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Clinical Phenotype of Scabies by Age

Franck Boralevi, Abou Diallo, Juliette Miquel, Morgane Guerin-Moreau, Didier Bessis, Christine Chiavérini, Patrice Plantin, Thomas Hubiche, Annabel Maruani, Martin Lassalle, Lucile Boursault and Khaled Ezzedine

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WHAT'S KNOWN ON THIS SUBJECT: Scabies is a frequent cause of consultation and has recently been classified as a neglected disease. The clinical presentation seems to be linked with age, although no specific study has aimed to delineate the clinical spectrum of scabies in infants and children.

WHAT THIS STUDY ADDS: Scabies in infants and children has distinct clinical features. This prospective observational study found that infants were more likely to have relapse, nodules, and to present involvement with extremities, face, and scalp, arguing for specific cares in this age group.

AUTHORS: Franck Boralevi, MD, PhD,[a,b] Abou Diallo, PhD,[c] Juliette Miquel, MD,[d] Morgane Guerin-Moreau, MD,[e] Didier Bessis, MD,[f] Christine Chiavérini, MD,[g] Patrice Plantin, MD,[h] Thomas Hubiche, MD,[i] Annabel Maruani, MD, PhD,[j] Martin Lassalle, PharmD,[a] Lucile Boursault, MD,[k] and Khaled Ezzedine, MD, PhD,[a,k]; on Behalf of the Groupe de Recherche Clinique en Dermatologie Pédiatrique

[a]Pediatric Dermatology Unit, Hôpital Pellegrin-enfants, Bordeaux University Hospital, Bordeaux, France; [b]CIC 0005, Centre d'investigation clinique pédiatrique, Hôpital Pellegrin-enfants, Bordeaux, France; [c]Department of Public Health and Statistics, Hôpital Avicenne, Bobigny, France; [d]Department of Dermatology, Rennes University Hospital, Rennes, France; [e]Department of Dermatology, Angers University Hospital, Angers, France; [f]Department of Dermatology, Montpellier University Hospital, Montpellier, France; [g]Department of Dermatology, Nice University Hospital, Nice, France; [h]Department of Dermatology, Centre Hospitalier de Cornouaille, Quimper, France; [i]Department of Dermatology and Infectious Diseases, Intercommunal Hospital, Fréjus, France; and [j]Department of Dermatology, Tours University Hospital, Tours, France; [k]Department of Dermatology, Bordeaux University Hospital, Bordeaux, France

KEY WORDS
infants, phenotype, scabies

ABBREVIATIONS
CI—confidence interval
OR—odds ratio

(Continued on last page)

abstract

OBJECTIVE: Scabies has a clinical presentation that seems to vary according to age. We conducted a prospective study with the goal of delineating the clinical presentation of the disease into 3 groups of age: infants, <2 years; children, 2 to 15 years; and adults, >15 years.

METHODS: This trial was a prospective, multicenter observational study in consecutive patients with a confirmed diagnosis of scabies who were seen in 13 French Departments of Dermatology and Pediatric Dermatology between April 2010 and April 2011. A standardized questionnaire was completed for each patient. To identify factors associated with patient age, comparisons between the 3 age groups were conducted by using univariate and multivariate multinomial logistic regression analyses.

RESULTS: A total of 323 individuals were included; the gender ratio (female:male) was 1.2:1. In univariate analysis, infants were more likely to have facial involvement. In multivariate logistic regression, relapse was more frequent in children (odds ratio [OR]: 2.45 [95% confidence interval (CI):1.23–4.88]) and infants (OR: 3.26 [95% CI: 1.38–7.71]). In addition, family members with itch (OR: 2.47 [95% CI: 1.04–5.89]), plantar (OR: 20.57 [95% CI: 7.22–58.60]), and scalp (OR: 16.94 [95% CI: 3.70–77.51]) involvement were also found to be independently associated with the age group <2 years.

