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Chapter 2

Skin diseases among schoolchildren in Ghana, Gabon and Rwanda

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Abstract

Background

Skin diseases, especially skin infections, among schoolchildren in Africa, can be a major health problem. The objective of this study was to determine the prevalence of skin diseases among children in rural and urban schools in three different African countries and to study the influence of the socioeconomic level.

Methods

Cross sectional, population based studies were performed in Ghana, Gabon and Rwanda. Point-prevalences of skin diseases were estimated on the basis of physical examination by at least one dermatologist.

Results

In total, 4839 schoolchildren were seen. The overall prevalence of schoolchildren with any skin disease was high; 34.6 % and 42.0 % in two Ghanaian studies, 45.8 % in Gabon and 26.7 % in the Rwanda study. From all children with skin diseases, those with skin infections formed the largest part with percentages of 14.7 % and 17.6 % in the Ghanaian studies, 22.7 % in Rwanda and 27.7 % in Gabon. The highest prevalences were seen for tinea capitis and bacterial skin infections especially in the rural areas and schools with lower socioeconomic level.

Conclusions

The prevalences of skin diseases among African schoolchildren were high with a leading role for skin infections like tinea capitis and pyoderma.

Introduction

Several studies from African countries conducted over the past two decades have reported high prevalences of skin diseases among schoolchildren.¹⁻⁵ These skin diseases can affect the well-being and health conditions of the children.^{6,7} To identify possible strategies for their prevention there is a great need to determine the burden of skin diseases in these communities.¹

The majority of the data on the prevalence of skin diseases in Africa comes from hospital or dispensary-based records and does not necessarily represent the real prevalence of skin diseases within populations.⁸ There are only few population-based studies on this subject.⁸⁻¹² The prevalence of one or more skin diseases among schoolchildren in Africa ranges between 35% and 80%.^{5,9,11} The majority of the skin diseases found among schoolchildren are dominated by infections such as fungal infections and pyoderma.^{5,10,13-15} Elsewhere in the world similar patterns have been observed among schoolchildren in poor socioeconomic circumstances.¹⁶⁻¹⁹ In industrialized countries, however, several hospital and population-based studies among schoolchildren showed much lower point-prevalences of fungal and other skin infections while the highest burden of skin diseases in these countries was formed by acne vulgaris and atopic dermatitis.²⁰⁻²³

The objective of this study was to determine the point-prevalences and the current spectrum of skin diseases among schoolchildren in rural and urban schools in three different African countries and to study the influence of the socioeconomic level (SEL).

Materials and Methods

Four cross-sectional studies with 4839 schoolchildren were conducted between 2004 and 2007. Specifically, these were carried out in Ghana (2004 and 2007), Gabon (2005) and Rwanda (2007). Details of the studies are presented in Table 1 and examples of some skin diseases are shown in Figure 1.

Ethical approval for the studies in Ghana was granted by the Institutional Review Board of the Noguchi Memorial Institute for Medical Research. The ethical approval number was CPN015 / 02-03. The study in Gabon was conducted with approval of the management of the Medical Research Unit of the Albert Schweitzer Hospital. In Rwanda the study was conducted in cooperation with a prevalence study of vernal keratoconjunctivitis in Rwandan schoolchildren and its association with atopy and parasitic infestation. Ethical approval was granted by the Rwandan National Ethics Committee.

The difference between skin diseases and skin disorders is not clear in the literature and is often subjective since both terms are used independently but are also often used in combination.^{3,9,11,13,19} We defined skin diseases as an impairment of health or a condition of abnormal functioning of the skin, with fungal and bacterial skin infections, eczema

Table 1 Characteristics of the studies and baseline characteristics of the children in the different countries.*

