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PILOT EVALUATION OF TWO CHILDHOOD OBESITY PREVENTION PROGRAMMES IN MALAYSIA

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Programmes that increase awareness of childhood obesity are vital to reducing the number of obese adults and adults with cardiovascular diseases. However, the effectiveness of these programmes must be evaluated to optimise resources for childhood obesity awareness programmes. The present study was conducted to assess the intermediate cost-effectiveness and provide a cost analysis of childhood obesity health promotion programmes. This quasi-experimental study compared the intermediate outcomes of the Sahabat Sihat and Be Best programmes over a six-month period. Data regarding health-related quality of life (EQ-5D and EQ-VAS), the Knowledge, Attitude and Practice questionnaire, and biomedical data were obtained from booklets prepared by MySihat for childhood obesity-related health promotion programmes. Data regarding cost was obtained from the expenditure records of the respective health promotion programmes. The intergroup and intragroup comparisons between the EQ-5D and EQ-VAS results, the Knowledge, Attitude, and Practice scores, and the biomedical data were explored using the Mann-Whitney and Friedman tests. Descriptive statistics were utilised in the analysis of the cost results. Be Best and Sahabat Sihat were successful in helping to prevent overweight respondents from becoming obese. The Attitude score was higher among the Sahabat Sihat cohort, but the Practice score was higher among the Be Best cohort. Be Best had a lower mean cost per participant and was more cost-effective than Sahabat Sihat.

Keywords: Childhood obesity, Health promotion, Economic evaluation

INTRODUCTION

The percentage of obese or overweight children in Malaysia has increased from 20.7% in 2002 to 26.4% in 2008 (Poh *et al.* 2013). Obese adolescent (70%) might become obese adults (Dehghan, Akhtar-Danesh and Merchant 2005) with an increased risk of cardiovascular diseases such as hypertension, diabetes, and hyperlipidaemia (D'Agostino *et al.* 2000).

Therefore, many countries conduct programmes to prevent childhood obesity by promoting a healthy lifestyle among children (Sharma 2006) through healthy eating and physical activities (Sharma 2006; Wake *et al.* 2008; McAuley *et al.* 2009; Cawley 2010). Such programmes are delivered through many mechanisms that require resources from both the provider and society at large. However, formal evaluations of such programmes are rarely conducted and show conflicting results. The published effectiveness of such programmes varies from a null to 40% reduction in body fat for the intervention group (Sharma 2006; Wang *et al.* 2008; Cawley 2010). Reports of the costs of providing such programmes are even rarer but are suggested to be in the range of USD 3,518.85 to

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USD 4,764.90 per 100 participants (Wang *et al.* 2003b; Brown and Summerbell 2009). Such evaluations are as uncommon in Malaysia as they are in other countries. Hence, this study was conducted as a pilot for the Malaysian authorities to evaluate two programmes intended to prevent childhood obesity in terms of their effectiveness and costs.

METHODOLOGY

Prior data indicates that the obesity prevalence among the controls was 0.117 (Rampal *et al.* 2007). If the risk difference to be detected was 9 percentage points, we would need to study 105 obese and 105 non-obese participants to be able to reject the null hypothesis that the participation rate in the Sahabat Sihat (SS) and Be Best (BB) programmes for obese and non-obese children were equal with a probability (power) of 0.8.

This quasi-experimental study with convenience sampling involved comparing the intermediate outcomes and conducting a cost analysis of two childhood obesity health promotion programmes (SS and BB) over a six-month period. The primary outcomes included the participants' knowledge, attitude, and practice of obesity prevention. The secondary outcomes included participant biomedical outcomes (systolic and diastolic blood pressure, blood sugar), anthropometric indicators (weight, height, waist circumference), and Health Related Quality of Life (EQ5D).

The programmes were conducted by two different non-governmental organisations (NGOs) and targeted obese and non-obese school children between the ages of 7 and 19 years who were literate in either Malay or English. Both programmes received funding from MySihat, a Malaysian government agency that promotes health.

The SS participants lived in an urban area, whilst the BB participants came from the rural area (Table 1). Both programmes were held over a six-month period. The programmes took place at Universiti Sains Malaysia, Pulau Pinang and Community Hall Tobiar, Kedah, respectively.

