

# Prevalence of Itch in German Schoolchildren: A Population-based Study

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**Itch is a common symptom, but there is limited evidence on the prevalence of itch in children. The aim of this study was to assess the prevalence of itch in schoolchildren. A questionnaire was developed by experts in the field and based on a literature search. The questionnaire was applied in a pilot study of 25 consecutively selected paediatric patients and their parents. It confirmed the high content validity of the questionnaire, and the questionnaire was comparable to hospital records regarding chronic itch ( $n=19$ , mean consistency 89.47%). The questionnaire was distributed among German schoolchildren in 9/12 randomly selected primary schools in Kiel, Germany. Of 1,722 invited students, 443 schoolchildren aged 6–10 years participated, and 26.2% ( $n=116$ ) reported itch. The prevalence of acute itch was 20.0% ( $n=87$ ), and 14.7% ( $n=65$ ) reported chronic itch. Reduced sleep and mood were often related to chronic itch. This study demonstrated that itch is a common symptom in German schoolchildren.**

**Key words:** itch; pruritus; epidemiology; quality of life; prevalence.

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Itch is a major contributor to an estimated 33.7 million-person years lived with disability caused by dermatological conditions (1). Itch is associated with sleeping problems, reduced quality of life (2) and increased costs for individuals and society (3). To the best of our knowledge, there are no population-based studies on the prevalence of acute and chronic itch in schoolchildren.

Atopic dermatitis (AD) is common in children and is reported to be the main underlying condition in itch in children (3–5); other aetiologies, such as systemic conditions, do not appear to play a major role (3). Itch is a mandatory diagnostic criterion in validated assessments for AD in children and adults (6, 7). Itch was self-reported

## SIGNIFICANCE

The aim of this work was to assess how common itch is in schoolchildren in Germany. A questionnaire was developed and distributed to schoolchildren between 6 and 10 years of age in Kiel, Germany. 1 in 5 of the children had itch and 1 in 7 had chronic itch (itch lasting over 6 weeks). Moreover, chronic itch was associated with reduced quality of life in schoolchildren in terms of impaired sleep and mood disorders.

or parent-reported in ~91–95% of children and adults with AD (6); nocturnal itch was reported in approximately 32% of children with AD (8).

Furthermore, there are limited data on general population-based samples regarding the intensity of itch in children. In addition to intensity, a recent qualitative study emphasized that itch quality, duration, and triggers were important characteristics in understanding and managing itch, and stressed the need for more comprehensive measures of paediatric itch (9). Therefore, general population-based studies on the prevalence and characteristics of itch in the paediatric population are highly warranted.

In epidemiological population-based studies and clinical practice, itch assessments via well-constructed, validated questionnaires are valuable. Validated questionnaires assessing itch prevalence exist for adults (10–12), but not for children. Understanding the prevalence and burden of itch in the paediatric population is important for decision-makers and healthcare professionals regarding public health policies and resources.

The main aim of this study was to assess the prevalence of acute and chronic itch in a general population-based sample of schoolchildren aged 6–10 years in Kiel, Germany. A questionnaire was developed and initial validation performed. The intensity of itch, relationship between itch and quality of life, and self-reported related conditions were also assessed.

At the time of this study there was no validated tool for assessing itch in the general population of schoolchildren. To the best of our knowledge, no method exists for as-

sessing the prevalence and intensity of itch in children up to 10 years old.

## MATERIALS AND METHODS

This study consists of 2 parts: (i) questionnaire construction and validation; and (ii) itch prevalence assessment.

After an expert panel discussion and an extensive literature search, a draft questionnaire was designed by consensus discussion (12–19) and the assessment of the prevalence was based on the only validated study in adults, by Mattered et al. (12). The chosen questions were adapted and simplified to be suitable for children and their parents (Appendix S1). The importance of additional questions was discussed; it was decided to evaluate family and personal histories of atopic conditions, demographic information, possible underlying conditions of itch, itch duration, itch intensity localization, disease-specific quality of life, and itch treatments. In detail, the prevalence of underlying itch-related comorbidities, such as AD, xerosis cutis, urticaria, scabies, pediculosis capitis, and other skin diseases, was assessed by the question, “were you/was your child diagnosed by a physician with 1 or several of the following diseases?” The structure and detailed questions of the questionnaire, and the validation part of the study, are shown in Appendix S1.

