Scabies in healthcare settings

Sophie Bouvresse[a] and Olivier Chosidow[a,b]

[a]Department of Dermatology, Hôpital Henri Mondor, Créteil and [b]Université Pierre et Marie Curie, Paris, France

Correspondence to Olivier Chosidow, Department of Dermatology, Hôpital Henri Mondor, 51 avenue du Maréchal de Lattre de Tassigny, 94010 Créteil, France
Tel: +33 1 49 81 25 01; fax: +33 1 49 81 25 08; e-mail: olivier.chosidow@hmn.aphp.fr

Current Opinion in Infectious Diseases 2010, 23:111–118

Purpose of review

In industrialized countries, epidemics of scabies are mainly described within families or in institutions such as healthcare settings. Control of institutional scabies is associated with a considerable working and economic burden, but guidelines for the management are scarce.

Recent findings

The prevalence of institutional scabies is probably underestimated. Identified risk factors for institutional scabies outbreaks include the institution type, extensive physical contact with patients and movement of patients, the existence of crusted scabies, a long diagnostic delay and failures in implementation of infection control or treatment plans. Atypical clinical features (hyperinfestation, scabies in the elderly or in children) may be misdiagnosed.

Control of institutional scabies outbreaks relies on prompt recognition of the index case, constitution of an outbreak management team, determination of the extent of the outbreak and risk factors for spread, immediate implementation of infection control practices, adequate education of all involved persons, simultaneous treatment of cases and of all exposed individuals and concomitant environmental disinfection. Prolonged surveillance is imperative to eradicate scabies.

Summary

The inclusion of institutionalized patients in randomized controlled trials would be beneficial as present data concerning scabicide effectiveness are obtained from trials that recruited individual participants and do not take into account a global strategy.

Keywords

crusted scabies, healthcare settings, outbreak, scabies

Curr Opin Infect Dis 23:111–118

0951-7375

Introduction

Scabies is a contagious, parasitic dermatosis with worldwide distribution that affects 300 million individuals annually, encompassing all age groups and social classes [1].

In industrialized countries, scabies occurs sporadically in outbreaks in healthcare settings, including long-term care facilities, nursing homes, acute care facilities and orphanages. Although scabies is associated with discomfort, morbidity and mortality are usually the result of secondary bacterial superinfection. Control of institutional scabies is associated with a considerable working and economic burden including prolongation of hospitalization, ward closures, patient's treatment and environmental disinfection procedures, laundry and extra staffing [2••,3,4]. In addition, scabies outbreaks may lead to adverse public perception of the establishment and to panic among the residents' family members. If there are several national guidelines for the treatment of individual cases of scabies, detailed guidelines for the management of institutional epidemic of scabies are scarce.

The aim of this review is to highlight and discuss interesting developments in recent literature concerning scabies in healthcare settings, focusing on its epidemiology and therapeutic strategy.

Current knowledge about scabies

Management of institutional scabies outbreaks requires updated knowledge about scabies.

Description

Scabies is a parasitic dermatosis caused by the acarine itch mite *Sarcoptes scabiei* var *hominis*.

Clinical symptoms result from a delayed (2–6 weeks to several months) host immune response to the mite [5]. Hypersensitivity reactions in case of reinfestation occur within a few days. The parasitic burden is usually low

(around 5–10 mites) and person-to-person transmission requires close skin contact. By contrast, the numerous mites found in severe scabies (up to millions) facilitate transmission through the environment (fomites, bedding, clothing or other inanimate objects) as *S. scabiei* may survive outside the host for 24–36 h [6].

Classic scabies manifests as generalized intensive pruritus with nocturnal predominance, inflammatory papules typically located on interdigital spaces of the hands, wrists, armpits, buttocks, male genitalia and areolas. Specific signs (linear burrows with a small pearl-like vesicule at the distal end) and scabious nodules may be absent or hidden by nonspecific lesions such as excoriations, eczematization or impetiginization. During the later stages of the disease, scabietic infestation is suspected by the presence of burrows but the diagnosis is microscopically confirmed when skin scrapings reveal mites, eggs or mite faeces [1]. New methods like epiluminiscence microscopy may increase sensitivity of skin scraping tests and, thus, limit false negative results [7,8].

Available treatments

Treatment of classic scabies may be topical or by the oral route (Table 1) [9••,10–18,19•,20,21]. In most countries, the choice of available and licensed scabicides is restricted.

