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# The relation of home and childcare/school environment to differential trajectories of externalizing problems

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This paper uses data from the NICHD study of Early Child Care to investigate how exposure to different home and childcare/school environmental settings are associated with children's trajectories of externalizing problem from age 2 to age 12. The sample included 1232 children (52% male). Different classes of children exhibiting low, moderate desisting, moderate, high desisting and chronic externalizing problems across the 10 year period were identified. Boys were more likely to be identified in the chronic group and girls in the low group. Furthermore, the findings suggested that the chronic externalizing problems group was also at high risk for experiencing a negative home environment across time, being born into a low familial socio-economic environment, and for experiencing a low quality classroom environment during middle childhood. Therefore, the quality of both the home and school environment are important for identifying these children at high and continuous risk for externalizing psychopathology. Finally, the findings suggested that the quality of the child's home environment had the more pervasive consequences for the establishment and continuation of externalizing problems in comparison to the quality of the child's childcare environment.

## Introduction

This study examines how children's exposure to different home and childcare/school settings over time are associated with their trajectories of externalizing problems. This idea is based on previous evidence that children at risk for developing externalizing problems are also at higher risk for experiencing negative and unsupportive home and childcare/school environments (e.g. Fanti, 2007; NICHD ECCRN, 2004). The quality of care, attention, and emotion children receive in both environmental settings can have positive or negative influences on the child's social and emotional development (Eisenberg et al., 2003; Howes, Phillips, & Whitebook, 1992).

However, previous studies usually investigate the relationship of the childcare/school and home environment separately, although identifying which setting has the more pervasive consequences for the establishment and continuation of externalizing problems can provide valuable information for early interventions. Based on this argument, we investigate the importance of the quality of the home and childcare/school environments by including both in the same model to investigate the unique effects of each.

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Also, it is important to disentangle the effects of earlier and later home and childcare/school experiences in order to investigate whether early environmental experiences continue affecting child outcomes (NICHD ECCRN, 2003). If early environmental settings affect the development of externalizing problems even after statistically controlling for later indices of these factors, we will conclude that early experiences do not just influence the onset of externalizing problems, but the continuation of externalizing problems as well.

In addition, we take a person oriented approach to identify the children at higher risk for developing externalizing problems. Studies using person oriented methodologies to investigate heterogeneity in the course of externalizing problems identified different groups of individuals exhibiting chronic, moderate desisting, moderate, high desisting, and low externalizing problem trajectories, and those differences have been found as early as the second year of life for both boys and girls (Fanti, 2007; NICHD ECCRN, 2004; Shaw, Gilliom, Ingoldsby, & Nagin, 2003). The majority of these studies suggest that there are at least four groups of children with different patterns of developing externalizing problems: (1) a group exhibiting low levels of externalizing problems early in development that declines over time;

(2) a group or groups with moderate or high scores early in development who exhibit decreases in externalizing problems after the preschool years; (3) a group who exhibit moderate continuous externalizing problems across development; and (4) a small group of children who exhibit high continuous externalizing problems across time were identified. The chronic and high externalizing group has been called the life-course persistent group, and according to Moffitt (1993) this group accounts for only 5 to 7% of the population, but these individuals are responsible for the majority of crimes committed.

We hypothesize that children who experience low quality child care and home environments in infancy are more likely to belong to externalizing groups that exhibit high levels of symptoms early in development. Additionally, children in a low quality home and childcare or school environment at all developmental periods under investigation, infancy, early childhood and middle childhood, are expected to be more likely to belong to the chronic externalizing group. Furthermore, we expect that increases over time in the quality of home and child care or school environment during early and middle childhood will be associated with decreased likelihood of exhibiting high externalizing problems over time. Therefore, we expect that experiences in different settings can influence the onset and continuation of behavioral problems, and they can also function as protective factors to help children refrain from such behaviors.

Methods

The present study used data from the NICHD Study of Early Child-Care (http://secc.rti.org). The trajectory analyses for the current study were based on 1232 children (52% male) whose mothers completed the Child Behavior Check List at least two times out of nine. The sample was diverse in terms of ethnicity, and family's financial status. Furthermore, 10% of the mothers had not completed high school and 21% were single.

