WHO/FCH/CAH/05.12

Epidemiology and Management of Common Skin Diseases in Children in Developing Countries

World Health Organization

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Acknowledgements

WHO/CAH thanks Dr Antoine Mahé, MD, PhD, Libreville, Gabon, for undertaking this review, and Dr Rod J Hay, DM, FRCP, Queens University, Belfast, Northern Ireland, United Kingdom, for contributing to it.

WHO/CAH is grateful to Drs Jonathan Carapetis, Gary Darmstadt, Carolyn MacLennan, Manuel Melis de la Vega, David Osrin and Neil Prose for reviewing the draft manuscript and providing valuable comments, and to Dr Ali Hussein for editing it.

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Executive Summary

Despite the high frequency of certain skin diseases in developing countries, they have so far not been regarded as a significant health problem in the development of public health strategies. This review: 1) provides comprehensive data on the epidemiology of the commonest skin disorders in a developing country environment, 2) documents their health importance, 3) describes measures that could be used to control them, and 4) permits a rational consideration of the problem. The study was performed with a view to future integration of matters relating to skin diseases in children with IMCI programmes (Integrated Management of Childhood Illness).

Methodology

The medical literature – since 1970 – of common skin diseases in children (and adults, when judged necessary) in developing countries was extensively and critically reviewed. The diseases were mainly pyoderma, ectoparasitoses, superficial mycoses, viral disorders, and dermatitis; unpublished data were included when relevant.

Epidemiology

A total of 18 prevalence studies of the general population in developing countries (10 in sub-Saharan Africa) can be considered representative of large geographical areas; of these, 13 provided data specific to children, 17 to rural areas, and 4 to urban areas. All reported high prevalence figures for skin diseases (21-87%), the following disorders being the commonest in children: pyoderma (prevalence range 0.2-35%, 6.9-35% in sub-Saharan Africa), tinea capitis (1-19.7%), scabies (0.2-24%, 1.3-17% in sub-Saharan Africa), viral skin disorders (0.4-9%, mainly molluscum contagiosum), pediculosis capitis (0-57%), dermatitis (0-5%), and reactions due to insect bites (0-7.2%). Children present a higher prevalence rate than adults for pyoderma (especially those under 5 years), certain mycoses (tinea capitis), and, to a lesser extent, scabies. In addition, there have been reports of a particularly high prevalence of pyoderma and/or scabies in more limited settings, or in particular communities (e.g., Aboriginal communities from Pacific).

Incidence data in the general population are scarce, those that are available varying considerably from one place to another for pyoderma (e.g. 10.7% by year to 1.57 per 100 person-weeks in children), and for scabies. Data from five areas suggest that skin disorders commonly represent one of the main organ-specific reasons for visiting a primary healthcare centre, the ratio of visits due to skin problems being in the range 6-23.7% (the highest rates in children); in such centres, the main disorders appear to be pyoderma and scabies, while diseases lacking a specific diagnosis are also common. The cost of skin diseases has been estimated on few occasions only, but was found significant in the two areas where evaluated. Community-based data from three areas indicated that certain disorders (mainly scabies and pyoderma) were more likely to result in a request for treatment than other skin diseases (tinea capitis, viral disorders, pediculosis capitis).

Data from 18 available bacteriological studies suggest that group A streptococci remain the main etiological agent of pyoderma (either primary or secondary to scabies) in many tropical developing countries, followed by *Staphylococcus aureus*. The prognosis of pyoderma appears overall to be good, with a global risk for post-streptococcal glomerulonephritis estimated to be largely under 1% in many areas. Lethality related to pyoderma appears very low, except possibly in children aged less than 3 months in whom it has been reported on occasions

to be a significant source of severe bacteraemic sepsis. The severity of scabies appears to be related to superinfection, which occurs in 16-67% of cases and bears the same risks as primary pyoderma, and to epidemics whose frequency over the world appears largely underestimated. Overall, tinea capitis appears to be a benign disorder, rarely presenting with superinfection, and with spontaneous healing around puberty. The other very common skin disorders (molluscum contagiosum, pediculosis capitis) are also almost constantly benign. Where HIV infection is common, its contribution to the epidemiology of common skin diseases is unknown.

Despite the relative paucity of objective data and some methodological restrictions, it can be assumed that the main etiological factors whose role is probably significant in developing countries are a hot and humid climate (pyoderma), low hygiene and poor access to water (pyoderma), high interpersonal contact and household overcrowding (scabies and pyoderma), and certain other skin conditions like reactions to insects bites and scabies (pyoderma).

Data on management

In the case of pyoderma, with the exception of community measures based on the large use of i.m. benzathine-penicillin during post-streptococcal glomerulonephritis epidemics, there is an almost complete lack of evidence-based data for the definition of curative management regimens adapted to the bacteriology and economic constraints in tropical developing areas. With scabies, classical topical drugs should remain the first-line treatment as the efficacy of oral ivermectin has so far been insufficiently quantified. During epidemics of scabies, where community measures appear necessary, there is a lack of data on recommendations, particularly as economic constraints would not permit implementation of the measures usually recommended.

Only recently has a public health perspective for the consideration of common skin diseases been adopted. Few global public health approaches to the problem have been tested. One of the only two such trials consisted of a one-day training programme of primary healthcare workers in the basic management of the commonest skin diseases through a specific algorithm, and this gave positive results.

With regard to prevention, there are indications that improving personal hygiene by thorough use of soap associated with easy access to water can reduce the incidence of pyoderma. However, important investments (such as intensive education of the community and/or broad environmental measures) seem necessary in order to have a significant impact, and the feasibility of these interventions may be low for many populations from developing areas.

Discussion

Overall, despite the obvious frequency of skin disorders, the relative paucity of relevant data has to be underlined. Although the epidemiological picture, as described above, is probably representative of wide areas in the developing world, it should be noted that gaps in evidence about issues with potential importance are numerous. At best, attempts should be made to improve the geographic representation of data and the methodological rigor of the studies (including standardization of data recording), and to obtain more data documenting the burden of skin diseases at the primary healthcare level and in the community, especially in young children, as well as the bacteriology of pyoderma, the frequency and consequences of scabies epidemics, and the precise role of etiological factors of practical relevance.

There is a great need for standardized recommendations on the treatment of the commonest skin disorders and, eventually, on preventive measures that would take into account the epidemiological characteristics and constraints in developing areas. Public health strategies adapted to this context should be defined and validated.

Given the relative severity of pyoderma and scabies and the high demand of many populations for effective management, especially at primary healthcare level where those disorders are in general poorly managed with undue cost, the introduction of organized global measures would be useful, while the low level of severity and low lethality of most skin disorders (when compared to other health problems in the same areas) suggest the opposite. Clearly, measures should be proportionate to the level of priority of the problem, i.e. simple, practical, low cost and with significant benefit. We propose a model for decision-makers, based on the evaluation of several criteria about the importance of skin disease within the local health context, and taking in consideration the capacity for action. We suggest that improving the quality of primary healthcare for the more severe and manageable skin disorders would be a reasonable solution in many areas, which might be compatible with the IMCI programmes. As regards prevention, a few basic recommendations for personal and household hygiene may be useful targets for health promotion, although the impact of such measures is largely unknown if they are not supported by intensive education programmes and/or broad environmental measures.

Introduction

While skin diseases are very common among the populations in many developing countries, they have not been regarded as a significant problem that could benefit from public health measures. Indeed, more attention is frequently given to some less common health problems in the same countries. This attitude is due to the assumption that skin diseases are a benign, not life-threatening minor nuisance, and that they do not merit measures that may appear out of proportion to their low priority. However, at least in some countries, there seems to be a high demand by patients and healthcare workers for more consideration to be given to skin diseases.

Based on a detailed review of the medical literature of the last three decades, this document presents comprehensive data on the epidemiology of common skin disorders and their importance as possible measures for controlling the problem. The study was performed with a view to eventual integration of matters relating to skin diseases in children with IMCI programmes (Integrated Management of Childhood Illness). The document aims to provide all the elements needed for a rational discussion of the problem by health leaders.

Scope and definitions

This review of current data for the rational management of common skin diseases in children in developing countries is presented in three parts:

- epidemiology;
- discussion of the options for treating the main disorders, especially those for use in developing countries;
- discussion of the rationale for public health measures to deal with skin diseases, with special reference to IMCI programmes.

DEFINITIONS

Skin disease here refers to disorders of exclusively (or predominantly) the superficial layers of the skin. Diseases with occasional or accessory skin features – such as leprosy, endemic treponematoses, or different varieties of filariasis – are not included as there is already an abundant literature on them. Other disorders that are excluded, despite the frequent presence of skin features, are measles, chickenpox, and dengue fever. Deep skin and soft tissue infections (e.g. erysipelas, cellulitis and abscess) are not considered although they may be cited in the context of, for example, complications of superficial infections. This applies also to burns and traumatic sores.

Common disorders refer to diseases that occur frequently in the general population (with a prevalence of $\geq$ 1%), or at a primary or peripheral healthcare level. This pragmatic definition is further explained below. Since disorders that are uncommon in some areas may be common in others, geographic specificities, as well as some constant features, should be indicated. Certain disorders – e.g. leishmaniasis, mycetomas, and infection due to *Mycobacterium ulcerans* – are excluded although their frequency may sometimes reach a significant level; in addition, their management is very specific to each condition.

The main disorders that are considered here belong to one of the following categories:

- *pyoderma*, the generic term used here to describe any variant of superficial bacterial skin infection (e.g. impetigo, impetigo contagiosa, ecthyma, folliculitis, “impetigo of Bockhart”, furuncle, carbuncle, tropical ulcer, etc.);
- *scabies,* and *other common ectoparasitoses* (pediculosis capitis, p. corporis, tungiasis, etc.);
- *tinea capitis* and *other superficial mycoses* (dermatophytosis, candidiasis, pityriasis versicolor, etc.);
- *benign viral tumours* (verrucae, molluscum contagiosum, etc.);
- *dermatitis* – irritative, allergic, or atopic.

Our main concern is disorders that have the greatest importance in terms of public health, a notion that will be discussed later. There is also a special focus on skin diseases associated with HIV infection.

The focus on *children* is justified because they are vulnerable to many skin diseases. But owing to the relative scarcity of data specific to this age group, some adult data are included and we shall point out, where necessary and possible, how they differ.

The notion of a *developing* or *less developed country* may be unclear, e.g. in the case of recently developed countries, or of disadvantaged areas or communities in a country that can hardly be considered as underdeveloped. Because of scarcity of data in specific fields, these will be considered where needed.

Unlike other subjects that are reviewed, the *current and recent literature* on common skin diseases in developing countries, as defined above, is sparse. Certain specific issues, although of potential importance, have not been evaluated for at least ten years. In certain respects, the epidemiological situation today seems quite similar to that described in the older medical literature [1-4]. However, rather than presenting an exhaustive but cumbersome historical review of data from the whole of the last century, we have restricted our review to publications after 1970, a period during which it is reasonable to assume that the disease pattern did not change greatly in most areas, and during which the main issues have generally been considered several times. Another limitation of our review is the fact that the great majority of the data were collected in a small selection of mainly tropical areas: data may be totally lacking, unavailable, minimal, or difficult to access owing to language or publication restrictions, in some wide geographical areas. Finally, it is important to adopt here a critical approach, rather than produce a simple compilation; indeed, some of the studies have been performed and analysed using inappropriate methods, and their results should therefore be interpreted with caution.

Epidemiology of common skin diseases in developing countries

METHODOLOGY

A review of the medical literature from the year 1970 included the following:

- Systematic review of articles in the Medline database (via Pubmed), using the following search terms:

  - [impetigo OR pyoderma OR scabies OR tinea capitis OR dermatophytes OR superficial mycoses OR skin disease OR dermatology] AND [(Africa OR Asia OR Latin America OR Pacific OR Oceania OR developing country OR tropical) OR (incidence OR prevalence OR public health OR community OR cost)] NOT (leishmaniasis OR mycobacterium OR ulcerans)
  - (pyoderma OR impetigo OR scabies) AND (bacterial OR agent OR microbiological OR glomerulonephritis OR streptococcus OR streptococcal OR post-streptococcal OR group A streptococcus) AND (Africa OR Asia OR Latin America OR Pacific OR Oceania OR developing country OR tropical)
  - (tropical) AND (ulcer) NOT (leishmaniasis OR mycobacterium OR ulcerans)
  - (prurigo OR papular urticaria) AND (child)
  - (HIV) AND (skin) AND (child).

  With some exceptions, the articles (or abstracts, when sufficiently detailed) were in English or French in journals indexed in the Current Contents.

- Selection of unpublished data from the WHO library database, including the recent review "Current evidence for the burden of group A streptococcal diseases", and from Mali; owing to their potential significance, we used data derived from a *Pilot Project of fight against common skin diseases in the Republic of Mali*, supported by the International Foundation for Dermatology, of which some data have not yet been published.

- Data from key opinion leaders like the International Foundation for Dermatology.

In the presentation of the results, we chose to present first the basic epidemiological data for *all skin diseases considered together* (i.e. prevalence, incidence, and etiological data). Indeed, the studies in the literature usually adopted a similar approach, and we judged that, although it would certainly be more exact technically to consider each disorder separately since situations for each skin disease may vary considerably in certain respects, it would be less cumbersome to follow the usual way of presentation. Specific issues, depending on the type of disorder, are considered below under "specific data".

RESULTS

Prevalence data

Our aim was to present here baseline data derived from prevalence studies performed in the general population (community or school surveys), which we judged representative for *large geographical areas*. We focused on

studies with clear methods and which brought data, as far as possible, on the whole range of skin diseases as defined above; two studies, however, focused exclusively on pyoderma without mention of any other skin disorder [5,6]. The total number of studies on the global prevalence of skin diseases according to these selection criteria was 18, as reported in Table 1 [5-21]. All 18 included children exclusively or mixed with adults, while 13 gave data specific to children (4 on school-age children). Studies not included in the Table, because the data were less precise, gave similar global results [22-24]. Some studies purporting to present "prevalence" data, but not when read and analysed, were excluded [25-27]. In addition, reports on scabies, taken from potential epidemics, gave prevalence figures in several areas: South-East Asia : India (9.7% and 13%) [28,29], Bangladesh (23-30% in under-6-year-olds in slum areas) [30]; Eastern Asia (4.3% in Cambodia [31]); and sub-Saharan Africa (0.7% in Malawi [31] and 6.1% in school-children in Burkina Faso [32]).

There have also been several reports on the frequency of skin diseases (mainly pyoderma and/or ectoparasitoses/scabies) in specific population groups: street-children in Kenya (prevalence of skin diseases, 50.9%) [33], child workers in Nigeria (skin infection, 12%) [34], refugee camp in Sierra Leone (scabies, 77-86% in children) [35], remote Amerindian villages in Amazonia (pyoderma, 11%) [36], jungle villages in Panama (pyoderma, 11-20% according to age) [37], an orphanage community in India (pyoderma, 10%) [38], slums in Brazil (scabies 8.8%, p. capitis 43%) [39], and remote aboriginal communities in Oceania, mainly Australia [40-43], and Malaysia [44]. Aboriginal communities from Australia and the Pacific islands exhibited particularly high prevalence figures in children, and often adults, for scabies, beta-haemolytic group A streptococcal pyoderma, and dermatophytoses (scabies: 25% (adults) to 50% (children); pyoderma: 10-70%).

