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**TITLE:** A systematic review of the impact of interventions targeting sleep on child body mass index, diet and physical activity.

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**AUTHOR CONTRIBUTIONS:** SLY conceived the study, supported the development of search terms, undertook screening, data analysis, and drafted the manuscript. LKC and SLY carried out the literature search and initial screening. SLY and LKC reviewed and selected studies for inclusion. SLY, LKC and LW performed data extraction and risk of bias assessments. All authors were involved in writing the paper and had final approval of the submitted and published versions.

## What is already known about this subject?

- Review of longitudinal and cross-sectional studies show an association between sleep and child overweight and obesity.
- Systematic reviews of randomised controlled trials in adults suggest that improvements to sleep may positively impact on weight.
- No review of trials examining the impact of sleep interventions on child weight has been undertaken.

## What does this study add?

- Meta-analysis of three randomised controlled trials show no impact of sleep interventions on child BMI however only one trial improved sleep.
- Where an improvement in sleep was achieved, improvements to child BMI, nutrition and physical activity were also reported.
- More randomised controlled trials are needed to confirm the impact of improving sleep on child BMI, nutrition and physical activity.

#### ABSTRACT

**Objective:** This review aimed to examine the impact of interventions involving an explicit sleep component on child body mass index (BMI), diet and physical activity.

**Methods:** A systematic search was undertaken in six databases to identify randomised controlled trials examining the impact of interventions with a sleep component on child BMI, dietary intake and/or physical activity. A random-effects meta-analysis was conducted assessing the impact of included interventions on child BMI.

**Results:** Of the eight included trials, three enforced a sleep protocol and five targeted sleep as part of multicomponent behavioural interventions either exclusively or together with nutrition and physical activity. Meta-analyses of three studies found that multicomponent behavioural interventions involving a sleep component are not significantly effective in changing child BMI (n=360,-0.04 kg/m2 [-0.18, 0.11]), I2=0%); however, only one study included in the meta-analyses successfully changed sleep duration in children. There were some reported improvements to adolescent's diet and only one trial examined the impact on child physical activity, where a significant effect was observed.

**Conclusions:** Findings from the included studies suggest that where improvements in child sleep duration were achieved, a positive impact on child BMI, nutrition and physical activity was also observed.

#### Introduction

The prevalence of overweight and obesity among children has increased dramatically over the past few decades (1, 2, 3). The 2013 Global Burden of Disease Study reported that over 20% of children and adolescents from developing countries were overweight and obese in 2013, more than a 40% increase from 1980 (4). Children who are overweight or obese have an increased risk of both childhood cardiovascular risk factors including elevated low density lipoprotein (LDL) cholesterol and blood pressure (5), and are at increased risk of developing chronic disease in adulthood (6). The prevention of childhood obesity has been identified by the World Health Organization as a public health priority for the prevention of non-communicable diseases (2, 7).

A significant amount of intervention research targeting child physical activity and nutrition has been undertaken in an effort to identify effective child obesity prevention interventions. Systematic reviews examining the effectiveness of such interventions however have reported mixed findings on weight and weight-related behaviours (8). A synthesis of systematic reviews which included eight reviews examining the impact of school-based interventions reported inconsistent findings regarding the effectiveness of these interventions on weight (9). A Cochrane review reported that school-based interventions had a significant positive impact on physical activity levels (10) while other reviews have reported limited effects of such interventions on moderate-to-vigorous physical activity and weight (11, 12). Similarly reviews of nutrition interventions have found mixed results regarding the impact of such interventions on child weight and dietary intake (13).

Given the complex aetiology related to the development of obesity (14), research considering a broader range of modifiable psychological and physical determinants for weight gain has been undertaken to better inform future efforts to reduce child obesity. In recent years, the relationship between sleep duration and obesity has received increasing research attention (15, 16, 17). Epidemiological studies show a rapid decline in sleep duration in children and adolescents (18), which has occurred in parallel with increasing weight trends. Systematic reviews of longitudinal and cross sectional studies (17, 19) consistently report a positive association between sleep duration and prevalence of overweight and obesity in children and adolescents. A review of 22 longitudinal studies reported that children and adolescents with short sleep duration had more than two times the odds (OR: 2.15, 95% CI 1.64-2.81) of being overweight or obese relative to those who slept for longer durations (16). The authors reported potential differences by age, with trends favouring a stronger association in adolescents and younger children, although most studies were conducted in children under three years of age (16). Another review found a dose-response relationship between sleep and BMI, where a meta-analyses of four studies found that every increase of one hour/day of sleep was associated with an annual BMI decrease of  $0.05 \text{ kg/m}^2$  (95% CI: -0.09 to 0.01) (20). A recent review of

randomised controlled trials which included studies conducted in mostly adults reported that improvements in duration of sleep resulted in a significant reduction of 0.54 kg (95% CI -1.01, -0.07) in body weight compared to those in the control arm (15).