For prevalence of itch, the questions for the prevalence of acute itch were: Children’s Acute Itch (CAI): Does your child experience itch? Now or within the last 24 hours? Within the last 7 days? Within the last 6 weeks? The final questions for the prevalence of chronic itch were: Children’s Chronic Itch (CCI): Did your child ever experience chronic itch ( $\geq 3$  days per week over a period of  $\geq 6$  weeks)? No; yes, within the last 24 hours; yes, within the last 12 months; yes, but more than 12 months ago.

The caregivers/children had to answer “yes” to at least one of the questions regarding the occurrence of itch for it to be classified as acute/chronic itch. The questions confirmed the presence of itch and the period in which itch developed.

To assess the itch intensity, the visual analogue scale (VAS) was adopted using smileys (5 smileys/emojis with different facial expressions were graded in 5 “degrees”, from “very happy” to “very sad”).

The intensity of acute itch was assessed with a VAS scale (from 0=no itch to 10=maximum itch) adopted for children using smileys in 5 categories, as described above. The intensity of chronic itch was also assessed using the smiley VAS.

Data on the area affected and itch-related quality of life (QoL) were also collected. For the symptom-specific assessment of QoL, the ItchyQoL questionnaire was used, translated into German (20). The ItchyQoL is a validated, itch-specific assessment that measures the degree to which itch affects QoL in terms of 3 dimensions: symptoms, functioning, and emotions. A higher score indicates a greater adverse impact on QoL (19).

A silhouette line drawing, which is commonly used in dermatological assessments of skin diseases, was applied to assess the location of itch (15). The children/caregivers marked the affected body sites.

### Study procedures

Among all 32 primary schools in Kiel in the federal state of Schleswig-Holstein, 12 were randomly selected. After approval by the ethics committee and school authorities of Schleswig-Holstein, the project was presented to the 12 selected schools. Of these, 9 agreed to participate. All children in the first to fourth grades (age range 6–10 years) were invited to participate. Thus, more than 1,700 eligible schoolchildren were invited to answer the survey

in September 2016 (Fig. S1). The questionnaires were distributed to the students, with consent forms to be signed by the parents and children. The completed questionnaires from the families who gave their consent were collected. The questionnaires were anonymized and entered into an electronic database in the Clinic of Dermatology, University Hospital, in Kiel (Fig. S1).

### Inclusion/exclusion criteria

Inclusion criteria for the second part of the study were patients aged 6–10 years and signed informed consent. Exclusion criteria were: age  $>10$  years and  $<6$  years at the time of the survey and lack of legal guardian consent.

### Statistical analysis

For the first part, the questionnaire validity, content validity, and feasibility were assessed by qualitative analysis. The reliability, item distribution characteristics, mean agreement between itch questionnaire results and medical records, and test-retest reliability were calculated. Differences between groups (children diagnosed with AD vs other conditions) were tested using the Mann–Whitney *U* test.

For itch intensity, the item distribution characteristic means, standard deviation (SD), median, interquartile range (IQR), and floor and ceiling effects were assessed. Furthermore, Spearman’s test was used to assess correlations of the itch prevalence and intensity with each parameter of the QoL and the strength of chronic itch in the test-retest reliability evaluation.

In the second part of the study, cross-tabulation, means, and medians were used to describe the study population. The distribution of the variables was assessed. For the daytime intensity of itch, night-time intensity of itch, relationships, and QoL relationships, the non-parametric Wilcoxon signed-rank test (non-parametric test for paired-samples) was used. For the intensity of itch and QoL, the (non-parametric) Mann–Whitney *U* test was used regarding sex and underlying diseases.

For all other relationships, the  $\chi^2$  test was used. For  $n < 5$ , Fisher’s exact test was used. Spearman’s Rho test was used to assess correlations among QoL, chronic itch strength, and itch area and evaluate age reliability. Bonferroni’s correction was used to adjust for multiple comparisons. A *p*-value lower than 0.05 or 95% confidence intervals (95% CI) not including 1.00 indicated statistical significance.