Most of the data presented here should be interpreted bearing in mind the limitations in the methods used in the different studies. For example:

- The reasons for the selection of the area and of the persons were not discussed in almost every study, and the samples may not be representative of a wider area than the one studied. It is possible that, in some cases, the decision to perform a skin disease prevalence study was taken by the investigators because of an intuitive perception of a high level of local endemicity of these disorders, a reason that would exclude areas with low endemicity; such prevalence figures might be biased towards upper estimates of the problem. It is therefore uncertain whether all the reported data in the studies on scabies, and the studies in Table 1 that appeared to us to be the most reliable, definitely represent the situation in a large area/country. Actually, only three prevalence studies can be considered as most certainly representative of a wide area [6,8,15].
- Almost all the data were derived from clinical examinations alone. Diagnoses of disorders were not standardized and, if there was lack of precision among the data collectors, inter-observer biases were not addressed. The validity of the results depends largely on the dermatological expertise of the observers so that over- or under-estimations are possible where reliance on clinical diagnosis is known to be imperfect.

Despite these deficiencies, the studies in Table 1 show remarkable homogeneity in the prevalence rates in different areas for the main disorders (after excluding extreme values). This strongly suggests that the reported prevalence figures are common, if not ubiquitous, in the developing world. We can conclude that in many tropical developing areas, especially in sub-Saharan Africa where the majority of the studies were carried out, the prevalence of pyoderma is commonly in the range of 5-10% and that of scabies 1-2 %.

Table 1. Main prevalence studies of skin diseases in less developed areas (results specified for children are given between { })

Year of study	Country	Environ-ment	Class of age	Study area	Sampling method	No. of people seen	Prevalence of skin diseases								Ref
							Global	Pyoderma	Scabies	Mycoses [a] (t. capitis)	Viral disorders	Dermatitis	Other disorders		
1971	Colombia	Urban	Children	3 cities	Unknown	1269		{2.4 - 32%} [b]							(5)
1975*	Tanzania [1]	Urban/rural	Children	Capital and villages	Random [c]	1855		{6.9%}	{16.6%}						(7)
1974-75	Brazil [d]	Urban/rural	Schoolchildren	Whole state	Exhaustive	9955	{21-87%} [e]	{12.2%}	{3%}	{19.5%}	{6.2%}	{0.14%}	P. capitis {50%}	P. alba {9.9%}	(8)
1975	Ghana	Rural	All ages	Southern Ghana	Random	3770		9.6 / {20 - 35%} [f]							(6)
1976-77	Gambia	Rural	All ages	1 village [g]	Exhaustive . wet season . dry season	 994 951		 8.7% 7.1%	 2.5% 2%	 12.4(2.8)% 8.5(4.6)%	 2.3% 2.7%		Heat rash 19.1% 1.9%		(9)
1980	Pakistan	Rural	< 5 years old	3 villages	Exhaustive	444	{35.6%}	{19%}	{2%}	{1%}	{2%}	{4%}		P. alba {1%}	(10)
1989	Vanuatu	Rural	All ages	1 island	Exhaustive	18223		12%{16%} [h]	16%{24%} [h]						(11)
1992	Honduras	Rural	0 to 16 years old	1 village	Non-random	206	{28 - 40%} [f]	{5 - 15%} [f]	{0-10%} [f]	{4-16%} [f]		{8-9%} [f]			(12)
1991	Tanzania [1]	Rural	All ages	1 village	Random	936		3%	6%	6.6(4)%	1%	0%	P. capitis 5.3%	"Sores" [i] 8%	(13)
1992	Ethiopia	Rural	5 to 16 years old	1 village	Exhaustive (school)	112	{80.4%}	{8.1%}	{17%}	{13.4(9)%}	{10.7%}	{0%}	P. capitis {57%}	P. alba {5.4%}	(14)
1993-94	Mali	Rural	< 13 years old	Region	Random	1817	{34%}	{12.3%}	{4.3%}	{10.2(9.5)%}	{3.6%}	{1%}	Prurigo {1.5%}	P. alba {1.3%}	(15)
1994	Tanzania [1]	Rural	All ages	2 villages	Random	1114	26.9%	1.6%	5%	4(1.2)%	2.9%	0.2%	Prurigo 7.2%	"Sores" [i] 2.3%	(16)
1998*	Tanzania [1]	Rural	All ages	1 village	Exhaustive	800	34.7%	Unspecified [j]	4%	7.5(4)%		3.5%			(17)
1998	Taiwan (Province of China)	Remote rural/urban	Primary school children	4 villages/ 1 city	Exhaustive (schools)	1624/ 1405		{3.8%/0.5%}	{2.6%/0%}	{13.6/4.2%}	{12/ 2.7%}		P. capitis {24/0.1%}		(18)
1999	Indonesia	Rural	> 12 years old	3 villages	Random	917	28.2%	1.4%	0%	12%	0.4%	5.1%			(19)
1999	Indonesia	Rural	< 12 years old	3 villages	Random	433		{0.2%}	{0.2%}	{7%}		{3.5%}			(20)
1999	Kenya	Rural	3 to 17 years old	4 villages	Schools	5780	{32.4%}	{12.7%}	{8.3%}	{10.1(7.8)%}	{0.6%}	{1.7%}			(21)
2001	Mali [k]	Rural	< 15 years old	2 villages	Exhaustive	1729	{41.8%}	{14.9%}	{1.3%}	{21(19.7)%}	{3.3%}	{0.2%}	Prurigo {6%}	P. alba {1%}	

* Year of publication; [a] Including scalp ringworm; [b] According to climate and hygiene; [c] Children attending school or health centres; [d] Amazonia; [e] According to municipality; [f] According to age; [g] Two passages of investigators, the first during wet season, the second during dry; [h] Under 10 years of age; [i] As written in the article; [j] First skin disease under 2 years of age; [k] Unpublished data from the Bamako Pilot Project;

[1] Reference to "Tanzania" should be interpreted as "United Republic of Tanzania" in accordance with the policy of WHO.

Studies involving subjects of different age ranges allow a comparison between prevalences of specific disorders in adults and in children [6,9,11]. For example:

- There is overall acknowledgement that the prevalence of pyoderma in children usually largely exceeds that in adults [10,36,40-43]. When considering separately smaller age intervals, a peak of prevalence for pyoderma was observed among 5-9-year-olds (35%, *vs* 20% for <1-year-olds and 10% for those over 19 years [6]), those under 10 years (10-19%, *vs* 7-14% above this age [9]), among 3-year-olds (38%, *vs* 28% under one year, with a progressive constant decrease with age above 3 [36]), and those under 6 years (12-15%, *vs* 5% above 12 years [12]). Concerning the first year of life, a period during which specific data are particularly scarce, a slightly lower prevalence has been reported during the first 6 months (12%, *vs* 25% above this age [10]), or during the whole first year (3.9%, *vs* 6.9% above this age [7]).
- Peak prevalence of scabies in children appears less marked than that for pyoderma: 70.3% for those under 14 years *vs* a mean prevalence of 59.2% [45], 23.7% for 5-14-year-olds *vs* a mean prevalence of 9.7% [28], 19.9% for <5-year-olds *vs* 8% above 5 years [29], 78% in 0-2-year-olds *vs* 60% for those aged 2-6 years, 54% for 6-10-year-olds, and 22% after puberty [46]; the younger age groups may experience high incidence (81% before 3-year-olds, *vs* 72% from 3 to 5 years [30]). As for primary pyoderma, superinfection appears to be more prevalent in the youngsters (superinfection in 31.6% of the cases under 5 years old *vs* 14.8% from 5 to 19 years old [29]).
- The superficial mycoses show a peak in children at an older age, being relatively rare under one year of age (prevalence = 1% under 5 [10], 5% from 0 to 6 years *vs* 16% at 13 years of age [12]; prevalence of tinea versicolor = 8-18% in the 14-15-years age-group *vs* 1% in the 5-9-year-olds [9]).

There is a sex differential for pediculosis capitis (71% in girls *vs* 53% in boys in Brazil, 8.9% *vs* 0.7% in Mali) [8,15]. This is probably due to the habit of shaving the scalp of boys in certain geographical areas such as sub-Saharan Africa, a procedure that will probably protect them against this disorder.

Incidence data

Data from non-specialized health centres

Data from these centres are important because a) they represent evaluations of the incidence and frequency of a health problem in the general population at the peripheral healthcare level, which is the one most used; b) they document the demand for care by the population; and c) they are relatively easy to obtain. Unfortunately, it is in this specific field that the quantity of published data concerning common skin diseases appears to be least; so far, only two published studies have tried to focus in a specific manner on this topic [47,48]; others have calculated or mentioned only briefly the importance of skin diseases in these centres [49,50]. In addition, it is sometimes possible to obtain data from national health statistics registers which are available in many countries, and which establish the relative proportions of defined categories of diseases [51]. These last sources of data are interesting because they are a relatively easy way of documenting the statistical importance of a health problem. However, their significance is limited because 1) the data were not transcribed in the registers, nor were they collected using a defined methodology; 2) the disorders were often poorly categorized, subcutaneous and skin infections often being confused; and 3) the data's quality depend directly on the care taken by health workers in filling the health centre registers, an important issue that cannot be assessed here.

The data from the available published studies, added to samples obtained from the national statistics health services in Mali, are reported in Table 2 [47,48,51-54]. From these data, it appears that skin diseases represent

one important component of primary healthcare as defined above, i.e. 6- 14% of the total of visits when all ages are considered together. These data are convincing because they are in agreement with the prevalence data where available. With respect to children, skin diseases accounted for 12.3% of the visits by under-15-year-olds in the Bamako study (compared with 11.7% overall) - slightly higher than in adults, the younger age group accounting for 73% of all visits [48], compared with 23.7% for under-3-year-olds in India [52], and 13% for under-1-year-olds in Cameroon [53].

Table 2. Data on the frequency of skin diseases (SD) in non-specialist health centres in developing countries

Year of study	Country	Study area	Type of health centres	No. of SD files available	Proportion of visits due to a SD	Main disorders	Ref
1985	Jamaica	Village	1st level of delivery of care	850	6%	Undiagnosed (33%), scabies (30%), pyoderma, mycoses, dermatitis	(47)
1989*	India	Village	1st level of delivery of care	316	23.6% [a]	Pyoderma	(52)
1991-92	Cameroon	83 Villages	1st level of delivery of care		13% [b]		(53)
1993	Mali	Bamako city	1st level of delivery of care	1639	11.7% (7.8 - 26.4) [c] 12.3% under 15 years old	Pyoderma (42%), dermatitis (15%), scabies, mycoses	(48)
1993	Mali	Whole country	All levels of public delivery of care	97107 [d]	6.9%		(51)
1982-83	Pakistan	Village	1st level of delivery of care	186 [d]	13.7%	Pyoderma (78%)	(54)
2001	Mali	Bamako area	1st level of delivery of care	1651	7.5%	Undiagnosed (37%), pyoderma (29%).	(57bis)

* Year of publication; [a] Children under 3 years old; [b] Children under 1 year old; [c] From a centre to another; [d] "Skin and subcutaneous disorders".

According to a common practice in health statistics, certain authors assigned a rank order to skin disorders among the different health problems encountered in these centres, classified in gross categories: fourth [26], fifth [6], and second [14]. In addition to the fact that these statements were not supported by referenced objective data, these data should be considered as imprecise since such categories of disorders may be poorly defined and are often artificial (e.g. should chickenpox be classified as a skin disease, or a viral disease, or a febrile illness?). The quality of the diagnoses in these centres should be considered as generally low, with resulting imprecision in the classification of disease (e.g. in many areas, “malaria” is often registered each time fever is present).

One should be sceptical about the specific diagnoses of skin disorders as recorded in the registers. While the diagnosis of “pyoderma” (or a related term for superficial skin infections) or of “scabies” might be considered as relatively precise, the other diagnoses encountered in these centres often appear less specific (e.g. “eczema” or “dermatitis”) or patently undiagnosed (“dermatosis”). Indeed, in certain areas, it has been shown that the proportion of cases with a diagnosis of “eczema” varied a lot from one centre to another, and the frequency was inversely proportional to that of “scabies”, suggesting strong diagnostic confusion between these two disorders [47,48]. In Mali, there was a global similarity of the compounds prescribed for each main disorder (pyoderma, scabies,

dermatitis), suggesting confusion between the disorders and/or use of a standard prescription for all skin disorders, including a high proportion of non-generic drugs as well as compounds of questionable efficacy [55]. This raises the question of the quality of care of skin diseases in these centres. Indeed, this appears low wherever it has been specifically assessed [22,48,56]. In Ethiopia, treatment for skin disease in a health centre was considered efficacious in only 34% of the cases [22]. In Mexico, treatment received from healthcare workers was considered ineffective in 70% of the cases [56]. In a primary healthcare centre in Brazil serving a poor neighbourhood (slums), a correct diagnosis was missed by physicians in 52% of scabies cases, 94% of tungiasis, and 100% of pediculosis capitis [39]. In the United Republic of Tanzania, skin diseases were among disorders that were associated with a comparatively high demand by patients for injections from healthcare workers [57]. According to data from the Bamako Pilot Project, only 41.7% of patients visiting primary healthcare centres for skin disease benefited from both a clear diagnosis and an adequate treatment [57 bis].

Finally, the available data from these health centres give indications on the global incidences in the general population (although of a much lower value than population-based incidence data). Thus, in rural Pakistan, an estimate of 10.7% for the annual incidence of pyoderma was obtained from the rates of presentation to a clinic where there were strong incentives for the population to visit and free availability of drugs [54]. In Malawi, a 4% annual incidence of scabies in a population of approximately 200,000 was estimated from one health centre's data [26]. In a small Tunisian city, the incidence of pyoderma in under-5-year-olds was estimated in 1976 to be 8.4% [58].

Community-based data

In some areas, a few health surveys have shown a high incidence of skin diseases in the community. A field study in three villages in rural India, aimed at calculating the personal cost of illness due to various diseases, found incidence rates for scabies of 7 and 34 episodes per 100 people in the years 1981 and 1982 [59]. In Pakistan, the mean incidence of impetigo among children was calculated to be 1.57 to 1.95 per 100 person-weeks in people using standard washing habits [60]; these rates were considered to be 40% lower than those expected for the season (summer) in that area. More recently, in the same setting, the basic incidence of impetigo in children less than 15 years old was calculated to be 0.94 episodes per 100 person-weeks [60bis]. In a rural community in Uganda, a six-year prospective incidence study of mucocutaneous disorders in 436 participants (51.6% were HIV-negative, 48.4% HIV-1-positive) found skin disorders in 306 (70.2%) (143 (63.6%) in HIV-negative) [61]. In an orphanage in India, the incidence of pyoderma was 72% over 2 years [38]. In the Caribbean, data from reports of a national surveillance system allowed investigators to draw estimates for the incidence of scabies during what was considered to be an epidemic (1981-88); from one island to another, the annual incidence varied from 8 to 1200 per 100,000 population [62]. In Panamean islands, there were 0.2 to 0.6 episodes of pyoderma by child-year, and 1.4 to 2.5 for scabies [63]. In different settings in Pakistan, the monthly follow-up of 1476 children under two years of age showed a 10.4% mean monthly incidence of skin features, including "skin rash" (6.2%), "skin infections" (3.6%) and scabies (0.57%), making it the third most common category of disorder (after diarrhoeal episodes and upper respiratory tract infections); skin infections were more common before one year of age (with the exception of the first months of life), during the warm season, and in the poorer and/or rural settings [64].

