

National survey in Switzerland calls for improved diagnosis and treatment in children with scabies

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Summary

AIM OF THE STUDY: The global prevalence of scabies is estimated to be up to 200 million cases annually, with young children particularly affected. In Europe, most cases are thought to originate in migrant populations. Scabies management is challenging in children. To identify knowledge gaps and research needs, we aimed to descriptively evaluate the management of children with scabies by different Swiss healthcare providers.

METHODS: An invitation for an anonymous online survey (36 questions) was sent to members of Swiss societies of dermatologists, general practitioners, paediatricians, paediatric dermatologists, paediatric infectious diseases specialists, and tropical medicine specialists, inviting clinicians to participate from 25th May to 8th August 2020. One reminder invitation was sent. Hospital pharmacies and the distributor of permethrin were contacted to report consumption trends of scabicides in 2018 and 2019.

RESULTS: The survey was completed by 248 clinicians: 146 (59%) paediatricians, 47 (19%) dermatologists, 28 (11%) general practitioners, 6 (2%) paediatric dermatologists, 13 (5%) paediatric infectious diseases specialists, and 8 (3%) tropical medicine specialists. Most consulted up to 10 scabies cases within a 16-month period, with similar numbers in migrant and Swiss children. Dermoscopy was used by 24% of non-dermatologists. Non-dermatologists did not consider co-treatment of close contacts in up to 59% of cases. While permethrin was the first-line treatment, treatment failures were frequently reported in children aged <5 years. Up to 67% of paediatric dermatologists regularly used oral ivermectin off-label in children weighing <15 kg. None of the paediatric dermatologists, 15% of the dermatologists, and 9% of the non-dermatologists used only one treatment cycle. Scabicide consumption increased. Treatment studies on ivermectin use in children weighing <15 kg had the highest research priority.

CONCLUSION: In Switzerland, scabies is a frequent dermatosis in migrant and Swiss children. While accessible, optimal diagnostics are underutilised, and treatment is suboptimal. Permethrin resistance appears to be an increasing problem. Dermatologists regularly use ivermectin

off-label in children weighing <15 kg. Treatment studies on ivermectin use in children weighing <15 kg, user-friendly diagnostic tools, new treatment protocols, and child-friendly dosage forms are needed to improve the diagnosis and treatment of children with scabies.

Introduction

Scabies, caused by infestation with the mite *Sarcoptes scabiei var. hominis*, is a contagious ectoparasitic dermatosis affecting all age groups, but particularly children [1, 2]. The global prevalence of scabies was estimated at 175 million across all age groups in 2017 [3]. Scabies-associated disability-adjusted life-years (DALYs) are highest in children aged 1–4 years [4]. In Europe, it is currently believed that scabies prevalence is rising mainly due to the influx of migrant populations. However, many countries, including Switzerland, lack national surveillance systems to formally monitor scabies [5–7].

Effective scabies management is challenging in children. The clinical presentation of scabies varies with age [2]. Infants often present with severe and widespread skin involvement. The presence of crusted nodules in the axillary area and on the back and the involvement of palmoplantar surfaces, the face, and the scalp may help differentiate scabies from atopic dermatitis and other inflammatory skin disorders in this age group [8]. In high-income countries, delays in diagnosing scabies may be due to reduced familiarity with this disorder among non-dermatologists. This diagnostic delay can lead to outbreaks in daycare facilities, schools, and other institutions [9]. The International Alliance for the Control of Scabies (IACS) recently developed international consensus diagnostic criteria and guidelines for common scabies [10].

Topical 5% permethrin cream (Scabi-med[®] Crème 5%; Permamed AG) is the only registered scabies treatment in Switzerland. Topicals are cumbersome since they require meticulous application to all skin areas for 8–12 hours of exposure [11]. Permethrin cream must be reapplied 7–10 days later, often resulting in poor treatment adherence, leading to persistent infection, further spreading, particularly in overcrowded settings, and increasing risk of drug

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resistance [12]. Other scabicides such as benzyl benzoate, topical ivermectin, crotamiton, and oral ivermectin must be imported from abroad and used off-label. Often, health insurance companies decline to cover these treatment options, resulting in a significant financial burden for affected families.

Oral ivermectin is generally effective in patients weighing >15 kg, including those with refractory infestations or immunocompromised [13, 14]. It is also reported to be safe and effective in children weighing <15 kg [15]. Since ivermectin is not ovicidal, repeat administration is required to ensure successful treatment. In France, following the recommendation of the French Medicines Regulatory Agency, oral ivermectin is used in children <1 year if topical 5% permethrin treatment fails [16].