	GHANA 2004	GHANA 2007	GABON	RWANDA
Region	Greater Accra Region: Accra Metropolitan Area and Ga West District	Greater Accra Region: Accra Metropolitan Area , Dangme East District and Ga East District	Albert Schweitzer Hospital which is located about 6 km from the city center of Lambaréné the capital of the Moyen-Ogooué province	Muhanga (Gitarama and Saki), Bugesera (Gicaca) and Kicuciro (Gicondo, Kigali)
Number of schools				
- Rural public (low SEL**)	2	6	1	3
- Urban public (low SEL)	1	3	1	3
- Urban private (middle SEL)	0	1	0	0
- Urban private (high SEL)	1	1	0	0
Part of these studies	Association of helminth infection with allergic sensitization and atopic eczema among schoolchildren. In cooperation with the department of Parasitology, Leiden University Medical Center.	EU project GLOFAL "Global view of food allergy: opportunities to study the influence of microbial exposure". In cooperation with the department of Parasitology, Leiden University Medical Center.	Association of helminth infection with allergic sensitization and atopic eczema among schoolchildren. In cooperation with the department of Parasitology, Leiden University Medical Center.	Prevalence of vernal keratoconjunctivitis in Rwandan schoolchildren and its association with atopy and parasitic infestation. In cooperation with the department of ophthalmology, Medical University Gent.
Number of children	463	1394	454	2528
Age distribution				
4-8	128 (27.6)	299 (21.4)	197 (43.4)	327 (12.9)***
9-12	275 (59.4)	804 (57.7)	188 (41.4)	1494 (59.1)
13-16	36 (7.8)	282 (20.2)	68 (15.0)	707 (28.0)
17-20	0	9 (0.6)	1 (0.2)	0
unknown	24 (5.2)	0	0	0
Sex				
Girls	201 (43.3)	734 (52.7)	227 (50.0)	1296 (51.3)
Boys	262 (56.6)	660 (47.3)	227 (50.0)	1224 (48.4)
Unknown	0	0	0	8 (0.3)
Characteristics of the schools				
Rural public (low SEL**)	226 (48.8)	753 (54.0)	209 (46.0)	1455 (57.6)
Urban public (low SEL)	125 (27.0)	214 (15.4)	245 (54.0)	1073 (42.4)
Urban private (middle SEL)	0	356 (25.5)	0	0
Urban private (high SEL)	112 (24.2)	71 (5.1)	0	0
Physical examination by dermatologist	A.A.H., J.N.B.B., A.P.M.L	A.A.H., A.P.M.L.	A.A.H., A.P.M.L.	A.A.H.

* The contents of this table have been published before.²⁷

** SEL: socioeconomic level.

***In Rwanda the youngest child was 8 years old.

Figure 1 Examples of children with dermatomycosis (a); tinea capitis (b); impetigo (c); eczema (d and e); and pityriasis rosea (f).



and psoriasis as the most important examples. In our study we considered skin disorders as skin diseases. Examples of skin disorders are acne vulgaris, benign nevi, freckles, hyperpigmentation, etc. Skin conditions were defined as symptoms or characteristics of the skin that were not considered as skin diseases or skin disorders. Examples of skin conditions are dry skin, keratosis pilaris, etc. All skin diseases found were subdivided into the following four categories: 1) skin infections (mycotic, bacterial, viral and parasitic), 2) inflammatory skin diseases, 3) benign skin tumors and nevi and 4) miscellaneous skin diseases. Skin conditions were categorized into a 5th category. The specific skin diseases and skin conditions which belong to these five categories are depicted in Table 2.

The presence of skin diseases and skin conditions was determined in all four studies by physical examination of all children by the same dermatologist (AAH) who was assisted by APML in both Ghanaian studies and Gabon and also by JNBB in the first Ghanaian study. The children were seen during a site-visit at school where the whole skin was inspected. The examination took place in a special room where privacy for each individual child was guaranteed. The skin findings were notified on a special intake form and in case of the presence of a skin disease photographs were taken of which some are shown in figure 1. The skin of each child was specifically examined for tinea capitis, pyoderma, inflammatory acne vulgaris, and eczema.^{24,26} The reason to separate skin diseases and skin conditions as different entities is the possibility to compare the found prevalences of skin diseases with results of other epidemiological studies. In most epidemiological studies skin condition as depicted in category 5 are not evaluated and they increase overall prevalence rates. For the diagnosis of tinea capitis we looked for scaling on the scalp, hair loss, black dots, pustules and scars. We did not test for minimal infection, termed carrier state, i.e. we did not collect samples from all children. We, therefore, may have missed some children with asymptomatic dermatophyte scalp carriage so that the real prevalence of tinea capitis may even be higher.^{24,26} Our clinical skills to diagnose tinea capitis were validated in the first Ghanaian study and in Gabon by direct microscopic examination and culture in the mycology laboratory of the department of Dermatology of the Leiden University Medical Centre (Leiden, the Netherlands).^{10,24,26} The agreement between the clinical diagnosis and the results of microscopic examination as well as culture was high. In Ghana 31 (79.5%) of the 39 clinically suspected tinea capitis and in Gabon 74 (70.5%) of the 105 clinically suspected tinea capitis could be confirmed by KOH or culture.^{24,26} We therefore did not collect hairs and skin scrapings in the Ghana 2007 study as well as in the Rwanda study and relied on our clinical diagnosis. In the current study, we only present the data of the clinical diagnosis of tinea capitis.

