

Should be cited as: *Psychiatr. Pol.* 2014; 48(2): 359–369

PL ISSN 0033-2674

www.psychiatriapolska.pl

Worrying behaviour in pre-school children aged three to seven years: a factor analysis of the results of a questionnaire

Maciej Wojciech Pilecki¹, Małgorzata Kowal², Agnieszka Woronkiewicz²,
Jan Sobiecki², Łukasz Kryst², Jadwiga Kamińska-Reyman³

¹Department of Child and Adolescent Psychiatry Jagiellonian University, Collegium Medicum
Acting Director: Dr n. med. Maciej Pilecki

²School of Anthropology in the University School of Physical Education (AWF) in Kraków
Director: Professor dr hab. Ryszard Żarów

³Institute of Psychology at the University of Silesia (retired staff member)
Head: dr hab. Zbigniew Spendel

Summary

Aim. The aims of the study were: 1) the assessment of the interaction between the factors specified for behavioural problems observed in pre-school children based on a factor analysis and 2) the assessment of the relationship the specified factors have with the age and gender of the study group.

Method. A factor analysis based on a Principal Component Analysis of the main results of a Disturbing Behaviour Questionnaire (DBQ) completed by pre-school teachers, which includes categories of behaviour observed among pre-school age children that provoke the greatest concern among parents, guardians and educators.

Material. Nine-hundred and sixty-one children aged from 2.7 to 7.9 years (mean: 5.4; SD 1.13) from randomly chosen pre-schools in all districts of Kraków.

Results. Based on a screen plot, as well as on a substantive analysis of the results, a decision was taken to employ a four-factor analysis (Lagging behind, Excessive behaviour, Eating-avoidance and Overeating) explaining 68% of the common factor variance. A very high Cronbach's alpha value was returned for the reliability of the individual scales. The conducted analysis of the relationship of the scales with age and gender indicated a greater intensity of disturbing behaviour in boys for the Lagging behind factor, the Excessive behaviour factor and the overall scale for the Disturbing Behaviour Questionnaire (DBQ). These were the scales, along with the Eating-avoidance scale, that were found to be related to age. A greater intensity of disturbing behaviour was found to occur in the younger children. The relationship between the Overeating and Excessive behaviour scales that was found among girls but not among

This study has no. 204/KA/2006 and forms part of the research the University School of Physical Education (AWF) finances and UJ CM own funds

boys indicated that – even at such a young age – the characteristics associated with eating in the context of gender were already present.

Conclusions. The authors consider that the coherence of the results obtained and their consistency with other studies of pre-school age children provide a sound platform for further analyses using the questionnaire described above.

Key words: emotional problems, psychopathology, pre-school, factor analysis

Introduction

Research into mental disorders and emotional problems in the pre-school period is a comparatively recent field of academic investigation [1]. As two of its researchers, Arnold and Egger [2] figuratively put it, our knowledge of mental health in the pre-school period – and especially of the nosology of its disorders – remains in its infancy. This is a issue that has also seldom been studied in Poland. It is therefore relevant to conduct research into the multiplex aspects of mental disorders and emotional problems occurring among children at pre-school.

A previous publication [3] presented data on the incidence and severity of disturbing behaviours in children from Krakow kindergartens which are suggestive of the presence of behavioural, emotional or developmental problems. Using a Disturbing Behaviour Questionnaire (DBQ) and based on provided descriptions, kindergarten teachers were asked to evaluate the prevalence and severity in children of 11 behaviours such as: Hyperactivity (Hyper), Excessive Crying (Cry), Motor Awkwardness (Awk), Lagging Behind (Lag), Excessive Dependence (Excdep), Developmental Delay (Del), Hyperactivity (with Aggression) (Hypag), Aggression (Ag), Autoaggression (Aag), Strange Behaviour (Stran), Self-Isolation (Isol) and 4 additional ones: Avoiding eating (Aveat), Avoiding certain foods (Avfd), Overeating (Overeat), Compulsive Eating (Compeat). The research encompassed nine-hundred and sixty-one children aged from 2.7 to 7.9 years (average: 5.4; SD 1.13) [3] from randomly chosen pre-schools in all districts of Kraków. The absence of any disturbing behaviours (answer: “Did not occur”) were recorded in 108 children (11.2%). Excessive disturbing behaviours (answer: “Very often” or “always” in at least one category) were found in 270 (28%) children. A number of disturbing behaviours associated with gender and age [3] were also observed.

