Examining the Reactive Proactive Questionnaire in Adults in Forensic and Non-
Forensic Settings: A Variable –and Person-Based Approach

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Abstract

The Reactive Proactive Questionnaire (RPQ) was originally developed to assess reactive and proactive aggressive behavior in children. Nevertheless, some studies have used the RPQ in adults. This study examines the reliability of the RPQ within an adult sample by investigating whether reactive and proactive aggression can be distinguished at a variable- and person-based level. Male adults from forensic samples ($N = 237$) and from the general population ($N = 278$) completed the RPQ questionnaire. Variable-based approaches, including factor analyses, were conducted to verify the two-factor model of the RPQ and to examine alternative factor solutions of the 23 items. Subsequently, a person-based approach, i.e. Latent Class Analysis (LCA), was executed to identify homogeneous classes of subjects with similar profiles of aggression in the observed data. The RPQ proved to have sufficient internal consistency. Multiple-factor models were examined, but the original two-factor model was statistically and theoretically considered as most solid and in line with previous research. The multi-level LCA identified three different classes of aggression severity (class 'one' showed low aggressive behavior, class 'two' subjects displayed modest aggression levels and class 'three' exhibited the highest level of aggressive behavior). In addition, class one and two showed more reactive than proactive aggression, whereas class three displayed comparable levels of reactive/proactive aggression. The RPQ appears to have clinical relevance for adult populations in the way that it can distinguish severity levels of aggression. Before the RPQ is implemented in adult populations, norm scores need to be developed.

Interpersonal aggression is a worldwide problem and, according to the World Health Organization, one of the main causes of death for people between 15-44 years old (WHO, 2007). The consequences of aggression are, however, much broader than physical injuries and death. Victims of violence are at high risk of developing

psychological problems, ranging from posttraumatic stress disorder to depression, anxiety disorders, substance abuse and suicidal behavior (Krug, Mercy, Dahlberg, & Zwi, 2002). On the other hand, individuals who show aggressive and violent behavior are also characterized by multiple (social) problems, such as isolation, greater legal costs and absenteeism from work (WHO, 2007). A better understanding of the taxonomy of aggression is necessary to develop and improve prevention and intervention strategies.

Aggression is defined as any behavior directed to another person with the intention to cause harm (Anderson & Bushman, 2002). It can be divided into different subtypes; e.g. hostile vs. instrumental (Anderson & Bushman, 2002) and impulsive vs. premeditated (Berkowitz, 1993). Another distinction often made is the bimodal classification between reactive and proactive aggression (Dodge & Coie, 1987). Reactive aggression refers to hostile and angry responses to provocation, frustration, or threat, and has its roots in the frustration-anger model of Berkowitz (1962). Proactive aggression is described as deliberate behavior to achieve a goal or personal gain (e.g., money, power) and stems from the social-learning theory of Bandura (1973).

The overall correlation between the two forms of aggression is high ($r = .64$) according to a meta-analysis that included 51 studies on reactive and proactive aggression in children and adolescents (Polman et al., 2007). This suggests that reactive and proactive aggressive behaviors are overlapping constructs. Despite criticism of the distinction between reactive and proactive aggression due to high overlap (Bushman & Anderson, 2001), there is considerable support for unique causes and outcomes related to reactive versus proactive aggression (Baş & Yurdabakan, 2012; Crick & Dodge, 1996; Fung, Raine, & Gao, 2009; Little, Henrich, Jones, &

Hawley, 2003; Merk, Orobio de Castro, Koops, & Matthys, 2005; Poulin & Boivin, 2000). For instance, reactive aggression is linked to problems in peer-relations, impairments in executive functioning, and higher cortisol levels, whereas proactive aggression is associated with low physiological arousal, lack of moral emotions and is an early risk factor for delinquent behavior in adolescence (Cima & Raine, 2009; Polman et al., 2007). These results suggest clinical relevance of the distinction between reactive and proactive aggression.

The described reactive-proactive distinction of aggression was first examined in a sample of elementary-school children (Dodge & Coie, 1987). Following this study, a large number of subsequent studies supported the existence of reactive and proactive aggression in children and adolescents in different cultures and contexts (e.g. Baş & Yurdabakan, 2012; Colins, 2015; Fossati, et al. (2009), often using the Reactive Proactive Aggression Questionnaire (RPQ) designed by Raine et al. (2006). Recently, the RPQ is even used in adults to assess the levels of reactive and proactive aggressive behavior (Cima & Raine, 2009; Lobbestael, Cima, & Arntz, 2013). Since the RPQ was originally developed for use with children, this raises the question whether the RPQ is a valid and reliable measure for use with adults.

