Predicting risky health behaviors 35 years later: Are parents or teacher's reports of childhood behavior problems a better judge of outcomes?

Jaimee Stuart

School of Applied Psychology, Griffith University, Brisbane, Australia

E-mail: j.stuart@griffith.edu.au

ORCID: <https://orcid.org/0000-0002-4376-1913>

The author declares that there are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data used for this manuscript come from the Aberdeen Children of the 1950s study (ACONF), the thanks go to the steering committee for granting access to the anonymized data set.

Abstract

Objectives

This study sought to understand (1) whether parents and teachers reports of childhood behavioral problems could predict smoking and alcohol consumption 35 years later, and (2) whether propensity for smoking and alcohol consumption differed on the basis of informant agreement in their classification of behavioral syndromes.

Methods

Participants included those from the Aberdeen Children of the 1950s study (ACONF) with full childhood information as well as self-reports in adulthood ($n = 1,342$). Latent Class Analysis was conducted to identify patterns of childhood problem behaviors as rated by teachers and parents. Regression models were then conducted predicting adulthood smoking and alcohol consumption. Informant agreement categories were constructed and differences across categories in both smoking and alcohol consumption were tested.

Results

Three subtypes of childhood behavior problems were identified by both teachers and parents: “Normative,” “Externalizing,” and “Internalizing.” Parents also identified a distinct fourth group “Mixed”. Teacher’s classification of the child as externalizing significantly predicted greater likelihood of being a current smoker, and parents’ classification as internalizing predicted lower likelihood of being an ex-smoker. Parents’ ratings as externalizing and mixed also predicted lower levels of alcohol consumption, which was opposite to the predicted effect. Additionally, informant agreement of externalizing indicated a greater propensity of smoking in adulthood, but did not indicate differences in alcohol consumption.

Conclusions

This study suggests that it is important to consider additive information from multiple informants when examining the life-course effects of childhood behavioral problems on risky health behaviors in adulthood.

Keywords: childhood behavioral problems; longitudinal; multiple informants; smoking; alcohol consumption

A growing body of literature has linked disturbances in childhood behavior to a range of negative health outcomes in both adolescence and adulthood (e.g., Althoff, Verhulst, Rettew, Hudziak, & Van Der Ende, 2010; King, Iacono, & McGue, 2004; Mcleod & Kaiser, 2004). These behavioral issues in childhood are typically described as manifesting in either externalizing or internalizing problems (Achenbach & Edelbrock, 1978; Achenbach, 1978). Externalizing problems refers to a child negatively acting on the external environment through behaviors such as aggression, restlessness, and delinquency. In contrast, internalizing problems tend to affect the child's internal psychology, and result in behaviors that can be characterized as withdrawn, anxious, and inhibited.

There is now a large body of evidence to suggest that externalizing problems in childhood predict health outcomes and health risk behaviors over the life course, having long-term influences on factors such as premature mortality, injury, anti-social and criminal behavior, substance abuse, problem drinking and smoking in adulthood (Campbell, Shaw, & Gilliom, 2000; Jokela, Ferrie, & Kivimäki, 2009; King et al., 2004; Pulkkinen & Pitkanen, 1993; Sourander et al., 2007; Timmermans, van Lier, & Koot, 2009). Internalizing problems, in turn, have been associated with psychological disorders such as anxiety and depression (Clark, Rodgers, Caldwell, Power, & Stansfeld, 2007; Pine, Cohen, Gurley, Brook, & Ma, 1998), as well as suicidal behaviors, and interpersonal instability (Caspi, Elder, & Bem, 1988; Fergusson, Horwood, & Ridder, 2005). Overall, the evidence from a variety of longitudinal studies suggests that childhood problem behaviors influence the manner and propensity of risk exposure as well as subsequent behavior during risky situations in later life. Even though the effect sizes of these associations tend to be modest (as is expected given the long-term period of these studies), it is agreed that childhood behavior problems have important health consequences over the life course.

As a case in point, a study by von Strumm et al. (2011) conducted on the Aberdeen Children of the 1950s (ACONF; Leon, Lawlor, Clark, & Macintyre, 2006) birth cohort found that behavior problems in childhood were significantly associated with smoking and alcohol consumption more than 40 years later. Specifically, childhood externalizing behavior was related to earlier smoking initiation, a later age of smoking cessation, greater number of cigarettes consumed, and a higher frequency of alcohol consumption (for men). In contrast, it was found that early internalizing behavior problems were associated with fewer extremes in risky behaviors (heavy drinking and smoking). The authors argue that these findings indicate early externalizing behavior problems result in the uptake of harmful habits which persist and are hazardous to both health and life expectancy, whereas internalizing problems do not have the same effects.

Similar to a number of other prospective studies on childhood behavior, von Strumm et al. (2011) examined externalizing and internalizing as measured by teacher report. This is an important point to note as there is a reliance on others as reporters of a child's psychopathology due to need for clinical referral and diagnosis, although there are often discrepancies between raters on children's behavioral/emotional problems (Achenbach, McConaughy, & Howell, 1987; Hinshaw, Han, Erhardt, & Huber, 1992). In fact, the number of childhood behavior problems reported has been found to vary depending on both the rater and the type of problems rated (i.e., internalizing vs. externalizing) (De Los Reyes & Kazdin, 2005; Stanger & Lewis, 1993). Yet studies which report on the long-term outcomes of externalizing and internalizing problems do not often differentiate between the raters of said behavior. Rather, teacher, parent and self-reports are either used separately to inform adult outcomes, or a mixture of these are utilized interchangeably or in combination without adequate attention paid to the differential predictive utility of such multi-informant data.