Topical scabicides have neurotoxic effects on mites, larvae and eggs. Although methodological quality varied between trials, a recent meta-analysis suggests that topical permethrin is the most effective scabicide [19•].

Ivermectin interrupts gamma-aminobutyric acid (GABA)-induced neurotransmission of many parasites (including mites). The results of a few randomized controlled trials (RCTs) make it difficult to evaluate the value of ivermectin compared with the main topical treatments; indeed, significant statistical heterogeneity and methodological weaknesses should be noticed in RCTs (i.e. differences in drug regimen or length of follow-up) [1,19•]. The recommended dosing regimen should be one oral dose of 200 μg/kg repeated on day 14 because of a possible lack of ovicidal effect [1,22]. A single dose of ivermectin could explain some treatment failure [23•].

Oral treatment should be preferred when topical therapy seems difficult to apply [1]. Oral ivermectin is convenient, allowing better patient compliance, and has been reported to be useful as a mass treatment in controlling endemic and epidemic scabies [24]; however, the level of evidence in healthcare settings is low [25,26]. Ivermectin is an interesting therapeutic option for scabies institutional outbreaks necessitating a large-scale treatment that should be performed simultaneously for all cases and contacts [2••].

Epidemiology in healthcare settings

Assessing the prevalence or associated risk factors of institutional scabies is difficult, thus making this information scarce.

Prevalence of scabies among healthcare settings

In industrialized countries, scabies occurs sporadically either in individuals or in outbreaks in healthcare institutions, including nursing homes [13–18,19•,20–22,23•, 24–27], long-term care facilities [5,28–30], acute care hospitals [3,31–34] and orphanages [35]. The prevalence of scabies is underestimated, as it is not a notifiable disease in most countries, including in healthcare settings. Moreover, scabies institutional outbreaks are underreported [36] as scabies carries a socially negative connotation and may be associated with economical prejudice for institutions, whether public or private. Few questionnaire-based surveys studied prevalence of institutional scabies (details in Table 2) [5,37–38,39•].

Vorou *et al.* [40••] studied epidemiological characteristics of 19 outbreaks. The mean duration was 14.5 weeks (range 4–52 weeks). The mean number of infested patients was 18 (range 3–82), with a mean attack rate of 12.9% (range 4–40%). The mean number of infested healthcare workers (HCWs) was 39 (range 6–278), with a mean attack rate of 34.6% (range 7–88%).

Risk factors for institutional epidemics

Risk factors for institutional scabies were mainly identified through outbreaks reports or retrospective questionnaire-based studies.

Factors depending on institution

Long-term care institutions tend to report scabies more often than acute care hospitals [5,41•]. An epidemiological survey showed that hospitals that possessed acute care and long-term care wards indicated higher prevalence of scabies [39•]. A large sized institution (number of residents and HCWs) [5,39•] and extensive physical contact with infested patients [2••,3,33,40••,42] are risk factors for the development of scabies. Some authors hypothesized that patient turnover was one of the most important factors to assess the risk of onset of scabies [39•,43].

Factors linked with patients' characteristics

Patients with crusted scabies serve as a reservoir for the mite [40••] and hyperinfestation facilitates transmission through the environment. In a review of 20 hospital outbreaks of scabies, 16 of 19 index cases were considered to have crusted scabies or a variant [36]. Another review analysed 19 outbreaks: all but one of the index patients had crusted scabies [40••]. These results, however, may be submitted to a nonnegligible publication bias. In case

Table 1 Treatments for scabies

Treatment	Dosage	Treatment regimen	Contraindication	Advantages	Disadvantages	Report of resistance	Note
Permethrin	5% cream	8–12 h		Effective; well tolerated; safe	Rare skin irritation; expensive	Increasing in-vitro tolerance [9••,10]	
Lindane	1% lotion or cream	Applied for 6 h	Pregnant women, infants, persons with a seizure disorder	Effective; inexpensive	Can cause numbness, cramps, dizziness, seizures in children	[11,12]	Withdrawn in the European Union owing to neurotoxicity concerns
Benzyl benzoate	25% ointment	One or several consecutive 24-h applications	Pregnant women and infants	Effective; inexpensive	Can cause severe skin irritation	Reports of treatment failure [13]	Some preparations include sulfiram with an antabuse-related effect
Esdepalletrine		Single 12-h application	Aerosol-conditioned preparations are contraindicated for people suffering from asthma				
Crotamiton	10% ointment	2 consecutive applications of 24 h		Reported antibacterial and antipruritic activity; low toxicity; well tolerated	Questionable efficacy [14,15]; multiple treatments required	[11]	Safe for infants
Malathion	0.05%						Not approved by the FDA for the treatment of scabies
Sulphur	2–10% precipitate in petroleum base				Noxious and malodorous; may cause skin irritation; multiple treatments required; lack of safety and efficacy data		
Tea tree oil	5%			Well tolerated; acaricidal properties [16]	More data regarding the safety and in-vivo efficacy are required		
Topical ivermectin	1.87% cream or 1% lotion			Success in uncontrolled studies [17,18]	No topical ivermectin preparation marketed		More studies are needed
Oral ivermectin	Pills	200 μg/kg repeated on day 14	Children weighing less than 15 kg; pregnant or lactating women	See chapter 1.2 [19•]	Minor and transient side effects: gastrointestinal disorders, neurological or skin; not licensed for scabies everywhere; expensive	Reported resistance in two overtreated patients [20] Increasing in vitro tolerance /resistance [9••].	A worsening of the skin eruption with exacerbation of pruritus may occur for the first few days after treatment [21]

