 2022. **Results:** A total of 3947 patients were included. The mean age was 6.19 ± 5.31 years with a M/F sex ratio of 1/1.17. Immunoallergic and infectious skin diseases constituted 82.2% of the sample. Eczema predominated ($n = 786, 19.91\%$) and was followed by prurigo ($n = 680, 17.23\%$), scabies ($n = 357, 9.04\%$), impetigo/furuncles ($n = 313, 7.93\%$), dermatophyte infections ($n = 265, 6.71\%$), and acne ($n = 191, 4.84\%$). Prurigo was associated with the rainy season ($p = 0.028$). Acne [aOR = 1.66 (1.23–2.26), $p = 0.001$] and pityriasis rosea [aOR = 2.25 (1.47–3.45), $p < 0.001$] were more likely diagnosed in females while dermatophyte infections were more likely diagnosed in males [aOR = 1.42 (1.03–1.95), $p = 0.031$]. **Conclusion:** Overall, 23.97% of children and adolescents consulted at DLH have a skin disease. The top three skin diseases diagnosed among children and adolescents were eczema, prurigo, and scabies.

Key words: Health care delivery, Allergy, Bacterial infections

INTRODUCTION

It has been reported that, on average, one in three patients seen at the outpatient clinic has a skin disease [1,2]. This is particularly true in pediatric clinics where skin conditions may represent 30% of all consultations [3]. Children and adolescents with skin conditions are less commonly seen by pediatricians and dermatologists [4]. Most patients are seen by general

practitioners, who are the first contact for patients with skin conditions [5], or do not even seek care [6], making the epidemiology of skin diseases difficult to map out. This is especially true in a setting such as Cameroon where medical records are not digitalized.

Skin conditions may be highly confusing. A simple papular lesion may be many things, from a simple mosquito bite [7] to the more worrisome Buruli ulcer in its initial

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phases [8,9]. Pediatric patients are unable to describe their symptoms and, therefore, are more vulnerable to misdiagnosis, overprescription of antibiotics and rapid dissemination of diseases [10]. This is also fueled by inadequate dermatology training during conventional medical training [11], with only 25% of general practitioners considering themselves fully confident when faced with a skin disease [12]. The availability of only a few trained dermatologists in the workforce in Cameroon, and other sub-Saharan African countries, widens this knowledge gap [13] and further threatens the quality of dermatological care in these regions.

Understanding the pattern of common skin diseases in pediatric patients in resource-limited settings is crucial for accurate development of context-specific diagnostic and treatment guidelines, public health planning, prevention and control, and research [14]. Moreover, it will help healthcare professionals identify risk factors and develop appropriate educational materials [15]. All this will eventually improve the overall well-being and quality of life of these children and adolescents. Thus, we attempted to describe the pattern of common skin diseases encountered in pediatric patients.

METHODS

Study Design and Setting

This was a hospital-based, cross-sectional study conducted at the pediatric and dermatology outpatient units at Douala Laquintinie Hospital (DLH), a second-category health structure in Akwa, Douala, Cameroon. Neither the pediatric nor dermatology outpatient units are open on weekends and public holidays and offer consultation services only on weekdays. The pediatric outpatient unit is made up of four consultation boxes where patients are seen daily by pediatricians. The pediatric outpatient unit offers consultation services, on average, to more than 6000 patients yearly, and up to 15% constitute systematic newborn screening consultations (unpublished hospital data). The dermatology unit is made up of a single consultation box where two dermatologists consult on alternate days. On average, the dermatology unit offers consultation services to 3000 patients yearly, with 1/4 of the cases ($n = 750$) representing children and adolescents [13].

Study Period and Study Population

The study period of interest was January 1, 2019, to December 31, 2022. The study population was made

up of all patients aged below 18 years consulting for a skin condition at Douala Laquintinie Hospital (DLH).