Achenbach, McConaughy, and Howell (1987) suggest that diverse informants offer different perspectives on a child's behavior, which, when taken together, can yield unique information. Following this contention, in studies of behavioral problems during childhood and adolescence using multiple raters (e.g., teacher, mother, father, child), it has been found that none of the ratings effectively serve as proxies for any other ratings and that combining information across informants does not improve predictive efficacy (Davé, Nazareth, Senior, & Sherr, 2008; Kolko & Kazdin, 1993; Stanger & Lewis, 1993; Verhulst & van der Ende, 1992). Furthermore, studies have found that overall, informants have a much greater ability to identify externalizing behaviors, although teachers tend to be more sensitive in the nomination of children with externalizing problems and parents more sensitive to both the degree of externalizing and the identification of internalizing problems (Dwyer, Nicholson, & Battistutta, 2006; Kolko & Kazdin, 1993). Therefore, rather than simply combining ratings of child behavioral problems, where it is possible to examine the effects of multiple informants, additional insights can be derived.

Given the paucity of very long-term studies where data on childhood behavior problems is assessed from multiple informants, there is a noticeable gap in the research. Therefore, the purpose of the current study is to test whether teacher and parent ratings of childhood behavior problems predict risky health behaviors in much later adulthood in similar ways, and subsequently, whether informant agreement itself predicts adult outcomes. Following previous research, firstly it is hypothesized that childhood behavioral issues will comprise of externalizing and internalizing problems. As such a research question is posed; do ratings of behavior from parents and teachers conform to clusters representing externalizing and internalizing behaviors? Secondly, it is hypothesized that children exhibiting externalizing behavioral problems will engage in more risky health behaviors in adulthood than those who do not. A second research question is posed as associated with this

hypothesis, namely; do children who exhibit internalizing behavioral problems engage in more risky health behaviors in adulthood? Finally, due to the lack of guiding theory regarding differences in predictive effects on agreement between raters, a third research question is posed; does informant (teacher and parent) agreement/disagreement on childhood behavioral problems predict adult risky health behaviors?

Methods

Participants

Data from the Aberdeen Children of the 1950s (ACONF) study, a population cohort study of all the children born in Aberdeen, Scotland between 1950 and 1956 was utilized. Although 12,150 participants took part in the initial data collection during 1962 (see Batty et al., 2004; Leon et al., 2006), the present study investigates the individuals ($N = 1342$) for whom data were available from teachers in childhood (collected in 1962 when participants were aged 6-12), from parents in childhood (collected in 1964 when participants were aged 9-14) and from self-report in late adulthood (collected between 2001-2003 when participants were aged 45-51). Because the full sample is outlined elsewhere (Batty et al., 2004), only the characteristics of the sub-sample utilized in the analyses are outlined in this paper.

The sample followed very similar demographic characteristics of the overall cohort study as reported by Batty et al. (2004). The age of participants as collected in adulthood ranged from 47 – 53 years old, nearly half of the sample were female (626, 46.6%), 50.5% had engaged in some post high school education and 85.5% were currently employed.

Measures

Childhood Behavioral Problems

Class teachers completed the Child Scale B, (Rutter, 1967) which consisted of 26 descriptions of various childhood behaviors against which the teacher was asked to indicate whether each description *does not apply*, *applies somewhat* or *definitely applies*. The

parental questionnaire, or Child Scale A, had 31 descriptions of behavior in total, 23 of which were included on the teachers' questionnaire. Unlike the teacher questionnaire this scale consisted of three sections. The first section consisted of 8 problems (e.g. complains of headaches, truants from school), the second section of five questions (e.g. whether child had a speech difficulty, whether child had an eating difficulty). The third section consisted of 18 descriptions of behavior against which the parent was asked to indicate whether each description 'does not apply' 'applies somewhat' or 'definitely applies' to the cohort member. In the current study, the behavioral items that were consistent between the parent and the teacher were used, although one of these items "Often destroys own or others' property/belongings" was removed due to very low numbers of identification by (2% teachers and 6% parents), resulting in a total of 17 items. Items were dichotomized into 1 = *behavior present* or 0 = *behavior absent* if the teacher or parent indicated that the behavior '*applies somewhat*' or '*definitely applies*'. Table 1 reports the number of individuals categorized by their parents and teachers as having a particular behavioral problem.

Risky Health Behaviors in Adulthood.

Adult health behaviors were measured with 2 items assessing history of smoking, and current alcohol consumption. History of smoking was assessed by one item; "Have you ever smoked cigarettes", options given were 1 = *yes, current smoker*, 2 = *yes, ex-smoker*, and 3 = *no*. Alcohol consumption was also assessed with one item asking how often the individual drinks alcohol, with the response options: 1 = *every day*; 2 = *most days during the week and weekends*; 3 = *weekends only*; 4 = *less than once a week*; and 5 = *special occasions*; and 6 = *have never drunk alcohol/no longer drink alcohol*. For ease of interpretation, this item was reverse scored so that higher ratings represented greater alcohol consumption.

Data Analysis

Data were analyzed in two stages. Firstly, rather than determining behavioral problems by predetermined scores, latent class analyses (LCA) were conducted in Mplus version 7.2 on teacher ratings of childhood behavioral problems and parent ratings of childhood behavioral problems separately. LCA is a latent variable modeling technique for categorical data which assumes that there are subgroups (labelled classes) of individuals who have similar response patterns on a set of indicators. Two major parameters are derived from this analysis; the probability of each individual belonging to a specific class (posterior class probability) and the probability of responses to each indicator given membership in a latent class (item-class probabilities) (Lanza, Flaherty, & Collins, 2003). The goal of LCA is to identify the smallest number of latent classes to describe the associations among the observed behaviors, the optimal number of which should be informed by evaluating multiple measures of model fit, theory, and prior empirical evidence (Oberski, 2016).