Given evidence of a longitudinal relationship between sleep duration and overweight and obesity in children, and the positive impact of improving sleep duration in adults, a synthesis of the available interventions that have aimed to change weight and its related risk factors (diet and physical activity) by targeting sleep is warranted. Such a review is likely to provide a better understanding of the causal links between sleep and child obesity, and allow the assessment of the impact of sleep modification on weight outcomes. To our knowledge, no systematic review of interventions targeting sleep, which aim to improve BMI, nutrition and physical activity in children, has been undertaken to date.

This systematic review aims to describe the impact of obesity prevention interventions (which includes an explicit sleep component) on body mass index, dietary intake and/or physical activity in children aged less than 18 years old.

## Methods

#### Registration

This review has been registered with PROSPERO (Reg number: CRD42015025405) and reported in accordance to the PRISMA guidelines (21).

### Eligibility criteria

Studies were included if (i) study participants were healthy children (representative of general population) aged up to 18 years, (ii) were randomised controlled trials (RCTs) reporting change or post intervention data, (iii) improving duration/quality of sleep was an explicit component of the exposure variable targeted by the intervention, (iv) the outcome was one or more of the following: body mass index (BMI), BMI percentile, dietary intake or physical activity. Only studies published in English were considered.

Studies were excluded if (i) participants were patients diagnosed with certain medical disorders (e.g. hyperactivity disorder, sleep disorder), ii) participants were using surgical and pharmacological strategies that impacted on body weight and/or sleep; and iii) they were not randomised controlled trials. Studies were also excluded if they had an active intervention phase of less than 24 hours. Letter to the editors, case reports, meta-analyses, and reviews were also excluded.

#### Information sources and search strategy

A literature search was conducted by one reviewer (LKC) to identify articles available on PubMed, Cochrane Library, Scopus, CINAHL, MEDLINE and EMBASE databases. Structured search strings employed in the search was developed based on those used in other reviews to locate relevant papers (see Supporting Information Table S1). Briefly, the keywords included were 'sleep pattern', 'sleep onset latency', 'sleep duration', 'bed time' and time in bed. Reference lists of all included studies and relevant review papers were checked for additional articles. Relevant protocol papers were checked prior to completion of data extraction and outcome papers included if they met the eligibility criteria.

#### Study selection

Initial title screening and abstract review was undertaken by one reviewer (LKC). A second reviewer (SLY) assessed a random sample of 20% of the papers. Prior to inclusion in the review, the full articles selected for retrieval were reviewed independently by two reviewers (LKC, SLY). Where agreement was not achieve via a consensus process, this was discussed with a third reviewer (LW). The number of articles at each screening stage is shown in a detailed flowchart consistent with the PRISMA reporting standards (see Supporting Information Figure S1) (21).

#### Data collection process

Relevant information was extracted from included studies by two independent reviewers (SLY, LKC) using a data extraction tool adapted from Cochrane data collection form for intervention reviews (22). The following information was extracted: study design, country, participant recruitment, number randomized, theoretical components, intervention components, intervention duration, measures, and all mean and standard deviation (SD) data for all continuous outcomes measured.

#### Risk of bias

Risk of bias for the included studies was assessed independently by two reviewers (SLY, LKC) using the Cochrane risk of bias tool for RCTs (23). For cross-over RCTs, additional criteria relating to suitability of the study design for the condition being studied, assessment of carry-over effect, availability of data from all periods of the trial, appropriate analysis and randomization of treatments across all periods was also assessed as potential other biases. Discrepancies in ratings were discussed until consensus was reached between the two reviewers. Risk of bias figures were generated with the Review Manager software (24).

