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Toddler obesity prevention: A two-generation randomized attention-controlled trial

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Abstract

Rapid weight gain increases risks of obesity and associated co-morbidities. The objective was to reduce the rate of body mass index (BMI) growth (BMI *z* score), relative to control. Secondary outcomes were toddler–mother physical activity, mealtime interactions and fruit/vegetable intake. The randomized three-arm, eight-session, 4-month trial, conducted 2009–2013, included two intervention arms (responsive parenting and maternal lifestyle) and an attention control (home safety). Baseline and 6- and 12-month follow-up evaluations included weight and length/height, ankle accelerometry, video-recorded mealtime interactions (Emotional Availability Scales) and 24-h diet recalls (Healthy Eating Index-2015 [HEI-2015]). Analyses used linear mixed-effects models with repeated measures comparing intervention versus control changes in BMI *z* score. We recruited 277 racially mixed (70% African American) toddler–mother dyads (mean ages 20.1 months and 27.3 years) from US WIC and primary care clinics and randomized them into intervention versus control; 31% toddlers and 73% mothers were overweight/obese. At follow-up, changes in the rate of toddler BMI *z* score and maternal BMI were non-significant. Maternal lifestyle group toddlers and mothers spent 24.43 and 11.01 more minutes in physical activity (95% confidence interval [CI]: 2.55, 46.32, and 95% CI: 1.48, 20.54, respectively). Fruit intake increased in both intervention groups. Hostile mealtime interactions increased in the maternal lifestyle group, and in supplementary analyses, mealtime interactions were significantly higher in the responsive parenting group than in the maternal lifestyles group, suggesting that toddler dietary interventions include responsive parenting. Intervention effects were stronger among older versus younger toddlers. Despite no impact on weight gain, additional research should examine integrated two-generation responsive parenting and maternal lifestyle interventions among toddler–mother dyads.

KEYWORDS

child feeding, childhood obesity, diet and physical activity intervention studies, growth, physical activity

1 | INTRODUCTION

Rapid weight gain during toddlerhood (age 12–30 months) (Ogden, Carroll, Kit, & Flegal, 2016; World Health Organization [WHO], 2016) increases risks for obesity and associated co-morbidities, especially among families in poverty (Cunningham, Kramer, & Narayan, 2014; WHO, 2016). In 2012, a national US sample found that 8.1% of children under age 2 years were obese (weight-for-length ≥95th percentile) (Ogden et al., 2016). On the basis of national WIC[1] data, in 2014, 14.5% of children age 2–4 years in WIC-participating families were obese (age- and sex-specific body mass index [BMI] ≥95th percentile) (Pan et al., 2016).

Home is a primary environment for toddlers (Birch & Davison, 2001), with caregivers, primarily mothers, managing toddlers' opportunities for physical activity, mealtime interactions and diet. Toddler–mother physical activity and dietary patterns are related (Hesketh et al., 2014; Papas, Hurley, Quigg, Oberlander, & Black, 2009), leading to recommendations for two-generation interventions involving mother–toddler pairs (Shonkoff & Fisher, 2013).

Toddlers learn by modelling lifestyle behaviour from caregivers (Shimpi, Akhtar, & Moore, 2013). Thus, promoting healthy maternal physical activity and diet lifestyle behaviours may be an effective intervention strategy to alter toddlers' lifestyle behaviours. Responsive parenting, characterized by responses that are warm, sensitive, developmentally appropriate and positive (Landry, Smith, Swank, Assel, & Vellet, 2001), has been associated with children's cognitive and social skills (Smith, Landry, & Swank, 2006). Applied to mealtimes, responsive parenting includes structure, clear expectations, emotional support and responses that are prompt, emotionally supportive, contingent and developmentally appropriate (Black & Aboud, 2011). Three randomized controlled trials found that responsive parenting interventions resulted in lower weight gain or BMI among infants of first-time mothers (Daniels et al., 2012; Savage, Birch, Marini, Anzman-Frasca, & Paul, 2016; Wen et al., 2012). On follow-up, one trial found lower BMI *z* scores at age 3 (Paul et al., 2018), and two found no BMI *z*-score differences at age 5 (Daniels et al., 2015; Wen et al., 2015). None mentioned maternal behaviour or weight status. Thus, responsive parenting interventions can be protective of rapid rate of weight gain among infants and merit further investigation among toddlers and mothers (Daniels et al., 2015; DiSantis, Hodges, Johnson, & Fisher, 2011; Hurley, Cross, & Hughes, 2011; Thompson, Adair, & Bentley, 2013).

We tested the hypothesis that maternal lifestyle or responsive parenting interventions would reduce the rate of BMI growth, relative to control, among toddlers (BMI *z* score) and mothers (primary outcome). We also hypothesized that the interventions would increase physical activity, responsive mealtime interactions and diet quality (fruit and vegetable intake) (secondary outcomes), compared with control. The hypotheses were based on two theories. Bioecological theory emphasizes interactive relationships across multiple ecological levels (Bronfenbrenner & Morris, 2006). Transactional theory emphasizes bidirectional relations between individuals (e.g., toddler–mother), including responsive interactions (responsive parenting) and modelling (maternal lifestyle) (Sameroff, 2009).

[1]Special Supplemental Nutrition Program for Women, Infants, and Children.

Key messages

- Despite no impact on weight gain, intervention effects on physical activity, fruit intake, and mealtime interactions warrant additional research to examine two-generation interventions among toddler-mother dyads.
- A maternal lifestyles intervention resulted in increased physical activity among toddlers and mothers, compared to controlled
- A responsive parenting intervention led to improvements in mealtime interactions, compared to a maternal lifestyles intervention, suggesting caution in mother-toddler dietary interventions that exclude responsive parenting.
- Intervention-related improvements in physical activity, mealtime interactions, and fruit consumption were significant for older (21-32 months), but not younger toddlers (12-20 months), suggesting that intervention impact may vary by toddlers' developmental readiness.

2 | METHODS

2.1 | Intervention

Three manualized (intervention and attention control) guides were created, informed by prior obesity prevention trials (Fitzgibbon et al., 2011), bioecological and transactional theories, guidelines from paediatric and dietetic professional organizations (Gidding et al., 2006), and a formative phase (Appendix A). Manuals incorporated social and interpersonal influences on behaviour change, including goal setting, modelling and perceived social norms, with specific activities, resource materials and responses to frequently asked questions.

Group activities were designed to build skills, encourage modelling, promote perception of social norms and increase self-efficacy. Childcare and healthy snacks were provided, along with small, topic-related gifts. The responsive parenting intervention (Tot-TOPS) emphasized parents' role in recognizing and responding to toddlers' signals, behaviour management, soothing without relying on food, promoting toddler emerging autonomy and providing opportunities for healthy toddler meals and physical activity. The maternal lifestyle intervention (Mom-TOPS) focused on maternal diet and physical activity, with no mention of responding to toddler diet, physical activity or behaviour. Both interventions incorporated fruits and

vegetables into group activities, snacks and goal setting. The attention control intervention (Safe-TOPS) provided a home safety intervention that significantly improved home safety scores (Wang, Gielen, Magder, Hager, & Black, 2018) with no mention of responsivity, diet or physical activity (Appendix A).

