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Economic evaluation of the Communicating Healthy Beginnings Advice by Telephone trial for early childhood obesity prevention

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Abstract

Objective: This study aimed to conduct an economic evaluation of the Communicating Healthy Beginnings Advice by Telephone (CHAT) trial to prevent childhood obesity.

Methods: Cost-effectiveness analyses were conducted for the telephone and short message service (SMS) delivery of Healthy Beginnings advice, compared with usual care, which included child health services unrelated to Healthy Beginnings. Costs were valued in 2018 Australian dollars, and costs and outcomes were discounted at 5% per year. The costs of upscaling both delivery modes to all yearly births in New South Wales, Australia, were estimated and compared with the original Healthy Beginnings home-visiting intervention.

Results: At child age 2 years, the SMS delivery was more cost-effective ($5154 per unit BMI and $979 per 0.1 BMI *z* score units avoided) than the telephone delivery ($10,665 per unit BMI and $2017 per 0.1 BMI *z* score units avoided). The costs of upscaling the SMS ($7.64 million) and the telephone delivery modes ($37.65 million) were lower than the home-visiting intervention ($108.45 million).

Conclusions: SMS delivery of Healthy Beginnings advice was more cost-effective than telephone delivery but less cost-effective than the original home-visiting approach

($4230 per unit BMI avoided, as calculated in an earlier study). Both the SMS and telephone interventions were more affordable than the home-visiting approach.

INTRODUCTION

The prevention of obesity has many individual and societal benefits, with early childhood recognized as a critical period for intervention [1]. Globally, there has been a rapid increase in the number of children living with obesity over the past two decades, with an estimated 39 million children under age 5 years experiencing overweight or obesity in 2020 [2]. In Australia in 2017 and 2018, a quarter of children aged 2 to 17 years were affected by overweight or obesity, with one in twelve identified as having obesity [3].

Interventions to establish healthy lifestyle behaviors in the first 2000 days of a child's life are important in reducing risks for childhood obesity [4]. Several randomized control trials (RCTs) have proven that such interventions can be effective in improving obesity-related behaviors such as infant feeding practices and active play [5-9]. However, their value for money is rarely evaluated even though this evidence is critical for decision-making in settings where health budgets are restricted. To date, economic evaluations conducted alongside RCTs have been published for only three obesity-prevention interventions in early childhood, to our knowledge [10-12]. One of these studies examined the Healthy Beginnings program, in which staged home visits to deliver early childhood obesity-prevention messages resulted in a lower mean body mass index (BMI) of participating children compared with those who did not participate in the program at the age of 2 years [9,10]. The program had similar cost-effectiveness to other interventions in this age group, but the home visits were relatively costly and had limited population reach [10,13].

To address this problem, the program investigators developed the Communicating Healthy Beginnings Advice by Telephone (CHAT) program, in which the health messages offered in the original Healthy Beginnings program were adapted for less-costly and more-accessible delivery approaches using telephone calls or short message service (SMS) [14, 15]. Interventions using these technologies have demonstrated promising effects on health behaviors relevant to obesity prevention and weight management [16–19]. A three-arm RCT of the CHAT program demonstrated that the telephone and SMS interventions were effective in improving infant feeding practices and early active play such as "tummy time" at 6 and 12 months of age [14] and were effective at reducing bottle use at bedtime at age 2 years [15]. Furthermore, the CHAT intervention groups had, on average, lower BMI and BMI *z* scores (BMI-z) than the control group at age 2 years [15]. Although this effect was not statistically significant, the direction of the effect on BMI and BMI-z suggests that the interventions could hold value as part of an obesity-prevention strategy. However, the value for money of these interventions, a key metric for decisions on health funding, is yet to be established.

Therefore, the objective of this study was to conduct an economic evaluation of the telephone and SMS interventions from the CHAT RCT, compared with usual care, from a health payer's perspective. Specifically, we aimed to conduct a cost-effectiveness analysis in which the outcome is BMI or BMI-z. To gain insight into the affordability of the interventions, an estimation of the cost of upscaling both the telephone and SMS interventions to all newborns in the state of New South Wales (NSW), Australia, was also included in the evaluation.

Study Importance

What is already known?