Recently, a validation study of the RPQ in children (N=324), juveniles (N=188) and adults (N=334) was published (Cima, Raine, Meesters, & Popma, 2013). It appeared that adult prisoners scored significantly higher on both reactive and proactive aggression than non-offender adults. In addition, a variable-based approach (using a factor analysis to examine the association between unique items and underlying factors) on the items of the RPQ showed a distinction between the items representing reactive versus proactive aggression. Although the study by Cima et al. (2013) seemed to show support for the bimodal classification system of the RPQ

within adults, there are two main reasons to doubt the applicability of the RPQ to adults. First, the full sample, including children, adolescents and adults, was used for the factor analysis. Therefore, it remains unclear whether the two-factor model of the RPQ is also applicable to adults only. Second, the statistical fit of the two-factor model was stronger than a one-factor model, but did not represent a robust model¹. Additional multiple-factor models, e.g., a three-factor model, were not explored. The results of the two-factor model of the RPQ in adults in the study of Lobbestael, Cima, and Arntz (2013) also raised further questions, since an exploratory factor analysis (EFA, varimax rotation, extracting two factors) showed that only a subset of items adequately differentiated between the two subscales. To our best knowledge, no other research exists on the factor structure of the RPQ in an adult sample by using an EFA to explore the possibility of a multiple-factor model other than a two-factor model.

A more recent paper by Smeets et al. (2016) investigated the distinction between reactive-proactive aggression in adolescents at-risk for aggressive behavior, using the RPQ. They found evidence that a three-factor model provided the best fit compared to a one-factor and a two-factor model. According to this three-factor model, reactive aggression in adolescents was best described by two constructs, namely reactive aggression due to internal frustration and reactive aggression due to external provocation. The results of Smeets et al. (2016), together with the limitations of the study by Cima et al. (2013), suggest that there is a need to investigate whether the RPQ is a reliable instrument to distinguish reactive and proactive aggression among adults.

¹ Ideally, a CFI between .90 and 1, an RMSEA below .06, and NNFI values >.95 indicate an acceptable to good fit of the model. In Cima et al. 2013 these values for the two-factor model are; CFI = .87, RMSEA = .069, NNFI = .85.(Bentler, 1990; Steiger, 1990).

In addition, Smeets et al. (2016) used a person-based approach to assess whether subgroups of participants existed with a distinctive aggression pattern. Using a combination of a variable-based and person-based approach is of great importance for clinical practice, as it enables one to make assumptions on the level of the group as well as the individual. Unexpectedly, their results provided no support for a clear distinction between reactive and proactive aggression. However, four classes of individuals were found based on the level of severity of aggressive behavior. Although Cima et al. (2013) showed that adult offender samples, on average, scored higher on both reactive and proactive aggression than non-offender adults, the study does not give insight in different individual patterns of aggressive behavior. Therefore, several questions still remain. For instance, is it possible to differentiate individuals with predominantly proactive or reactive aggression or should we focus on their overall level of severity of aggression? In the current study, we therefore used a combination of a variable-based and person-based approach to answer our research questions.

* Insert text box here *

In line with previous research, we predicted that proactive and reactive aggression forms are distinguishable in a sample consisting of adults from forensic and non-forensic settings. Second, in line with Smeets et al. (2016), it was predicted that LCA would yield four different classes of individuals (one with low reactive/proactive aggression, one with predominantly proactive aggression, one with predominantly reactive-only and one with high reactive/proactive aggression).