We recruited masters-level health educators to deliver the interventions. Under the supervision of a licenced psychologist, they participated in a six-session training that included conducting the manualized interventions and motivational interviewing (Miller & Rollnick, 1991). During the intervention, fidelity was maintained by Personal Contact Records completed following each session, weekly group supervision and training, and periodic supervisor visits.

We implemented eight-session interventions (four group sessions, three individual telephone coaching sessions and a final group session), based on the Triple-P (Positive Parenting Program) model (Sanders, Kirby, Tellegen, & Day, 2014). Sessions were held biweekly over 4 months. Groups met at separate times to reduce contamination and followed a similar structure.

2.2 | Study design and participants

Mothers were recruited by research assistants through WIC clinics (semiurban) and paediatric clinics (urban) serving similar low-income communities and followed for 12 months. Eligible mothers were age 18 years or older, not pregnant, WIC eligible, English speaking and without medical/physical conditions that limited physical activity (Physical Activity Readiness Questionnaire [PAR-Q]) (Thomas, Reading, & Shephard, 1992). Eligible toddlers were age 12–32 months, term birth (>37 weeks), birthweight >2,500 g, without health restrictions, congenital problems or developmental delays, and ambulatory. Of 304 consented dyads, 277 completed baseline data collection and were randomized (Figure 1).

Mothers and children were enrolled and completed a baseline evaluation. After a cohort of ~30 dyads completed baseline, statisticians created SPSS randomization syntax, adopting a randomization ratio of 1:1:1 (responsive parenting/maternal lifestyles/attention control), stratified by maternal overweight/obesity.

The health educator notified participants of the group assignment at the initial intervention session. We assembled nine cohorts over the 2.5-year recruitment period (2009–2012). Follow-up evaluations were conducted 6 and 12 months following baseline.

2.3 | Evaluation and measures

Data for baseline and 6- and 12-month follow-up evaluations were collected during a lab session and a home visit, scheduled 1 week apart. Data collectors were unaware of group assignment.

The protocol was approved by the university and state Department of Health. Participants provided written informed consent for themselves and their toddler and were compensated for evaluations. No adverse events occurred.

2.3.1 | Lab session

Mothers completed computer-administered questionnaires, including demographics and health history for themselves and their toddler using voice-generating software (QDS, Nova Research Company). Data collectors collected anthropometry and provided instructions for physical activity measurement.

Anthropometry

Mothers undressed their toddler to a clean diaper or underpants. Weight was measured twice to the nearest 0.1 kg and a third time if measures differed by >0.1 kg with a TANITA 1584 Baby Scale (Tanita Corp) and averaged. Recumbent length was measured to the nearest 0.5 cm with a Shorr measuring board (Shorr Productions), using a similar protocol. BMI-for-age *z* scores and percentiles were calculated using WHO standards (SPSS program [IBM SPSS] (WHO, 2006). BMI percentiles were used to classify underweight <5th percentile, overweight ≥85th and <95th percentile, and obese ≥95th percentile. No children were underweight at any evaluation.

Mothers were weighed (kilograms) (TANITA 300GS; Tanita Corp) and measured (centimetres) in duplicate, or triplicate if necessary (Shorr measuring board), using similar procedures. Maternal BMI (kg/m^2) was calculated and classified as underweight (BMI < 18.5 kg/m^2), normal weight (BMI = 18.5 to <25 kg/m^2), overweight (BMI ≥ 25 to <30 kg/m^2) and obese (BMI ≥ 30 kg/m^2).

Physical activity

Toddler–mother physical activity was measured by ankle accelerometry (Actical, Phillips Respironics, Inc.), strung on a nonremovable hospital bracelet and fastened superior to the lateral malleolus of the non-dominant or left ankle, per manufacturer instruction (next to the skin, under socks). Instructions were to wear the accelerometer for seven consecutive days without removal. The Actical is small, light and waterproof and can be worn during sleep, play, bathing or swimming. Activity counts were collected in 1-min intervals. Cut points for counts per minute have been validated for toddlers (Hager et al., 2016) (≥2,201: moderate/vigorous physical activity [MVPA]) and adolescents girls (Hager et al., 2015).

2.3.2 | TOPS home session

Acticals were removed, a mealtime was video recorded and 24-h dietary recalls were conducted.

Mealtime observation

A camera was set up, and data collectors left the area to reduce observer effect. Mothers chose the food, and recording continued until they indicated termination. Graduate students, naïve to hypotheses, family history and intervention status, coded video-recorded data using the Emotional Availability Scales (EAS) (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Biringen, Robinson, &