Inclusion and Exclusion Criteria

Only patients consulting at the dermatology or the pediatric unit during the study period were included in the study. We excluded patients with incomplete data: records without either the year of consultation, age, sex, or presumptive diagnosis. Data that was illegible was also excluded. Only new consultations were considered, and follow-up visits were excluded to prevent cases of duplicated data.

Sampling and Sample Size Calculation

We used a non-probability sampling technique (convenience sampling). All eligible cases were recorded in successive manner and no randomization was conducted. The main objective of the study was to identify the pattern of pediatric dermatoses. Based on a previous study conducted at DLH, Cameroon, 26.1% of dermatology cases were diagnosed in pediatric patients [13]. For our study to have 80% power, significance of 5%, and a 95% confidence interval, the minimum sample size was calculated using OpenEpi software [16] and yielded 297 participants.

Study Tools and Procedure

We used consultation registers and pretested data collection forms to fill in data relevant to our study. Clinical diagnoses as reported by dermatologists and pediatricians were classified according to the WHO International Classification of Diseases 11th Edition (ICD-11) [17]. All clinical conditions for patients with multiple diagnoses were noted. As a result, the number of diagnoses and the total number of patients do not match up since some patients had several diagnoses. Data was presented as counts and the appropriate percentages for each count.

Data Analysis

Data was anonymized and ethical considerations were respected. SPSS, version 23, was used for statistical analyses. Differences between continuous variables were analyzed using the Student *t*-test while differences between categorical variables were analyzed using the chi-squared (X^2) test where applicable. The multivariable logistic model was used to find independent associations between the individual diseases and sex or climatic season. The significance level was set at $p < 0.05$.

Ethical Considerations

Administrative clearance was obtained from the Director of the Laquintinie Hospital Douala. Ethical clearance was not requested since this research involves existing hospital data, codified, and anonymized. Furthermore, the current study is part of the hospital's strategic research plan. The principles of respect for persons, beneficence and non-maleficence, and justice were respected. Data was collected anonymously with no identifiable information gathered. The data was retrospective in nature, so there was no chance that it would lead to tension, worry, or a decline in self-esteem. No matter their socioeconomic status, race, or other demographic characteristics, all prospective eligible participants had the same access to participation.

Operational Definitions

- Neonates: Patients aged less than 31 days.
- Infants: Patients aged 31 days to 11 months.
- Children: Patients aged between 1 and 12 years.
- Adolescents: Patients aged between 13 and 17 years.
- Dry season: Period running from November to February and from July to August each year [18].
- Rainy season: Period running from March to June and from September to October each year [18].
- Immuno-allergic skin conditions: relate to ICD-11 codes EA80, EA82, EA84, EA8Z, ME62.2 and EB00.
- Papulosquamous disorders: relate to ICD-11 codes EA90.Z, EA91 and EA10.
- Acne and acneiform disorders: relate to ICD-11 code ED80.Z.
- Infectious skin disorders: relate to ICD-11 codes IF01-05, EA94.2_DER, 4V7J_DER, IB72, IB75.0, IG04, EA60.Z, fig 1F28.Z and IF2D.0.
- Vascular skin conditions: relate to ICD-11 codes BD9Y_DER, EA86.0, BD74.Z and BD5Z.
- Pigmentary skin disorders: relate to ICD-11 codes ED63.0, ED60.2, ED64
- Disorders of the hair, nails, and sweat glands: relate to ICD-11 codes ED70.Z, ED92.0, EE02 and EE1Z.
- Benign skin tumors: relate to ICD-11 codes 2F20.0-2F2Z.

RESULTS

Recruitment Flow Chart

A total of 38,026 patients were consulted during the study period in both the pediatric and the dermatology

unit during the study period. Follow-up visits, which represented 42.0% of the cases ($n = 15976$), were excluded. Pediatric skin diseases were diagnosed in 6.35% (850/13372) of pediatric consultations and 37.1% (3097/8338) of dermatology consultations. Incomplete data was recorded in 286 cases, illegible data in 54 cases, and follow-up visits in 15976 cases. From the eligible population, we excluded 7.93% (340/4287) of new cases and a total of 3947 patients were included (Fig. 1). Therefore, the overall proportion of skin diseases among children and adolescents was 23.97% (3497/16469).