A national surveillance system for scabies does not exist in Switzerland. One study concluded that most scabies cases were treated by general practitioners and paediatricians [17]. Swiss data on the review of infectious diseases in arriving asylum-seeking minors show that scabies is a relevant and common skin infection [18, 19]. To our knowledge, data on diagnostic and treatment strategies for scabies in Swiss children do not exist.

We aimed to survey the management of children infected with scabies by different Swiss healthcare providers to identify knowledge gaps and research needs to optimise the diagnosis and treatment of children with scabies.

Methods

Pre-survey discussions with expert colleagues from dermatology, paediatric infectious diseases, tropical medicine, and adult and paediatric generalists revealed that scabies is a frequently encountered dermatosis associated with management uncertainties in Switzerland. A literature search of the *PubMed* database (search terms: scabies AND Switzerland; Filters: child [birth to 18 years], human), focusing on articles describing diagnostic and treatment strategies for scabies in children in Switzerland, identified only two reports of single-centre experiences with multiple infectious and dermatological diseases that only mentioned the number of scabies cases [18, 19]. Therefore, we initiated a survey among dermatologists and non-dermatologists to describe the current situation regarding scabies in Switzerland and to generate research questions. We formulated 36 survey questions reviewing the general management of scabies cases, the approximate number of cases seen by age group during a 16-month period (January 2019 to April 2020), treatment practices, oral ivermectin use,

treatment failures, and research priorities. Survey questions were formulated in German, English, and French (supplemental material see appendix 1: English version). They were pretested by medical students, paediatric infectious disease specialists, paediatric dermatologists, and paediatric generalists. Improvement suggestions were integrated to create the final version. A completion time of 15–20 minutes was proposed. The surveys were hosted at *Unipark QuestBack* (<https://www.unipark.com>).

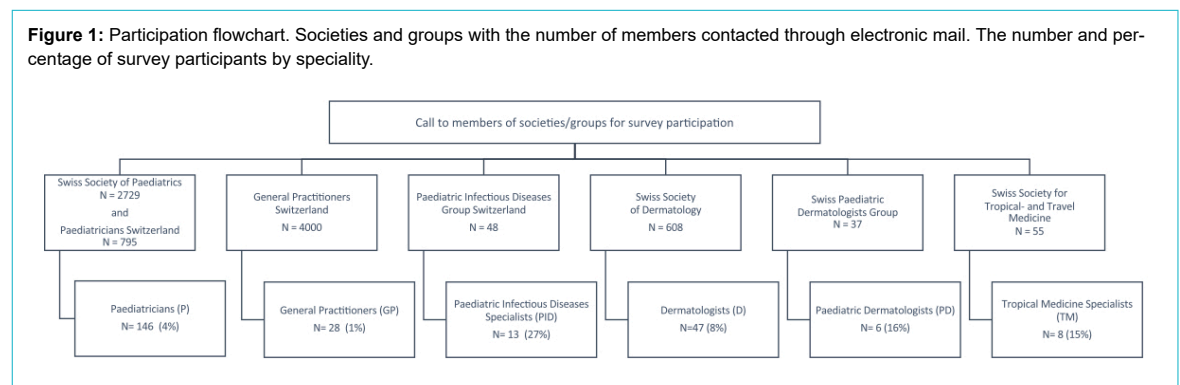
In Switzerland, the following healthcare providers manage scabies in children: paediatricians, dermatologists, general practitioners, paediatric dermatologists, tropical medicine specialists, and paediatric infectious disease specialists. The following professional societies were contacted to motivate their members to participate in the survey: Swiss Society of Paediatrics (SSP; 2729 members), General Paediatricians Switzerland (“Kinderärzte Schweiz”; 795 members), General Practitioners (GP) and Paediatricians (“Haus- und Kinderärzte Schweiz - mfe”; 4000 general practitioners and 500 paediatricians), Paediatric Infectious Disease Group of Switzerland (PIGS; 48 members), Swiss Society of Dermatology (608 members), Swiss Group for Paediatric Dermatology (SGPD; 37 members), and the Swiss Society for Tropical and Travel Medicine (55 members) (figure 1). A call for participation with the link to the survey was sent on 25th May 2020, with a reminder sent on 25th June 2020. The survey was inactivated on 8th August 2020. Participation was anonymous. Statements regarding diagnostic criteria used were compared with the IACS Consensus Criteria for the Diagnosis of Scabies (confirmed: visualisation of mites, eggs, and faeces with an optical device; clinical: visualisation of burrows at typical anatomic areas/distribution including two history features; suspected: typical lesions with one history feature or atypical lesions with two history features; history features include itch and/or positive contact history) [20].

Furthermore, we contacted 15 cantonal hospital pharmacies throughout Switzerland, asking about trends in ivermectin prescriptions/consumption for 2018 and 2019. Peramed AG was contacted, enquiring about trends for orders of Scabi-med® 5%. Statistics were descriptive. Analyses were conducted by calculating the frequencies and percentages of the survey answers provided by the different clinicians. No statistical software was used.