In the following analyses in order to determine the most appropriate number of latent classes, various measures of fit were assessed including the Log Likelihood (LL), Akaike information criterion (AIC), Bayesian information criterion (BIC), and the sample-size adjusted Bayesian information criterion (SSBIC), as well as measures of relative fit including both the Vuong-Lo-Mendell-Rubin (VLMR) likelihood ratio test and the adjusted Lo-Mendell ratio test, as well as the normalized entropy criterion and examinations of the average latent class probabilities (Finch & Bronk, 2011; Lanza, Flaherty, & Collins, 2003; Nylund, Asparouhov, & Muthén, 2007; Oberski, 2016). Data fit was determined by estimating models with an increasing number of classes and comparing fit indices between models. Because there is no one method or gold standard criterion for classifying cases in LCA, final models were developed on the basis of an overall assessment of best fit (Tein, Coxé, & Cham, 2013).

In the second stage of data analysis regression models were fitted in IBM SPSS on each of the dependent variables separately (history of smoking and alcohol abuse). Given the nature of these dependent measures (nominal for smoking, and ordinal for alcohol abuse) multinomial logistic regressions and linear regressions¹ were conducted for the respective dependent variables. Three models were run for each risky health behavior, the first included adulthood covariates (gender and level of education) as well as dummy coded variables representing teacher rated class membership. The second included covariates and parent rated class membership. The third and final model included adult covariates and both teacher and parent rated class membership.

In the final stage of data analysis, agreement between informants was derived by examining the overlap between the clusters as defined by parents and teachers. The method of computing agreement is explained in detail below. In order to investigate the influence of these derived groups on adult risky behavior, a chi-square analysis was conducted to examine differences in smoking behavior, and an ANOVA was conducted to examine mean level differences in drinking behavior across the agreement groups.

Results

Initial descriptive analyses indicated that the prevalence of childhood behavior problems as rated by teachers and parents was generally low. The most common behavior problem identified by teachers was that the child lacks concentration (24%), whereas the most common behavior problem identified by parents was that their child worries unnecessarily (43%). The least common behaviors as rated by teachers were that the child had a tic (4%) and that the child was a bully (4%), whereas the least common behavior as rated by parents was that their child was not liked by other children (5%). Overall, parents

¹ Note alcohol consumption approximated a normal distribution and for the purposes of model building was treated as a continuous variable.

were more likely to identify behavior problems in their children (range 5% - 43%) than were teachers (4%-24%).

Latent Class Analyses

Teacher rated behavioral problems

Table 1 illustrates the model building process for teacher-rated behavioral problems. The 3-class solution was selected as the best fitting model as it was interpreted to provide the most parsimonious description of the data. This was indicated by the change in fit at each step (AIC, BIC, SSBIC), with models showing large decreases from the 2 to 3 class model (>100) compared with the decrease between the 3 and 4 class models or the 4 and 5 class model (<100). Similar results were evident in the relative fit indicators, with the VLMR and adjusted LMR likelihood ratio tests indicating strong significant differences (better fit) from the 2 to 3 class solution ($p < .001$). Although the likelihood ratio tests were still significant for the 3 to 4 class model and the 4 to 5 class model, this effect was weak ($p = .03$). Regarding the appropriateness of the classification, the entropy level for the 3-class model was relatively high (.87) as were the average posterior class probabilities (0.88–0.95). Additionally, examining the 4 and 5 class models indicated that very small groups (<50) were emerging in these solutions, suggesting that the 3-class model was the best fit to the data.

The probabilities, which refer to the probability of the teacher identifying a specific behavior problem, are outlined in Table 2. Class 1, was labelled the normative class, consisted of 68.3% ($n = 917$) of the sample, and included individuals with very low probabilities of being identified by their teacher as having any behavior problem. Class 2 was labelled the externalizing class comprised of 20.3% ($n = 273$) and consisted of individuals with a high probability of being identified as having hyperactive and aggressive behavioral problems. Finally, 11.3% ($n = 152$) were categorized into Class 3, labelled the internalizing class, which comprised of individuals with high levels of anxiety related behavior problems.

Parent rated behavioral problems

Table 1 illustrates the model building process for parent-rated behavioral problems. The 4-class solution was selected as the best fitting model as it was interpreted to provide the most parsimonious description of the data. This was indicated by the change in fit at each step (AIC, BIC, SSBIC), with models showing large decreases from the 3 to 4 class model (>100) compared with the decrease between the 4 and 5 class model (<100). Similar results were evident in the relative fit indicators, with the VLMR and adjusted LMR likelihood ratio tests indicating strong significant differences in fit from the 3 to 4 class solution ($p < .001$), and a non-significant change from the 4 to 5 class model. Regarding the appropriateness of the classification, the entropy level for the 3-class model was moderate (.69) although the average latent class probabilities were high (.81-.87)². Together these results suggest that a 4-class model is the best solution based on the fit indices and interpretation of the class indicator scores.

The probabilities are outlined for each of the 4 latent classes in Table 2. Class 1, the normative class, consisted of 36.8% ($n = 494$) of the sample, and included individuals with very low probabilities of being identified by their parent as having any behavior problem. Class 2, the externalizing class comprised of 28.5% ($n = 382$) of the sample and consisted of individuals with a high probability of being identified as having hyperactive and aggressive behavioral problems. Class 3, the internalizing class comprised of 23.7% ($n = 318$) of the sample and consisted of individuals with a high probability of being identified as having hyperactive and aggressive behavioral problems. Finally, 11% ($n = 148$) of the sample were categorized into Class 4, the internalizing class, which comprised of individuals with high levels of anxiety related behavior problems.

² It should be noted that entropy levels across all the models for parent-rated behavior problems were low in comparison to teacher-rated behaviour problems. This is likely due to greater nuance in parents' assessments of children, and therefore, reductions in discrimination of classes. Research suggests that entropy can be an unreliable indicator of fit (Tein, Coxé, & Cham, 2013), and should not be used as the only criteria for judging model fit.