In the analysis on which the present study is based a decision was made to employ a factor analysis to attempt to assess the interaction between the different categories of disturbing behaviour. This was prompted by the desire to seek the structure of the latent variables responsible for the relationships between the categories of disturbing behaviour and to create scales that would be of use in further analyses of the relationships between the disturbing behaviour, the somatic growth of the children and their socio-economic situation. A second goal that has been set was to assess – based on the results of a factor analysis – to what extent the relationships between age and gender found in the context of the different categories recur.

Method

The Disturbing Behaviour Questionnaire (DBQ) by Jadwiga Kamińska-Reyman (2005) [4] was used in the study of behaviours which deviate from the standard. The source of categories in DBQ were descriptions (made by kindergarten teachers) of behaviours of children who present educational problems or raise concerns. The author analysed specific behaviours of children (behavioral indicators) and consequently distinguished the following 11 categories (according to M.H. Bornstein's formal criteria) disturbing behaviors: Hyperactivity (Hyper), Excessive Crying (Cry), Motor Awkwardness (Awk), Lagging Behind (Lag), Excessive Dependence (Excdep), Developmental Delay (Del), Hyperactivity (with Aggression) (Hypag), Aggression (Ag), Autoaggression (Aag), Strange Behaviour (Stran), Self-Isolation (Isol). As a result of the study involving 32 kindergarten teachers and applying BDQ, observational data on 429 children were gathered. The aim of the quantitative analysis was to determine the frequency of occurrence of each category of disturbing behaviours in relation to the total number of disturbing behaviours in the study group, as well as to determine the most disturbing behaviours in the perception of the kindergarten teachers[4].

Due to the fact that in the described project the questionnaire represented part of a study on the psycho-physical development of children, in the present study BDQ was supplemented by four categories of behaviours in the area of nutrition: Avoiding eating (Aveat), Avoiding certain foods (Avfd) Overeating (Overeat), Compulsive Eating (Compeat). The second modification was the introduction of a 5-point Likert scale (0 – does not occur, 1 - very rare, 2 - rare, 3 - frequent, 4 - very frequent, 5 - always) in place of the does/does not occur.

The author of the original questionnaire did not conduct analyses of its psychometric properties. However they were carried out on the basis of this study [3].

The Disturbing Behaviours Questionnaire was completed by kindergarten teachers based on the provided more detailed descriptions of disturbing behaviours. The questionnaire was conducted from March to the end of the school year (in June). During the study, data on the teachers' age, working hours, and how well they knew the children were not collected.

Material

The research involved children from randomly chosen pre-schools in all districts of Kraków. Disturbing Behaviour Questionnaires (DBQ) were obtained for a group of 961 children aged from 2.7 to 7.9 years (mean: 5.4; SD 1.13). Of the study group 49.8% were girls and 50.2% boys. The research was conducted in the years 2007–2008 in accordance with the binding procedures, that is, with the agreement of the Bioethics Committee of the Regional Association of the Medical Profession in Kraków (no. 26/KBL/OIL/2007) and with the consent of the family or legal guardians of the children. The issues of eligibility for the survey and of the representativeness of the group are discussed in the first paper which is listed at [3] in the bibliography. 75% of parents expressed their consent for the study. Of the parents who volunteered for the study and did not do so, there were no differences in terms of education and marital status. There were no significant differences in the birth parameters between the studied children and children

born in one of Krakow's maternity hospitals [5]. Despite this, due to the lack of obligation of pre-school education in Poland, the studied group can not be clearly defined as representative. The presence of disturbing behaviours was not to be reported to parents. It was assumed that these observations were directly provided to them by the teachers.

