High prevalence of scabies in Auckland pre-schools

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ABSTRACT

AIM: Scabies is a difficult disease to diagnose and its prevalence not well established. A strong association between scabies and more serious illnesses in children, for instance acute rheumatic fever, suggests greater understanding of scabies prevalence is warranted. Here, we present initial findings of a study of childcare centres, to estimate the prevalence of scabies in the Auckland community.

METHODS: Children in three childcare centres from socio-economically challenged areas were examined for scabies. Diagnoses were made according to the International Alliance for the Control of Scabies (IACS) criteria, whose "clinical" or "suspected" definition consists of examination findings of papules: either "typical" or "atypical" distribution, along with history features of itch and contact with likely other cases. A quantitative polymerase chain reaction (qPCR) test was also used.

RESULTS: A total of 67 children were examined, with over half (*n*=38 or 56.7%) showing signs of typical (14; 20.9%) or atypical (24; 35.8%) scabies lesions. History information was available for 50 children. Of these, nine (18%) met the criteria for "clinical" or "suspected" scabies. Of 27 qPCR tests performed nine (33%) tested positive.

CONCLUSION: The prevalence with scabies is high in early childcare centres in socio-economically challenged areas of Auckland.

Recent evidence indicates that scabies may play a more important role in the aetiology of various important diseases of childhood than has been appreciated.[1] One study links scabies infestation with bacterial skin infection, particularly cellulitis and abscess.[2] Scabies has also been implicated in the causation of kidney disease through post-streptococcal glomerulonephritis,[3] and mounting evidence suggests a link with acute rheumatic fever.[5]

The last formal assessment of the prevalence of scabies in New Zealand was published in the late 1970s.[6] This study showed a prevalence of scabies in high school children of about 18% in Pacific, 10% in Māori and 2% in NZ European children. A recent study in Samoa highlighted a high prevalence of scabies (14.4%) and the closely linked condition impetigo (57.1%). This island nation has close connections with many Pacific people living in Auckland.[7] Samoans comprise 50% of the Pacific population of New Zealand, the majority of whom reside in Auckland.

To further investigate the prevalence of scabies in New Zealand, we conducted a study in early childhood education centres and schools in the Auckland Region. Here, we present the results from the survey of children's skin in three early childhood education centres, situated in socio-economically challenged areas of Auckland.

Methods

We have started a study which initially planned to look for scabies in 23 childcare centres. The initial results from three in low socio-economic areas show a higher prevalence of infection than expected. We believe this is of public health concern. To protect privacy, the names of the centres are withheld.

Parents or guardians of children attending each sampled centre were invited and gave written informed consent for their child to participate. Parents were invited to fill in a written questionnaire relating to skin symptoms, signs and recent diagnoses and treatments of their child and other household members. Sociodemographic information including age, gender and ethnicity were also collected.

If parents selected more than one ethnicity, this was "prioritised" in the following order: Māori, Pacific, Chinese, South Asian, South-East Asian and NZ European and Other. This is consistent with standard practice for the handling of ethnicity data in the New Zealand health sector.[8]

Examination of the child's skin consisted of examining the child's arms, legs and abdomen for the presence of skin lesions. Two general practitioners conducted the assessment procedures after training and testing from an experienced paediatrician (DE), with expertise in the clinical diagnosis of scabies. Neither skin scrapings, der-

moscopy nor examination of the genitalia were carried out. Lesions were classified as either: i) typical for scabies; ii) atypical but possibly consistent with scabies; or iii) not consistent with scabies, according to international consensus definitions.[9] Examination findings were combined with history information of personal itch and history of close contact with an individual who has itch or typical scabies lesions. Children were classified according to the 2020 International Alliance for Scabies Control (IACS) criteria, as either "Clinical scabies", "Suspected scabies", or "No scabies" (including where other skin conditions were considered more likely than scabies).[9,10]

Examiners also assessed children for the presence of impetigo, defined during training as papules, pustules or ulcerative lesions with associated erythema, crusting or pus.