Predictive Models of Risky Health Behavior in Adulthood

Predicting Smoking and from Parent and Teacher Ratings

Smoking was relatively common, with a quarter ($n = 370$, 27.7%) of the sample currently smoking, and a quarter previously being a regular smoker ($n = 334$, 25%). Gender was not found to be a significant predictor of smoking, although education was, with those having higher levels of education being more likely to be a current smoker (Odds ratio = 2.61, $p < .001$, 95% CI[1.99 – 3.43]), and more likely to be a previous smoker (Odds ratio = 1.38, $p = .02$, 95% CI[1.05 – 1.82]). Controlling for covariates, overall tests of model effects indicated that teacher ratings of behavior ($\chi^2(2) = 14.90$, $p < .01$) significantly predicted adulthood history of smoking although parents ratings of behavior did not ($\chi^2(3) = 7.82$, $p = .25$). However, results show that teacher ratings and parent ratings significantly and independently predicted class differences (see Table 3 for full model information). Specifically, children rated by teachers as belonging to the externalizing class were more likely to be current smokers than non-smokers compared to those in the normative class (Odds ratio = 2.06, $p < .001$, 95% CI[1.42 – 2.99]), and children belonging to the internalizing class were 56% less likely and children in the normative class 51% less likely to be current smokers than non-smokers compared to those in the externalizing class (Odds ratio = .44 and .49, $p < .001$, 95% CI[.26 – .75]). Furthermore, children rated by parents as belonging to the internalizing class were less likely to be previous smokers than non-smokers compared to those in the externalizing class (Odds ratio = .62, $p < .001$, 95% CI[.47 – .94]).

Predicting Frequency of Alcohol Consumption from Parent and Teacher Ratings

The mean levels of alcohol consumption were relatively high and dispersed around the mid-point of the scale ($M = 3.75$, $SD = 1.26$). Specifically, 4.9% had either never or currently do not drink, 14.7% only drink on special occasions, 14.8% drink less than once a week, 38.2% drink on weekends, 20% drink most days and 7% drink every day of the week.

Both gender and education were found to be significant predictors of drinking, with females having significantly lower levels of alcohol consumption than males ($\beta = -.21, p < .001$), and those with greater education having significantly lower alcohol consumption ($\beta = -.14, p < .001$) (see Table 4 for full model information). Controlling for covariates, results suggest that contrary to the hypotheses, children rated by their parents as belonging to the externalizing class had significantly lower levels of alcohol consumption than those belonging to the normative class ($\beta = -.10, p < .01$). There were no other significant differences between the classes evident. In order to account for this unexpected finding, interaction effects between parent-rated behavioral problems and the covariates were investigated. It was found that the significant effect of externalizing was being driven by the female participants, for whom those in the normative class had significantly higher levels of alcohol consumption than those in the externalizing class ($M_{Norm} = 3.92$ in comparison to $M_{Ext} = 3.21$). However, for men, no such significant differences emerged ($M_{Norm} = 4.05$ in comparison to $M_{Ext} = 3.95$).

Risky Health Behavior and Agreement in Ratings

The full classification overlaps between informants is illustrated in Table 5. These categories were further defined in order to capture agreement and disagreement between raters. Overall, nearly half of the sample were categorized as agreeing in their ratings (629, 47.7%), this was broken down into the following three groups; (1) both teacher and parent rated the child as normative (388, 28.9%), (2) teachers rated child as externalizing and parents as either externalizing or mixed (171, 12.7%), and (3) teachers rated child as internalizing and parents as either internalizing or mixed (81, 6.0%) children. The other half of the sample disagreed in their ratings which was also broken down into three groups; (1) teachers rated the child as normative and parents believed that the child had any behavior problems (551, 41.1%), (2) parents rated the child as normative and teachers rated the child

as having any behavior problem (113; 8.4%), and finally teachers and parents disagreed on the behavioral syndrome of the child (externalizing or internalizing; 38, 2.8%).

In order to test whether agreement in ratings predicted smoking behaviors in adulthood, a chi-square analysis was conducted. Overall, smoking history was found to differ significantly by agreement across raters ($\chi^2(10) = 26.01, p = .004$). Post-hoc analyses indicate that children who were consistently rated by both teachers and parents as belonging to the normative class and children who were rated by their teachers as normative, but by parents as having any behavioral problem, were significantly more likely to have never smoked than those who were rated as by teachers and parents as belonging to the externalizing class. Furthermore, those who were rated as consistently belonging to the externalizing class were significantly more likely to be current smokers than those in the parent only rated behavioral problem group. There were no differences across the agreement groups in percentage of ex-smokers. See table 6 for full results.

Finally, in order to test whether agreement in ratings predicted alcohol consumption in adulthood, an ANOVA was conducted. No significant mean level differences across the categories were found (see Table 5).

Discussion

The aim of the current study was to examine whether teacher and parent ratings of childhood behavioral problems predicted risky health behaviors in much later adulthood (35 years later) in similar ways. Using person-centred analyses it was found that both parents and teachers identified children who had a tendency to engage in externalizing behaviors (characterized by high levels of disobedience, lying, bullying others, lacking concentration) as compared to those who tend to engaged in internalizing behaviors (characterized by high levels of the child being solitary, not liked by others, and irritable). Unlike previous studies, this research also found that parents identify another group of children who engage in both externalizing and internalizing behaviors (labelled the mixed class). This result may indicate

that parents have a more nuanced understanding of their child as they are privy to behavior across contexts, and therefore are more readily able to identify obscure issues the child may have. Indeed, research undertaken by both clinicians and parents themselves suggests that parents tend to be more accurate in assessments that concern internalizing disorders, which are often hidden, whereas teachers tend to be more accurate in assessing externalizing behavior (Loeber, Green, & Lahey, 1990; Phares, 1997; Smith, 2007).

Following previous research, it was found that children identified by their teachers as externalizing tended to be more likely to smoke in adulthood than those identified as having no behavioral problems (normative), or those exhibiting internalizing behavioral problems. Additionally, those who were identified by their parents as internalizing in childhood were less likely to be ex-smokers than those identified by parents as externalizing. These results indicate that both teacher and parent reports of childhood behavior have distinct properties in the prediction of smoking in adulthood. Furthermore, differences were also found across informant agreement categories, indicating that where a child is consistently identified by more than one informant as externalizing, they have a higher likelihood of being a current smoker than if they are consistently rated as normative, or if only parents identify a behavioral problem. This supports the notion that multiple informants offer unique and distinctly important perspectives on a child's behavior, and extends previous findings by showing the usefulness of multi-faceted measures of behavior subsists for many years following assessment.