Results

A factor analysis was carried out on the all 15 variables of the Disturbing Behaviour Questionnaire (DBQ). The factor space was isolated using Principal Component Analysis (PCA). A scree plot was produced to facilitate the estimation of the number of factors. The Kaiser criterion made it possible to select the number of factors in advance as four and the scree plot was produced for four factors as a maximum. A distinct inflection point for one factor as well as a second, weaker one for four factors was observed. A check was therefore made to see what the outcome of four decompositions for between one and four factors would be. Factor analyses were performed in which 1, 2, 3 and 4 factors were isolated.

A factor analysis was performed on the 15 variables belonging to the Disturbing Behaviour Questionnaire (DBQ) and – using the Principal Component Analysis (PCA) method – between one and four factors were extracted calculated on a correlation matrix.

The factor space was rotated using varimax rotation for the two-, three- and four-factor solutions. Table 1. contains the results of the individual analyses. Those factor loadings whose absolute value was greater than 0.4 were discounted. The factor loadings whose value was greater than 0.7 are presented in bold type.

Table 1. Matrix of the loadings of the different variables after varimax rotation

Question	1factor	2 factors		3 factors			4 factors			
	factor I	factor I	factor II	factor I	factor II	factor III	factor I	factor II	factor III	factor IV
Percentage of variance explained	31%	27%	19%	27%	18%	13%	24%	18%	13%	13%
Eigen values	4.63	4.11	2.78	4.02	2.71	1.97	3.59	2.69	1.95	1.92
Excessive crying	0.56	0.57	0,13	0.54	0,23		0.43	0,22	0,36	
Motor awkwardness	0.70	0.73	0,12	0.77	0,02		0.81	0,02	0,09	
Lagging behind	0.73	0.78	0,09	0.82	0,03		0.83	0,03	0,14	
Self-isolation	0.69	0.73	0,10	0.73	0,12		0.74	0,12	0,16	
Hyperactivity	0.41	0,12	0.66	0,04	0.76	0,02		0.76	0,06	
Hyperactivity (with aggression)	0.59	0,24	0.81	0,16	0.90	0,08		0.90	0,07	
Aggression	0.57	0,23	0.77	0,16	0.86	0,08		0.85	0,12	
Auto-aggression	0,35		0.48	0,09	0.57	0,00		0.57	-0,04	
Excessive dependence	0.68	0.74	0,05	0.76	0,03		0.72	0,02	0,25	
Developmental delay	0.63	0.60	0,22	0.62	0,16		0.70	0,17	-0,04	
Strange behaviour	0.69	0.59	0,36	0.57	0,38		0.62	0,38	0,03	

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Avoiding eating	0,48	0,60	-0,10	0,55	0,07	-0,31	0,19		0,91	-0,02
Avoiding certain foods	0,48	0,58	-0,08	0,53	0,10	-0,32	0,16		0,92	-0,03
Overeating	0,18		0,56	0,06		0,92	0,06	0,07		0,96
Compulsive eating	0,16		0,55	0,05		0,91	0,03	0,07		0,97

Due to the clarity of the division obtained in the four-factor version and the fact that the criteria for the estimation of the number of factors in the factor analysis were met (Kaiser criterion -value greater than one - and the inflection point criterion). It was decided that further analyses would be based on this solution.

Next, it was decided based on the factor analysis performed, to calculate an overall scale of the survey and to create four questionnaire scales. (key enclosed) the internal consistency of which is presented in Table 2. With over 25% missing test items, no result was entered in the score sheet. If the number of missing items was less than or equal to 25%, the invalid reply was replaced by the average for the test item calculated for the entire sample. In scale I, from 1 to 3 missing items were observed for each one. In the other scales, there were no missing items below 25%. To calculate each of the items, from 951 to 960 questionnaires were used. Based on a qualitative analysis of the results of factor analysis, four scales were devised to correspond with individual factors. The items for which factorial load was greater than 0.4 were assigned to individual scales. Scales were prepared by summing (but not weighting) items assigned to each scale.

Table 2. Internal consistency of scales

Scale	Number of items	Reliability Cronbach's α	Questions whose elimination would improve Cronbach's α
Scale I	7 items	0,841	Excessive crying (0,848).
Scale II	4 items	0,754	Autoaggression (0,810).
Scale III	2 items	0,896	-
Scale IV	2 items	0,931	-
Total DBQ	15 items	0,831	Overeating (0,833).

