A latent class analysis of adolescent adverse life events based on a Danish national youth probability sample

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The aim of this study was to determine if there are meaningful clusters of individuals with similar experiences of adverse life events in a nationally representative sample of Danish adolescents. Latent class analysis (LCA) was used to identify such clusters or latent classes. In addition, the relationships between the latent classes and living arrangements and diagnosis of post-traumatic stress disorder (PTSD) were estimated. A four-class solution was found to be the best description of multiple adverse life events, and the classes were labelled “Low Risk”, “Intermediate Risk”, “Pregnancy” and “High Risk”. Compared with the Low Risk class, the other classes were found to be significantly more likely to have a diagnosis PTSD and live with only one parent. This paper demonstrated how trauma research can focus on the individual as the unit of analysis rather than traumatic events.

Adolescents, Life events, National sample, PTSD, Traumatic events.

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Although national representative studies of a broad range of traumas and their impacts in adolescent populations are crucial for estimation of unmet needs and for planning of public health prevention and clinical services, they are very rare (1, 2). Previous research on adolescents has studied the prevalence and psychological aftermath of a narrow range of trauma events in convenient samples typically concentrating on community and family violence, and especially child sexual abuse (CSA) has been a focus of interest.

Several studies have explored the impact of childhood maltreatment and subsequent adult mental health and concluded that maltreatment is widespread (3, 4) and documented that a number of sequelae such as depression, psychiatric illness, suicidal attempts, physical symptoms, health-risk behaviours and disease (3).

Four national representative studies have investigated the prevalence of a broad range of traumatic events in adult populations (US: 5, Germany: 6, Sweden: 7, Finland: 8) and collected evidence that a large number of adults have been subjected to adverse events in childhood and adolescence. In these studies, the onset of the traumas is generally not stated; therefore, trauma studies of adolescents that are closer in time to report childhood adverse events (and might have other trauma “profiles” than adults) will give valuable information.

Rosenman & Rodgers (9) concluded from a study of childhood adversity in a large Australian population that multiple adversities are common and only a minority experience single adversities. They also conclude that physical abuse, sexual abuse and neglect rarely occur alone, but indicate a context of abuse. Therefore, they advocate that the concentration on single and extreme ill-treatment should be substituted by inclusion of some of the more ordinary domestic disadvantages and misuses experienced by many children. Studies also need to consider the other adversities that frequently co-occur and also the unfavourable context in which the individual adversities occur, as this context might be as important as the nature of any one adversity. Studies that examine single adversities are likely to place misleading causal weight on that type of adversity (9).

Edwards et al. (10) argue that single type abuse studies may suffer from two methodological limitations. First, they may assume the absence of other forms of maltreatment among comparison subjects; second, participants classified as “abused” may have heterogeneous abuse experiences, ranging from single incident to
chronic long-term victimization. In the first case, between-group differences may be minimized; in the second case, within-group variability may be increased. Both misclassification biases have the potential of reducing the probability of detecting significant outcomes of maltreatment. The analyses reported by Edwards et al. (10, 11) are typical of the research literature in the area of trauma in that they use trauma(s) as the unit of analysis. Typically, variables representing the prevalence of a traumatic event, or the cumulative effect of multiple traumas, are used as predictors of future psychopathology, physical problems, or service use. However, this fails to capture adequately the different traumatic histories of individuals. Individuals may differ in terms of the number of traumas and the type of traumatic events experienced. In order to determine adequately the effect of different and complex patterns of traumatic histories, the unit of analysis should be the individual rather than variables representing traumas.

We contend that the probability of experiencing any adverse life event, or multiple events, is not uniformly distributed in the population. However, we propose that the heterogeneity of adverse life events at the population level may be explained by a number of homogeneous subgroups, that is, there may be groups of individuals who have experienced similar patterns of adverse life events. The aim of this study was to determine if there are meaningful clusters of individuals with similar experiences of adverse life events in a nationally representative sample of Danish adolescents. Latent class analysis (LCA) was used to identify such clusters, or latent classes. In addition, we aimed to examine the relationships between the latent classes and background variables (sex, living arrangements and parental education) and diagnosis of post-traumatic stress disorder (PTSD).