Statistical analysis was performed with Stata Statistical Software: Release 16 (StataCorp LP, College Station, TX, USA).

### Power calculation

For the power calculation, 1,700 individuals with an estimated itch prevalence of 15.0%, CI of 3.0%, and expected response rate of 35.0% should be sufficient to estimate the prevalence of itch in patients with AD with a power of 80.0%.

Based on these statistical requirements, 12/32 primary schools in Kiel, Northern Germany, were randomly selected to participate. Private schools were not included, and the random selection did not consider any other variables.

### Ethics

Ethical approval from the Kiel regional ethics committee was obtained at the regional research ethics committee in Kiel, Germany (registration number A112/14). All participants provided informed consent after receiving a comprehensive written explanation of the aims of the study. The study was conducted in full accordance with the World Medical Association’s Declaration of Helsinki.

## RESULTS

### Content validity and feasibility

To assess content validity, 25 patients participated, along with physicians, non-experts, and parents. The test-retest was performed by 33 individuals: 23 students from 1 of the participating schools in Kiel and 10 patients from the department. The psychometric measures were assessed in 19 patients.

The 25 patients and their parents found that the questionnaire was understandable and relevant to the prevalence and intensity of acute and chronic itch. The feasibility of the questionnaire was assessed as high. It took a mean of 7.6 min to answer all itch-related and background questions.

### Test-retest reliability

The mean agreement of the CCI including the questions regarding comorbidities and background factors, was 0.85 (95% CI 0.59–1.00). For the VAS, the non-parametric Spearman correlation was high for nocturnal itch for the test-retest reliability ( $c=0.67$ ).

### Validity

The prevalence of chronic itch assessed by the questionnaire was well correlated with medical records in the 19 patients assessed. The itch of all participants could be confirmed by patient records (mean consistency 89.47%).

The test performance was equally high across all self-reported conditions. Regarding the mean, SD, median, and IQR, the measurements of itch intensity and floor and ceiling effects were acceptable. The intensity of acute itch changed (either increased or decreased) in 64% (95% CI 35–87%).

### Prevalence of itch

To assess the prevalence of itch, 9/12 invited schools participated. Among all children invited ( $n=1,722$ ), 443 answered the questionnaire, including 48.6% females ( $n=215$ ) and 51.4% males ( $n=227$ ). The response rate was 25.7%. The median age was 8 years. Most participants (98.9%) were born in Germany, and 21% had no siblings. The characteristics of the studied population are shown in Table SI.

**Table II. Intensity of acute and chronic itch by sex**

Sex	Intensity of itch				
	Acute itch within the last 24 h	Chronic itch			Any itch within the last 24 h
		Anytime/both day and night	During the day	During the night	
Male	$n=24$	$n=31$	$n=31$	$n=31$	$n=19$
	Mean 2.65	Mean 3.55	Mean 3.45	Mean 3.16	Mean 2.84
	SD 0.70	SD 0.81	SD 0.85	SD 1.04	SD 0.90
	Median 3.0	Median 3.0	Median 3.0	Median 3.0	Median 3.0
Female	$n=21$	$n=31$	$n=31$	$n=31$	$n=25$
	Mean 2.57	Mean 3.90	Mean 3.58	Mean 3.48	Mean 2.68
	SD 0.68	SD 0.87	SD 0.81	SD 1.31	SD 0.75
	Median 2.0	Median 4.0	Median 4.0	Median 4.0	Median 3.0
Total	$n=38$	$n=62$	$n=62$	$n=62$	$n=44$
	Mean 2.61	Mean 3.73	Mean 3.52	Mean 3.32	Mean 2.75
	SD 0.679	SD 0.85	SD 0.83	SD 1.18	SD 0.81
	Median 2.5	Median 4.0	Median 3.5	Median 3.0	Median 3.0
	IQR 2.0–3.0	IQR 3.0–4.0	IQR 3.0–4.0	IQR 3.0–4.0	IQR 2.0–3.0

SD: standard deviation; IQR: interquartile range.