**Measures**

*Mother's ratings of externalizing problems.*

Mothers rated participants' externalizing problems at 2, 3, 4.5, 6, 7, 9, 10, 11, and 12 years of age with the Child Behavior Checklist (CBCL; Achenbach, 1991, 1992). There are two versions of the CBCL: the preschool version for children ages 2-3 and the school-age version for children ages 4-18. For the present study items that appear on both versions of the CBCL were used to maximize comparability over time: "Can't sit still, restless, or hyperactive," "Cruel to animals," "Destroys his own things," "Destroys things belonging to his family or others," "Disobedient," "Doesn't seem to feel guilty after misbehaving," "Gets in many fights," "Physically attacks people," and "Temper tantrums or hot tempered." Mothers rated how descriptive each item was of the child's usual behavior now or within the past 6 months on a three-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true), and raw sum scores were used in the study's analysis. The Cronbach's alphas for externalizing problems across time ranged from .73 to .79 for the current study.

*Familial SES Risk index.*

A socioeconomic risk index was created reflecting mothers' reports of family finances, maternal marital status, and maternal education during the first two years of life (Henrich, Schwab-Stone, Fanti, Jones, & Ruchkin, 2004). Items indicating early low familial SES (scoring below the poverty threshold, single marital status, and less than high school maternal education) were dichotomized into 0 (no risk) or 1 (risk). The items with a score of 1 were summed to indicate an overall risk score, and the SES index ranged from 0 to 3.

*Family environment.*

The quality of the home environment was assessed using the HOME Inventory (Caldwell & Bradley, 1984). The HOME is a semistructured interview and observational procedure designed to describe the stimulation and responsiveness of mothers, their involvement with and acceptance of their children, the availability of play and learning materials, and the organization and variety of the physical environment. Each item is scored in a binary fashion (yes/no). The HOME provides an appraisal of the child's overall "home life" and higher scores indicate more enriched and positive home environments. The Home inventory was used over time as an indication of the infancy (averaged between 6 and 15 months, α = .77), early childhood (averaged between 36 and 54 months, α = .85), and the middle childhood (third grade, α = .82) home environment quality.

*Childcare/school quality.*

The Observational Record of the Caregiving Environment (ORCE; http://secc.rti.org) was used to measure the qualities of the child care environment in infancy and early childhood. The ORCE is based on the composite of 5 subscales – sensitivity to child's nondistress signals, stimulation of cognitive development, positive regard for child, emotional detachment (reflected), and flatness of effect (reflected). The ORCE was used over time as an indication of the infancy (averaged between 6 and 15 months, α = .72), and early childhood (averaged between 36 and 54 months, α = .83) childcare quality. The Classroom Observation System (COS-3; http://secc.rti.org) was used to measure the school classroom quality at third grade. The qualities of the classroom environment are based on the

composite of four categories – activity, content, teacher behavior, and child behavior – which were grouped together to indicate overall classroom quality (α = .76).

## Analyses

Analyses proceeded in two stages. In the first stage, Latent Class Growth Analysis (LCGA) in Mplus 4.2 (Muthén & Muthén, 2006) was used for the externalizing problem trajectory analysis. In the second stage, multinomial logistic regressions in SPSS were performed to identify environmental characteristics that distinguished membership in the identified groups.

*Latent Class Growth Analysis - LCGA*

LCGA identifies heterogeneous groups by modeling a mixture of distinct multivariate normal distributions. Heterogeneity of trajectory groups is data-driven based on estimation of individual growth curves for each child. LCGA uses a polynomial function to model the relationship between an attribute and age. The function takes the form (Nagin, 1999):

$y_{it}^{j} = \beta^{j}_{o} + \beta^{j}_{1}Age_{it} + \beta^{j}_{2}Age^{2}_{it} + \varepsilon$

where $y_{it}^{j}$ is a latent variable which characterizes the level of externalizing problems for participant ı at time t given membership in group j. $Age_{it}$ is participant ı's age at time t, $Age^{2}_{it}$ is the square of participant ı's age at time t, and ε is a disturbance assumed to be normally distributed with zero mean and constant variance. The model's coefficients, $\beta^{j}_{o}$, $\beta^{j}_{1}$, and $\beta^{j}_{2}$, determine the shape of the trajectory. The coefficients are superscripted by j to denote that they are not constrained to be the same across j groups and are free to vary, which allows for cross-group differences in the shape of developmental trajectories. Furthermore, the model does not permit individual variability in the intercepts or slopes within classes, and children within a class share a single trajectory of change over time.