Although all these studies indicate clearly the possibility for a high incidence of pyoderma in children, and sometimes scabies, it would in our opinion be risky to extrapolate too broadly from these conclusions to precise numerical data, owing to their questionable representation and because of large differences between one location and another.

Data from specialized dermatology centres

In practice, published reports on skin diseases in developing countries are mostly studies involving the compilation of disorders identified in specialized dermatology centres. This source of data provides the broadest geographical picture. It should be noted that certain studies correctly belong under this heading, although their titles may suggest that they provide different data such as true incidence or prevalence [25-27].

Table 3. Main disorders encountered in specialized dermatology centres in developing countries (results are given as proportions of the total of visits in the considered period) {results for children when available}

Year of study	Country	No. of files studied	1st rank of disease	2nd rank	3rd rank	4th rank	5th rank	Ref
1971-72	Uganda	**3097**	Dermatitis 24%	Pyoderma 11%	Scabies 7%	Sup mycoses 6%		(65)
1972-73	Latin America (several countries) [a]	**3140** [b] **{1000}**	Dermatitis 25% (17-33)	Scabies 21% (2-47) {40%}	Sup mycoses 13% (4-27)	Pyoderma 9% (3-19) {20%}	Acne 7%	(66)
1971-75	Mexico	**{10000}**	Prurigo {16%}	Atopic dermatitis {13%}	Scabies {10%}	Warts {8%}	Pyoderma {7%}	(67)
1973-75	Nigeria	**8013**	Sup mycoses 16%	Dermatitis 12%	Scabies 9%	Viral disorders 7%	Keratoderma 4%	(68)
1977	Zambia	**12610**	Ectoparasitoses 32% [c]	Pyoderma 20%	Dermatitis 15%	Sup mycoses 6%	Viral disorders 2%	(69)
1979	India	**{18340}**	Scabies {39.5%}	Pyoderma {38%}	Sup mycoses {11%}	Dermatitis {10%}	M. rubra {3%}	(70)
1980	Rwanda	**Rural 1958**	Scabies 30%	Sup mycoses 29%	Keratoderma 9%	Dermatitis 6%	Pyoderma 4%	(25)
		Urban 861	Scabies 31%	Dermatitis 17%	Pyoderma 9%	Sup mycoses 7%	Viral disorders 6%	
1984-7	Peru	**1277**	Dermatitis 27%	Acne 21%	Viral disorders 11%	Sup mycoses 4%	Pyoderma 2%	(71)
1986	Malawi	**11305**	Scabies 37%	Pyoderma 28%	Dermatitis 12%	Sup mycoses 6%	Prurigo 5%	(72)
1990	India [d]	**808**	Dermatitis 24%	Viral disorders 17%	Scabies 16%	Pyoderma 9%	Sup mycoses 6%	(73)
1990-5	Togo	**12100**	Dermatitis 25%	Sup mycoses 13%	Scabies 7%	Pyoderma 7%	Acne 7%	(74)
1993	Mali	**10575 {3479}**	Dermatitis 20% {17.5%}	Scabies 17% {23.4%}	Sup mycoses 14% {10.6%}	Pyoderma 6% [e] {9.6%}	Prurigo 4% {6.8%}	(75)
1994	India	**{400}**	Pyoderma {34%}	Scabies {25%}	Sup mycoses {11%}	Viral disorders {9%}	Dermatitis {6%}	(76)
1994-98	Nigeria	**1091**	Dermatitis 36%	Sup mycoses 11%	Pigmentary disorders 4.7%	Urticaria 4.6%	Scabies 4.2%	(27)
1995-96	Ethiopia	**7760**	Pyoderma 19%	Sup mycoses 18%	Dermatitis 18%	Viral disorders 6%	Ectoparasitoses 10%	(77)
1995-97	Ethiopia	**{1000}**	Dermatitis {42%}	Sup mycoses {14%}	Pyoderma {10%}	Scabies {4%}	Prurigo {3.5%}	(78)
1995-97	Ethiopia [f]	**1505**	Photodermatoses 23%	Dermatitis 22%	Sup mycoses 16%	Pyoderma 4%	Viral disorders 4%	(79)

Sup myc = superficial mycoses; [a] Guatemala, Honduras, Nicaragua, Colombia, Peru, Bolivia, Paraguay, Brazil; [b] Results given as follows: mean (extremes according to country); [c] Mainly scabies; [d] Himalaya area; [e] 13.7% if including superinfection of other skin diseases; [f] 75% of patients aged 21 to 40 years.

The main data available from this type of study are reported in Table 3 [25,27,65-79]. Most studies have been conducted in the main (often one and only) specialized centre in the country, generally in the capital; the data present a comprehensive record of cases presenting in the centre, classified by diagnosis according to current practice in the centre. Less well defined data from other key regions such as Asia provide similar results [80]. Historical studies from the 1960s have been omitted here, but they provided similar results [81-85]. Only one study gave the rate of primary and secondary pyoderma [75], which more than doubled the importance of this disorder.

A common problem in interpreting the data is due to variation in the classification of disease categories from one study to another (e.g. the term "dermatitis" may sometimes include seborrheic dermatitis). Above all, there is a major limitation in the value of these studies because the results from a specialized (referral) centre cannot represent the situation prevailing in the general population due to possible selection bias. For instance, in 1993 the Bamako reference centre reported only one visit for pediculosis capitis, while a prevalence study conducted in the same year in the general population found a prevalence of 4% in children [15,75]. However, one could argue - based on studies of skin disease in Mali which gave data from, respectively, the one and only specialized centre, non-specialized healthcare centres in Bamako, and a rural community near Bamako [15,48,75] - that the information from specialized centres may have relevance for the general population because: a) these centres often function as a general dermatology centre, with the majority of patients being seen for the first time, rather than as a true "secondary referral" centre; b) there is remarkable homogeneity, in general, of the main disorders encountered in these centres from one country to another; and c) considering the more serious disorders, data from specialized centres are consistent with data from primary healthcare centres in the corresponding areas, when these are available.

The main skin diseases seen in specialized centres are almost always pyoderma, scabies, tinea capitis and variants of superficial mycoses, and dermatitis (mainly eczema). A noteworthy point is the fact that the classical tropical diseases constitute a low proportion of the dermatological visits in every area where these have been specifically registered (estimated, for example, to be only 1% of the total number of visits in Bamako) [75,83].

In the instances where data were presented by age, children were shown to have a more clearly defined profile of skin diseases than adults [66,75,85]. For example, in Bamako, 85% of the total of visits by children were due to ten disorders (scabies, dermatitis, superficial mycoses, pyoderma, prurigo, pityriasis alba, keratoderma, miliaria, molluscum contagiosum, and seborrheic dermatitis) [75]. The relative incidence in Latin America of pyoderma was reported to be highest in children under 9 years, scabies in those under 4 years, and tinea versicolor above 15 years [66]. In an older study carried out in a deprived, Black population in South Africa, the four main diagnostic categories (pyoderma, scabies, mycoses, and eczema) accounted for 63% of the diagnoses in children, compared with 44% in adults [85].

In conclusion, the studies from specialized centres can be admitted to be a useful source of information on the main dermatological disorders in their area; however, the epidemiological aspects (including frequency in the general population) are clearly better studied by prevalence or incidence surveys.

Cost data

Only two studies tried to assess specifically the costs related to skin disease [56,59]. In Mexico, an assessment based on questionnaires backed by clinical examination calculated the costs (of drugs, visits, travel) due to

common skin diseases [56]; a skin disorder was present in 207 out of 370 households, the commonest being pyoderma and scabies; the average time of school absence was 8 days for scabies and 15 for pyoderma; treatments were inadequate in 70% of the cases, with mean costs of US$24 for scabies and US$52 for pyoderma (compared with a mean daily wage of about US$6). In a study in India [59], scabies was the cause of a long duration of work incapacity (mean of 12 days, 408 days of work were lost for 100 persons during a year with a 34% incidence of scabies) and of costly treatment, especially in periods with peak incidence, during which scabies represented the second most expensive call on health cost for families when compared to common water-related disorders such as enteric fever or conjunctivitis (US$5.29 per year, compared with an average annual income of US$113). According to unpublished data recorded in 1993 in primary healthcare centres in Bamako (Mali), the mean cost for prescriptions of medication for skin disease was approximately 4000 CFA francs (i.e., about US$15) [55]. The inefficacy of treatment prescribed by healthcare workers has been correlated with the high costs observed [56].

Other data

The importance of skin disease, as felt by the affected families, has sometimes been evaluated. The health-seeking behaviour for the different skin disorders recorded during a prevalence study in children was determined in rural Mali [15]; scabies and pyoderma (especially in its more serious forms) elicited the most numerous and variable pattern of health-seeking behaviour, establishing the relative importance of these diseases for the families. On the other hand, tinea capitis, pediculosis capitis, or molluscum contagiosum, despite comparable prevalences, were generally ignored (presence of one or several health-seeking behaviours in 78% of scabies cases, 63% of severe pyoderma cases, 42% with mild pyoderma, 40% of tinea capitis cases, and 6% with molluscum contagiosum; only scabies and pyoderma justified a visit to a health centre [15]). Similar data, establishing the major importance of scabies for the families concerned, were found in Brazilian slums (visit to a health centre in 52% of the scabies cases *vs* 0% of those with pediculosis capitis and 5% of tungiasis cases) [39], and rural Ethiopia (scabies *vs* pediculosis capitis and tinea capitis) [14]. It can be noted that this pattern of health-seeking behaviour observed in the field fits well with the main skin disorders encountered at the primary healthcare level (even if it is probable that only a minority of cases actually benefit from such consultations). There is also indirect evidence that epidemics of scabies represent an important problem for the communities involved; unfortunately, except once in terms of cost or days of work lost [59], no study has documented directly the likely high specific demand for care in the community for that specific situation.

Etiological factors with epidemiological importance

Three main factors have been generally incriminated to explain the high prevalence and incidence of common skin diseases in developing areas: a low level of hygiene, including difficulties in access to water; climatic factors; and overcrowding.

There are problems in interpreting the few available data addressing these issues, notably: a) the main predisposing factors are generally associated or interdependent, making epidemiological confusion sometimes almost impossible to exclude; b) the low general condition of hygiene and overcrowding in the areas make it difficult to study fully this parameter owing to the lack of controls, the only possibility being, for instance, to compare households with poor hygiene to others with less poor hygiene; and c) the majority of authors group all skin diseases as a single entity in relation to these predisposing factors, although differences between different skin diseases seem likely. One certainty is that the observed high prevalence rates are strongly linked to low socioeconomic levels. It seems that similar epidemiological features were seen in developed countries before economic progress and improvements in hygiene in the twentieth century.

In addition to these classical factors, it is the current experience in tropical areas that certain skin diseases can be considered as common predisposing factors for other skin disorders, due mainly to the common occurrence of superinfection.

Climatic factors

A hot climate, especially if humid, is a classical predisposing factor to the development of *pyoderma*. In Colombia, the prevalence of streptococcal pyoderma in children was 5.2% in the more temperate area, and was found to increase as the weather became hotter and more humid: 12.2% in the subtropical zone and 26.8% in the tropical zone [5]. In rural India, the maximum incidence of pyoderma in health centres was during the summer, where the number of cases nearly tripled compared to winter [52]. In rural Pakistan, the monthly incidence rate of pyoderma was 2.1 during temperate months against 6.9 during the warm months [64]. In an economically deprived black population in southern United States of America, the incidence of pyoderma in children aged 2-6 years was found to reach 50% during humid summer months *vs* 4% in winter [86]. In rural Gambia the examination of the same community showed a prevalence of pyoderma of 8.9% during the wet season *vs* 7.2% in the dry season; this seasonal difference was much more marked in children under 10 years of age [9]. Other studies reported similar trends, with peaks of incidence/prevalence during summer [6,26,54,60]. However, exceptions have been observed in Trinidad and Tobago [87] where the climate remains relatively hot and humid during the whole year, and in Aboriginal communities of tropical northern Australia [J. Carapetis, unpublished data]. A similar climatic influence has been reported for *superficial mycoses* [9], but not *scabies*; considering this last disorder, higher incidences have generally been reported during the colder months [88, 89]. Insects, either biting or not (mosquitoes and flies such as *Hippelates*), may be important vectors or inducers of bacterial infection in the humid areas where they are common.

Poor hygiene – Role of water

Pyoderma is the skin disorder for which the role of hygiene appears to be the best established. Thus, in Colombia, for each climatic zone, the prevalence of pyoderma was higher in children with a low level of hygiene [5]. In Mali, the presence of pyoderma in children was significantly correlated with low personal hygiene (OR = 1.68), and with the presence of rubbish in the courtyard of the family housing (OR = 1.47), but not with the frequency of baths or the use of soap [15]. In the United Republic of Tanzania, scabies-related pyoderma (but not non-scabies pyoderma) correlated well with personal hygiene (41% in rural children with the lowest hygiene *vs* 7.9-16.8% in urban children) [7]. It should be noted that, in these studies, the definition of poor individual hygiene was based more on subjective than objective data. In addition, in Trinidad and Tobago, a placebo-controlled study looking at an eventual preventative effect of soap (either plain or with added hexachlorophene) by washing legs (the commonest site of pyoderma) of children twice a day did not find a positive impact on pyoderma prevalence [90]. However in Pakistan, a programme of free distribution of soap was associated with a trend in lowering the incidence of impetigo in children [60]. More recently, in the same geographical area, a programme of intensive education combined with the distribution of free soap (either plain or with added triclocarban), in an area with easy access to water, resulted in a significant decrease in pyoderma incidence [60bis].

The role of water has been studied more specifically, but data appear somehow to be conflicting. While in certain studies a statistically significant higher use of water for washing has been found to be associated with a reduced rate of impetigo (OR = 0.45 [63], mean amount of water used = 5.7 litre/day by children without impetigo *vs* 2.7 by those with impetigo [91]), scabies (OR = 0.57) [63], or so-called “infectious skin diseases” (prevalence = 45% with <7 baths per week *vs* 14.6% if >20 baths per week) [92], this was not confirmed in other studies [16, 93, 94].

The interpretation of the data on this specific topic is complicated by the fact that, in the studies considered, all skin disorders were generally grouped together in accordance with their classical "water-related" character [95], irrespective of eventual differences according to the type of skin disorder [92,93]. According to one study, the individual amount of water used for washing might be more important than its quality, considering its role in pyoderma [92]. More recently, a convincing study in Aboriginal Australian communities, where baseline prevalence and incidence of pyoderma are known to be particularly high, found that providing access to swimming pools was followed by a marked decrease in the prevalence of pyoderma in children under 17 years old (e.g. from 62% to 18% in one targeted community), as well as severe pyoderma [96], which suggests that, like hygiene to which it is strongly linked, use of water plays a role mainly for this disorder.

Concerning *scabies*, the influence of hygiene (like that of water) appears much less clear. It is well known that scabies may affect people with good standards of hygiene (like the Cuna Indians from Panama, who are known to have careful daily personal hygiene) [97]. A correlation between low socioeconomic status and the presence of scabies has been suggested, although the disease can be present in every social class, sometimes at very high rates; while the mean duration of scabies in children in urban Bangladesh was significantly shorter in families with the highest income, prevalence in that group was still 76% [30]. Low level of knowledge about hygiene practices has been found to be associated with a higher prevalence of scabies, but this might be only a confounding factor [30]. No correlation between scabies and personal or household hygiene has been found in other deprived settings [15]. On the other hand, superinfection of scabies has been shown to be more common in cases where there is poor hygiene [7], and where there is a lower socioeconomic status, a fact that may be more likely here, in our opinion, to be attributed to a lower level of hygiene: in Bangladesh, 73% of the scabies cases in a deprived population were superinfected *vs* 3% of cases with a high socioeconomic level; post-streptococcal glomerulonephritis cases were seen almost exclusively in the category with the lowest level [98].