If any skin lesion was found and the child's parents consented, the skin was swabbed using a FLOQSwab® dipped in saline and placed in an Eppendorf Tube® and frozen. This sample was then sent to collaborators at the QIMR Berghofer Medical Research Institute (Queensland, Australia) for qPCR analysis using primers and probes designed to detect specific coding (*Cox 1*) and abundant non-coding regions (*SSR5* and *SSR6*) of the *Sarcoptes scabiei* var *hominis* genome.[11] The qPCR assay with three targets has undergone *in vitro* testing for specificity and sensitivity to the human scabies mite and tests negative to other common skin parasites. A preliminary study of the clinical use of the test has shown a high degree of clinical agreement with clinically confirmed scabies (5/7 tested positive), and tests negative when samples are taken from people with other dermatological conditions such as dermatitis, psoriasis and tinea (19 were negative for all three targets).[11] Further testing of the qPCR test against an existing gold standard, such as dermoscopy, would be desirable.

Parents of children who were assessed as having either clinical or suspected scabies or who had a positive qPCR test were offered 5% permethrin lotion or cream for the participant and their household.

Statistical analysis

Descriptive analysis of clinical and laboratory tests were undertaken, by demographic factor and centre. Chi-squared, Fisher and *t*-tests were used to check for associations between sociodemographic characteristics and scabies diagnoses. R software (version 4.1.0) was used for analysis.[12] The *srd* package was used to illustrate the relationships and overlap between categorical data.[13]

Ethics

Ethical approval was granted by the New Zealand Ministry of Health, Health and Disability Ethics Committee (20/STH/41).

Results

The sample for analysis is of children recruited between 11 March 2021 and 25 May 2021. This cohort is tabulated by IACS scabies category (Table 1 and Table 2). The mean age of children was 3.4 years (standard deviation: 1.1). Most parents identified as either Pacific (48.0%) or as Māori (32.0%).

A total of 67 children were examined, with 14 (20.9%) showing examination signs of typical scabies lesions. A further 24 (35.8%) had atypical lesions. The questionnaire was offered to all parents, 50 were completed (75% of children) which enabled classification by IACS criteria (clinical or suspected). Almost all missing responses (14/17; 82.4%) attended one childcare centre. Of the 50 children with history information, five (10%) met the IACS criteria for clinical scabies, and four (8%) were classified as suspected, giving a prevalence of 18% by these criteria.

A total of 27 qPCR tests were taken from the three centres in children with lesions which were considered either typical or atypical for scabies. Of the total, one third (nine) were positive, with two positives in children diagnosed with clinical scabies, two suspected and four did not meet the IACS criteria.[9] One child with a positive sample had typical scabies examination findings, but no history was available. Of the four who did not meet the criteria, two presented with "atypical" and two "typical" scabies lesions but had no itch or contact history. The positive qPCR results were spread through all childcare centres, with at least one positive in each. Of the three targets assayed, only *Cox 1* tested positive.

Of the 41/50 (82%) participants who had history and examination information but did not meet the IACS criteria for scabies, five (10%) had typical scabies lesions, and 14 (28%) atypical lesions but were not classified as scabies as they did not give a sufficient history of itch or exposure to contacts. Of the total children examined, three (4%; 3/67) had impetigo. A high proportion of children had a large number of lesions, suggesting that scabies had been present for some time without treatment.

A scaled rectangle diagram depicts the degree of overlap between different classifications (Figure 1). The outer rectangle represents the total population. The grey rectangle represents those with history information available, yellow are those

Table 1: Demographic characteristics of study cohort by IACS[9]* diagnosis category.