The CBCL variables were specified in the model as count variables because they represent a count of the number of externalizing behaviors weighted by frequency of occurrence from 0-2 (NICHD ECCRN, 2004). Furthermore, because all the variables were highly skewed with a large number of zeros at each time point, a zero inflated poisson (ZIP) model was used (see Nagin & Land, 1993 for information on the ZIP model).

The LCGA model estimation in Mplus results in two outputs. The first is the shape of the trajectory for each group, which is based on the parameter estimates. The second one is the posterior probability of group membership, which estimates the probability of each child in the sample belonging to each of the trajectory groups.

In addition, Mplus accommodates missing data by using full information maximum likelihood, and children with incomplete assessments do not have to be dropped from the analysis (Muthén & Muthén, 2006).

The model fit statistics used are the Bayesian Information Criterion (BIC) and the Lo, Mendel, Rubin (LMR) statistic. The BIC, which is based on a maximization of a log likelihood function, is usually used for mixture models. The model with a lower BIC is preferred (Schwartz, 1978). In addition, because the BIC criterion tends to favor models with fewer classes by penalizing for the number of parameters, the LMR fit statistic, which is a likelihood statistic based on the sum of chi-square distributions, was used (Lo, Mendell, & Rubin, 2001).

The LMR statistic is used to compare non-nested models with different number of classes and tests $k - 1$ classes against $k$ classes. A significant chi-square value ($p < .05$) indicates that the $k - 1$ class model has to be rejected in favor of the k-class model. A non-significant chi-square value ($p > .05$) suggests that a model with one fewer class is preferred.

Finally, the average posterior probabilities and the entropy value were taken under consideration to indicate whether the classes in the final model were distinct (Jedidi et al., 1997). Average posterior probabilities can be used to check for the precision of classification because they indicate the degree to which the classes are distinguishable. In addition, the entropy value, which is a standardized summary measure based on the posterior class membership probabilities derived from each model, was used to judge the classification accuracy of placing participants into classes and the degree of separation between classes. Entropy can range from 0 to 1, and an entropy value closer to one indicates greater power to predict class membership.

*Multinomial logistic regression analyses*

Multinomial logistic regression analyses were used to identify factors that discriminate among individuals with divergent developmental trajectories for externalizing problems. Multinomial Logistic Regression is appropriate when the dependent variables are unordered categorical, such as the differential trajectory groups derived from this study. The analysis proceeded in three steps. At step 1 gender, SES risk, and the infancy home and child care environments were entered in the analysis. At step 2 the early childhood home and preschool environment were added in the analysis, and finally at step 3 the middle childhood home and classroom environment were added in the analysis.

## Results

To identify the optimal number of trajectories for externalizing problems, models with one to six groups were estimated with the use of LCGA. The BIC scores kept decreasing up to the 5 class model. Furthermore, the six-group model had a higher BIC (33929.27) than the 5 class model (33920.43), suggesting that the 5 class model fit the data better. Moreover, the LMR statistic fell out of significance for the 6-class model ($p$ = .62), indicating that the better fitting model was the 5-class model ($p$ = .03). Therefore, the five class model represented the sample best. Furthermore, the mean probability score for the five externalizing groups ranged from .77 to .94 and the entropy value was .76, suggesting that the classes were well separated.

The trajectory groups identified with LCGA are shown in figure 1. Children in the low ($n$ = 302) and moderate desister ($n$ = 467) groups only engaged in some externalizing behaviors early in development, but refrained from such behaviors after middle childhood. Children in the moderate group ($n$ = 131) started at the same levels as the moderate desister group, but remained at moderate levels for externalizing problems across time. Children in the high desister group ($n$ = 220) started at high levels of externalizing problems but desisted to low levels across time. Children in the chronic group ($n$ = 103) started higher on externalizing problems in comparison to the other groups and remained high on externalizing problems from age 2 to age 12 (see Figure 1, Appendix)

*Demographic differences.*

The latent classes were not differentiated in terms of ethnicity, but some gender differences emerged. The low group was overrepresented by girls, $x^2_{(1,\ N\ =\ 1232)} = 8.17$, $p < .001$, and the chronic group by boys, $x^2_{(1,\ N\ =\ 1232)} = 11.05$, $p < .001$.

