

INVESTIGATIVE REPORT

Itch and Mental Distress: A Cross-Sectional Study among Late Adolescents

Jon Anders HALVORSEN^{1,2}, Florence DALGARD^{2,3}, Magne THORESEN⁴, Espen BJERTNESS² and Lars LIEN^{5,2}

¹Department of Dermatology, Rikshospitalet University Hospital, Faculty of Medicine, University of Oslo, ²Institute of General Practice and Community Medicine, University of Oslo, Norway, ³Judge Baker Children Center, Harvard Medical School, Boston, USA, ⁴Department of Biostatistics, Institute of Basic Medical Sciences, and ⁵Institute of Psychiatry, University of Oslo, Oslo, Norway

Itch is known to be associated with psychological factors in adults, but has not been explored among adolescents. A cross-sectional, questionnaire-based population study involving adolescents born mostly in 1986 was carried out in 2004. A total of 4744 individuals were invited and the participation rate was 80%. The Hopkins Symptom Checklist-10 was used to measure mental distress. The prevalence of itch was 8.8%. Itch was associated with mental distress, gender, socio-demographic factors, asthma, rhinoconjunctivitis and eczema. In a logistic regression model adjusting for possible confounders (including eczema), an association between itch and mental distress was found (odds ratio 3.1). In a subgroup analysis of those without eczema, the association was stronger. When the severity of itch increased, in both genders mental distress also increased. Mental distress and eczema are the variables in the study that contributes most to the distribution of itch at population level among adolescents in Oslo, Norway. Key words: itch; pruritus; adolescents; mental problems; mental distress; eczema.

(Accepted June 30, 2008.)

Acta Derm Venereol 2009; 89: 39–44.

Jon Anders Halvorsen, Department of Dermatology, Rikshospitalet University Hospital, N-0027 Oslo, Norway. E-mail: j.a.halvorsen@medisin.uio.no

The symptom itch is a common and distressing complaint that is associated with many conditions. In a new clinical classification, the following underlying categories that could cause itch have been listed: dermatological, systemic, neurological, psychogenic, mixed and other (1). Diseases commonly associated with chronic itch are chronic renal insufficiency, cholestatic liver diseases and atopic dermatitis (1); the last of these is probably the most common in adolescents.

In the main, the association between itch and psychological factors has been explored in patient populations (2–6), but this has also recently been found in the general adult population (7). Further evidence of the relationship between itch and psychological factors is the fact that antidepressants may be used to reduce itching (8), experimentally induced stress can increase

pruritus in healthy subjects (6) and that psychotherapy can sometimes help patients with itchy conditions (6, 9).

Mental health problems, especially depression and anxiety, are common in adolescents and the increase in prevalence starts at puberty (10, 11). Girls report twice as much depression in adolescence than boys do (12). Studies have shown an association between somatic symptoms (headaches, musculoskeletal problems and gastrointestinal complaints) and mental health problems in adolescence (13–15). However, to our knowledge no population-based study has scrutinized the comorbidity between itch and mental health problems in adolescents.

Adolescence is a time of transition between childhood and the independence of adult. Adolescence can be classified into three stages: early adolescence (10–13 years), middle adolescence (14–17 years) and late adolescence (17–21 years) (16).

The objective of this study is to explore the association between itch and mental distress among late adolescents, while taking into account possible confounding factors.

MATERIALS AND METHODS

Participants and study design

The study population consisted of non-healthcare-seeking late adolescents in a multicultural Western city. The design of the study was questionnaire-based and cross-sectional. The study itself (Youth 2004) was conducted by the University of Oslo, the Norwegian Institute of Public Health and the Regional Centre for Child and Adolescent Mental Health, Eastern and Southern Norway. The data were collected at schools and by post.