- The Communicating Healthy Beginnings Advice by Telephone (CHAT) trial showed that short message service (SMS) and telephone interventions targeted to mothers of infants reduced obesity-related behaviors.
- The value for money of these interventions is yet to be established and compared with the original Healthy Beginnings home-visiting intervention.

What does this study add?

- The SMS intervention was more cost-effective for the outcome, BMI, at child age 2 years than the telephone intervention, but both were less cost-effective than the original home-visiting intervention.
- The SMS and telephone interventions were estimated to be considerably more affordable than the home-visiting intervention if scaled up to all births in New South Wales, Australia.

How might these results change the direction of research or the focus of clinical practice?

- The results suggest that a combination of SMS, telephone, and home-visiting approaches to delivering obesity-prevention messages for infants may be favorable in resource-constrained settings.

METHODS

The CHAT trial

The CHAT trial was a three-arm RCT with the aim of promoting healthy infant feeding and active play behaviors among children in the first 2 years of life [20]. The trial aimed to determine the effectiveness of delivering nurse-led telephone advice or SMS advice compared with a control group, representing usual care. A total of 1155 pregnant women in the third trimester, hereby referred to as mothers, were recruited into

the study across eight hospital sites within four local health districts in the state of NSW, Australia, in 2017. For mothers randomized to the telephone and SMS groups, the interventions were delivered at nine stages between the third trimester of pregnancy and child age 24 months, corresponding to key developmental milestones of child feeding and movement. The outcomes of the CHAT trial at 12 and 24 months have been reported elsewhere [14,15].

Mothers in all groups, i.e., interventions and control, could access usual care. This included universal child and family health services provided by local health districts comprising one nurse home visit, multiple visits up to 2 years for high-risk families, or attendance to child and family health centers available to all families [21,22]. These usual care visits were not related to the original Healthy Beginnings home-visiting program. Mothers from the control group were also mailed resources about infant care, which included information unrelated to obesity prevention, such as promoting infant safety. Mothers in the telephone group additionally received nine telephone support sessions of approximately 30 to 60 minutes each plus complementary information booklets. Mothers in the SMS group received text messages twice a week over 4 weeks at each of the nine developmental stages plus the complementary booklets. Mothers in the SMS group could also send SMS messages, which were reviewed and responded to by research nurses. The key messages delivered to both the telephone and SMS intervention groups focused on infant feeding, active play, and television-viewing behaviors. The infant feeding messages included the promotion of breastfeeding, no solids until 6 months of age, water as the only drink, and fruit and vegetable consumption after 6 months [20]. These interventions also provided reminders to get vaccinations and regular universal health checks as well as referrals to other services when required and with the consent of the mother. All participants were invited to complete a computer-assisted telephone survey at baseline (third trimester) and follow-up surveys at child age 6, 12, and 24 months. At 24 months, child height and weight were measured, and mothers were asked questions about their child's health care use and about any time they or a family member missed work or their usual activities because of their child's illness (online Supporting Information).

Economic evaluation

We carried out a trial-based economic evaluation of CHAT, which accounted for resources spent and outcomes measured during the time frame of the RCT (in this case, from birth until age 2 years). We used a health-payer perspective, as local health districts are the primary entity funding child and family health services in NSW. The costs of delivering each intervention per child were determined using standard micro-costing methods in which every input to deliver the program is accounted for and valued. The costing of the SMS and telephone interventions has been reported elsewhere [13]. Briefly, the costs counted included costs of all resources needed to reproduce the intervention but excluded any research and development costs. The costs of the telephone intervention included the costs of mobile phones, service provider costs of telephone calls, nurse time, training of nurses, payment of interpreters, administration time, and educational materials. The SMS intervention included the costs of training of nurses, time taken for sending and responding to texts, and service provider costs. Other health care resources used during the trial period included the number of general practitioner (GP) and medical specialist visits for the child participant and this was determined through mother self-report at child age 2 years. We assumed the number of visits was evenly distributed across the 2 years, which is consistent with an earlier study of health care utilization patterns in the early childhood years [23]. Median imputation was used to estimate the number of GP and specialist visits for the small proportion of participants with missing data (1.8% of those with complete data on BMI). Unit costs of GP ($38.75) and specialist ($89.55) consultations were determined from the Medical Benefits Advisory Schedule (MBS) listed costs per presentation, as specified for MBS Item number 23 and 104, respectively [24]. The reference year and currency for the analysis was 2018 Australian dollars. All costs and outcomes accrued beyond year 1 were discounted at 5%, consistent with Australian pharmaceutical funding guidelines [25].