The diagnosis of pyoderma was used to describe any variant of superficial bacterial skin infection like impetigo, ecthyma, folliculitis, furuncle or tropical ulcer.⁵ The Ghana 2004 study was performed in an area endemic for Buruli ulcer. The diagnosis of Buruli ulcer was made on clinical grounds and this disease was not seen in Gabon and Rwanda.

Table 2 Point-prevalences of skin diseases and skin conditions in African schoolchildren.

	Ghana 2004 N (%)	Ghana 2007 N (%)	Gabon 2005 N (%)	Rwanda 2007 N (%)
Number of children	463	1394	454	2528
One or more skin diseases (1-4)	160 (34.6)	585 (42.0)	208 (45.8)	675 (26.7)
One or more skin diseases and skin conditions total (1-5)	206 (44.5)	642 (46.1)	220 (48.5)	736 (29.1)
1. One or more skin infections total	68 (14.7)	245 (17.6)	125 (27.7)	575 (22.7)
One or more mycotic infections	43 (9.3)	150 (10.8)	117 (25.8)	525 (20.8)
Tinea capitis	39 (8.4)	121 (8.7)	105 (23.1)	522 (20.6)
Tinea other	4 (0.9)	8 (0.6)	12 (2.6)	3 (0.1)
Pityriasis versicolor	0 (0)	23 (1.6)	0 (0)	4 (0.2)
One or more bacterial infections	28 (6.0)	95 (6.8)	8 (1.8)	33 (1.3)
Pyoderma	20 (4.3)	81 (5.8)	7 (1.5)	32 (1.3)
Leg ulcers	1 (0.2)	11 (0.8)	2 (0.4)	0 (0)
Buruli ulcer	7 (1.5)	1 (0.1)	0 (0)	0 (0)
Rest bacterial	0 (0)	6 (0.4)	0 (0)	1 (0)
One or more viral infections	4 (0.9)	10 (0.7)	6 (1.3)	25 (1.0)
Verrucae	3 (0.6)	4 (0.3)	5 (1.1)	11 (0.4)
Mollusca contagiosa	1 (0.2)	0 (0)	0 (0)	9 (0.4)
Herpes simplex	0 (0)	6 (0.4)	1 (0.2)	1 (0.04)
Varicella	0 (0)	0 (0)	0 (0)	4 (0.2)
One or more parasitic infections	0 (0)	1 (0.1)	0 (0.7)	1 (0.04)
Scabies	0 (0)	1 (0.1)	3 (0.7)	1 (0.04)
2. One or more inflammatory skin diseases total	38 (8.2)	148 (10.6)	51 (11.2)	109 (4.3)
Acne vulgaris	15 (3.2)	66 (4.7)	5 (1.1)	33 (1.3)
Eczema	7 (1.5)	22 (1.6)	18 (4.0)	20 (0.8)
Seborrheic dermatitis	4 (0.9)	4 (0.3)	11 (2.4)	4 (0.2)
Prurigo simplex	9 (1.9)	52 (3.7)	17 (3.7)	52 (2.1)
Lichen simplex	1 (0.2)	4 (0.3)	2 (0.4)	0 (0)
Orthoergic eczema	0 (0)	2 (0.1)	0 (0)	0 (0)
Lichen planus	0 (0)	1 (0.1)	0 (0)	1 (0.04)
Psoriasis vulgaris	0 (0)	0 (0)	1 (0.2)	0 (0)
Pityriasis rosea	1 (0.2)	0 (0)	0 (0)	1 (0.04)
Alopecia areata	0 (0)	1 (0.1)	0 (0)	0 (0)
Granuloma annulare	1 (0.2)	0 (0)	0 (0)	0(0)

Table 2 Continued.

