

Paper I

Subjective health complaints in adolescence: dimensional structure and variation across gender and age

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Aims: The aim of this study is to investigate dimensional structures in subjective health complaints in adolescents and to examine the variation in levels and dimensionality across gender and age groups. *Methods:* Data from two studies were used: (1) a study based on a convenience sample, consisting of 1427 Norwegian students (11- to 15-year-olds) from schools participating in the European Network of Health Promoting Schools; (2) a nationwide survey amongst 7,059 Norwegian students (aged 11, 13, 15, and 16) from the Health Behaviour in School-aged Children (HBSC) study. Subjective health complaints were measured by revised versions of the HBSC symptoms checklist (HBSC-SCL). *Results:* In study 1 confirmatory factor analysis revealed that a model of two highly correlated factors, which can be labelled somatic and psychological, fitted the data reasonably well (CFI=0.91). This two-factor model was applied in study 2 and latent means were tested across sub-samples defined by gender and age. The results indicate that girls show higher mean levels compared with boys on both factors. There is also an indication of an increase in these factors with age amongst girls, while amongst boys there is less, if any, difference across age groups. The correlation between the somatic and psychological factors was virtually constant across age groups and gender. *Conclusions:* The identification of a somatic and a psychological factor indicates the existence of two different dimensions that may have different aetiologies. The gender difference in latent means across age groups may suggest a different developmental pattern amongst girls and boys.

Key words: adolescents, children, dimensional structure, latent mean, gender difference, subjective health complaints.

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INTRODUCTION

Subjective health complaints constitute a public health problem with severe personal and economic consequences in the adult population (1, 2). In the last decade it has been well documented that subjective health complaints are also common amongst adolescents (3, 4). A better understanding of the development of complaints in the younger population is needed because of the suffering and reduction of life quality accompanying these complaints. Research on their early development might give further clues to the origins of these complaints in the adult population.

An important question is whether health complaints reflect different underlying dimensional structures. Different symptom dimensions may have different aetiologies, and require different remedial actions (5). In clinical samples somatic complaints have tended to cluster together into different clinical syndromes (5, 6) supporting the validity of different categorical diagnoses. However, the clustering of symptoms observed in clin-

ical samples could be generating a diagnostic artefact that does not exist in the general population (7).

Knowledge about the dimensionality of health complaints is of great importance for future research. If unidimensionality is assumed, and data analyses therefore are based on single global sum scores, crucial information can be left out. On the other hand, by wrongly assuming that complaints reflect several underlying dimensions, one may waste efforts and present analyses that are too detailed and that also may unnecessarily reduce the reliability of sum scores.

Previous research has shown that co-occurrence of symptoms is common in the general population (5, 7–10), as well as amongst children and adolescents (4, 11–13). Different underlying dimensional structures have been suggested in these younger populations (14–16). The different dimensional structures that are found vary in specificity, and comparison and interpretation of the results is complicated by differences in both the measurement and the definition of health problems (14).

Previous studies have shown that girls report more symptoms than boys (4, 17, 18). Kristjansdottir (13) has found that the gender difference is more pronounced for co-occurrent symptoms than for single symptoms. The prevalence of somatic and psychological symptoms increases over age (4, 12), and the gender differences also increase over age (17).

According to symptom perception theory (19) there are gender differences in how individuals notice, define, and react to symptoms. Females seem to be more sensitive to external environmental cues and males to internal physiological clues. Girls may therefore be more sensitive to settings they perceive as stressful, and to a larger extent than boys develop multiple complaints as a result of psychosocial stressors in the environment.

Environments where children and adolescents live and spend their time may be of importance to the development of somatic and psychological complaints. Recent studies have revealed psychosocial factors in different arenas that relate to children's and adolescents' level of health complaints. School-related stress, for example, is shown to be related to subjective health complaints amongst adolescents (20), and families that show high levels of somatic complaints often experience more psychological strains than other families (21). The extent to which children and adolescents are exposed to social stress in their environment may vary across age and gender, and this may again cause differences in level of complaints.