Ethics statement

The project synopsis was approved by the ethics committee (EKNZ) (ID: Req-2020-00681).

Figure 1: Participation flowchart. Societies and groups with the number of members contacted through electronic mail. The number and percentage of survey participants by speciality.



Results

Characteristics of the responding clinicians

The 36 survey questions were completed by 248 clinicians: 146 (59%) paediatricians, 47 (19%) dermatologists, 28 (11%) general practitioners, 6 (2%) paediatric dermatologists, 13 (5%) paediatric infectious diseases specialists, and 8 (3%) tropical medicine specialists. Among the responding clinicians, 70%, 27%, and 2% were from the German-, French-, and Italian-speaking cantons of Switzerland, respectively.

Experience and cases seen

By specialisation, the following proportions of clinicians had been practising for >5 years since their Swiss Medical Association (FMH) board qualification: 94% of paediatricians, 96% of general practitioners, 83% of dermatologists, 100% of paediatric dermatologists, 82% of paediatric infectious diseases specialists, and 86% of tropical medicine specialists. Among respondents, 20% worked in a hospital, 65% in a private practice, and 15% in both settings. Among the dermatologists, 60% of dermatologists and 34% of paediatric dermatologists worked in private practice. Non-paediatricians (general practitioners, dermatologists, and tropical medicine specialists) stated that up to 25% of children with scabies were aged <5 years. When asked to estimate which age group was particularly affected by scabies, 78% of paediatricians, 89% of paediatric infectious diseases specialists, and 80% of paediatric dermatologists considered children aged <5 years the most affected group compared to 67% of non-paediatricians (dermatologists, general practitioners, and tropical medicine specialists); 5% of respondents did not answer this question. Scabies was perceived to affect the Swiss local population and children with a migrant background at similar rates between January 2019 and April 2020 (table 1).

Diagnostics and management

The management and treatment results are summarised in table 2. Most non-dermatologists (i.e. general practitioners, paediatricians, paediatric infectious diseases specialists, and tropical medicine specialists) relied on history (itchy skin lesions plus contact history) and suggestive skin findings (skin lesions, distribution, and burrows) alone to diagnose scabies, which would correspond to the IACS diagnosis category “clinical scabies”. Diagnostic criteria, including tools used by the different clinicians, are shown

in figure 2. Dermoscopy was frequently used by dermatologists (dermatologists and paediatric dermatologists) and less often by non-dermatologists. Dermatologists were also more likely to use laboratory tests, including skin scrapings, to visualise mites, eggs, or faeces than non-dermatologists. These diagnostic modalities correspond to the IACS criteria for “confirmed scabies” and suggest that dermatologists rely on the most specific criteria.

Treatment

Topical 5% permethrin and oral ivermectin were the treatment options most frequently prescribed. Children aged <5 years were most frequently treated with 5% permethrin, with ivermectin use steadily increasing with age (figure 3). Paediatric dermatologists were the most frequent off-label prescribers of oral ivermectin in children weighing <15 kg. Most dermatologists used two treatment cycles of oral ivermectin. Non-dermatologists rarely prescribed adjuvant therapy (emollient and topical steroids from the first treatment day). Around a third of non-dermatologists feared adverse events when using ivermectin in children (table 2).

Most clinicians recommend washing clothes and bedlinen at 60°C (100% dermatologists, 69% non-dermatologists). Most clinicians considered oral ivermectin, followed by topical permethrin, the most effective treatment (figure 4). The question “In your opinion, which treatment is the most effective?” was not answered by 18% of general practitioners, 7% of paediatricians, and 6% of dermatologists.

Treatment failure and adverse events

All clinicians reported treatment failures with topical permethrin in children and adolescents. However, the dermatologists reported the highest numbers. Clinicians who used oral ivermectin for scabies reported fewer treatment failures in children and adolescents (table 2). Most participating clinicians mentioned that “communication problems”, “compliance issues”, “inadequate hygienic measures”, and “severe form of scabies” were contributing factors to treatment failure.

Around a third of dermatologists but fewer non-dermatologists reported adverse events with topical permethrin (“burning/stinging/redness of the skin”) in children aged one month to five years. Both dermatologists and non-dermatologists rarely observed “stomachache/diarrhoea/vomiting” with oral ivermectin treatment (table 2).

Table 1:

Approximate numbers of scabies cases seen in children aged <5 years during a 16-month period (01/2019–04/2020) by group/speciality expressed in percentages.

