

Singapore Longitudinal Early Development Study (SG LEADS)



Panel Survey Wave 1

Technical Report 6

Calculation of Behaviour Problems Index

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This technical report documents the calculation of behaviour problems using the Behaviour Problems Index (BPI; Peterson & Zill, 1986) in a nationally-representative sample of young children between 3 and 6 years in Singapore ($n = 2,960$), from the Singapore Longitudinal EARly Development Study (SG LEADS) Wave I conducted in 2018-2019.

Behavioural functioning is one of the key developmental outcomes that predict adjustment later in life. Behaviour problems are indicative of emotional and behavioural development. Broadly speaking, behaviour problems 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).

The 30-item BPI 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 in the United States, with a satisfactory internal reliability. Many of the items were selected from the more extensive Achenbach Behaviour Problems Checklist (Achenbach & Edelbrock, 1981). The primary caregiver rated the child's behaviours on this three-point Likert-type scale (1=often true, 2=sometimes true, 3=never true).

Factor Loadings, Internal Consistencies, and Scoring Method

First of all, to confirm the items for externalizing and internalizing behaviour problems subscales in our sample, an exploratory factor analysis with principal component extraction and varimax rotation was performed. As displayed in Table 1, the items grouped into two factors well, with 13 items clearly loading on each of the two subscales. Four items were excluded from the final categorization, for their low factor loadings on both subscales or the inconsistent factor loadings with their theoretical constructs. To be specific, item i “*bullies or is cruel or mean to others*” and item z “*is too dependent on others*” did not load on either subscale (loadings < 0.4). Item v “*breaks things on purpose or deliberately destroys things*” and item bb “*hangs around with kids who get into trouble*” loaded on the internalizing behaviours subscale, but this was inconsistent with their theoretical constructs of externalizing behaviour problems. These four items were therefore removed from the final analysis.

Cronbach's alphas were computed to examine the internal consistencies of the BPI. Both the Externalized Behaviour Problems subscale ($\alpha = .86$; 13 items) and the Internalizing Behavior Problems subscale ($\alpha = .88$; 13 items) exhibited good internal consistencies. The entire BPI possesses an excellent internal reliability ($\alpha = 0.92$; 26 items).

Scores of externalizing and internalizing behaviour problems were computed by summing the items in each subscale 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 5.33, with a range from 0 to 26, and a standard deviation of 4.52; the mean score of internalized behaviour problems was 1.98, with a range from 0 to 26, and a standard deviation of 3.24. Externalizing and internalizing behaviour problems scores were highly correlated with each other ($r = .65, p < .001$).

Table 1. Factor Analysis results of BPI

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.	0.43	0.36	EXT
d. cheats or tells lies.	0.47	0.15	EXT
f. argues too much.	0.67	0.13	EXT
g. has difficulty concentrating, cannot pay attention for long.	0.44	0.40	EXT
j. is disobedient.	0.58	0.19	EXT
k. does not seem to feel sorry after (he/she) misbehaves.	0.45	0.29	EXT
m. is impulsive, or acts without thinking.	0.49	0.31	EXT
q. is restless or overly active, cannot sit still.	0.62	0.17	EXT
r. is stubborn, sullen, or irritable.	0.70	0.15	EXT
s. has a very strong temper and loses it easily.	0.68	0.15	EXT
w. clings to adults.	0.55	0.12	EXT
x. cries too much.	0.55	0.20	EXT
y. demands a lot of attention.	0.64	0.18	EXT
b. feels or complains that no one loves him/her.	0.25	0.44	INT
c. is rather high strung, tense and nervous.	0.30	0.53	INT
e. is too fearful or anxious.	0.31	0.50	INT
h. is easily confused, seems to be in a fog.	0.33	0.54	INT
l. has trouble getting along with other children.	0.19	0.62	INT
n. feels worthless or inferior.	0.13	0.65	INT
o. is not liked by other children.	0.16	0.64	INT
p. has a lot of difficulty getting (his/her) mind off certain thoughts.	0.34	0.53	INT
t. is unhappy, sad or depressed.	0.24	0.61	INT
u. is withdrawn, does not get involved with others.	0.14	0.68	INT
aa. feels others are out to get (him/her).	0.18	0.69	INT
cc. is secretive, keeps things to (himself/herself).	0.15	0.64	INT
dd. worries too much.	0.07	0.68	INT
i. bullies or is cruel or mean to others.	0.36	0.34	EXCLUDED
v. breaks things on purpose or deliberately destroys (his/her) own or another's things.	0.33	0.45	EXCLUDED
z. is too dependent on others.	0.39	0.38	EXCLUDED
bb. hangs around with kids who get into trouble.	0.15	0.58	EXCLUDED

Note. EXT=externalizing behaviours. INT=Internalizing behaviours. Value in bold indicated acceptable factor loading.