$p>0.05$  (Wilcoxon signed-rank test); the Wilcoxon signed-rank test did not show a significant difference in itch intensity between itch during the day and itch during the night,  $p>0.05$  (Mann-Whitney  $U$  test); the Mann-Whitney  $U$  test did not show a significant difference in the intensity of itch between sexes.

The total prevalence of itch was 26.2% (95% CI 19–36%) ( $n=116$ ). The prevalence of acute itch and chronic itch was 20.0% (95% CI 12–29%) ( $n=87$ ) and 14.7% (95% CI 7.0–26%) ( $n=65$ ), respectively. There were no differences in the itch prevalence by sex or age (Table I).

A total of 21.2% ( $n=94$ ) developed itch within the last 6 weeks, with 10.6% ( $n=47$ ) having itch on the day of the assessment. In addition, 15.1% ( $n=67$ ) reported itch within the last week. There were no differences in age or sex.

Chronic itch was reported within the previous 24 h by 1.8% ( $n=8/443$ ), within the last year by 10.0% ( $n=44/443$ ), and for more than 1 year by 4.7% ( $n=21/443$ ). There were no differences in age or sex.

### Itch intensity

The intensity of acute itch assessed by VAS scores showed a mean strength of 2.61 and median [IQR] of 2.5 [2.0, 3.0] with no significant difference between boys and girls (Table I).

Regarding chronic itch ( $n=65$ ), the mean intensity was 3.73, with a median [IQR] of 4.0 [3.0, 4.0], with no significant difference between daytime and night-time itch and between boys and girls (Table II).

The intensity of chronic itch in the daytime was higher in individuals with AD-related chronic itch compared

**Table I. Prevalence of itch in German schoolchildren aged 6–10 years**

Sex	$n$	Acute itch <sup>a</sup>			Chronic itch				Any itch <sup>b</sup>
		Within the last 24 h	Within the last 7 days	Within the last 6 weeks	Within the last 24 h	Within the last year	> 1 year	Any chronic itch	
Male	225	18 (8.1)	28 (12.4)	41 (18.2)	2 (0.9)	19 (8.4)	13 (5.7)	32 (14.1)	56 (24.7)
Female	210	22 (10.5)	32 (15.2)	46 (21.9)	6 (2.8)	25 (11.7)	8 (3.7)	33 (15.4)	60 (27.9)
Total	436	40 (9.2)	60 (13.8)	87 (20.0)	8 (1.8)	44 (10.0)	21 (4.7)	65 (14.7)	116 (26.2)

<sup>a</sup>Can overlap. <sup>b</sup>Any itch=acute and/or chronic itch.

**Table III. Relationship between chronic itch and dimensions of the self-reported quality of life**

Sex	Quality of life			
	Mood	Sleep	Concentration	Leisure time
Male	<i>n</i> = 31	<i>n</i> = 31	<i>n</i> = 25	<i>n</i> = 30
	Mean 2.53*	Mean 2.45	Mean 1.92*	Mean 2.23
	SD 0.99	SD 1.15	SD 0.91	SD 0.90
	Median 3.0	Median 2.0	Median 2.0	Median 2.0
Female	<i>n</i> = 29	<i>n</i> = 30	<i>n</i> = 28	<i>n</i> = 29
	Mean 2.72*	Mean 2.68	Mean 2.11*	Mean 2.43
	SD 0.88	SD 1.28	SD 1.10	SD 0.98
	Median 3.0	Median 3.0	Median 2.0	Median 2.5
Total	<i>n</i> = 60	<i>n</i> = 61	<i>n</i> = 53	<i>n</i> = 59
	Mean 2.63*	Mean 2.57*	Mean 2.02*	Mean 2.33*
	SD 0.94	SD 1.21	SD 1.01	SD 0.94
	Median 3.0	Median 3.0	Median 2.0	Median 2.0
	IQR 2.0–3.0	IQR 1.0–4.0	IQR 1.0–3.0	IQR 2.0–3.0

SD: standard deviation; IQR: interquartile range.

