School for Public Health Research (SPHR)

Project Title	***Systematic Reviews of determinants of obesity related dietary and physical activity behaviours in preschool children***
Project ID	SPHR-CAM-PH1-PSO
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Start Date	1 April 2012
End Date	31 March 2014
Outline	**Background:** The aim of these reviews is to inform the design and content of interventions to reduce obesity in young children. Over the past few years, the focus of obesity prevention has shifted to preschool children due to high prevalence of obesity at school entry and recognition that habits formed in early life could track into adulthood. The energy balance related behaviours (EBRBs) that are associated with obesity/overweight have been studied extensively; however determinants prospectively associated with these behaviours in young children (0-6 years) and the qualitative literature have not been systematically reviewed. Identifying determinants, including barriers and facilitators, of EBRBs is essential when designing effective and sustainable interventions to change these behaviours and prevent obesity. Hence these reviews focus on the more upstream determinants of EBRBs and include observational, intervention and qualitative studies to enable conclusions to be drawn for developing future interventions and thus go beyond updating current research. **Methods:** Following an iterative scoping stage, a combined search strategy with terms related to population (preschool children aged 0-6 years), exposure (observational, intervention, qualitative studies and review articles) and outcome (1. physical activity (PA) and sedentary behaviours (Sed), 2. fruit and vegetable intake (F&V), 3. sugar sweetened beverage (SSB) and other obesogenic diet (OD) intake was used to identify papers from eight electronic databases (Medline, Embase (via OVID), Cinhal, Psychinfo (via Ebsco), Web of Knowledge (via Thomson Reuters), British Nursing Index (BNI), Applied Social Sciences Index and Abstracts (ASSIA) and Sociological Abstracts (via Proquest)). No language or period restrictions were applied. Titles and abstracts of 37,686 retrieved articles were screened by three reviewers. Full texts of articles appearing to meet the inclusion criteria were retrieved for further review and their status recorded in a pre-piloted IN/OUT spread sheet, along with specific study details and reasons for exclusion (for excluded studies). Studies in clinical populations, in children over the age of 6 years at baseline, and laboratory-based studies were excluded. Study inclusion, quality assessment, and data extraction were independently assessed by two researchers. Quantitative data were synthesised in harvest plots or tables to demonstrate strength and direction of association and quality of study. Thematic analysis was used for qualitative studies. The reviews for 1) PA and Sed behaviour and 2) F&V intake followed similar methods and synthesised evidence from intervention, prospective and qualitative studies. The reviews for 3) SSB and Obesogenic diet intake synthesised the quantitative (intervention, prospective and cross-sectional) and qualitative evidence separately. **Overall Conclusions:** Multi-level interventions, including parental modelling of healthy behaviours, show promise in changing EBRBs in young children. However, few conclusions could

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be drawn regarding other specific modifiable determinants. Furthermore, qualitative evidence indicates that future interventions should also target the barriers to behaviour change. Long-term sustainability, impact on inequalities and potential for implementation in routine practice of interventions should be considered.
Further conclusions will be drawn following consideration of findings of updated searches and from the critical revision of arising full scientific reports.

Table 1: Number of full text articles and studies included in the reviews.

Behaviour	Full text articles	Quantitative			Qualitative	Total
		Intervention	Cohort	X-section		
Physical activity and sedentary behaviour	164	16	6	-	21	43
Fruit and vegetable intake	337	29	7	-	13	49
Quantitative: Sugar sweetened beverage intake	286	13	6	23		39 (+3)
Quantitative: Obesogenic food intake	286	19	6	36		57 (+4)
Qualitative: SSB and Obesogenic food intake	286	-	-	-	20	20

Findings

1) Systematic review of quantitative and qualitative evidence of determinants of change in, and barriers and facilitators to, physical activity in children, aged 6 years and under
Lead analyst: Kathryn Hesketh

Results: A total of 43 articles were included (prospective cohort studies=6; intervention studies=16; qualitative studies=21). All studies were conducted in North America, Australasia and Europe, and 42 were published after 2004. 27 determinants of change in activity were identified in 19 distinct quantitative studies (3 prospective; 16 intervention) across individual, interpersonal and organisational domains. Two determinants (sex, enhanced school curriculum) were assessed in four or more studies, with only an enhanced curriculum showing a consistent positive association with change in activity. A total of 51 barriers and facilitators to preschool-aged children's physical activity were identified in 13 distinct qualitative studies, across all 5 socio-ecological domains (individual; interpersonal; organisational; community; policy). Parents, childcare providers and children themselves most frequently (in four or more studies) mentioned the role of parents; the role of teachers, childcare setting; children's perceived safety; and the weather as important positive and negative influences on preschool-aged children's physical activity.