Items included in the individual scales and the percentage of explained shared variance are shown in Table 3

Table 3. Categories forming individual scales and the percentage of explained variance in factor analysis

Scale	Items	Percentage of explained variance in factor analysis
Scale I	Lagging behind	0.83
	Motor awkwardness,	0.81
	Self-isolation	0.74
	Excessive dependence	0.72
	Developmental delay	0.70
	Strange behaviour	0.62
	Excessive crying	0.43

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Scale II	Hyperactivity (with aggression)	0.90
	Aggression	0.85
	Hyperactivity	0.76
	Autoaggression	0.57
Scale III	Avoiding certain foods	0.92
	Avoiding eating	0.91
Scale IV	Compulsive eating	0.97
	Overeating	0.96

Table 4. presents descriptive statistics for the scales. A Kolmogorov-Smirnov test was also performed to test the null hypothesis of the normality of the distribution. The variables whose distribution differs significantly from a normal distribution are entered in bold type.

Table 4. Descriptive statistics for the scales

Name	Mean	SD	Min	Max	Kolmogorov-Smirnov Statistic	Significance of the Kolmogorov-Smirnov test	Skewness	Kurtosis
Scale I	0.698	1.305	0	7	11.745	0.000	2.215	4.782
Scale II	0.3899	0.7710	0	4	13.277	0.000	2.230	4.656
Scale III	0.3493	0.7104	0	2	14.749	0.000	1.705	1.157
Scale IV	0.0479	0.2920	0	2	16.639	0.000	6.214	37.734
Overall scale DBQ	1.485	1.986	0	12	7.092	0.000	1.656	2.771

Next, a Pearson χ^2 independence test was performed between the individual scales and the overall scale of the DBQ factor (Table 5). Recoded factors were used for the test. The presence of disturbing behaviour was defined as follows: if the result was less than or equal to 2 it was coded as 'Absence of disturbing behaviour'. If it was above 2 it was coded as 'Greater intensity of disturbing behaviour.'

Table 5. Summary of results of Pearson χ^2 independence tests

Name of column variable	Name of row variable	χ^2 Result	Significance	Cramér's V	Pearson's C
Scale I	Scale II	34.611	0.000	0.190	0.186
Scale I	Scale III	54.906	0.000	0.239	0.233
Scale I	Scale IV	0.401	0.527	0.020	0.020
Scale I	Overall scale DBQ	384.844	0.000	0.633	0.535
Scale II	Scale III	5.842	0.016	0.078	0.078
Scale II	Scale IV	3.117	0.077	0.057	0.057
Scale II	Overall scale DBQ	293.858	0.000	0.553	0.484
Scale III	Scale IV	0.648	0.421	0.026	0.026

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Scale III	Overall scale DBQ	222.917	0.000	0.482	0.434
Scale IV	Overall scale DBQ	24.207	0.000	0.159	0.157

Tests statistically significant at the level of significance: $\alpha = 0.05$ are shown in bold type.

The study then proceeded to analyse the relationships between the scales obtained and age and gender. Table 6 presents a summary of the results of five Pearson χ^2 independence tests performed to investigate the relationship with the gender and age variables.

Table 6. Pearson χ^2 independence tests performed to determine whether there is a relationship with the gender and age variables.

Scales	Gender				Age			
	χ^2 Result	Significance	Cramér's V	Pearson's C	χ^2 Result	Significance	Cramér's V	Pearson's C
Scale 1	4.905	0.027	0.073	0.073	13.511	0.000	0.121	0.120
Scale II	32.881	0.000	0.189	0.186	4.886	0.027	0.073	0.073
Scale III	1.712	0.191	0.043	0.043	9.330	0.002	0.101	0.100
Scale IV	1.243	0.265	0.037	0.037	2.156	0.142	0.048	0.048
Overall Scale DBQ	20.817	0.000	0.150	0.149	16.328	0.000	0.133	0.132

Tests statistically significant at the level of significance: $\alpha = 0.05$ are shown in bold type.

Tables seven and eight below present the statistics for those factors that returned a statistically significant difference in the Pearson χ^2 independence tests performed to investigate the relationship with the gender and age variables. If a child's result was below the median (5.421 years) the child was assigned to the category of 'younger children', while in the opposite case to the category 'older children.'