A common view in psychology is that somatic complaints develop as a result of psychological reinforcement of physiological signals (21). By directing attention inwards and giving more attention to signals from the body, an increased awareness of pain and suffering may occur (19, 21). Watson and Pennebaker (19) claim that an underlying personality factor, negative affectivity (NA), may influence the development of somatic as well as psychological complaints. Individuals with high NA experience more distress and dissatisfaction over time across different situations, and are also more introspective and tend to dwell differentially on their failures and shortcomings (19).

This paper contains results from two studies. The aim of study 1 is to investigate dimensional structures in subjective health complaints in adolescents. In study 2 the aims are to examine variation of these dimensional structures across gender and age groups, and to investigate whether latent mean level differences exist in dimensional structures across gender and age.

STUDY 1: METHODS

Sample

Sample 1 was a convenience sample, consisting of 1,601 Norwegian students in grades 5 to 10 (11- to 15-year-

olds) from 10 pilot schools participating in the European Network of Health Promoting Schools study, a WHO, and EU cooperative project. From the full study sample 1,427 students participated in the study, giving an overall response rate of 89%. The main reasons for non-participation were parental non-consent and absenteeism on the day the survey was conducted.

Procedure

The study was carried out at the end of November and the beginning of December 1994. Data were collected through anonymous, self-completion questionnaires administered by a teacher to the students who were present during an ordinary class-hour.

Materials

HBSC-symptom checklist (HBSC-SCL) extended version (b). Subjective health complaints were measured by a revised version of the HBSC symptom checklist (HBSC-SCL). The respondents report the frequency of 15 different symptoms (headache, stomach-ache, back pain, upper back pain, sleeping difficulties, dizziness, feeling low, nervousness, irritability, fatigue, anxiety, body-ache, palpitations, nausea, and pain in arms and legs) on a five-point scale ranging from "daily" to "seldom or never". The HBSC symptom checklist and other scales with similar outline have shown adequate internal consistency for adolescent populations (16).

Missing data

To prepare the data files for SEM analysis missing data were treated as follows. Cases with more than 30% of responses missing on the relevant variables were excluded, while on the remaining missing observations mean value imputation was used. After this procedure the data set consisted of 1,412 cases.

Statistical analysis

A confirmatory factor analysis was performed to investigate the underlying structure in subjective health complaints. Several indices of goodness of fit exist. In the present study the following goodness of fit indices were applied: chi-square ($\Delta\chi^2$, model fit), Comparative Fit Index (CFI, model fit), and Akaike Information Criterion (AIC, model comparison).

Two models were tested: Model 1, a one-factor model, where the covariance between the 15 subjective health complaints is accounted for by one single factor;

Model 2, a two-factor model, where two correlated factors account for the covariance between the complaints. The two factors can theoretically be labelled somatic (headache, stomach-ache, back pain, upper back pain, dizziness, body-ache, palpitations, pain in arms and legs, and nausea) and psychological complaints (feeling low, nervousness, irritability, sleeping difficulties, fatigue, and anxiety). All the Analyses were undertaken using AMOS 4.01.

RESULTS

Confirmatory factor analyses revealed that a model of two correlated factors (Model 2: AIC= 644.64), fitted the data better than a one-factor model (Model 1: AIC= 833.91). The two-factor model had a reasonably high goodness of fit (chi-square= 582.64; df= 89; CFI= 0.91), while the one-factor model showed a poor fit (chi-square= 773.908; df= 90; CFI= 0.87). The two factors in the two-factor model were highly correlated ($r=0.82$), and they had acceptable factor loadings (Figure 1). All the loadings were significant.

DISCUSSION

The results from study 1 indicate that health complaints in the general adolescent population reflect two broad underlying dimensions, a somatic and a psychological dimension. However, the two dimensions are highly correlated. The existence of one single complaint dimension is not supported.