#### Analysis

Standardised mean difference was used for studies that reported BMI or zBMI (BMI z-score), total energy (kJ or kcal) or physical activity data where available. Where studies reported both BMI and zBMI, the non-standardised version was used as per previous reviews (25). Review Manager (26) was used to calculate the standardised mean differences between treatment and control groups when sample sizes, means and standard errors or standard deviations were reported. To maximise number of trials included in the meta-analysis, authors were contacted to request for additional data which initially precluded the study from inclusion in the meta-analysis. Where available, immediate post-intervention outcome data were used; otherwise data provided closest to end of the intervention provided were used. For cluster trials, the effective sample size was calculated as suggested in the Cochrane Handbook. The I<sup>2</sup> was used to examine and quantify statistical heterogeneity between studies (<50%). Where the studies were sufficiently homogenous, the studies were pooled into a Hedges-g random effects model using Review Manager, version 5.3.5 (26). Where studies were unable to be pooled, narrative synthesis of results was performed.

#### Results

#### Study selection

Overall, 2152 records were screened for eligibility, of which 32 were included in the full text screen (see Supporting Information Figure S1 for PRISMA diagram). Of these, eight different studies were included (see Table 1). Two studies were cluster randomised controlled trials, three were crossover trials, one employed a factorial design and two were child-level randomised trials.

#### Study characteristics

Two studies were conducted with adolescents (27,28), one with primary school-aged children (29), two with pre-school aged children (30, 31) and three with infants (31, 32, 33). Five were conducted in United States (27, 28, 29, 30, 31), one in Switzerland (24), one in Australia (32) and one in New Zealand (33). All studies included both males and females, and all children regardless of overweight status. Three trials included a sample which consisted of over 30% African American and Hispanic children.

## Interventions

Across the eight included studies, sleep duration was modified by either: i) prescribed sleep manipulation (i.e. participants were directly instructed to restrict or increase their sleep duration based on an established protocol and sleep manipulation was monitored) (n=3) (27, 28, 29) or ii) as part of a multicomponent behavioural intervention which targeted sleep exclusively (31, 32) or in conjunction with nutrition and physical activity (n=5) (24, 30, 33). Intervention duration varied from five days to 12 months. All three active sleep manipulation trials successfully changed sleep duration. Of the five multicomponent studies with a sleep component (see Table 1), only one was successful in improving sleep in children (30) and one did not report sleep outcomes (33).

#### Risk of bias

Information related to random sequence generation and allocation concealment was not clearly reported by five (24, 27, 28, 31, 32) and four (27, 28, 29, 31) studies respectively (see Figure 1 and 2). Four studies were rated as having incomplete outcome data due to large percentage (>20%) of loss to follow up and use of inappropriate statistical techniques to account for such losses (27, 28, 31, 32). While a number of studies did not undertake blinding of outcome assessment, studies where an objective outcome measure (e.g. weight) was used were assessed as having a low risk of bias. Selective outcome reporting was observed in a number of trials where not all outcomes (e.g. diet measures, sleep outcomes) reported in the published study protocol or trial registration was included in the publication (30, 33). Other biases included not adequately describing the washout period for cross-over trials (31).

#### Impact of sleep interventions on child BMI

Of the five studies that had a weight-related outcome (24, 29, 30, 31, 32), three reported BMI or zBMI (24, 30, 32), one reported absolute weight (29), and one reported weight-for-length percentile for infants (31). Pooling of the three studies that examined BMI (see Figure 3) found that weight loss interventions which included a sleep component did not significantly change BMI (-0.04 kg/m<sup>2</sup> [-0.18, 0.11]), I<sup>2</sup>=0%). All three interventions were multicomponent behavioural interventions which attempted to improve sleep as part of a behavioural intervention.

One of the studies included in the synthesis reported significant effects on BMI (30) whilst the other two did not.(24, 32) Haines and colleagues examined the impact of a motivational coaching intervention with low income, ethnic minority parents of children aged 2-5 years old who had a TV in the child's bedroom (30). The intervention aimed to promote household routines in relation to family meals, improving sleep and reducing television time. At six-

months follow up, the intervention did not significantly improve mealtime routines or overall time spent watching television; however, there were significant positive changes in sleep duration (increased of 0.75 hours/day in the intervention group compared to decreases of 1.06 hours/day in the control group; p=0.02) and improvement between baseline and follow up for child BMI (a difference of -0.40 kg/m<sup>2</sup>; p=0.05) between groups.