In 2004, all students (mostly born in 1986 and thus 18 or 19 years old) in Oslo in their final year at compulsory school were invited to participate. This part of the study was conducted in class. Of the 3659 pupils invited, 3308 (90%) participated. In addition, 1085 adolescents in Oslo aged 18 or 19 years who were not in their final year were invited by post to participate and 467 (43%) returned the questionnaire. These 1085 adolescents had participated earlier in a population-based study in Oslo (17). In total, 4744 adolescents were invited to participate and 3775 (80%) did so. In addition, missing values on single questions ranged from 4.0% ($n = 150$) for itch to 19.4% ($n = 734$) for family income. In the regression models, all the variables had to be present for inclusion in the analyses, and the total

missing percentage was 24.9% ($n = 942$). Further details about the study can be found elsewhere (18).

Measures

Itch. The question regarding itching was worded as follows: "During last week, did you have itchy skin?" The possible answers were: "no", "yes, a little", "yes, quite a lot", "yes, very much". The question was one of the five covering skin complaints. The questions have been validated and the repeatability of the question about itch was demonstrated to have an overall agreement of 77% and a Kappa value of 0.32 (95% confidence interval (CI): -0.08–0.72) when tested on 31 adolescents (19). The question about itch was dichotomized in the analysis to "no" and "yes, a little" vs. "yes, quite a lot" and "yes, very much".

Mental distress. This was measured using Hopkins Symptom Checklist (HSCL-10), which is a ten-item, shortened version of the more widely used HSCL-25, an instrument that mainly measures symptoms of anxiety and depression (20). The questions in HSCL-10 concern the following symptoms during the last week: "Suddenly scared for no reason, feeling fearful, faintness or dizziness, feeling tense or keyed up, blaming yourself for things, trouble falling asleep, feeling blue, feeling of worthlessness, feeling everything is an effort, feeling hopeless about the future" (20, 21). Each item is rated on a scale from 1 (not at all) to 4 (extremely). An average score for all the 10 items is calculated and a score equal to or greater than 1.85 has been shown to be a valid predictor of mental health distress in subjects aged 16–24 years (20). For inclusion in the total HSCL-10 score, six of the ten questions had to be completed. The missing values were replaced by the sample mean for each value (20). When more than six answers were missing, this variable was considered missing.

Ethnicity. This variable was obtained from Statistics Norway and was based on the father's country of birth. Statistics Norway has information about all Norwegian residents. Western Europe, North America and Australia are considered to be Western countries in these analyses. Other countries are considered to be non-Western (22).

Family income. This is the sum of both parents' gross income. The information was obtained from Statistics Norway and has been divided into three categories: > 1.0 million Norske kroner (NOK), NOK 1.0–0.5 million, and <NOK 0.5 million. One million NOK is approximately 125,000 euros.

Asthma, rhinoconjunctivitis and eczema. These were self-reported variables. The following questions were asked: "Do

you have, or have you ever had asthma/hay fever/eczema?" The possible answers were: "yes, now", "yes, before" and "no".

Adjustment variables

We choose to adjust for sociodemographic variables as these are known to be associated with health in general (23) and with skin problems (24). Eczema was adjusted for since it is associated with itch and associated with mental health problems among 15–16 year old adolescents in Oslo (25). The rationale for inclusion of hay fever and asthma is that these conditions share many of the immunological features of eczema and therefore might be associated with both itch and mental health problems.

Ethics

The study has been approved by the Regional Committee for Medical Research Ethics, the Norwegian Data Inspectorate and the educational authorities in Oslo. It has been conducted in full accordance with the World Medical Association's Declaration of Helsinki. Written, informed consent was obtained from all the participants.

Statistics

SPSS for Windows version 14.0 was used for the statistical analyses. Data were analysed with frequencies and cross tables and Pearson's χ^2 test was used to check for statistically significant differences between groups. Odds ratios (OR) were calculated in both crude and adjusted logistic regression models. Tests of statistical interaction were performed on some predefined variables in crude models. The level of significance was set at $p < 0.05$ and 95% CI were calculated.

RESULTS

The symptom itch was reported by 8.8% (95% CI: 7.9–9.7%) ($n = 319$) of the adolescents in our sample (Table I). There was a significant gender difference: 6.0% (95% CI: 4.8–7.2%) ($n = 97$) of the males and 11.0% (95% CI: 9.6–12.4%) ($n = 222$) of the females reported itch. The prevalence of itch was higher in adolescents with non-Western backgrounds and among those with low family incomes.