Method

Participants

In order to create a large-scale and a diverse research sample, data from 515 male adults collected in several Dutch studies were aggregated². Of the full sample, 237 individuals were consecutively recruited in forensic psychiatric in- and outpatient clinics and in prisons ('forensic sample') and 278 individuals were recruited from the general population ('non-forensic sample'). The age ranged from 18 to 63 years ($M = 28.52$, $SD = 10.82$). Details with regard to the recruitment of participants from forensic settings are described elsewhere (Cornet, van der Laan, Nijman, Tollenaar & de Kogel, 2015; Smeijers, Rinck, Bulten, & Verkes, submitted). All non-forensic participants were recruited at Maastricht University using flyers, posters and a student-participation system. Some participants were recruited via a list of persons who had previously participated in other studies of Maastricht University. Participation was voluntary and they all received a small financial compensation (i.e., study credits or gift vouchers). Details with regard to the recruitment of the non-forensic sample can be found elsewhere (Brugman et al., 2015; Lobbestael, Cima, & Lemmens, 2015; Van Teffelen, 2013, Lobbestael, Arntz, & Cima, 2013; Lobbestael & Cima, in preparation; Lobbestael, in preparation, Lobbestael, Cima, & Lemmens, 2015).). For all studies, research approval was received from Ethical Committees. Descriptives of the sample can be found in Table 1.

Insert Table 1 about here

² Names of studies are intentionally removed.

Materials

Reactive Proactive Questionnaire (RPQ). The RPQ (Raine et al., 2006) is a 23-item self-report questionnaire designed to measure reactive aggression (RA) versus proactive aggression (PA) in children and adolescents. The reactive subscale consists of 11 items, whereas the proactive subscale consists of 12 items. The items are rated 0 (never), 1 (sometimes) or 2 (often). These subscales represent a two-factor model with acceptable fit indices in adolescents, based on data from the USA (Raine et al., 2006). A study on the Dutch version of the RPQ showed good internal consistency, an adequate convergence criterion and a construct validity in a sample with children, adolescents and adults (Cima & Raine, 2009).

Data Analysis

First, the internal reliability of the RPQ in the current sample was investigated using Cronbach's alpha analysis. In addition, a Confirmatory Factor Analysis (CFA) was used to verify the two-factor model of the RPQ (Raine et al., 2006) and an Exploratory Factor Analysis (EFA) was conducted to examine alternative factor solutions of the 23 items of the RPQ using Mplus 6.11. Subsequently, a multi-level Latent Class Analysis (LCA) was conducted. This analysis considers within-center measurement bias, by using the factor solution of the RPQ and the forensic versus non-forensic groups as input. LCA is a cluster analysis that is used to identify homogeneous classes of subjects with similar profiles of aggression in the observed data. Furthermore, repeated-measures ANOVA was used to assess differences between reactive and proactive subscales across different classes.

Fit Indices

Multiple fit indices were used to interpret the results of the EFA; the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), the Comparative Fit Index (CFI; Bentler, 1990), the Root Mean Square Error of approximation (RMSEA; Steiger, 1990), and the eigenvalue. Both a TLI and CFI between 0.90 and 1.00 display an acceptable to good fit of the model. An RMSEA of 0.06 or lower and an eigenvalue of 1 or higher indicate a good model fit. A factor loading of ≥ 0.4 indicates a strong factor loading (Field, 2013). Furthermore, the Bayesian Information Criteria (BIC; lowest) and Entropy (highest) were used to define the best LCA fit. The total participants in each class should be higher than the used parameters in the model.

Results

Internal Consistency RPQ

To investigate the internal consistency of the RPQ items in the current sample, Cronbach's alpha values were calculated. The two original subscales showed good internal reliability; Cronbach's alpha was .851 for proactive aggression, and .847 for reactive aggression. Both subscale scores were strongly correlated ($r = .69, p < 0.001$). The corrected item total correlations of item 10 ('Hurt others to win a game'), 13 ('Gotten angry or mad when you lost a game') and 18 ('Made obscene phone calls for fun') were below .40, indicating that these items should be interpreted with caution.

Factor Analysis on RPQ Items

A CFA was conducted to replicate the original two-scale factor solution of the RPQ (Raine et al., 2006). The CFA showed an acceptable fit (RMSEA 0.067-0.077, CFI = .920, TLI = .911). To examine whether three or more factors showed a better fit

of the data, an EFA was conducted. Results of the EFA are shown in Table 2. A solution of four factors showed a better fit compared to two or three factors (RMSEA <0.06 and highest TLI/CFI). However, this four-factor model indicated that several items could be assigned to multiple factors (see supplementary material for the item factor loadings of the four-factor model). Since the two-factor model shows a reasonable fit and is in line with previous research regarding the original constructs of proactive and reactive aggression, this model was considered as the most adequate representation of the structure of the RPQ.