Scabies case range consulted	1–5		6–10		11–25		26–35		35–50		>50		Non-responders	
	Swiss	Migrant	Swiss	Migrant	Swiss	Migrant	Swiss	Migrant	Swiss	Migrant	Swiss	Migrant	Swiss	Migrant
Paediatricians (paediatrician + paediatric infectious disease specialist), n = 159	90%	87%	7%	12%	2%	2%	0%	0%	0%	0%	0%	0%	1%	1%
Dermatologists (dermatologist + paediatric dermatologist), n = 53	92%	80%	1%	13%	4%	4%	3%	3%	0%	0%	0%	0%	4%	4%
General practitioners, n = 28	79%	86%	7%	0%	0%	4%	7%	0%	7%	9%	0%	0%	8%	8%
Tropical medicine specialists, n = 8	67%	75%	33%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	14%

Persistent scabies

When asked to consider “persistent scabies if itching and eczematous lesions persist”, 43% of dermatologists (dermatologists and paediatric dermatologists) and 8% of non-dermatologists responded that this depends on further diagnostics, such as dermoscopy or microscopy. While 2% of respondents did not answer this question, 13% of der-

matologists and 13% of non-dermatologists suspected recurrent or persistent scabies when symptoms remained two weeks post-treatment, increasing to 26% and 31% at four weeks, respectively. However, 20% of non-dermatologists did not know when to consider persistent or recurrent scabies. When persistent scabies was suspected, 33% of paediatric dermatologists, 23% of dermatologists, and 17% of

Table 2:

Summary of the results for scabies diagnosis and management in children by clinical group. The non-dermatologist group included general practitioners (n = 28), paediatricians (n = 146), paediatric infectious diseases specialists (n = 13), and tropical medicine specialists (n = 8).

	Non-dermatologists		Dermatologists		Paediatric dermatologists	
	n = 195	Non-responder	n = 47	Non-responder	n = 6	Non-responder
Scabies diagnosis						
Rely on history and suggestive skin findings (IACS criteria: clinical scabies)	155 (80%)	0 (0%)	14 (30%)	1 (2%)	0 (0%)	0 (0%)
Use dermoscopy (IACS criteria: confirmed scabies)	47 (24%)	17 (9%)	42 (89%)	1 (2%)	6 (100%)	0 (0%)
Use PCR testing (skin sample)	3 (2%)	17 (9%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)
Use burrow ink test	2 (1%)	17 (9%)	3 (6%)	1 (2%)	0 (0%)	0 (0%)
Refer to a dermatologist for a second opinion	20 (10%)*	0 (0%)				
Treatment and complications						
Use ivermectin off-label in children weighing <15 kg	20 (10%)**	18 (9%)	8 (17%)	3 (6%)	4 (67%)	0 (0%)
Use of a single ivermectin cycle at 200 µg/kg	17 (9%)	108 (55%)	7 (15%)	9 (19%)	0 (0%)	0 (0%)
Use of two ivermectin cycles at 200 µg/kg	46 (24%)	108 (55%)	15 (32%)	9 (19%)	6 (100%)	0 (0%)
Use of adjuvant therapy (emollient and topical steroids from the first treatment day)	27 (14%)	18 (9%)	20 (43%)	1 (2%)	3 (50%)	0 (0%)
Co-treat all close contacts	115 (59%)	1 (1%)	43 (91%)	1 (2%)	6 (100%)	0 (0%)
5% Permethrin cream						
Observe treatment failure: age (1 month–5 years)	111 (57%)	38 (19%)	35 (81%)	3 (6%)	6 (100%)	0 (0%)
Observe treatment failure: age (>5–16 years)	91 (47%)	38 (19%)	37 (86%)	3 (6%)	4 (67%)	0 (0%)
Observe burning/stinging/redness	24 (12%)	0 (0%)	18 (38%)	0 (0%)	3 (50%)	0 (0%)
Oral Ivermectin						
Observe treatment failure: age (1 month–5 years)	39 (20%)	39 (20%)	12 (48%)	6 (13%)	6 (100%)	0 (0%)
Observe treatment failure: age (>5–16 years)	46 (24%)	39 (20%)	24 (59%)	6 (13%)	5 (83%)	0 (0%)
Fear of adverse events when used in children	69 (35%***)	17 (9%)	18 (38%)	3 (6%)	1 (17%)	0 (0%)
Observe stomachache/diarrhoea/vomiting	9 (5%)	5 (3%)	1 (2%)	1 (2%)	0 (0%)	1 (17%)