Method

Participants and procedure

The data used in this study was collected and initial findings reported by Elklit (1). The data in this study were collected from a questionnaire survey with a national representative probability sample of 390 school children age 13 to 15. The gender distribution was 50% females and 50% males. Seventy-four per cent of the pupils lived with both parents, 25% lived with one parent and 1% had other arrangements. The difference between the parents’ education was not significant (fathers vs. mothers, respectively: primary school 28% vs. 25%, high school 18% vs. 25%, “college” (3–4 years professional education after high school) 34% vs. 35% and “university” (5–8 years professional education after high school) 21% vs. 15%). There were no significant differences in the participation from the various regions of the country. Full details of the sample, sampling procedures and recruitment were presented in Elklit (1).

Measures

The first part of the questionnaire contained questions about the participant, their family and their living arrangements. Specifically details were recorded on

1) Gender.
2) Age.
3) Highest level of parental education. Information on the highest educational level achieved (primary, high school, college, or university) by the respondent’s mother and father was recorded. This information was recoded into a single variable by selecting the highest level achieved by either mother or father.
4) Living arrangements. Respondents were asked whether they lived with one parent, two parents, others such as grandparents or within an institution. This information was recoded into one variable that identified whether the child lived with both parent.

The second part of the questionnaire contained 20 questions about traumatic events and life events they had experienced. Each question offered the possibility of students answering according to direct exposure or indirect exposure (i.e. witnessing an event or a person close to them experiencing an event): only responses in relation to direct expose were used in this study. Because of the similarity of some traumatic events, a list of 15 grouped traumas was compiled.

The third part of the questionnaire included The Harvard Trauma Questionnaire Part IV (HTQ: 12). The HTQ assess both DSM-IV (13) symptoms and culture-specific symptoms associated with PTSD. The scale yields both a PTSD self-diagnosis according to DSM-IV criteria and a measure of PTSD symptom severity. The respondents were asked how much each symptom bothered them at the time when the event most disturbing to them happened. The items are answered on a 4-point Likert scale (“not at all” = 1, “a little” = 2, “quite a bit” = 3 and “all the time” = 4). The summed score provides a score for symptom severity. The first 16 items were derived directly from the 17 DSM-III-R (14) criteria for PTSD. The HTQ uses one item to assess both psychological and physiological reactions to events that symbolize or resemble aspects of the traumatic event (in accordance with DSM-IV this item is part of the re-experiencing cluster). The items are divided into three subscales that correspond to the three main symptom groups of PTSD: re-experiencing, avoidance and arousal. Similarly to Mollica et al. (12), the present study had good estimates of reliability for each of the subscales.
[re-experiencing ($\alpha = 0.74$), avoidance ($\alpha = 0.79$) and arousal ($\alpha = 0.78$)], and the scale as a whole ($\alpha = 0.90$). Following the DSM-IV, the self-diagnosis of PTSD was made if participants reported at least one re-experiencing symptom, three avoidance symptoms and two arousal symptoms. A symptom was rated as present if the item corresponding to the symptom was scored 3 (“quite a bit”) or greater (this is a more conservative approach that that taken by others, such as Foa et al. (15), who included scores corresponding to our “point 2” or greater for symptom endorsement).

Analysis

Latent class analysis (LCA) is a statistical method used to identify homogeneous groups, or classes, from categorical multivariate data. In this study, LCA was employed to determine the number and nature of subtypes of trauma exposure based on the absence or presence of direct exposure to each of the 14 traumatic events. The fit of five models (two-class latent class model through to a six-class model) was assessed. Selection of the optimal number of latent classes was based on several statistical fit indices. The statistical fit indices were: likelihood ratio chi-square ($LR\chi^2$), Akaike information criterion (AIC; 16), Bayesian information criterion (BIC; 17), sample-size adjusted BIC (SSABIC; 18), the Bootstrapped Lo–Mendell–Rubin’s adjusted likelihood ratio test (BLRT; 19) and entropy measures (20). A non-significant likelihood ratio chi-square indicates acceptable model fit. The information statistics AIC, BIC and SSABIC are goodness-of-fit measures used to compare competing models; lower observed values indicate better fit. The BLRT (19) statistic was used to compare models with differing numbers of latent classes; a non-significant value ($P < 0.05$) suggests that the model with one less class should be accepted. Entropy (20) is a standardized measure of how accurately participants are classified. Entropy values can range from 0 to 1 with higher values indicating better classification. The LCA analysis was conducted using Mplus 3.12 (21). Based on evidence from Monte Carlo simulations, the BLRT is an accurate and consistent indicator of the correct number of classes (22) and should be used as the primary index for determining the correct number of classes. To avoid solutions based on local maxima, 100 random sets of starting values initially and 50 final stage optimizations were used.