Dimensional structure

The results support the assumption that different clustering of symptoms will occur in clinical samples

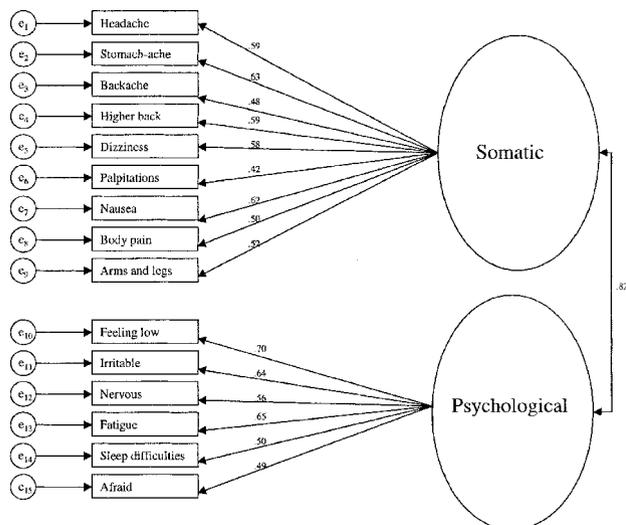


Fig. 1. Standardized factor loadings and correlation between factors for a two-factor model (Model 2).

compared with the general population. While in clinical samples more specific clusters have been identified (5, 6), the two dimensions identified in this study seem more general in nature. The current findings are also important because of the disagreement in previous research A(14). Both in the psychological literature and the diagnostic tools used in clinical work it is common to distinguish between somatic and psychological symptoms, and our results confirm that such a distinction may be reasonable. However, it is important to consider the fact that the two dimensions are highly correlated. One possible interpretation is that the two dimensions are sub-dimensions of an even more general dimension, and that two sub-dimensions may reflect different levels of stress. On the other hand the somatic and psychological dimensions may constitute two qualitatively different dimensions that are highly related, but with some unique aetiological factors that are not shared by the other factor. The two dimensions will be discussed further in study 2.

STUDY 2: METHODS

Sample

The second study is based on a nationally representative sample, consisting of 7,059 Norwegian students (aged 11 ($n=1,733$), 13 ($n=1,623$), 15 ($n=1,670$), and 16 ($n=2,033$)) from the Health Behaviour in School-aged Children (HBSC) study. A standard cluster sampling procedure was followed using school class as the sampling unit. The original sample consisted of 2,303 11-year-olds, 2,144 13-year-olds, 2,165 15-year-olds, and 2,520 16-year-olds, giving an overall response rate of 77%. The two main sources of non-response were non-participating schools and absenteeism on the day that the survey was conducted.

Procedure

The data collection was carried out in November/December 1997. Data were collected through anonymous, self-completion questionnaires administered by a teacher to the students who were present during an ordinary class-hour. A standardized procedure was followed in order to ensure comparability across schools (22).

Materials

HBSC-symptom checklist (HBSC-SCL) extended version (a). Subjective health complaints were measured by a revised version of the HBSC symptom checklist (HBSC-SCL). The respondents reported the frequency of 11 different symptoms (headache, stomach-ache, back pain, upper back pain, sleeping difficulties,

dizziness, feeling low, nervousness, irritability, fatigue, anxiety) on a five-point scale ranging from 'daily' to 'seldom or never'.

Missing data

In the SEM analysis the missing observations (612 cases) were treated by full-information maximum likelihood (FIML). The FIML assumes multivariate normality and maximizes the likelihood of the model given the observed data (23).

Statistical analysis

To investigate the variation of a two-factor model across age and gender a latent mean analysis was applied. Using methods that use error-laden composites on a theoretically error-free construct may lead to an inaccurate assessment of group differences, and the use of structural equation modelling is therefore more appropriate for answering research questions regarding latent constructs (24). The sample was divided by age and gender into eight sub-samples, and the two-factor model tested using a multi-group procedure. In the analysis different models were compared by evaluating change in chi-square relatively with the change in degrees of freedom. The models differed in terms of constraints applied across the different groups. For example, a significant decrease of chi-square when allowing boys' and girls' mean factor levels to be different indicates that a gender difference in that factor exists.