*Correlations between and within contexts over time*

Childcare quality during infancy correlated positively with childcare quality during early childhood, $r = .19$, $p < .001$, and school quality during middle childhood, $r = .18$, $p < .001$. Childcare quality during early childhood correlated positively with school quality during middle childhood, $r = .16$, $p < .001$. Home quality during infancy correlated positively with home quality during early childhood, $r = .63$, $p < .001$, and home quality during middle childhood, $r = .60$, $p < .001$. Home quality during early childhood correlated positively with home quality during middle childhood, $r = .61$, $p < .001$. Furthermore, the childcare/school quality was moderately correlated with home quality across time (Pearson's $r$ ranged from .19 to .43).

*Environmental effects*

Table 1 incorporates odd ratios to compare the five groups. In general, odd ratios reflect the odds likelihood of being in one group over the other based on the level of the independent variable. As mentioned, the multinomial logistic regressions proceeded in three steps (see Table 1, Appendix).

Step 1. Infancy.

The first step was significant, $x^2_{(16,\ N\ =\ 1232)} = 102.68$, $p < .001$. According to the findings boys were more likely to belong to the chronic group in comparison to the other four groups, but girls were more likely to belong in the low group in comparison to the other four groups. A one unit increase in SES risk was associated: (1) to a higher likelihood of being in the chronic group compared to the other four groups, and (2) to a higher likelihood of being in the high desister and moderate groups in comparison to the low group. Children who experienced a more positive home environment were less likely to be in the chronic, moderate, and high desister groups, compared to the low and moderate desister groups.

Step 2. Early Childhood.

The variables in Step 2 led to a significant increase in model fit, $\Delta\chi^2_{(8,\ N\ =\ 1232)} = 157.90$, $p < .001$. The findings indicated that after including the early childhood variables the infancy home environment was not significant anymore. Furthermore, children who experienced a more positive home environment were less likely to belong to the chronic group in comparison to the other four groups, and children who experienced a more positive home environment were more likely to belong to the low group in comparison to the other four groups.

Step 3. Middle Childhood.

Finally, step 3 also led to a significant increase in model fit, $\Delta\chi^2_{(8,\ N\ =\ 1232)} = 36.43$, $p < .001$. According to the findings, the early childhood home environment remained significant even after including the middle childhood home and school variables. Furthermore, children who experienced a more positive home environment during middle childhood were less likely to belong to the chronic and moderate groups in comparison to the other three groups. Also, children in higher quality school classrooms were less likely to belong to the chronic group compared to the other four groups.

Discussion

The present study provides information for the development of externalizing problems from age 2 to age 12 and factors influencing these trajectories. The findings provided only partial support for our hypotheses that both the child's childcare/school and home environments can differentiate between children exhibiting different trajectories of externalizing problems.

*Development of externalizing problems*

Replicating the findings of previous research, the latent class growth analysis identified five latent classes for externalizing problems, with children exhibiting low, moderate desisting, moderate, high desisting, and chronic externalizing problems (Fanti, 2007; NICHD ECCRN, 2004; Shaw et al., 2003). These findings propose the existence of two groups at high risk for exhibiting continuous externalizing problems, although they differ in the severity of externalizing problems they exhibit across time. Furthermore, identifying the chronic externalizing problems group is important because these individuals are considered to be at the higher risk for developing psychopathology, for following a path of deviant and delinquent behaviours, and for committing the majority of crimes in society (Moffitt, 1993).

*Predictors related to externalizing problems – Informing interventions*

One particular important from a prevention viewpoint finding was that early indices of familial socio-economic status differentiate children who are at risk for developing chronic externalizing problems from the rest of the groups. Previous research indicated that children who come from low SES families are more likely to be at higher risk for externalizing problems (e.g. Deater-Deckard et al., 1998), and the current investigation suggests that exposure to SES risk early in life and to the higher stressful life events associated with low SES might set the stage for children to develop chronic externalizing psychopathology.

Moreover, children from more negative home environments in infancy were at higher risk for exhibiting continuous externalizing problems, chronic and moderate, and high but desisting externalizing problems, compared to the moderate desister and low externalizing problem groups. However, when the early childhood indices of home environment were taken into account, the infancy home environment fell out of significance, which might suggests that the infancy home environment only contribute to the onset of externalizing problems and not to the continuation of these problems.