Multinomial logistic regression was used to assess the association between class membership (posterior probabilities from the model were used to assign each participant to their most likely class) and gender, highest level of parental education, living arrangements and PTSD diagnosis (clinical or subclinical). The odds ratios indicate the expected increase/decrease in the likelihood of scoring positively on a given variable compared with the reference, or control group.

Results

Table 1 shows the frequency of experiencing each event for the total sample and males and females separately. The most common event recorded (Table 1) was death of a family member, followed by a threat of being beaten, humiliation or persecution by others, near-drowning and traffic accident. Least prevalent were sexual abuse, rape, pregnancy-abortion, severe childhood neglect and physical abuse.

The average number of direct events per pupil was 2.5 (percentage who experienced one event = 17%, two

<table>
<thead>
<tr>
<th>Event</th>
<th>Total ($n = 390$)</th>
<th>Male ($n = 195$)</th>
<th>Female ($n = 192$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death of a someone close</td>
<td>202 (51.8)</td>
<td>96 (49.2)</td>
<td>104 (54.2)</td>
</tr>
<tr>
<td>Threats of physical violence</td>
<td>160 (41.0)</td>
<td>82 (42.1)</td>
<td>76 (39.6)</td>
</tr>
<tr>
<td>Serious accident</td>
<td>92 (23.6)</td>
<td>47 (24.1)</td>
<td>44 (22.9)</td>
</tr>
<tr>
<td>Divorce</td>
<td>74 (19.0)</td>
<td>38 (19.5)</td>
<td>36 (18.8)</td>
</tr>
<tr>
<td>Near-drowning</td>
<td>73 (18.7)</td>
<td>31 (15.9)</td>
<td>41 (21.4)</td>
</tr>
<tr>
<td>Life threatening situation</td>
<td>67 (17.2)</td>
<td>30 (15.4)</td>
<td>37 (19.3)</td>
</tr>
<tr>
<td>Serious illness</td>
<td>49 (12.6)</td>
<td>25 (12.8)</td>
<td>24 (12.5)</td>
</tr>
<tr>
<td>Robbery/theft</td>
<td>46 (11.8)</td>
<td>22 (11.3)</td>
<td>24 (12.5)</td>
</tr>
<tr>
<td>Attempted suicide</td>
<td>24 (6.2)</td>
<td>16 (8.2)</td>
<td>6 (3.1)</td>
</tr>
<tr>
<td>Physical assault</td>
<td>18 (4.6)</td>
<td>9 (4.6)</td>
<td>9 (4.7)</td>
</tr>
<tr>
<td>Physical abuse</td>
<td>14 (3.6)</td>
<td>8 (4.1)</td>
<td>6 (3.1)</td>
</tr>
<tr>
<td>Childhood neglect</td>
<td>12 (3.1)</td>
<td>6 (3.1)</td>
<td>6 (3.1)</td>
</tr>
<tr>
<td>Abortion/pregnancy</td>
<td>10 (2.6)</td>
<td>6 (3.1)</td>
<td>4 (2.1)</td>
</tr>
<tr>
<td>Rape</td>
<td>7 (1.8)</td>
<td>2 (1.0)</td>
<td>5 (2.6)</td>
</tr>
<tr>
<td>Sexual abuse</td>
<td>6 (1.5)</td>
<td>3 (1.5)</td>
<td>3 (1.6)</td>
</tr>
</tbody>
</table>
The amount of missing data on the HTQ items ranged from 11% to 19% with a mean of 14%. This pattern of missing data was similar for males and females. Missing HTQ scores were imputed using the EM algorithm (see Bunting et al. (23) for details on the benefits of using the EM algorithm to treat missing data) and the prevalence rate of PTSD, estimated from the total sample of 390 participants, was 9.7%. This was almost identical to Elklit’s estimate of 9% based on 289 participants using listwise deletion to treat missing data.

The fit indices from the latent class analyses are reported in Table 2.

The four-class solution was considered the best model; the BLRT indicates that the five-class solution is not significantly better than the four-class solution (and so the four-class solution should be preferred on the basis of parsimony). This decision is also supported by the AIC having the lowest value for the four-class solution. The entropy value (0.74) indicates acceptable classification of participants, and is the highest for all the models. Although the BIC suggests a two-class solution and the SSABIC a three-class solution, the choice of the four-class solutions is based on the research findings that the BLRT outperforms all other tests that are available to identify the correct number of classes in mixture modelling.

