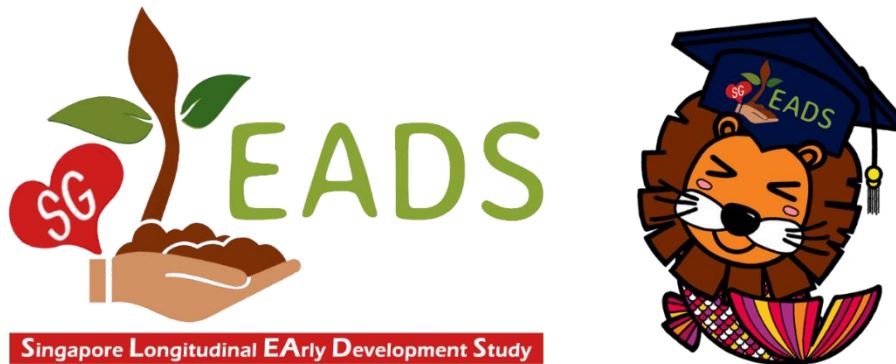


Singapore Longitudinal Early Development Study (SG LEADS)



Panel Survey Wave 2

Technical Report 6

Calculation of Behaviour Problems Index

Luxi Chen & Wei-Jun Jean Yeung

Centre of Family and Population Research
National University of Singapore

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This technical report documents the calculation of behaviour problems using the Behaviour Problems Index (BPI; Peterson & Zill, 1986) in the second wave of the Singapore Longitudinal EARly Development Study (SG LEADS) conducted in 2021. Our participants were a nationally-representative sample of children between 3 and 9 years in Singapore ($n = 3,968$).

The 30-item BPI was derived from the Achenbach Behaviour Problems Checklist (Achenbach & Edelbrock, 1981), and it has been used in many other panel studies, such as the National Longitudinal Surveys of Youth (NLSY) and the Panel Study of Income Dynamics (PSID) Child Development Supplement (CDS) in the United States, with satisfactory psychometric properties. This scale was also used in SG LEADS Wave I conducted in 2018-2019 to measure behaviour problems among 3- to 6-year-olds.

Behaviour problems are indicative of emotional and behavioural development. It can be categorized as (1) externalizing behaviour problems, characterized by an under-control of emotions, such as irritability, aggression and hyperactivity, and (2) internalizing behaviour problems, characterized by an over-control of emotions, such as withdrawal, dependency, anxiety and depression (Achenbach & Edelbrock, 1978; McCulloch, Wiggins, Joshi, & Sachdev, 2000).

1. Factor Loadings, Internal Consistencies, and Scoring Method

The primary caregiver rated the child's behaviours on the three-point Likert-type scale (1=often true, 2=sometimes true, 3=never true) with 30 items. Raw data contains 3,968 observations. Weighted data (for more details, see technical report 2 about sampling weights) was used for factor analysis ($N = 4,543$).

An exploratory factor analysis with principal component extraction and varimax rotation was performed to confirm the items for externalizing and internalizing behaviour problems subscales in the current sample in Wave II. As displayed in Table 1, the items grouped into two factors well. Three items were excluded from the final categorization. Item d "*cheats or tells lies*" and item i "*bullies or is cruel or mean to others*" were excluded due to their low factor loadings on both subscales (loadings < 0.4). Item bb "*hangs around with kids who get into trouble*" was also excluded because its factor loading was not consistent with its theoretical construct: it loaded on the internalizing behaviours subscale whilst theoretically speaking it is an externalizing behaviour problem. Finally, the Externalized Behaviour Problems subscale contains 14 items (Cronbach's $\alpha = .85$) and the Internalizing Behaviour Problems subscale contains 13 items (Cronbach's $\alpha = .83$), with good internal consistencies. The entire BPI exhibited an excellent internal reliability ($\alpha = 0.90$; 27 items).