Insert Table 2 about here

Multi-level Latent Class Analysis

A multi-level Latent Class Analysis was conducted and three classes were derived (see Figure 1 and Figure 2), based on the best fit of the model (BIC) and the best fit of the individual distribution into a specific class (Entropy) (See Table 3). Post-hoc test indicated a difference between classes based on the severity of aggression (Class 3 > Class 2 > Class 1, see Table 4). Moreover, class one predominantly included individuals from the general population, whereas class three included solely individuals from forensic settings. The three different classes did not differ in age.

Insert Figure 1 and 2 about here

Insert Table 3 about here

To analyze whether the three different classes differ in their pattern of proactive and reactive aggression a 2 (aggression: proactive, reactive) x 3 (class: 1, 2, 3) repeated-measures ANOVA was conducted. Significant main effects of *aggression* and *group* and a significant *aggression* x *group* interaction were found, $F(1, 504) = 188.90, p < .001, \eta^2 = .273$; $F(2, 504) = 615.81, p < .001, \eta^2 = .710$; and $F(2, 504) = 13.37, p < .001, \eta^2 = .050$, respectively. The results indicate that overall the levels of proactive and reactive aggression differ from each other. Moreover, all classes differed significantly from one another regarding the proactive and reactive aggression scale. Finally, the classes differ in their pattern of proactive and reactive aggression in the way that class three exhibits comparable levels of reactive and proactive aggression, whereas class one and two display more reactive than proactive aggressive behavior.

Insert Table 4 about here

Discussion

In the current study, the reliability of the RPQ in adults from a forensic and non-forensic sample was examined. The results revealed two main findings: 1) the variable-based approach revealed sufficient internal consistency and acceptably supported the original two-factor model and 2) the person-based approach revealed three classes of individuals based on severity of aggression rather than on different subtypes of aggression. These results are discussed in further detail.

First, the results of the factor analyses revealed that proactive and reactive aggression were distinguishable in an adult sample. The fit indices of the two-factor

model showed comparable fit to the results of several other studies (Baş & Yurdabakan, 2012; Cima et al., 2013; Fung et al., 2009; Raine et al., 2006). However, the current study additionally examined alternative factor solutions by using an EFA, which, to our knowledge, has never been used before regarding the RPQ in an adult sample. Previously, other factor solutions have been investigated with respect to children (Tuvblad, Dhamija, Berntsen, Raine, & Liu, 2015). Regarding adults, on the other hand, previous research mainly focused on investigating a one-factor model in comparison with a two-factor model. When using a CFA as well as an EFA, the bimodal classifications did not fit the data best. Up to a four-factor model the fit indices of the EFA improved, suggesting that aggressive behavior could be classified into four subtypes³.

Based on the distribution of items, we propose a potential interpretation of the four factors: 1) impulsive-reactive aggression in reaction to frustration or provocation, 2) instrumental, proactive aggression, 3) aggression in the context of playing games, and 4) reactive, defensive aggression. This model shows that, in addition to the two original factors (reactive vs proactive), there are two other, more specific forms of aggressive behavior (in the context of playing games and a defensive form). Nevertheless, within the four-factor model, 10 items load marginally ($> .3$) on more than one factor. This indicates that statistically there might be a the four-factor model, but interpretation of the four factors should be considered as theoretically less solid as several items refer to different aggressive behavior traits. On the other hand, the results of the two-factor model also showed acceptable fit indices, although somewhat

³ Factor 1 – items: 1, 3, 5, 7, 8, 11, 16; Factor 2 – items: 4, 6, 9, 12, 15, 17, 20, 21; Factor 3 – items: 10, 13, 18, 20; Factor 4 - items: 2, 14, 19. Items 22 loads marginally on Factor 1 (.322) and 23 loads marginally on both factor 1 (.373) and 2 (.374).

lower than the four-factor fit indices. In addition, the two-factor model demonstrated that items were more uniquely associated with either reactive or proactive aggressive behavior traits. All in all, we considered the original two-factor model to be statistically and theoretically more solid than the four-factor model.