Age, Age Distribution, Sex, and Consultant Seen

The mean age in our sample was 6.19 ± 5.31 years with the minimum of 1 day of age to 17 years. The median age was 5 years (Q1-Q3: 1.5-10). Most patients were children ($n = 2699$, 68.38%) followed by adolescents ($n = 697$, 17.66%), infants ($n = 423$, 10.72%), and finally neonates ($n = 128$, 3.24%). Females constituted 53.89% ($n = 2127$) of the sample, giving a M/F sex ratio of 1/1.17. All age distributions had similar proportions of males and females except the adolescents who had a much higher proportion of females ($n = 454$, 65.14%) than males ($n = 243$, 34.86%) (Table 1). Most patients were seen by a dermatologist ($n = 3097$, 78.46%). Neonates and infants were most seen by the pediatrician, while up to 97.27% ($n = 678$) of adolescents were seen by the dermatologist. The year 2019 was the year with the highest proportion of consultations ($n = 1078$, 27.31%).

Common Skin Diseases Observed

Immunoallergic skin diseases ($n = 1642$, 41.60%) and infectious skin diseases ($n = 1603$, 40.61%) with bacterial infections predominating, constituted 82.2% of the sample. This was followed by acne and acneiform disorders ($n = 191$, 4.84%), papulosquamous skin diseases ($n = 162$, 4.10%) and solid benign tumors ($n = 91$, 2.31%).

Distribution of Commonly Diagnosed Skin Diseases within Different Age Groups

The three most common individual skin diseases encountered were eczema ($n = 786$, 19.91%), prurigo ($n = 680$, 17.23%), and scabies ($n = 357$, 9.04%) (Table 2). In neonates, eczema ($n = 29$, 22.86%) predominated, followed by scabies, dermatophyte

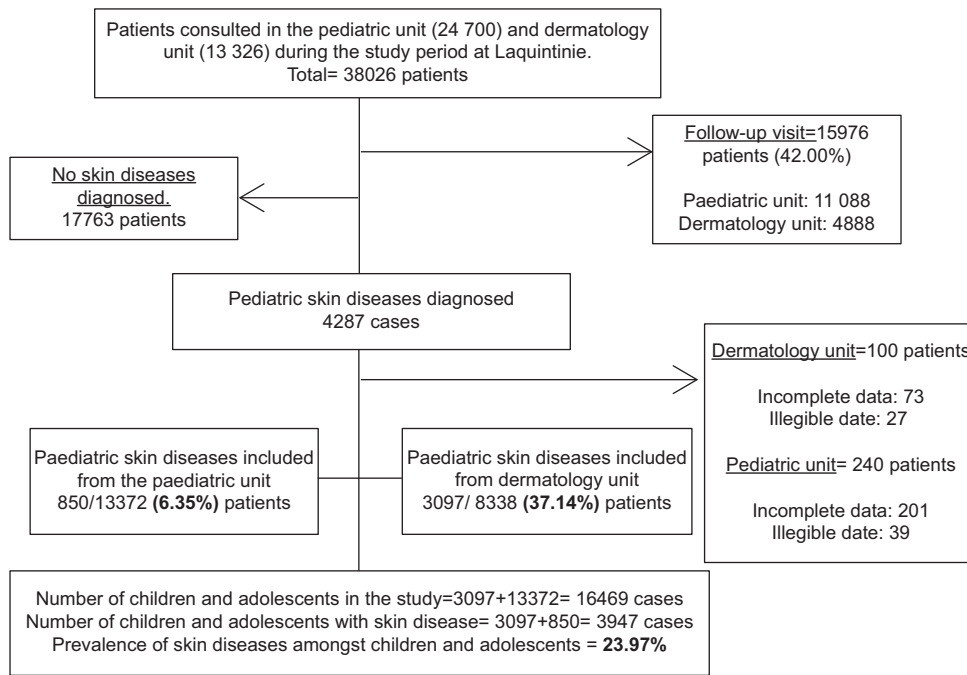


Figure 1: Patient recruitment flowchart.