The cost-effectiveness analyses determined outcomes in BMI-z and BMI at child age 2 years in the telephone group, compared with control, and the SMS group, compared with control. To calculate incremental cost-effectiveness ratios (ICER), the difference in overall costs (intervention and health care) among the intervention and control groups was divided by the difference in outcomes among the intervention and control groups. Joint uncertainty in costs and outcomes was determined using bootstrapping with replacement, and cost-effectiveness acceptability curves were constructed. This allowed calculation of the probability of cost-effectiveness at a range of willingness to pay thresholds for units of health benefit.

We followed best-practice reporting guidelines as specified by the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement (online Supporting Information) [26]. All analyses were conducted in Stata version 16 (StataCorp LLC), and figures were created in GraphPad Prism version 9.3.1 [27].

Sensitivity analysis

As a sensitivity analysis, we recalculated all ICER from a limited societal perspective. The opportunity costs of missed days of work were determined from mothers' self-reported days of work or usual activities missed. These were valued based on national median weekly earnings, which were used to estimate median daily earnings ($215 per day) [28]. The costs of these productivity losses were incorporated into the incremental cost calculations, which also included health care and intervention costs.

Costs of upscaling

To examine the affordability of the SMS and telephone groups and the original Healthy Beginnings home-visiting intervention [9] for comparison, the costs of upscaling the interventions to every child born in NSW were estimated. The mean costs per child for CHAT SMS, CHAT telephone, and Healthy Beginnings home visiting [13] were multiplied by the number of births in NSW in 2018. A 95% uncertainty interval was

calculated by multiplying the number of births with the lower and upper bounds of the 95% uncertainty interval of the mean costs per child.

RESULTS

Study participants

In total, 797 (69%) trial participants completed the 2-year follow-up survey and, of these, 666 (84%) had home visits to measure height and weight. However, the height of 4 children could not be accurately measured, which left 662 complete measurements of BMI. Of those participants with complete BMI measurements, 3 (0.5%) and 11 participants (1.7%) answered "do not know" to the questions regarding number of specialist and GP visits, respectively. Median visits were used to impute these values. Therefore, a sample of 662 participants, with 220, 200, and 242 participants in the control, telephone, and SMS groups, respectively, was used in this economic evaluation. Across the trial groups, the distribution of sociodemographic characteristics was reasonably similar, and any differences were not statistically significant (Table 1).

Cost-effectiveness analyses

The costs of delivering the SMS and telephone interventions were $80 and $394 per child, respectively [13]. All mothers had visited the GP for their child at least once in the previous 2 years, whereas 34% to 38% of participants in each group had visited a specialist for their child (Table 2). The mean number of GP and specialist visits and

TABLE 1 Mothers' baseline characteristics by group allocation

	Telephone, $n = 200$	SMS, $n = 242$	Control, $n = 220$	p value
Mother's age (y)				0.607
16-24	9 (5)	20 (8)	14 (7)	
25-29	47 (23)	47 (20)	47 (21)	
30-34	73 (36)	99 (41)	91 (41)	
35-39	58 (29)	63 (26)	51 (23)	
40-49	13 (7)	13 (5)	17 (8)	
Country of birth				0.824
Australia	73 (37)	95 (39)	82 (37)	
Other	127 (63)	147 (61)	138 (63)	
Language spoken at home				0.749
English	110 (55)	127 (52)	113 (51)	
Other	90 (45)	115 (48)	107 (49)	
Annual household income				0.197
<$40,000	14 (7)	27 (11)	28 (13)	
$40,000-$79,999	41 (20)	50 (21)	55 (25)	
≥$80,000	124 (62)	147 (61)	114 (52)	
Do not know/refused	21 (11)	18 (7)	23 (10)	
Employment status				0.063
Employed	148 (74)	160 (66)	137 (62)	
Unemployed	26 (13)	52 (22)	47 (21)	
Other	26 (13)	30 (12)	36 (17)	
Marital status				0.655
Married/de facto partner	187 (94)	229 (95)	211 (96)	
Other	12 (6)	13 (5)	9 (4)	
Education level				0.905
Up to HSC to TAFE/diploma	59 (30)	72 (30)	69 (31)	
University	141 (70)	169 (70)	151 (69)	
First-time mother				0.086
No	85 (43)	97 (40)	110 (50)	
Yes	115 (57)	145 (60)	110 (50)	

Abbreviations: HSC, Higher School certificate (the highest educational award in secondary education in New South Wales, Australia); SMS, short message service; TAFE, technical and further education (an Australian vocational education and training provider). Data given as *n* (%).