Interpersonal transmission

It is noteworthy that the main diseases considered here (pyoderma, scabies, and tinea capitis) are infectious communicable disorders, which are more or less contagious. Interpersonal transmission of pyoderma and the importance of this way for dissemination are well established [99]. One could incriminate the high level of interpersonal contact observed in many developing countries, where households are often overcrowded, as one major reason to explain some of the observed epidemiological pictures. However, this has been specifically studied only rarely in the present context and, in general, did not take into account multiple possible biases in the interpretation of the available data [16].

Concerning scabies, there are more objective data. The occurrence of severe scabies epidemics in communities with close interpersonal contact such as jails [100], refugee camps [35], or orphanages [101], strongly suggests the importance of such contact. Sharing bedding is common in many settings, especially among children, and it is probably a major factor in dissemination of communicable disease, especially scabies, in families, as suggested in one study by the rising prevalence of this disorder with the level of crowding at night (i.e. family size divided by the number of rooms for sleeping) in an Egyptian village [102]. In rural Mali, for each case of scabies identified during a cluster prevalence study in children, there was an average of 6 other cases by family [15]. Children have repeatedly been considered as a main vector of transmission of scabies in families and, as already pointed out, they often show higher rates than adults [28,29,102]. Unfortunately, the precise reasons why stable levels of endemic scabies in settings such as villages or islands suddenly increase to epidemic level have not been assessed.

Another example of inter-human transmission is the transmission of the dermatophytes causing tinea capitis by fomites, or by razor blades used for communal haircuts.

Role of other skin conditions

Certain dermatoses can be considered as a definite risk factor for pyoderma. This is especially true for *scabies*, which is commonly superinfected, and, to a much lesser extent, tinea capitis. When it is present, scabies is indeed a major risk factor for pyoderma in patients with lesions of scabies, but also in those without scabies, because of separate dissemination of pyoderma from superinfected scabies; this has been well shown by control programmes that found a lower prevalence of pyoderma, whether consisting in the superinfection of lesions of scabies or not, which followed a reduction in the prevalence of scabies [40,42,46]: thus, in aboriginal communities from Australia where prevalence rates of scabies and pyoderma are very high, it has been stated that scabies underlies 50-70% of cases of streptococcal pyoderma, by way of either superinfection of scabies or secondary dissemination [40,41]. The contribution of scabies to the prevalence of pyoderma varies with the prevalence of scabies, and with the proportion of cases of scabies that are superinfected (i.e. according to studies: 16% [29], 24% [100], 28% [32], 30% [101], 33% [42], 30-50% [46], and 67% [15]); thus, in rural Mali, a quarter of all the cases of pyoderma appeared directly related to scabies.

The role of *traumatic sores* as a predisposing factor for pyoderma is also probably very common, although poorly assessed; limbs, especially legs, which are main locations for pyoderma in older children, and, less commonly, ears (because of septic ear piercing) in girls (e.g. a sixth of all pyoderma cases in girls from rural Mali [15]) are common examples of post-traumatic pyoderma. As judged by clinical experience or anecdotal comments of authors, *local reactions due to insects*, either biting or not (e.g. mosquitoes, flies), taking sometimes the form of "prurigo" or "papular urticaria", appear to be a very common cause of secondary pyoderma in many tropical areas [5-7,10,103-105], especially in hot and humid areas, although it appears difficult to quantify this.

Host-related factors

The striking frequency of pyoderma and/or scabies in certain limited groups of population suggests that immune factors might be important in certain cases; these might be either constitutional, mediated by genetics (e.g. probably in Aboriginal populations from the Pacific [40-44]), or acquired (e.g. occurring in HIV-infected persons [61]). The epidemiological importance of HIV-infected individuals as a reservoir for wide dissemination of infectious disorders such as scabies or pyoderma, which are indeed more common in HIV-infected people [61], has not been evaluated.

The Table below presents a summary of the estimated strengths of the links between specific skin disorders (SD) and the main suspected risk factors:

	Risk factor				
Disorder	**Climate**	**Poor hygiene**	**Low water use**	**Overcrowding**	**Other SD**
Pyoderma	+++ [a]	+++	++	++	++ [b]
Scabies	+ [c]	+/- [d]	-	+++	-
Tinea capitis	? [e]	+/- [d]	-	++	-

Strengths of links were estimated according mainly to the amount of evidence-based data; [a] if hot and humid; [b] mainly scabies, insect bites, traumatic sores; [c] cold season; [d] risk factor for superinfection; [e] superficial mycoses more frequent where humid/hot climate, but lack of data specific to tinea capitis.

Specific data

While presentation of data on skin diseases as a whole might be a simple option, it appears that, in reality, the significance of global data differs widely from one disorder to another in terms of frequency, objective severity, risks for complications, nature of complications, demand of populations for care, etiological factors (as already seen), and potential treatments (as will be described below). Moreover, certain types of data are unique to certain entities, such as the microbiological features of pyoderma or of tinea capitis.

Pyoderma

Clinical data

A more precise *clinical description of pyoderma* has been given by some authors:

- *Sites*: lesions of primary pyoderma are commonest on the limbs and on the head [6,36,106]; if accompanying scabies, the usual sites of parasitosis are involved, mainly upper limbs [41]; the legs are more likely to be involved in non-scabies-related pyoderma. There seems to be a correlation with age, older children showing traumatic lesions on the legs as the origin of pyoderma, while lesions predominate on the head in younger children [36].
- There have been attempts to *quantify the severity* of the pyoderma lesions. This is an important issue for prevalence studies because every skin disease observed, even mild ones, may be included due to the methodology of recording (simple observation, lack of definition of objective diagnostic criteria, etc.). In the Malian study, severe pyoderma, defined as the presence of more than five lesions or at least one lesion >2 cm in diameter, accounted for a quarter of the total number of cases [15]; in addition, 59% of the pyoderma cases were recorded to last for at least one month. During an epidemic of scabies in an Aboriginal community in Australia, the grade of severity of pyoderma was defined by a score calculated from the number of lesions (>20 in a single site giving the highest score), their clinical appearance (presence of pus being graded the highest), and the involvement of selected defined sites [41]; severe pyoderma accounted for approximately half the cases.
- Finally, although different types of pyoderma are commonly combined in the same category, one should remember that follicular bacterial infections differ from non-follicular in signs, epidemiology (follicular pyoderma being more common in older children and adults), prognosis, and bacteriology (follicular pyoderma mostly due to *Staph. aureus*). Bullous pyoderma (bullous impetigo) is often considered as more likely to be due to *S. aureus*.

Bacteriological agents

Studies on the nature of the *bacteriological agents* that are responsible for pyoderma in developing areas are scarce, only 14 studies having assessed this subject. Their principle conclusions are presented in Table 4 [5-7,36,103-112]; results from Singapore and French Guyana, although not in the “less developed countries” group, have been included [111,112].

In other less systematic studies, group A streptococcus (GAS) was the main etiological agent of pyoderma in Ethiopia in 1972 [113], in children in an orphanage in India in 1978 [38], in patients with scabies in Ghana [114], and in superinfected scabies cases in an Aboriginal population in Australia [41]. Thus, the available data suggest that beta haemolytic streptococci (BHS), especially group A, remains the main agent of pyoderma in many tropical areas, either primary or secondary to scabies; the role of *S. aureus* is less well documented, although it was

Table 4. Bacteriological findings in pyoderma in tropical areas

Year of study	Country	Type of pyoderma	No. of samples	Streptococcus	Staphylococcus	Streptococcus + Staphylococcus	Other germs	Ref
1971	Colombia		199	BHS 82%	*S. aureus* 76% [a]			(5)
1972*	Uganda	Primary and secondary	94	BHS 76% (96% GAS)	*S. aureus* 57%	45%		(105)
1974-76	Egypt	Primary	627	BHS 91% (92% GAS, 8% group G, 3% group C)				(106)
1975	Ghana	Primary or post-trauma	76	BHS 74% (82% group G, 18% group C)	*S. aureus* 63%	46.1%		(6)
1975*	United Republic of Tanzania	Primary and secondary (scabies)	151	BHS 48% (GAS)	*S. aureus* 65%	30.5%	C. diphtheriae 34% [b]	(7)
1976	Brazil (Amazonia)	Primary	39	BHS 95% (GAS predominating)	0%	36%	C. diphtheriae 38% [c]	(36)
1987-88	Trinidad and Tobago	88% secondary (eczema, other SD)	123	BHS 27% (53% GAS)	*S. aureus* 82%	19%		(104)
1985*	Papua New Guinea	Primary, secondary (scabies), and tropical ulcer	480	BHS 95% (GAS 61%, C 19%, G 19%)	*S. aureus* 83%		C. diphtheriae 72%[d], C. haemolyticum 35%, Vincent's organisms [e]	(107)
1987*	Nigeria	Primary and secondary (scabies)	50	BHS 8%	*S. aureus* 70%			(103)
1990	Australia [f]	Primary	52	BHS 80% (GAS 95%)				(108)
1990-91	Ethiopia	Primary	55	BHS 96% (GAS 96%)				(109)
1997*	Ghana	Secondary (scabies)	110	GAS 9%	*S. aureus* 37%		Anaerobics 35%	(110)
1997	Singapore	Primary and secondary - adults - children	 233 53	 GAS 13.9% GAS 6.5%	 *S. aureus* 47.9% *S. aureus* 72.6%		Gram-negative bacillus 32.4% 16.2%	(111)
1996-97	French Guyana	Primary and secondary	41	46%	*S. aureus* 80%	34%		(112)

* Year of publication; BHS = beta-haemolytic streptococci; GAS = Group A streptococci; [a] Most commonly associated with BHS; [b] Isolated, or associated with S. aureus and/or BHS; [c] Non-toxigenic; [d] 2% toxigenic; [e] Found in 74% of tropical ulcers; [f] Aboriginal community

reported to predominate in more recent studies. In the older reports, *S. aureus*, although commonly isolated from lesions, was nearly always considered a secondary infection [5,6,105]; indeed, it should be underlined that streptococci are bacteria that might be relatively difficult to identify from swabs performed in the field, particularly in the presence of *S. aureus* which can inhibit their growth; if there is mixed growth of bacteria, *S. aureus* can survive GAS if swabs are not plated rapidly; in Australia, studies using two different swabbing techniques at different periods in the same population found GAS in pyoderma secondary to scabies in 30% and 82% of the cases [41]. It should be kept in mind that while the available data on pyoderma in the tropics report the predominance

of GAS, this is only a second-line agent in temperate countries where *S. aureus* is clearly the main cause of pyoderma; therefore, the fact that two recent bacteriological studies in tropical (but more developed) areas showed a predominance of *S. aureus* might be of concern [111,112].

Another limitation with some of the published studies is, as already pointed, the confusion between entities with distinct bacteriological profiles, such as impetigo and folliculitis (a type of pyoderma generally due to *S. aureus*). In addition, the lack of correlation between bacteriological data and therapeutic information is almost uniform. Indeed, one further argument for the primary role of GAS in pyoderma would be the sensitivity of lesions to antibiotics with no or low anti-staphylococcal activity, such as penicillins. There is also little information on the sensitivity to antibiotics among tropical isolates of *S. aureus* or BHS [43,109,111,112], but so far, contrary to the situation in temperate countries, there does not seem to be a wide problem due to resistance of *S. aureus* or streptococci to macrolides, or of *S. aureus* to cloxacillin (apart from the classical resistance of *S. aureus* and streptococci to cyclins and of *S. aureus* to amoxicillin). This certainly reflects the low use of antibiotics in tropical developing areas for the treatment of these disorders, but this situation could change as a result of raised antibiotic pressure.

Complications of pyoderma

The prognosis of superficial bacterial skin infection has been little studied, but is considered to be generally good. The natural history of superficial pyoderma is largely unknown; it is often believed that spontaneous resolution may be a common occurrence, but there are no objective data to support this statement. Overall, the risk for septic dissemination, either local or regional (adenitis, cellulitis, abscess), is probably statistically relatively low, the commonest possible negative outcome being superficial dissemination of impetigo; dissemination of follicular infection to abscess or cellulitis might also be seen, mainly after puberty. Although they may be related to superficial skin lesions, deep skin infections such as erysipelas are unusual, or frankly rare (fasciitis). Compared to the very high incidences and prevalences of pyoderma, the global risk for such septic complications appears to be very low.

However, it is likely that these classical considerations should be tempered. Severe sepsis secondary to the superinfection of skin lesions of chickenpox have recently been reported repeatedly all over the world [115,116]. There have also been reports in Australia of GAS invasive (bacteraemic) infections secondary to skin infection, followed eventually by death, at an unexpected rate (incidence of GAS bacteraemia: 9.3 per 100,000 per year for the whole population of the “Top End” area in Northern Australia, 23.8 for Aboriginals; this category of population exhibited in addition some particularities: pyoderma and superinfected scabies were the most common primary sources; children might be affected) [117]. A cluster of *S. aureus* invasive infections, secondary to skin sores/scabies in 31% of the cases, was reported in the same geographical area [118]. A WHO collaborative study on the etiology and signs of serious infections in young infants in developing countries brought additional data in infants less than 91 days old: while their burden appeared very variable according to the geographical area considered, skin disorders appeared to be at the origin of a marked proportion of severe sepsis in these children in several areas: in Gambia, *S. aureus* was the leading cause of septicaemia in that age group, with a 21% case-fatality rate, and the presence of skin lesions in about half of them, estimated to be often secondary to scabies [119]; in Papua New Guinea, GAS was the leading cause of septicaemia in children <1 month old, and was often associated with symptomatic infection of the umbilical cord, while *S. aureus* was the second cause of sepsis and also commonly associated with skin lesions [120].

The most widely documented serious complication of pyoderma is *post-streptococcal glomerulonephritis* (PSG) [121]. Globally, the annual incidence of PSG in tropical areas has been estimated at around 20 cases for 100,000 inhabitants (with striking peaks in aboriginal communities from the Pacific) [121]. Compared with throat infections, skin infection accounts probably for a high proportion of the cases of PSG in the tropics, approximately one half of all cases (56% in Guadeloupe [122], 61% in Ethiopia [109], 45% in Nigeria [123]). Pyoderma resulting in glomerulonephritis may be primary or secondary, especially to scabies.

If the general incidence of PSG has been evaluated with some precision, data are much less clear in demonstrating the individual risk of pyoderma for PSG. The data documenting the frequency of PSG secondary to cutaneous infection in the tropical world are presented in Table 5 [15,38,106,124-126]. In addition, in Senegal, 114 cases of PSG secondary to scabies were collected in 1992-93 [127]. Age groups of PSG vary moderately according to geographical area: 2-14 years old (mean, 5 years) [128], 3-15 years [124], and 3-11 years (mean, 7 years) [109], although cases have been observed in younger ages [129]. Because data are scarce, an underestimate of PSG in large parts of the tropical world cannot be excluded. However, it is likely that PSG in most areas is an unusual complication of pyoderma, occurring with a risk largely under the classical estimates of 2-4% [130,131]. Owing to the relative rarity of observations of demonstrable PSG compared with the huge frequency of pyoderma in many developing areas, such classical rates may indeed be overestimates. For example, if we assume as correct the estimate of an overall PSG incidence in children of less developed countries (especially sub-Saharan Africa) to be 24.3 per 100,000 per year [121,123], and if we also assume that pyoderma prevalence in children in the same areas is 5-10% and represents a minimal yearly incidence estimate, and that approximately half the PSG cases are secondary to skin lesions, it can be estimated that, overall, the risk for pyoderma being complicated by PSG in this geographical area is approximately 1/800 (with a 10% incidence of pyoderma) to 1/400 (with a 5% incidence); if only “serious” pyoderma is considered, this risk would be between 2 and 4 times higher.