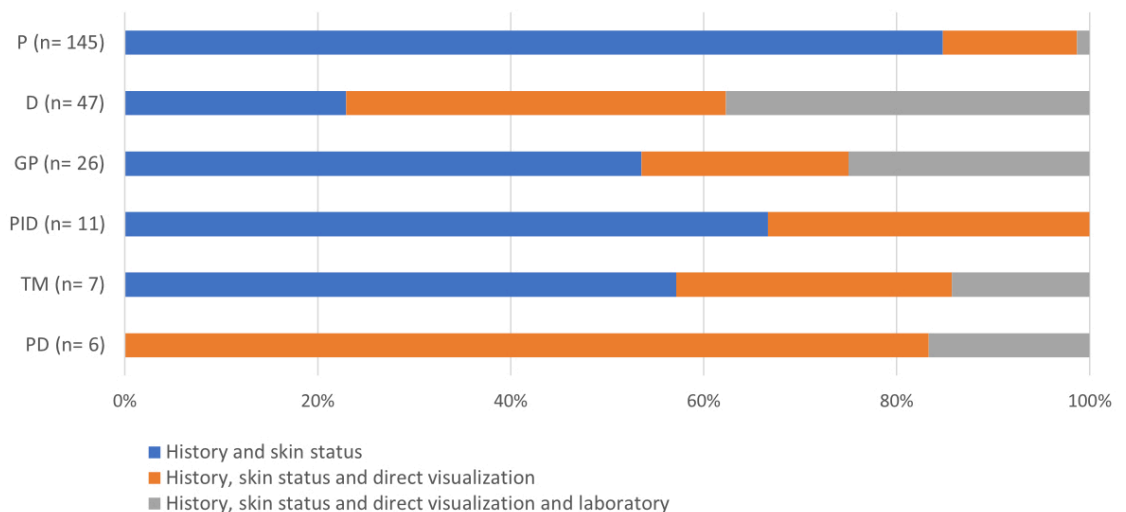
IACS: International Alliance for the Control of Scabies; PCR: polymerase chain reaction.

* Refer patient to a dermatologist for a second opinion: 5/28 general practitioners, 15/146 paediatricians, 0/13 paediatric infectious diseases specialists, and 0/8 tropical medicine specialists.

** Use ivermectin in patients weighing <15 kg: 0/28 general practitioners, 16/146 paediatricians, 4/13 paediatric infectious diseases specialists, and 0/8 tropical medicine specialists.

*** Fear of adverse events when oral ivermectin is used in children: 12/28 general practitioners, 51/146 paediatricians, 1/13 paediatric infectious diseases specialists, and 5/8 tropical medicine specialists.

Figure 2: Diagnostic criteria used by clinicians to diagnose scabies in children. History (itchy lesions plus contact history and family members with itching), skin status (skin lesions, distributions, and burrows), direct visualisation (dermoscopy), and laboratory test (scrapings for parasitology). P: paediatrician; D: dermatologist; GP: general practitioner; PID: paediatric infectious disease specialist; TM: tropical medicine specialist; PD: paediatric dermatologist.



non-dermatologists would switch from permethrin cream to oral ivermectin. In addition, 66% of paediatric dermatologists, 43% of dermatologists, and 12% of non-dermatologists would start combination treatment with permethrin cream and oral ivermectin.

Research priorities

The most relevant research priorities for dermatologists, paediatric infectious disease specialists, and tropical medicine specialists were studies examining the safety and efficacy of using ivermectin in infants and toddlers. The most relevant research priority for paediatricians and general practitioners was easier diagnostic tools for scabies (table 3).

Ivermectin and permethrin consumption

The following 9 of 15 contacted Swiss hospital pharmacies reported that prescriptions for ivermectin tablets increased from 2018 to 2019: Thurgau (80 to 430 tablets), Zug (30 to 36 tablets), Basel City (adults: 572 to 1848 tablets; children: 0 to 12 tablets), Basel Country (2040 to 2440 tablets), Ticino (1275 to 3022 tablets), St Gallen (172 to 372 tablets), Bern (adults: 1372 to 1736 tablets; children: 0 to 40 tablets), Chur (adults: 20 to 28 tablets), and Aarau (500 to 550 tablets). Permamed AG reported an increase in 5% permethrin cream prescriptions from 10,779 to 24,895 packs.

Figure 3: First-line treatment modalities dermatologists and non-dermatologists used to treat scabies by age group. N: the number of clinicians (grouped) who answered the question; X-axis: percentage.