Table 7. Frequency of DBQ scales stratified by greater intensity with respect to the gender variable

Scale/Behaviour		Gender	girls	boys	Voids	Total (with voids)
Scale 1	No disturbing behaviour	Frequency	330	308	0	638
		Percentage	51.72%	48.28%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	124	159	0	283
		Percentage	43.82%	56.18%	0.00%	100.00%
Scale II	No disturbing behaviour	Frequency	373	306	0	679
		Percentage	54.93%	45.07%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	81	161	0	242
		Percentage	33.47%	66.53%	0.00%	100.00%

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Overall scale DBQ	No disturbing behaviour	Frequency	247	184	0	431
		Percentage	57.31%	42.69%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	207	283	0	490
		Percentage	42.24%	57.76%	0.00%	100.00%

Table 8. Frequency of DBQ scales stratified by greater intensity for the age variable

Scale/Behaviour		Age	Younger children	Older children	Voids	Total (with voids)
Scale I	No disturbing behaviour	Frequency	286	352	0	638
		Percentage	44.83%	55.17%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	164	119	0	283
		Percentage	57.95%	42.05%	0.00%	100.00%
Scale II	No disturbing behaviour	Frequency	317	362	0	679
		Percentage	46.69%	53.31%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	133	109	0	242
		Percentage	54.96%	45.04%	0.00%	100.00%
Scale III	No disturbing behaviour	Frequency	337	392	0	729
		Percentage	46.23%	53.77%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	112	79	0	191
		Percentage	58.64%	41.36%	0.00%	100.00%
Overall scale DBQ	No disturbing behaviour	Frequency	180	251	0	431
		Percentage	41.76%	58.24%	0.00%	100.00%
	Greater intensity of disturbing behaviour	Frequency	270	220	0	490
		Percentage	55.10%	44.90%	0.00%	100.00%

Ten log linear tests were performed to determine whether it was sufficient to consider only the first-order interaction effects and the main effects to explain the number of reckonings in the contingency tables that take into account the two variables from the Disturbing Behaviour Questionnaire (DBQ) and gender. Of the ten tests that were conducted only one returned a significant result. An interaction was demonstrated between Scales II and IV and gender. The relationship between the factors was found to be significantly greater in the group of girls (where there is a distinct correlation between the factors) than in the group of boys: $X^2(1) = 6.974$; $p = 0.008$; $p < 0.05$.

Following this, a Pearson χ^2 independence test was performed between the variables Scale IV and Scale II separately for each of the sexes. The test was performed on 453 cases. The following values were obtained for girls: $\chi^2(1) = 12.4$; $p = 0.000$; $p < 0.001$. There is a significant, very weak relationship between the variables examined. The strength of this relationship as expressed by the C Pearson contingency coefficient is 0.16 and its strength as expressed by Cramér's V coefficient is 0.17. The following values were obtained for boys: $\chi^2(1) = 0.1$; $p = 0.782$; $p > 0.05$. No relationship was demonstrated between the examined variables.

Discussion

The results of the analysis conducted that considered one, two and three factors are coherent, unambiguous and in accord with many studies of children in the early stages of development, which point to the existence of two clearly-delineated groups of problems: internalising (Factor I) and externalising (Factor II) [2, 6]. It should be noted that the descriptive categories that were created could have had an effect on the result of the factor analysis that was performed. In the questionnaire employed these have a general character, which can produce less differentiation of categories than, for example, in studies that use more complex diagnostic tools [7]. On the other hand, a single-factor solution – in the case of similar tools that investigate pre-school children, such as the Eyberg Child Behavior Inventory and the Toddler Behavior Screening Inventory – is suggested both by theorists and by the results of the factor analyses conducted [8, 9]. Qualification: the problems of externalisation and internalisation represent, here, a certain simplification, especially in the context of statements defining the first factor, which could be described as a factor of developmental disharmonies, of withdrawal and of emotional problems.