Conclusions: Few of the determinants studied were consistently associated with change in preschoolers' physical activity, although similarities between determinants assessed and the barriers and facilitators to activity identified in qualitative studies were seen. Across all study types, the most frequently explored determinants, barriers and facilitators to activity were in the interpersonal and organisational domains (i.e. the role of other people and the child's immediate environment on their activity), with little research conducted in the individual, community and policy domains. Heterogeneity in study samples, outcome measures and methods of data collection limit the ability to draw firm conclusions about prospective influences on change in preschool-aged children's activity. This review highlights the potential utility of qualitative research to inform where interventions may be best targeted to change young children's activity, but further quantitative evidence is required to identify determinants of change in preschool-aged children's physical activity.

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2) Systematic review on the determinants of fruit and vegetable intake in young children (aged 0-6 years)
Lead analyst: Claire O'Malley
Results are presented separately for qualitative, intervention and prospective studies
Qualitative studies: 13 qualitative studies were identified. The majority involved interviews/focus groups with parents/caregivers of young children (n=10), two examined the child's perspective and one, related to the opinions of a childcare management team. Most commonly identified barriers/facilitators to fruit and vegetable intake included; accessibility, costs of food, behaviours of child (demanding food, reluctance to try fruits and vegetables etc.), lack of transport, convenience of unhealthy food, time constraints, convenience of cheap unhealthy food. Interestingly, given that the children are so young, in one study children also highlighted the availability of fast food preventing them from eating fruits and vegetables.

Intervention studies: Evidence from 29 studies, which were published between 1992 and 2012 were identified. Eleven studies were set in the Americas (USA n=10 and Brazil n=1), twelve in Europe (UK n=7, Germany n=2, Belgium n=1, Netherlands n=1 and Finland n=1) and 2 in Asia (Thailand n=2). Children's ages ranged from infancy to 6 years. Duration of intervention ranged from 12 weeks to 2 years with post-intervention follow-up ranging from immediately to 4 years. Twenty of the studies targeted multi-level determinants of fruit and vegetable intake with the most frequently occurring being a combination of the following; school, family, community and individual (either parent and/or child). Sixteen interventions were underpinned by theory (Social Learning n=6, Socio ecological n=1, Health belief model n=1, other stated behavioural change models n=8).
Significant increases in F&V consumption and/behaviour were reported in 13 studies. The remaining studies reported non-significant beneficial increases or no effect (n=15). Those studies relating to policy change in nursery school (n=2) showed no improvements in fruit and/or vegetable consumption with one having a seemingly detrimental effect, reporting a reduction in fruit consumption following the implementation of a school policy intervention.
Increased parental knowledge, education, higher SES status and Children's liking/preference for specific F&V were all positively associated with an increase in F&V consumption.

Prospective studies: Seven prospective cohort studies published between 1999 and 2012 were included in this review. Four studies were set in the Americas (USA n=3 and Brazil n=1), two in Europe (Germany n=1 and Finland n=1), and one in Australia.
Maternal feeding practices were investigated by one study which found significantly positive associations between maternal modelling of a healthy diet and an increase in fruit and vegetable intake. Conversely this study also found that using pressure to eat and restricting food had a detrimental effect on fruit and vegetable consumption. Inverse associations were found between age and fruit and vegetable intake in four of the studies, however these were deemed non-significant.
Two studies reported no correlations with fruit and vegetable consumption. One examined fruit juice intake as a determinant and the other gender, birth weight, maternal schooling, annual family income, maternal employment and maternal overweight.