\**p* < 0.01 with Bonferroni's correction (Wilcoxon signed-rank test).

with those with non-AD-related chronic itch (Mann–Whitney *U* test). For acute itch, itch severity did not differ between individuals with and without AD (*p* < 0.05, data not shown).

#### Itch localization

Of the total body surface area (BSA), a mean of 8.7% was affected by acute itch, with a median [IQR] of 3.3% [2.3, 9.0] (Table SII). The scalp was the most frequently affected site (28.9%, *n* = 11), followed by the arm flexures at 21.1% (*n* = 8). On the trunk, the abdomen was the most affected area. On the upper extremities, acute itch mainly affected the flexures. On the lower extremities, the dorsal side of the foot and extensor side of the upper and lower leg were mainly affected (Table SIII).

For chronic itch, a mean of 8.2% of BSA was affected (Table SII). The flexural sides of the upper and lower extremities, lower back, and abdomen were predominantly affected (Table SIII).

#### Itch and quality of life

Itch was related to a decreased QoL; sleep and mood were disturbed in individuals with chronic itch compared with individuals without chronic itch (Table III). For individuals with itch, mood was more disturbed than concentration or leisure time, and concentration was disturbed less than sleep. Chronic itch in genital regions (*p* < 0.001) was more closely related to mood disturbances than itch in

other regions (i.e. not sensitive sites). Facial itch tended to be related to decreased concentration (*p* = 0.015).

Concentration was better in individuals who reported chronic itch with AD and/or xerosis cutis compared with individuals with chronic itch, but without either AD or xerosis (*p* < 0.05). Sleep and mood were decreased in individuals with chronic itch related to AD compared with those with chronic itch not related to AD (Mann–Whitney *U* test, *p* < 0.05). The presence of a comorbid condition in addition to AD did not worsen the QoL or intensity of chronic itch (Mann–Whitney *U* test, *p* < 0.05, data not shown).

All dimensions of the QoL measure (sleep, concentration, leisure, mood) were significantly correlated with itch intensity (Table III).

#### Itch treatments

Most of the 62 children experiencing chronic itch 85.5% (*n* = 53) were treated by paediatricians (*n* = 44, 71%) and dermatologists (*n* = 31, 50%), followed by general practitioners (*n* = 4, 6.5%) or other doctors (*n* = 1, 1.6%). Treatment was primarily topical corticosteroids and calcineurin inhibitors. Some patients were treated with antihistamines and systemic corticosteroids. Homeopathy, bioresonance, acupuncture, and natural remedies were also used (Table IV).

## DISCUSSION

This is the first population-based study on the prevalence of acute and chronic itch in schoolchildren from randomly selected primary schools. This study revealed several important findings. Most importantly, the prevalence of itch in schoolchildren aged 6–10 years was high. Approximately 25% reported itch; 20% had acute itch, and >14% reported chronic itch. The study also showed that itch was associated with impaired QoL in terms of reduced sleep and mood.

The content validation and feasibility assessment of the questionnaire used in this study showed good content validity, feasibility, and reliability. Correlation of the questionnaire with hospital records was also good. The questionnaire appeared to be useful for several self-reported underlying conditions related to itch, and thus can be used in population-based setting and may be useful in epidemiological research.

**Table IV. Treatment of chronic itch**

	Treatment of chronic itch, <i>n</i> (%)										
	Topical treatments <sup>a</sup>			Systemic treatments <sup>a</sup>				Alternative medical treatments <sup>a</sup>			
	CS	CIs	OTT <sup>b</sup>	AIs	sCS	Cyc	OST	HOM	ACU	BIO	OAT
Total <i>n</i> = 62 <sup>b</sup>	37 (59.7)	3 (4.8)	30 (49.2)	12 (19.4)	1 (1.6)	0	0	13 (21.0)	1 (1.6)	8 (12.9)	9 (14.5)

<sup>a</sup>Multiple responses possible. <sup>b</sup>Three missing in "other topical therapy".

CS: corticosteroids; CIs: calcineurin inhibitors; OTT: other topical treatment; AIs: antihistamines; sCS: systemic corticosteroids; Cyc: cyclosporine; OST: other systemic therapy; HOM: homeopathy; ACU: acupuncture; BIO: bioresonance; OAT: other alternative therapy.