CONCLUSIONS: There is a specific clinical presentation of scabies in infants and children. Taking into account these specificities may be helpful for the early diagnosis and the identification of cases to prevent the propagation of the disease. *Pediatrics* 2014;133:e910–e916

Scabies is a frequent condition, recently listed by the World Health Organization as one of the main neglected diseases, affecting ~300 million people worldwide each year.[1] In France, the annual incidence is currently estimated at 337 cases per 100 000 inhabitants, and it seems to have increased over the past several years.[2] Scabies affects both adults and children, and according to the results of a study conducted in the southwest of France, almost one-third of patients with scabies seen by dermatologists are aged <16 years.[3] The clinical presentation of scabies seems to vary according to age, but to the best of our knowledge, no prospective clinical study has been conducted to characterize the clinical presentation of scabies when comparing data obtained in infants, children, and adults. Although the diagnosis of scabies may be facilitated in the context of a community-acquired disease, the index case may be misdiagnosed, which leads to the propagation of the disease. Indeed, failure to diagnosis scabies in the pediatric population is common. In a recent study, Pouessel et al[4] found a failure rate for scabies diagnosis as high as 41% in children admitted to a French pediatric emergency unit and examined by ≥1 physician before admission at that unit. In this context, the goal of the present study was to delineate the clinical spectrum of scabies according to patient age in a prospective cohort of patients with a confirmed diagnosis of scabies.

METHODS

We conducted a prospective, multicenter, cross-sectional observational study. The study was approved by the local ethics committee of the University Hospital of Bordeaux. Consecutive patients with a confirmed diagnosis of scabies, seen in 13 French Departments of Dermatology and Pediatric Dermatology (Bordeaux, Rennes, Quimper, Angers,

TABLE 1 Descriptive Characteristics of 323 Patients With Confirmed Diagnosis of Scabies

Characteristic	Aged <2 Years		Aged 2 to 15 Years		Aged >15 Years		Total	
	N	%	*N*	%	*N*	%	*N*	%
Gender								
Female	40	43.5	58	54.2	70	61.9	168	53.8
Male	52	56.5	49	45.8	43	38.1	144	46.2
History of atopic dermatitis								
No	63	85.1	72	81.8	90	93.8	225	87.2
Yes	11	14.9	16	18.2	6	6.2	33	12.8
Relapse								
No	41	45.1	48	44.0	66	62.3	155	50.7
Yes	50	54.9	61	66.0	40	37.7	151	49.3
Pruritus								
No	7	9.7	4	4.6	3	3.1	14	5.5
Yes	65	90.3	83	95.4	93	96.9	241	94.5
Time of pruritus								
Daytime itching	8	21.6	9	18.7	9	14.1	26	17.5
Evening/nighttime itching	29	78.4	39	81.3	55	85.9	123	82.5
Sleep disturbances								
No	51	78.5	68	81.9	68	73.1	187	77.6
Yes	14	21.5	15	18.1	25	26.9	54	22.4
Family members with itch								
No	33	50.7	29	35.0	58	62.4	120	49.8
Yes	32	49.3	54	65.0	35	37.6	121	50.2
Burrows								
No	20	21.5	23	20.5	28	23.7	71	22.00
Yes	73	78.5	89	79.5	90	76.3	252	78.00
Nodules								
No	36	38.7	76	67.9	70	59.3	182	56.4
Yes	57	60.3	36	32.1	48	40.7	141	43.6
Vesicles								
No	20	21.5	33	29.5	52	44.1	105	32.5
Yes	73	78.5	79	70.5	66	55.9	218	67.5
Blisters								
No	86	92.5	107	95.5	116	98.3	309	95.7
Yes	7	7.5	5	4.5	2	1.7	14	4.3
Hands and wrists								
No	23	24.7	14	12.5	22	18.6	59	18.3
Yes	70	75.3	98	87.5	96	81.4	264	81.7
Arms and forearms								
No	35	37.6	34	30.4	31	26.3	100	31.0
Yes	58	62.4	78	69.6	87	73.7	223	69.0
Ankles and foot								
No	16	17.2	53	47.3	81	68.6	150	46.4
Yes	77	82.8	59	52.7	37	31.4	173	53.6
Armpits								
No	38	40.9	67	59.8	72	61.0	177	54.80
Yes	55	59.1	45	40.2	46	39.0	146	45.20
Knees, knee folds, and legs								
No	44	47.3	62	55.4	79	66.9	185	57.3
Yes	49	52.7	50	44.6	39	33.1	138	42.7
Thigh and groin								
No	40	43.0	54	48.2	54	45.8	148	45.8
Yes	53	57.0	58	51.8	64	54.2	175	54.2
Head and neck, excluding scalp								
No	59	63.4	84	75.0	99	83.9	242	74.9
Yes	34	36.6	28	25.0	19	16.1	81	25.1
Scalp								
No	68	73.1	102	91.1	112	94.9	282	87.3
Yes	25	26.9	10	8.9	6	5.1	41	12.7
Face								
No	70	75.3	102	91.1	118	100.0	290	89.8
Yes	23	24.7	10	8.9	0	0.0	33	10.2