Second, in contrast to the expectations, the person-based approach revealed three distinct classes that were not characterized by different aggression profiles; the classes were based on a combination of both reactive and proactive aggression. Compared to the other classes, class one and class two were characterized by low proactive/high reactive aggression and class three was characterized by relatively high proactive/high reactive aggression. These results might suggest that either proactive aggression does not occur without reactive aggression, or that the RPQ is not able to identify groups showing solely proactive aggression. In line with previous studies, which showed that proactive aggression is a unique predictor of future delinquent behavior (Brendgen, Vitaro, Tremblay, & Lavoie, 2001; Vitaro, Gendreau, Tremblay, & Oligny, 1998), a subgroup displaying solely proactive aggressive behavior may exist. However, based upon the data, conclusive decisions on whether the RPQ is able to identify a subgroup of proactive aggressive adults or whether such a group exists, cannot be made. In the present study, no other measures of aggressive behavior were included. Therefore, it was not possible to test whether other aggression instruments *do* identify a subgroup of solely proactive aggressive adults or that this group is non-existent in adults. Future research on this topic should include multiple aggression instruments to answer this question. The most severe class, revealed by the LCA, displayed very high scores on proactive aggression. However, this specific class consisted of a very small sample and therefore the results need to be interpreted with care. In sum, the results of the LCA analysis demonstrated the discriminative power of the RPQ in a forensic and

non-forensic sample as class one predominantly included individuals from the general population, whereas class three included solely individuals from forensic settings. However, this distinction is mainly based upon the severity level of aggression and not on distinctive patterns of reactive and proactive aggression. This may be in line with literature that suggests a general psychopathological factor that underlies all forms of psychopathology (Caspi et al., 2014). These authors assert that the general underlying dimension summarizes individuals' tendency to develop any and all forms of common psychopathologies. Regarding aggressive behavior, one might argue that there is one overriding aggression factor that displays a general tendency to develop aggressive behavior irrespective of aggression subtype (reactive/proactive) and which, therefore, merely is displayed in terms of severity.

The present study is characterized by several strong points. First, the current sample consisted of a relatively large adult sample compared to other similar studies (Cima & Raine, 2009). Moreover, various samples were included (forensic psychiatric in- and outpatient clinic, offenders and general population), which enables generalizability to a large population of male adults. Another important asset of this study is the fact that multiple-factor models were explored in addition to the existing two-factor model of the RPQ, as alternatives for this bimodal distinction have not often been explored in research.

Although the current study extends the knowledge on the applicability of the RPQ within adult samples, a number of limitations have to be considered regarding the current study. First, this study included only male participants. More research is needed on the reliability and concurrent validity of the RPQ among female participants. Second, the RPQ is a self-report measure of aggressive behavior, which might be biased due to lack of insight or social desirable answering (Vigil-Colet,

Pamies, Carrasco, & Seva, 2012). It is possible that social desirability in this sample suppressed self-reported aggression overall, or that one of the two forms of aggression is less reported as it is seen as a less socially desirable form of behavior (e.g., proactive aggression). Further, the external validity of either the factors or the classes was not examined. Also, future research should look into the association between currently found factors and/or the classes and external behavioral measures, e.g., psychopathy and impulsivity. In addition, future studies on applicability of the RPQ in adult sample should include other self-report instruments on aggression to be able to compare the reliability and validity of these instruments among adults. Nevertheless, the RPQ is very time-efficient, easy to administer and score, making it possible to give (some) insight into aggressive behavior patterns of patients rather effortlessly.

Overall, this study adds to the knowledge of the reliability of the RPQ in (male) adult populations. The findings show that the RPQ appears to be reliable for male adult samples and can be used in clinical practice to distinguish subgroups with clinical and non-clinical levels of aggression. This distinction is based upon the severity of reported aggression and not upon the type of aggression, which gives an estimation on which subgroup needs less intensive interventions and which group benefits best from a more intensive treatment. Currently, norm scores are not available for the RPQ. The mean scores of our classes may serve as potential indicators of clinical severity of aggression. However, in order to use this instrument in clinical practice at an individual level, norm scores need to be developed using larger sample sizes. The influence of age on the development of aggression must be taken into account when developing norm- and cut-off scores. Moreover, extension of knowledge is also needed on the characteristics of the subgroups that have been found

with the RPQ in this research (e.g. neurocognitive functioning, behavioral traits, and genetics).