Variable	Level	Clinical (n=5)	Suspected (n=4)	No scabies (n=41)	Missing (n=17)	Total (n=67)	p-value
Age (years)	**mean (sd)**	**3.5 (1.3)**	**2.9 (1.2)**	**3.4 (1.2)**	**3.4 (0.8)**	**3.4 (1.1)**	**0.664**
Ethnic group	Pacific	3 (60.0)	3 (75.0)	18 (43.9)	0 (0.0)	24 (48.0)	0.666
	Māori	2 (40.0)	0 (0.0)	14 (34.1)	0 (0.0)	16 (32.0)	
	Indian	0 (0.0)	0 (0.0)	4 (9.8)	0 (0.0)	4 (8.0)	
	NZ European	0 (0.0)	1 (25.0)	2 (4.9)	0 (0.0)	3 (6.0)	
	South-East Asian	0 (0.0)	0 (0.0)	3 (7.3)	0 (0.0)	3 (6.0)	
	missing	0	0	0	17	17	
Childcare centre	A	2 (40.0)	2 (50.0)	9 (22.0)	2 (11.8)	15 (22.4)	
	B	1 (20.0)	0 (0.0)	11 (26.8)	1 (5.9)	13 (19.4)	
	C	2 (40.0)	2 (50.0)	21 (51.2)	14 (82.4)	39 (58.2)	0.183

Those with missing history information are included in the "missing" column.
*IACS: International Alliance for the Control of Scabies.

Table 2: Clinical characteristics of study cohort by IACS[9]* scabies diagnosis category.

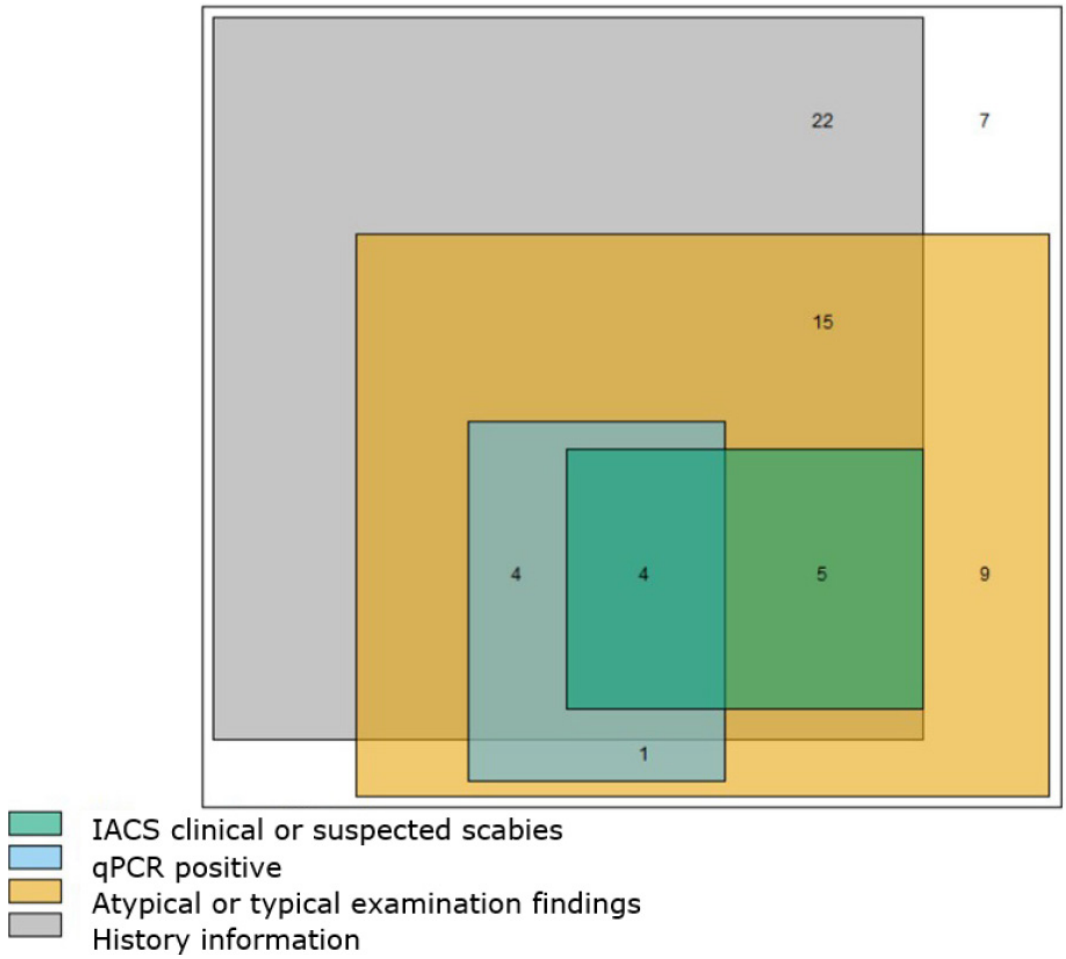
Variable	Level	Clinical (n=5)	Suspected (n=4)	No scabies (n=41)	Missing (n=17)	Total (n=67)	p-value
qPCR result	Positive	2 (50.0)	2 (66.7)	4 (33.3)	1 (12.5)	9 (33.3)	
	Negative	2 (50.0)	1 (33.3)	8 (66.7)	7 (87.5)	18 (66.6)	0.313
	missing	1	1	29	9	40	
Household contact with rash	Yes	4 (80.0)	2 (50.0)	2 (4.9)	0 (0.0)	8 (16.0)	-
	No	1 (20.0)	2 (50.0)	39 (95.1)	0 (0.0)	42 (84.0)	
Close contact with itch	Yes	3 (60.0)	3 (75.0)	1 (2.4)	0 (0.0)	7 (14.0)	-
	No	2 (40.0)	1 (25.0)	40 (97.6)	0 (0.0)	43 (86.0)	
Child itchy	Yes	4 (80.0)	2 (50.0)	7 (17.1)	0 (0.0)	13 (26.0)	-
	No	1 (20.0)	2 (50.0)	34 (82.9)	0 (0.0)	37 (74.0)	
	Missing history	0	0	0	17	17	
Rash	Typical lesions	5 (100.0)	1 (25.0)	5 (12.2)	3 (17.6)	14 (20.9)	0.002
	Atypical lesions	0 (0.0)	3 (75.0)	14 (34.1)	7 (41.2)	24 (35.8)	
Scabies lesion site	Arms	5 (100.0)	3 (75.0)	15 (36.6)	6 (35.3)	29 (43.3)	0.025