Similar results regarding teachers reports of externalizing behavior and its implications for adulthood smoking were found by von Strumm et al. (2011) utilizing the larger cohort of the Aberdeen Children of the 1950s study. However, unlike the results of von Strumm et al. (2011), where hyperactivity was related to an increased likelihood of heavy drinking and emotional problems were related to a decreased likelihood of heavy drinking for

men, in this study no evidence was found for increased risk of alcohol consumption on the basis of childhood behavior. In fact, when controlling for the effect of gender, the opposite was found to be true, with those who did not exhibit behavioral problems (as rated by parents) being more likely to drink than those who were classified as engaging in externalizing or mixed behaviors. Although intensive examinations of gender effects were outside the scope of the current study, it may be the case that gender has a more substantive relationship with childhood behavioral problems in the prediction of alcohol consumption during adulthood that warrants further investigation. Indeed, Englund and colleagues (2008) found that externalizing at 9 years old was one of the only long-term predictors of heavy alcohol use (beyond alcohol abuse in adolescence) at age 28 for males, but not females. Yet our follow-up investigations show that the effects were driven by females in the sample, with women who were classified as normative in childhood actually having the highest levels of alcohol abuse. Future research should seek to examine and explicate these effects in depth.

While this study has a number of strengths including a large sample that was followed from early childhood until middle adulthood with ratings of behavior from multiple informants, it is also not without its limitations. Firstly, there was a very large gap between data collections, meaning that factors influencing risky health behaviors at different developmental periods cannot be assessed. Secondly, LCA models assume that patterns of indicators reflect underlying subpopulations, meaning that individuals do not fall perfectly into the classes, and as such latent classes should be seen as descriptive rather than definitive. Furthermore, although overlapping, the teacher and parent behavioral clusters were not the exactly the same in content (or ratings), rather these represent different perceptions of the child's behavioral patterns. It is worth noting that these measurement differences across informants are not a source of bias, but actually extend our knowledge concerning the underlying behavioral syndromes as rated by multiple sources. Indeed, regardless of the

limitations of this research, the longitudinal, multi-informant design of the study enables credible inferences concerning the associations between childhood behavioral disturbance and long-term adult outcomes.

For many individuals' childhood behavior problems do not result in serious negative consequences in later life. Yet it does seem that behavioral issues in early life can indicate an elevated propensity to engage in risky health behaviors in adulthood, with a growing body of literature showing the effects of externalizing on smoking. These findings draw attention to the importance of developing interventions for children exhibiting such behaviors, as well as identifying the precursors of the behaviors themselves. A promising area of investigation suggests that impulsivity, low behavioral self-control, and disinhibition are key factors that could be targeted, although more research is needed in this area (Jackson, Henriksen, Dickinson, Messer, & Robertson, 1998; Tarter, Kirisci, Habeych, Reynolds, & Vanyukov, 2004). Knowing how to identify and intervene with children who might be at high risk for early initiation into risky and addictive behaviors can mitigate a host of negative long-term consequences. The results of this study add to the growing body of knowledge concerning the long-term effects of childhood behavioral problems on risky health outcomes in adulthood, and further suggests that it is important to consider additive information from multiple informants when examining these relationships.

Statement 1: Role of Funding Sources

No funding sources were accessed for this publication

Statement 2: Contributors

The sole author completed the entire manuscript.

Statement 3: Conflict of Interest

The author declares no conflict of interest.

Statement 4: Acknowledgements (optional)

Data used for this manuscript come from the Aberdeen Children of the 1950s study (ACONF), the thanks go to the steering committee for granting access to the anonymized data set.

ACCEPTED MANUSCRIPT

References

- Achenbach, T. M. (1978). The child behavior profile: An empirically based system for assessing children's behavioral problems and competencies. *International Journal of Mental Health*, 7(3-4), 24–42. Retrieved from <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L9126409>
- Achenbach, T. M., & Edelbrock, C. S. (1978). The classification of child psychopathology: A review and analysis of empirical efforts. *Psychological Bulletin*, 85(6), 1275–1301. <http://doi.org/10.1037/0033-2909.85.6.1275>
- Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin*, 101(2), 213–232. <http://doi.org/10.1037/0033-2909.101.2.213>
- Althoff, R. R., Verhulst, F. C., Rettew, D. C., Hudziak, J. J., & Van Der Ende, J. (2010). Adult outcomes of childhood dysregulation: A 14-year follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 49(11), 1105–1116.e1. <http://doi.org/10.1016/j.jaac.2010.08.006>
- Batty, G. D., Morton, S., Campbell, D., Clark, H., Davey Smith, G., Hall, M., ... Leon, D. A. (2004). The Aberdeen Children of the 1950s cohort study: background, methods and follow-up information on a new resource for the study of life course and intergenerational influences on health. *Paediatric and Perinatal Epidemiology*, 18(3), 221–239.
- Campbell, S. B., Shaw, D. S., & Gilliom, M. (2000). Early externalizing behavior problems: Toddlers and preschoolers at risk for later maladjustment. *Development and Psychopathology*, 12(3), 467–488. <http://doi.org/10.1017/S0954579400003114>
- Caspi, A., Elder, G. H., & Bem, D. J. (1988). Moving away from the world: Life-course patterns of shy children. *Developmental Psychology*, 24(6), 824–831. <http://doi.org/10.1037/0012-1649.24.6.824>
- Clark, C., Rodgers, B., Caldwell, T., Power, C., & Stansfeld, S. (2007). Childhood and Adulthood Psychological Ill Health as Predictors of Midlife Affective and Anxiety Disorders. *Archives of General Psychiatry*, 64(6), 668. <http://doi.org/10.1001/archpsyc.64.6.668>
- Davé, S., Nazareth, I., Senior, R., & Sherr, L. (2008). A comparison of father and mother report of child behaviour on the strengths and difficulties questionnaire. *Child Psychiatry and Human Development*, 39(4), 399–413. <http://doi.org/10.1007/s10578-008-0097-6>
- De Los Reyes, A., & Kazdin, A. E. (2005). Informant Discrepancies in the Assessment of Childhood Psychopathology: A Critical Review, Theoretical Framework, and Recommendations for Further Study. *Psychological Bulletin*, 131(4), 483–509. <http://doi.org/10.1037/0033-2909.131.4.483>
- Dwyer, S. B., Nicholson, J. M., & Battistutta, D. (2006). Parent and teacher identification of children at risk of developing internalizing or externalizing mental health problems: A comparison of screening methods. *Prevention Science*, 7(4), 343–357. <http://doi.org/10.1007/s11211-006-0026-5>
- Englund, M. M., Egeland, B., Oliva, E. M., & Collins, W. A. (2008). Childhood and adolescent predictors of heavy drinking and alcohol use disorders in early adulthood: A longitudinal developmental analysis. *Addiction*, 103(SUPPL. 1), 23–35. <http://doi.org/10.1111/j.1360-0443.2008.02174.x>
- Fergusson, D. M., Horwood, L. J., & Ridder, E. M. (2005). Show me the child at seven: The consequences of conduct problems in childhood for psychosocial functioning in