TABLE 2 Health care resource utilization and productivity costs in the first 2 years of the CHAT trial[a]

Costs	Unit costs (A$)	Control ($n = 220$) Number of participants, n (%)	Occasions, mean (SD)	Cost per participant (A$), mean	Telephone ($n = 200$) Number of participants, n (%)	Occasions, mean (SD)	Cost per participant (A$), mean	SMS ($n = 242$) Number of participants n (%)	Occasions, mean (SD)	Cost per participant (A$) mean
GP visits	38.75[b]	220 (100)	10.87 (7.01)	411.11	200 (100)	12.87 (12.84)*	486.84	242 (100)	12.38 (8.13)*	468.15
Specialist visits	89.55[c]	74 (34)	1.05 (2.45)	92.19	67 (34)	1.52 (7.34)	132.44	92 (38)	1.46 (3.42)	127.88
Total health care (for base case analysis)				503.30			619.28			596.03
Days missed work	215	121 (55)	4.64 (7.15)	973.08	129 (65)	5.86 (9.40)	1228.85	130 (54)	4.95 (7.56)	1039.87
Total health care + productivity (for sensitivity analysis)				1476.39			1848.13			1635.89

Abbreviations: A$, Australian dollar; CHAT, Communicating Healthy Beginnings Advice by Telephone; GP, general practitioner; SMS, short message service.

[a]The tabulated costs are the total costs over the 24 months of the trial, discounted at 5% per year and valued in 2018 Australian dollars.

[b]From Medical Benefits Advisory Schedule Item 104.

[c]From Medical Benefits Advisory Schedule Item 23.

*Significant at $p < 0.05$ compared with occasions in control using a negative binomial regression.

therefore the mean costs of the services per child were slightly greater in the intervention groups than in the control group. Overall health care costs were $116 and $93 higher per child in the telephone and SMS groups, respectively, than in the control group.

Both the telephone and SMS interventions resulted in nonsignificantly lower BMI and BMI-z than in the control group (Table 3). The mean effect sizes for the telephone intervention were 0.048 kg/m^2 for BMI and 0.025 for BMI-z. The mean effect sizes for the SMS intervention were 0.034 kg/m^2 for BMI and 0.018 for BMI-z. Incremental costs, accounting for both health care and intervention costs, were higher in the telephone group ($510 per child) than in the SMS group ($173 per child). The overall ICER were lower in the SMS group ($5154 per unit BMI avoided and $979 per 0.1 BMI-z units avoided) than in the telephone group ($10,665 per unit BMI avoided and $2017 per 0.1 BMI-z units avoided), indicating that the SMS intervention had better cost-effectiveness than the telephone intervention.

At most of the cost per BMI and BMI-z thresholds investigated, SMS was more cost-effective than telephone (Figure 1B,D). At a threshold of $1000 per 0.1 BMI-z units avoided, SMS and telephone had a 48% and 41% probability of being cost-effective, respectively.

Sensitivity analysis

Productivity costs ranged from $972 to $1229 per child (Table 2). The estimated total costs, including mothers' productivity losses, were $766 per child and $240 per child higher in the telephone and SMS groups, respectively, compared with the control group (Table 3). Including the productivity costs increased the ICER, but the ICER for SMS remained more favorable than for telephone.

Costs of upscaling

The estimated costs of upscaling the CHAT telephone, CHAT SMS, and the original Healthy Beginnings home-visiting interventions to all births in NSW in a single year are presented in Table 4. The total costs of the original Healthy Beginnings home-visiting intervention ($108 million) were $71 million greater than the costs of the CHAT telephone intervention ($38 million) and $101 million greater than the costs of the CHAT SMS intervention ($7.6 million).