The latent class profile plot is shown in Fig. 1.

Class 4 was the largest class (58.2%; n = 227) and was characterized by very low probabilities of experiencing most of the adverse life events. The probabilities of experiencing the death of someone close (0.41) and threats of physical assault (0.22) were relatively high. This class was considered the baseline, or normative, group who tend to experience few adverse life events.

This class was labelled the “Low Risk” group. Class 3 is similar in profile to class 4 but smaller accounting for 35.9% (n = 140) of the sample. This group have a similar pattern of probabilities to the normative group in terms of the low probabilities associated with serious traumatic events such as physical assault, physical abuse, neglect, abortion, rape or sexual abuse. The probabilities associated with all other events are higher for class 3 compared with class 4. This class was labelled the “Intermediate Risk” group. Class 2 was a small class (n = 15: 3.8%) and was characterized by having the highest probability of pregnancy or abortion of all the classes. The probabilities associated with experiencing a serious accident, divorce, attempted suicide, physical abuse and neglect, rape and sexual abuse were all higher than the “Intermediate Risk” class. This class was labelled the “Pregnancy” class, but is characterized by moderate probabilities of experiencing a range of adverse life events. Class 1 was the smallest class (2.1%; n = 8) and was characterized by a relatively high probability of having experienced all the adverse life events. This class was labelled the “High Risk” group.

### Table 2. Fit indices for the latent class analysis of the direct traumas.

<table>
<thead>
<tr>
<th>Model</th>
<th>Log likelihood</th>
<th>LRχ²</th>
<th>AIC</th>
<th>BIC</th>
<th>SSABIC</th>
<th>BLRT</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 classes (df)</td>
<td>−1879</td>
<td>391 (32719)</td>
<td>3821</td>
<td>3944</td>
<td>3845</td>
<td>205</td>
<td>0.67</td>
</tr>
<tr>
<td>3 classes (df)</td>
<td>−1834</td>
<td>349 (32702)</td>
<td>3763</td>
<td>3949</td>
<td>3800</td>
<td>90</td>
<td>0.71</td>
</tr>
<tr>
<td>4 classes (df)</td>
<td>−1815</td>
<td>360 (32698)</td>
<td>3756</td>
<td>4006</td>
<td>3806</td>
<td>39</td>
<td>0.74</td>
</tr>
<tr>
<td>5 classes (df)</td>
<td>−1800</td>
<td>321 (32672)</td>
<td>3758</td>
<td>4071</td>
<td>3820</td>
<td>30</td>
<td>0.71</td>
</tr>
<tr>
<td>6 classes (df)</td>
<td>−1790</td>
<td>326 (32658)</td>
<td>3770</td>
<td>4147</td>
<td>3845</td>
<td>22</td>
<td>0.72</td>
</tr>
</tbody>
</table>

LRχ², likelihood ratio chi-square; AIC, Akaike information criterion; BIC, Bayesian information criterion; SSABIC, sample-size adjusted BIC; BLRT, Bootstrapped Lo-Mendell-Rubin’s adjusted likelihood ratio.
PTSD, post-traumatic stress disorder.

This class was characterized by participants having a much higher probability of experiencing serious traumatic events such as physical assault, physical abuse, neglect, abortion, rape or sexual abuse.

Each participant was allocated to a class based on the posterior probabilities from the four-class solution; this class membership variable was then used as the dependent variable in a multinomial logistic regression model. Variables representing gender, highest level of parental education (primary, high school, college or university), living arrangements (child lives with both parent or not) and PTSD diagnosis (present or not present) were entered as predictors. Class 4, or the Low Risk group, acted as the reference group. Table 3 shows the likelihood ratio tests for the multinomial logistic regression. Table 4 shows that the effects for the PTSD and living arrangements variables were statistically significant. Table 4 shows the odds ratios associated with each predictor.