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Table 2

Fit Indices of Exploratory Factor Analysis Based on RPQ

Factor structure EFA	TLI	CFI	RMSEA	Eigen-value
2 factors	0.919	0.933	0.063-0.074	1.929
3 factors	0.956	0.967	0.044-0.057	1.561
4 factors	0.974	0.983	0.032-0.046	1.164
5 factors	0.982	0.989	0.024-0.040	0.915

Note. EFA = Exploratory Factor Analysis, TLI = Tucker-Lewis Index, CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation. A CFI and TLI between .90 and 1, RMSEA value of .06 or lower and an Eigen-value of >1 indicates a good model fit.

Table 3

Fit indices of the Latent Class Analysis

Amount of classes	BIC	Entropy	Parameters
2 classes	6167.01	.950	N per class > amount of parameters

3 classes ^a	6048.57	.943	N per class > amount of parameters
4 classes	5894.64	.932	N per class < amount of parameters

Note. The lowest BIC and highest Entropy are indicators of a good fit. Furthermore, the N per class should be bigger than the amount of parameters. BIC = Bayesian Information Criteria.

^a Model with the best fit indices compared to '2 classes' and '4 classes'.

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Table 4

Demographic Characteristics of the Three Classes Derived From the Latent Class Analysis

	Age (<i>SD</i>)	Sample % ^a	RA (<i>SD</i>)	PA (<i>SD</i>)	Within-class comparison RPQ
Class 1 (<i>N</i> =376)	28.27 (11.22)	1 = 64.6% 2 = 35.4%	6.91 (3.21)	1.58 (1.45)	$p < .001$ RA>PA
Class 2 (<i>N</i> =122)	28.86 (9.75)	1 = 28.7% 2 = 71.3%	13.13 (3.54)	7.48 (2.25)	$p < .001$ RA>PA
Class 3 (<i>N</i> =17)	31.47 (9.2)	1 = 0.0% 2 = 100%	17.68 (3.53)	16.35 (2.8)	$p = .406$ RA = PA
Between-class comparison	$p = .454$	$p < 0.001$	$p < .001$ 1 < 2 < 3	$p < .001$ 1 < 2 < 3	

Note. RA = Reactive Aggression, PA = Proactive Aggression, RPQ = Reactive Proactive Questionnaire.

^a 1 = non-forensic sample; 2 = forensic samples.

Table 1

Characteristics Of The Three Aggregated Studies

	Forensic samples			Non-forensic sample
	1	2	3	4
<i>N</i>	106 ^a	56 ^b	74 ^c	278 ^d
Age (<i>SD</i>)	28.78 (8.46)	38.17 (9.21)	34.66 (10.19)	24.91 (10.19)
RA (<i>SD</i>)	9.68 (4.53)	9.68 (5.46)	11.62 (5.17)	7.42 (3.61)
PA (<i>SD</i>)	4.62 (4.53)	6.00 (4.77)	4.34 (4.51)	2.27 (2.55)

Note. 1 = prisoners convicted for both violent and non-violent offenses, 2 = forensic psychiatric inpatients (Forminds), 3 = forensic psychiatric outpatients diagnosed with an aggression regulation disorder, 4 = students from Maastricht University and males from the general population recruited with advertisement, posters, and flyers, RA = Reactive Aggression score, PA = Proactive Aggression score.

^a Cornet, Van der Laan, Nijman, Tollenaar & De Kogel, 2015.

^b Brugman, et al., 2016 (*part of the sample corresponds to current study*).

^c Smeijers, Rinck, Bulten, v.d. Heuvel, & Verkes, submitted.

^d Brugman, et al., 2015, Lobbestael, Cima, & Lemmens, 2015, Van Teffelen, 2013, Lobbestael, Arntz, & Cima, 2013,

Lobbestael & Cima, in preparation, Lobbestael, in preparation, Lobbestael, Cima, & Lemmens (2015).

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Figure 1. Structured model showing the relationship between the two studies and the three classes of aggression severity (class 1 = low aggressive traits, class 2 = medium aggressive traits, class 3 = severe aggressive traits), related to subtypes of aggressive behavior as resulted from factor analyses. Note that the original reactive/proactive aggression factors were confirmed and that class 1 and class 2 were characterized by more reactive aggression than proactive aggression (dotted lines).

Figure 2. Derived classes of the multi-level LCA with correcting for forensic vs. non-forensic sample.

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