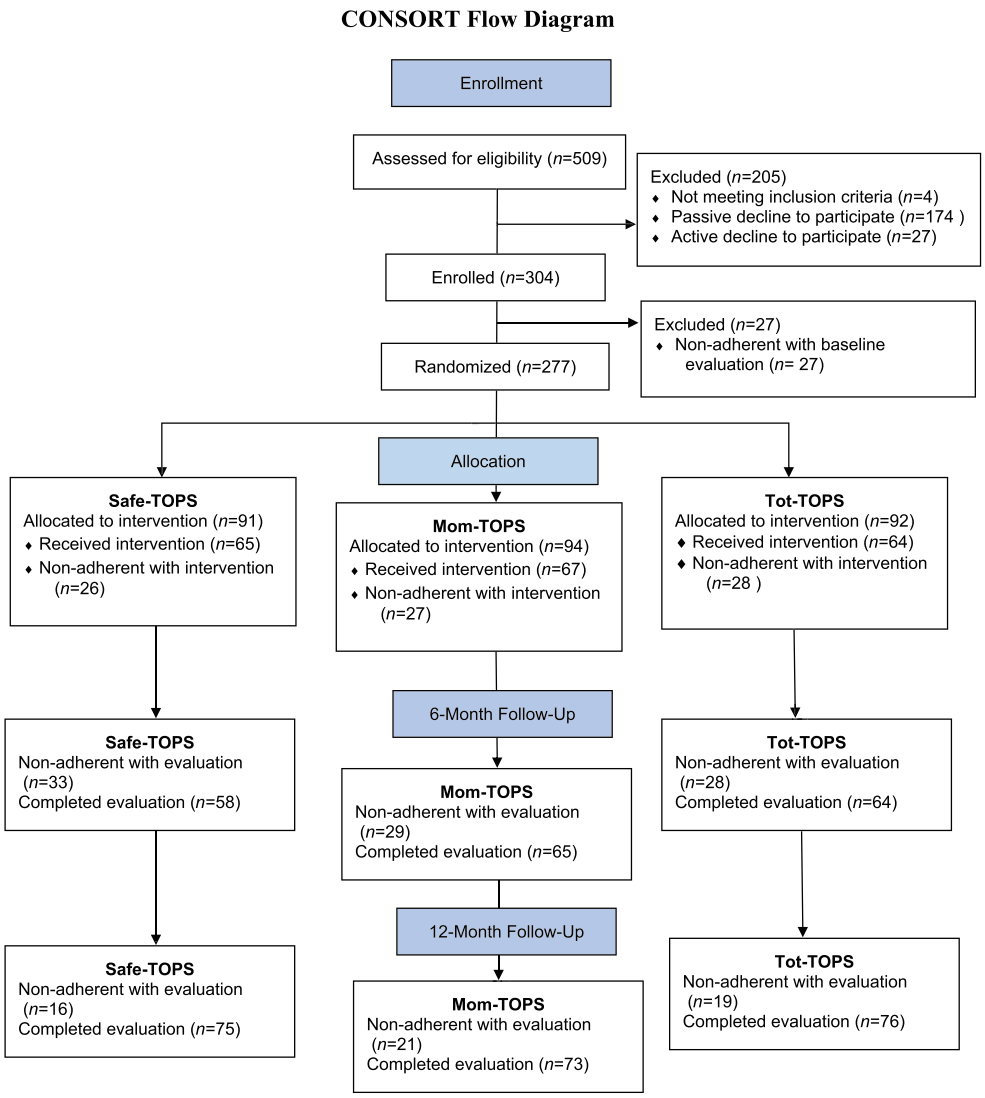

FIGURE 1 Consort flow diagram

Emde, 2000), which include four maternal scales (sensitivity: responsive to toddler's cues and requests; structuring: organize meal and facilitate transitions; non-intrusiveness: calm and not pressuring; and non-hostile: not irritable or angry) and two child scales (responsiveness: acknowledge and respond to caregiver, and involvement: involved with mealtime activities), rated on 7-point Likert scales, with high scores optimal. The non-intrusiveness and non-hostile scales range from intrusive/hostile to non-intrusive/non-hostile, meaning the absence of intrusive or hostile behaviour. Toddler–mother scale scores were averaged for a total mealtime interaction score. Coders were trained until they demonstrated interrater reliability >0.80 based on intraclass correlation coefficients [ICCs] with 10 observations from the scale creator and 10 observations with the faculty coordinator. Interrater reliability was reviewed through weekly reliability checks, with retraining as necessary.

Diet

Dietary recalls were conducted for mothers and toddlers, separately. Mothers were informed of the 24-h recall in advance and asked to gather information on the child's intake in childcare or elsewhere. A trained data collector administered the US Department of Agriculture (USDA) Automated Multiple-Pass Method (AMPM), including food model booklets and serving dishes. Breast milk consumption (n = 12) was estimated by toddler age and milk intake (Heinig, Nommsen, Peerson, Lonnerdal, & Dewey, 1993).

Maternal and toddler dietary intake data were coded and analysed using the Healthy Eating Index-2015 (HEI-2015). The HEI-2015, based on the 2015–2020 Dietary Guidelines for Americans (DGA) (Krebs-Smith et al., 2018), measures diet quality (Guenther, Reedy, & Krebs-Smith, 2008; Krebs-Smith et al., 2018) and has been used with toddlers (Au et al., 2018; Lioret et al., 2015). We used the population ratio method of calculating HEI scores, recommended for 1-day diet recalls (Au et al., 2018; Freedman, Guenther, Krebs-Smith, & Kott, 2008). The HEI-2015 includes 13 food group components that sum to 100 (0–59 graded F, 60–69 D, 70–79 C, 80–89 B and 90–100 A) (Krebs-Smith et al., 2018). Fruit and vegetable intake were targeted in the intervention and considered as secondary outcomes, along with HEI-2015 total score.

TABLE 1 Background and sociodemographic information of toddler–mother dyads at baseline

Characteristics	Overall (*n* = 277)	Control (*n* = 91)	Mom-TOPS (*n* = 94)	Tot-TOPS (*n* = 92)
Maternal characteristics				
Age (years), mean (SD)	27.28 (6.17)	28.16 (5.99)	26.17 (5.90)	27.53 (6.50)
Poverty (% below poverty threshold), *n* (%)	185 (69)	58 (66)	68 (75)	59 (65)
High school graduate (GED) or higher, *n* (%)	224 (81)	75 (82)	74 (79)	75 (82)
Married, *n* (%)	78 (28)	29 (32)	24 (26)	25 (27)
Urban, *n* (%)	167 (60)	53 (58)	56 (60)	58 (63)
BMI (kg/m^2), mean (SD)	31.80 (9.47)	31.51 (9.24)	31.98 (9.48)	31.90 (9.78)
Weight status				
BMI < 25 kg/m^2, *n* (%)	75 (27)	26 (29)	26 (28)	23 (25)
BMI ≥ 25 to <30 kg/m^2, *n* (%)	61 (22)	21 (23)	17 (18)	23 (25)
BMI ≥ 30 kg/m^2, *n* (%)	141 (51)	44 (48)	51 (54)	46 (50)
Toddler characteristics				
Age (months), mean (SD)	20.11 (5.50)	20.14 (5.46)	19.98 (5.55)	20.22 (5.56)
Female, *n* (%)	130 (47)	45 (49)	48 (51)	37 (40)
Race/ethnicity, *n* (%)				
Non-Hispanic African American	193 (70)	62 (68)	64 (68)	67 (73)
Hispanic	5 (2)	3 (3)	2 (2)	0
Non-Hispanic White	62 (22)	22 (24)	21 (22)	19 (21)
Mixed/other	17 (6)	4 (5)	7 (8)	6 (6)
BMI-for-age *z* score, mean (SD)	0.54 (1.13)	0.63 (1.14)	0.49 (1.10)	0.51 (1.16)
BMI-for-age percentile, *n* (%)				
<85th	189 (69)	57 (63)	66 (70)	66 (73)
≥85 to <95th	38 (14)	18 (20)	11 (12)	9 (10)
≥95th	47 (17)	15 (17)	17 (18)	15 (17)

Abbreviations: BMI, body mass index; GED, general educational development test.

2.4 | Statistical analyses

Data were checked for outliers, normality and internal consistency, and differences by demographic and baseline values (Table 1). Accelerometer data were reduced using Actical software (Version 2.12). Days with <80 counts per minute were removed. Days with complete data (24 h) were included, truncating the first and last day. Valid data included at least one 24-h period. Thresholds were applied to determine time spent in MVPA for toddlers (Hager et al., 2016) and mothers (Hager et al., 2015). To account for variability in days with accelerometer data, we adjusted for days in the physical activity analysis.

Intent-to-treat analyses were conducted, regardless of participation, providing unbiased comparisons between the two intervention groups and control group (McCoy, 2017). Analyses were conducted using linear mixed-effects models for continuous variables and generalized linear mixed-effects models for categorical variables, using random intercept to account for repeated measures. To estimate the intervention effect, we compared the between-group difference (between each intervention and control group) in the changes in BMI *z* score within each group (within-group change). We estimated the intervention effects in the model by including the interaction terms between intervention status (each intervention group vs. control group) and time (6 and 12 months vs. baseline, separately). Analyses were not adjusted for multiple comparisons because dependent variables are unique, hypothesized and not confounded by method invariance (Savitz & Olshan, 1995).

Retention was 68% at 6-month follow-up[2] and 81% at 12-month follow-up, based on the enrolled sample of 277 (Figure 1); *t*-tests for continuous variables and chi-squared tests for categorical variables showed no significant differences in any baseline variables between toddler–mother dyads lost to follow-up and dyads retained at each follow-up (*P*s > 0.05). Maximum likelihood estimation was used in the mixed models, accounting for missingness.