Table 1: Overview of the programme structures of Sahabat Sihat and Be Best 2012.

Programme	Childhood obesity programmes in Pulau Pinang (Sahabat Sihat)	Childhood obesity programmes in Tobiar (Be Best 2012)
Subject	Obese and non-obese primary and secondary school children	Obese and non-obese primary and secondary school children
Catchment area	Primary and secondary school children in Pulau Pinang	Primary and secondary school children in Tobiar, Kedah
Number of subjects	98	112
Venue	Universiti Sains Malaysia Hall	Tobiar Community Hall
Activities	Health promotion for obesity prevention with an emphasis on seminars, physical activity, and treasure hunts.	Health promotion for obesity prevention with an emphasis on seminars, counselling, camping, proper cooking techniques, and carnivals for the participants.

Tables 2 and 3 summarise the activities that took place in the SS and BB 2012 programmes in chronological order. The SS activities included seminars, physical activities, and treasure hunts, whilst BB emphasised seminars, counselling, camping, proper cooking techniques, and carnivals.

Table 2: Details of the health promotion programme activities for Sahabat Sihat.

Health promotion programme	Date	Activities	Personnel
Sahabat Sihat	04/02/2012	Opening ceremony, seminar, health screening (baseline)	Teacher, facilitator
	18/02/2012	Exploration	Teacher, facilitator
	03/03/2012	Marathon	Teacher, facilitator
	31/03/2012	Telematch	Teacher, facilitator
	07/04/2012	Cycling	Teacher, facilitator
	21/04/2012	Health screening (intermediate)	Teacher, facilitator
	12/05/2012	Hiking	Teacher, facilitator
	19/05/2012	Treasure hunt	Teacher, facilitator
	03/06/2012	Jogging	Teacher, facilitator
	23/06/2012	Hurdle	Teacher, facilitator
	07/07/2012	Paintball competition	Teacher, facilitator
	15/07/2012	Health screening (final)	Teacher, facilitator
	14/08/2012	Closing ceremony	Teacher, facilitator
	45 sessions	School activities (twice per week)	Teacher

Table 3: Details of the health promotion programme activities for Be Best 2012.

Health promotion programme	Date	Activities	Personnel
Be Best 2012	10/05/2012	Opening ceremony, health screening (baseline)	Teacher, facilitator, health personnel
	19/05/2012	Exploration	Teacher, facilitator
	May (12 sessions)	School activities (12× per month)	Teacher, facilitator
	25/05/2012 – 26/05/2012	Seminar, counselling	Teacher, facilitator, speaker

(*continued on next page*)

Table 3: (*continued*)

Health promotion programme	Date	Activities	Personnel
Be Best 2012	June (12 sessions)	School activities (12× per month)	Teacher, facilitator
	12/07/12012 – 14/07/2012	Camping, seminar	Teacher, facilitator, speaker
	15/07/2012	Health screening (intermediate)	Teacher, facilitator, health personnel
	July (12 sessions)	School activities (12× per month)	Teacher, facilitator
	01/09/2012	Sport day (Sekolah Menengah Kebangsaan Kubor Panjang [SMKKP])	Teacher, facilitator
	08/09/2012	Sport day (Sekolah Kebangsaan Penghulu Jusoh [SKPJ])	Teacher, facilitator
	September (12 sessions)	School activities (12× per month)	Teacher, facilitator
	29/09/2012	Cooking demonstration	Teacher, facilitator
	19/10/2012	Health forum, health screening (final)	Teacher, facilitator, health personnel
	20/10/2012	Healthy Lifestyle Carnival, closing ceremony	Teacher, facilitator

Letters requesting parental consent were distributed to the students one week before the study and collected on the day of the study. Statements that ethical approval was not necessary were obtained from the ethics committee of MySihat.

Health-related quality of life factors were measured using EQ-5D using the value sets based on the UK Social Tariff (Dolan *et al.* 1995). The biomedical, anthropometric, and Knowledge, Attitude and Practice (KAP) questions were based on MySihat's obesity prevention modules. The number of questions was based on the number of activities and the time allocation for each unit in the module (Saad and Taib 2011).