Table I. Prevalence of itch¹ in the whole sample and in different socio-demographic groups among adolescents ($n = 3775$) in Oslo, Norway

	<i>n</i>	Itch (%) (95% CI)	<i>p</i> -value	Missing (<i>n</i>)
Whole sample	3625	8.8 (7.9–9.7)		150
Gender			<0.001	150
Males	1605	6.0 (4.8–7.2)		
Females	2020	11.0 (9.6–12.4)		
Ethnicity ^a			<0.001	445
Western	2524	7.8 (6.8–8.8)		
Non-Western	806	12.3 (10.0–14.6)		
Family income ^b			0.004	734
> 1.0 million NOK	719	6.4 (4.6–8.2)		
0.5–1.0 million NOK	1616	8.4 (7.0–9.8)		
<0.5 million NOK	706	11.3 (9.0–13.6)		

¹Self-reported itch (yes quite a lot, yes very much).

^aBased on fathers' country of birth obtained from Statistics Norway.

^bBased on mother's and father's gross income obtained from Statistics Norway. 1.0 million Norske kroner (NOK) is equivalent to approximately 125,000 Euros.

CI: confidence interval.

Table II. Prevalence of itch¹ in mental distress, asthma, rhinoconjunctivitis and eczema among adolescents (*n* = 3775) in Oslo, Norway

		<i>n</i>	Itch (%) (95% CI)	<i>p</i> -value	Missing (<i>n</i>)
Mental distress	No	2676	5.9 (5.0–6.8)	<0.001	175
	Yes	924	17.3 (14.9–19.7)		
Asthma	No	2946	7.7 (6.7–8.7)	<0.001	316
	Yes, before	293	12.6 (8.8–16.4)		
	Yes, now	220	15.0 (10.3–19.7)		
Rhinoconjunctivitis	No	2156	6.4 (5.4–7.4)	<0.001	272
	Yes, before	576	10.8 (8.3–13.3)		
	Yes, now	771	13.6 (11.2–16.0)		
Eczema	No	2484	5.3 (4.4–6.2)	<0.001	303
	Yes, before	652	8.4 (6.3–10.5)		
	Yes, now	336	36.6 (31.4–41.8)		

¹Self-reported itch (yes quite a lot, yes very much).

CI: confidence interval.

In those with mental distress, the prevalence of itch was 17.3% (95% CI: 14.9–19.7%) (*n* = 160) compared with 5.9% (95% CI: 5.0–6.8%) (*n* = 157) in those without mental distress (Table II). There was a linear rise in the mean scores of the HSCL-10 when itch increased in severity, and this was seen in both males and females (Fig. 1). In the test for trend, *p*-values for both males and females are < 0.001. The prevalence of mental distress in the sample was 25.7% (95% CI: 22.9–27.7%) (*n* = 946). The prevalence of mental distress in females was 34.7 % (95% CI: 31.7–38.2%) (*n* = 716), and in males it was 14.2% (95% CI: 9.7–18.7%) (*n* = 230).

In adolescents who reported eczema, the prevalence of itch (quite a lot and very much) was 36.6% (95% CI: 31.4–41.8%) (Table II).

Crude bivariate analyses using itch as the dependent variable demonstrated that mental distress was associated with itch at an OR of 3.9 (95% CI: 2.9–5.1) (Table III). Gender, socio-demographic variables, asthma, rhino-

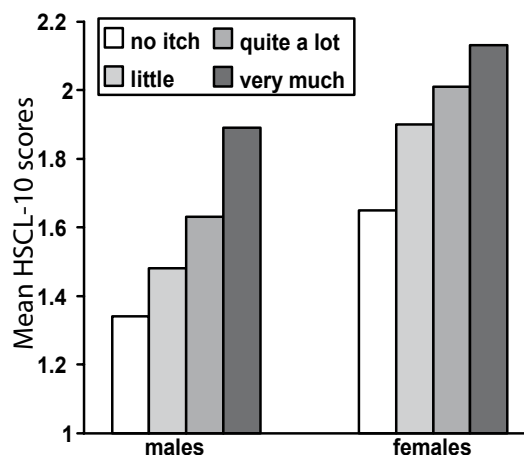
conjunctivitis and eczema were also independently associated with itch. When performing regression analyses and adjusting for gender, socio-demographic variables, asthma, rhinoconjunctivitis and eczema, the OR for reported itch when mentally distressed was 3.1 (95% CI: 2.3–4.2). Performing the same adjusted analysis for