Wake and colleagues undertook a nurse-led behavioural intervention targeting infant sleep at eight months (34, 35). BMI was measured once five-years post intervention. No significant differences in sleep or BMI were observed. Puder and colleagues conducted a multi-component intervention in schools, which targeted physical activity, nutrition and sleep using teacher delivered classroom lessons and discussion with parents regarding sleep. There were no differences in sleep or BMI outcomes at 12 months follow up (24).

Of the two remaining studies with a weight outcome, Hart undertook a sleep restriction study with 37 children aged 8-11 years (29). Using a crossover design, children were randomised to increase or decrease their time in bed by 1.5 hours per night for a week. During the increased sleep condition, child measured weights were 0.22 kg lower than in the restricted bed-time (p<0.001). Finally, Paul et al randomised infants to one of four arms: i) a sleep-soothing technique, ii) nutrition (introduction to solids), iii) sleep-soothing techniques and nutrition and, iv) control arm (31). At follow up, a change in weight-for-length percentile was lower only in the combined sleep-soothing and nutrition arm compared to the control group (p=0.009).

#### Impact of sleep interventions on child dietary intake

Seven studies examined the impact of the intervention on some measure of diet. Three used 24-hour recall multiple pass method (27, 28, 29). Of the remaining four, two used a variety of parent-completed questionnaires to assess food groups and proportion of healthy eaters (24, 30), one used a validated food frequency questionnaire (33) and the other assessed infant

acceptance of new food (31). Two studies were undertaken by the same researchers and findings from these two studies were pooled and reported in the later publication (27, 28). This study reported that participants consumed 10% more calories in a 24-hour period during sleep restriction (1934  $\pm$  740 kcal) than during healthy sleep (1764  $\pm$  649 kcal), (p = 0.039), and 110% more servings of sweets/desserts during sleep restriction (1.46  $\pm$  2.11 servings) than during healthy sleep (0.75  $\pm$  1.13 servings) (p = 0.017) (28). Hart found that during the increased sleep condition, children reported consuming an average of 134 kcal/day less than in the reduced sleep conditions (-261 to -8 kcal/day) (P=0.04) (29). Fangupo undertook a four arm factorial trial (Usual care (UC), sleep only; food, activity and breastfeeding (FAB); FAB and sleep) (33). Overall, the intervention did not significantly change energy or nutrient intake across all groups. When comparing the intervention arms that included a sleep component with those that did not include a sleep component (FAB + Control), no significant difference in dietary intake was identified at 12 months.

#### Impact of sleep interventions on child physical activity

Only one study examined impact of the intervention on physical activity (24). The intervention included four 45-minute physical activity programs per week, school-based lessons on nutrition, media use and sleep, modification to the build environment of the preschool and sessions with the parents. The study found significant improvement in aerobic fitness stage at the end of the intervention (adjusted mean difference: 0.32 stages (95% CI 0.07 to 0.57; P=0.01).

#### Discussion

To our knowledge, this is the first systematic review to examine the impact of obesity prevention interventions including an explicit sleep component on child BMI and weightrelated behaviours and overcomes some of the limitations of reviews of longitudinal studies (16). This review identified a small number of randomised controlled trials of interventions targeting sleep, highlighting the relative infancy of the field. Findings from the meta-analysis of trials examining the impact of behavioural interventions on sleep suggest no impact of such interventions on child BMI. As two of the three studies included in the meta-analysis did not improve sleep, the specific impact of sleep interventions on child BMI is unknown. There is some early evidence that improving sleep positively effects on adolescent's diet, however the impact on physical activity is largely unknown.

Findings from individual studies included in the review however suggest that improvements in sleep can benefit child weight related outcomes. Two of the five trials assessing weight or BMI outcomes improved child sleep (29, 30), with both also finding significant improvements in measures of child weight and BMI. In contrast, the remaining three interventions neither significantly improved child sleep or BMI (24, 31, 32). Other systematic reviews have reported that behavioural interventions which include parent education, standardization of bedtime routine and creating conducive sleep environments can facilitate improved sleep behaviour in children for up to 12 months (36, 37). While the long term efficacy of such interventions are unknown, the inclusion of these strategies in future randomised trials are required to understand the potential causal role of sleep focused interventions in child obesity management and prevention in the community.