Age and Gender Differences in Behaviour Problems

Furthermore, we examined the developmental trajectories of externalizing and internalizing behaviour problems among children aged 3 to 6 years. Analyses of variance (ANOVAs), 4 (age: 3, 4, 5 vs. 6) x 2 (gender: boy vs. girl), were performed to examine the age and gender differences in behaviour problems. Weighted mean scores of externalizing and internalizing behaviour problems by age and gender are presented in Table 2, and ANOVAs results are presented in Table 3.

We observed a significant main effect of gender ($F(1, 2952) = 8.36, p = .004, \eta^2 = .003$) on externalizing behaviours, but the main effect of age ($F(3, 2952) = 1.71, p = .16, \eta^2 = .002$) and the interaction effect between age and gender ($F(3, 2952) = 1.64, p = .18, \eta^2 = .002$) were nonsignificant. In general, boys displayed more externalizing behaviours than girls (see Figure 1a).

As for internalizing behavior problems, only a significant main effect of age was found ($F(3, 2952) = 5.38, p = .001, \eta^2 = .005$), and the main effect of gender ($F(1, 2952) = 0.98, p = .32, \eta^2 < .001$) and the interaction effect of age and gender ($F(3, 2952) = 1.94, p = .12, \eta^2 = .002$) were nonsignificant. As illustrated in Figure 1b, compared to three-year-olds, older age groups (i.e. 4- to 6-year-olds) showed significantly more internalizing behaviours problems (ps were .001, .013, and <.001, respectively); while the levels of internalizing behaviour problems were comparable among children between 4 and 6 years ($ps > .10$).

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

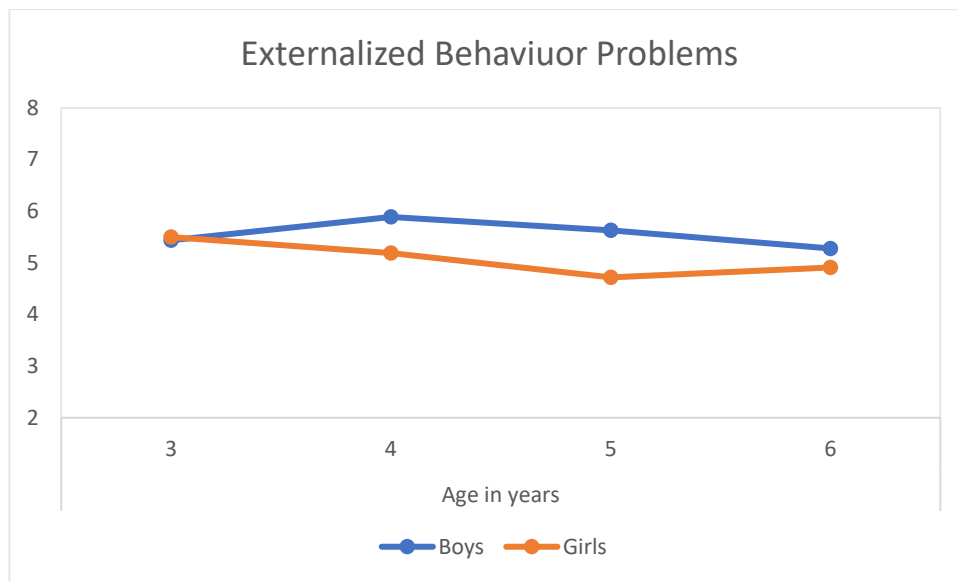
	3 Years			4 Years			5 Years			6 Years			Total		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
EXT	5.44 (4.67)	5.50 (4.29)	5.47 (4.47)	5.89 (4.42)	5.19 (4.49)	5.54 (4.43)	5.63 (4.66)	4.72 (3.97)	5.21 (4.36)	5.28 (4.84)	4.91 (4.87)	5.12 (4.79)	5.55 (4.56)	5.10 (4.46)	5.33 (4.52)
INT	1.91 (2.76)	1.65 (2.63)	1.78 (2.83)	2.49 (3.55)	1.96 (3.14)	2.22 (3.35)	2.26 (3.36)	2.07 (3.12)	2.17 (3.25)	2.15 (3.09)	2.37 (3.81)	2.26 (3.4)	2.20 (3.26)	2.00 (3.19)	2.20 (3.26)
<i>N</i>	376	411	787	348	363	711	379	346	725	394	343	737	1497	1463	2960