DISCUSSION

This economic evaluation of the CHAT trial shows that, despite smaller effects on BMI and BMI-z at 24 months, the SMS intervention (base case ICER: $5154 per unit BMI avoided and $979 per 0.1 BMI-z units avoided) was more cost-effective than the telephone intervention (base case ICER: $10,665 per unit BMI avoided and $2017 per 0.1 BMI-z units avoided) from a health-payer perspective. Similar results were found under a limited societal perspective in sensitivity analyses. These results can be explained by the greater costs of delivering the telephone

TABLE 3 Economic evaluation outcomes of the CHAT trial at 24 months[a]

	Control	Telephone		SMS	
	Mean (bootstrapped 95% CI)	Mean (bootstrapped 95% CI)	Mean difference (bootstrapped 95% CI), telephone-control	Mean (bootstrapped 95% CI)	Mean difference (bootstrapped 95% CI), SMS-control
BMI (kg/m^2)	16.94 (16.74 to 17.14)	16.89 (16.70 to 17.09)	−0.05[b] (−0.35 to 0.23)	16.90 (16.70 to 17.11)	−0.03[b] (−0.30 to 0.25)
BMI-z	0.86 (0.72 to 1.00)	0.83 (0.70 to 0.96)	−0.03[b] (−0.22 to 0.15)	0.84 (0.72 to 0.97)	−0.02[b] (−0.19 to 0.17)
Health care costs (A$)	503.30 (455.81 to 552.38)	619.28 (518 to 746)	115.98 (2.19 to 255.11)	596.03 (537.31 to 662.05)	92.73 (21.54 to 176.78)
Health-payer perspective (base case)					
Health care + intervention costs (A$)	503.30 (455.81 to 552.38)	1013.28 (911.70 to 1139.98)	509.98 (396.19 to 649.11)	676.03 (617.31 to 742.05)	172.73 (101.54 to 256.78)
ICER (A$ per unit BMI avoided)		10,664.89		5154.14	
ICER (A$ per 0.1 BMI-z units avoided)		2017.16		979.15	
Limited societal perspective (sensitivity analysis)					
Health care + productivity + intervention costs (A$)	1476.39 (1256.29 to 1695.70)	2242.13 (1947.07 to 2557.06)	765.74 (384.67 to 1143.18)	1715.89 (1507.40 to 1959.65)	239.51 (−64.33 to 548.80)
ICER (A$ per unit BMI avoided)		16,013.66		7146.85	
ICER (A$ per 0.1 BMI-z units avoided)		3028.83		1357.72	

Abbreviations: A$, Australian dollar; BMI-z, BMI *z* score; CHAT, Communicating Healthy Beginnings Advice by Telephone; ICER, incremental cost-effectiveness ratios; SMS, short messaging service.

[a]The tabulated BMI and BMI-z figures use measurements at the end of the 24-month trial period, whereas the costs are calculated cumulatively over the 24-month trial period. All costs are valued in 2018 Australian dollars using a 5% per year discount rate.

[b]The bootstrapped 95% CI of these results contain the null and are nonsignificant at $p = 0.05$.