The early childhood home quality did remain significant in differentiating the chronic group from the rest of the sample even after taking into account the middle childhood home variables. This finding suggests that the home environment during this time is important for identifying the children at risk for high and continuous externalizing problems. Thus, interventions that focus on the children's home environment during early childhood may have a high probability of success for preventing these children's lifelong severe antisocial behaviour.

Finally, children's middle childhood home environment was also associated with their likelihood of exhibiting continuous externalizing problems, chronic and moderate. Therefore, a negative home environment during middle childhood might also contribute to the continuation of externalizing problems for both the moderate and chronic groups. Additionally, children with negative home environments in middle childhood were less likely to belong to the high desister group. This finding suggest that changes in the home environment during middle childhood might have acted as a protective factor that resulted in decreases in the levels of externalizing problems these children exhibited.

As opposed to the home environment, the childcare environment during infancy and early childhood did not differentiate between any of the externalizing problem groups. This finding might be explained by previous research which provided evidence that the childcare quality is more strongly associated with cognitive outcomes than behavioural problems (NICHD ECCRN, 2003). However, the middle childhood classroom environment separated the chronic group from the rest of the sample, suggesting that the quality of settings other than the home might become important during the middle childhood developmental period.

Thus, the findings suggested that the setting that has the more pervasive consequences for the establishment and continuation of externalizing problems is the child's home environment. The home environment can also protect some children from exhibiting continuous externalizing problems. Moreover, non-family settings might become important during middle childhood, and therefore interventions that focus on school settings might need to start during the beginning of elementary school.

Finally, the current study has important implications for better understanding the children exhibiting chronic and high externalizing problems. The findings suggest that chronic externalizing problems may start as early as the second year of life, and this group of children is at high risk for being born into a low familial socio-economic environment. Furthermore, the chronic externalizing problems group was also at high risk for experiencing a negative home environment across time, suggesting that a continuous negative home environment might be one factor influencing the maintenance of chronic externalizing problems across development.

In addition, the middle school classroom environment might also influence the continuation of chronic externalizing problems. Therefore, the quality of both the home and school environment are important for identifying these children at high and continuous risk for externalizing psychopathology. Thus, interventions need to be initiated early in life in multiple settings, before antisocial outcomes become inevitable (Dodge & Pettit, 2003).

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# Appendix

Figure 1. Final LCGA model for externalizing problems.