Given the wide age distribution, we conducted supplementary analyses to examine whether findings were modified by toddler age (younger 12–20 months, *n* = 138, and older 21–32 months, *n* = 139). We included a three-way interaction (age, intervention and time) and all lower-order interaction terms. Significance was set at $P < 0.05$.

At baseline, toddlers in the control group spent more minutes per day in physical activity than toddlers in intervention groups. We

[2]Follow-up at 6 months was hindered by loss of a data collector.

conducted a sensitivity analysis by including baseline physical activity as a covariate in the mixed model. Results were similar, and therefore, we retained the original analysis.

2.5 | Power analyses

We conducted a posterior power analysis (the effect size and power given the sample size). Power depends on the sample size, number of repeated measures, the ICC and percentage of loss to follow-up. For the primary outcome, the correlation between repeated measures of BMI *z* score was 0.74. Using STATA SAMPSI for repeated measures, a sample size of ∼90 per group provides adequate power (>0.8). This represents the between-group difference (each intervention group vs. control group) in the within-group changes in BMI *z* score (Cohen's d > =0.3, ∼0.3 *z*-score decrease given the standard deviation [SD] as =1), assuming 25% loss to follow-up. For secondary outcomes, the ICC was 0.37 for maternal–toddler physical activity and 0.40 for HEI-2015 score. A sample size of 90 per group provides enough power (80%) to detect a moderate intervention effect on physical activity (Cohen's d > 0.47, ∼18.8-min increase given the SD as ∼40 min) and diet (Cohen's d > 0.45, ∼5.4-unit increase given the SD as ∼12.1 units). With no previous studies on mealtime interactions, a sample size of ∼90 enables us to detect a modest intervention effect (Cohen's d > 0.45), assuming the ICC as ∼0.4 within repeated measures. We used maximum likelihood to account for missingness in loss to follow-up in analyses with mixed models; this method improves power more than power analyses based on the listwise deletion method.

3 | RESULTS

3.1 | Sample characteristics

Mean child age at baseline was 20.1 months (SD = 5.5), 47% females, 14% overweight, 17% obese and mixed race/ethnicity (70% non-Hispanic Black, 22% non-Hispanic White, 2% Hispanic and 6% mixed/other) (Table 1). Mean maternal age was 27.3 years (SD = 6.2), 72% were single, widowed or divorced, 81% completed high school and 60% resided in urban (vs. semiurban) location. Most mothers (73%) were overweight/obese and 69% were below the 2009 poverty threshold, based on mother-reported income and family size (US Census Bureau, 2020).

3.2 | Fidelity and attendance

Fidelity, based on reports from the Personal Contact Records, indicated that over 90% of the planned topics for each session were delivered, with no difference between intervention and control groups.

Attendance across intervention sessions did not differ between intervention and control groups (56–60%), 71% attended at least one session. Follow-up evaluations were scheduled regardless of attendance. Evaluation completion rates were higher (74–80% 6 months; 86–89% 12 months) among mothers who attended at least one intervention session, compared with non-attenders (56–73% vs. 38–46%). We conducted a per-protocol analysis by restricting the analyses to dyads who participated in at least one intervention session. Results were similar to the intent-to-treat analyses, which we retained.

3.3 | Change in BMI *z* score—Primary outcome

BMI *z* scores were stable and did not increase over time in either intervention or control groups. Thus, there were no intervention effects on toddler BMI *z* scores or maternal BMI in either intervention group at 6 or 12 months. The odds ratio of overweight/obesity or obesity was not significant between the intervention and control groups for either toddlers or mothers (Tables 2 and 3).

3.4 | Physical activity—Secondary outcome

Among toddlers, at 6 months, there were no intervention effects on physical activity in either intervention group. At 12 months, the Mom-TOPS group spent 24 more minutes per day in physical activity than control (24.43, 95% confidence interval [CI]: 2.55, 46.32), with no intervention effects for the Tot-TOPS group (Table 2).

Among mothers, at 6 months, there were no intervention effects on physical activity in either intervention group. At 12 months, the Mom-TOPS group spent 11 more minutes per day in physical activity than control (b = 11.01, 95% CI: 1.48, 20.54) (Table 3).

3.5 | Toddler–mother mealtime interactions—Secondary outcome

There were no intervention effects in mean total mealtime interaction score or in five of six scales. At 6 and 12 months, there was a negative intervention effect on maternal non-hostile behaviour in the Mom-TOPS group (b = −0.57, 95% CI: −1.08, −0.06, and b = −0.51, 95% CI: −1.02, −0.001, respectively) (Table 4).

To understand this unexpected finding, we conducted a supplementary analysis to compare the two interventions on mealtime interactions. At 6 months, the Tot-TOPS group had significantly higher scores than the Mom-TOPS group in toddler involvement (b = 0.69, 95% CI: 0.16, 1.22), toddler responsivity (b = 0.51, 95% CI: 0.01, 1.00), maternal sensitivity (b = 0.51, 95% CI: 0.01, 1.00) and maternal structured activities (b = 0.68, 95% CI: 0.20, 1.16). At 12 months, the Tot-TOPS group had significantly greater scores than the Mom-TOPS group in maternal non-hostile behaviour (b = 0.67, 95% CI: 0.16, 1.19).

TABLE 2 Intervention effect for toddlers: BMI *z* score, physical activity and diet quality at 6 and 12 months

	Control (*n* = 91)			Mom-TOPS (*n* = 94)			Tot-TOPS (*n* = 92)			Intervention vs. control, 6 months		Intervention vs. control, 12 months	
	Baseline	FU6	FU12	Baseline	FU6	FU12	Baseline	FU6	FU12	Mom-TOPS vs. control	Tot-TOPS vs. control	Mom-TOPS vs. control	Tot-TOPS vs. control
Toddler Characteristics	Mean[a]	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	*b* (95% CI) or OR (95% CI)[c]	*b* (95% CI) or OR (95% CI)[c]	*b* (95% (CI) or OR (95% CI)[c]	*b* (95% (CI) or OR (95% CI)[c]
BMI *z* score	0.62	0.56	0.57	0.49	0.59	0.52	0.5	0.62	0.61	0.15 (−0.10, 0.41)	0.18 (−0.07, 0.44)	0.07 (−0.17, 0.31)	0.16 (−0.08, 0.39)
BMI ≥ 85th percentile (%)	36	28	29	30	29	31	26	26	27	1.40 (0.72, 2.72)[c]	1.42 (0.70, 2.83)	1.43 (0.77, 2.69)	1.46 (0.75, 2.86)
BMI ≥ 95th percentile (%)	17	14	12	18	14	13	16	11	15	0.88 (0.36, 2.14)[c]	0.76 (0.33, 1.73)[c]	1.01 (0.39, 2.61)[c]	1.32 (0.59, 3.00)[c]
MVPA (min/day)[b]	68.7	75.45	73.17	49.05	65.77	77.95	57.15	82.58	75.14	9.96 (−9.84, 29.76)	18.67 (−0.86, 38.2)[c]	24.43 (2.55, 46.32)[c*]	13.52 (−7.98, 35.03)[c]
Total vegetables (0–5)	1.9	2.62	2.07	1.92	2.14	2.03	2	2.16	2.18	−0.5 (−1.17, 0.17)	−0.56 (−1.24, 0.12)	−0.07 (−0.7, 0.56)	0.01(−0.62, 0.64)
Greens and beans (0–5)	0.77	0.78	0.9	0.72	0.55	0.76	0.59	1.15	0.8	−0.19 (−0.9, 0.52)	0.55 (−0.17, 1.27)	−0.09 (−0.76, 0.58)	0.08(−0.59, 0.74)
Total fruit (0–5)	4.36	3.92	3.76	3.6	3.64	3.81	3.88	4.39	3.98	0.48 (−0.25, 1.22)	0.95 (0.21, 1.7)*	0.81 (0.12, 1.5)*	0.71 (0.02, 1.4)*
Whole fruit (0–5)	3.41	2.95	2.7	2.77	2.96	2.49	3.19	3.25	2.72	0.65 (−0.32, 1.61)	0.52 (−0.45, 1.5)	0.43 (−0.48, 1.33)	0.24 (−0.66, 1.14)
Total HEI-2015 (0–100)	55.1	52.97	52.19	52.44	52.16	52.84	54.58	55.04	52.49	1.85 (−3.16, 6.86)	2.59 (−2.48, 7.66)	3.31 (−1.4, 8.02)	0.82 (−3.88, 5.52)