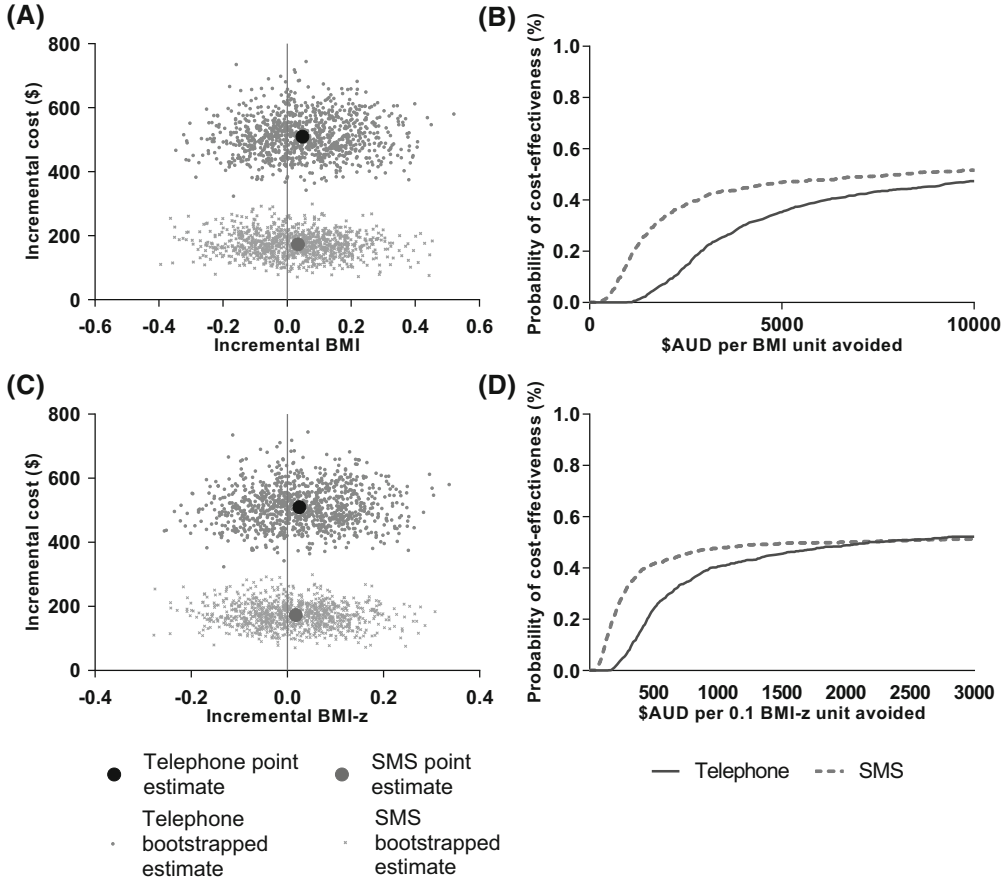

FIGURE 1 Incremental CEPs and CEACs for the telephone and SMS interventions from the CHAT trial. (A) CEP for BMI outcomes, (B) CEAC for BMI outcomes, (C) CEP for BMI-z outcomes, and (D) CEAC for BMI-z outcomes. BMI-z, BMI *z* score; CEAC, cost-effectiveness acceptability curve; CEP, cost-effectiveness plane; CHAT, Communicating Healthy Beginnings Advice by Telephone; SMS, short message service.

intervention than the SMS intervention, which a previous study found could largely be attributed to the time required to reattempt calls if participants did not answer their phone on first contact [13]. Furthermore, both intervention groups had slightly higher health care costs compared with the control group, which was not an unexpected finding. In both intervention groups, self-referrals and professional referrals to universal health care routine visits and specialist services were made when necessary [15]. Self-referrals included making recommendations to participants to access specific health services for additional support, whereas professional referrals required the research nurses to contact the services to refer participants. The telephone group was more likely to receive professional referrals compared with the SMS group.

This study and the economic evaluation of the original Healthy Beginnings home-visiting program [10] are among the very small number of cost-effectiveness studies for early childhood obesity prevention. According to the mean ICER, the cost-effectiveness of the home-visiting program as calculated in the earlier study ($4230 per unit BMI avoided and $631 per 0.1 BMI-z units avoided) was similar to the SMS intervention but better than the telephone intervention. Similarly, according to the mean ICER, the CHAT telephone and SMS interventions at 2 years were less cost-effective than recently evaluated face-to-face interventions supporting sleep, nutrition, breastfeeding, and physical activity behaviors at age 5 years [11]. However, both the CHAT telephone and SMS interventions were more cost-effective than a nurse-led motivational interviewing intervention set in child health centers at age 4 years [12].

However, when accounting for joint uncertainty in costs and benefits, the probability of being cost-effective was lower for both SMS and telephone groups compared with the original Healthy Beginnings intervention at most thresholds of BMI and BMI-z. For example, at a nominal threshold

TABLE 4 Total costs of upscaling CHAT SMS, CHAT telephone, and the original Healthy Beginnings home-visiting intervention to NSW, Australia[a]

	Intervention cost per child[b] (A$) (95% UI)	Total costs for NSW (A$ × 1 million) (95% UI)
CHAT SMS	80 (77-82)	7.64 (7.36-7.84)
CHAT telephone	394 (373-412)	37.65 (35.64-39.37)
Healthy Beginnings	1135 (1059-1189)	108.45 (101.19-113.61)

Abbreviations: A$, Australian dollar; CHAT, Communicating Healthy Beginnings Advice by Telephone; NSW, New South Wales; SMS, short message service; UI, uncertainty interval.