	Ghana 2004 N (%)	Ghana 2007 N (%)	Gabon 2005 N (%)	Rwanda 2007 N (%)
3. One or more benign skin tumors and nevi total	4 (0.9)	61 (4.4)	2 (0.4)	3 (0.1)
Normal nevi	0 (0)	51 (3.7)	0 (0)	0 (0)
Sebacous nevus	0 (0)	1 (0.1)	0 (0)	0 (0)
Epidermal nevus	1 (0.2)	2 (0.1)	1 (0.2)	1 (0.04)
Café au lait macula	1 (0.2)	6 (0.4)	0 (0)	0 (0)
Depigmented nevus	2 (0.4)	0 (0)	0 (0)	0 (0)
Congenital nevus	0 (0)	0 (0)	0 (0)	1 (0.04)
Syringomata	0 (0)	1 (0.1)	0 (0)	0 (0)
Lipoma	0(0)	0 (0)	1 (0.2)	0 (0)
Granuloma pyogenicum	0 (0)	0 (0)	0 (0)	1 (0.04)
4. One or more miscellaneous skin diseases total	78 (16.8)	225 (16.1)	63 (13.9)	3 (0.1)
Traction alopecia	0 (0)	3 (0.2)	0 (0)	0 (0)
Miliaria/ heat rash	3 (0.6)	72 (5.2)	19 (4.2)	0 (0)
Papular urticaria	10 (2.2)	16 (1.1)	7 (1.5)	2 (0.1)
Scars	56 (12.1)	98 (7.0)	34 (7.5)	0 (0)
Keloids	3 (0.6)	12 (0.9)	0 (0)	0 (0)
Ulcers	0 (0)	1 (0.1)	0 (0)	0 (0)
Wounds	0 (0)	2 (0.1)	1 (0.2)	0 (0)
Striae	2 (0.4)	0 (0)	0(0)	0(0)
Albinism	0 (0)	2 (0.2)	0 (0)	0 (0)
Orange hair	0 (0)	1 (0.1)	0 (0)	0 (0)
Vitiligo	0 (0)	1 (0.1)	0(0)	0 (0)
Hyperpigmentation	0 (0)	6 (0.4)	3 (0.7)	1 (0.04)
Freckles	1 (0.2)	0 (0)	0 (0)	0 (0)
Varix	0 (0)	3 (0.2)	0 (0)	0 (0)
Nail problems	1 (0.2)	3 (0.2)	0 (0)	0 (0)
Acanthosis nigricans	0 (0)	3 (0.2)	0 (0)	0 (0)
Neurofibromatosis	1 (0.2)	0 (0)	0 (0)	0 (0)
Ichthyosis	2 (0.4)	2 (0.1)	0 (0)	0 (0)
Dysmorph syndrome	0 (0)	4 (0.3)	0 (0)	0 (0)
5. One or more skin conditions total	83 (17.9)	110 (7.9)	35 (7.7)	85 (3.4)
Xerosis cutis	75 (16.2)	40 (2.9)	33 (7.3)	14 (0.6)
Keratosis pilaris	7 (1.5)	43 (3.1)	2 (0.4)	75 (3.0)
Pityriasis alba	1 (0.2)	1 (0.1)	0 (0)	0 (0)
Dyshidrosis lamellosis sicca	0 (0)	26 (1.9)	0 (0)	0 (0)
Fissure	0 (0)	0 (0)	1 (0.2)	0 (0)
Hyperkeratosis	2 (0.4)	1 (0.1)	0 (0)	1 (0.04)

Cases of scabies were confirmed by direct microscopic examination with 20% potassium hydroxide (KOH) solution.

The diagnosis of inflammatory acne was defined by the presence of at least six pustules or papulopustules on the face.²⁵ The diagnosis of eczema was determined by the clinical diagnosis by a dermatologist.²⁷ Very dry skin among the children was diagnosed as xerosis cutis, a skin condition characterized by a dull color, rough texture and an elevated number of ridges.²⁸

In Ghana, the rural and urban areas were selected according to the guidelines of the Ghana Statistical Service. The urban schools were all located in the Accra Metropolitan Area while the rural target areas were all settlements some distance from this area with low population densities and where the main income generating activities revolved around agriculture (fishing or farming). In Rwanda and Gabon the urban schools were located in the middle of the capital city or one of the major towns of the country, close to main roads while rural schools were situated in villages some distance from the main road with lower population densities than the urban areas.

Schools were selected for recruitment based on a broad social economic classification. This broad social economic classification reflects the average socioeconomic level (SEL), respectively low, middle and high. Schools located in these urban or rural areas were randomly selected from the district school lists, using a random digit generator sheet and according to probability proportional to size. Urban middle/high SEL schools were private fee-paying schools while urban low schools and rural schools were public, government-run schools where no school fees were paid.

Categorical data were analyzed for statistical differences by chi-square test. Point prevalences were estimated by calculating the proportions of children with skin diseases compared to the total groups of children with 95% confidence intervals. For the statistical analyses, we used SPSS for Windows version 17.0 (SPSS Inc, Chicago, IL, USA) and software which is freely available on the internet (http://www.dimensionresearch.com/resources/calculators/conf_prop.html).

Results

The characteristics of the studies and the baseline characteristics of the children in the different countries are presented in Table 1 and have been previously published.²⁷ In the two Ghanaian studies out of 15 schools screened 8 were rural schools, 4 were urban public schools and 3 were schools with middle to high SEL. In Gabon and in Rwanda only schools with a low SEL were screened, equally divided between rural and urban. Most children were between 4 and 16 years old and boys and girls were equally distributed (Table 1).