FDA, Food and Drug Administration.

Table 2 Main results of major prevalence studies

Reference	Description of the study	Duration of the study	Type of institution	Rate of responding institutions	Prevalence of scabies among responding institutions
Pennington [37]	Questionnaire survey	1-year period	725 nursing homes in Michigan, USA	-	17%
Holness *et al.* [5]	Questionnaire survey	1-year period	179 long-term care facilities in Ontario, Canada	130 (73%) institutions responded to the survey	25% reported cases of scabies in either their residents or the staff
Anonymous BEH [38]	Questionnaire survey	1-year period	1458 nursing homes and 605 long-term facilities in France	647 (44%) of nursing homes and 242 (40%) of long-term facilities responded	Scabies cases were reported by 6.6% of responding nursing homes and 14% of long-term care facilities
Makigami *et al.* [39•]	Questionnaire survey	1-year period	1795 psychiatric hospitals and long-term care hospitals in Japan	741 (41.3%) hospitals responded	Scabies cases, scabies outbreak and crusted scabies were reported by 333 (44.9%), 159 (47.7%) and 51 (15.3%) of responding hospitals, respectively

of outbreaks in healthcare institutions, a considerable number of residents, once infested, are at risk of developing crusted scabies because of their underlying medical condition [42]. Movement of patients without assistance has been shown to be a dementia-specific risk factor for scabies [odds ratio (OR) = 11.3, 95% confidence interval: 2.9–44.8] [44]. Intrafacility transfers of individuals would then contribute to persistent epidemics [45].

Factors related to management of scabies

The institutional outbreaks of scabies are usually the result/consequence of delay in diagnosing scabies in an infested patient [33,40••,42,45]. Misdiagnosis of crusted scabies is caused by lack of itching in some patients, a relatively long incubation period and/or clinicians being unfamiliar with the disease [39•]. In addition, these patients are frequently treated with topical or systemic steroids, which may mask symptoms [43]. Then, in some outbreaks, investigation for scabies only began when HCWs developed itching [40••]. To date, there is no general policy for early and systematic detection of scabies for newcomers to a healthcare setting [46].

Failures in implementation of treatment plan have been associated with persistent epidemic, including:

(1) insufficient appreciation of the extent of the outbreak [42,45];
(2) lack of attention to individual protection measures (like use of short-sleeved coats [47]) [3,33,43,48];
(3) infested asymptomatic contacts as well as therapeutic failures due to resistance or re-infestation [40••,42,45];
(4) incomplete postintervention monitoring [42,45].

Atypical clinical features

Scabies may present with atypical clinical features, thus potentially delaying the diagnosis.

Crusted scabies variant

Crusted scabies is a highly contagious hyperinfestation variant of scabies.

It develops in immunocompromised patients, including HIV-infected or human T cell leukemia/lymphoma virus type 1 (HTLV-I)-infected patients, organ transplant recipients, institutionalized elderly or debilitated individuals as well as those receiving immunosuppressive medications or long-term topical corticosteroids [40••]. The common feature is a depressed immunity [49] and/or absence of scratching. Crusted scabies is a scaly dermatosis, with common involvement of the nails and occasional generalized lymphadenopathy. Burrows are frequently absent or masked. Staphylococcal superinfection may complicate crusted scabies increasing morbidity and even mortality [40••].