Table 2 (continued): Clinical characteristics of study cohort by IACS[9]* scabies diagnosis category.

Variable	Level	Clinical (n=5)	Suspected (n=4)	No scabies (n=41)	Missing (n=17)	Total (n=67)	p-value
	Legs	5 (100.0)	2 (50.0)	15 (36.6)	9 (52.9)	31 (46.3)	0.053
	Torso	1 (20.0)	3 (75.0)	4 (9.8)	3 (17.6)	11 (16.4)	0.010
Number of scabies lesions	1 to 2	0 (0.0)	1 (25.0)	3 (15.8)	1 (10.0)	5 (13.2)	
	3 to 10	1 (20.0)	2 (50.0)	9 (47.4)	7 (70.0)	19 (50.0)	
	11 to 49	2 (40.0)	0 (0.0)	6 (31.6)	1 (10.0)	9 (23.7)	
	More than 50	2 (40.0)	1 (25.0)	1 (5.3)	1 (10.0)	5 (13.2)	0.356
	missing	0	0	22	7	29	
Impetigo	Yes	1 (20.0)	0 (0.0)	0 (0.0)	2 (100.0)	3 (100.0)	
	No	4 (80.0)	4 (100.0)	41 (100.0)	15 (0.0)	64 (0.0)	1.000

Those with missing history information are included in the "missing" column. qPCR: quantitative polymerase chain reaction.
*IACS: International Alliance for the Control of Scabies.