Model 1: A default model with two correlated factors accounting for the covariance was first applied across the eight groups. The measurement error means, factor loadings, and indicator variable intercepts were constrained to be equal, while the latent variable means and measurement error variance were allowed to vary, across the eight groups. For the 11-year-old boys both the factor means were set to be 0, as the analysis needs one group to have a set value to serve as reference point for the other groups in the analysis.

A further six versions of the default model containing different constraints on the latent factor means were tested. *Model 2:* All latent factor means were constrained to be equal in the eight groups. *Model 3:* latent factor means across age were released to vary, while latent factor means between gender were constrained to be equal. *Model 4:* Latent factor means between gender were allowed to vary, while age was constrained across the groups. *Model 5:* Boys' latent factor means were allowed to vary across age, while girls' were constrained to be equal. *Model 6:* Girls' latent factor means were allowed to vary across age, while boys' were constrained to be equal. *Model 7:* On factor 1 latent

means for both boys and girls were allowed to vary across gender and age, while on the second factor boys' latent means were constrained to be equal and girls' were allowed to vary.

All the analyses were undertaken using AMOS 4.01.

RESULTS

Table I presents the standardized factor loadings for the somatic and psychological factors, showing a reasonable consistency across the eight different groups. All the factor loadings were significant. Both factors have acceptable factor loadings across groups, except "sleeping difficulties", which has a low loading on the psychological factor in the 11-year-old boys group. Overall the psychological factor contains somewhat higher factor loadings than the somatic factor. The correlation between the somatic and psychological factors was virtually constant across age groups and gender (Table I).

Figures 2 and 3 present the somatic and psychological latent factor means across the eight groups (default model), using the 11-year-old boys' factor mean levels as a reference point. Figure 2 shows that the somatic latent factor means for both boys and girls increase over age, except that the 15-year-old girls show a slightly higher mean level than the 16-year-olds. The increase across age groups amongst girls is marked, while the increase amongst boys is moderate. Figure 3 shows a development amongst girls on the latent mean level of psychological complaints similar to that of the somatic factor, while for the boys there is almost no change of latent mean level across the age groups.

To test for age and gender differences and a possible interaction in latent mean levels, six additional models were tested, and a comparison of the models is presented in Table II.

Gender and age main effects

A comparison of a model where both the somatic and psychological factor mean levels are constrained across gender (Model 2), with a model where gender was released (Model 3), revealed a significant decrease in chi-square ($\Delta\chi^2 = 241.73$; $df = 2$; $p < 0.001$), indicating a gender difference in the latent somatic and psychological factor means. A comparison between Model 2 and a model where the constraint of equal factor means across age was released (Model 4) indicates that an age difference in the somatic and psychological latent factor means levels also exists. The comparison shows a decrease in chi-square between Model 2 and Model 4 ($\Delta\chi^2 = 90.79$; $df = 6$; $p < 0.001$).

Table I. Standardized factor loadings and correlation between factors for a two-factor model across gender and age

Factor	Boys (age in years)				Girls (age in years)			
	11	13	15	16	11	13	15	16
Somatic								
Headache	0.58	0.56	0.56	0.58	0.55	0.62	0.58	0.56
Stomach ache	0.48	0.53	0.54	0.55	0.45	0.53	0.61	0.54
Back pain	0.57	0.50	0.47	0.44	0.59	0.56	0.50	0.48
Dizziness	0.59	0.57	0.54	0.57	0.65	0.59	0.58	0.55
Neck pain	0.56	0.56	0.56	0.54	0.59	0.63	0.56	0.53
Psychological								
Feeling low	0.68	0.72	0.71	0.68	0.69	0.69	0.67	0.67
Irritable	0.56	0.60	0.59	0.62	0.63	0.66	0.67	0.69
Nervousness	0.55	0.59	0.56	0.57	0.59	0.61	0.58	0.62
Sleeping difficulties	0.38	0.43	0.43	0.42	0.41	0.47	0.45	0.46
Fatigue	0.58	0.59	0.58	0.56	0.64	0.67	0.66	0.66
Afraid	0.48	0.53	0.58	0.59	0.44	0.50	0.50	0.54
Correlation between factors	0.77	0.78	0.76	0.70	0.76	0.75	0.76	0.75