Table 5. Available data on post-streptococcal glomerulonephritis (PSG) secondary to cutaneous infection in tropical areas

Year of study	Country	Type of study	Methodology	Main findings	Ref
1969-71	Nigeria	Hospital-based (paediatric service)	Research of skin lesions in patients with PSG	16 patients on 20 with PSG had scabies	(124)
1970-71	Trinidad and Tobago	Hospital-based	Research of skin lesions in patients with PSG	Scabies present in 51% of 139 cases of PSG, non-scabietic skin lesions in 24%; incidence of PSG paralleled incidence of scabies in the community	(125)
1974-76	Egypt	Hospital-based	Urinalysis and C3 dosage in 627 children with impetigo	Biological features of PSG in 11% of the cases of impetigo	(106)
1976-78	India	Population-based (orphanage)	Repeated research of PSG in a 89 children community with high incidence of GAS skin infection	No case of PSG over 2 years	(38)
1981-83	India	Hospital-based	Follow-up of 135 PSG cases	Majority of the cases due to scabies or GAS pyoderma; excellent prognosis	(126)
1993-94	Mali	Population-based	Detection of proteinuria in 224 children with pyoderma	Non-significant difference of the presence of slight proteinuria between children with pyoderma and those without	(15)

To explain such low rates, it should be underlined that all group A streptococcal infections are not nephritogenic [128]. The situation probably varies considerably from one place to another - from situations of patent epidemics of PSG, as reported in the Caribbean [125], to occasional occurrences in other areas.

Overall, the *mortality* due to pyoderma - either because of glomerulonephritis where lethality has been estimated to account for approximately 1% of the cases of PSG in developing areas [121], or because of regional or general septic complications - is probably statistically low. The situation seems to be more serious, as already pointed out, in young infants [119,120], and in Aboriginal communities. In addition, the discrepancy between the high incidence of rheumatic fever and the low presence of GAS in throat infections, coincident with the high prevalence of GAS in the skin, has led to the suggestion that skin sores may play a role in rheumatic fever in the Aboriginal population [43]; a similar role for skin infections in rheumatic fever has been suggested elsewhere [109], but there are few data to suggest that it is a common eventuality. It has also been suggested that recurrent or persistent episodes of PSG might contribute in Australian Aboriginal people to a high prevalence of end-stage renal disease [62,132,133], but there are no data that justify extrapolation of these assumptions to other populations.

Other varieties of superficial skin infections

Anthrax has been of recent interest because of its potential use as a bioterrorism agent, but spontaneous cutaneous anthrax appears to be uncommon [134]. The situation might be different for diphtheria. Indeed, several studies performed in various areas of the world have found *Corynebacterium diphtheriae* an occasional, or sometimes common, agent of superficial skin infections [7,135-137], with low or no toxigenicity. Due to the common isolation of *C. diphtheriae* from the throats of contacts, the role of such skin lesions in the dissemination of the disease is suspected to be important [138].

Tropical ulcer, sometimes referred in the literature to as “phagedenic ulcer”, has been reported to be common in children and teenagers in some well-defined tropical areas, although it probably occurs from time to time in many humid tropical areas [139-142]; for example, a study in Papua New Guinea showed that it was the commonest skin disease, and that management of tropical ulcer was occupying a third of the time of the health aid posts, and almost half their healthcare budget [139]. Unfortunately, there is confusion sometimes in the literature since this term seems to be used by certain authors to describe any septic “sore” [143]. Classically, there is also said to be a risk for malignant transformation of chronic tropical phagedenic ulcers, and it is commonly considered that this specific type of ulcer is a main etiological factor for skin cancer in tropical areas; it is, however, probable that many authors assumed without evidence that the majority of chronic ulcers in their geographical area were “tropical ulcers”, even in areas where this kind of ulcer is uncommon. We therefore recommend that the denomination of “tropical/phagedenic ulcer” should be kept only for clinical pictures that are typical of this entity, i.e. a rapidly developing, necrotic, foul-smelling ulcer on the limb of a child, with well-defined borders; ideally, bacteriological confirmation by stained smears should be attempted: “true” tropical ulcer is indeed considered to be due to a combined infection of a number of different bacteria together with a fusiform bacterium (*Fusobacterium ulcerans*) and a still unidentified spirochaete.

Ectoparasitoses

Scabies

The only currently known means of transmission of scabies is from human to human. While often classified as a sexually transmitted disease [144], it should be underlined that this mode of transmission appears to be rather unusual in countries with high basal endemicity. Close interpersonal contact is the main way of transmission, the

act of sleeping together often being underlined [88, 89]. Fomite transmission is theoretically possible after the demonstration that mites live for up to three days away from the human body, but, in practice, this is probably very unusual. The role of dogs as reservoirs of mites and a source of re-infestation has been discussed [125], but it has been established that dog scabies is different from human scabies [145]. The role of hyperinfested people ("crusted scabies") has been thought to be important in certain communities [40].

The *prognosis* of scabies can be considered in several different ways. First, one should evaluate the health risk for an individual patient. Although there might be a tendency for spontaneous healing in individuals, this seems to occur (if it does) very late in the natural history of the disease, possibly after one or more years of infestation. In a rural area near Bamako, 47% of the cases of scabies in children were reported to last for more than 4 months, 14% for more than one year [15]. Bacterial superinfection of scabies occurs commonly, and, according to the context and geographical area, varies from 16% to 67% (median, one third) of the cases, with similar bacteriological agents to those observed in primary pyoderma. The medical risk is the same as for the most serious variants of pyoderma, including the risk for glomerulonephritis; the risk of superinfected scabies for PSG seems to be comparable to that for primary pyoderma, and thus appears low in certain areas, and higher in others, where it might show an epidemic picture [125], a situation that does not seem to be common however. Mortality due to scabies, which overall is probably extremely low, appears to be related mainly to nephritis, or, as recently described, to bactaeriema in young infants [117-120]; crusted scabies represents a rare variant which seems to have a higher mortality, mainly because of secondary severe sepsis [146].

Another important issue for prognosis of scabies is the occurrence of *epidemics*. In addition to basal and variable levels of endemic infection (Table 1), epidemic peaks have been reported from all continents and are a focus of research interest. There is no definition of the level of prevalence at which an epidemic is said to occur, but prevalences might reach critical peaks: 13% [29], 22% [147], 29% [41], 35% [42], 59% [45], 33-70% [46]; as already pointed out, children appear to be particularly affected, with prevalences of 77% in children under 5 years of age in refugee camps [35] and 70% in under-15-year-olds in a village in India [45]. Closed communities, such as jails or displacement camps, are at high risk for the highest figures [35, 100]. High incidence figures have also been recorded [26,59,62,148,149]. The reasons why there are such bursts of cases among endemic levels of infection that seem stable have been largely ignored, with the exception of gross overcrowding in closed communities.

It seems that epidemic situations are often a serious problem for the community. In addition to the risks of superinfection, there can be impairment in the quality of day-to-day life due to lost days from work and excessive costs of medications [59]. It is often said that there is a level of collective immunity above which epidemics have a tendency to fade spontaneously ("seven year itch"); however, scabies may remain at high endemic levels for decades without such spontaneous improvement [46,148]; repeated epidemics may occur at relatively short periods [45]; this suggests that immunity is relatively unprotective. From the scarce epidemiological data that are available, it is impossible to estimate the frequency of such epidemics around the world, but it is probable that these situations, with all their consequences, are much more common than the few observations reported in the literature.

Other ectoparasitoses

According to prevalence studies (Table 1), *Pediculosis capitis* is common in some areas. It is generally considered a minor health problem in developing countries, including by families, and will not be considered further in this review. *Body lice* do not seem to be a common skin problem, except in high-risk conditions, e.g. refugee camps,

and other situations where there are opportunities for very close contact; the body louse is a potential vector for life-threatening bacterial infections, such as epidemic typhus, relapsing fever, and trench fever [150]. *Pubic lice* appear to be an uncommon sexually transmitted disease in tropical areas [144]. In endemic areas such as certain zones of Brazil, *tungiasis* appears to be exceedingly common in poor communities with, for example, an incidence rate of 100% over 3 weeks in an exposed community [151]; this disorder yields high risks for superinfection and, eventually, tetanus. In a similar context, *cutaneous larva migrans* (creeping disease) may reach prevalences of 1-3% [152].

Superficial mycoses

Tinea capitis

This topic has been studied mainly with respect to the different *mycotic agents* that may be responsible. It should be noted first that prevalence studies using a confirmation of the diagnosis of tinea capitis by a mycological examination produced similar high rates in children as clinical surveys, i.e. 7-33% of children of various age groups in every developing area where such research was carried out [153-159]. Several studies have documented the spectrum of the organisms involved, with variations according to the geographical area [160-166]. In fact, almost all the varieties of dermatophytes involved produce a similar picture of pseudo-alopecia associated with scales, with the exception of *Trichophyton schoenleinii*, the agent of favus. In this last entity, lesions are extensive, very symptomatic, and may induce definite widespread alopecia, compared with other variants. Favus can be observed occasionally in many tropical areas, but it has been reported to be common in very limited zones [167]. Data on the public health importance of tinea capitis are particularly scarce. Owing to its high frequency in many tropical developing countries, it appears from personal experience shared with experts that complications of tinea capitis are unusual. Pyoderma appears possible, although its incidence and severity in patients with tinea capitis have not been studied. Kerion, which is a pustular, parasitic non-bacterial variant of tinea capitis, is unusual. It is well known that the great majority of tinea capitis cases will heal spontaneously with time, although slowly, generally around puberty. This is attested by the rarity of this picture in adults, coincidently with the fact that the majority of infected children in many areas were never treated for this condition.

Another important epidemiological issue concerning tinea capitis is that it is highly communicable, especially at family level; data from developed countries have established the common occurrence of cases as well as healthy carriers among children and adults from the same families and in schools. These facts suggest that huge difficulties would arise from the implementation of a control programme on a large scale for this problem in developing areas.

Other variants of superficial mycoses

Although some of these infections are extremely common, such as pityriasis versicolor or fungal infections of the web spaces, few data are available concerning the epidemiological and public health aspects of what appears to be generally a minor nuisance in the tropics [168-173]. *Tinea imbricata* is an exceptional variant of superficial mycosis, which appears dramatically common in only very limited geographical areas [174].

Molluscum contagiosum and other viral disorders

Molluscum contagiosum is due to a poxvirus and is common in children; it is transmitted by incidental contact and the prevalence may be high, particularly in young children. In adults it is likely to be a sexually transmitted disease. Cure is often spontaneous, but superficial dissemination is possible. Superinfection, the only known complication,

appears to be relatively unusual. Widespread dissemination can also occur in immuno-compromised HIV-infected people. Other common viral disorders with low impact on health are *viral warts*.

Dermatitis and other non-infectious disorders

Data for the general population are scarce (Table 1), but the prevalence of 'dermatitis' in children has been found to vary from 0% to 5%. In non-specialized health centres, although this diagnosis appears to be commonly cited as the reason for consultation, it may be that many cases are not really dermatitis because of the poor ability of primary healthcare workers to diagnose skin disorders. The diagnosis of 'dermatitis' in a specialized centre is likely to be correct, and has been reported to be one of the main reasons for going to that type of centre. However, this term appears to be understood in different ways according to investigators (seborrheic dermatitis, for instance, may or may not be included in that category). In addition, the fact that data are coming from reference centres makes it difficult to estimate the real impact of this problem in the general population.

In adults, contact dermatitis appears to be the commonest variety of dermatitis encountered and is frequently due to work-related exposure or self-treatment, or use of cosmetics and traditional topical plant remedies. In children, atopic dermatitis is another common possibility, but the frequencies of these two main types of dermatitis have not been established in this age group in tropical areas.

Prurigo / papular urticaria, another common entity, is distinct from dermatitis and is believed to be secondary to hyperergic reactions to acarids or insect bites [175,176]. Both terms are commonly used, but there is some confusion as "prurigo" may refer to different entities (e.g. actinic prurigo), while the same entity has little to do with typical urticaria. Different topographic variants have been described, and are believed to reflect the involvement of different types of insects. The most common variant affects the limbs, and appears to be secondary to common insect bites, e.g. by mosquitoes or sometimes sandflies. The prevalence of prurigo in children has been estimated to vary from 0.1% to 24% (Table 1); it is most common in young children, with a marked tendency to improve spontaneously with time, as the disease is uncommon in older children. Superinfection is common, and probably represents a very common cause of pyoderma in many areas, especially in humid climates. It is probable that the real frequency of this disorder is underestimated in both prevalence studies and health centre-based studies, since superinfection might dominate the clinical picture and therefore be the only disease registered. On the other hand, owing to the lack of definition of standardized diagnostic criteria for this entity, there is likely to be confusion between true prurigo and banal reactions to insect bites.

HIV-related skin disorders

The spectrum of skin complications of HIV infection in tropical/developing areas has been documented, including in children [177-182]. The main skin complications of HIV infection are herpes zoster, herpes virus simplex infections, common bacterial skin infection, scabies, superficial mycoses, prurigo, drug reactions, verrucae, molluscum contagiosum (often widespread), seborrheic dermatitis, and Kaposi's sarcoma; this last complication appears to be less common in children than in adults. Cancrum oris is another possible complication that is seen in certain tropical areas. Thrush is very common, but does not involve "skin" as defined in this review.

The great majority of data on this topic has been collected in specialized centres, and it is difficult to estimate the magnitude of the problem in the general population, as well as the influence that HIV-related complications may have on the incidence of common disorders (e.g. pyoderma or scabies) in the non-HIV-infected population.

Obviously, these issues should be considered to be directly linked to the level of HIV prevalence in the population; in a rural community in Uganda with a baseline HIV prevalence of 8%, a six-year prospective incidence study in 436 participants (51.6% HIV-negative) found skin disorders in 306 (70.2%), 143 (63.6%) among HIV-negatives, and slightly more, 163 (77.3%), among the HIV-infected [61].

DISCUSSION OF THE RESULTS - GAPS IN EVIDENCE

This review of the available data on the magnitude of the problem of common skin diseases in developing countries gives a contrasting picture.

On one hand, the data - although obtained using variable methodological rigor and sometimes recorded in disparate areas - provide, when put together, a homogeneous picture, which most probably reflects the genuine pattern of skin disease in large areas of the developing world. They show a very high prevalence of pyoderma and superficial dermatophytoses (above all, non-favic tinea capitis); high frequency of scabies, with occasional epidemic peaks; and varying frequencies of other disorders in different places (pediculosis capitis, tropical ulcer, etc.). Children are clearly more vulnerable to each of these disorders (especially pyoderma which is particularly common in under-5-year-olds), and to their general complications (PSG being the main one, although relatively unusual when compared to the frequency of pyoderma); young infants (less than 3 months old) appear exposed to the risk of developing severe sepsis. Scabies affects significantly all age groups; it is more common in children, but to a lesser extent than pyoderma. Superficial mycoses are more common in older children.