The 37-item KAP questionnaire elicits 3 response options (yes, no, and unsure) for the Knowledge dimension; each 'yes' response receives a score of one, whilst other responses receive a null score. The score was summed to produce the total Knowledge score. A five-point Likert scale option was used for the Attitude (strongly disagree, disagree, neutral, agree, strongly agree) and Practice (very frequent, frequent, sometime, seldom, never) dimensions. Those scores were summed to give the total Attitude and Practice scores (Saad and Taib 2011).

The post-test validity was determined for the shortened KAP questionnaire, and the α values for Knowledge, Attitude, and Practice were 0.653, 0.658, and 0.763, respectively.

Obesity was defined as a body mass index (BMI; in kg/m^2) in the 95 percentile or above according to the Centre for Control's BMI-for-age charts for the ages of 2 to 20 years (Kuczmarski *et al.* 2002). Waist circumferences were measured with a measuring tape between the two mid-points between the lowest rib and the iliac crest (Wang *et al.* 2003a).

Data Analysis

Cost data were obtained from expenditure records submitted by the organiser to MySihat. All analyses were conducted using PASW Statistics 19, Release Version 19.0.0 (SPSS Inc. 2009). The Mann-Whitney and Friedman non-parametric tests were used for the analyses.

RESULTS

Ninety eight out of 120 eligible students participated in the SS programme, while 112 out of 120 eligible students participated in the BB programme. The proportion of participants by gender was almost identical for both programmes (33% and 29% of SS and BB participants were male, respectively). The mean age of the participants in SS and BB was 14.9 (SD = 0.8) and 15.9 (SD = 1.7) years, respectively.

After three months, the number of participants declined to 32 and 52 for SS and BB, respectively. At the end of the study, only 18 and 51 participants from the initial cohort of SS and BB, respectively, completed the study. Participants were considered to have dropped out if they decided not to participate anymore or were absent three consecutive times. The drop-out rate was lower in BB because BB was more interesting and rewarding for the participants compared to SS. BB also conducted home surveys to assess well-being and to encourage the participants throughout the programme.

Six percent of the participants from SS and 35% of the participants from BB were obese ($p = 0.016$). There were no statistically significant differences ($p>0.05$) at baseline, after three months or at the end of the study in the mean Knowledge score for intergroup comparisons between SS and BB.

There were statistically significant differences ($p<0.05$) in the baseline Attitude and Practice scores for the SS and BB participants. The mean Attitude score was higher for SS (80.1%) than BB (76.0%), and the mean Practice score was lower for SS (48.2%) than for BB (55.3%).

There were also statistically significant differences ($p<0.05$) in the Attitude and Practice scores of both cohorts after three months according to the Mann-Whitney test. The mean Attitude score was higher for SS (81.4%) than for BB (76.6%), and the mean Practice score was lower for SS (43.0%) than for BB (60.3%).

In addition, there were statistically significant differences ($p<0.05$) in the Attitude and Practice scores of both cohorts at the end of the study. The mean Attitude score was higher for SS (79.0%) than for BB (72.3%), whilst the mean Practice score was lower for SS (43.7%) than for BB (51.8%).

In comparison, there were statistically significant increases ($p<0.05$) in the mean Knowledge scores (baseline [mean = 70.9%]; after three months [mean = 79.0%]; final study [mean = 80.3%]), significant decreases in the mean Attitude scores (baseline [mean = 76.0%]; after three months [mean = 76.6%]; final study [mean = 72.3%]) and significant decreases in the mean Practice scores (baseline [mean = 55.3%]; after three months [mean = 60.3%]; final study [mean = 51.8%]) at the baseline, after three months and at the final study for the BB participants.

Table 4: Health parameters of the participants in the health promotion programmes.