The observed factors defined in the same manner do not fundamentally change throughout the conducted versions of factor analysis. Despite some volatility in definitional claims in the two-, three- and four-factor version, first two factors proved to be consistent and stable. An analysis of all the results indicates a different nature of compulsive eating and overeating than avoiding food or avoiding certain foods. Excessive eating and compulsive eating are less associated with aggression and hyperactivity than avoiding eating and avoiding certain foods with other behaviours defining Factor I. This was confirmed by the results analysis of Pearson's independence test.

From an analysis of the defining statements the following names for scales were adopted (with all of the reservations expressed above in mind) based on the results of a factor analysis: Scale I: Lagging Behind, Scale II: Excessive Behaviour, Scale III: Avoiding eating, Scale IV: Overeating. The authors are aware of the fact that the names are not ideal. They have their negative connotations. However, due to the fact that the subject of the analyses was children's behaviours rather than children's behaviours and feelings they seem more appropriate than the other terms suggested above.

The analysis conducted of the relationship of the scales with age and gender indicated a greater intensity of disturbing behaviour in boys with regard to Lagging behind, Excessive behaviour and the overall scale for the Disturbing Behaviour Questionnaire (DBQ) than was the case with girls. These were the scales, along with the Avoiding eating scale, that were found to be related to age. A greater intensity of disturbing behaviour was found to occur in the younger children than in the older ones. These analyses confirmed the relationship described in the first publication a correlation between age, gender and the different categories of statements [3]. This adds strength to the hypothesis that at least some of the behaviour observed in the children could be described as adaptive with respect to the pre-school.

The gender of the children described by the kindergarten teachers turned out to be significant for one more reason. The relationship between the Overeating and Excessive behaviour factors that was found among girls but not among boys indicated that – even at such a young age – the specific characteristics associated with eating

in the context of gender were already present. With this in mind it is worth referring here to the results of studies that found a high risk of the occurrence of bulimic-type eating disorders and obesity among girls diagnosed with ADHD [10].

All of the limitations of the method used discussed in the context of the analysis of the responses to the different categories were included in the first part of the publication listed in the bibliography at [3] and also apply in the case of the analysis above. We must refrain here from seeking analogies of any kind with existing diagnostic categories either of psychiatric nature or connected with retardation or somatic disorders. The questionnaire used did not refer to the emotional states of the children described, but only to their behavioural representation. The questionnaire should not be treated as a diagnostic tool either in the context of the greater intensity of the different phenomena or in the context of their co-occurrence. The behaviour observed could represent the expression of adaptive difficulties conditioned in a variety of ways. Anxiety may be manifested in the various ways defined within the scope of the statements of each scale. The scales assemble clusters of behaviour whose clinical interpretation can be different for different children. This is also why the factors obtained can be regarded only as the result of one of the possible analyses of the material. They are also no substitute for clinical diagnoses – no matter how complicated a matter it is to use the binding psychiatric classifications in the diagnosis of pre-school children [11]. It should be added here that any attempt to relate the behaviours of young children to psychiatric diagnoses in the classifications raises founded controversies [12]. These results have also not been compared with psychiatric studies nor with other questionnaire tools. The observations of the pre-school teachers have also not been correlated with the opinions of parents. These are reasons why the scope for clinical interpretation of the results is limited. It is also necessary to point out here that we did not take into account the positive aspects of child development, whose consideration would make a significant additional contribution to the study of the negative developmental aspects [13].

A weakness of the study is the fact that it does not include the data on the kindergarten teachers who describe the behaviours of the children. The assessment of children could be affected by variables connected with the process of informing teachers about the aims of the research project, individual features of the teachers [14], description of the teachers' relations with the assessed child [15] not connected explicitly with the assessed characteristics [16]. It should also be remembered that children are often assessed in the context of the group to which they belong [17]. The relation between the assessment and the assessments of other children in class will be the subject of separate analysis.

The Disturbing Behaviour Questionnaire (DBQ) was intended to stand as a supplementary method to research the somatic development of children and its connection with socio-economic and family variables. It is also necessary to emphasise the value of the observations of the pre-school teachers: they are often the first people in children's lives to assess the way they behave and function in an impartial manner. It is the authors' opinion that the coherence of the results obtained and their consistency with other studies of pre-school age children provide a sound platform for further analyses using the questionnaire described above.

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