Table 1: Distribution of certain sociodemographic characteristics within specific age ranges

Variables	Neonates (< 1 month) n=128	Infants (1–11 months) n=423	Children (1–12 years) n=2706	Adolescents (13–17 years) n=697	Total n=3947
Sex					
Male	64 (50.00%)	211 (49.88%)	1302 (48.12%)	243 (34.86%)	1820 (46.11%)
Female	64 (50.00%)	212 (50.12%)	1397 (51.88%)	454 (65.14%)	2127 (53.89%)
Consultant					
Dermatologist	12 (9.38%)	125 (29.55%)	2282 (84.33%)	678 (97.27%)	3097 (78.46%)
Pediatrician	116 (90.62%)	298 (70.45%)	417 (15.67%)	19 (2.73%)	850 (21.54%)
Year of Consultation					
2019	33 (25.78%)	120 (28.37%)	736 (27.19%)	189 (27.12%)	1078 (27.31%)
2020	32 (25.00%)	101 (23.88%)	625 (23.10%)	192 (27.55%)	950 (24.07%)
2021	28 (21.88%)	121 (28.60%)	675 (24.94%)	167 (23.96%)	991 (25.11%)
2022	35 (27.34%)	81 (19.15%)	663 (24.50%)	149 (21.38%)	928 (23.51%)
Climatic Season					
Dry season	67 (52.34%)	219 (51.77%)	1370 (50.76%)	347 (49.78%)	2003 (50.75%)
Rainy season	61 (47.66%)	204 (48.23%)	1329 (49.24%)	350 (50.22%)	1944 (49.25%)
Academic Period					
School period	94 (73.44%)	347 (82.03%)	1958 (72.55%)	502 (72.02%)	2901 (73.50%)
Holiday period	34 (26.56%)	76 (17.97%)	741 (27.45%)	195 (27.98%)	1046 (26.5%)

infection, and impetigo/furuncles, which had a prevalence of 7.03% each. In infants, eczema (n = 108, 25.53%) and impetigo/furuncles (n = 50, 11.82%) predominated, followed by scabies and prurigo. In children, common individual skin diseases were similar to the overall sample. In adolescents, however, the most common pathology was acne (n = 157, 22.53%), followed by eczema, prurigo, and pityriasis versicolor (Table 3). All pathologies were most diagnosed in children except for acne which was most diagnosed in adolescents (n = 157, 82.20%).

Distribution of Commonly Diagnosed Skin Diseases with Climatic Season and Sex

Most consultations were in the dry season (n = 2003, 50.75%) and school period (n = 2901, 73.50%) (Table 1). Skin diseases did not vary much with climatic season except for prurigo, which had a higher prevalence in the rainy season (n = 361, 53.09%, p = 0.028) (Table 4). Moreover, skin diseases were more commonly diagnosed in females. Multivariable logistic regression revealed that acne [aOR = 1.66 (1.23-2.26), p = 0.001]