The point-prevalences of skin diseases and skin conditions among the schoolchildren are presented in Table 2. The prevalences of children with one or more skin diseases (category 1-4) were high; 34.6% and 42% in the Ghanaian studies, 45.8% in Gabon and 26.7% in the Rwanda study.

Skin infections formed the largest group of all skin diseases with percentages of 14.7% and 17.6% in the Ghanaian studies, 27.7% in Gabon and 22.7% in Rwanda which corresponds with percentages of 42.5%, 41.9%, 60.1% and 85.2% relative to all skin diseases in the four studies respectively. Within the group of skin infections, the highest prevalences were seen for tinea capitis (8.4% in the Ghana 2004 study, 8.7% in the Ghana 2007 study, 20.6% in the Rwanda study and 23.1% in the Gabon study).

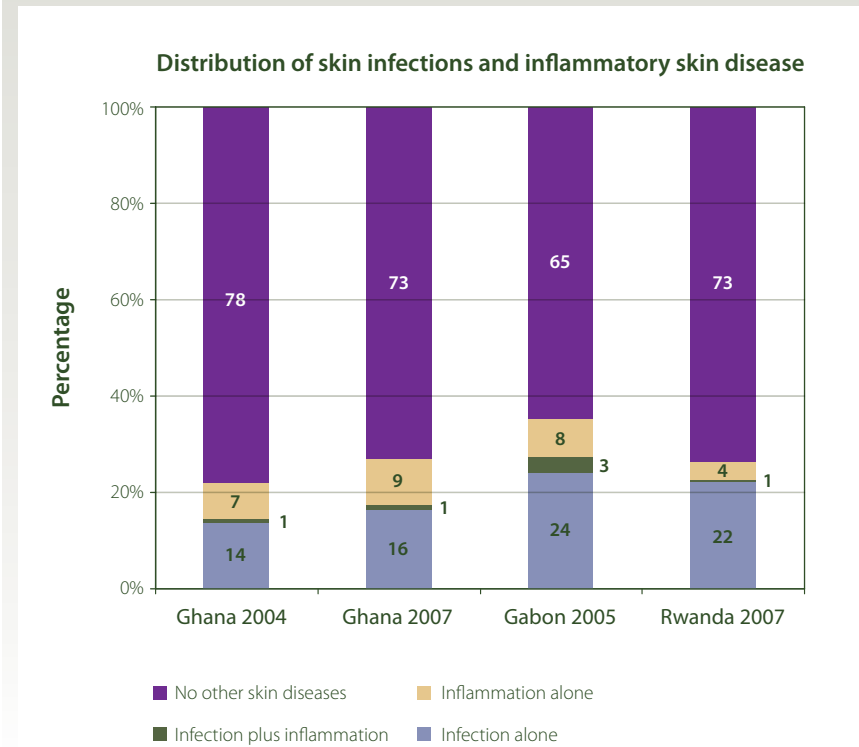
Relatively high prevalences were also found for bacterial skin infections with prevalences ranging between 1.3% in the Rwanda study and 6.8% in the Ghana 2007 study. The prevalences found for scabies and viral infections like verrucae vulgaris and mollusca contagiosa were very low. Buruli ulcer was only found in Ghana.

The point-prevalences of eczema ranged between 0.8% in Rwanda and 4.0% in Gabon and have been published before.²⁷ Acne vulgaris showed prevalences of 3.2 % and 4.7% in the studies performed in Ghana while these percentages were lower with 1.1% in Gabon and 1.3% in Rwanda. The prevalences of other inflammatory skin diseases like lichen planus, psoriasis and CDLE were low in our study.^{20;21;23;29}

Heat rash (miliaria) was most frequently seen in the Ghana 2007 and Gabon studies with percentages of 5.2% and 4.2%. With regards to skin conditions (Table 2, category 5) our studies showed much higher prevalences of xerosis cutis in Ghana 2004 and Gabon compared with Ghana 2007 and Rwanda.

In other studies skin infections and inflammatory skin diseases are the most prevalent and also have the most impact on the children's health and, therefore, we present these categories separately in figure 2 to allow a better comparison with other past and future studies. The combined prevalences of infectious and inflammatory skin diseases (category 1 and 2) were 22% in the Ghana 2004, 26% in the Ghana 2007, 35 % in the Gabon and 27% in the Rwanda study.