- adulthood. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 46(8), 837–849. <http://doi.org/10.1111/j.1469-7610.2004.00387.x>
- Finch, W. H., & Bronk, K. C. (2011). Conducting confirmatory latent class analysis using Mplus. *Structural Equation Modeling*, 18(1), 132–151. <http://doi.org/10.1080/10705511.2011.532732>
- Hinshaw, S. P., Han, S. S., Erhardt, D., & Huber, A. (1992). Internalizing and Externalizing Behavior Problems in Preschool Children: Correspondence Among Parent and Teacher Ratings and Behavior Observations. *Journal of Clinical Child Psychology*, 21(2), 143–150. http://doi.org/10.1207/s15374424jccp2102_6
- Jackson, C., Henriksen, L., Dickinson, D., Messer, L., & Robertson, S. B. (1998). A Longitudinal Study Predicting Patterns of Cigarette Smoking in Late Childhood. *Health Education & Behavior*, 25(4), 436–447. <http://doi.org/10.1177/109019819802500403>
- Jokela, M., Ferrie, J., & Kivimäki, M. (2009). Childhood Problem Behaviors and Death by Midlife: The British National Child Development Study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48(1), 19–24. <http://doi.org/10.1097/CHI.0b013e31818b1c76>
- King, S. M., Iacono, W. G., & McGue, M. (2004). Childhood externalizing and internalizing psychopathology in the prediction of early substance use. *Addiction*, 99(12), 1548–1559. <http://doi.org/10.1111/j.1360-0443.2004.00893.x>
- Kolko, D. J., & Kazdin, A. E. (1993). Emotional/Behavioral Problems in Clinic and Nonclinic Children: Correspondence Among Child, Parent and Teacher Reports. *Journal of Child Psychology and Psychiatry*, 34(6), 991–1006. <http://doi.org/10.1111/j.1469-7610.1993.tb01103.x>
- Lanza, S. T., Flaherty, B. P., & Collins, L. M. (2003). *Latent class and latent transition analysis. Research Methods in Psychology Volume 2 of Handbook of Psychology*. <http://doi.org/10.1002/9780470567333>
- Leon, D. A., Lawlor, D. A., Clark, H., & Macintyre, S. (2006). Cohort Profile: The Aberdeen Children of the 1950s Study. *International Journal of Epidemiology*, 35(3), 549–552. <http://doi.org/10.1093/ije/dyi319>
- Loeber, R., Green, S., & Lahey, B. (1990). Mental Health Professionals' Perception of the Utility of Children, Mothers, and Teachers as Informants on Childhood Psychopathology. *Journal of Clinical Child & Adolescent Psychology*, 19(2), 136–143. http://doi.org/10.1207/s15374424jccp1902_5
- McLeod, J. D., & Kaiser, K. (2004). Childhood emotional and behavioral problems and educational attainment. *American Soc*, 69, 636–658.
- Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation Study. *Structural Equation Modeling: A Multidisciplinary Journal*, 14(4), 535–569. <http://doi.org/10.1080/10705510701575396>
- Oberski, D. L. (2016). Beyond the number of classes: separating substantive from non-substantive dependence in latent class analysis. *Advances in Data Analysis and Classification*, 10(2), 171–182. <http://doi.org/10.1007/s11634-015-0211-0>
- Phares, V. (1997). Accuracy of informants: Do parents think that mother knows best? *Journal of Abnormal Child Psychology*, 25(2), 165–171. <http://doi.org/10.1023/A:1025787613984>
- Pine, D. S., Cohen, P., Gurley, D., Brook, J., & Ma, Y. (1998). The Risk for Early-Adulthood Anxiety and Depressive Disorders in Adolescents With Anxiety and Depressive Disorders. *Archives of General Psychiatry*, 55(1), 56. <http://doi.org/10.1001/archpsyc.55.1.56>
- Pulkkinen, L., & Pitkanen, T. (1993). Continuities in Aggressive Behavior From Childhood