Table 2: Distribution of the top 10 skin diseases within specific age ranges

Diagnosis (International Classification of Diseases 11th edition: ICD0-11 CODES)	Neonates (< 1 month) n=128	Infants (1–11 months) n=423	Children (1–12 years) n=2706	Adolescents (13–17 years) n=697	Total n=3947
Eczema (EA80)	29 (22.86%)	108 (25.53%)	546 (20.23%)	103 (14.78%)	786 (19.91%)
Prurigo (EC91.Z)	1 (0.78%)	36 (8.51%)	551 (20.41%)	92 (13.2%)	680 (17.23%)
Scabies (1G04)	9 (7.03%)	39 (9.22%)	273 (10.11%)	36 (5.16%)	357 (9.04%)
Impetigo and furuncles (L01.00, L02.92)	9 (7.03%)	50 (11.82%)	241 (8.93%)	10 (1.43%)	310 (7.85%)
Dermatophyte infection (1F28.Z)	9 (7.03%)	34 (8.04%)	97 (3.59%)	21 (3.01%)	265 (6.71%)
Acne (ED80.Z)	2 (1.56%)	1 (0.24%)	31 (1.14%)	157 (22.53%)	191 (4.84%)
Molluscum contagiosum (1E76)	-	1 (0.24%)	148 (5.48%)	6 (0.86%)	155 (3.93%)
Pityriasis versicolor (1F2D.0)	2 (1.56%)	11 (2.60%)	68 (2.52%)	65 (9.33%)	146 (3.70%)
Pityriasis rosea (EA10)	-	-	69 (2.56%)	38 (5.45%)	107 (2.71%)
Urticaria (EB00)	-	4 (0.95%)	46 (1.70%)	34 (4.88%)	84 (2.14%)

Table 3: Distribution of grouped skin diseases within specific age ranges

Skin Disease	Neonates (< 1 month) n=128	Infants (1–11 months) n=423	Children (1–12 years) n=2706	Adolescents (13–17 years) n=697	Total n=3947
Immuno-allergic skin diseases	57 (44.53%)	180 (42.55)	1173 (43.35%)	232 (33.29%)	1642 (41.60%)
Infectious skin diseases	59 (46.09%)	210 (49.65%)	1148 (42.42%)	186 (26.67%)	1603 (40.61%)
Bacterial	36 (28.13%)	115 (27.19%)	372 (13.75%)	26 (3.73%)	549 (13.9%)
Fungal	14 (10.94%)	48 (11.35%)	273 (10.09%)	99 (14.20%)	434 (10.99%)
Parasitic	9 (7.03%)	40 (9.46%)	282 (10.42%)	36 (5.16%)	367 (9.29%)
Viral	-	8 (1.89%)	255 (9.42%)	28 (4.02%)	291 (7.37%)
Acne and acneiform disorders	2 (1.56%)	1 (0.24%)	31 (1.14%)	157 (22.53%)	191 (4.84%)
Papulosquamous skin diseases	-	2 (0.48%)	107 (3.95%)	53 (7.60%)	162 (4.10%)
Solid benign tumors	-	-	57 (2.12%)	34 (4.88%)	91 (2.31%)
Disorders of pigmentation	-	5 (1.18%)	53 (1.96%)	22 (3.16%)	80 (2.03%)
Vascular skin diseases	1 (0.78%)	14 (3.31%)	52 (1.92%)	9 (1.29%)	76 (1.93%)
Disorders of keratinization	6 (4.69%)	1 (0.24%)	34 (1.26%)	12 (1.72%)	53 (1.34%)
Hair, nail, and sweat glands disorders	1 (0.78%)	5 (1.18%)	18 (0.67%)	10 (1.43%)	34 (0.86%)
Cosmetic counseling	-	-	17 (0.63%)	9 (1.29%)	26 (0.65%)
Connective tissue disease	-	-	1 (0.04%)	7 (1.00%)	8 (0.20%)

Table 4: Distribution of the top 10 skin diseases within climatic seasons and sex