On the other hand, there are many gaps in evidence concerning issues that would aid our understanding in managing this problem effectively. Regarding the geographical areas where the studies were performed, it is noteworthy that 10 out of the 18 prevalence studies were conducted in sub-Saharan Africa, 4 in Asia, 3 in Latin America and 1 in Oceania (studies on Aboriginal Australian communities excluded) (Table 1); the majority of studies were conducted only in rural areas. Data from specialized health centres showed a similar balance; those from non-specialized centres were particularly poor. Only one country (Republic of Mali) presented a suitable amount of data from various complementary settings.

From a pragmatic perspective, while acknowledging the global implications of these results, we should study further, as a priority, the gaps for which a better knowledge would have clear consequences in the practical management of skin disorders. These are discussed below:

- Concerning methodology, a preliminary recommendation would be to improve the technical quality of the studies addressing the different aspects of skin disease in developing countries. Indeed, the methodologies of the available studies do not constantly follow the basic rules of epidemiology. In addition, although certain skin diseases might be related, an attempt should be made to study each disorder separately, and to distinguish in each category entities of different significance (e.g. folliculitis versus impetigo). Finally, an attempt should be made to standardize the modalities of data collection, i.e. defining what is understood by the term ‘skin disease’, providing criteria for diagnosis of the main skin diseases, and where possible to grade their severity by reproducible methods. Thus, the definition of simple, specific, and easy-to-reproduce diagnostic criteria for the main dermatological disorders would be of great help.
- The collection of data documenting the general magnitude of the problem and/or the related demand of populations at a primary healthcare level should be given priority, especially in geographical areas where data are totally lacking. In practice, a first and easy step could be the collection of data from national health

statistics or from health centre registers, which are available in many countries. At best, such statistics should be stratified according to the patients' ages. Studies in specialized dermatology centres could eventually be linked with this work in order to give a more precise picture of the nature of the skin disorders encountered in a specific area, but this should be considered as only complementary.

- *Pyoderma.* It is essential to obtain more data on the types of bacteriological agents that are responsible for pyoderma in developing countries and their profiles of sensitivity to antibiotics. Variations from one place to another may occur. To establish the roles of streptococci (including Group A), *Staphylococcus aureus* and *Corynebacterium diphtheriae*, reference methods of sampling and bacteriological identification should be used. Also, more should be known about the prognosis of pyoderma, including the rates and risk factors for the more severe complications, such as PSG or severe sepsis in young children.
- *Scabies.* Studies on epidemics of scabies and their impact on populations, as well as the epidemiological determinants of such situations, should be carried out. Although certainly a top priority skin disease, the scarcity of contributing data to elucidate this problem is striking. We suggest that a simple system of epidemiological surveillance of such situations could be encouraged.
- *Tinea capitis*. A major issue would be to document the frequency of severe variants, including favus.
- There is also a need for more data in younger populations (<3 months, <1 year and 2-5 years old). These age groups appear to be more exposed to pyoderma and its complications, especially the more serious ones, but are rarely considered on their own.
- Finally, with the exception of poor hygiene whose correlation with pyoderma can be considered as established, the main etiological and transmission factors associated specifically with each main skin disorder should be determined with more precision. Changes in behaviour and/or the environment would influence some of these factors, with eventual improvement in skin health. However, more evidence would be welcomed before definite recommendations can be promoted.

Management of common skin diseases in developing countries

DEFINITION AND SCOPE

Reported here are data from the medical literature for treating or preventing the commonest skin disorders in children in developing countries. Only data concerning the main disorders, as defined in the previous sections of this report, i.e. pyoderma, scabies, and superficial mycoses (mainly tinea capitis) are included. It was not our aim to give an exhaustive review of all recent data that would focus on diseases in developed countries [183]. Instead, we concentrated on aspects that were specific to developing areas, like the means of delivering treatments, or that concerned situations common in these areas, such as epidemics. Proposals on public health management of these disorders, including preventive measures and global approaches, were especially considered.

METHODOLOGY

In addition to the data collected on the epidemiological aspects (see above), our research was carried out by exploring the Medline database (via Pubmed), using the following search terms:

- (pyoderma OR impetigo) AND (treatment OR antibiotic OR antiseptic) AND (tropical OR Africa OR Asia OR Latin America OR Pacific OR Oceania OR developing)
- (scabies) AND (treatment OR ivermectin).

RESULTS

Recommendations for standard management

Pyoderma

Treatment of individual cases

Basically, the aim of treatment for pyoderma is to reduce the nuisance related to that disorder by shortening its course, limiting dissemination in the individual (local or rarely systemic) or to other individuals, and reducing the risk of glomerulonephritis. It should be noted that to what extent the treatment of an individual with group A streptococcal infection will prevent the occurrence of glomerulonephritis and other delayed post-streptococcal complications is not clear.

Recommendations for the treatment of pyoderma should take into account the type(s) of bacteriological agent involved. In developed countries, where *Staphylococcus aureus* predominates, recommended treatment relies commonly on one of the following drugs: macrolides, cloxacillin/flucloxacillin, first and second generation cephalosporins, clavulanic acid associated with amoxicillin, fusidic acid, or synergystins. Topical antibiotic treatment (with fusidic acid or mupirocin) is indicated, at least, as an isolated treatment in limited lesions. Optimal duration of treatment is generally 7 to 10 days for oral, and 5 to 7 days for topical treatment. Resistance to macrolides is a growing concern for *S. aureus* as well as for streptococci, resistance to flucloxacillin for *S. aureus*, and, more recently, resistance to antibiotics used topically. Owing to lack of evidence-based data, antiseptics are not recommended as an isolated treatment for pyoderma. Waiting for spontaneous resolution is considered

unacceptable because information on the natural history of the disease is lacking. Topical cleansing, which was advised 30 years ago, is now considered no more effective than placebo [183].

There is no specific recommendation for the treatment of pyoderma in tropical areas, where the bacteriological profile is somewhat unclear, although beta-haemolytic streptococcus (BHS) seems to predominate in many areas, and where access to expensive drugs may be difficult. In areas where BHS largely predominates, the treatment could rely on antibiotics such as penicillin or amoxicillin, while in areas or clinical situations where *S. aureus* accounts for a noticeable proportion of cases, macrolides, flucloxacillin, or first-generation cephalosporins might be more suitable. However, although some of these drugs are widely used in practice, there are, so far, insufficient evidence-based data on their respective efficacy. The only drug with wide controlled experience is intra-muscular benzathin-penicillin, which is used in situations where post-streptococcal complications (such as during post-streptococcal glomerulonephritis epidemics) are to be feared [41,184-187]. However, obligatory intra-muscular administration of benzathin-penicillin, while it solves certain problems of compliance, may be considered unsuitable for general use.

Some open studies testing various drugs have been carried out in tropical areas: oral flucloxacillin in a majority of cases of follicular infection [188], oral cotrimoxazole [103], topical mupirocin associated with topical steroid in superinfected cases of dermatitis [189], fucidin ointment [190], and topical antiseptics (Dalibour's solution, methylene blue, fluorescein) [58]. Another potentially interesting candidate for topical treatment would be gentian violet associated with brilliant green, which has been shown (only *in vitro*) to have an inhibitory effect on a wide variety of bacterial agents commonly involved in pyoderma [191]. However, it appears that the data available from those studies do not answer key issues for several reasons: these were only open studies; most obvious candidates for oral treatment of pyoderma, such as oral forms of penicillin V and A, or classical macrolides (such as erythromycin), have not been tested, nor topical ones such as antiseptics [192]; and the comparative efficacy or effectiveness of these different regimens have not been assessed.

An open randomized trial, recently conducted in Bamako, compared oral erythromycin with oral amoxicillin (both associated to polyvidone iodine) which were given during seven days in the treatment of 132 cases of serious pyoderma (primary or secondary to prurigo). No bacteriological tests were performed. No statistical difference was found in the efficacy of the two drugs, which yielded a high rate of cure (89% *vs* 89%, p = 0.98) (unpublished data from the Bamako Pilot Project).

Community measures

Measures during post-streptococcal glomerulonephritis epidemics. IM benzathin-penicillin is usually considered the main compound for controlling outbreaks of acute post-streptococcal glomerulonephritis [185-187]. The two main proposed options are: to treat all children in the community; or to perform targeted treatment of children, focusing on those with skin sores and/or those who are household contacts of cases. In a similar context, other prevention procedures (e.g. use of plain soap or hexachlorophene soap) were not shown to be efficacious [90].

Mass treatment with oral azithromycin to reduce the prevalence of trachoma or of upper respiratory tract infection was shown to reduce the prevalence of impetigo 2-3 weeks [43] and 10 days [193] after intake; however, emergence of strains of *S. pneumoniae* resistant to azithromycin occurred later in the regions where these trials were performed [193,194].

Prevention

In South Africa, an improvement in water supply did not lower the prevalence of infectious skin disorders [92]; in fact, there was a negative correlation between the frequency of total body washing and the prevalence of "infectious skin disorders", which suggests that the installation of an improved water supply would be followed by an improvement in skin health only if accompanied by educational measures to improve personal hygiene.

In remote aboriginal communities in Australia, building of swimming-pools was associated with a marked decline in the prevalence of pyoderma (as well as perforation of tympanic membrane) in children [96].

In Trinidad and Tobago, distribution of free soap with a recommendation to wash the legs of children twice a day did not improve pyoderma prevalence [90].

In Pakistan, a randomized trial showed a significant 43% reduction in the incidence of impetigo by using a 1.2% triclocarban-containing soap that was distributed free, compared with standard hygiene practices among controls [60]; however, no significant difference was present between use of a placebo soap and standard hygiene practices, and between use of the triclocarban soap and a placebo soap; the duration of episodes of impetigo was significantly shorter in users of soaps (placebo or antiseptic), compared to standard hygiene practice (1.89 and 1.99 weeks *versus* 2.59 weeks); while the data from this study suggested the preventive effect on impetigo of triclocarban soap, a lack of statistical power limited their relevance. More recently, a randomized controlled trial in Pakistan assessed the effect of promotion of handwashing with soap in the community, by intensive education and distribution of free soap (in an area where access to water was not problematic), on the incidence in children of acute respiratory infection, diarrhoea, and impetigo [60bis]. There was a 34% (95% CI, 52% to 16%) statistically significant lower incidence of impetigo in children younger than 15 years old (as well as of diarrhoea, and of respiratory infection in children less than 5 years old) in the arm with hand washing promotion and plain soap use, compared with standard hygiene practice (mean incidence of impetigo = 0.62 per 100 person-weeks with use of plain soap *vs* 0.90 in the control group); use of a triclocarban antiseptic soap did not add any benefit, compared with plain soap.

Zinc supplementation during pregnancy was shown to reduce the risk of impetigo and other disorders in low-birth-weight children until 6 months old [195].

Scabies

Treatment of individual cases

The aim of treatment for scabies is to suppress the discomfort due to the disease, to limit the risk for superinfection and related complications such as PSG, and to limit the dissemination of the disease in the family and more widely in the community.

The main topical drugs recommended today [196] for the treatment of scabies are 0.3- 1% lindane, 10-25% benzyl benzoate lotion, 5% permethrin cream, esdepallethrine (aerosol), 2-10% sulfur [197], 25% sulfiram, and 10% crotamiton; DDT is no longer recommended. The respective efficacies of these drugs have scarcely, if ever, been compared; permethrin is often said to be the most effective agent, but this is debated [196]; this last drug is not available in many areas and is the most expensive of scabicid drugs. Common adverse effects due to topical treatments are irritation and dermatitis. In addition, lindane has a rare but well documented risk for neurological complications (convulsions) and aplastic anaemia, following excessive use or application on the skin with an

impaired barrier function in youngsters. More recently, the WHO Collaborating Centre for International Drug Monitoring (Uppsala, Sweden) has been informed about cases of convulsions with most topicals used to treat scabies (more with lindane and permethrin) and about the occurrence of deaths with lindane (1 case), crotamiton (1 case), and permethrin (5 cases); owing to the huge use of these compounds all over the world, added to technical uncertainty concerning these reports of serious adverse effects, it can be assumed that severe complications with topical treatment of scabies is extremely unusual, and appears to occur mainly (possibly only) in cases of very incorrect use.

Recently, the treatment of scabies has been marked by a major interest in the use of oral ivermectin. Several studies have established the efficacy of this compound in the treatment of scabies, either in the common form or in crusted variants in the immuno-compromised patient. Table 6 presents data from comparative therapeutic trials on the efficacy of oral ivermectin in the treatment of common scabies [198-203]. In addition to the data reported here, ivermectin (150 microg/kg) was considered successful in eradicating an epidemic of scabies (818 cases in a population of 1153 prisoners) in a jail in the United Republic of Tanzania, with an 88% cure rate at 4 weeks [100]. However, an open study reported that a single oral dose of 100-200 microg/kg of ivermectin, used for onchocerciasis, was not efficacious in lowering the prevalence of scabies in villages in Sierra Leone [204]. In Papua New Guinea, among the population in 31 villages who received a single dose of 400 microg/kg of ivermectin during a lymphatic filariasis control programme, the prevalence of concomitant scabies fell from 85% to 7% two months after intake [205]. Topical ivermectin was also found to be effective in treating 32 patients with scabies [206]. In addition, mass treatment with ivermectin helped patients with multiple parasitic infections (in the digestive tract and/or the skin) sensitive to this compound [207].

Table 6. Comparative therapeutic trials of oral ivermectin in the treatment of common scabies

Ivermectin dosage	Comparative drug	Sample size	Results [a]	Ref
100 microg/kg once	10% benzyl benzoate	44	70% vs 48% at 1 month (nsd)	(198)
200 microg/kg once or twice [b]	5% permethrin	85	70% vs 98% at 2 weeks (sd) 95% vs 95% at 4 weeks (nsd)	(199)
150-200 microg/kg once or twice [b]	1% lindane	53	74% vs 54% at 2 weeks (nsd) 95% vs 96% at 4 weeks (nsd)	(200)
200 microg/kg once	1% lindane	200	82% vs 44% at 4 weeks (sd)	(201)
200 microg/kg once	10% benzyl benzoate	110	56% vs 51 % at 3 weeks (nsd)	(202)
200 microg/kg once	25% benzyl benzoate	58	93% vs 48% at 30 days (sd)	(203)

[a] Cure rate with ivermectin followed by comparative drug; sd = statistically significant difference; nsd = no statistically significant difference; [b] Two weeks after first intake.

From these studies, it appears that the efficacy of ivermectin in scabies varied from 56% to 95% after one dose; the dosage used varied from 100 microg/kg to 400 microg/kg; and the probable time for symptoms to disappear was 4 weeks after treatment. Some authors suggested that a second dose of ivermectin would improve its efficacy [199,208], particularly in the more severe forms of scabies [200]. It should be noted that there was often a high rate of patients who were lost to follow-up in these studies, and that the diagnosis of scabies was confirmed by a

parasitological examination in only three out of six studies. In addition, the efficacy of certain drugs that were compared to ivermectin in these trials was, in our opinion, unexpectedly low. We therefore believe that, despite the fact that it appears to be a possible useful treatment, the optimal modalities of intake of ivermectin in common cases of scabies and its level of efficacy, in comparison with reference topical treatments, are still not clearly defined.