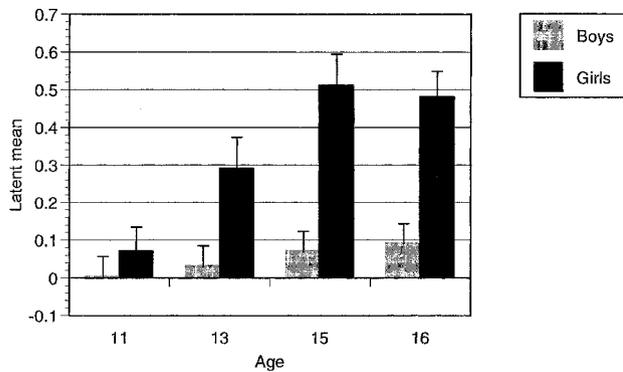


Fig. 2. Somatic factor latent mean by gender and age.

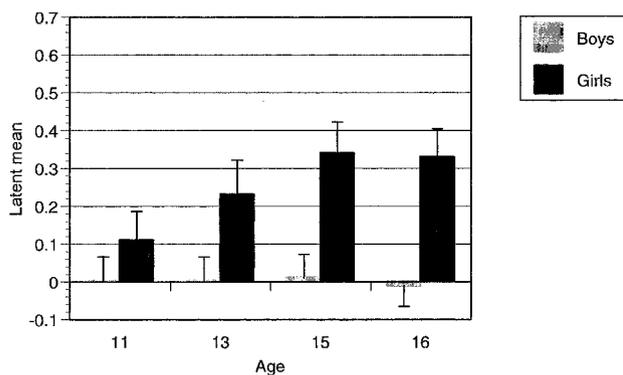


Fig. 3. Psychological factor latent mean by gender and age.

Interaction between gender and age

To test for an interaction between gender and age the model with gender released (Model 3) was compared with two models where boys (Model 5) and girls (Model 6) were released separately across age. Table II shows a non-insignificant decrease of chi-square from Model 3 to Model 5 ($\Delta\chi^2 = 8.94$; $df = 6$, $p < n.s.$), indicating that for boys there are no age differences on

either the somatic or psychological latent factor means. The comparison of Model 3 with Model 6 reveals a significant decrease of chi-square ($\Delta\chi^2 = 159.76$; $df = 6$; $p < 0.001$), indicating that such an age difference exists amongst girls, and also indicating a gender by age interaction in latent means.

To test if the gender by age interaction was evident in both the somatic and psychological latent factors means, Model 7 was compared with the model where girls were unconstrained across age group (Model 6). In Model 7 boys were released on the somatic factor while the psychological factor was constrained to be equal over age. The results showed that there is a significant decrease in chi-square from Model 6 to Model 7 ($\Delta\chi^2 = 9.78$; $df = 3$, $p < 0.002$). Overall, the best-fitting model included age differences for both girls and boys on the somatic latent factor mean, but age differences only for girls on the psychological latent factor mean.

DISCUSSION

The results from study 2 give additional support to a model suggesting two related dimensions in complaints amongst children and adolescents. The two dimensions are highly correlated and the correlation is fairly constant across age groups and gender. The results further indicate a different developmental pattern of the dimensions amongst girls and boys, as an age by gender interaction is found in the psychological dimension.

Variations in complaints across gender and age groups

Previous publications from the HBSC study show that a large number of adolescents report a high level of symptoms (3, 14, 20). Almost a fifth of the

Table II. Model comparison by gender and age

	Chi-square	df	CFI	Model comparison	Δ chi-square
M1: Default model	3113.47	470	0.978	–	–
M2: Constrain across age and gender	3519.35	484	0.975	–	–
M3: Release gender	3277.74	482	0.977	M2:M3	241.73**
M4: Release age	3428.56	478	0.975	M2:M4	90.79**
M5: Boys released across age	3268.80	476	0.977	M3:M5	8.94
M6: Girls released across age	3123.01	476	0.978	M3:M6	159.76**
M7: Release girls both factors and boys factor 2	3113.99	473	0.978	M6:M7	9.68*

* $p < 0.002$; ** $p < 0.001$.

adolescents in the study experienced at least one somatic complaint weekly.