Encouragingly, interventions that solely focussed on improving sleep reported significant changes in adolescent's consumption of energy dense foods such as sweets/desserts. As other studies and reviews have reported particular challenges with changing adolescent health risks including diet and physical activity (13, 38) these findings provide support for potential new

approaches to improving dietary intake amongst adolescents. The review has identified the infancy of sleep intervention research and its potential to impact on child weight. Only one trial examined the impact of a sleep only intervention on longer-term weight outcomes (32), and only one assessed the impact of interventions including a sleep component on physical activity (24). Of the multicomponent behavioural interventions, only two integrated a brief sleep intervention into other settings-based interventions (i.e. schools, childcare centres and maternal child health centres) and none examined the impact of sleep interventions on younger children's dietary intake (24, 32).

The current evidence-base has several shortcomings. All trials except one (32) had short periods of follow-up (12-months and less) that may be insufficient to detect changes in BMI. A number of the characteristics of included studies were consistently assessed as at high risk of introducing study bias. The meta-analyses examining the impact of interventions on BMI was based on only three studies, using data available within published articles. While additional information was requested from authors, we did not obtain any additional data. The review combined findings across all age groups. While the development of sleep behaviour is substantially different amongst infant, pre-schoolers and adolescents, the limited number of RCTs included did not allow for assessment by different age groups. Opportunities for future trials with longer follow up periods, in younger children and utilising sleep strategies with established efficacy are needed (39) to assess the impact of sleep interventions on child weight and weight-related outcomes are considerable.

#### Conclusion

While limited evidence exists, the findings of the review suggest that improving sleep has the potential to be an important modifiable risk factor to improve child diet or prevent excessive

weight gain. The findings are of particular relevance in the context of recent systematic review evidence which has identified that traditional healthy eating and physical activity approaches have only small effects in reducing prevalence of child obesity (25). Future trials are required to substantiate the potential benefits of sleep interventions in improving child obesity prevention outcomes.

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Author	Intervention	Variable	Did sleep	Intervent	Study	Ν	Sample	Follow up	Outcome	Findings
name	description	manipulated	improve?	ion	design	rando		duration	assessed	
				duration		mised				
Sleep pro	tocol administered									
Beebe	Sleep restriction	Sleep	Yes - sleep	5 days	Cross	54	Healthy	3 weeks	Dietary	No significant
2013	(6.5 hours)		restriction		over		adolescent		intake	change in total
	compared to		condition:		RCT		( <i>n</i> =41), 59%			energy intake
	healthy sleep (10		6.33 hours				female, 54%			and
	hours)		(SD 0.52);				Caucasian BMI			macronutrient
			healthy				23.4 (4), mean			consumption.
			sleep				age 15.3			During the
			condition:							sleep
			8.86 (SD							restriction
			0.89)							condition,
										teens had a
										significant

# Table 1: Results of individual studies included in the current review

										higher
										consumption
										of sweets and
										desserts
										(p=0.016).
Hart	Sleep increased	Sleep	Yes -	5 days	Cross	39	Children ( <i>n</i> =37)	3 weeks	Dietary	During the
2013	or decreased by		increase		over		aged 8-11, 57%		intake	increase sleep
	1.5 hours each		sleep		RCT		male, 81%		BMI	condition,
	night for 1 week.		condition:				White, mean			children
	Naps were not		627 mins				age: 9.6 (1.0),			measured
	allowed.		(95% CI				mean zBMI:			weights were
			618-636);				0.21 (0.89)			0.22 kg lower
			decreased							(P<.001) and
			sleep							reported
			condition:							consuming an
			486 mins							average of 134
			(95% CI							

			479-493); p-							kcal/day less
			value:							(P<.05).
			< 0.001							
Simon	Sleep restriction	Sleep	Yes – sleep	5 days	Cross	38	Healthy	3 weeks	Food	Intake of
2015	(6.5 hours)		restricted		over		adolescent		appeal,	overall
	compared to		condition:		RCT		( <i>n</i> =31), 59%		hunger	calories was
	healthy sleep (10		6.7 hours (ds				female, 52%		rating,	11% higher
	hours)		0.6); healthy				Caucasian,		dietary	(non-
			sleep: 9.1				mean age 15.7		intake	significant)
			hour (ds 0.7)							and intake of
										sweet/desert
										servings was
										52% greater
										during sleep
										restriction than
										healthy sleep
										condition.
1	1		1	1	1	1	1	1	1	