Table III. Odds ratios (OR) for reporting itch¹ with mental distress, socio-demographic variable, asthma, rhinoconjunctivitis and eczema in a crude model among adolescents (*n* = 2833) in Oslo, Norway. OR for reporting itch¹ with mental distress, adjusted for the other factors in the table among adolescents (*n* = 2833) in Oslo, Norway

	Itch	
	Crude OR (95% CI)	Adjusted OR (95% CI)
Mental distress		
No	1.0	1.0
Yes	3.9 (2.9–5.1)	3.1 (2.3–4.2)
Gender		
Male	1.0	1.0
Female	2.0 (1.5–2.6)	1.3 (0.9–1.8)
Ethnicity		
Western	1.0	1.0
Non-Western	1.8 (1.3–2.4)	1.6 (1.1–2.3)
Family income		
>1.0 million NOK	1.0	1.0
0.5–1.0 million NOK	1.4 (1.0–2.0)	1.3 (0.8–1.9)
< 0.5 million NOK	2.0 (1.3–3.0)	1.4 (0.9–2.4)
Asthma		
No	1.0	1.0
Yes, before	1.9 (1.2–2.8)	1.2 (0.8–2.0)
Yes, now	2.3 (1.4–3.5)	1.4 (0.8–2.3)
Rhinoconjunctivitis		
No	1.0	1.0
Yes, before	1.9 (1.4–2.8)	1.3 (0.9–2.0)
Yes, now	2.5 (1.9–3.5)	1.5 (1.1–2.2)
Eczema		
No	1.0	1.0
Yes, before	1.7 (1.2–2.5)	1.5 (1.0–2.2)
Yes, now	11.4 (8.2–15.9)	9.3 (6.5–13.3)

¹Self-reported itch (yes quite a lot, yes very much).

CI: confidence interval; NOK: Norske kroner.

Fig. 1. Mean scores on the 10-item Hopkins Symptoms Check List (HSCL-10) among males and females with increasing severity of self-reported itch among adolescents (*n* = 3540) in Oslo, Norway.

both genders separately, we found for girls an OR of 3.4 (95% CI: 2.4–4.9) and for boys 2.3 (95% CI: 1.3–4.2). We also performed an analysis with additional variables (mother's level of education, cigarette smoking, and participants from the school vs. the postal part of the study), but this did not alter the adjusted OR for reported itch when mentally distressed.

A statistical interaction was found between mental distress and eczema when itch was the dependent variable. Separate analyses were performed for those with reported eczema ($n = 123$) and for those with no reported eczema ($n = 186$). The trend was that the association between itch and mental distress was stronger in those without eczema, with a crude OR of 4.2 (95% CI: 3.0–5.9) and an adjusted OR of 3.4 (95% CI: 2.4–4.9) (Table IV). In the analyses we did not find any statistical interaction between gender and mental distress or ethnicity and mental distress when itch was the dependent variable. No further analyses of interaction were performed.

DISCUSSION

The principal finding from this population-based study is a strong and independent association between itch and mental distress among 18/19-year old adolescents. This association remains strong in the adjusted model. Previously, high levels of psychosocial morbidity have been found in adults with pruritic skin disorders (2–5) and in the general population (7). The result from the present study points in the same direction, but to our knowledge no such association has been shown before in adolescents. The reason for the strong association between mental distress and itch in adolescents is uncertain, but psychiatric or psychosomatic diseases are thought to be one of the causes of itching (1). Another result from our study that supports a link between itch and mental health problems is the linear increase in mental distress when the severity of itch increases.