The prevalences of the 8 most frequent skin diseases and skin conditions are presented separately for the urban and rural schools in Table 3. In all 4 studies the prevalences of tinea capitis were higher in the rural schools (Table 3). The same pattern was seen for pyoderma with higher prevalences in the rural school with the exception of the Gabon study where a higher prevalence of pyoderma was found in the urban school (Table 3). Acne vulgaris was more frequently seen in the urban schools (Table 3). Especially in the Ghana 2007 study there was an important difference between the urban and rural schools (10.1% versus 0.1%) because in this study two urban schools with a higher/middle SEL were included where acne vulgaris was more prevalent.²⁵ Prurigo simplex and xerosis cutis were most frequently seen in the rural areas (Table 3).

Figure 2 The distribution of skin infections and inflammatory skin diseases.

In Table 4 the differences in prevalences of the 8 most frequent skin diseases and skin conditions are shown according to the SEL. Because the schools in Gabon and Rwanda were all of low SEL, only the Ghana studies are shown. In the schools with a low SEL tinea capitis was seen much more frequently (with percentages of 10.8% and 10.3%), compared to the prevalences in schools with a middle/high SEL (with prevalences of 0.9% and 4.9%). Considerable differences were also seen for pyoderma where we saw the same pattern; high prevalences of 5.1% and 7.0% in schools with a low SEL and lower prevalences of 1.8% and 3.0% in schools with a middle/high SEL. Among schoolchildren with a middle/high SEL the prevalences of acne vulgaris and eczema were significantly higher comparing the schoolchildren with a low SEL as has been published before.^{25,27} Other significant differences were seen for xerosis cutis. Higher prevalence rates were found among schoolchildren with a low SEL (19.7% and 4%) compared with schoolchildren with a middle/high SEL (5.4% and 0.2%).

Table 3 Prevalences of the most common skin diseases and skin conditions in rural and urban schools.*

	GHANA 2004		GHANA 2007		GABON		RWANDA	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Urban / Rural N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)
Total 463	Total 1394	Total 454	Total 2528					
Number of children	237	226	641	753	245	209	1073	1455
Tinea capitis	9 (3.8)	30 (13.3)	42 (6.6)	79 (10.5)	50 (20.4)	55 (26.3)	204 (19.0)	318 (21.9)
	(1.4;6.2)	(2.7;8.8)	(4.7;8.5)	(8.3;12.7)	(15.4;25.5)	(20.4;32.3)	(16.7;21.4)	((19.7;24.0)
Pyoderma	10 (4.2)	10 (4.4)	21 (3.3)	60 (8.0)	4 (1.6)	3 (1.4)	11 (1.0)	21 (1.4)
	(1.7;6.8)	(1.7;7.1)	(1.9;4.7)	(6.0;9.9)	(0.1;3.2)	(0.0;3.1)	(0.4;1.6)	(0.8;2.1)
Acne vulgaris	7 (3.0)	8 (3.5)	65 (10.1)	1 (0.1)	3 (1.2)	2 (1.0)	18 (1.7)	15 (1.0)
	(0.8;5.1)	(1.1;6.0)	(7.8;12.5)	(0.0;0.4)	(0.0;2.6)	(0.0;2.3)	(0.9;2.5)	(0.5;1.6)
Eczema	5 (2.1)	2 (0.9)	12 (1.9)	10 (1.3)	6 (2.4)	12 (5.7)	10 (0.9)	10 (0.7)
	(0.3;3.9)	(0.0;2.1)	(0.8;2.9)	(0.5;2.2)	(0.5;4.4)	(2.6;8.9)	(0.4;1.5)	(0.3;1.1)
Prurigo simplex	0 (0)	9 (4.0)	16 (2.5)	36 (4.8)	1 (0.4)	16 (7.7)	12 (1.1)	40 (2.7)
		(1.4;6.5)	(1.3;3.7)	(3.3;6.3)	(0.0;1.2)	(4.1;11.3)	(0.5;1.8)	(1.9;3.6)
Papular urticaria	4 (1.7)	6 (2.7)	7 (1.1)	9 (1.2)	6 (2.4)	10 (5)	1 (0.1)	1 (0.1)
	(0.1;3.3)	(0.6;4.8)	(0.3;1.9)	(0.4;2.0)	(0.5;4.4)	(0.0;1.4)	(0.0;0.3)	(0.0;0.2)
Xerosis cutis	27 (11.4)	48 (21.2)	2 (0.3)	38 (5.0)	5 (2.0)	28 (13.4)	3 (0.3)	11 (0.8)
	(7.4;15.4)	(15.9;26.6)	(0.0;0.7)	(3.5;6.6)	(0.3;3.8)	(8.8;18.0)	(0.0;0.6)	(0.3;1.2)
Keratosis pilaris	3 (1.3)	4 (1.8)	27 (4.2)	16 (2.1)	1 (0.4)	1 (0.5)	31 (2.9)	44 (3.0)
	(0.0;2.7)	(0.1;3.5)	(2.7;5.7)	(1.1;3.2)	(0.0;1.2)	(0.0;1.4)	(1.9;3.9)	(2.1;3.9)

*Italic is statistically significant

Table 4 Differences in prevalences of the most common skin diseases and conditions between low and middle/high SEL in Ghana.