Diagnosis (International Classification of Diseases 11th edition: ICD0-11 CODES)	Dry season n=2003	Rainy season n=1944	p value	Males	Females	p value
Eczema (EA80)	406 (50.52%)	380 (48.35%)	0.570	355 (45.17%)	431 (54.83%)	0.552
Prurigo (EC91.Z)	319 (46.91%)	361 (53.09%)	0.028	316 (46.47%)	364 (53.53%)	0.836
Scabies (1G04)	191 (53.50%)	166 (46.50%)	0.275	168 (47.06%)	189 (52.94%)	0.706
Impetigo and furuncles (L01.00, L02.92)	152 (49.03%)	158 (50.97%)	0.529	146 (47.10%)	164 (53.90%)	0.717
Dermatophyte infection (1F28.Z)	75 (46.58%)	86 (53.42%)	0.281	89 (55.28%)	72 (44.72%)	0.017
Acne (ED80.Z)	96 (50.26%)	95 (49.74%)	0.891	66 (34.55%)	125 (65.45%)	0.001
Molluscum contagiosum (1E76)	81 (52.26%)	74 (47.74%)	0.701	77 (49.68%)	78 (50.32%)	0.363
Pityriasis versicolor (1F2D.0)	74 (50.68%)	72 (49.32%)	0.988	63 (43.15%)	83 (56.85%)	0.465
Pityriasis rosea (EA10)	53 (49.53%)	54 (50.47%)	0.799	30 (28.04%)	77 (71.96%)	<0.001
Urticaria (EB05)	40 (47.62%)	44 (52.38%)	0.566	36 (42.86%)	48 (57.14%)	0.545

and pityriasis rosea [aOR = 2.25 (1.47-3.45), $p < 0.001$] were more likely to be diagnosed in females while dermatophyte infections were more likely to be diagnosed in males [aOR = 1.42 (1.03-1.95), $p = 0.031$].

DISCUSSION

This study aimed to determine the pattern of common skin diseases encountered in children and adolescents

and their variations with sex, age, and climatic season in Cameroon.

Overall, pediatric skin diseases were noted in 23.97% of children and adolescents: 6.35% at the pediatric outpatient unit and 37.14% at the dermatology outpatient unit. Several authors have reported varied information [3,13,19]. The low proportion of skin diseases at the pediatric outpatient unit may be

explained by the high amount (15%) of systematic newborn consultations at Laquintinie. Despite these, we understand that these proportions are more likely underestimated, since many patients with skin conditions do not seek medical care for skin diseases [6,20] or do so at the level of their primary care physician [5].

Females constituted 53.89% of the sample. The female predominance in outpatient consultations has been recorded by several authors [13,21,22]. Skin diseases usually pose cosmetic concerns, and therefore, women are more likely to initiate consultation for these issues [23]. In the younger age groups (< 13 years), as it is believed that consultations are initiated by parents or guardians, we noted a similar proportion between males and females. However, in adolescents, who generally initiate consultations, the proportion of females was much higher. This correlates with the high proportion of acne in this age group. Puberty leads to a rise in the level of circulating androgens, which boosts the pilosebaceous unit's production of sebum [24]. Acne has been recognized as one of the skin diseases that significantly impairs self-esteem and quality of life [25,26]. The importance of appearance in determining one's value and self-esteem has proven to be more important for women, as such, they will seek care more often than men [27].

Immunoallergic skin diseases have been reported by several authors [13,28,29] as the most common skin diseases in urban settings such as in our study and may be explained by the industrialization in cities and the constant exposure to allergens [30]. In rural settings, however, infectious skin diseases have been reported to predominate and this may be attributed to the degree of poverty, promiscuity and poor hygiene, which are favorable factors for the transmission of infections [31]. In concordance, eczema, which includes atopic dermatitis, has been reported as the most diagnosed skin disease in our sample. Acute and subacute forms are frequently marked by excruciatingly itchy, erythematous papules and vesicles with excoriations and a serous discharge, while plaques and papules with lichenification and excoriations are typical of chronic forms [32]. It is frequently misdiagnosed due to the variety of clinical features, severity levels, and clinical courses [33,34]. Physicians have reported low confidence when faced with eczema [35,36]. However, this could be improved through CME courses [37].

