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Title: Latent Class Analysis of Youth Behavioral and Emotional risk: Associations with Demographic Characteristics

Authors and Affiliations:
Jihye Kim, Georgia State University
Randy W. Kamphaus, Georgia State University

Abstract Body

Background:

The Behavioral and Emotional Screening System – Student Form (BESS; Kamphaus & Reynolds, 2007) is one of the behavioral and emotional risk screening tests that is in more widespread use in U.S. schools systems from preschool through high school. The reliability and validity of score inferences for the BESS has been studied extensively with numerous studies being published in the last five years. The conceptualization of the latent construct underlying the BESS, however, has its roots in the work of Edelbrock & Achenbach (1980), Peterson (1961), Quay (1987), and other seminal investigations of the structure of child psychopathology.

Much of this recent research has been focused on evaluating the internal structure of the BESS using a variety of factor analytic methods (Dever, Mays, Dowdy, & Kamphaus, 2012; Dowdy, Chin, Twyford, & Dever, 2011). Identifying the heterogeneity of behavioral and emotional risk subgroups has received far less attention. Thus, we made an attempt to identify behavioral and emotional latent traits of the BESS participants, rather than explore the factor structure of the instrument per se.

Purpose of Study:

The main purpose of this study was to better understand the structure of children's behavioral and emotional risk and the associations between group structure and demographic characteristics. In other words, we sought to reveal the heterogeneity or uniqueness of the adolescents screened with the BESS Student Form, and then classified them into number of classes holding similar latent features and demographic backgrounds.

Setting, Participants and Practice:

From 2007 to the present, the BESS Student Form has been used for screening in the Los Angeles United School District (LA), which was part of a research grant from the Institute of Education Sciences (Grant # R324B060005). All middle and high schools of the Bibb County Public Schools, an urban schools system surrounding Macon, Georgia, has also participated in BESS screening from 2009 to the present.

The BESS Student Form (Kamphaus & Reynolds, 2007; BESS) is made up of 30-items with four-point rating scales (Never, Sometimes, Often, Almost always) to measure youth levels of risk for behavioral and emotional problems. The items were created to reflect four latent factors: Personal adjustment (positively worded items), Internalizing problems, Inattention/Hyperactivity problems, and School problems (Dowdy et. al., 2011). The BESS Student Form requires no informant training, can be completed in 5 min or less, and is available in both Spanish and English. The sum of the item raw scores is transformed to a linearly derivated total T score, where higher scores reflect more problems: T = 20–60 are classified as a "normal" level of risk, 61–70 an "elevated" level of risk, and scores of 71 or higher an "extremely elevated" level of risk. These classification labels of risk were determined by pre-publication Receiver Operator Characteristic Curve analyses, and according to the distance of the scores from the norming sample mean (Kamphaus & Reynolds, 2007). They are intended to assist practitioners with making decisions regarding which students may need additional assessment or services.

Research Design, Data Collection, and Analysis

For sample 1, high school students in grades 9 through 12 in three high schools in the Los Angles United School District reported on their behavioral and emotional risk in the 2011-2012 academic year (*N*=4,017). Of the total of 4,017 students, 45.5% were female. The grade level sample sizes were; 23% 9th grade, 22.8% 10th grade, 18.5% 11th grade, and 18.5% 12th grade. In total, about 88% obtained total T scores in the normal level of risk and 12% showed some level of risk (9% of elevated and 3% of extremely elevated level).

In Bibb County, 2,221 students in grade 9-12 participated in screening in 2012. Of the students screened in the 2011-2012 academic year, approximately 53% were female. With regard to grade level, 29% of the students screened were 9th graders, 26% were 10th graders, 23% were 11th graders, and 22% were 12th graders. In total, about 87% self-identified as having a normal level of risk, and 13% of the students screened were identified as exhibiting an elevated risk (9.6%) or extremely elevated risk (3.2%) for emotional and/or behavioral problems.

The primary analytic method was latent class analysis using Mplus 6.11(Muthen and Muthen, 1998), was employed in order to classify the heterogeneity of the BESS participants. The latent class analysis has been widely used to classify unobserved populations with similar characteristics in psychological research (Frick, Burn, & Kamphaus, 2009). It was proposed by Lazarsfeld (1950) and has been developed as a sophisticated research method by Goodman (1974). Additionally, follow-up multivariate analysis was conducted with latent class probabilities as dependent variables for three types of demographic information (gender, grade level, risk-level classification) as independent variables for finding out the significant effect of demographic information within each class.