Table 4 shows that, compared with the low risk group (class 4), participants in the high risk group (class 1) are over eight times more likely to have had a diagnosis of PTSD (OR = 8.15, \( P < 0.05 \)) and over 13 times more likely to not be living with both parents (OR = 13.67, \( P < 0.05 \)). Compared with the low risk group participants in class 2 are six times as likely to have had a diagnosis of PTSD (OR = 4.66, \( P < 0.05 \)) and over seven times as likely to not be living with both parents (OR = 7.13, \( P < 0.05 \)). The Intermediate Risk class are three times as likely to have had a diagnosis of PTSD (OR = 3.06, \( P < 0.05 \)) and to not be living with both parents (OR 3.30, \( P < 0.05 \)).

**Discussion**

The findings of this study show that Danish adolescents are commonly exposed to a range of adverse life events. The most commonly reported were death of a family member, threat of physical attack, humiliation or persecution by others, near-drowning and traffic accident. The least commonly reported were sexual abuse, rape, pregnancy-abortion, severe childhood neglect and physical abuse. There was evidence that adverse life events do not occur in isolation, as the average number of adverse life events was 2.5.

The co-occurrence of adverse life events was modelled explicitly using latent class analysis. The four-class solution was found to fit the data and provided the best solution. Classes 3 and 4 accounted for 94.1% of the participants. Class 4 represented a group with a very low probability of experiencing any adverse life events outside of experiencing death of a family member and the threat of physical attack. These events are probably not considered excessively traumatic. Class 3, similarly to class 4, represented a group that had a very low probability of experiencing serious adverse life events such as physical assault, abuse, neglect, abortion, rape or sexual abuse. Class 3 differed from class 4 in that the probabilities were higher for all events except pregnancy, rape and sexual abuse for which the probabilities for both classes are zero. The profiles of class 3 and class 4 are similar and this suggests that they are quantitatively different. However, class 2 appears to be qualitatively different to classes 3 and 4. Members of class 2 show the highest probability of experiencing a pregnancy or abortion, and a higher likelihood of experiencing other social (divorce), interpersonal (rape and sexual abuse)
and physical (accident, physical assault and abuse) events compared with the Intermediate and Low Risk classes. Members of class 1 show relatively high probabilities of experiencing all the adverse life events. This suggests that almost all the adverse life events are clustering in a small group of participants. Unlike the other classes, this group is not limited to having a high probability of experiencing minor events: this group also has high probabilities associated with major traumatic events such as physical assault, physical abuse, neglect, abortion, rape and sexual abuse.

These findings support the views of Mullen et al. (24) that “children who are victims of one form of abuse are more likely to also experience other forms of abuse”. Classes 3 and 4 represents groups where adverse life events tend to cluster. The profile of class 4 also suggests that the relatively high probabilities associated with experiencing less frequently occurring traumatic events, such as rape and sexual abuse, could be used a useful indicator of the co-occurrence of other less traumatic events and adverse life events.

The results of the multinominal logistic regression showed that classes 1, 2 and 3 were significantly different to class 4 in terms of the probabilities associated with PTSD and living arrangements (Table 4). It could be argued that living with only one parent is an antecedent risk factor that increases an individual’s likelihood of exposure to traumatic events, and it is these traumas that increase the likelihood of serious psychological problems such as PTSD. An explicit test of such a causal model would require a prospective design.

There are some clinical implications associated with this study. The LCA approach to identifying types of traumatic experience and their psychological consequences have some implications for social welfare politics and clinical work. The estimation of multiple stressors’ cumulative effects paves the way to strategies of prevention and intervention that are more precisely targeted. A cluster of multiple adversities immediately calls for a much comprehensive effort, while an intermediate number of adversities combined with varying family resources demands a thorough analysis of vulnerability and resiliency factors in the environment of the adolescent before intervention. In this way, resource allocation can be better informed. In addition, the results from this paper show that individuals who report major traumatic events, such as rape or physical abuse, are also very likely to have experienced other less traumatic adverse life events such as illness, accidents or threats of physical assault.

There are some limitations to this study. First, experiences of traumatic events were measured by retrospective self-report, which introduce the possibility of recall bias. Prior research on retrospective self-report studies shows a tendency for respondents to minimize or under-report traumatic events (25–27). Second, PTSD was assessed by means of self-report rather than structured interview. Despite a conservative approach being taken to the diagnoses, it is possible that that the prevalence of PTSD was overestimated. This, however, is unlikely to account for the very large effects that were found (OR = 3.06–8.15). Finally, there is a need for this type of analysis to be replicated in order to determine the stability and cross-cultural consistency of the results. Given the relatively small sample size and age range, it would useful if subsequent studies were based on larger samples with a wider age range.

References

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