TABLE 1 Continued

Characteristic	Aged <2 Years		Aged 2 to 15 Years		Aged >15 Years		Total	
	N	%	*N*	%	*N*	%	*N*	%
Back								
No	27	29.0	42	37.5	50	42.4	119	36.8
Yes	66	71.0	70	62.5	68	57.6	204	63.2
Nipples								
No	78	83.9	99	88.4	82	69.5	259	80.2
Yes	15	16.1	13	11.6	36	30.5	64	19.8
Abdomen								
No	28	30.1	43	38.4	52	44.1	123	38.1
Yes	65	69.9	69	61.1	66	55.9	200	61.9
Buttocks and genital area								
No	48	51.6	58	51.8	54	45.8	160	49.5
Yes	45	48.4	54	48.2	64	54.2	163	50.5

Montpellier, Nice, Fréjus, Tours, Dijon, Lille, Reims, Nantes, and Argenteuil) between April 2010 and April 2011, were included. The inclusion criteria were patients with a diagnosis of scabies confirmed by visualization of the so-called delta sign on dermoscopic examination and, if available, parasitologic confirmation of the presence of *Sarcoptes scabiei* on the basis of microscopic examination of skin scabs.[5] A questionnaire was specially designed for the study and used for each patient (see Supplemental Information). This questionnaire included demographic characteristics (age, gender, and number of people in household) and individual clinical data (personal history of atopic eczema, duration of symptoms before treatment, number of relapses [if any], site and type of lesions, and treatment). The body was divided into 15 areas; each area was carefully examined, and the presence or absence of burrows, nodules, vesicles, blisters, and other clinical signs was recorded.

Statistical Analysis

Descriptive characteristics were first classified according to the age of patients (<2, 2–15 years, and >15 years). Basic summary statistics, such as proportions, means, and SDs, were used to characterize population attributes. To identify factors associated with the age of patients, comparisons between groups were conducted by using univariate and multivariate multinomial logistic regression analyses. All potential predictors associated with the age of patients were first assessed individually, and odds ratio (ORs), the corresponding 95% confidence intervals (CIs), and *P* values were computed. The OR significance was determined by using the Wald χ^2 test, and predictors with $P < .20$ were subsequently assessed by using multivariate analysis with a forward stepwise selection procedure. Possible interactions and multicollinearity were examined; whenever ≥2 potential risk factors were highly correlated, the predictor that was known as being more clinically important was selected for entry. Finally, the goodness-of-fit of the final model was assessed by using the logistic regression diagnostics procedure. All *P* values ≤.05 were considered to be statistically significant. The Hosmer-Lemeshow test was performed to test the adequation of the model. Statistical analyses were performed by using SAS version 9.1.3 (SAS Institute, Inc, Cary, NC).

RESULTS

Descriptive Analysis

A total of 323 patients were enrolled in the study, with a gender ratio (female:male) of 1.2:1 (168 women, 144 men [11 missing data]). The study included 92 infants (age <2 years), 107 children (age between 2 and 15 years), and 113 adults (age >15 years). Mean diagnostic delay was 62 days, with no significant difference between age groups. Relapse was observed in all age groups and was more frequent in patients aged ≤15 years. Demographic and clinical features are detailed in Table 1. In brief, burrows, nodules, and vesicles were observed in 78.0%, 67.6%, and 43.5% of patients, respectively. Infants (36 of 57 [63%]) were more likely to have nodules than older children and adults, especially in the axillary and back area. Strikingly, facial involvement was found only in patients aged <15 years, with an increased gradient according to age. A history of atopic dermatitis was found mainly in patients aged <15 years.