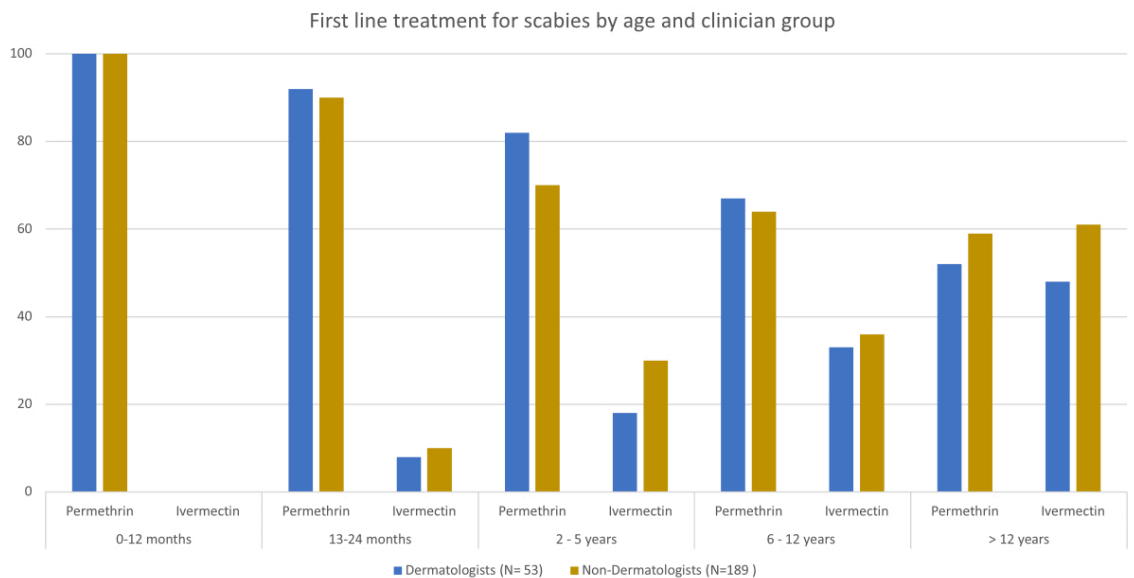
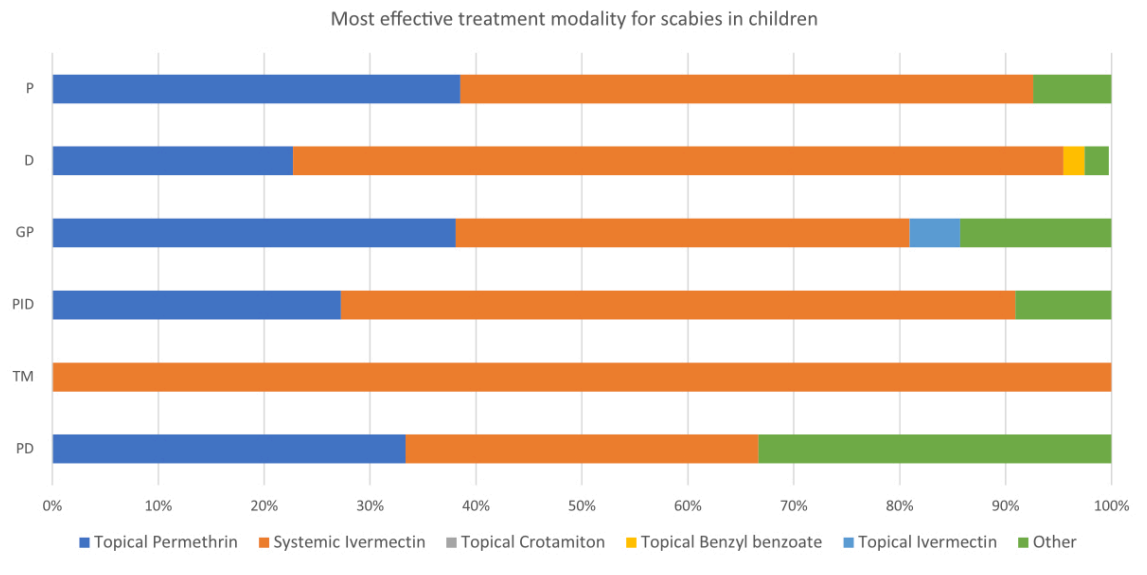


Figure 4: The treatment modality clinicians found the most effective for scabies in children. GP: general practitioner; P: paediatrician; PID: paediatric infectious diseases specialist; D: dermatologist; PD: paediatric dermatologist; TM: tropical medicine specialist.



Discussion

Infants and children with scabies may present to clinicians with differing expertise and in different settings in high-income countries. There is limited data on scabies management across specialities. Previous surveys involved only single groups, such as paediatricians [21], general practitioners [22] and dermatologists [23, 24] and contained only a few questions on management. We included a diverse group of clinicians nationwide and reviewed many aspects of their scabies management, including research priorities.