Table 3 Epidemiological definitions during scabies institutional outbreak

Denomination	Definition	Note
Suspected case	Patients and hospital caregivers who had presented with symptoms suggesting scabies infestation during the outbreak period	Attempts should be made to confirm the diagnosis of scabies through direct microscopic examinations of *Sarcoptes scabiei*
Definite case		
Common scabies		
	Person with pruritic rash with a typical clinical presentation ± findings of mites at skin scraping OR atypical rash with evidence of scabies at skin scrapings	
Crusted scabies		
	Erythematous lesions and scales, with or without itching with detection of numerous mites at scrapings	
Contacts		Contacts should be categorized into several groups according to how close their relation was with the index case.
First circle	Persons having had intimate or prolonged, direct skin-to-skin contact with an infested person	e.g. hospital caregivers, sexual partners, family members
Second circle	Persons working, residing or admitted in the ward/institution during the outbreak period	
Third circle	Persons having been visiting occasionally the institution and household members of persons visiting frequently the healthcare setting	

Data from [54••].

Scabies in the elderly

The clinical picture in the elderly can be atypical, with papules and persistent nodular lesions [50]. The lesions preferentially involve the trunk and nonexceptionally the scalp [13] or the back for bedridden patients [33]. It is hypothesized that scabies may present differently in the extreme elderly because the skin harbouring the mite is different.

Scabies in healthcare workers

Infested HCWs may present with lesions involving abdomen, axillary folds, thighs and groin rather than interdigital spaces of the hands or wrists. This atypical distribution has been attributed to the specific hand hygiene frequently used in the HCWs [51].

Scabies in infants and children

In younger patients, lesions are vesicles, and nodules frequently involving face, scalp, palms and soles. Eczematization and impetigo are common. Pruritus should be suspected in infants in case of irritability, eating or sleeping disturbance [1]. Young children may be more susceptible to scabies because of their close exposure to family members and their thinner skin. In a large institutional outbreak report, it was observed that five (56%) of the nine infested household members were small children (mean age: 3.2 years) who were not adequately preventively treated. The authors hypothesized that the infestation of children was a key factor in healthcare-related scabies outbreaks, thus explaining reinfestation within families [2••].

Management of institutional scabies

Management of institutional scabies has never been evaluated in RCTs, but the following height-step strategy should be advocated.

Step 1: prompt recognition of the index case

The onset of scabies in a staff person who has had scabies before can be an early warning sign of undetected scabies in a patient. Diagnosis should be microscopically confirmed [31,40••,45,52].

Step 2: constitution of an outbreak management team

The management of these outbreaks can best be handled by outbreak management teams, ideally consisting of members of the medical and nursing staff, representatives from the pharmacy and local centres for disease control and prevention, a dermatologist and microbiologist [43,53•,54••]. Failure to coordinate notification, education, treatment and disinfection leads to failure to control scabies epidemics [43,52,55]. The team's missions are summed up as follows (outbreak management team tasks):

(1) Implementation of an active programme for early detection of infested patients and staff with identification of persons to be treated.
(2) Notification to the local health department of any outbreak that may have community implications, including possible spread by patients or staff to other institutions.
(3) Education of the staff that should be involved in coordinating scabies control.
(4) Implementation of a model treatment plan to stop scabies epidemic. This plan coordinates treatment of all persons exposed, isolation of infected patients, environmental disinfection as well as education and reassurance of the staff. Scheduling treatment time and coordinating therapy is necessary as treatment is of low risk, but cumbersome because many individuals need to be treated.
(5) Establishing surveillance plan.

Step 3: infection detection and surveillance measures

(1) Records must be maintained with patient identification, roommate(s) name(s), skin scraping status and identification of all staff who provided hands-on care to the patient before implementation of infection control measures. Active case finding includes contact tracing of patients and family members having been in contact with index cases.
(2) Epidemiologic and clinical data should be reviewed to determine the extent of the outbreak and risk factors for spread (http://www.cdc.gov/scabies/hcp/index.html).
(3) Ongoing surveillance must be maintained to identify new or unsuccessfully treated cases of scabies [45] (http://www.cdc.gov/scabies/hcp/index.html).
(4) The epidemiological definitions that should be used are shown in Table 3 [54••].

Step 4: infection control practices

Contact precautions should be strictly implemented, especially in case of crusted scabies wherein transmission can occur through inanimate objects (http://www.cdc.gov/scabies/hcp/index.html).

(1) Infested patients should be isolated in a single ward until control skin scrapings are negative, especially for crusted scabies [1,3,40••,45,52,53•] (http://www.cdc.gov/scabies/hcp/index.html).
(2) Strict contact precautions with cases include the use of protective garments: long-sleeved disposable gowns, nonsterile gloves, shoe covers and hand washing [28,53•]. Note that barrier protection does not include insecticide spray or alcohol-based compounds.