There is a tendency that non-eczema itch is more strongly associated with mental distress than itch in those with eczema. This should be interpreted cautiously but might point to eczema and mental problems being

two different causes of itch. This result may therefore be understood as in accordance with the classification of itch in which psychogenic diseases and dermatological diseases are separate causes of itch (1).

Almost one in ten adolescents reported quite a lot or very much itch over the past week, and this indicates that itchy skin is a widespread health problem that is as frequent as other, more frequently studied health problems in adolescence (26). A study conducted in four European countries and which examined the health complaints over the last week of 15-year-old adolescents showed, for example, a prevalence of abdominal pain in the range of 6–23% and backache in the range of 8–19% (26). The prevalence of itch in the present study is at the same level as that found among adults (8.4%) (24).

In the present study, the distribution of itch across socio-demographic variables is consistent with previous studies about skin complaints and itch in adults (7, 24), but this has not earlier been demonstrated among adolescents. We have found associations between itch and asthma, rhinoconjunctivitis and especially eczema. We use the term "eczema" in this paper since according to the World Allergy Organization atopic dermatitis is now referred to as eczema (27). Eczema was also the term used in the questionnaire. The strong association between itch and eczema could illustrate that eczema is the main cause of itchy skin in the population studied. It also points to the fact that itch is one of the hallmarks of eczema (28, 29). We also found associations between itchy skin and asthma and rhinoconjunctivitis. Such associations have, to our knowledge, not previously been demonstrated at population level, but are not surprising since asthma, rhinoconjunctivitis and eczema are established co-morbidities.

In this study, mental distress is the main independent variable. Mental distress is not the same as mental disease, but is a wider term describing some of the symptoms and experiences of mental illness, e.g. anxiety and depression. In this survey HSCL-10 was used to measure mental distress, and results should not be interpreted clinically as depression or anxiety (30).

We found a higher prevalence of mental distress among girls than boys, and indeed it is well known that there is a greater prevalence of depression in adolescent girls than boys (12). In the present study, itch was reported more often by girls than boys. This is in accordance with other somatic complaints that are more prevalent in females (15, 26). This gender difference in somatic complaints emerges in adolescence and continues into adulthood (15). In the present study, however, when examining the prevalence of mental distress when itchy skin was reported, the trend was identical for both genders; when the severity of the itch increased, mean mental distress scores also increased. When calculating associations in the crude model, girls had twice as high an odds compared with boys for reporting itch. How-

Table IV. Odds ratios (OR) for reporting itch¹ with mental distress among adolescents with or without reported eczema among adolescents ($n = 2833$) in Oslo, Norway

		Itch	
		Crude OR (CI)	Adjusted OR ^a (CI)
No eczema	No mental distress	1.0	1.0
	Mental distress	4.2 (3.0–5.9)	3.4 (2.4–4.9)
Eczema	No mental distress	1.0	1.0
	Mental distress	2.6 (1.5–4.4)	2.5 (1.4–4.5)

¹Self-reported itch (yes quite a lot, yes very much).

^aAdjusted for gender, ethnicity, family income, rhinoconjunctivitis and asthma.

CI: 95% confidence interval.

ever, in the adjusted analysis, the OR for reported itch did not show any significant gender difference. There was no statistical interaction between gender and mental distress when itch was the dependent variable. Therefore we did not explore the gender perspective further, even though gender differences are important in epidemiology.

The strength of the present study is that it has been performed in a large non-healthcare seeking population with a high response rate. By performing surveys of the general population, the selection biases inherent to clinical studies can be avoided and the results can be more easily generalized. The main independent variable mental distress was measured with a well-validated instrument, the HSCL-10. Itch was a self-reported variable, as in other similar studies (2, 4, 7, 31). In the multivariate analysis we checked for possible confounders, including eczema, which is lacking in some other studies (7).