Univariate Multinomial Logistic Regression

Results of the univariate analysis according to age class are presented in Table 2. Relapse and history of atopic dermatitis were more frequently observed in the age groups <2 years (OR: 2.62 [*P* = .01] and 2.01 [*P* = .05], respectively) and 2 to 15 years (OR: 3.33 [*P* = .01] and 2.10 [*P* = .05]).

Nodules were significantly more common in infants (OR: 2.31; *P* = .0002) and vesicles were significantly more frequent in the age groups <2 years and 2 to 15 years (OR: 2.88 and 1.89, respectively; *P* = .002). With regard to areas involvement, arms and forearms, nipples, and genitals were more frequently involved in adults; the face, ankles and foot, soles, head and neck, and scalp were almost exclusively involved in patients aged ≤15 years.

There was a nonsignificant difference among the 3 groups for the presence of pruritus, burrows, and blisters. There were also no significant differences between groups in the involvement of

hands and wrists, arms and forearms, thigh and groin, back, abdomen, buttocks, and genital area.

Multivariate Multinomial Logistic Regression

When conducting multivariate analysis (Table 3), relapse, presence of nodules, and involvement of soles and scalp were found to be independently associated with the age group <2 years. The involvement of nipples was more frequent in patients aged >15 years. Finally, patients aged 2 to 15 years were found to be more at risk for relapse, with more frequent shared pruritus and involvement of soles and scalp, compared with those aged >15 years.

DISCUSSION

In the present study, we found several clinical signs and localizations of scabies to be independently associated with children compared with adults. Differences between clinical signs of scabies according to age have been long reported,[6] although this is the first study specifically designed to delineate the clinical spectrum of the disease in 3 groups of age. The clinical presentation of scabies has been mainly studied in patients from the developing world in whom clinical features may differ from those observed in patients from Western countries.[7] Indeed, in these countries from the developing world, scabies is often endemic, chronic, and frequently complicated by superinfections that may overlap with and obscure the specific clinical signs of scabies.

However, in the last decades, the prevalence of scabies in Western countries appears to be on the rise, although periodic variations have been observed, with a greatest number of scabies in the pediatric age groups.[2,3,8–10] It is thus important to present clues for the clinical presentation of scabies according to age to avoid delay in diagnosis and to provide a higher chance of the patients

TABLE 2 Univariate Multinomial Logistic Regression of Patients With Confirmed Diagnosis of Scabies According to Age Group