Conclusions: There is minimal prospective evidence on the determinants of fruit and vegetable intake in very young children. However parental feeding practices, in particular modelling of healthful behaviour shows promise. This was also seen to be true in those intervention studies which included similar behavioural components. Interventions which were most successful in terms of increasing fruit and vegetable consumption/behaviour were those which targeted both family/parent and child, included an educational component and were underpinned by a theoretical framework/theory.
An updated search was carried out for this review on July 24th 2014. It identified 1217 new hits which are currently being screened for inclusion. Any new evidence will be included in future publications.

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3) Systematic review of qualitative and quantitative evidence on the correlates and determinants of obesogenic dietary behaviours in preschool children (0-6 years)
Lead analyst: Veena Mazarello Paes
Results are presented separately for qualitative, intervention, prospective and cross-sectional studies.
Qualitative evidence on SSB and obesogenic food intake: Twenty qualitative studies involving 1067 participants (901 parents/caregivers, 37 children, 87 teachers, 15 dieticians and 27 nursery staff). Eighteen studies were published after 2004, 9 were conducted in America, 6 in Europe, 4 in Australia and 1 in Canada. Focus groups were the main study design (n=16), followed by individual interview studies (n=6) and 1 ethnographic study. Despite wide differences in study context and focus, several consistent themes emerged. Parental factors influencing young children's obesogenic diets were: time constraints, affordability, knowledge, modelling, concerns about child's health and use of food as a reward. Child preferences also influence feeding decisions. Environmental factors include: availability, advertising, and family, peer, societal, cultural, and school/childcare influences. Intervention strategies should aim to model positive behaviours, create home and preschool environments that promote healthy diets, and simultaneously target barriers at the family and preschool levels.

Interventional evidence on SSB intake: Thirteen studies were published between 2007- 2013 and were conducted in America (n=4), Europe (n=4), Australia (n=4) and Asia (n=1). Seven studies tested interventions targeting multi-level determinants of SSB intake (community, school/centre environment, parents and/or child) and four studies reported statistically significant beneficial effects on SSB intake. Two out of four studies testing interventions targeting only parental determinants (knowledge, food and parenting skills, self-efficacy, goal setting and motivation, social support), reported statistically significant beneficial effects on SSB intake. No study tested interventions targeting exclusively child determinants of SSB intake. Almost all effective studies were set outside of Europe (Australia n=3, Asia n=1, USA n=1, UK=1). There was no apparent relationship between study setting (home, school or healthcare) or the types of determinants targeted and the intervention effectiveness.

Interventional evidence on obesogenic food intake: Nineteen intervention studies, published between 2003 and 2013 came from the Americas (n=6), Asia (n=2), Australia (n=6) and Europe (n=5). The study settings were clinic/home-based (n=11), school-based (n=7) and community-level (n=1). Eleven interventions were based on theoretical models of behaviour change. Interventional evidence on obesogenic dietary behaviour were categorised into a) sweet, b) savoury and c) obesogenic meals consumption. Eight out of nineteen included studies were in non-representative population and six of these interventions targeted parental determinants (nutritional knowledge, infant feeding, parenting skills). Twelve interventions targeted multi-level (child, parent environment), parental (n=6) and environmental (n=1) determinants and most reduced obesogenic food behaviours.

Determinants of SSB intake: Six prospective cohort studies, mainly in non-representative populations, reported seven determinants. Of these child's age, maternal high pre-pregnancy BMI, maternal SSB consumption/negative modelling and early introduction of SSB/solids in infants were associated with higher SSB consumption in children whereas socio-economic status was not.

Correlates of SSB intake: Twenty-three cross-sectional studies identified 79 correlates. Of these socio-demographic (low maternal age, low education, low income, ethnicity and child's age), child-behavioural (obesogenic food consumption and TV viewing), parental (maternal obesogenic diet and early weaning/introduction of solids) and environmental (availability) correlates were studied more extensively than others and were associated with increased SSB consumption in children.