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a]Standard errors are included in ClinicalTrials.gov and are available upon request.

[b]For physical activity, *n* = 222. The categorical variable changes or difference are based on logit scale (95% CI). Mean (standard error) was estimated on the basis of the PROC MIXED model.

[c]OR (94% CI).

*$P < 0.05$.

TABLE 3 Intervention effect for mothers: BMI, physical activity and diet quality at 6 and 12 months

	Control (n = 91)			Mom-TOPS (n = 94)			Tot-TOPS (n = 92)			Intervention vs. control, 6 months		Intervention vs. control, 12 months	
	Baseline	FU6	FU12	Baseline	FU6	FU12	Baseline	FU6	FU12	Mom-TOPS vs. control	Tot-TOPS vs. control	Mom-TOPS vs. control	Tot-TOPS vs. control
Maternal Characteristics	Mean[a]	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	*b* (95% (CI) or OR (95% CI)[c]	*b* (95% (CI) or OR (95% CI)[c]	*b* (95% (CI) or OR (95% CI)[c]	*b* (95% (CI) or OR (95% CI)[c]
BMI (kg/m^2)	31.51	31.76	31.85	31.98	31.93	32.22	31.9	31.86	32.21	−0.3 (−0.96, 0.37)	−0.29 (−0.95, 0.38)	−0.11 (−0.74, 0.52)	−0.04 (−0.66, 0.59)
Overweight/obese (%)	71	70	73	72	70	69	75	75	78	0.96 (0.68, 1.46)[c]	1.04 0.75, 1.45)[c]	0.80 (0.55, 1.17)[c]	1.12 (0.70, 1.77)[c]
Obese (%)	48	50	49	54	52	56	50	47	54	0.88 (0.71, 1.08)[c]	0.84 (0.61, 1.14)[c]	1.07 (0.76, 1.52)[c]	1.15(0.75, 1.75)[c]
MVPA (min/day)[b]	27.37	24.17	20.71	22.72	21.9	27.06	25.73	27.22	20.04	2.38 (−6.55, 11.31)	4.69 (−4.29, 13.68)	11.01 (1.48, 20.54)*	0.99 (−8.77, 10.74)
Total vegetables (0–5)	2.93	2.75	2.76	2.74	2.65	2.86	2.71	3.03	2.82	0.1 (−1.11, 0.28)	0.51 (−0.19, 1.22)	0.29 (−0.38, 0.97)	0.29 (−0.38, 0.97)
Greens and beans (0–5)	1.38	0.82	0.82	1.22	1.01	1.32	1.16	1.75	0.92	0.34 (−0.51, 1.2)	1.14 (0.29, 2)*	0.66 (−0.16, 1.47)	0.32 (−0.51, 1.14)
Total fruit (0–5)	2.62	2.22	2.23	2.51	2.53	2.2	2.34	2.68	2.16	0.41 (−0.45, 1.28)	0.74 (−0.12, 1.6)	0.09 (−0.73, 0.91)	0.21 (−0.61, 1.04)
Whole fruit (0–5)	1.98	1.57	1.5	1.5	1.76	1.39	1.59	2.15	1.45	0.68 (−0.21, 1.57)	0.97 (0.08, 1.85)*	0.38 (−0.46, 1.22)	0.34 (−0.51, 1.19)
Total HEI-2015 (0–100)	48.52	45.89	46.74	46.88	48.49	48.39	48.71	50.24	46.9	4.25 (−0.91, 9.42)	4.17 (−0.97, 9.31)	3.3 (−1.6, 8.2)	−0.03 (−4.97, 4.91)

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a]Standard errors are included in ClinicalTrials.gov and are available upon request.

[b]For physical activity, n = 238. Analyses excluded 12 pregnant mothers at 6-month follow-up and 20 pregnant mothers at 12-month follow-up. The categorical variable changes or difference are based on logit scale (95% CI). Mean (standard error) was estimated on the basis of the PROC MIXED model.

[c]OR (94% CI).

*$P < 0.05$.

TABLE 4 Intervention effect: Mealtime interactions at 6 and 12 months

	Control (*n* = 91)			Mom-TOPS (*n* = 94)			Tot-TOPS (*n* = 92)			Intervention vs. control, 6 months		Intervention vs. control, 12 months	
	Baseline	FU6	FU12	Baseline	FU6	FU12	Baseline	FU6	FU12	Mom-TOPS vs. control	Tot-TOPS vs. control	Mom-TOPS vs. control	Tot-TOPS vs. control
Dependent Variables	Mean[a]	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	*b* (95% (CI)	*b* (95% (CI)	*b* (95% (CI)	*b* (95% (CI)
Mean mealtime interactions	4.75	5.10	5.41	4.70	4.69	5.10	4.41	5.05	5.20	−0.33 (−0.75, 0.09)	0.20 (−0.22, 0.62)	−0.36 (−0.78, 0.06)	0.03 (−0.39, 0.45)
Child involvement	4.57	4.94	5.3	4.61	4.66	5.17	4.36	5.09	5.27	−0.33 (−0.86, 0.21)	0.36 (−0.19, 0.90)	−0.18 (−0.72, 0.36)	0.18 (−0.37, 0.72)
Child responsive	4.93	5.23	5.65	4.83	4.99	5.3	4.6	5.26	5.41	0.14 (−0.65, 0.37)	0.37 (−0.14, 0.88)	−0.25 (−0.76, 0.26)	0.09 (−0.42, 0.61)
Maternal non-hostility	5.13	5.62	5.64	5.2	5.12	5.2	4.83	5.24	5.5	−0.57 (−1.08, −0.06)*	−0.08 (−0.60, 0.43)	−0.51 (−1.02,-0.001)*	0.16 (−0.36, 0.68)
Maternal non-intrusive	4.18	4.93	5.28	4.2	4.56	4.87	3.98	4.75	5.01	−0.4 (−0.92, 0.13)	0.02 (−0.50, 0.55)	−0.44 (−0.96, 0.08)	−0.07 (−0.60, 0.45)
Maternal sensitivity	4.64	4.98	5.48	4.57	4.58	5.02	4.35	4.87	5.02	−0.33 (−0.83, 0.11)	0.18 (−0.89, 0.11)	−0.39 (−0.89, 0.11)	−0.17 (−0.68, 0.34)
Maternal structured	4.86	4.85	5.33	4.73	4.48	4.89	4.4	4.83	4.93	−0.25 (−0.74, 0.24)	0.43 (−0.06, 0.92)	−0.32 (−0.80, 0.17)	0.06 (−0.43, 0.55)

Abbreviation: CI, confidence interval.