Variable	Age (y)	OR* (95% CI)	*N*	*P*
Gender (men versus women)	>15	1		.032
	2–15	1.38 (0.80–2.35)		
	<2	2.12 (1.21–3.71)	312	
History of atopic dermatitis (yes versus no)	>15	1		.05
	2–15	3.33 (1.24–8.95)		
	<2	2.62 (0.92–7.45)	258	
Relapse (yes versus no)	>15	1		.01
	2–15	2.10 (1.21–3.62)		
	<2	2.01 (1.14–3.56)	306	
Pruritus (yes versus no)	>15	1		.18
	2–15	0.67 (0.15–3.08)		
	<2	0.30 (0.08–1.20)	255	
Family members with itch (yes versus no)	>15	1		.001
	2–15	3.09 (1.67–5.71)		
	<2	1.61 (0.85–3.05)	241	
Burrows (yes versus no)	>15	1		.83
	2–15	1.20 (0.64–2.25)		
	<2	1.14 (0.59–2.18)	323	
Vesicles (yes versus no)	>15	1		.002
	2–15	1.89 (1.09–3.25)		
	<2	2.88 (1.56–5.31)	323	
Blisters (yes versus no)	>15	1		.15
	2–15	2.71 (0.51–14.26)		
	<2	4.72 (0.96–23.29)	323	
Nodules (yes versus no)	>15	1		<.001
	2–15	0.69 (0.40–1.19)		
	<2	2.31 (1.32–4.03)	323	
Hands and wrists (yes versus no)	>15	1		.08
	2–15	1.60 (0.78–3.32)		
	<2	0.70 (0.36–1.35)	323	
Arms and forearms (yes versus no)	>15	1		0.20
	2–15	0.82 (0.46–1.45)		
	<2	0.59 (0.33–1.07)	323	
Ankles and foot (yes versus no)	>15	1		<.001
	2–15	2.44 (1.42–4.17)		
	<2	10.53 (5.42–20.46)	323	
Knees, knee folds, and legs (yes versus no)	>15	1		.01
	2–15	1.63 (0.96–2.79)		
	<2	2.26 (1.29–3.95)	323	
Thigh and groin (yes versus no)	>15	1		.75
	2–15	0.91 (0.54–1.52)		
	<2	1.19 (0.65–1.93)	323	
Armpits (yes versus no)	>15	1		.006
	2–15	1.05 (0.62–1.78)		
	<2	2.26 (1.30–3.94)	323	
Head and neck excluding scalp (yes versus no)	>15	1		.004
	2–15	1.74 (0.91–3.33)		
	<2	3.00 (1.57–5.73)	323	
Scalp (yes versus no)	>15	1		<.001
	2–15	1.83 (0.64–5.21)		
	<2	6.86 (2.68–17.58)	323	
Face (yes versus no)	>15	1		.01
	2–15	>999.999		
	<2	>999.999	323	
Back (yes versus no)	>15	1		.13
	2–15	1.225		
	<2	1.797	323	
Nipples (yes versus no)	>15	1		.001
	2–15	0.30 (0.15–0.60)		
	<2	0.44 (0.22–0.86)	323	
Abdomen (yes versus no)	>15	1		.12
	2–15	1.26 (0.75–2.14)		

TABLE 2 Continued

Variable	Age (y)	OR* (95% CI)	*N*	*P*
	<2	1.83 (1.03–3.24)	323	
Buttocks and genital area (yes versus no)	>15	1		.59
	2–15	0.79 (0.47–1.32)		
	<2	0.79 (0.46–1.36)	323	

OR, odds ratio.

TABLE 3 Multivariate Multinomial Logistic Regression of Patients With Confirmed Diagnosis of Scabies According to Age Group (n = 241)

Variable	Age (y)	OR* (95% CI)	*P*
Relapse (yes versus no)	>15	1	
	2–15	2.45 (1.23–4.88)	.01
	<2	3.26 (1.38–7.71)	
Family members with itch (yes versus no)	>15	1	
	2–15	3.59 (1.78–7.22)	.001
	<2	2.47 (1.04–5.89)	
Nodules (yes versus no)	>15	1	
	2–15	0.87 (0.42–1.78)	.08
	<2	2.07 (0.88–4.87)	
Soles (yes versus no)	>15	1	
	2–15	3.34 (1.32–8.46)	<.001
	<2	20.57 (7.22–58.60)	
Nipples (yes versus no)	>15	1	
	2–15	0.24 (0.1–0.61)	.008
	<2	0.33 (0.10–1.08)	
Scalp (yes versus no)	>15	1	
	2–15	3.15 (0.68–14.64)	<.001
	<2	16.94 (3.70–77.51)	

being treated before they contaminate their relatives.

It is widely believed that burrows represent a pathognomonic sign of scabies, although studies conducted in countries from the developing world have found this sign to be less frequent than expected.[7,11] In our study, in which dermatologists performed a careful clinical examination of the entire body, we confirmed the importance of burrows as a useful sign; we observed it in ~3 of 4 patients regardless of their age. Nodules were also common, although they appeared in different locations according to age; for example, from 40% in adults with a genital preponderance to 60% in infants, especially in axillary and back locations (Fig 1 A and B).