Determinants of obesogenic food intake: Observational evidence from six prospective cohort

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	studies (one in non-representative population) identified eight determinants. Two socio-demographic (child's age and gender), four parental (maternal restriction, pressure to eat, negative modelling and early introduction of non-core foods in infants) and one environmental (food availability) determinants were associated with higher obesogenic food consumption in children. **Correlates of obesogenic food intake:** Thirty six cross sectional studies reported on 115 correlates of obesogenic food behaviours. Most studies investigated correlates of obesogenic sweet foods and/or meals. Socio-demographic correlates (low household-income, maternal age & education, parent ethnicity, family size, child's age and male-child), child behavioural correlates (eating patterns & preferences and TV viewing), parental correlates (not breast feeding/early weaning, smoking and obesogenic-dietary habits) and environmental correlates (food-availability and food-security) were associated with higher levels of obesogenic-food consumption in young children. **Conclusions**: Multi-level interventions targeting parents/family, children and school/childcare environments appear to be effective in changing obesogenic dietary behaviours in young children. However, few conclusions could be drawn regarding specific modifiable determinants. Qualitative evidence indicates that future interventions should also target the barriers, especially at the family and preschool levels simultaneously by promoting healthy dietary behaviours at home and in preschools. An updated search was carried out using the original search strategy (as described in the published protocol) in eight electronic databases on 10th June 2014. This search identified 8124 articles (after de-duplication) which are currently being screened for inclusion. Any new evidence will be included in future publications.
Lay summary	The aim of this project is to inform the design and content of interventions to reduce obesity in young children. Over the past few years the focus of obesity prevention has shifted to preschool children because of the high prevalence of obesity at school entry and recognition that habits formed in early life often persist into later life. In order to develop effective interventions and change behaviour, it is important to understand the factors that are associated with those behaviours. The energy-balance related behaviours (EBRB) associated with obesity are 1) intake of sugary drinks 2) intake of high calorie foods 3) less fruit and vegetable intake and 4) sedentary behaviour and low levels of physical activity. We searched through almost 40,000 papers and identified studies describing interventions to change the four behaviours we were interested in, studies that describe which factors are associated with these behaviours and studies that asked children and caregivers their opinions on changing these behaviours. Provisional findings suggest that multi-level interventions (child, parents, school, community), including parental modelling of healthy behaviours, show promise in changing EBRBs in young children. We identified few specific modifiable factors associated with these behaviours in young children. Furthermore, qualitative evidence indicates that future interventions should also target the barriers to behaviour change. Long-term sustainability, impact on inequalities and potential for implementation in routine practice of interventions should be considered. When completed, the findings of these reviews can be used by policy makers and researchers to develop and test interventions to prevent childhood obesity.
Publications	1) Title: *Protocol for systematic reviews of determinants/correlates of obesity related dietary and physical activity behaviours in young children (preschool 0-6yrs): evidence mapping and syntheses.* Systematic Reviews Journal: ID 4998316359114059 2) Title: *Systematic reviews of determinants/correlates of obesity related dietary and physical activity behaviours in young children (preschool 0-6yrs): evidence mapping and syntheses.* Submitted to: PROSPERO: registration number: CRD42012002881

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	3) The search strategy has been rerun, more recent papers identified and a further four publications are in progress.
Impact	1) The findings of all the reviews were presented at an ASO (Association for Study of Obesity) symposium (on Early life obesity (0-6): Interventions and determinants) led by Prof Carolyn Summerbell on 16th September 2014. The presentations are available to view here http://www.kc-jones.co.uk/files/uploads/1411484878.pdf http://www.kc-jones.co.uk/files/uploads/1411484890.pdf http://www.kc-jones.co.uk/files/uploads/1411484866.pdf 2) Posters were presented at - SPHR Annual Scientific Meeting, October, 2013, UCL, London - Centre for Diet and Activity Research (CEDAR), Research and policy meeting: What shall we do about diet and physical activity? October 2013, Cambridge, - Faculty of Public Health Annual conference, July 2014, Manchester - Cambridge Institute of Public Health, showcase event, July 2014, Cambridge 3) We will aim to present the findings at the local Cambridge NIHR SPHR stakeholder event in Feb/March 2015. 4) Although we have not been successful in securing funding for intervention development and evaluation, we have shared the findings with a number of national and international researchers who are developing early life obesity prevention interventions. The results have also been sent to the NIHR PHR programme who requested this information. 5) In terms of capacity building, Veena Paes has secured a PhD position at UCL, Kathryn Hesketh is doing a post-doc at UCL. The reviews form an integral part of Claire O'Malley's and Kathryn Hesketh's PhDs.
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