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

Table 3. (Weighted) Two-way ANOVA results

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>η</i> ²
EXT	Age	105.3	3	35.1	1.71	.16	.002
	Gender	171.9	1	171.9	8.36	.004	.003
	Age x Gender	101.3	3	33.8	1.64	.17	.002
	Residual	60730.3	2952	20.6			
INT	Age	170.6	3	56.9	5.38	.001	.005
	Gender	10.3	1	10.3	0.98	.32	<.001
	Age x Gender	61.4	3	20.5	1.94	.12	.002
	Residual	31208.0	2952	10.6			

(A)



(B)

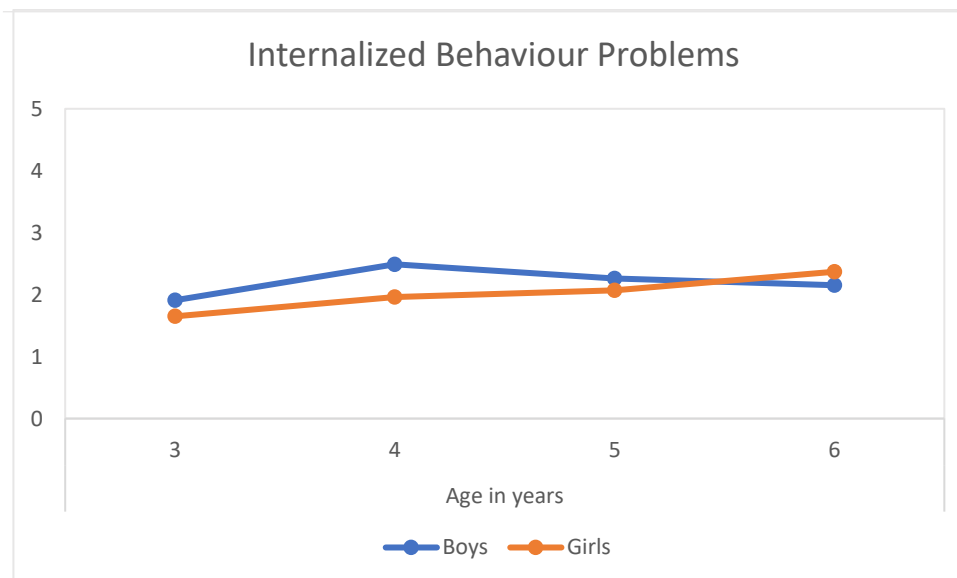


Figure 1. The developmental trajectory in (A) externalizing behaviour problems and (B) internalizing behaviour problems among 3- to 6-year-olds

Effects of Socioeconomic Status on Behaviour Problems

Finally, we examined whether housing type¹, which in Singapore serves as a crude indicator of family socioeconomic status (SES), is related to children's behaviour problems. 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. SES was classified into three levels based on the housing type, namely, Low-SES (HDB 1- to-3-room), Middle-SES (HDB 4-room), and High-SES (HDB 5-room, Condominium and Landed property). ANOVAs were then performed to examine the effects of SES on behaviour problems (see Table 4 and Table 5).

The main effects of SES were significant on both externalizing behavior problems ($F(2, 2957) = 6.44, p = .002, \eta^2 = .004$) and internalizing behavior problems ($F(2, 2957) = 11.4, p < .001, \eta^2 = .008$). 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 .003 and .004, respectively) and few internalizing behaviour problems (ps were $<.001$ and .004, respectively). These results were somewhat consistent with the literature that childhood socioeconomic disadvantages may be associated with more behaviour problems (for reviews, see Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Conger & Donnellan, 2007).