Other anatomic areas have also been incriminated in scabies. In textbooks and clinical reviews, based on limited series and case reports, it is often mentioned that involvement of the palms and soles is particularly common in infants and young children.[12–14] Our study confirmed that palmoplantar lesions were more frequently observed in infants, with sole involvement being more frequent than palm involvement in children and infants. Although rarely mentioned in the literature, the dorsum of the forefoot was also frequently involved in infants and represents an area to assess during physical examination (Fig 1C). Of note, although we did not specifically looked for periungueal involvement in our study, involvement of this area has been observed in infants and children (figure available on request). However, palm involvement was not independently associated with scabies in infants and children. In addition, the involvement of the lower limbs (including foot, ankle, knee, and leg area) revealed an increasing gradient according to age, with infants having more frequently involved lower limbs than children, and children more than adults.

One of the striking findings of our study, with potential recommendation for the treatment of scabies, is the frequent involvement of the head in children and infants. Indeed, we found that scalp involvement (Fig 1D) was independently associated with age. In addition, face involvement (Fig 1E) was only found in children and infants. Another independent factor associated with age of patients is the relapse rate, which was more frequent in children and infants. One hypothesis could be that treatment failure of scabies in children and infants may be linked, at least partly, to poor compliance with scalp topical treatment because of reluctance by parents and physicians to treat the scalp and face in these children. This finding may indicate the need to develop specific educational programs intended for both parents and general practioners that provide clear instructions on how to treat scabies.

It is assumed that generalized pruritus and its nocturnal predominance are major signs of scabies.[15] Moreover, it has also been recognized that pruritus or pruritic eruption shared by family members or contacts is also a good diagnostic criterion for scabies. However, our study found that nearly 20% of infants and children had mainly daytime pruritus and that shared pruritus in family or contact members was only found in one-half of the cases. Pruritus was even absent in ~10% of infants. Therefore, the lack of these characteristics should not refute the diagnosis of scabies, at least in Western countries.

Differential diagnosis of scabies may be challenging, especially in children. In our daily practice, infants or children with scabies may be misdiagnosed as having atopic dermatitis, even when the Williams' criteria are used.[16] Papular urticaria, Langerhans cell histiocytosis, and urticaria pigmentosa should be ruled out because those conditions are

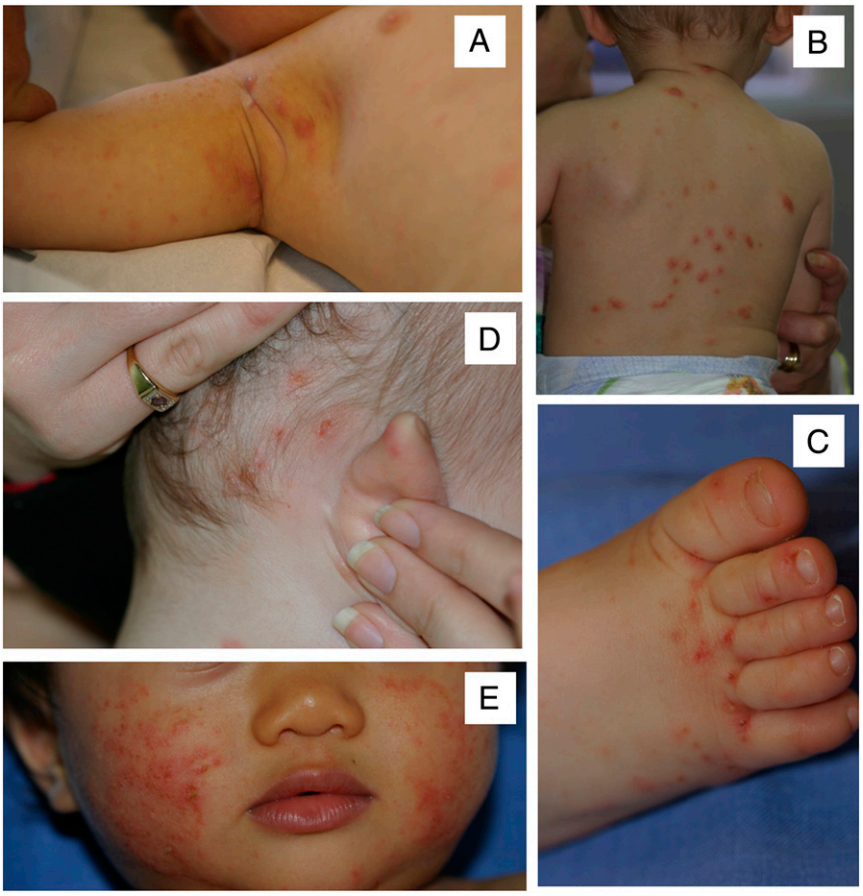

FIGURE 1
Key features of scabies in infants. A and B, Suggestive nodules and papulonodules usually located on the axillary or inguinal folds and back. C, Papulopustules, vesicles, and burrows usually present at the dorsum of the foot. D, Scalp involvement frequently observed in infants. E, Facial eczematous lesions sometimes associated with specific burrows, especially on eyelids.