Prurigo was the second most common diagnosis in our study and its prevalence was higher in the rainy

season. The term *prurigo* refers to a reactive cutaneous condition marked by papules or nodules [38]. The main form seen in pediatrics is called prurigo strophulus and has been linked to atopy [39]. It is characterized by pruritic, papular, or papulovesicular erythematous skin lesions mainly on the exposed areas of the body and is caused by cellular hypersensitivity to environmental arthropods [40]. The high prevalence of prurigo in the rainy season has been reported before and it has been attributed to the fact that rainy conditions favor the breeding and growth of arthropods [39].

Scabies (n = 357, 9.04%) was the third most diagnosed skin disease especially in patients aged < 13 years. The prevalence of scabies varies with settings and has been reported to be as low as 1% in primary schools in Cote d'Ivoire [20], 17.8% in Cameroonian boarding secondary schools [41], and 19.25% in Ethiopian communities [42]. The predominance of scabies in the younger age groups [43,44] relates to the close personal contact children have with each other as they play and sleep together in the same bed [45].

Scabies and impetigo/furuncles were the second commonly diagnosed skin disease in neonates in conjunction with dermatophyte infections. Diagnosing the latter fungal zoonotic infections in neonates is unexpected [46]. Since this age group was most commonly seen by pediatricians, these results may reflect misdiagnosis as infantile seborrheic dermatitis/cradle cap, a highly common fungal infection caused by *Malassezia* in first months of life, may be mistaken for tinea capitis, a dermatophyte infection of the scalp [47].

Impetigo is a superficial infection of the skin caused by Gram-positive bacteria. A furuncle/boil is a bacterial infection of the hair follicle. These infections affected 7.85% of children and adolescents in our study. A much higher prevalence value (19.4%) has been reported before among children living in remote communities [48]. Its prevalence in infants may reflect immaturity of the immune system yet also, the change from relatively sterile environment of the neonate's crib to the non-sterile environment encountered by infants when learning how to crawl, walk, eat, etc. Conditions that permit the infant to explore its environment in a more hygienic manner may be helpful in limiting these pathologies.

This study was a monocentric hospital-based study in a single urban city setting in Cameroon, and therefore, results cannot be generalized. Moreover, since diagnoses were not independently confirmed by a team of

pediatric dermatologists, the risk for misdiagnoses cannot be overemphasized. Nonetheless, this study is one of the few in Cameroon, if not the first, that gives us insight on the most common pediatric skin diseases encountered in both dermatology and pediatric outpatient units and their variation with age, sex, and climatic season. These skin diseases may be linked to genetic predispositions, hygienic habits, auto-immunity, and/or environmental factors. This study paves the way for further research geared toward the development of public health interventions and educational activities.

CONCLUSION

Overall, 23.97% of children and adolescents seen at Laquintinie had a skin disease. The top three skin diseases diagnosed among children and adolescents were eczema, prurigo, and scabies.

What Is Known about the Topic?

- Skin diseases may represent 30% of all pediatric consultations.
- Skin conditions in pediatrics may be highly confusing as pediatric patients are unable to describe their symptoms and, therefore, are more vulnerable to misdiagnosis, overprescription of antibiotics and rapid dissemination of diseases.
- Understanding the pattern of common skin diseases in pediatric patients in resource-limited settings is crucial for accurate development of context-specific diagnostic and treatment guidelines, public health planning, prevention and control, and research.

What does this Study Add?

- Overall, 23.97% of children and adolescents seen at Laquintinie had a skin disease.
- Immunoallergic skin diseases (n = 1642, 41.60%) and infectious skin diseases (n = 1603, 40.61%) with bacterial infections predominating constituted 82.2% of skin diseases diagnosed in the pediatric population.
- The top three skin diseases diagnosed among children and adolescents were eczema, prurigo, and scabies.

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Statement of Human and Animal Rights

All the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 2008 revision of the Declaration of Helsinki of 1975.

Statement of Informed Consent

Informed consent for participation in this study was obtained from all patients.

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