Findings / Results:

As it is shown in table 1, when reviewing the results for latent class analyses for 2 to 6 classes, the four class solution was deemed optimal for both samples (LA and Bibb), based on considerations beyond merely indicators of model fit. As shown in the figures 1 and 2, four latent classes were distributed with clear patterns across items within the factor of personal adjustment: Class 1 had the lowest latent class probabilities, followed by classes 2 and 3. Class 4 showed the highest probabilities. Classes 5 and 6 were rejected because they produced no new information in that classes 5 and 6 had the same item profiles as classes 3 and 4; an absence of behavior problems accompanied by relative strengths in personal adjustment. Although classes 3 and 4 share a similar pattern of a lack of behavioral and emotional problems, they differ on the personal adjustment dimension where class 4 possesses more competencies than class 3.

For easy reference, the 30 items in figures 1 and 2 were sorted and clustered within four factors in the same order as the factors yielded in the Dowdy et.al. (2011) investigation: Personal adjustment, Inattention/hyperactivity, Internalizing problem, and School problems.

Insert Table 1, Figure 1, and Figure 2

The distinguishing classes were class 1 and class 2 in both the LA and Bibb samples. The class profile patterns were consistent, with gentle slope across all items within all four factors. Classes 3 and 4 showed high probabilities across items within the factor of personal adjustment, but very low probabilities on items relevant to inattention/hyperactivity, internalizing problems,

and school problems. In particular, latent class 2 was most informative cluster among four classes in both samples. Proportions of risk level (normal, elevated, extremely elevated) were distributed generally within class 2, while the proportions of these risk levels in classes 1, 3, and 4 showed were limited primarily to the normal level of risk (Figure 3).

Insert Figure 3

The multivariate analysis showed that there was a different distribution of demographic characteristics in class 2 between LA and Bibb, even though the class profile plots showed a similar pattern in both samples. The risk level by grade level was statistically significant in the LA sample (Table 2), indicating that 9th graders exhibited more elevated risk than the other three grade levels (Figure 4), $F\ (6, 3993) = 3.468,\ p = 0.002$, whereas there was little evidence of grade effect on risk level in the Bibb sample. Another difference in class 2 was revealed in the gender distribution between LA and Bibb: the proportion of girls in LA was 43.8%, which is almost even to that of boys (56.2%). On the other hand, the proportion of girls (60.5%) was much bigger than of boys (39.5%) in the Bibb sample (Figure 5).

Insert Table 2, Figure 4, and Figure 5

Conclusions:

We explored the uniqueness within subgroups of the BESS Student Form participants with the goal of providing a more comprehensive understanding of youth behavioral and emotional risk, using samples from different regions (LA and Bibb). In the latent class analysis with 4-class solution class 2 produced statistically significant findings with regard to students' demographic information. There was a significant interaction between student grade and risk level, indicating that younger students were more salient in exhibiting an elevated level of risk than older students. This finding, however, was only present for the LA sample. The gender proportions were also different between LA and Bibb in that girls predominated the high risk class 2 in Bibb, even though the item response patterns within classes were similar.

The central question and potential limitation of the study lies in these inconsistent findings between two samples within class 2. This result might be caused by heterogeneous and unknown demographic information, such as a dissimilar dispersion of race/ethnicity from these geographically distinct two regions. Another limitation to our understanding of these findings is that we examined the class membership based on only three demographics. For this reason, our future research plans include collecting more comprehensive student demographic information and exploring the undiscovered uniqueness within each class. This data collection is already underway in Los Angeles.

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1

Model fit iIndices in the latent class analyses from 2 classes to 6 classes solution

# of	LA				BIBB			
class	logL	BIC	Entropy	AIC	logL	BIC	Entropy	AIC
2	-108809.00	218971.08	0.86	217944.50	-50133.71	101495.85	0.87	100593.42
3	-106911.00	215854.47	0.83	214311.40	-49230.30	100307.01	0.84	98950.60
4	**-105998.00**	**214709.43**	**0.82**	**212649.90**	**-48798.04**	**100060.47**	**0.84**	**98250.08**
5	-105285.00	213964.16	0.80	211388.20	-48479.94	98742.86	0.84	97777.87
6	-104721.00	213517.27	0.81	210424.80	-48232.09	100164.54	0.83	97446.19