Other infection control measures may be considered in cases of severe outbreak:

(1) Assigning a cohort of caretakers to care only for scabietic patients with restriction of staff rotation in the facility [45,52] (http://www.cdc.gov/scabies/hcp/index.html).
(2) Reducing social contact with the confirmed cases with limitation of visits [53•] (http://www.cdc.gov/scabies/hcp/index.html).
(3) Restricting movement of institutionalized patients with temporary suspension of routine activities [29].

Step 5: adequate information

Adequate communication is necessary to halt the spread of scabies and to prevent deterioration of labour and public relations. Considerable time and energy should be spent educating all possibly affected people (including patients, staff, other health or social workers, family and friends) with an institution-wide information programme about scabies and how scabies is and is not spread [5,31,40••,45,52,55] (http://www.cdc.gov/scabies/hcp/index.html). Prewritten fact sheets may be useful [54••] (http://www.cdc.gov/scabies/hcp/index.html).

Step 6: treatment plan

One of the keys to successful control of an outbreak is the simultaneous treatment of cases and of all exposed individuals to prevent reexposure and continued transmission [2••,5] (http://www.cdc.gov/scabies/hcp/index.html).

Who should be treated?

In any case, treatment must be given to the entire group of individuals who may be affected [5]. Close contacts, that is, first circle contacts, should receive the same treatment simultaneously, regardless of symptoms [1,3,28,45] (Table 3).

In the case of a large outbreak or in the presence of severe or crusted scabies, preventive treatment should be extended to second or even third circle contacts [2••]. Indeed, the preventive treatment of high-risk HCWs may not be sufficient considering indirect transmission [3]. As risk associated with treatment is relatively low, treatment should occur proactively and even in equivocal circumstances [52] (http://www.cdc.gov/scabies/hcp/index.html).

How to treat?

Treatment of scabies must be adjusted depending on parasitic burden.

Common scabies and preventive treatment

Individuals should be treated with a potent acaricide agent, either by topical or oral route. If topical scabicide is chosen, it should be applied to all areas of the body from head to toes, including scalp, neck and genitals [1]. Permethrin is now preferred over other topical scabicides as the first-line treatment in Western countries [53•]. In case of oral treatment, the present ivermectin recommended dosing regimen is one oral dose of 200 μg/kg repeated on day 14 for patients and their contacts (see above). Staff generally can return to work the day after treatment [28] (http://www.cdc.gov/scabies/hcp/index.html). Healing criterion for individuals is disappearance of clinical signs and itching within 2–4 weeks after treatment.

Crusted scabies

Several doses of ivermectin, combined with repeated topical scabicide (± keratolytic agents) is the appropriate first-choice treatment in severe or crusted scabies [49,56]. Nail cutting, debridement of subungual material and repeated applications of scabicide are advised [53•,55]. Ideally, cases of crusted scabies should be treated in specialized departments. Healing is defined as resolution of clinical signs and symptoms with negative testing

Table 4 Causes of persisting itching after scabicide therapy

Cutaneous irritation	Overtreatment
	Eczematization
	Contact dermatitis
Treatment failure	Poor compliance: inappropriate or insufficient treatment
	Resistance to scabicide
	Reinfestation or relapse
Psychogenic pruritus	Delusions of parasitosis
	Nonparasitic dermatosis

Data from [57].

for scabies 2–4 weeks after treatment completion [1,3,45,52].

Step 7: simultaneous environmental disinfection

Fomites should only be handled by laundry personnel using protective garments. Clothing and bedding used anytime during the 3 days before treatment should be machine-washed in hot water and dried thoroughly or ironed. Items that cannot be washed should be treated with insecticidal powder or stored in plastic bags for 10 days [1,40••,52] (http://www.cdc.gov/scabies/hcp/index.html). It has been suggested that storing nonwashable items in a freezer at −20°C for 72 h could be a useful disinfection procedure [28].

Environmental disinfestation is neither necessary nor warranted in case of classic scabies (http://www.cdc. gov/scabies/hcp/index.html). In case of severe scabies, routine cleaning and vacuuming of the room should be done. Use of insecticide sprays and fumigants is not recommended (http://www.cdc.gov/scabies/hcp/index.html).