- to Adulthood, 19, 249–263.
- Rutter, M. (1967). A Children's Behaviour Questionnaire for Completion By Teachers: Preliminary Findings. *Journal of Child Psychology and Psychiatry*, 8(1), 1–11. <http://doi.org/10.1111/j.1469-7610.1967.tb02175.x>
- Smith, S. R. (2007). Making Sense of Multiple Informants in Child and Adolescent Psychopathology. *Journal of Psychoeducational Assessment*, 25(2), 139–149. <http://doi.org/10.1177/0734282906296233>
- Sourander, A., Jensen, P., Davies, M., Niemelä, S., Elonheimo, H., Ristkari, T., ... Almqvist, F. (2007). Who is at greatest risk of adverse long-term outcomes? The Finnish From a Boy to a Man study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46(9), 1148–61. <http://doi.org/10.1097/chi.0b013e31809861e9>
- Stanger, C., & Lewis, M. (1993). Agreement Among Parents, Teachers, and Children on Internalizing and Externalizing Behavior Problems. *Journal of Clinical Child Psychology*, 22(1), 107–116. http://doi.org/10.1207/s15374424jccp2201_11
- Tarter, R. E., Kirisci, L., Habeych, M., Reynolds, M., & Vanyukov, M. (2004). Neurobehavior disinhibition in childhood predisposes boys to substance use disorder by young adulthood: Direct and mediated etiologic pathways. *Drug and Alcohol Dependence*, 73(2), 121–132. <http://doi.org/10.1016/j.drugalcdep.2003.07.004>
- Tein, J-Y, Coxe, S., & Cham, H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modelling*, 20 (4), 640-657. <http://doi.org/10.1080/10705511.2013.824781>
- Timmermans, M., van Lier, P. A. C., & Koot, H. M. (2009). Pathways of behavior problems from childhood to late adolescence leading to delinquency and academic underachievement. *Journal of Clinical Child and Adolescent Psychology*, 38(5), 630–638. <http://doi.org/10.1080/15374410903103502>
- Verhulst, F. C., & van der Ende, J. (1992). Agreement between parents reports and adolescent self reports of problem behavior. *Journal Of Child Psychology And Psychiatry And Allied Disciplines*, 33(6), 1011–1023.
- Von Stumm, S., Deary, I. J., Kivimäki, M., Jokela, M., Clark, H., & Batty, G. D. (2011). Childhood behavior problems and health at midlife: 35-year follow-up of a Scottish birth cohort. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 52(9), 992–1001. <http://doi.org/10.1111/j.1469-7610.2011.02373.x>

Table 1. *Fit Indices for Latent Class Models*

		Fit Indices				Likelihood ratio tests		Entropy	Posterior probabilities
		<u>LL</u>	<u>BIC</u>	<u>SSBIC</u>	<u>AIC</u>	<u>VLMR</u>	<u>Adjusted LMR</u>		
Teacher Models	2 classes	-6580.03	13412.12	13300.94	13230.05	1880.10***	1865.71***	.87	.94, .97
	3 classes	-6335.41	13052.51	12884.15	12776.81	489.24**	485.50**	.87	.93, .96, .88
	4 classes	-6234.67	12980.67	12755.14	12611.34	201.47*	199.93*	.86	.88, .87, .90, .95
	5 classes	-6163.49	12967.95	12685.24	12504.98	142.36*	141.27*	.87	.91, .91, .90, .88, .94
Parent Models	2 classes	-10945.81	22143.70	22032.52	21961.63	1415.22***	1404.39***	.74	.90, .93
	3 classes	-10812.59	21731.17	21838.52	21731.17	266.46**	264.42**	.70	.89, .81, .90
	4 classes	-10687.23	21885.80	21660.27	21516.47	250.71**	248.78**	.69	.87, .81, .81, .85
	5 classes	-10620.65	21882.26	21599.55	21419.29	131.18	132.16	.72	.76, .89, .84, .80, .79

Note: * $p < .05$, ** $p < .01$, *** $p < .01$

Table 2. Prevalence of behavioral problems and probabilities of class membership by teachers and parents

	Teacher				Parent				
	Prevalence	Normative	Externalizing	Internalizing	Prevalence	Normative	Externalizing	Internalizing	Mixed
Worries	15%	.03	.64	.01	38%	.18	.48	.35	.74
Lacks Concentration	19%	.05	.74	.05	26%	.05	.47	.11	.66
Fearful	10%	.01	.12	.02	18%	.03	.05	.08	.17
Fidget	8%	.02	.15	.11	5%	.05	.10	.09	.22
Restless	18%	.15	.31	.21	43%	.22	.31	.32	.47
Bites Nails	12%	.12	.63	.32	35%	.09	.30	.25	.57
Solitary	7%	.05	.28	.81	34%	.15	.27	.78	.87
Fight	7%	.03	.23	.77	15%	.05	.15	.64	.83
Tearful	4%	.00	.16	.26	6%	.02	.13	.16	.60
Disobedient	5%	.01	.30	.02	10%	.07	.51	.31	.75
Not liked	19%	.03	.08	.25	30%	.15	.28	.39	.52
Fussy	9%	.01	.30	.10	38%	.00	.04	.05	.22
Irritable	24%	.05	.19	.34	25%	.20	.32	.49	.58
Sucks Thumb	16%	.01	.23	.02	32%	.01	.32	.04	.58
Lies	6%	.02	.40	.00	29%	.07	.72	.19	.84
Bullies Others	5%	.00	.44	.04	17%	.03	.23	.17	.53
Has a tic	4%	.00	.20	.01	10%	.01	.14	.00	.44
Total n (%)		917 (68.3%)	273 (20.3%)	152 (11.3%)		494 (36.8%)	382 (28.4%)	318 (23.7%)	148 (11%)

Table 3. Multinomial logistic regressions on history of smoking including Odds ratios and 95% confidence intervals in parentheses