No precise epidemiological data are available since scabies is not a notifiable disease in Switzerland. Scabies is one of the most prevalent dermatoses in the migrant population [6, 19]. However, within our national survey, most clinicians reported similar numbers in the local population and children with a migrant background. An increase in scabies or scabicide consumption has been reported in countries with a high sociodemographic index [5, 7, 25, 26]. A recent study in the Netherlands reported a more than threefold increase in incidence from 2011 to 2020 [27]. In Spain, 5% permethrin cream prescriptions for scabies increased sixfold from 2008 to 2021 [28]. In Switzerland, hospital pharmacies and Permamed AG reported that scabicide prescriptions increased from 2018 to 2019, indicating a similar trend to those in other European countries. The findings from our and other studies indicate that scabies is not a rare disease in high-income countries but rather an increasing problem.

The scabies burden in low- and middle-income countries is highest among children aged <5 years [4], which was also confirmed in our survey. Scabies management in very young children frequently challenges clinicians in Switzerland.

Few national guidelines on managing scabies in children exist in Europe. These guidelines are often not harmonised, particularly regarding diagnostic and therapeutic modalities [11, 29–31]. The IACS has recently developed practical guidelines for categorising scabies diagnoses into confirmed, clinical, and suspected scabies that are appropriate for use in all income settings [10]. Our survey showed that most non-dermatologists rely only on history and suggestive skin findings. Almost all dermatologists and paediatric dermatologists used dermoscopy, and some used adjunctive diagnostics such as skin scrapings. A recent survey among dermatologists in Italy found that dermoscopy was only used in half of suspected cases [24].

Regarding the IACS criteria, most Swiss non-dermatologists would diagnose “clinical” or “suspected” scabies.

Using less specific diagnostic criteria may result in misdiagnosis since there are several differential diagnoses mimicking scabies, resulting in the spread of scabies in families or institutions or the application of incorrect treatment modalities (e.g. steroids for presumed eczema in young children with scabies leading to crusted scabies [32]). Our survey showed that almost all dermatologists correctly treat close contacts simultaneously [11, 33]. However, up to 40% of non-dermatologists do not follow this critical management step. Not treating contacts of index patients risks spread or recurrence [12, 34].

Dermatologists readily prescribe emollients and topical steroids as adjuvant treatment from the first day of treatment, while non-dermatologists are reluctant to use topical steroids. They are safe to use as adjunct first-line treatment and can help control the eczematous and inflammatory components of scabies [2, 35]. Inflammation may last 4–6 weeks after treatment initiation [2, 36].

This survey revealed that approximately a third of non-dermatologists consider the “recurrent scabies” diagnosis, but only if itching and eczematous lesions persist at four weeks post-treatment, and only 6% use further diagnostic tools to support their diagnosis. This gap in optimal treatment and follow-up diagnostics may explain overdiagnosing “recurrent scabies” or “treatment failure” [37, 38].

In Switzerland, the younger the patient, the more likely permethrin will be prescribed. Conversely, the older the patient, the more likely oral ivermectin will be prescribed. A study in France made similar observations [21]. However, most clinicians in our survey felt that oral ivermectin was the most effective treatment modality.

Dermatologists observed treatment failures with permethrin cream in 46–90% of cases involving children aged <5 years. In contrast, non-dermatologists observed treatment failure in nearly a third of such cases. Our study did not provide information on patient education (treatment application and duration). Furthermore, our survey did not ask whether the heads of children aged <5 years were included when applying permethrin. These factors (incorrect application of topical treatment) may potentially contribute to permethrin treatment failure. A recent Italian survey among dermatologists reported similar numbers (52%) of permethrin failure, but this was not specified by age group [24]. However, these observations may have a particular bias since most children are primarily seen by paediatricians and general practitioners, starting with the first-line treatment. They may refer particularly difficult cases to dermatologists for further management. However, studies by Mazzatenta et al. [39] and Balestri et al. [38] suggest

Table 3:

Research priorities for scabies management suggested by the clinicians. Multiple answers were allowed. Respondents answered each question on a scale from 0 (irrelevant) to 6 (very relevant). Only highly relevant answers (scores of 5–6) are shown.

Highly relevant (Score of 5–6)	Ivermectin use in infants and toddlers (safety and efficacy studies)	New dosages and treatment protocols for ivermectin	New drug agents for scabies	Easier diagnostic tools for scabies	Research regarding scabies resistance	Non-responders
Paediatricians (n =146)	53%	43%	30%	59%	26%	0%
Dermatologists (n = 47)	57%	51%	38%	43%	51%	0%
General practitioners (n = 28)	15%	19%	38%	35%	27%	0%
Paediatric infectious disease specialists (n = 13)	82%	64%	27%	45%	18%	0%
Tropical medicine specialists (n =8)	86%	57%	71%	57%	57%	0%
Paediatric dermatologists (n = 6)	100%	33%	50%	17%	83%	0%

that permethrin is becoming less effective against scabies. In vitro resistance studies on scabies mites are rare [40], and, to our knowledge, conclusive resistance data are not yet available in Europe.