Variable	Participant HRQoL (comparisons at t0, t1 and t2)						*p* (SS vs BB) at t0	*p* (SS vs BB) at t1	*p* (SS vs BB) at t2
	SS (t0)	**BB (t0)**	**SS (t1)**	**BB (t1)**	**SS (t2)**	**BB (t2)**			
	median (IQR)	**median (IQR)**	**median (IQR)**	**median (IQR)**	**median (IQR)**	**median (IQR)**			
EQ-5D	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)	$p = 0.665$	$p = 0.346$	$p = 0.006$
EQ-VAS	85 (85–91)	85 (70–90)	95 (80–90)	85 (80–90)	90(84–95)	95 (90–95)	$p = 0.237$	$p = 0.612$	$p = 0.823$
Weight (kg)	50.0 (39.8–56.3)	66.7 (58.4–75.0)	48.1 (42.6–58.7)	67.2 (59.2–72.2)	49.0 (42.6–57.5)	65.0 (58.0–72.0)	$p<0.01$	$p<0.01$	$p = 0.027$
Height (cm)	156 (153–162)	157 (153–161)	155 (152–155)	157 (153–161)	160 (154–160)	157 (153–161)	$p = 0.967$	$p = 0.481$	$p = 0.208$
Waist circumference (cm)	67.0 (61.5–71.6)	79.0 (72.0–86.0)	65.5 (60.8–69.0)	79.0 (73.0–84.0)	71.5 (67.4–72.6)	79.0 (71.0–85.0)	$p<0.01$	$p<0.01$	$p = 0.019$
BMI	19.0 (17.4–22.6)	26.7(24.1–30.4)	19.8 (17.6–23.2)	26.1 (23.6–29.7)	19.8 (17.7–22.2)	26.1 (23.1–29.6)	$p<0.01$	$p<0.01$	$p<0.01$
Glucose (mmol/L)	5.2 (4.9–5.3)	5.1 (5.1–5.8)	5.0 (4.8–5.0)	5.2 (4.7–5.8)	5.0 (4.8–5.4)	5.1 (4.7–5.6)	$p = 0.816$	$p = 0.069$	$p = 0.978$
Systolic BP	114 (107–126)	110 (110–110)	116 (110–121)	118 (111–125)	110 (105–113)	117 (110–121)	$p = 0.128$	$p = 0.388$	$p = 0.022$
Diastolic BP	71 (67–77)	70 (70–70)	63 (56–68)	73 (66–78)	71 (66–74)	70 (66–79)	$p = 0.219$	$p<0.05$	$p = 0.584$

Notes: SS = Sahabat Sihat, BB = Be Best, t0 = baseline, t1 = intermediate, t2 = final, HRQoL = Health Related Quality of Life, IQR = Inter Quartile Range.

As Table 4 shows, there were no statistically significant differences (p>0.05) in the EQ-5D and EQ-VAS scores at the baseline, after three months and at the final study between the SS and BB participants. Furthermore, there were statistically significant differences (p<0.05) in weight, waist circumference and BMI at the baseline, after three months and at the final study for intergroup comparisons between the SS and BB groups. There were no statistically significant differences (p>0.05) in weight at baseline, after three months and at the final study for the SS participants.

However, there were statistically significant differences (p<0.05) in height, waist circumference, BMI and diastolic blood pressure at baseline, after three months and at the final study for the SS participants. The Friedman test results indicated statistically significant differences (p<0.05) in weight, waist circumference, BMI and systolic blood pressure based on at the baseline, after three months and at the final study for the BB participants.

Basically, both SS and BB were successful in preventing all overweight children from becoming obese after six months. However, there were 0% and 28% reductions in the number of obese participants for the SS and BB cohorts, respectively, after six months compared with the baseline.

As Table 5 shows, the mean cost per participant was calculated as the sum of cost of food, souvenirs, honoraria, rental, transportation, medical kits, and miscellaneous items divided by the number of participants. Therefore, the mean total cost per participant for SS was RM 50,625.36/98 = RM 516.59 and the mean total cost per participant for BB was RM 48,603.38/112 = RM 433.96. The difference in costs between SS and BB was RM 82.63 per participant.

Table 5: Costs of childhood obesity health promotion programmes.

Items	Cost (RM)	
	Sahabat Sihat (N = 98)	**Be Best 2012 (N = 112)**
Food	16479.57	6812.31
Souvenirs	15888.86	4740.71
Honoraria	7310.30	7290.05
Rental	6631.92	17198.46
Transportation	2784.39	5499.93
Medical kit	335.14	2957.65
Miscellaneous	1195.17	4104.28
Total cost	50625.36	48603.38
Average cost	516.59	433.96

Because BB cost less and was more effective than SS in terms of reducing the obesity percentage and increasing Knowledge and Practice scores, it was deemed more cost-effective (Figs. 1, 2, and 3). In addition, the incremental cost effectiveness ratio for the BB programme, calculated as the cost divided by the effectiveness, is RM 9 for each percentage change in the Attitude domain score compared with SS (Fig. 4).