characterized most often, contrary to scabies, as monomorphous rashes.[17–21] Infantile acropustulosis, which in most cases occur after scabies infestation, may greatly mimic scabies due to the frequent presence of acral vesiculopustular lesions in both conditions.[22,23] Therefore, a careful clinical examination is mandatory, and frequent signs such as burrows (even if only 1), axillary nodules, and involvement of the soles, dorsum forefoot, and scalp should be tracked.

Our study has several strengths, and a few limitations. One of the main strengths is the large number of included cases and their ascertainment. Differential diagnoses were carefully ruled out and the presence of *S scabiei* variety *hominis* was confirmed according to dermoscopy and/or direct examination. Diagnostic confirmation by direct examination was obtained for almost all the patients examined in a hospital setting. In addition, it should be acknowledged that all dermatologists involved in the study were currently using dermoscopy, which has been proven to be useful for the diagnosis of scabies, with a sensitivity and specificity close to those of parasitological examination even in inexperienced users.[5] Another strength was the representation of all age groups, which allowed us to reach sufficient statistical power. We do acknowledge some limitations. The main limitation was the exclusive recruitment from dermatologists, with no participation of pediatricians and general practitioners.

CONCLUSIONS

Scabies in infants and children has specific signs. In that sense, searching for axillary nodules and specific involvement such as scalp, face, soles, and dorsum of the foot should be systematically conducted when suspecting scabies in the pediatric population. In addition, our findings have potential indications for reevaluating counseling for treatment in children and infants. In particular, parents' reluctance for the treatment of scalp and face localization should be taken into account when performing therapy. These findings should prompt further interventional trials specifically dedicated to this age population.

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Dr Boralevi conceptualized and designed the study, contributed to analysis and interpretation of data, drafted the initial manuscript (with Drs Ezzedine, Diallo, and Boursault), and reviewed comments by coauthors; Dr Diallo contributed to the statistical design and analysis plan, conducted data analyses, and participated in the drafting of the manuscript; Drs Miquel and Guerin-Moreau participated in the study design, contributed to acquisition of data, and critically revised the manuscript; Dr Bessis contributed to the study concept, acquisition of data, and interpretation of data, and critically revised the manuscript; Dr Chiavérini made substantive contributions to the conceptualization of the study, contributed to acquisition of data, and critically revised the manuscript; Dr Plantin participated in the conceptualization of the study, contributed to acquisition of data, assisted with interpretation of results, and critically revised the manuscript; Dr Hubiche made substantive contributions to the conceptualization of the study, contributed to acquisition of data, contributed to interpretation of data, and critically revised the manuscript; Dr Maruani contributed to study concept and acquisition of data, and critically revised the manuscript; Dr Lassalle made substantive contributions to the conceptualization of the study, prepared data for analysis, contributed to analysis and data, and critically revised the manuscript; Dr Boursault participated in the study design, prepared data for analysis, contributed to acquisition of data, assisted with interpretation of results, and participated in the drafting and revision of the manuscript; Dr Ezzedine made substantive contributions to the conceptualization of the study, supervised and conducted data analyses, assisted with interpretation of results, drafted the initial manuscript, and reviewed comments by coauthors; and all authors approved the final manuscript as submitted.

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Address correspondence to Franck Boralevi, MD, PhD, Unité de dermatologie pédiatrique, Hôpital Pellegrin-enfants, place Amélie Raba-Léon, F-33076, Bordeaux cedex, France. E-mail: franck.boralevi@chu-bordeaux.fr

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Clinical Phenotype of Scabies by Age

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