Permethrin cream adherence issues are multifactorial, particularly in families with many children. Risk factors for treatment failure include communication problems in migrant families, treatment of all family members, and difficult housing settings. These factors may reflect the cumbersome process of applying cream to all skin areas, making this topical treatment modality prone to incorrect application. An oral treatment modality such as ivermectin could reduce these risk factors.

Interestingly, up to 23% of clinicians, particularly dermatologists, use oral ivermectin regularly off-label in children weighing <15 kg. Ivermectin is an off-label treatment modality in this young age group due to its limited pharmacokinetic, safety, and efficacy data. In recent years, increasing studies on post-off-label treatment observations have been reported, concluding that oral ivermectin is safe and has no significant adverse events [15, 41–44]. However, data from randomised controlled trials on ivermectin's safety, pharmacokinetics, and efficacy in children weighing <15 kg are currently unavailable. This aspect is a research priority, particularly for the clinicians who participated in our survey. Other priorities for clinicians are new user-friendly diagnostic tools, treatment protocols, child-friendly dosage forms, and clinical research regarding scabies treatment resistance. This finding aligns with recently reported research priorities discussed in the IACS and the World Health Organization [45].

Study limitations

It should be noted that our survey results are based on the answers provided by a limited number of clinicians who were reached by mail through their societies and could participate. Our low number of respondents may reflect that our survey fell within the initial months of the lockdown during the COVID-19 pandemic, during which many physicians were preoccupied with other tasks and overwhelmed by electronic mail. In addition, some clinicians did not answer all questions. It can be hypothesised that only clinicians who have been in contact with paediatric scabies and experienced management problems were keen to participate, and the findings from our survey may be biased towards the answers of these clinicians and, therefore, not generalisable. Some questions were unanswered due to time constraints or unfamiliarity with the topic, which may add bias and reduce generalisability. However, being key players in managing children with dermatologic problems, paediatricians and dermatologists were the largest group of clinicians to provide answers on their management of scabies, providing a perspective on potential gaps and shortcomings of scabies diagnosis and treatment in children. Nevertheless, our findings can guide necessary management and research topics to focus on in the future.

Conclusions

In Switzerland, scabies is a frequently observed dermatosis in migrant and Swiss children aged <5 years. While accessible, optimal diagnostics are underutilised, and treat-

ment is suboptimal. There is indirect evidence that resistance to permethrin may be an increasing problem. Up to two-thirds of dermatologists regularly use oral ivermectin off-label in children weighing <15 kg. Clinical studies on ivermectin use in children weighing <15 kg, user-friendly diagnostic tools, new treatment protocols, and child-friendly dosage forms are needed.

Data availability statement

The data presented in this manuscript are available from the corresponding author upon reasonable request.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest related to the content of this manuscript was disclosed.

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Appendix: Survey questions

1. Are you a Paediatrician, General Practitioner, Dermatologist, Paediatric Infectiologist, Tropical Medicine Specialist, or Paediatric Dermatologist?
2. Approximately how many children do you see in your daily practice?
3. Year of your FMH specialisation:
4. In which Swiss canton are you working?
5. Do you work in a hospital, a private practice, or both?
6. Do most of your patients come from the rural or urban population?
7. Are you involved in the care of recent migrants or asylum seekers?
8. Do you consider Scabies a problem?
9. Which age group is particularly affected by scabies?
10. Where do you feel least confident when treating scabies?
11. Approximately how many scabies cases did you see in 2019?
12. Approximately how many scabies cases did you see in 2020?
13. What criteria do you use to diagnose scabies?
14. What diagnostic tools do you use?
15. What are your next steps when you suspect scabies?
16. What do you do if you suspect scabies in a child aged <12 months?
17. Do you treat all family members/close contacts at the same time?
18. What is your first-line treatment in each age group?
19. Do you use systemic ivermectin?
20. Do you regularly use systemic ivermectin in children weighing <15 kg (approximately <4 years)?
21. If you use ivermectin in children weighing <15 kg, what adverse events do you see?
22. What ivermectin dose do you prescribe?
23. How frequent?
24. Do you obtain a cost credit for ivermectin from your health insurance company?
25. Are the costs for ivermectin reimbursed by the health insurance?
26. Do you prescribe adjuvant treatment?
27. What do you recommend regarding hygiene measures?
28. If you treat scabies, after how much time do you consider "recurrent scabies" if itching and eczematous lesions persist?
29. What is your management if a recurrence is suspected?
30. In your opinion, which treatment is the most effective?
31. Do you see treatment failure with permethrin?
32. Do you see adverse events with permethrin?
33. Do you see treatment failure with ivermectin?
34. Do you see adverse events with ivermectin?
35. What do you think are the reasons for treatment failure?
36. What would be your research priorities regarding scabies?