Step 8: long-term surveillance

Prolonged surveillance is imperative to eradicate institutional scabies [45,52] (http://www.cdc.gov/scabies/hcp/index.html). The epidemic is considered as controlled if all the infested individuals are healed and if no new cases of scabies occur during the surveillance that should reasonably be extended for 6–8 weeks after treatment completion. Itching following outbreaks and attributed to psychogenic causes has been described [33], but persistent itching several weeks after adequate treatment may be associated with different diagnoses (Table 4) [57].

Conclusion

The onset of an institutional outbreak of scabies is associated with considerable morbidity and economic burden. Management of institutional scabies requires coordination of all involved personnel and sustained effort as the failure to be vigilant can result in needless worry and expense for all concerned. Prompt recognition of cases, immediate implementation of intensive infection control measures, widespread preventive simultaneous treatment of all contacts, decontamination of the environment and prolonged monitoring are key factors for controlling scabies epidemic in healthcare settings.

Institutions should maintain a high index of suspicion for crusted scabies in all debilitated patients with chronic 'eczematous' lesions, especially when corticosteroids are used.

Therapeutic strategy in institutional scabies has yet to be better qualified as present published data concerning efficacy of scabicides were obtained from trials that recruited individual participants. Given the burden caused by scabies within institutions, the inclusion of such patients in RCTs of effectiveness would be beneficial. Similarly, approaches to the control of outbreaks in institutions require further evaluation in order to characterize an optimal therapeutic strategy. Control of institutional scabies epidemics requires attention to treatment effects and logistics. Thus, sufficient institutional and administrative support should be provided to enhance hospital-based control practices.

Acknowledgements

O.C. reports receiving consulting fees from laboratoire Pierre Fabre, consulting fees from Johnson & Johnson and lecture fees from Pohl Boskamp.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 191).

1 Chosidow O. Clinical practices. Scabies. N Engl J Med 2006; 354:1718–1727.

2 •• Buehlmann M, Beltraminelli H, Strub C, *et al.* Scabies outbreak in an intensive care unit with 1,659 exposed individuals: key factors for controlling the outbreak. Infect Control Hosp Epidemiol 2009; 30:354–360.

This study retrospectively analyses one of the largest hospital outbreaks of scabies. It highlights the importance of the simultaneous, strict and widespread treatment of all exposed individuals and the possible role of infestation of small children in healthcare-related outbreaks.

3 Obasanjo OO, Wu P, Conlon M, *et al.* An outbreak of scabies in a teaching hospital: lessons learned. Infect Control Hosp Epidemiol 2001; 22:13–18.

4 Papini M, Maccheroni R, Bruni PL. O tempora o mores: the cost of managing institutional outbreaks of scabies. Int J Dermatol 1999; 38:638–639.

5 Holness DL, DeKoven JG, Nethercott JR. Scabies in chronic healthcare institutions. Arch Dermatol 1992; 128:1257–1260.

6 Arlian LG. Biology, host relations, and epidemiology of Sarcoptes scabiei. Annu Rev Entomol 1989; 34:139–161.

7 Argenziano G, Fabbrocini G, Delfino M. Epiluminescence microscopy. A new approach to in vivo detection of Sarcoptes scabiei. Arch Dermatol 1997; 133:751–753.

8 Dupuy A, Dehen L, Bourrat E, *et al.* Accuracy of standard dermoscopy for diagnosing scabies. J Am Acad Dermatol 2007; 56:53–62.

9 •• Mounsey KE, Holt DC, McCarthy J, *et al.* Scabies: molecular perspectives and therapeutic implications in the face of emerging drug resistance. Future Microbiol 2008; 3:57–66.

Comprehensive and updated review of treatments for scabies. Recent advances are providing new insights into scabies mite biology and genetic mechanisms underlying drug resistance.

10 Walton SF, Myerscough MR, Currie BJ. Studies in vitro on the relative efficacy of current acaricides for Sarcoptes scabiei var. hominis. Trans R Soc Trop Med Hyg 2000; 94:92–96.

11 Roth WI. Scabies resistant to lindane 1% lotion and crotamiton 10% cream. J Am Acad Dermatol 1991; 24:502–503.

12 Purvis RS, Tyring SK. An outbreak of lindane-resistant scabies treated successfully with permethrin 5% cream. J Am Acad Dermatol 1991; 25: 1015–1016.

13 Moberg SA, Lowhagen GB, Hersle KS. An epidemic of scabies with unusual features and treatment resistance in a nursing home. J Am Acad Dermatol 1984; 11:242–244.