In accordance with previous research (17, 25) the results indicate a higher mean level on the somatic and psychological dimensions amongst girls than boys, and the difference between the genders increases with age. It is important to consider whether the difference between genders found in the present study is not simply a cohort effect. Analysis of previous data from the HBSC study has revealed similar patterns (26) and it is therefore likely that the increasing gender difference is predominantly an effect of age.

One possible explanation for the gender difference in symptom reporting is that differences in the perception of symptoms between the genders cause girls to experience more symptoms than boys (19). Furthermore, it is likely that girls to a greater extent than boys are internalizing their psychosocial problems (27), and therefore develop more symptoms than boys. It has also been suggested that the difference in reporting of symptoms may be affected by societal influences and expectations (28). From this point of view girls may, to a greater extent than boys, consider that it is more socially accepted to report symptoms, and it is also likely that the differences between boys and girls in this perceived acceptance of symptom reporting increases over age. A qualitative study of adolescents' interpretation of complaints indicates that gender differences in validity seem to be limited to the level of symptoms rather than the understanding of symptoms or impact on everyday life (29). This gives additional support to the assumption that reported level of discomfort or pain is a reflection of social norms (30).

Attentiveness to one's body and introspection are believed to be part of normal development during adolescence (18), and it has been shown that self-awareness and introspection are fundamentally related to inner distress and greater symptom reporting (31). Both somatic and psychological complaints may therefore increase during adolescence.

Rauste-von Wright and Wright (17) found in a

longitudinal study that somatic symptoms reach a peak at the age of 13 for both genders. The present study indicates a peak age for somatic and psychological symptoms amongst girls at 15 years of age, while amongst boys there are no indications of a peak age on either of the complaint dimensions. However, there is some evidence of a moderate increase of the somatic latent mean level amongst boys with increasing age.

In spite of the various explanations provided above, the possibility that the gender differences observed are "real" cannot be excluded. Modern life and current gender roles may cause higher levels of social stress impacting on girls than on boys. In studies where major sources of social stress are measured, this hypothesis could be tested.

Dimensional structure

The results from study 2 give additional support to the two-factor model suggested in study 1, showing little change in the factor structures and correlation across age and gender. It may be hypothesized that younger children have more immature cognitive and verbal skills than older children, and their vocabulary for emotional expression is therefore more limited (32). From a developmental point of view one would therefore assume that the two dimensions become more distinct with increasing age. The present study confirms, however, that the underlying dimensionality of complaints is equally clear and distinct across all age groups, the 11-year-olds included.

The fact that the two somatic and psychological dimensions are highly correlated may question the existence of two distinct dimensions. However, the different developmental patterns found amongst boys on the somatic and the psychological dimensions may add some additional support to the value of distinguishing between these two dimensions. Furthermore, differences in patterns of associations with new predictors and differences in variations across sub-groups may add supporting evidence.

Methodological considerations

One limitation in the current study may be that the HBSC symptom checklist consists of a rather low number of items. It is possible that with a more comprehensive and thorough measurement of complaints, more specific clusters or syndromes might have been identified. The detection of more specific factors is, however, not necessarily inconsistent with the pattern revealed in the present study. It is possible and most likely that there is a hierarchy of nested dimensions. An advantage in the current study is the use of a national representative sample consisting of a great number of subjects, giving highly reliable results.

Conclusion

The results provide some evidence for a distinction between somatic and psychological complaints, and that different developmental patterns between boys and girls and across dimensions of complaints exist. The two dimensions identified are general by nature, and this may indicate that in the general population more broad-based intervention approaches should be considered. Future research based on longitudinal data, looking into the development of these dimensions and their causal relationships with different social stressors, is called for.

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