There may also be problems with this drug related to toxicity: there are restrictions by the manufacturer on its use by pregnant and lactating women, and by children under 5 years of age. Although inadvertent intake during pregnancy in lymphatic filariasis control programmes has not been shown to be associated with increased risks of congenital malformation or abortions [209], these are serious limitations for wider use, particularly in developing countries, where cases to be treated are numerous and of all ages including very young children (in the first year of life and first trimester), and where assurance that a woman is not pregnant may be difficult to obtain, and supervision for detecting rare adverse effects would be problematic. The need to take the medication on an empty stomach may also be difficult to apply on a large scale. Tolerance in older patients has been questioned, but it is now admitted that the excess death rates reported previously could not be attributed to ivermectin. Finally, there has been recent concern about the emergence of acquired resistance of scabies to oral ivermectin [210] and to topical drugs [211], but this outcome appears so far to be much less common than in pediculosis capitis [212].

Community measures

When faced with an isolated case of scabies, the standard recommendation is to treat every person living in the household of the index case, including those not presenting symptoms of the disease. This recommendation is relatively easy to implement in the case of a small family, but there can be difficulties in a larger community. In very closed communities, such as homes for the elderly, the current recommendation is to treat every inhabitant of the community; oral ivermectin seems to be very efficacious in such a context [100]. In larger communities, specific public health measures are considered to be necessary. Table 7 shows the main protocols described in the literature in such situations, which may be common in developing areas [41,42,46,103,147, 212bis]. In addition, one trial aimed at controlling scabies in a Trinidadian village by self-treatment with monosulfiram soap led to a non-significant reduction in the prevalence of scabies [213]. The effect on the prevalence of scabies as a result of ivermectin, given during mass treatment programmes for other parasitoses, appears variable [204,205,207].

Thus, it appears that community measures are necessary in order to have an impact when there are high levels of prevalence; however, the proposed measures available so far are expensive and relatively difficult to implement, and therefore of questionable value in their present modalities in poorly organized health systems like those in many developing countries. Compared to other interventions, the programme that appeared to be easiest to implement was the one proposed in Egypt with a relatively low level of community involvement, but screening of the whole community for cases was still recommended [102]; in addition, the baseline prevalence was relatively low. Less well-documented data suggest that lighter procedures, such as treatment of cases and close contacts (e.g. from shared bedding), might be an acceptable option for situations where baseline prevalences are low (e.g. 7% [214]), but there are no data on the ideal rates when such measures should be recommended. The place of oral ivermectin as a mass treatment measure has to be defined in an epidemic context. It is also important to note that the classical recommendations on washing or treating clothes and beds (or even, in some cases, pet dogs) with aggressive procedures are likely to be superfluous [41,97].

Table 7. Community control programmes for scabies (excluding institutions)

Year of study	Community	Procedures of the control programme	Results	Ref
1974	Rural village of 2902 inhabitants (Galilee)	- Intensive community education - Screening of the whole community for cases of scabies - Treatment of cases and household contacts; spray clothes and bedding with exterminator - Follow-up: active control of cases until cure	Prevalence of scabies dropped from 22% to nearly 0% at one year	(147)
1986	Island of 724 inhabitants (Indians in Panama)	- Community information - Supervised treatment of the whole community with permethrin - Follow-up: treatment of any new arrival on the island, specific surveillance	Prevalence of scabies dropped from 33% to 0.7-3.6% at 3 years, but increased to 12% at 3 months after breakdown of surveillance programme	(103)
1994-95	Island of 250 inhabitants (Australian aborigines)	- Screening and treatment of the whole community with permethrin; no strict environmental measures - Follow-up: closed visits of the whole community (every 1-6 months), with re-treatment of new cases	Prevalence of scabies dropped from 29% to less than 10% at 2 years; pyoderma in children from 69% to 30%; pyoderma cases were less severe and no longer scabies-related	(41)
1997-98	Rural village of 3147 inhabitants (Egypt)	- Screening of the whole community for cases - Treatment of patients and household contacts with topical permethrin; treatment of recalcitrant cases with oral ivermectin - Follow-up: active control of treated patients and referral of new cases by the community	Prevalence of scabies dropped from 5.4% to 1.1% at 1 year	(46)
2001*	Rural village of 2200 inhabitants (Australian aborigines)	- Intensive community education - Treatment of the whole community with permethrin; fumigation of houses occupied by cases - Monthly control of households with cases, and examination every 3 months of all children under 5 years old	Prevalence of scabies in children under 5 years old dropped from 35% to 4% at 7 months, infected scabies from 11% to 2%, and non-scabies pyoderma from 11% to 3%	(42)
1997-2000	5 Pacific islands with 1558 inhabitants (Solomon islands)	- Mass treatment with oral ivermectin (160-250 g/kg once or twice), permethrin cream in children with weight < 15 kg and in pregnant women - Treatment of any new arrival on the islands, specific surveillance of children every 4 months	In children, prevalence of scabies dropped from 25% to less than 1% (up to 36 months after mass treatment), statistically significant decreases in the prevalence of sores (mostly due to GAS, from 40% to 22%), in streptococcal contamination of fingers, and in the frequency of haematuria	(212bis)

* Year of publication

Tinea capitis

Treatment of individual cases

Current recommendations in developed countries are to treat patients orally with either griseofulvin (10-25 mg/kg during 4 to 8 weeks) or, more recently, terbinafine or itraconazole. Topical treatments are commonly used as well, although they seem useful for only limiting transmission; they are generally considered insufficient to allow cure when used alone, except in under-1-year-olds for whom oral treatment is contraindicated.

In developed countries, the identification of infected contacts in families (including healthy carriers amongst adults) and schools is now considered essential in order to prevent recontamination or dissemination. Identification and disinfection of fomites are also necessary complementary measures. In several developed countries, it is illegal for children with tinea capitis to attend school until proof of cure. It is understandable that many, if not most, of these measures would be difficult to implement in developing countries. Simplified treatments have therefore been proposed, such as single dose treatment with oral griseofulvin [215-219]. However, the efficacy is generally low.

In our opinion, the many limitations to optimal treatment of tinea capitis in developing countries should lead to discussion about the aims of treatment in such situations. Theoretically, the aim of optimal management of a child with tinea capitis is to suppress the patient's discomfort and to limit the risks for superinfection and for more serious variants such as kerion, as well as for dissemination and reinfestation. The relevance of these goals in developing countries should be discussed in terms of the considerable actions that would be needed, especially because they would concern a high proportion of the child population (approximately 10%) and necessitate a level of community measures that would seem out of proportion to the available resources. The high spontaneous rate of cure around puberty should also be taken in consideration.

With the other superficial mycoses, compounds belonging to the imidazole class are most widely used and recommended, but older compounds such as Whitfield's ointment are still, albeit slowly, effective [220].

Public health aspects

WHO: Essential Drugs List

WHO's list of essential drugs [221] includes several components that are active on skin diseases, including some that are specific for skin disorders. These are:

- oral and parenteral antibiotics, including the main compounds considered to be efficacious in skin infections: phenoxymethylpenicillin, benzathin penicillin, amoxicillin, cloxacillin, erythromycin, cotrimoxazole
- topical antibiotics: sulfadiazin silver (1% cream), neomycin sulfate + bacitracin ointment
- topical and oral antimycotics: oral griseofulvin, miconazole, benzoic acid + salicylic acid (Whitfield's ointment), thiosulfate sodium
- antiseptics: gentian violet (0.5% in alcohol or water), potassium permanganate (1/10,000 in aqueous solution), chlorhexidine, iodine polyvidone (solution 10%)
- scabicides: benzyl benzoate 25% solution, permethrin (5% cream or 1% solution)
- topical steroids: 1% hydrocortisone, 0.1% betamethasone valerate
- various topical preparations: calamine lotion, 5% salicylic acid solution, dithranol, urea (5% or 10% cream or ointment).

It should be noted that topical drugs such as neomycin or bacitracin, which are considered by most dermatologists to be responsible for a high rate of adverse effects and to have a questionable effect on skin disorder, are included, while some very commonly used products like 3% tetracycline ointment are not (the latter is very well tolerated and often used more as a basic ointment than for its antibiotic activity).

WHO: specific recommendations

Recommendations for the treatment of scabies have been included in WHO's "Guidelines for the management of sexually transmitted infections" [144]. In the IMCI programme, only peri-umbilical infection in neonates is considered [222].

Specific global procedures for managing skin diseases in developing areas

Theoretical discussions about the importance of skin diseases as a public health problem have been reported in specialized dermatology journals [223-228]. In practice, the main proposals for rational management of the problem

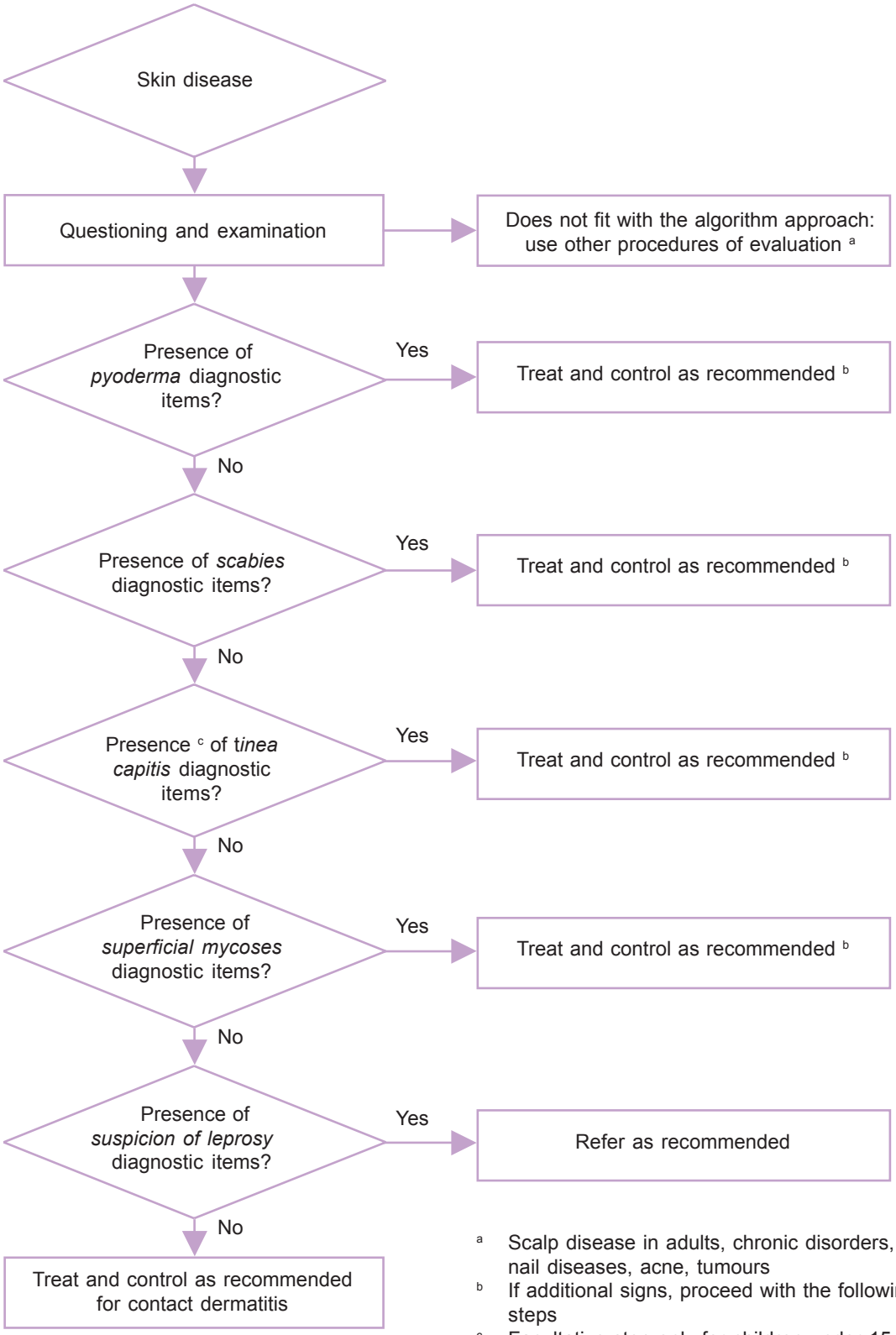
of common skin diseases have focused on the training of healthcare workers (HCWs) at a nurse/primary healthcare level, according to several modalities: intensive training over two years of a limited number of HCWs, as is currently performed in the Regional Dermatologic Training Centre at Moshi in the United Republic of Tanzania [229,230], or a shorter programme (two weeks) like the one in Guerrero (Mexico) [231]. Unfortunately, no systematic evaluation of either of these approaches is available. To the best of our knowledge, a community dermatology programme, which was proposed in India, has not been described or evaluated [232].

A programme in Kenya [21,233] provided repeated yearly training of community health workers, who then carried out regular visits to schools and treated children with free topical drugs for scabies, pyoderma, tinea capitis and dermatitis. Positive results after 2 years were indicated by a slight lowering in the prevalences of certain disorders (e.g. pyoderma was 10.8% after the intervention, compared with 12.7% before, $p < 0.05$) and a reduction in their severity [21]. However, the programme was finally found not to change persistently the prevalences of the main disorders after six years of consecutive training [233]. Several comments can be made concerning this study: a) prevalence is probably one of the most difficult issues of a health problem to act on; b) the proposed therapeutic regimens could not be considered as "gold-standards" for the skin disorders considered (for instance, only topical treatments were used, and complementary measures were not systematically considered in the families of involved children); c) active identification of cases in children, with consecutive treatment, might be a procedure with low predictable effects on disorders for which there is a low spontaneous demand by families; d) community health workers with very little basic medical knowledge might not be suitable for such training programmes; e) the reproducibility of such funded actions at a wider level would seem problematic in terms of recovery of costs.

A pilot project against common skin diseases was conducted recently in Mali (2001-2003). Its main results are given below:

- Simplified diagnostic procedures and treatment of priority skin disorders were defined through a specific algorithm, relying on the identification of key objective signs and on treatment with low-cost drugs available in a generic formulation (Figure 1) [234]. The evaluation of this algorithm in standardized conditions found satisfying results for both identification (intrinsic and extrinsic properties) and treatment (concordance with a reference treatment) of the priority skin diseases (pyoderma, scabies, superficial mycosis, and contact dermatitis), as could be wished for at primary healthcare level.
- Training of healthcare workers (nurses, midwives, general practitioners) at the most peripheral level of care in the Bamako area in the management of defined priority skin diseases (pyoderma, scabies, superficial mycoses, contact dermatitis) was provided through short (1 day) training sessions on the use of the above algorithm, supported by slide projections of typical cases of diseases and presentations of selected patients. Evaluations at 6 to 18 months after the training showed a marked and persistent improvement of knowledge and practical performance of the trained healthcare workers in identifying and treating the above-mentioned disorders. The estimated number of patients who visited the targeted primary healthcare centres for a skin disorder and who had a clear diagnosis and a prescription adapted to the indicated diagnosis, which was considered a surrogate indicator for good management, rose from 42% before training to 81% after, with a 25% lowering in the cost of prescriptions [57bis]. Improvement was greater among nurses than doctors, and when patients were under 15 years old.