14 Taplin D, Meinking TL, Chen JA, Sanchez R. Comparison of crotamiton 10% cream (Eurax) and permethrin 5% cream (Elimite) for the treatment of scabies in children. Pediatr Dermatol 1990; 7:67–73.

15 Amer M, el-Gharib I. Permethrin versus crotamiton and lindane in the treatment of scabies. Int J Dermatol 1992; 31:357–358.

16 Walton SF, McKinnon M, Pizzutto S, *et al.* Acaricidal activity of Melaleuca alternifolia (tea tree) oil: in vitro sensitivity of Sarcoptes scabiei var hominis to terpinen-4-ol. Arch Dermatol 2004; 140:563–566.

17 Yeruham I, Hadani A. Control of human scabies by topical application of ivermectin. Ann Trop Med Parasitol 1998; 92:627–629.

18 Victoria J, Trujillo R. Topical ivermectin: a new successful treatment for scabies. Pediatr Dermatol 2001; 18:63–65.

19 • Strong M, Johnstone PW. Interventions for treating scabies. Cochrane Database Syst Rev 2007:CD000320.
This review, based on the available evidence from RCTs, discusses scabicides efficacy.

20 Currie BJ, Harumal P, McKinnon M, *et al.* First documentation of in vivo and in vitro ivermectin resistance in Sarcoptes scabiei. Clin Infect Dis 2004; 39:e8–e12.

21 Burkhart CG, Burkhart CN, Burkhart KM. An epidemiologic and therapeutic reassessment of scabies. Cutis 2000; 65:233–240.

22 Usha V, Gopalakrishnan Nair TV. A comparative study of oral ivermectin and topical permethrin cream in the treatment of scabies. J Am Acad Dermatol 2000; 42:236–240.

23 • Ly F, Caumes E, Ndaw CA, *et al.* Ivermectin versus benzyl benzoate applied once or twice to treat human scabies in Dakar, Senegal: a randomized controlled trial. Bull World Health Organ 2009; 87:424–430.
This study compares the effectiveness of oral ivermectin and two different modalities of topical benzyl benzoate for treating scabies in a community setting.

24 Lawrence G, Leafasia J, Sheridan J, *et al.* Control of scabies, skin sores and haematuria in children in the Solomon Islands: another role for ivermectin. Bull World Health Organ 2005; 83:34–42.

25 Marty P, Gari-Toussaint M, Le Fichoux Y, Gaxotte P. Efficacy of ivermectin in the treatment of an epidemic of sarcoptic scabies. Ann Trop Med Parasitol 1994; 88:453.

26 Barkwell R, Shields S. Deaths associated with ivermectin treatment of scabies. Lancet 1997; 349:1144–1145.

27 Chan LY, Tang WY, Ho HH, Lo KK. Crusted (Norwegian) scabies in two old-age home residents. Hong Kong Med J 2000; 6:428–430.

28 Andersen BM, Haugen H, Rasch M, *et al.* Outbreak of scabies in Norwegian nursing homes and home care patients: control and prevention. J Hosp Infect 2000; 45:160–164.

29 De Beer G, Miller MA, Tremblay L, Monette J. An outbreak of scabies in a long-term care facility: the role of misdiagnosis and the costs associated with control. Infect Control Hosp Epidemiol 2006; 27:517–518.

30 Degelau J. Scabies in long-term care facilities. Infect Control Hosp Epidemiol 1992; 13:421–425.

31 Clark J, Friesen DL, Williams WA. Management of an outbreak of Norwegian scabies. Am J Infect Control 1992; 20:217–220.

32 Garcia C, Iglesias D, Terashima A, *et al.* Use of ivermectin to treat an institutional outbreak of scabies in a low-resource setting. Infect Control Hosp Epidemiol 2007; 28:1337–1338.

33 Larrosa A, Cortes-Blanco M, Martinez S, *et al.* Nosocomial outbreak of scabies in a hospital in Spain. Euro Surveill 2003; 8:199–203.

34 Zafar AB, Beidas SO, Sylvester LK. Control of transmission of Norwegian scabies. Infect Control Hosp Epidemiol 2002; 23:278–279.

35 Pruksachatkunakorn C, Wongthanee A, Kasiwat V. Scabies in Thai orphanages. Pediatr Int 2003; 45:724–727.

36 Lettau LA. Nosocomial transmission and infection control aspects of parasitic and ectoparasitic diseases. Part III. Ectoparasites/summary and conclusions. Infect Control Hosp Epidemiol 1991; 12:179–185.