	GHANA 2004 n/N (%) (95%CI) Total 463		GHANA 2007 n/N (%) (95%CI) Total 1394	
Socioeconomic (SEL)	Low N (%)	Middle/High N (%)	Low N (%)	Middle/High N (%)
Number of children	351	112	967	427
Tinea capitis	38 (10.8) (7.6;14.1)*	1(0.9) (0.9;2.6)*	100 (10.3) (8.4;12.3)*	21 (4.9) (2.9;7.0)*
Pyoderma	18 (5.1) (2.8;7.4)	2 (1.8) (0.7;4.2)	68 (7.0) (5.4;8.6)*	13 (3.0) (1.4;4.7)*
Acne vulgaris	11 (3.1) (1.3;5)	4 (3.6) (0.1;7.0)	19 (2.0) (1.1;2.8)*	47 (11.0) (8.0;14.0)*
Eczema	2 (0.6) (0.2;1.4)	5 (4.5) (0.6;8.3)	12 (1.2) (0.5;1.9)	10 (2.3)(0.9;3.8)
Prurigo simplex	9 (2.6) (0.9;4.2)	0 (0.0)	38 (3.9) (2.7;5.2)	14 (3.3) (1.6;5.0)
Papular urticaria	6 (1.7) (0.4;3.1)	4 (3.6) (0.1;7.0)	10 (1.0) (0.4;1.7)	6 (1.4) (0.3;2.5)
Xerosis cutis	69 (19.7) (15.5;23.8)*	6 (5.4) (1.2;9.5)*	39 (4.0) (2.8;5.3)*	1 (0.2) (0.0;0.7)*
Keratosis pilaris	5 (1.4) (0.2;2.7)	2 (1.8) (0.7;4.2)	26 (2.7) (1.7;3.7)	17 (4.0) (2.1;5.8)

*Italic is statistically significant

Discussion

The prevalences of skin diseases among schoolchildren in Ghana, Gabon and Rwanda varied between 27% and 46%. Focusing on only skin infections and inflammatory skin diseases these prevalences were 22% and 27% in the two Ghanaian studies and 35% in Gabon and 27% in Rwanda, respectively.

Of all skin diseases, skin infections were the most prominent cause which confirms earlier studies in African children.^{5;9-11} Factors such as overcrowding, malnutrition and climatic conditions such as heat and humidity can lead to an increase in fungal and bacterial infections in tropical and semi-tropical countries.^{3;4;9;12;30}

Tinea capitis was the most prevalent skin infection in all four studies. With a prevalence of 9% the Ghana 2007 study matched the prevalence of 8% found in the Ghana 2004 study.²⁴ The higher prevalence of 21% in the Rwanda study resembled the prevalence of 26% found in the Gabon study.²⁶ The difference between the prevalences in the Gabon and Rwanda study and both Ghanaian studies is remarkable. One of the reasons for this

difference may be that both Ghanaian studies also included schools with a high or middle SEL where the prevalences of tinea capitis were much lower. Additionally, in most schoolchildren in Ghana the scalps were shaven, reducing the contagiousness, while in Gabon and Rwanda girls wore longer hairstyles. The Ghana Education Service requires that boys and girls in basic and secondary public schools cut their hair very short. It seems that this rule is actually beneficial.³¹ However there is also evidence that in some cases the use from a common source (e.g. haircutting or barber) and the cutting of the hair itself may introduce an infection. In all four studies tinea capitis was more prominent in rural areas and in schools with a low SEL, but the differences in Gabon and Rwanda were much smaller. This may be explained by the fact that the differences between rural and urban areas in Rwanda and Gabon were less pronounced than those in Ghana and the fact that only schools with a lower SEL were studied in these countries. Tinea capitis is highly contagious especially at family level. A low SEL and consequent overcrowding appears to be a major risk factor for tinea capitis.^{5;9;11;16} Although the clinical appearance is variable, late detection and lack of treatment of this disease can result in widespread infections and, in rare cases, permanent alopecia.³² Tinea capitis is spread worldwide and a major public health concern.³³