Following the scoring method used in the PSID-CDS and SG LEADS Wave I, we summed the items in each subscale to indicate externalizing or internalizing behaviour problems using the following coding: *not true* = 0, *sometimes* = 1, and *often* = 2. Higher scores indicated more behaviour problems. The mean score of externalizing behaviour problems was 7.21, with a range from 0 to 26, and a standard deviation of 4.93; the mean score of internalized behaviour problems was 2.68, with a range from 0 to 24, and a standard deviation of 3.25. Externalizing and internalizing behaviour problems scores were highly correlated with each other ($r = .62$, $p < .001$).

Table 1. Factor Analysis results of BPI (Weighted Data; Weighted $N = 4543$)

For the next set of statements, decide whether they are not true, sometimes true, or often true, of (CHILD)'s behaviour. He/She...	Factor 1	Factor 2	Dimension
a. has sudden changes in mood or feeling.	.490	.225	EXT
f. argues too much.	.584	.138	EXT
g. has difficulty concentrating, cannot pay attention for long.	.472	.215	EXT
j. is disobedient.	.626	.081	EXT
k. does not seem to feel sorry after (he/she) misbehaves.	.506	.163	EXT
m. is impulsive, or acts without thinking.	.541	.296	EXT
q. is restless or overly active, cannot sit still.	.617	.146	EXT
r. is stubborn, sullen, or irritable.	.668	.199	EXT
s. has a very strong temper and loses it easily.	.668	.133	EXT
v. breaks things on purpose or deliberately destroys (his/her) own or another's things.	.447	.257	EXT
w. clings to adults.	.499	.151	EXT
x. cries too much.	.512	.148	EXT
y. demands a lot of attention.	.644	.124	EXT
z. is too dependent on others.	.508	.260	EXT
b. feels or complains that no one loves him/her.	.273	.444	INT
c. is rather high strung, tense and nervous.	.256	.565	INT
e. is too fearful or anxious.	.221	.566	INT
h. is easily confused, seems to be in a fog.	.298	.477	INT
l. has trouble getting along with other children.	.164	.511	INT
n. feels worthless or inferior.	.123	.619	INT
o. is not liked by other children.	.137	.561	INT
p. has a lot of difficulty getting (his/her) mind off certain thoughts.	.323	.508	INT
t. is unhappy, sad or depressed.	.317	.508	INT
u. is withdrawn, does not get involved with others.	.152	.596	INT
aa. feels others are out to get (him/her).	.279	.528	INT
cc. is secretive, keeps things to (himself/herself).	.119	.426	INT
dd. worries too much.	.103	.539	INT
d. cheats or tells lies. ^a	.379	.199	EXCLUDED
i. bullies or is cruel or mean to others. ^a	.371	.256	EXCLUDED
bb. hangs around with kids who get into trouble. ^b	.043	.601	EXCLUDED
Cronbach's α	0.85	0.83	0.90
N of items	14	13	27

Note. EXT=externalizing behaviours. INT=Internalizing behaviours. Value in bold indicated acceptable factor loading. ^a The item is excluded due to low factor loading (< .40) in both dimensions. ^b The item is excluded because its factor loading was inconsistent with its theoretical construct.

2. Age and Gender Differences in Behaviour Problems

The developmental trajectories of externalizing and internalizing behaviour problems among children aged 3 to 9 years were examined. We grouped 8-year-olds ($n = 592$) and 9-year-olds ($n = 91$) as the same age group due to the small sample size of the 9-year-olds. Analyses of variance (ANOVAs), 6 (age: 3, 4, 5, 6, 7, 8-9) x 2 (gender: boy vs. girl), were performed to examine the age and gender differences in behaviour problems. Child-level normalized weight in W2 was entered as the Weighted Least Squares (WLS) weight in ANOVA. Mean scores of externalizing and internalizing behaviour problems by age and gender are presented in Table 2.

2.1. Age and Gender Effects on Externalized Behaviour Problems

We observed a significant main effect of gender ($F(1, 3967) = 21.8, p < .001, \eta^2 = .005$) and a significant main effect of age ($F(5, 3967) = 7.13, p < .001, \eta^2 = .009$) on externalizing behaviours, but the interaction effect between age and gender ($F(5, 3967) = 0.27, p = .93, \eta^2 < .001$) were nonsignificant.