The limitations of this study are mainly linked to problems associated with questionnaire-based, cross-sectional studies. Since the data were collected at the same time and the questions had a focus on present health complaints, it is not possible to draw any conclusion regarding causality from the results. Another problem is the possibility of dependent misclassification, since all the data, except ethnicity and family income, were self-reported. Such a misclassification would imply that there were measurement errors in both the independent and dependent variables, and that the degree of error in the one is dependent on the degree of error in the other (32). Some individuals (e.g. personality types) may have a tendency to score highly on many different questions regardless of the degree of their mental or somatic problems. A third concern is the possibility of recall bias, but this is probably limited since the main variables are about health complaints in the last week. A fourth concern connected to the study is that information about asthma, rhinoconjunctivitis and eczema was covered by just one question about each condition, and this was mainly due to a lack of space in the questionnaire. It would have been better if these variables had been collected through established and validated questions such as the ones used elsewhere (29) or by examining the participants. However, examining many participants is difficult and expensive. A last concern is the high number of missing observations in the adjusted analyses, and this is mainly due to the high number of missing observations regarding the socio-demographic variables.

Earlier studies have found an association between psychopathology and somatic complaints in adolescents (13–15). The present study would point out itchy skin as an additional and unrecognized somatic complaint in mentally distressed young people. Our results draw attention to important questions: does itchy skin cause mental problems or do mental problems cause itchy skin? Are there one or more common factors at work in-

fluencing both itch and mental distress? Is there a stronger association between itch and mental distress in those without eczema? Why is itch more prevalent among girls and in certain socio-demographic groups?

Itch is a prevalent, understudied and complex symptom. Our study provides evidence for an association between itch and mental distress and raises important research questions that we would suggest should be examined in future studies. We would also suggest that physicians who encounter adolescents with itchy skin should have an awareness of possible mental problems in young people.

ACKNOWLEDGEMENTS

The data collection for the study was carried out and funded by the Norwegian Institute of Public Health, the University of Oslo and the Centre for Child and Adolescent Mental Health, Eastern and Southern Norway.

REFERENCES

1. Ständer S, Weisshaar E, Mettang T, Szepietowski JC, Carstens E, Ikoma A, et al. Clinical classification of itch: a position paper of the International Forum for the Study of Itch. *Acta Derm Venereol* 2007; 87: 291–294.
2. Gupta MA, Gupta AK, Schork NJ, Ellis CN. Depression modulates pruritus perception: a study of pruritus in psoriasis, atopic dermatitis, and chronic idiopathic urticaria. *Psychosom Med* 1994; 56: 36–40.
3. van Os-Medendorp H, Eland-de Kok PC, Grypdonck M, Bruijnzeel-Koomen CA, Ros WJ. Prevalence and predictors of psychosocial morbidity in patients with chronic pruritic skin diseases. *J Eur Acad Dermatol Venereol* 2006; 20: 810–817.
4. Schneider G, Driesch G, Heuft G, Evers S, Luger TA, Ständer S. Psychosomatic cofactors and psychiatric comorbidity in patients with chronic itch. *Clin Exp Dermatol* 2006; 31: 762–767.
5. Picardi A, Abeni D, Melchi CF, Puddu P, Pasquini P. Psychiatric morbidity in dermatological outpatients: an issue to be recognized. *Br J Dermatol* 2000; 143: 983–991.
6. Gieler U, Niemeier V, Brosig B, Kupfer J. Psychosomatic Aspects of Pruritus. *Dermatol Psychosom* 2002; 3: 6–13.
7. Dalgard F, Lien L, Dalen I. Itch in the community: associations with psychosocial factors among adults. *J Eur Acad Dermatol Venereol* 2007; 21: 1215–1219.
8. Summey BT Jr., Yosipovitch G. Pharmacologic advances in the systemic treatment of itch. *Dermatol Ther* 2005; 18: 328–332.
9. Ehlers A, Stangier U, Gieler U. Treatment of atopic dermatitis: a comparison of psychological and dermatological approaches to relapse prevention. *J Consult Clin Psychol* 1995; 63: 624–635.
10. Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in childhood and adolescence. *Arch Gen Psychiatry* 2003; 60: 837–844.
11. Roberts RE, Attkisson CC, Rosenblatt A. Prevalence of psychopathology among children and adolescents. *Am J Psychiatry* 1998; 155: 715–725.
12. Angold A, Erkanli A, Silberg J, Eaves L, Costello EJ. Depression scale scores in 8–17-year-olds: effects of age and gender. *J Child Psychol Psychiatry* 2002; 43: 1052–1063.