Figure 1. Algorithm for management of skin diseases at PHC level (Bamako project) [234]



[a] Scalp disease in adults, chronic disorders, nail diseases, acne, tumours

[b] If additional signs, proceed with the following steps

[c] Facultative step only for children under 15 years of age (omit if >15 years)

Figure 1. Algorithm for management of skin diseases at PHC level (Bamako project) [234]

Notes on the algorithm

The algorithm (Fig. 1) presents a flow-chart with successive diagnostic steps based on identification of key objective signs. In practice, after exclusion of patients with clinical features (e.g. acne, nail diseases, tumours, scalp disorders in adults) that are not relevant to the chart and who should be managed separately, each patient has to be evaluated, first, for the presence of signs that would lead to a diagnosis of pyoderma; if these signs are present, then he/she has to be managed as described for this diagnostic category; if they are absent, the patient has to be evaluated, in the second step, for the presence of symptoms and signs for the diagnosis of scabies; and so on, through the subsequent steps; a patient remaining undiagnosed at the final step is considered to have "contact dermatitis". If, after establishing a diagnosis at any step, other symptoms or signs are present, the patient has to be evaluated also according to the next steps. This approach raises the possibility of more than one diagnosis and treatment option in the same patient.

The key diagnostic signs selected for identification of the targeted skin diseases are the following (optimal combinations of signs are discussed in [234]):

1) *Pyoderma*: presence of yellow crusts, pus, dirty-looking sore, blister.
2) *Scabies*: presence of itching involving at least two sites of the body, visible lesions involving typical sites for scabies (i.e. interdigital spaces of hands, wrists, axillae, elbows, knees, buttocks, genitalia in men, breast areolae in women, palms and soles in children under 2 years of age), presence of itch in others in the same household.
3) *Tinea capitis*: scalp disorder in a child under 15 years of age, visible loss of hair, scaling.
4) *Superficial mycosis* (other than tinea capitis and pityriasis versicolor): involvement of a skin fold, presence of a circular skin lesion.
5) *Suspected leprosy*: presence of a clear (i.e. hypochromic) patch, reduced sensation within the patch, chronic duration.
6) *Contact dermatitis*: any other skin disease.

Once the diagnosis has been established, the recommended treatments and follow-up are as follows:

1) *Pyoderma*: first, evaluate for the presence of an abscess, and refer if there is one; if not, evaluate severity by a standardized assessment of diffusion of lesions: if mild pyoderma, give antiseptic treatment (10% polyvidone iodide or 1/10,000 potassium permanganate) for one week; if severe or after failure of a course of topical treatment, give oral antibiotics for one week (erythromycin or amoxicillin) in addition to antiseptics; evaluate at one week for cure and presence of additional skin diseases; refer if there was failure.
2) *Scabies*: if not superinfected, apply 10% benzyl benzoate solution once and leave on for 24 hours; if superinfected, begin with a one-week course of treatment of pyoderma, followed by topical benzyl benzoate; evaluate at one week: if not cured and symptoms are still compatible with scabies, treat again; refer, if still not cured after one week.
3) *Tinea capitis*: give oral griseofulvin for 6 weeks if over 2 years of age, topical miconazole if under 2 years; evaluate at one month; refer if not cured.
4) *Superficial mycoses* (other than tinea capitis): apply miconazole cream twice daily for 4 weeks; evaluate at one month; refer if not cured.
5) *Suspected leprosy*: refer; if there is a clear patch and no other feature of leprosy is present, consider diagnosis of pityriasis versicolor or pityriasis alba and treat with miconazole twice daily; refer after one month if not cured.
6) *Dermatitis:* stop any former topical application and apply a basic neutral ointment; evaluate at two weeks; refer if not cured.

DISCUSSION OF THE RESULTS - GAPS IN EVIDENCE

Objective, evidence-based data are particularly scarce in this field. Thus, while action could now be taken using the available data (often adapted from developed countries), the actions would benefit greatly from additional data, specific to tropical or developing areas, as discussed below.

Treatments

There is obviously a need for standardized recommendations on treating the main skin disorders (scabies, pyoderma, and tinea capitis), which would take into account the epidemiological characteristics and economic constraints in tropical developing areas:

- *Scabies*: feasible and effective treatment procedures in the context of high levels of interpersonal contact, particularly in an epidemic, should be defined as a priority; limiting the burden of the community's involvement with simple adapted measures should be attempted. Additional therapeutic trials should also be encouraged in order to quantify precisely the efficacy of oral ivermectin in the treatment of scabies, and to compare the results with classical topical treatments, which should remain the first-line drugs for the treatment of scabies, ivermectin being at present only an alternative. The efficacy of topical drugs should also be quantified with more precision.
- *Pyoderma*: standard procedures of treatment, with alternatives, should be defined; the place of topical antiseptic treatment should also be defined, as well as the optimal duration of treatment in terms of efficacy and effectiveness. Attention should be given to the age of the patient since young infants appear particularly exposed to septicaemic complications of skin infections (due to either group A streptococci or *S. aureus*). Another issue is the risk of resistant strains of streptococci and staphylococci, particularly considering the frequency of these disorders worldwide and the number of antibiotic prescriptions that could result.
- *Tinea capitis*: treatment goals should be discussed objectively; a rationale for treatment modalities and decisions on treatment in developing countries should be defined.

Public health strategies

There are important gaps in our knowledge and a real need for the definition and validation, by objective evaluation, of strategies adapted to the context of developing countries. With regard to the curative aspects, so far only one study [57bis] has produced coherent data on this topic; others should be developed and tested, taking into consideration both feasibility and cost-effectiveness.

As regards prevention, recent data have established that a thorough use of plain soap can reduce the occurrence of pyoderma in children (as well as of pneumonia and diarrhoea) [60bis]. However, a positive impact was obtained only after a relatively complex programme combining intensive community education and distribution of free soap in an area where access to water was easy [235], while more simple tested interventions had no or only an equivocal effect. Therefore, there should be additional attempts to define efficacious and simple messages and/or preventive actions (e.g. improving personal or household hygiene, or rational self-care of sores), and to evaluate their impact and cost-effectiveness when promoted and applied.

Finally, we suggest that the dermatological section of the WHO list of essential drugs should be revised.

Rationale for organized action against common skin diseases in less developed countries

In the light of the data presented in this article, we shall now develop a more personal case in order to answer the following questions:

Should public health action be taken against skin diseases in developing countries? If so, for what reasons, for which purpose, and under what conditions? And finally, what kind of actions? In addition, we shall discuss briefly the question of the eventual inclusion of "skin diseases" in the IMCI programme; this matter would also need separate consideration, including adaptation of current diagnoses and therapeutic data to the IMCI format.

There are objective reasons to suggest that organized action against skin diseases would be useful. Thus, certain disorders are extremely common in the general population and contribute to the burden of infestation and low health levels, especially among children (including the youngest). Some disorders have a relative severity, with a definite, albeit low fatality rate in young infants. These disorders (mainly pyoderma and scabies) represent a high proportion of the visits to primary healthcare centres where they are often poorly managed, and in general seem to provoke a high demand in the population for better management. Although not confirmed by any studies, it is reasonable to suggest that the lack of an adequate response by the health system to this demand may be responsible for the perception by patients that the system is ineffective, with the risk that families are discouraged from returning when the child has something more serious. In addition, the problem appears to have a significant cost, which might unduly deprive families of resources that could be used to benefit more serious problems. Certain disorders might be accessible to preventive measures, such as improving hygiene.

On the other hand, there are factors that have retarded taking a decision on collective measures to face the problem: thus, skin diseases are largely benign, with an almost insignificant lethality when compared with other health problems in the same area, which are therefore given priority. Since dermatology is often perceived as a complex subject, with numerous entities that appear to be difficult to simplify, very few attempts to adapt it to public health objectives have been proposed so far. This matter must be resolved if actions are to be taken at the primary healthcare level. The measures shown to be efficacious for the prevention of certain disorders (pyoderma) might be considered too complex or costly, considering the socioeconomic context of most developing areas [60bis,96]. In summary, it is feared that actions against skin diseases would be exceedingly complicated and costly, considering the relatively low priority now given to the problem; ultimately there is a risk of hampering poorly funded healthcare systems in developing countries and of diverting resources from current priority health objectives.

Review of the available literature, particularly one recent programme [57bis,234] suggests that it is possible to provide very simple actions with a significant impact on the quality of care of certain defined priority skin disorders at the primary healthcare level. This promising pilot programme established the possibility of action that was reasonable in terms of involvement and cost, proportionate to the relative second-line level of priority of the problem, and that responded to the strong demand by the population at the primary healthcare level.

Considering possible differences in geographical situation, it is important to include pertinent local data in a model for discussion before making a decision on general measures for skin diseases. Indeed, a "skin disease programme" should be implemented only if it is focused on disorders with high local demand, if the local health system is able to undertake the programme (taking into account time, drugs, etc.), and if education and training facilities are available.

Several issues need to be addressed, taking into consideration relevant items in the local context (see Table below); each item should be objectively defined by a "low" or "high" score. A final decision will be based on the global score.

	Estimated level		
Local skin disease (SD) context	**"Low"**	**"High"**	**Unknown**
Prevalence/incidence of SD			
Objective severity of SD			
Incidence of severe complications of SD			
Accessibility of identified SD to curative and/or preventive measures			
Estimated costs of SD			
Demand for taking in consideration SD:			
- at primary healthcare level			
- at community level			
- from healthcare workers			
- from health authorities			
Local general health context			
Rank of skin diseases (compared to other health priorities)			
Global performance of the health system			
Possibility of integrating SD actions into the health system			
Availability of essential/generic drugs for SD			
Local feasibility of actions			
Capacities for training			
Funding capacities			
Integration into current training programmes			
Feasibility of environmental measures			
Feasibility of education programmes on preventive measures			
Estimated gain in cost			
Global score			

While the discussion should be on the "skin disease problem" in general, it would be sensible also to discuss separately every common skin disorder. Thus, it should be possible to differentiate, from among skin diseases of similar frequency, between those that would benefit from priority actions and those that would not. Therefore, the discussion should focus on defining the problem more clearly.

The actions to be taken against skin diseases would depend on the results of the above discussion, but in the context of most (if not all) developing countries, it would be reasonable, in our opinion, to prepare for actions similar to those conducted in the Bamako Pilot Project, i.e. to provide a short period of training of general healthcare workers focused on a very limited number of disorders. It would be necessary to devise integrated actions rather than vertical ones using, as far as possible, levels of action that are already in place. The primary health care level seems a logical target. Depending on the context, there can be discussion about providing either a comprehensive programme, or a programme focusing only on certain aspects (e.g. young infants). Action for specific situations, e.g. scabies epidemics or PSG epidemics, should be discussed case by case because no simple and effective programme devoted to the control of such a situation in this kind of context is available so far. Large-scale programmes, e.g. screening of cases of one or several skin disorders, like those promoted sometimes for leprosy, are clearly inappropriate as skin disorders are largely benign.

Other actions with preventive objectives, e.g. the promotion of measures to improve predisposing factors like poor personal and general hygiene or water supply, should be discussed in relation to their cost. Indeed, there is some evidence that improvements in individual hygiene, thorough use of plain soap [60bis], and easy access to large quantities of water [96], can reduce the frequency of pyoderma. However, the large-scale feasibility and cost-effectiveness of the interventions that obtained positive impact for these items are probably low for the more deprived settings. Control of interpersonal contact within households would also certainly reduce the prevalence of several infectious disorders, but this may be difficult to achieve in the poorest communities for specifically dermatological objectives. Finally, it would be possible to promote basic general recommendations on hygiene with established or presumed beneficial health impacts, such as the widespread use of water and soap, but with an uncertain range of impact if not supported by intensive education programmes and/or broad environmental measures.

Integration of training in skin disease into IMCI programmes would require 1) evaluating the local context as described above, 2) defining a course on skin disease adapted to the pedagogy and presentation of IMCI programmes, and 3) finding space in the IMCI curriculum for a skin disease course.

Conclusions

From the available epidemiological data and management modalities reviewed here, it can be concluded that certain skin diseases are very common in many developing countries - especially infectious disorders such as pyoderma, ectoparasitoses (scabies and pediculosis capitis), superficial mycoses (tinea capitis), and certain viral disorders (molluscum contagiosum). Non-infectious disorders, such as pityriasis alba or dermatitis, are also common. Other skin disorders are globally less common. Children, especially the very young, are particularly vulnerable to these disorders, including the more severe ones and their complications. However, scabies and - to a lesser extent - pyoderma should not be seen as disorders specific to children.

Pyoderma and *scabies* are disorders with the highest objective severity, and are thought of as such by the community; other disorders could be considered in the same way in certain geographical settings. These disorders commonly account for a high proportion of visits to non-specialized health centres, where in many settings they are one of the most common organ-specific reasons for visiting the health centre. Other cutaneous disorders (tinea capitis, molluscum contagiosum, pediculosis capitis), although very common, do not seem to have as high a priority index, either objectively or as felt by the communities. It should be underlined that in most geographical settings, the objective severity of all these disorders globally is mild, with rare systemic complications - post-streptococcal glomerulonephritis (PSG) being the commonest, occurring probably in less than 1% of pyoderma cases, although skin infection accounts for about half of all PSG cases - and low mortality (although in certain areas they may cause death in young infants). Overall, the severity of pyoderma and scabies is related to the discomfort they cause and the demand for care by the communities, and not to the usual indicators of severity like high lethality or disability. The main etiological factors whose role is probably significant in developing countries are a hot and humid climate (pyoderma), low hygiene and poor access to water (pyoderma), high interpersonal contact and household overcrowding (scabies and pyoderma), and certain other skin conditions like reactions to insect bites and scabies (pyoderma).

Owing to the low level of priority given by health decision-makers almost everywhere, there is nearly total ignorance about common skin disorders in the different levels of the health system in less developed countries. As a result, there is low efficacy of management at the primary healthcare (PHC) level, with undue costs for families. Global health strategies directed at skin diseases and adapted to the needs of developing countries are especially scarce, but public health thinking in this direction has made advances recently.

Discussion of this problem is faced with a dilemma: on the one hand, it seems unfair to ignore the high demand of many populations for correct management, particularly at the PHC level. On the other hand, there is fear that accommodating this relatively minor problem would divert limited health resources from current priority health problems. The feasibility, efficacy, and effectiveness of future actions are therefore of paramount importance; in other words, *the actions should be proportionate to the severity of the problem*, in terms of involvement and cost.

Management of common skin diseases in less developed areas would benefit from standard guidelines - at present almost totally lacking - for their diagnosis and treatment, like those that are available for other health problems. In our opinion, a partial revision of the WHO essential drugs list for skin diseases would be useful. In addition, considering the potential severity of certain skin disorders in young infants, specific recommendations addressing this issue are needed.

Concerning decisions on more organized action, we suggest a rationale based on the evaluation of several issues - e.g. local importance of the skin disease problem, its impact on PHC activity in the local health context, and options and feasibility for possible action. It is our opinion that improving primary healthcare in an integrated way for the more severe cases, like pyoderma and scabies, as was performed during the recent Bamako Pilot Project, seems a reasonable procedure because of simplicity and good recorded results. We believe that such action may be valuable in many developing areas where there is a need, and will fill this hitherto neglected component of PHC. In addition, the actions might prove to be compatible with more comprehensive training programmes, as developed in the IMCI.

Considering prevention, basic recommendations for improving hygiene (promotion of use of soap, of water for washing, of better household hygiene) would probably benefit certain disorders (e.g. pyoderma). However, this raises the question of the feasibility and cost-effectiveness of associated measures (like improving the water supply and/or providing intensive education programmes aimed at changing standard hygiene practices) which seem necessary to obtain a significant impact; if these associated measures are lacking, the range of impact of such basic recommendations appears largely unknown. Nevertheless, improving the socioeconomic level of large populations would certainly benefit these disorders, as well as reduce other health problems that are related to poverty.

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