Boys displayed more externalizing behaviour problems than girls in the entire sample ($\Delta M = 0.73, p < .001, 95\% CI [0.42, 1.04]$).

In general, there was a decline in externalizing behaviour problems with age among 3- to 9-year-olds (see Figure 1a). Age differences were mainly observed between 3 and 6 years of age. In particular, all the older age groups between 4 and 9 years of age were reported to have fewer externalized behaviour problems compared to 3-year-olds, (ps were from $< .001$ to $.020$). Among the children aged 6 to 9 years old, externalized behaviour problems were comparable ($ps > .10$), and all these older age groups showed fewer externalized behaviour problems than 4- and 5-year-olds (ps were from $.008$ to $.019$).

2.2. Age and Gender Effects on Internalized Behaviour Problems

Only a significant main effect of age was found ($F(5, 3967) = 16.7, p < .001, \eta^2 = .021$) on internalized behaviour problems, but the main effect of gender ($F(1, 3967) = 0.12, p = .73, \eta^2 < .001$) and the interaction effect of age and gender ($F(5, 3967) = 0.75, p = .59, \eta^2 = .001$) were nonsignificant.

Boys and girls showed comparable internalizing behaviour problems in our sample ($\Delta M = 0.035, p = .73, 95\% CI [-0.17, 0.24]$).

As illustrated in Figure 1b, there was an increase of internalizing behaviour problems with age among 3- to 9-year-olds, in general. Three- and four-year-olds showed comparable internalized behaviour problems ($p = .20$). The frequency of internalized behaviour problems increased from 5 to 7 years of age, and all these age groups showed more internalized behaviour problems than 3- to 4-year-olds (ps were from $< .001$ to $.038$). Children between 7 and 9 years of age displayed comparable internalized behaviour problems ($p = .24$), and they were reported to have more internalized behaviour problems than all the younger groups (ps were from $< .001$ to $.035$).

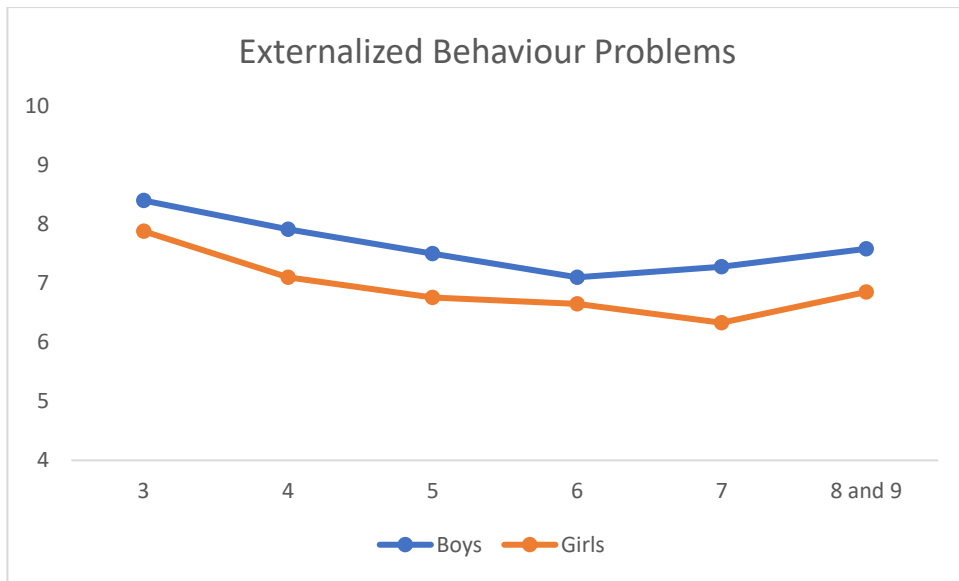
The decrease of externalizing symptoms and the increase of internalizing symptoms throughout the development was in line with previous research (e.g., Bongers et al., 2003; Shaw et al., 2005).