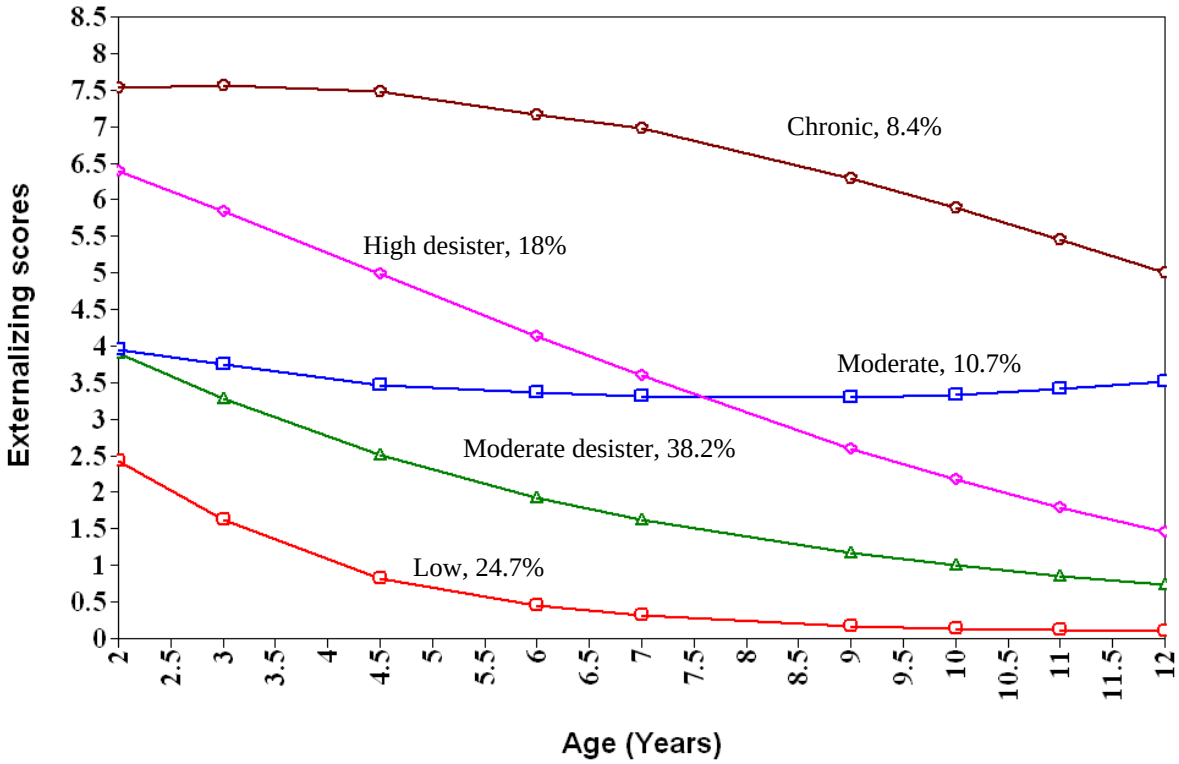


**Table 1: Multinomial Logistic Regression Analyses (N=1232)**

| | Group comparisons based on Odds Likelihoods | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5 vs 1 | 5 vs 2 | 5 vs 3 | 5 vs 4 | 4 vs 1 | 4 vs 2 | 4 vs 3 | 3 vs 1 | 3 vs 2 | 2 vs 1 |
| Step 1 | | | | | | | | | | |
| Gender | 2.86** | 2.06** | 1.80** | 1.99** | 1.43* | 1.03 | .96 | 1.60* | 1.15 | 1.39* |
| SES risk | 1.55** | 1.36** | 1.22* | 1.27* | 1.22* | 1.07 | 1.00 | 1.28* | 1.12 | 1.14 |
| Home quality - infancy | .92** | .90** | .98 | .98 | .94* | .92** | .96 | .94* | .92** | 1.02 |
| Childcare quality - infancy | 1.00 | 1.07 | 1.03 | 1.07 | .93 | 1.00 | .90 | .97 | 1.04 | .93 |
| Step 2 | | | | | | | | | | |
| Home quality – infancy | 1.03 | .97 | 1.04 | 1.02 | 1.01 | .95 | 1.02 | .99 | .94 | 1.05 |
| Childcare quality – infancy | 1.03 | 1.10 | 1.05 | 1.08 | .95 | 1.02 | .97 | .98 | 1.04 | .94 |
| Home quality – early childhood | .81** | .87** | .90** | .93** | .87** | .94 | .97 | .90** | .97 | .93** |
| Childcare quality – early childhood | 1.05 | 1.03 | 1.01 | 1.06 | .99 | .98 | .95 | 1.04 | 1.03 | 1.02 |
| Step 3 | | | | | | | | | | |
| Home quality – infancy | 1.08 | 1.01 | 1.06 | 1.05 | 1.03 | .97 | 1.01 | 1.02 | .96 | 1.07 |
| Childcare quality – infancy | 1.05 | 1.12 | 1.07 | 1.09 | .96 | 1.02 | .97 | .99 | 1,05 | .94 |
| Home quality – early childhood | .83** | .89** | .90** | .94** | .88** | .95 | .96 | .92** | .99 | .93** |
| Childcare quality – early childhood | 1.08 | 1.06 | 1.02 | 1.08 | 1.00 | .98 | .94 | 1.06 | 1.04 | 1.02 |
| Home quality – middle childhood | .91** | .93** | .99 | .93* | .96 | .97 | 1.06* | .93** | .94** | .99 |
| Classroom quality – middle childhood | .85** | .88** | .91* | .91** | .93 | .97 | 1.00 | .93 | .97 | .96 |

*Note*: comparisons are based on odds likelihoods; *$p$ ? .01; **$p$ ? .001; the table shows the odds likelihoods of belonging to the reference group as opposed to the comparison group. Group 1 is the low group; Group 2 is the moderate desister group; Group 3 is the moderate group; Group 4 is the high-desister group; Group 5 is the chronic group