[a]Based on number of live births in 2018 (95,552), as reported in [28]. Costs are valued in 2018 Australian dollars using a 5% per year discount rate.

[b]As reported in Brown et al. [13].

of $1000 per 0.1 BMI-z units avoided, the probability that the SMS and telephone interventions were cost-effective (48% and 41%, respectively) was considerably lower than the original Healthy Beginnings home-visiting intervention (approximately 75% from inspection of the cost-effectiveness acceptability curve) [10]. Nonetheless, without an understanding of the health payer's willingness to pay for the prevention of BMI or BMI-z gain, it is difficult to gauge whether the ICER and probabilities of cost-effectiveness calculated in our study represent value for money. To put the ICER and probabilities calculated in our and other obesity-prevention studies into context, further work is needed to determine the health payer's willingness to pay for prevention of BMI or BMI-z gain. In our study, both the SMS and telephone interventions were found to be considerably more affordable than the original Healthy Beginnings home-visiting program if they were to be provided to all babies born in the state of NSW, Australia, in a single year. The total costs of the Healthy Beginnings home-visiting program were markedly higher than that of the telephone intervention and two orders of magnitude higher than the SMS intervention, suggesting that budgetary constraints could be an important driver of scale-up decisions.

The findings from this study imply that the home-visiting, telephone, and SMS delivery modes could each play a part in the implementation of the Healthy Beginnings program. The higher-intensity home-visiting mode, which had the greatest probability of being cost-effective, should be considered the "gold-standard" intervention because of the "best-practice" personalized support offered to mothers. Personalized care with meaningful relationships and effective communication is central to achieving health outcomes in maternal and child health care [29], and this aligns with existing child health services in Australia [30,31]. However, the lower-intensity SMS and telephone delivery modes were substantially more affordable than the home-visiting mode, and in a resource-scarce environment, it may be feasible to implement the SMS or telephone programs and reach many more people than might otherwise be possible. A less-intense program that reaches a high proportion of the population could deliver health benefits to more people than a more-intensive program that reaches only a small number of people [32]. Therefore, a favorable approach could be to implement all three modes across a population, according to the resources available and the needs and preferences of mothers.

This study has several strengths. First, the health and economic outcomes of the interventions have been derived prospectively from an RCT, with child height and weight directly measured, providing high-quality evidence of the relationship among the intervention and these outcomes. Furthermore, the intervention costs were identified from a published study that used a standardized costing protocol alongside interventions from four other trials, reducing the potential for bias in these costs [13]. Another unique strength was the use of both a health-payer and societal perspective in analyses. Accounting for societal costs such as the productivity losses collected in this study allows for broader economic impacts of an intervention to be considered. However, there are also some limitations to our study. First, owing to loss to follow-up and missing anthropometric data, only 662 out of the 1155 originally recruited mothers (57%) were included in this analysis. Despite these losses, the distribution of sociodemographic characteristics was similar across the three trial groups in the final analysis sample (Table 1), suggesting that randomization was maintained. Furthermore, this economic evaluation did not account for improvements in secondary or intermediate outcomes such as infant feeding practices and active play. Finally, health care cost and productivity cost measurements were subject to potential recall bias, as they were self-reported at the 2-year follow-up assessment.

In conclusion, this study shows that, at child age 2 years, the CHAT SMS intervention was more cost-effective than the CHAT telephone intervention. However, neither intervention was found to be as cost-effective as the original Healthy Beginnings home-visiting intervention, as determined in an earlier study [10]. Nonetheless, both SMS and telephone interventions would be more affordable than the home-visiting intervention to scale up to all births across the state of NSW. To account for longer-term outcomes, including child health-related quality of life, future work should measure or model health and economic outcomes of the intervention over a longer period.

AUTHOR CONTRIBUTIONS

Anagha Killedar contributed to the economic evaluation study design, analyzed the data, and led the writing of the paper. Li Ming Wen, Louise A. Baur, and Chris Rissel designed the randomized control trial and data collection. Limin Buchanan and Sarah Taki contributed to project implementation. Eng Joo Tan contributed to data analysis and cleaning. Huilan Xu contributed to data collection and cleaning. Alison Hayes supervised the study and designed the economic evaluation. All authors were involved in interpreting results and writing the paper and had final approval of the submitted version.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

CLINICAL TRIAL REGISTRATION

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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