Table 2. Mean scores (standard deviations) of Externalizing and Internalizing Behaviour Problems by age and gender

		EXT	INT	N
3 Years	Boys	8.40 (5.06)	2.12 (3.17)	322
	Girls	7.88 (5.39)	1.86 (2.85)	284
	Total	8.17 (5.22)	2.01 (3.03)	606
4 Years	Boys	7.91 (5.79)	2.19 (3.27)	324
	Girls	7.10 (5.41)	2.25 (3.41)	379
	Total	7.49 (5.60)	2.22 (3.34)	703
5 Years	Boys	7.50 (5.30)	2.57 (3.40)	356
	Girls	6.76 (5.19)	2.59 (3.44)	333
	Total	7.15 (5.25)	2.58 (3.42)	689
6 Years	Boys	7.27 (5.25)	2.67 (3.44)	300
	Girls	6.39 (4.94)	2.85 (3.23)	354
	Total	6.82 (5.11)	2.76 (3.33)	654
7 Years	Boys	7.10 (5.34)	3.07 (3.54)	323
	Girls	6.65 (4.79)	3.20 (3.71)	310
	Total	6.89 (5.08)	3.13 (3.62)	633
8-9 Years	Boys	7.28 (5.17)	3.52 (3.79)	364
	Girls	6.33 (5.20)	3.17 (3.85)	319
	Total	6.85 (5.20)	3.36 (3.82)	683
Total	Boys	7.57 (5.33)	2.71 (3.49)	1989
	Girls	6.82 (5.18)	2.66 (3.46)	1979
	Total	7.21 (5.27)	2.68 (3.47)	3968

Note. EXT=externalizing behaviours. INT=Internalizing behaviours. Standard Deviations are presented in the parentheses

(A)



(B)

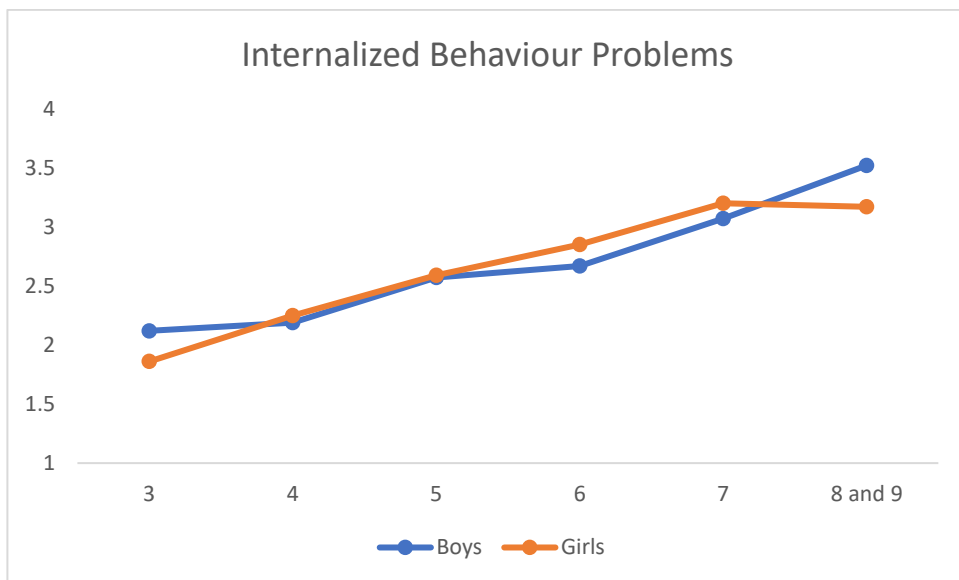


Figure 1. The developmental trajectory in (A) externalizing behaviour problems and (B) internalizing behaviour problems among 3- to 9-year-olds

3. Effects of Socioeconomic Status on Behaviour Problems

We examined whether child behaviour problems would be affected by socioeconomic status (SES). In this report, we selected housing type¹ as an indicator of family SES. About 85% of Singaporeans live in a government-subsidized and government-constructed standardized HDB (Housing Development Board) unit while the rest live in the private condominiums or landed properties. Based on housing type, SES was classified as Low (HDB 1- to-3-room), Middle (HDB 4-room), and High (HDB 5-room, Condominium and Landed property). Child-level normalized weight in W2 was entered as the Weighted Least Squares (WLS) weight in ANOVA. Mean scores of externalizing and internalizing behaviour problems by housing type are presented in Table 3.