[a]Standard errors are included in ClinicalTrials.gov and are available upon request.

*$P < 0.05$.

3.6 | Diet quality—Secondary outcome

For HEI-2015 fruit and vegetables, among toddlers, at 6 and 12 months, the Tot-TOPS group had a significant HEI-2015 fruit intervention effect (b = 0.95, 95% CI: 0.21, 1.7, and b = 0.71, 95% CI: 0.02, 1.40, respectively). At 12 months, the Mom-TOPS group had a significant HEI-2015 fruit intervention effect (b = 0.81, 95% CI: 0.12, 1.50) (Table 2).

Among mothers, at 6 months, Tot-TOPS mothers had a significant HEI-2015 greens and beans effect and whole fruit effect (b = 1.14, 95% CI: 0.29, 2.00, and b = 0.97, 95% CI: 0.08, 1.85, respectively) (Table 3). There were no effects at 12 months.

Toddler–mother dyads had poor diet quality, with mean baseline HEI-2015 total score within the lowest grade for toddlers and mothers. There were no intervention effects on HEI-2015 total score for toddlers or mothers at either follow-up.

3.7 | Moderation by toddler age

We did not find significant moderation effects for toddler BMI z scores, but moderation was significant for physical activity, total mealtime interactions and HEI-2015. Among older toddlers, intervention effects were significant for physical activity, mealtime interactions and HEI-2015. In physical activity, the Mom-TOPS group exceeded control by 50.22 min (95% CI: 24.98, 75.46) at 6 months and by 53.30 min (95% CI: 24.05, 82.56) at 12 months. The Tot-TOPS group exceeded control by 36.73 min (95% CI: 24.05, 82.56) at 6 months and by 45.92 min (95% CI: 19.28, 72.55) at 12 months. In both mealtime interactions and HEI-2015, the Tot-TOPS group exceeded control at 6 months (b = 0.67, 95% CI: 0.06, 1.28, and b = 7.2, 95% CI: 0.31, 14.09), with no significant effects at 12 months.

Among younger toddlers, there were no significant intervention effects on physical activity or HEI-2015. For mealtime interactions, the Mom-TOPS group had significantly lower total mealtime interaction scores than control at 6 and 12 months (b = −0.91, 95% CI: −1.45, −0.38, and b = −0.82, 95% CI: −1.36, 0.27, respectively).

4 | DISCUSSION

This two-generation randomized attention-controlled trial among toddler–mother dyads had no intervention effect on BMI z score among toddlers or BMI among mothers. There were significant positive intervention effects on physical activity and fruit intake and significant negative effects on mealtime interactions. Over two thirds of the toddlers (69%) had a BMI-for-age below the 85th percentile. BMI z score remained stable in the intervention and control groups, indicating that the toddlers did not experience the increased rate of BMI z score growth that has been described previously among toddlers from low-income, predominantly African American families (Thompson & Bentley, 2013). However, 31% were overweight/obese at baseline, indicating that rapid rate of BMI z score growth occurred prior to recruitment.

There are several possible explanations for the lack of intervention effects in BMI z scores. A previous investigation found that mothers did not perceive their children to be overweight/obese and most preferred that their toddlers be heavier (Hager et al., 2012). Three quarters of the mothers were overweight/obese themselves, and most consumed a diet of low quality (and provided a similar diet for their toddlers) (Papas et al., 2009). Thus, mothers may have had little interest in altering their diet or in adopting obesity prevention behaviours. These findings are consistent with reviews that have found few trials that successfully altered weight gain among toddlers and preschoolers (Bleich, Segal, Wu, Wilson, & Wang, 2013; Wang et al., 2015).

The lack of BMI z-score differences between intervention and control and the stable BMI z scores in all groups may reflect decreases in obesity among children age 2–4 years reported by the Centers for Disease Control and Prevention (CDC) (Pan et al., 2016; Pan et al., 2019). Obesity prevalence decreased from 15.9% in 2010 to 13.9% in 2016 among children age 2–4 years who participated in WIC state or territory agencies. The CDC report points to multiple potential explanations, including modification of the WIC food package in 2009, which resulted in increases in children's dietary intake of fruits, vegetables and whole grains and decreases in juice, white bread and whole milk (Schultz, Byker Shanks, & Houghtaling, 2015), along with adoption of the 2005 DGA, and food and feeding practice guidelines of the American Academy of Paediatrics. Most TOPS families were WIC participants and may have benefitted from these advances.

The maternal lifestyle interventions led to 24-min increases in accelerometry-measured physical activity among toddlers and 11-min increases among mothers at 12 months. The increase in maternal physical activity is consistent with increases in physical activity among adolescents with a lifestyle behaviour coach (Black et al., 2010), suggesting sustained benefits when lifestyle behaviours are targeted. These improvements are encouraging, particularly given WHO's recently released guidelines for physical activity among children under age 5 years (WHO, 2019) and illustrate the impact of two-generation interventions. At baseline, toddler–mother physical activity was related in this sample (Hager et al., 2017), perhaps suggesting toddler–mother joint activities.

The diets of the mothers and toddlers overall were of low quality, based on the DGA, with most toddlers and mothers achieving an HEI-2015 score in the lowest grade. There were intervention effects in dietary fruit among toddlers in both intervention groups and total fruit and greens and beans among mothers in the responsive parenting group but no overall intervention effects on diet quality. These findings are consistent with a national study of WIC-participating toddlers that found low diet quality, particularly in vegetables, greens and beans (Au et al., 2018).

The negative effects on mealtime interaction in the maternal lifestyles group at both 6 and 12 months occurred in non-hostile behaviour, meaning that the maternal lifestyle intervention group increased in hostile interactions compared with the control group. One

possibility is that with a focus on healthy foods, without attention to responsivity and toddler–mother interactions, mothers adopted a controlling pattern during meals. Analyses between the two intervention groups (independent of the control group) suggest that in the responsive parenting group, mothers increased in sensitivity and mealtime structure and toddlers increased in involvement and responsivity. These patterns are consistent with the responsive parenting intervention (Hurley & Black, 2011) and represent the bidirectional, back-and-forth interaction pattern that characterizes healthy toddler–mother interactions (Sameroff, 2009). These findings illustrate that responsive parenting behaviours can be incorporated into mealtime interactions (Magarey et al., 2016), even in the absence of changes in weight gain. Adoption of responsive feeding behaviours may protect toddlers from rapid BMI *z*-score growth as age-inappropriate feeding behaviours have been associated with both energy intake and body size (Thompson & Bentley, 2013). However, the effects were not sustained through 12 months, suggesting that responsive parenting interventions with toddlers that target mealtime interactions may benefit from boosters to address toddlers' emerging developmental skills and the parenting environment (Bailey, Duncan, Odgers, & Yu, 2017).