Figure 1: Scaled rectangle diagram illustrating study by diagnosis category, availability of history, qPCR category and skin appearance. The numbers give the frequencies of the data combinations.



with “atypical” or “typical” examination findings, and the light green lower central rectangle represents the qPCR positive subjects. Children who had confirmed scabies by IACS criteria[9] are shown in dark green. The area and degree of overlap of the rectangles are proportional to the number in each group. qPCR positive tests were obtained in children with suspected scabies. The figure highlights that 50% (4/8; one who tested positive had missing history information and so could not have their IACS status determined) of the positive qPCR tests occurred in children who were otherwise classified as not having scabies by IACS criteria.

Discussion

The prevalence of children with scabies is high in several early childcare centres in socio-economically challenged areas of Auckland. The use of a qPCR test undergoing investigation as an adjunct to the diagnosis of scabies strengthens the evidence that some of the identified lesions are caused by scabies mites.

Although the sample size of this survey is limited and preliminary, and the study had some missing history information, the findings suggest the presence of scabies within these communities, with at least one positive qPCR test present in each childcare centre. When parents were phoned and the diagnosis conveyed, several had recently visited a family doctor and had a diagnosis of an alternative skin disease given, such as eczema or insect bites. Misdiagnosis of scabies may be common in New Zealand primary care, even where the prevalence of the condition is high, because it resembles eczema and insect bites, and can be complicated by impetigo, all of which are common in young children. “Normalisation” of scabies, as occurs in high prevalence communities in Australia,[14] may be a feature of diagnosis of the condition in Auckland.

The findings of a high prevalence of scabies in these childcare centres in children whose parents identify as either Pacific or Māori is consistent with the epidemiology of scabies in other areas of the Pacific. Samoa, for example, an island nation with close ties to Auckland, has recently undertaken a survey of scabies and skin disease and returned a prevalence of scabies of 14.4%, with a prevalence of impetigo of 57.1%.[7]

The study also highlights the uncertainty in ascertaining the diagnosis of scabies. Here, we have used several different methods, including clinical criteria, clinician training and qPCR to establish the diagnosis as rigorously as possible. Only 50% of children who tested positive to the qPCR test were diagnosed with scabies by IACS criteria. However, all had skin lesions considered either typical or atypical for scabies. This may be due to the inaccuracy of clinical history collected and possibly the normalisation of symptoms in high prevalence communities.

Given the finding of discrepant recent treatment, and under diagnosis that we believe is common, use of objective methods, such as qPCR, seems attractive particularly in the context of a child attending an institution such as a childcare centre, where establishing a positive diagnosis will affect the likelihood of the diagnosis of other children’s lesions and carries public health implications. Further work may further investigate the validity of the qPCR test against a gold standard such as dermatoscopy, which would facilitate the wider deployment of this test to assist in accurate diagnosis, without the need for expert assessment.

Given the accumulating evidence of association between scabies, bacterial skin infection and serious complications such as acute rheumatic fever and post-streptococcal glomerulonephritis,[1] the impetus to improve the control of scabies is growing.[16] Many different opportunities exist to reduce the prevalence of scabies. Our study suggests several, including improving clinical diagnosis, raising clinician awareness of the features of the disease, and using objective laboratory methods, such as qPCR. Further prioritisation of this disease, such as investing in public health follow-up of cases to ensure treatment success is another option, given the risk of spread to others in the community.

This paper reports the analysis of just three centres. In due course, the study will be extended, with more in-depth analysis. Due to low uptake by schools and childcare centres in relatively wealthy areas and delays in field work due to COVID-19; however, we may not be able to complete the study as originally planned.

In summary, we highlight the high prevalence of scabies in several early childcare education centres in Auckland, among the Pacific and Māori community. Improving the diagnosis and ensuring treatment success of this important and neglected disease is likely to reduce ethnic inequality in health status. The use of qPCR is an existing technology, which may improve the accuracy of diagnosis and reduce the prevalence of this condition.

COMPETING INTERESTS
Nil.

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