With prevalences of 4% and 6% in Ghana and 2% and 1% in Gabon and Rwanda, pyoderma was the second highest cause of skin infection in our study. The climate in Rwanda is much cooler and the humidity lower which can explain the lower prevalence of bacterial skin infections in this country compared with Ghana. For the lower prevalence of bacterial skin infections in Gabon we do not have a good explanation. Other point-prevalence studies among schoolchildren in Ethiopia, Mali and 2 studies in Tanzania showed prevalences of pyoderma comparable with our Ghana studies, while another study from Kenya showed a higher prevalence of 12.7%.^{8;10;13;34;35} In the study from Kenya the prevalence of bacterial infections was even slightly higher than fungal infections.³⁵

The low prevalence of scabies in our study is remarkable but not exceptional. Prevalence rates ranging from 0.7% to 30.4% in other studies document considerable regional differences, probably due to differences in socioeconomic situations in the various countries.^{11;34-37} In some studies high prevalences of parasitic infestations like scabies are seen.^{9-11;13;38} Despite thorough inspection of the scalp we didn't find any case of pediculosis capitis. Although this disease is endemic among Caucasian children in Europe and Northern America, it was not observed in studies from west Africa, maybe due to the different hair type.^{11;34;39;40} However in studies from east Africa and especially Ethiopia prevalences ranging from 3.6 % to 57.1% are mentioned.^{8;9;41}

The prevalence of mollusca contagiosa was low; most probably because most children who were examined were above the age of 8 years (see Table 1). The low prevalence rate found for verrucae vulgaris was comparable with most other community based studies among schoolchildren in sub Sahara Africa.^{9;10;13;35}

With the exception of the Buruli ulcer in Ghana, like in other studies, the classical tropical diseases such as leprosy or filarial lymph edema were not found among schoolchildren in this study. The exotic aspect of tropical dermatology seems to be over-emphasized in the literature.^{5,13,34,35}

The prevalences of acne vulgaris and eczema were higher in the urban areas and in both Ghanaian studies especially in the schools with a middle/high SES, but were still lower in comparison with industrialized countries.^{25,42} With the arrival of urbanization and westernization in developing countries, it is believed that the prevalence of acne vulgaris and eczema will increase to the level of industrialized countries.

The prevalence of heat rash (miliaria) was higher in the Ghana 2007 and Gabon studies which could be explained by differences in temperature and humidity in the different countries and in different time periods. The Ghana 2007 study was performed in March which is normally the end of the dry season with high temperatures. The Ghana 2004 study was performed in June which is in the rainy season when the temperatures are somewhat lower. Gabon has a typical tropical climate with high temperatures and high humidity. However Gabon also has a dry and wet season similar to Ghana. The temperature and humidity in the mountainous Rwanda are much lower.

In the four studies xerosis cutis was seen most frequently in the rural areas with the highest prevalences in the Ghana 2004 and the Gabon study. The etiology of xerosis cutis is multifactorial. The role of the barrier function of the stratum corneum is important. When the barrier is impaired the skin will be dry because of trans-epidermal water loss and will be more vulnerable for both infectious and inflammatory skin diseases.^{43,44} Frequent washing with soap is considered to be a healthy exercise in Ghana and can damage the barrier function of the skin. Despite the advice to use less soap, children often continue their habits, also due to the hot, humid climate and the subsequent sweating which may lead to dry skin.⁴² Differences between temperature and humidity could partly explain the different prevalences of xerosis cutis in the four studies. Prurigo simplex, like xerosis cutis, had the highest prevalences in the rural areas suggesting a relationship between these two conditions. It is plausible that xerosis cutis could lead to prurigo simplex.

The strength of our study is that we studied large numbers of schoolchildren in three different countries and that all children were seen by a dermatologist or a team of dermatologists. A limitation of our study is that when one measures a point-prevalence there is always a chance of underestimation especially in diseases with a chronic relapsing course.

While there are certainly some advantages by differentiating skin diseases from skin conditions, this may also lead to some difficulties and limitations. The main problem is that most investigators in the past did not make this difference so that their data cannot be directly compared with the data of the current study. On the other hand, future investigators could use the definitions used in the current study as a guidance to design

their new study, so that more precise prevalence data of the different skin diseases and skin conditions could be obtained.

Most skin diseases found in our and other studies from developing countries were not life threatening and could easily be treated.^{8,35,45-47} However, they can potentially harm the skin, the health and well-being of children affected. Skin diseases are often not considered of high priority as was concluded in a recent WHO discussion paper.⁵ The occurrence of skin diseases does not only depend on improved treatment schemes within the health system but also on improvement of socioeconomic conditions.^{45,48} In addition to the need to improve the quality and availability of skin disease treatment in Africa, there is also a great need to determine the burden of skin diseases in communities and to identify possible strategies for their prevention.¹

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