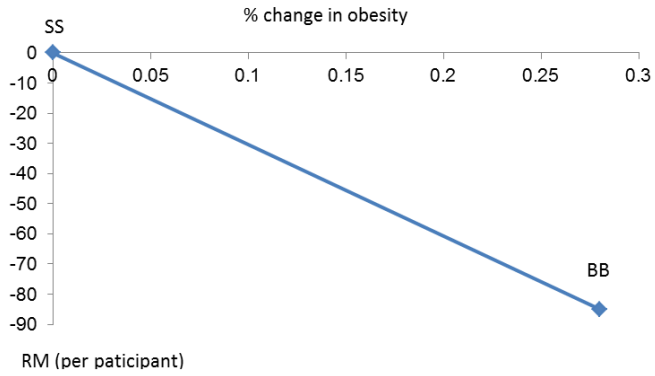

Fig. 1: Intermediate cost effectiveness of Be Best vs Sahabat Sihat for weight reduction.

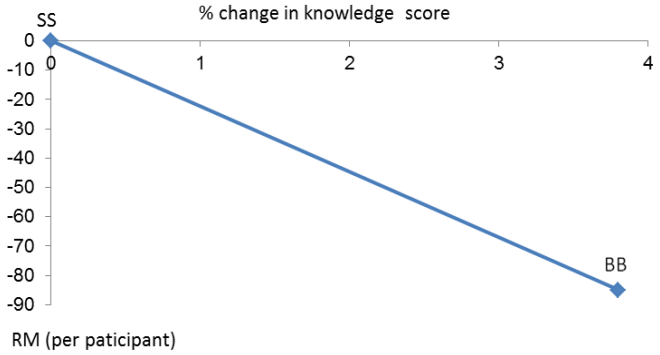

Fig. 2: Intermediate cost effectiveness of Be Best vs Sahabat Sihat for the Knowledge domain.

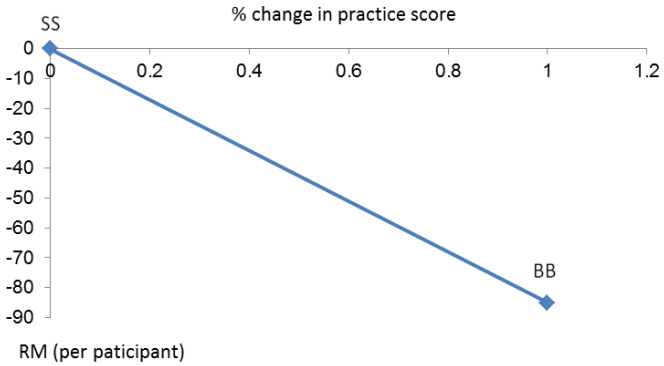

Fig. 3: Intermediate cost effectiveness of Be Best vs Sahabat Sihat for the Practice domain.

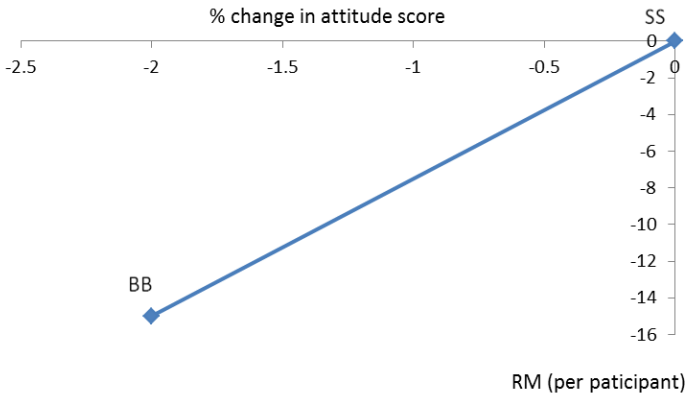

Fig. 4: Intermediate cost effectiveness of Be Best vs Sahabat Sihat for the Attitude domain.