ANOVAs yielded significant main effects of SES on both externalizing behaviour problems ($F(2, 3967) = 12.84, p < .001, \eta^2 = .006$) and internalizing behaviour problems ($F(2, 3967) = 47.3, p < .001, \eta^2 = .023$). As illustrated in Figures 2a and 2b, compared to children from Low- and Middle-SES families, children with High-SES background showed significantly fewer externalizing behaviour problems (ps were .010 and $<.001$, respectively) and fewer internalizing behaviour problems ($ps <.001$).

The effect of family SES on child behaviour problems aligned with the literature (e.g., Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Conger & Donnellan, 2007; Yeung et al., 2002).

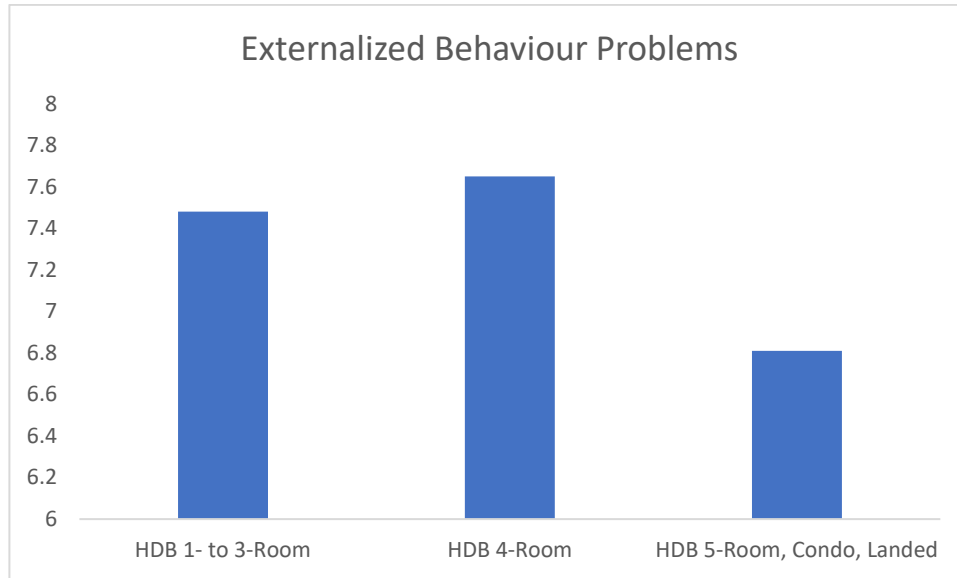
Table 3. Mean scores of Externalizing and Internalizing Behaviour Problems by housing type

	HDB 1-2 Room and 3-Room	HDB 4-Room	HDB 5-Room, Condominium, and Landed property	Total
EXT	7.48 (3.53)	7.65 (5.82)	6.81 (6.06)	7.21 (5.27)
INT	3.20 (2.56)	3.16 (4.13)	2.18 (3.49)	2.68 (3.47)
<i>N</i>	1345	1236	1387	3968

Note. EXT=externalizing behaviours. INT=Internalizing behaviours. Standard Deviations are presented in the parentheses.

¹ The median monthly household income by type of dwelling in 2018 was S\$2765 (US\$2402) for HDB 1- & 2-room flats; S\$6497 (US\$4799) for 3-room; S\$9306 (US\$6874) for 4-room; and S\$12716, S\$20593 and S\$27134 (US\$9392, US\$15211, and US\$20043) for HDB 5-Room flats, Condominiums & Other Apartments, and Landed Properties respectively. Reported by the Department of Statistics Singapore. Key household income trends, 2018. Available at <https://www.singstat.gov.sg/-/media/files/publications/households/pp-s25.pdf>

(A)



(B)