The prevalence of itch in the general paediatric population is poorly investigated. This study adds new findings on the epidemiology of itch in schoolchildren.

Prevalence of AD among children is high across all continents and in Northern Europe, the prevalence is estimated to be approximately 15%. We speculate that the high prevalence of itch in the current study reflects the high prevalence of AD in children (5).

These findings are in line with those reported by Mattered et al. (12), who conducted a cross-sectional, questionnaire-based pilot study in 2009 and reported a chronic itch prevalence of 23%.

To the best of our knowledge, the mean itch intensity has not been previously assessed in a paediatric population. The current study showed a mean itch intensity of 2.61, which possibly reflects that a high proportion might have mild AD.

The location of itch has not been assessed in a general paediatric population. In this study, acute itch predominantly affected the head and folds of the arms, and chronic itch mainly affected the folds of the arms and legs. We speculate that the affected areas in the current study reflect the high prevalence of AD in the study population.

The inverse association between higher treatment intensity and QoL may be explained by the intensity of the treatment itself and the fact that more intense itch requires stronger treatment. (21). Since this study was performed, another group developed the KidsItchyQoL for 6–7-year-old children, which assesses the QoL related to itch, and 1 validation study was performed (19).

Most children with chronic itch were treated by a specialist physician, reflecting the high burden of itch. Interestingly, most patients reporting chronic itch were treated by a paediatrician or dermatologist, usually with topical treatment, but sometimes oral antihistamines were given. Surprisingly, oral glucocorticoids and alternative medicine were used, which does not comply with current guidelines and evidence (22, 23).

### *Strength and limitations*

An advantage of the current study is that it assessed the sites of itch, timing of itch, and QoL. In addition, the study was population-based and included reasonably large numbers of participants. The assessment of content validity was beneficial. Chronic itch evaluated by the questionnaire was compared with information in hospital records; this was beneficial, as the prevalence and intensity of itch are patient-reported outcome measures, and there are currently no gold standards for children.

This study has some limitations. First, the study was performed in primary schools only in a single large city, which may have caused selection bias. The findings may be related to geographical, cultural, and/or socio-economic factors. A multicentre study is warranted to confirm these findings. Secondly, the validation part of

the current study was based on low numbers. However, the important parts of validation were performed. There was no indication that the questions were invalid, but these results should be interpreted with caution. Further validation studies with a larger study population in different regions are warranted. For the itch intensity, further studies are required to assess the possibility of a ceiling effect. A similar study on adults found a good correlation between the Numeric Rating Scale and a tool using visual assessment of the itch severity, which is encouraging (24). Regarding the assessment of itch-related quality of life, a limitation is the lack of a specific instrument validated for children at the time of study. We chose the ItchyQoL, which showed excellent validation properties in adults and was considered applicable by our expert panel. This choice is supported by a recent study using the tool in a validation study, which includes children with AD (25).

A major limitation of this study was the rather low participation rate, which potentially introduced selection bias. It cannot be excluded that children with itch may be over-represented in the current study, as they or their parents may be more willing to participate in such a study. Recall errors may occur when caregivers/children are asked to report chronic itch or the intensity and localization of itch on a questionnaire, which might have introduced recall bias.

The findings represent chronic itch in schoolchildren in Germany; however, the schoolchildren represent the general population of children well, and the results can thus be transferred to other western countries, especially in recognition of similar lifestyle, comparable psycho-social factors and access to healthcare system, all factors that also affect AD and associated symptoms, such as itch.

For excellent healthcare, it is important that the medical community and policymakers are aware that itch is a highly prevalent burdensome symptom. The need for a valid and reliable method to estimate the prevalence of itch in the general paediatric population is apparent, because itch is common in this population and not restricted to a single disease group. There is a clear need to focus on itch in schoolchildren. The results of this study can be used for optimizing guidelines, early intervention, and prevention.

### *Conclusion*

This population-based study emphasizes the high prevalence of itch among schoolchildren and its association with impaired QoL. This study highlights the need for future research into chronic itch in other paediatric populations and settings.

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