Table 4. (Weighted) 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	5.74 (3.02)	5.55 (5.01)	5.03 (5.54)	5.33 (4.54)
INT	2.45 (2.15)	2.12 (3.54)	1.70 (4.02)	1.98 (3.26)
<i>N</i>	1146	930	884	2960

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

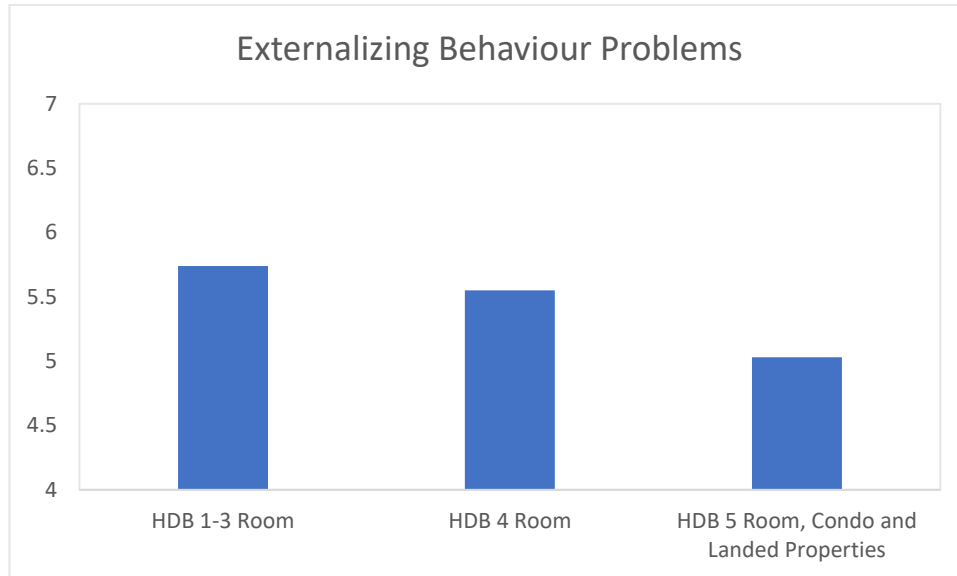
Table 5. (Weighted) Two-way ANOVA results

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
EXT	SES	264.8	2	132.4	6.44	.002	.004
	Residual	60820.9	2957	20.6			
INT	SES	240.0	2	120.0	11.4	<.001	.008
	Residual	31205.7	2957	10.6			

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

¹The 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)

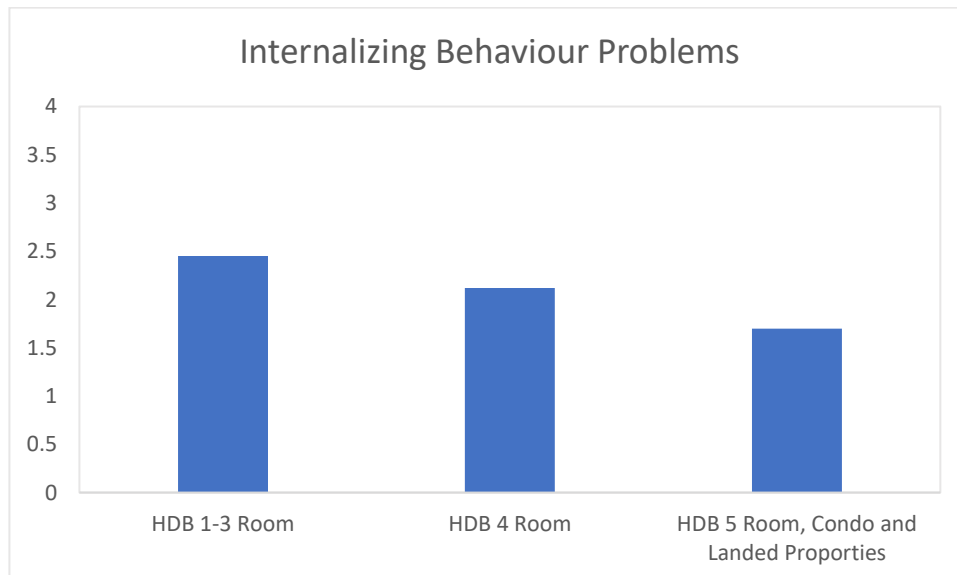


Figure 2. (A) Externalizing behaviour problems scores and (B) Internalizing behaviour problems scores by housing type

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