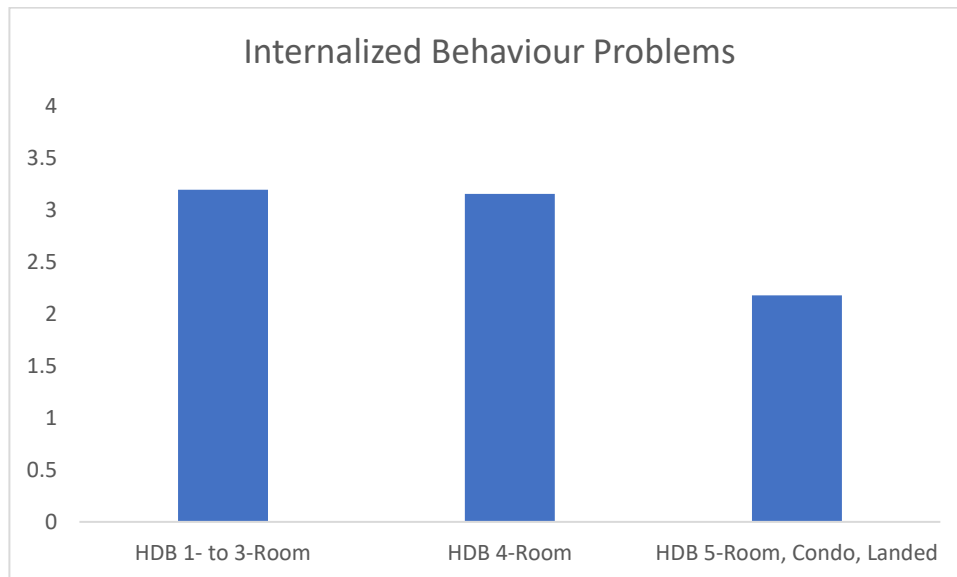


Figure 2. (A) Externalizing behaviour problems scores and (B) Internalizing behaviour problems scores by housing type

References

- Achenbach, T. M., & Edelbrock, C. S. (1978). The classification of child psychopathology: a review and analysis of empirical efforts. *Psychological Bulletin*, 85(6), 1275. <https://doi.org/10.1037/0033-2909.85.6.1275>
- Achenbach, T.M., and Edelbrock, C.S. (1981). Behavioural problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monographs of the Society for Research in Child Development*, 46(1), 82. <https://doi.org/10.2307/1165983>
- Bongers, I. L., Koot, H. M., Van der Ende, J., & Verhulst, F. C. (2003). The normative development of child and adolescent problem behavior. *Journal of abnormal psychology*, 112(2), 179. <https://doi.org/10.1037/0021-843X.112.2.179>
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, 53(1), 371-399. <https://doi.org/10.1146/annurev.psych.53.100901.135233>
- Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children*, 7(2), 55-71. <https://doi.org/10.2307/1602387>
- Conger, R. D., & Donnellan, M. B. (2007). An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology*, 58, 175-199. <https://doi.org/10.1146/annurev.psych.58.110405.085551>
- Shaw, D. S., Lacourse, E., & Nagin, D. S. (2005). Developmental trajectories of conduct problems and hyperactivity from ages 2 to 10. *Journal of Child Psychology and Psychiatry*, 46(9), 931-942. <https://doi.org/10.1111/j.1469-7610.2004.00390.x>
- McCulloch, A., Wiggins, R. D., Joshi, H. E., & Sachdev, D. (2000). Internalising and externalising children's behaviour problems in Britain and the US: Relationships to family resources 1. *Children & Society*, 14(5), 368-383. <https://doi.org/10.1111/j.1099-0860.2000.tb00191.x>
- Peterson, J.L., and Zill, N. (1986). Marital disruption, parent-child relationships, and Behaviour problems in children. *Journal of Marriage and the Family*, 48(2), 295–307. <https://doi.org/10.2307/352397>
- Yeung, W. J., Linver, M. R., & Brooks–Gunn, J. (2002). How money matters for young children's development: Parental investment and family processes. *Child development*, 73(6), 1861-1879. <https://doi.org/10.1111/1467-8624.t01-1-0051>