Multicomponent behavioural intervention												
Fangupo	Four arm trial	Nutrition	Not reported	18	Factoria	802	New-borns	24 months	Dietary	No		
2014	consisting of:	Sleep		months	1 RCT		(n=666),		intake	difference in		
	consisting of:						79% New			food or		
	a) Usual care :						Zealand			nutrient		
	standard government						European,			intake or		
	funded service						37% low			eating		
	b) Food, Activity						deprivation			behaviours		
	and Breastfeeding						score			in sleep vs		
	group (FAB) group									non-sleep		
	received an									arms		
	additional eight									combined at		
	contacts targeting									24 months.		
	food.											
	c) Sleep group:											
	received 2 additional											
	parent contact to											

	support development									
	of appropriate sleep									
	habits									
	d) FAB and sleep									
	group combined									
Haines	Four household	Household	Yes -	6 months	Simple	121	Children	6 months	Child	Mean change
2013	routines were	routine	intervention:		RCT		(n=121) aged		television	in BMI
	targeted including -	relating to	increase of				2-5 years		viewing	between
	family meals,	sedentary	0.56 hours/d				with TV in		Changes in	group was
	adequate sleep,	activities,	of child sleep				the room,		household	significantly
	limiting TV time,	sleep and	duration,				52%		routine	different
	and removing the	nutrition	decreases in				Hispanic,		BMI	(p=0.05).
	TV from the child's		weekend TV				mean age:		Sleep	Larger
	bedroom, using (1)		viewing of				4.1 (1.1),		Presence of	decrease in
	motivational		1.06 hours/d				BMI 17.4		TV	weekend TV
	coaching at home		(p=0.02);				(2.4)			viewing
	and by phone, (2)		control:							among

	mailed educational		decrease of							intervention
	materials, and (3)		0.19 hours/d							group (-1.06
	text messages.		of child sleep							hours/d;
			duration; p-							P=0.02).
			value = 0.03							Family meal
										times
										remained
										unchanged.
Paul	Four arm trial	Sleep	No in overall	12	Simple	160	Infants	12 months	Sleep	Only parents
2011	1. Soothe/sleep	and/or food	groups- only	months	RCT		(n=110),		Weight for	who received
	2. Introduction of	intake	breastfed				with a		length	both
	solids		dyad within				gestational		percentile	interventions
	3. Both 1 and 2		the group				age of at		Infant solid	(soothe and
	4. Control		showed				least 34		food intake	introduction
			improvement				weeks, 51%			of solids)
			s in sleep				female, mean			reported a
			(p=0.04)							lower weight

							birth weight			for length
							3.33kg.			percentile
										(p=0.02)
Puder	The intervention	Sleep	No -	10	Cluster	652	Preschool-	12 months	Physical	No impact
2011	targeted schools and	Physical	intervention:	months	RCT		aged children		activity	on BMI
	parents. A physical	activity	10.9 hours/d				(n=652) from		(aerobic	(p=0.31) but
	activity programme	Nutrition	(SD: 0.6);				public		fitness)	significant
	(four lessons/week),	Media use	control: 10.8				preschools		Sleep	changes in %
	lesson on nutrition		hours/d (SD:				with high		Diet	body fat
	(22 sessions), media		0.6)				migrant		Media use	(p=0.02),
	use and sleep and						population			physical
	adaptation of the						(>40%), 50%			fitness
	preschool						female mean			measures
	environment. Parents						age 5.2 (0.6).			(aerobic
	participated in three									fitness
	interactive									(p=0.01),

	information and									agility(p<0.0
	discussion evenings									1) and eating
	about promotion of									habits
	physical activity,									
	healthy food,									
	limitation of TV use,									
	and importance of									
	sufficient sleep.									
Wake	Intervention	Sleep	No - at 6	2 months	Cluster	328	Infants	5 years	Sleep	No impact
2011	maternal and child		years-		RCT		( <i>n</i> =193), 4.6		BMI	on BMI at 6
	health nurses were		intervention:				months (0.6)			years follow
	trained to deliver a		10.8 hours;							up (p=0.3)
	brief, behavioural		Control: 10.8							
	sleep intervention at		hours							
	the routine 8-month									
	well-child check to									
	mothers reporting									

infant sleep					
problems.					

RCT: randomized controlled trial

## Titles and captions for each figure

Figure 1: Risk of bias ratings for individual studies included in the review

Figure 2: Summary risk of bias ratings for studies included in the review

Figure 3: Meta-analysis of multicomponent behavioural interventions which include a sleep intervention on child body mass index (post-intervention data)