13. McCauley E, Carlson GA, Calderon R. The role of somatic complaints in the diagnosis of depression in children and adolescents. *J Am Acad Child Adolesc Psychiatry* 1991; 30: 631–635.
14. Lien L, Claussen B, Hauff E, Thoresen M, Bjertness E. Bodily pain and associated mental distress among immigrant adolescents. A population-based cross-sectional study. *Eur Child Adolesc Psychiatry* 2005; 14: 371–375.
15. Egger HL, Costello EJ, Erkanli A, Angold A. Somatic complaints and psychopathology in children and adolescents: stomach aches, musculoskeletal pains, and headaches. *J Am Acad Child Adolesc Psychiatry* 1999; 38: 852–860.
16. Neinstein LS, editor. Adolescent health care: a practical guide. Philadelphia: Lippincott, Williams & Wilkins; 2002.
17. Sjøgaard AJ, Eide T. The Oslo Health Study (HUBRO) – the youth part (UNGHUBRO). Aims, materials and methods (online) 2008 Nov 22. Available from: URL: <http://www.fhi.no/dav/AD07555E4B.doc>
18. Sagatun A, Sjøgaard A-J, Bjertness E. Youth 2004. Material and methods (online) 2006 Aug 28. Available from: URL: <http://www.fhi.no/dav/A34847D246.pdf>
19. Halvorsen JA, Olesen AB, Thoresen M, Holm JO, Bjertness E, Dalgard F. Comparison of self-reported skin complaints with objective skin signs among adolescents. *Acta Derm Venereol* 2008; 88: 573–577.
20. Strand BH, Dalgard OS, Tambs K, Rognerud M. Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nord J Psychiatry* 2003; 57: 113–118.
21. Lipman RS, Covi L, Shapiro AK. The Hopkins Symptom Checklist (HSCL) – factors derived from the HSCL-90. *J Affect Disord* 1979; 1: 9–24.
22. Lie B. Innvanding og innvandrere, 2002. [Immigration and immigrants 2002.] Statistics Norway 2002 (in Norwegian).
23. Berkman L, Kawachi I, editors. Social epidemiology. Oxford: Oxford University Press; 2000.
24. Dalgard F, Svensson A, Holm JO, Sundby J. Self-reported skin morbidity in Oslo. Associations with sociodemographic factors among adults in a cross-sectional study. *Br J Dermatol* 2004; 151: 452–457.
25. Lien L, Hamar DPS. The association between mental health problems and inflammatory conditions across gender and immigrant status: a population-based cross-sectional study among 10th-grade students. *Scand J Pub Health* 2008; 36: 353–360.
26. Haugland S, Wold B, Stevenson J, Aaroe LE, Woynarowska B. Subjective health complaints in adolescence. A cross-national comparison of prevalence and dimensionality. *Eur J Public Health* 2001; 11: 4–10.
27. Johansson SG, Bieber T, Dahl R, Friedmann PS, Lanier BQ, Lockey RF, et al. Revised nomenclature for allergy for global use: report of the Nomenclature Review Committee of the World Allergy Organization, October 2003. *J Allergy Clin Immunol* 2004; 113: 832–836.
28. Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol* 1980; Suppl 92: 44–47.
29. Williams HC, Burney PG, Pembroke AC, Hay RJ. The U.K. Working Party's Diagnostic Criteria for Atopic Dermatitis. III. Independent hospital validation. *Br J Dermatol* 1994; 131: 406–416.
30. Cyr JJ, Kenna-Foley JM, Peacock E. Factor structure of the SCL-90-R: is there one? *J Pers Assess* 1985; 49: 571–578.
31. Dalgard F. Self-reported skin morbidity in Oslo. Associations with sociodemographic factors among adults in a cross-sectional study. *Br J Dermatol* 2004; 151: 452–457.
32. Kristensen P. Bias from nondifferential but dependent misclassification of exposure and outcome. *Epidemiology* 1992; 3: 210–215.