DISCUSSION

The SS participants had a more positive attitude towards preventing obesity compared with the BB participants. This is probably a reflection of the distributions of obese participants, which were lower in SS (6%) compared with BB (35%). However, daily practices for preventing obesity were found to be better among the BB participants compared with the SS participants. This is probably because the BB programme included more active and entertaining activities, such as camping, carnivals, and a cooking demonstration, whereas the SS activities were limited to seminars, physical activities, and treasure hunts.

Health promotion programmes are known to have varied effectiveness, and many are found to be ineffective. For example, a randomised controlled trial conducted by Wafa *et al.* (the Malaysian Childhood Obesity Treatment Trial [MASCOT] trial) among obese children in Malaysia showed that there were no statistically significant differences between the intervention (behaviour change counselling) and control groups in BMI and weight after six months (Wafa *et al.* 2011).

Based on previous studies, the lower percentage of obese BB participants compared with SS participants after six months could be a result of the more effective programme mix that encouraged participation and reduced the drop-out rate. Similarly robust studies by Wang *et al.* (2003b) in Planet Health in the United States detected a 14% reduction in obese cohorts with a participation rate of 25.8% (Wang *et al.* 2003b; Cawley 2010). Obese children in Malaysia have higher eating behaviour and body image discrepancy scores (Wahida, Nasir and Hazizi 2011), higher sedentary activity levels, and lower physical activity levels compared with children in the United States (Wafa *et al.* 2013). However, neither SS nor BB was able to improve Attitude and Practice scores via obesity prevention interventions.

An effective school-based intervention could help to prevent obesity: 68% of studies worldwide showed that school-based intervention was effective in reducing BMI or skin-fold thickness and increasing both a healthy diet and physical activity (Veugelers and Fitzgerald 2005; Doak *et al.* 2006).

One interesting trend that we found was that Knowledge improved, but both Attitude and Practice declined, after six months of participation in BB. This finding shows that BB was successful in imparting knowledge to participants, but there was a lack of

continuity, follow-up, and implementation of interesting activities to encourage a change in Attitude and Practice, which resulted in high drop-out rate and a low reduction in childhood obesity.

The main cost drivers of the SS programme were food (RM 16,815.89 per 100 participants) and souvenirs (RM 16,213.12 per 100 participants), whilst the main programme cost for BB was rentals (RM 15,355.76 per 100 participants). This study also found that SS allocates more resources to food and souvenirs, whilst BB allocates more to venue rental. Moreover, BB was found to be more cost-effective than SS. Other school-based interventions, such as Planet Health and Child and Adolescent Trial for Cardiovascular Health (CATCH), were also proven to be cost-effective (Wang *et al.* 2003b; Brown *et al.* 2007).

Limitations

Both the SS and BB samples were limited by small sample sizes (neither fulfilled the sample size required for the power of the study), missing subjects on follow-up (up to 83.7% drop-out in the final assessment), incomplete questionnaires and the short duration of the programme. In addition, the structures of both programmes were beyond the control of the researcher. Accordingly, much of the information, particularly on sample selection and resource utilisation, was based on secondary data collected from the organisers of the SS and BB programmes. Consequently, the analysis was limited to less-precise non-parametric tests based on complete case data, and the high drop-out rates might inflate the cost structure of both the SS and BB programmes.

Recommendations

The lack of quality information gleaned from the secondary data can be improved in the future if the organisers were to present their reports according to the RE-AIM framework, which would allow us to compare health promotion programmes based on their reach (subject willingness-to-participate rate), effectiveness (the effectiveness of the intervention on target outcomes and quality of life), adoption (the representativeness of the setting and the staff implementing the programmes), implementation (the consistency and skill of various staff members), and maintenance (the maintenance of long-term behaviour changes or the sustainability of the organisation delivering the programme) (Glasgow, Vogt and Boles 1999). However, using the RE-AIM frameworks will require more thorough data collection, more time, more resources, and more manpower, which could be a severe hindrance to NGOs conducting health promotion programmes without proper guidance from experts.

CONCLUSION

In summary, BB was more effective and cost-effective than SS in reducing the percentage of obese participants and improving their Knowledge and Practice levels. However, a longer evaluation period might be required to assess the long-term effects of both programmes. Therefore, a longer-term follow up of the children based on questionnaire surveys of the participants at six-month intervals is recommended.

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