	Model 1 Teacher-Ratings		Model 2 Parent-Ratings		Model 3 Teacher and Parent ratings	
	Reference Normative	Reference Externalizing	Reference Normative	Reference Externalizing	Reference Normative	Reference Externalizing
Current Smoker						
Gender	1.05 [.80-1.38]	1.05 [.77- 1.32]	1.00 [.77- 1.32]	1.00 [.77- 1.32]	1.07 [.81- 1.40]	1.07 [.81- 1.40]
Education	2.59*** [1.97-3.42]	2.61*** [1.99-3.43]	2.61*** [1.08 - 1.87]	2.61*** [1.08 -1.87]	2.61*** [1.99-3.43]	2.61*** [1.99-3.43]
Teacher – Externalizing	2.17*** [1.52-3.10]	-	-	-	2.06*** [1.42-2.99]	-
Teacher – Internalizing	.88 [.58 – 1.33]	.41*** [.25-.67]	-	-	.91 [.60-1.39]	.44*** [.26-.75]
Teacher - Normative	-	.46*** [.32-.66]	-	-	-	.49*** [.33-.71]
Parent – Externalizing	-	-	1.07 [.94 – 1.83]	-	1.07 [.75-1.52]	-
Parent – Internalizing	-	-	.79 [.55 – 1.11]	.59 [.41-.86]	.78 [.55-1.12]	.73 [.49-1.08]
Parent – Mixed	-	-	1.05 [.65 – 1.68]	.80** [.49-1.30]	.92 [.57-1.49]	.86 [.52-1.41]
Parent - Normative	-	-	-	.76 [.55-1.06]	-	.93 [.66-1.33]
Ex- Smoker						
Gender	.81 [.62-1.06]	.81 [.62- 1.06]	.81 [.62- 1.06]	.81 [.62- 1.06]	.83 [.63-1.05]	.81 [.62- 1.06]
Education	1.43* [1.08 - 1.87]	1.43* [1.08 -1.87]	1.39* [1.05 - 1.82]	1.39* [1.05 -1.82]	1.38* [1.05 - 1.82]	1.43* [1.08 -1.87]
Teacher – Externalizing	1.46* [1.00-2.13]	-	-	-	1.34 [.90 – 1.99]	-
Teacher – Internalizing	.83 [.54-1.28]	.57* [.34-.96]	-	-	.87 [.57-1.34]	.65 [.38-1.13]

Teacher - Normative	-	.68* [.47-1.00]	-	-	-	.75 [.50-1.11]
Parent – Externalizing	-	-	1.31 [.94 – 1.83]	-	1.12 [.79-1.59]	-
Parent – Internalizing	-	-	.78 [.55 – 1.11]	.58** [.39-.85]	.70 [.49-1.01]	.62* [.42-.94]
Parent – Mixed	-	-	1.05 [.65 – 1.68]	.92 [.57-1.48]	1.07 [.67-1.71]	.95 [.59-1.56]
Parent - Normative	-	-	-	.82 [.59-1.16]	-	.89 [.63-1.27]

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Table 4. *Multivariate linear regressions on alcohol consumption*

	Model 1 Teacher-Ratings				Model 2 Parent-Ratings				Model 3 Teacher and Parent-Ratings			
	Reference Normative		Reference Externalizing		Reference Normative		Reference Externalizing		Reference Normative		Reference Externalizing	
	β	$\underline{SE}$	β	$\underline{SE}$	β	$\underline{SE}$	β	$\underline{SE}$	β	$\underline{SE}$	β	$\underline{SE}$
Gender	-.21**	.07	-.21**	.07	-.21**	.07	-.21**	.07	-.21**	.07	-.21**	.07
Education	-.15**	.07	-.15**	.07	-.14**	.07	-.14**	.07	-.14**	.07	-.14**	.07
Teacher – Externalizing	-.03	.09	-	-	-	-	-	-	-.01	.10	-	-
Teacher – Internalizing	.01	.11	.04	.13	-	-	-	-	.01	.11	.01	.13
Teacher - Normative	-	-	.03	.09	-	-	-	-	-	-	.00	.10
Parent – Externalizing	-	-	-	-	-.10**	.09	-	-	-.10**	.09	-	-
Parent – Internalizing	-	-	-	-	-.05	.09	-.05	.10	-.05	.09	.05	.10
Parent – Mixed	-	-	-	-	-.05	.12	-.02	.12	-.05	.12	.02	.07
Parent - Normative	-	-	-	-	-	-	.11**	.09	-	-	.11**	.09

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5. Agreement/disagreement in ratings of class membership by parents and teachers (% of overall sample)

Parent Ratings	Teacher Ratings			
	Normative	Externalizing	Internalizing	Total
Normative	388 (28.9%)	40 (3.0%)	73 (5.4%)	501
Externalizing	225 (16.8%)	135 (10.1%)	14 (1.0%)	374
Internalizing	248 (18.5%)	24 (1.8%)	60 (4.5%)	332
Mixed	78 (5.8%)	36 (2.7%)	21 (1.6%)	135
Total	939	235	168	1342

Table 6. Differences in proportions and means across groups of informant agreement/disagreement

	Agree Normative	Agree Externalizing	Agree Internalizing	Disagree Parent rated problem	Disagree Teacher rated problem	Disagree Behavioral symptoms
Never smoked	184 _a (47.7%)	58 _b (33.9%)	41 (50.6%)	281 _a (51.4%)	54 (47.8%)	13 (35.1%)
Ex-Smoker	104 (26.9%)	49 (28.7%)	19 (23.5%)	132 (24.1%)	22 (19.5%)	8 (21.6%)
Current Smoker	98 (25.4%)	64 _b (37.4%)	21 (25.9%)	134 _a (24.5%)	37 (32.7%)	16 (43.2%)
Alcohol Consumption	3.80 (1.25)	3.70 (1.20)	3.72 (1.19)	3.68 (1.28)	3.86 (1.23)	3.72 (1.27)
Total	388 (28.9%)	171 (12%)	81 (6%)	551 (41.1%)	113 (8.4%)	38 (2.8%)

Note: *a* = significantly higher proportion than other groups *b* = significantly lower proportion than other groups

Highlights

- Teacher ratings of childhood externalizing predict higher likelihood of smoking.
- Parent ratings of childhood internalizing predict a lower likelihood of being an ex-smoker.
- Consistency in informant ratings of childhood externalizing problems increases the likelihood of both currently smoking and being an ex-smoker.