In contrast to the responsive parenting intervention, the maternal lifestyle intervention focused exclusively on healthy maternal diet and physical activity, not on maternal responsivity or toddler feeding behaviour. There are several possible explanations for the decline in mother–toddler mealtime interactions that occurred at 6 and 12 months in the maternal lifestyles group, compared with the control group. In response to the focus on a healthy diet, the maternal lifestyle group may have adopted a feeding pattern characterized by maternal control, rather than a pattern with recognition of children's cues, prompt responses and positive interactions (Black & Aboud, 2011). This finding raises concerns that dietary interventions that do not include responsive parenting and toddler–mother mealtime interactions may inadvertently promote controlling feeding patterns. In addition, by increasing maternal attention and responsivity to toddler safety (Wang et al., 2015), home safety group mothers may have increased their responsivity during mealtimes, leading to fewer intrusive mealtime interactions. The health educators noted that lessons on poison control and fall prevention often led to discussions on what to expect from toddlers, potentially increasing mothers' acceptance of and attunement to toddler mealtime behaviour.

The supplementary analysis on toddler age found significant intervention effects on physical activity, mealtime behaviour and diet quality among older, but not younger, toddlers. Developmental differences in language, motor and eating skills are one plausible explanation for the age effects. Younger toddlers have emerging language skills, are acquiring motor skills such as coordination and running and are transitioning to the family diet and learning to self-feed. In contrast, older toddlers have accomplished these basic tasks, and both they and their mothers may have been ready for the recommended behaviour changes. Thus, the impact of two-generation interventions in this age range may vary by children's developmental readiness.

The worsening of the mealtime interactions at 6 and 12 months among mothers and toddlers in the maternal lifestyles group occurred primarily among the younger toddlers. An emphasis on healthy diet with no attention to toddlers' emerging feeding behaviours or responsive feeding may have led to coercive strategies, particularly among mothers of younger toddlers. Older toddlers often demonstrate increasing autonomy through refusals and behaviours such as food neophobia and pickiness (Cole, An, Lee, & Donovan, 2017). Thus, parents of older toddlers may have been differentially responsive to the intervention in response to challenging toddler behaviour. Changes in mealtime behaviours, intakes and interactions are expected as toddlers mature and assume more independence. Corresponding changes in maternal sensitivity, structure and intrusiveness are also expected, reflecting the developmental changes in children's skills. A recent review to inform the development of the DGA for children from birth through 24 months includes recommendations for caregiver–toddler feeding interactions (Spahn et al., 2019).

Several limitations should be considered. Over one quarter (29%) of the mothers across all three intervention groups did not participate in any intervention sessions, raising concerns about the feasibility of group sessions for mothers in low-income settings and suggesting that alternative intervention platforms be considered. Power was compromised because of the lack of participation in the interventions and to small sample sizes in the supplementary age moderation analyses. Thus, the risk of a type 2 error, not finding a difference that exists, was increased. An additional limitation is that 1-min intervals were used to measure physical activity for toddlers and mothers. Shorter intervals enable spontaneous activity to be captured. Dietary data collection relied on single-day 24-h recall at each evaluation. Finally, although we designed the intervention based on a recognized model used in the Triple-P Program (Sanders et al., 2014), the design may not have been intensive enough for participants to internalize, adopt and sustain two-generation toddler–mother behaviour changes included in the intervention. Strengths of the investigation are a theory-based orientation focused on two generations, a randomized trial design with an attention control group and comparison of two intervention strategies with the control group. Other strengths include evaluations at 6- and 12-month follow-ups to examine sustainability and direct measures of anthropometry, physical activity, mealtime interaction and diet quality among mothers and toddlers.

Future directions include examination of differential intervention effects based on baseline weight status and investigation of the mechanisms underlying the impact of the intervention, including mediators and predictors of sustainability and fade-out (Bailey et al., 2017). Dyadic cross-lagged models of toddler–mother physical activity and mealtime interaction patterns could examine the timing of mother and toddler behaviours and differences between younger and older toddlers. A concurrent process evaluation would be helpful in understanding the findings.

5 | CONCLUSIONS

This two-generation randomized attention-controlled trial among toddler–mother dyads did not impact weight gain among toddlers or mothers in either intervention group. The lack of increase in BMI-for-age over 12 months across all groups, including the control group, suggests stable weight gain, although almost one third were overweight/obese at baseline. The maternal lifestyle intervention improved physical activity among toddlers and mothers. Both interventions improved fruit intake, although overall diet quality was low. Neither intervention improved mealtime interactions, compared with a home safety attention control. However, declines in the maternal lifestyle group, coupled with improvements in the responsive parenting group compared with the maternal lifestyles group, suggest that aspects of both interventions be considered in future trials. Others have shown positive impacts of two-generation interventions on obesity risk behaviours, such as self-regulation and healthy habits, with null or modest effects on obesity prevalence among toddlers and preschoolers (Anderson, Sacker, Whitaker, & Kelly, 2017; Lumeng et al., 2017). To prevent rapid rate of BMI *z*-score growth in toddlers, additional research is needed on two-generation strategies that integrate responsive parenting and maternal lifestyle behaviours and promote healthy physical activity, mealtime and dietary habits.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

All authors contributed to the conceptualization and implementation of the trial, critically reviewed and revised the manuscript, and approved the final version. MMB obtained funding, supervised the overall conduct of the trial and prepared the first draft. ERH provided expertise on the overall implementation, especially the physical activity assessments, evaluation and interpretation. YW conducted the data analysis. KMH provided expertise on the overall implementation, especially dietary assessments, evaluation and interpretation. LWL served as the project manager and supervised the intervention and evaluations. MC provided expertise on the responsive parenting intervention, supervision, assessment and interpretation. LEC provided expertise on dietary assessment and interpretation and on clinical trial requirements.

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APPENDIX A: TOPS INTERVENTION GROUP DESCRIPTION AND SESSIONS

A.1 | TOPS intervention sessions

A.1.1 | Home safety (Safe-TOPS)

The safety intervention was an attention control to ensure that intervention effects could not be explained by attention alone. The safety intervention addressed home child proofing, poison control, hotlines, car seats, common toddler illnesses, over-the-counter medications, and fire and fall prevention. No information was provided on physical activity, parenting, mealtime interactions or nutrition. The impact of the safety intervention on home safety problems has been reported. (Wang et al., 2018)

A.1.2 | Maternal lifestyle (Mom-TOPS)

Rates of overweight/obesity among women of childbearing age have increased dramatically (Ogden et al., 2016). The intervention included modules and activities on maternal physical activity and dietary patterns, informed by a prior successful intervention focused on lifestyle behaviours (Black et al., 2010), and was delivered exclusively to mothers without emphasizing toddler involvement.

A.1.3 | Responsive parenting (Tot-TOPS)

The responsive parenting intervention, informed by transaction theory (Sameroff, 2009), responsive parenting (Landry, Smith, Swank, & Guttentag, 2008) and principles of Active Parenting™, included modules and activities on toddlers' signals, toddler behaviour and development, communication, managing behaviour without relying on food, and toddler temperament and emerging autonomy. It also addressed toddler physical activity, mealtime routines, foods and portion sizes.