37 Pennington NE. Scabies: an itchy problem. Michigan Department of Public Health – EOH. Focus 1986; 2:9.

38 Anonymous. La gale dans les établissements pour personnes âgées en France en 1996. BEH 1997; 7:27–29.

39 • Makigami K, Ohtaki N, Ishii N, Yasumura S. Risk factors of scabies in psychiatric and long-term care hospitals: a nationwide mail-in survey in Japan. J Dermatol 2009; 36:491–498.
This questionnaire-based study was conducted to assess the prevalence of scabies and control measures in Japanese psychiatric hospitals and long-term care hospitals.

40 •• Vorou R, Remoudaki HD, Maltezou HC. Nosocomial scabies. J Hosp Infect 2007; 65:9–14.
Clear and updated review of nosocomial outbreaks of scabies, detailing factors that facilitate the development of hospital-acquired scabies and measures for containment of an outbreak.

41 • Smith P, Bennett G, Bradley S, *et al.* SHEA/APIC guideline: infection prevention and control in the long-term care facility. Am J Infect Control 2008; 36:504–535.
Epidemiological information and guidelines for treatment and prevention of infections in long-term care facilities, including scabies.

42 Van Vliet JA, Samsom M, van Steenbergen JE. Causes of spread and return of scabies in healthcare institutes: literature analysis of 44 epidemics. Ned Tijdschr Geneeskd 1998; 142:354–357.

43 Achtari Jeanneret L, Erard P, Gueissaz F, Malinverni R. An outbreak of scabies: a forgotten parasitic disease still present in Switzerland. Swiss Med Wkly 2007; 137:695–699.

44 Tsutsumi M, Nishiura H, Kobayashi T. Dementia-specific risks of scabies: retrospective epidemiologic analysis of an unveiled nosocomial outbreak in Japan from 1989–1990. BMC Infect Dis 2005; 5:85.

45 Jimenez-Lucho VE, Fallon F, Caputo C, Ramsey K. Role of prolonged surveillance in the eradication of nosocomial scabies in an extended care Veterans Affairs medical center. Am J Infect Control 1995; 23:44–49.

46 Juranek DD, Currier RW, Millikan LE. Scabies control in institutions. In: Orkin M, editor. Cutaneous infestations and insect bites. Maiback HI, New York: Dekker; 1985.

47 Gil AJ, Aparici CD, Salazar CA, *et al.* Brote de sarna en personal sanitario. Enfermeria Integral 1999; 48.

48 Pasternak J, Richtmann R, Ganme AP, *et al.* Scabies epidemic: price and prejudice. Infect Control Hosp Epidemiol 1994; 15:540–542.

49 Roberts LJ, Huffam SE, Walton SF, Currie BJ. Crusted scabies: clinical and immunological findings in seventy-eight patients and a review of the literature. J Infect 2005; 50:375–381.

50 Meyers LN. Clinical presentation of scabies in a nursing home population. J Am Acad Dermatol 1988; 18:396–397.

51 Robles Garcia M, de la Lama Lopez-Areal J, Avellaneda Martinez C, *et al.* Nosocomial scabies outbreak. Rev Clin Esp 2000; 200:538–542.

52 Scheinfeld N. Controlling scabies in institutional settings: a review of medications, treatment models, and implementation. Am J Clin Dermatol 2004; 5:31–37.

53 • Tjioe M, Vissers WH. Scabies outbreaks in nursing homes for the elderly: recognition, treatment options and control of reinfestation. Drugs Aging 2008; 25:299–306.
This review summarizes aspects of scabietic infestation in nursing homes: clinical presentation, epidemiology treatment and preventive measures.

54 •• Castor C, Bernadou I. Epidémie de gale communautaire – Guide d'investigation et d'aide à la gestion. Saint-Maurice (France): Institut de veille sanitaire. http://www.invs.sante.fr/publications/2008/epidemie_gale_commmunautaire/index.html. [Accessed at 2008]
This French guideline explains the recommended strategy for controlling scabies outbreaks in healthcare settings with emphasis on practical information.

55 Estes SA, Estes J. Therapy of scabies: nursing homes, hospitals, and the homeless. Semin Dermatol 1993; 12:26–33.

56 Corbett EL, Crossley I, Holton J, *et al.* Crusted ('Norwegian') scabies in a specialist HIV unit: successful use of ivermectin and failure to prevent nosocomial transmission. Genitourin Med 1996; 72:115–117.

57 Chosidow O. Scabies and pediculosis. Lancet 2000; 355:819–826.