Session	Safe-TOPS	Mom-TOPS	Tot-TOPS
Group 1	*Car seat safety* 1.1Lesson plan 1.2TOPS schedule 1.3Incentive plan 1.4Membership agreement 1.5Resource list for Baltimore City and Anne Arundel County 1.6Goal setting for safe habits worksheet 1.7Long-term goal worksheet 1.8Maryland's child safety seat law 1.8bMaryland's child passenger safety laws (orange card) 1.9Boosters are for big kids 1.10Every child deserves a safe ride 1.11Check your child's car seat 1.12Questions about car seat safety? 1.13TOPS weekly goal tracker 1.14Contact sheet 1.15Participant evaluation	*A balanced diet, a healthy lifestyle* 1.1Lesson plan 1.2TOPS schedule 1.3Incentive plan 1.4Membership agreement 1.5Resource list for Baltimore City 1.6Be smart! 1.7Healthy habits chart 1.8Long-term goal worksheet 1.9Recreational resource guide 1.107 steps for success (?) 1.11Walking chart 1.12TOPS weekly goal tracker 1.13Contact sheet 1.14Participant evaluation	*You and your child—a special relationship* 1.1Lesson plan 1.2TOPS schedule 1.3Incentive plan 1.4Membership agreement 1.5Resource list for Baltimore City 1.6Long-term goal worksheet 1.7Ages and stages 1.8Physical activity for toddlers 1.9Recreational resource guide 1.10TOPS weekly goal tracker 1.11Goal setting worksheet 1.12Contact sheet 1.13Participant evaluation
Gift	•Baby sunscreens •Colouring book and crayons	•Canned cookbook •Pedometer	•Colouring book and crayons
Group 2	*Poison prevention* 2.1Lesson plan 2.2Look-a-like activity 2.3Poison prevention tips 2.4All-purpose cleaner recipe 2.5Creating your own cleaning supplies 2.6What you need to know brochure (from poison control centre) 2.7TOPS weekly goal tracker 2.8Participant evaluation	*Healthy snacking and drinking* 2.1Lesson plan 2.2I'm tempted to snack when I'm … 2.3Alternatives to eating 2.4Healthy snack ideas 2.5Think about what you drink 2.6TOPS weekly goal tracker 2.7Participant evaluation	*Preventing problems and discipline* 2.1Lesson plan 2.2Choices worksheet 2.3When–then rule worksheet 2.47 tips for making rules 2.5Making rules worksheet 2.6Daily routine worksheet 2.7TOPS weekly goal tracker 2.8Participant evaluation
Gift	•Outlet covers •Cabinet latches	•Water bottles •'CanFidential' creations recipes	•Cups and snack bowls
Group 3	*Fire safety* 3.1Lesson plan 3.2Teaching preschoolers about fire safety 3.3Home fire escape plan 3.4Home fire safety checklist 3.5Prepare, practice, prevent the unthinkable 3.6Household hazards doorknob hanger 3.7TOPS weekly goal tracker 3.8Participant evaluation	*Fruits and veggies—more matters* 3.1Lesson plan 3.25 a day the colour way 3.3Tips for buying fruits and vegetables 3.4Fruit and vegetable storage and selection 3.5Seasonal fruits and vegetables 3.6Farmers' market locations and hours of operation 3.7Reading food labels 3.8Resistance band exercises 3.9TOPS weekly goal tracker 3.10Participant evaluation	*Encouraging positive behaviour and mealtime behaviours* 3.1Lesson plan 3.2Nonfood rewards 3.3Pathways to good communication with your toddler during mealtimes 3.4Tips to help your toddler eat new foods 3.5Tips to help your toddler eat vegetables 3.6TOPS weekly goal tracker 3.7Participant evaluation
Gift	•First aid kits	•Printed exercise cards •Salad dressing recipe book	•Stickers •Animal foam puzzles
Group 4	*Fall prevention* 4.1Lesson plan 4.2Keeping kids safe from falling injuries at home 4.3Preventing childhood falls 4.4Home safety checklist 4.5TOPS weekly goal tracker 4.6Participant evaluation	*Trimming the fat* 4.1Lesson plan 4.2Favourite fast-food meal 4.3Fast-food nutrition guide 4.4Choosing healthier fast foods 4.5Let us trade 4.6Cardio and abs exercises 4.7TOPS weekly goal tracker 4.8Participant evaluation	*Encouraging healthy habits for a lifetime* 4.1Lesson plan 4.2Toddler and preschooler mealtime management (12–24, 24–36 and 36–48 months) 4.3P.L.A.N. ahead for mealtime behaviour problems 4.4Plan scenario worksheet 4.5Suggested amounts to serve toddlers 4.6TOPS personal goal tracker 4.7Participant evaluation
Gift	•Table corner covers	•Printed exercise cards •Frappe recipe book	•Bowls and utensils

(Continues)

Session	Safe-TOPS	Mom-TOPS	Tot-TOPS
Phone 5	*Individual goal setting related to safety* 5.1Review goal tracker and progress 5.2Analysis of enablers and barriers 5.3Relate to group session topics 5.4Update goals and plans for success	*Individual goal setting related to maternal diet and physical activity* 5.1Review goal tracker and progress 5.2Analysis of enablers and barriers 5.3Relate to group session topics 5.4Update goals and plans for success	*Individual goal setting related to toddler–mother healthy habits* 5.1Review goal tracker and progress 5.2Analysis of enablers and barriers 5.3Relate to group session topics 5.4Update goals and plans for success
Phone 6	*Individual goal setting related to safety* 6.1Review goal tracker and progress 6.2Analysis of enablers and barriers 6.3Relate to group session topics 6.4Update goals and plans for success	*Individual goal setting related to maternal diet and physical activity* 6.1Review goal tracker and progress 6.2Analysis of enablers and barriers 6.3Relate to group session topics 6.4Update goals and plans for success	*Individual goal setting related to toddler–mother healthy habits* 6.1Review goal tracker and progress 6.2Analysis of enablers and barriers 6.3Relate to group session topics 6.4Update goals and plans for success
Phone 7	*Individual goal setting related to safety* 7.1Review goal tracker and progress 7.2Analysis of enablers/barriers 7.3Relate to group session topics 7.4Update goals and plans for success	*Individual goal setting related to maternal diet and physical activity* 7.1Review goal tracker and progress 7.2Analysis of enablers and barriers 7.3Relate to group session topics 7.4Update goals and plans for success	*Individual goal setting related to toddler–mother healthy habits* 7.1Review goal tracker and progress 7.2Analysis of enablers and barriers 7.3Relate to group session topics 7.4Update goals and plans for success
Group 8	*Review and celebration* 5.1Lesson plan 5.2Safe habits worksheet 5.4TOPS weekly goal tracker 5.4Participant evaluation	*Review and celebration* 5.1Lesson plan 5.2Healthy habits worksheet 5.3TOPS weekly goal tracker 5.4Participant evaluation	*Review and celebration* 5.1Lesson plan 5.2Parenting habits worksheet 5.3TOPS weekly goal tracker 5.4Participant evaluation
Gift	•TOPS recipe book •Certificate of completion	•TOPS recipe book •Certificate of completion	•TOPS recipe book •Certificate of completion