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Centre-based childcare in early childhood and child obesity: systematic review and meta-analysis protocol

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ABSTRACT

Objectives Centre-based childcare has been identified as a promising environment for obesity prevention in early childhood, but the longitudinal relationships between attending centre-based childcare and child obesity are not well understood. The objective of this systematic review is to evaluate the longitudinal associations between centre-based childcare attendance in early childhood and child body mass index compared with other childcare settings or parental care. Subgroup analyses will also be conducted to determine if socioeconomic factors and characteristics of the childcare setting modify the relationships.

Methods Databases that will be searched include MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature, the Cochrane Database and Web of Science. Longitudinal prospective cohort studies, retrospective cohort studies, case–control studies and intervention trials conducted in middle-income and high-income countries will be included in the search strategy. Sensitivity and subgroup analyses will be conducted to explore factors that may modify the findings. Study selection, data extraction, risk of bias and quality of evidence assessments will be conducted independently and in duplicate by two reviewers. Risk of bias will be assessed using the Risk Of Bias In Non-randomized Studies - of Exposure tool. Meta-analysis will be conducted using random effects models to account for between-study variation. Heterogeneity across included studies will be estimated using the I^2 statistic. If meta-analysis is not possible, a narrative summary will be provided. The quality of the evidence will be assessed using the Grading of Recommendations Assessment, Development and Evaluation tool.

Ethics and dissemination Ethical approval is not required for this study since no data will be collected. Findings aim to inform interventions and guide efforts in childcare settings to support optimal child growth. Results will be published in a peer-reviewed journal. Results may be of relevance for childcare and public health policy, researchers, parents and healthcare practitioners.

PROSPERO registration number CRD42023436911.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A comprehensive search strategy involving multiple databases and study selection protocol will be used to identify and summarise the existing literature.
⇒ Study selection, data extraction and study assessments will be performed by two independent reviewers to improve the accuracy and consistency of reporting.
⇒ Sensitivity and subgroup analyses will be conducted to evaluate the robustness of the results and explore important complexities that may influence the findings.
⇒ Included studies are anticipated to be observational which are often regarded as lower quality evidence. Given the nature and complexity of childcare attendance, randomised controlled trials may not be feasible emphasising the importance of observational research to explore clinically and policy relevant questions.
⇒ Included studies are anticipated to have high heterogeneity attributable to a variety of demographic, methodological and childcare exposure characteristics between studies, which may limit the interpretation of the findings.

INTRODUCTION

One in three children are living with overweight or obesity in North America.[1] Obesity in early childhood tracks into adulthood, increasing the risk of cardiovascular disease and type 2 diabetes.[2–5] According to Bronfenbrenner's ecological systems theory, many inter-related environments influence child development including health and growth outcomes.[6–8] Childcare environments exist within the microsystem, which is the most proximal system within the theory to the individual and is considered to be the most influential to the child.[7 9] This framework highlights that childcare may be an important consideration for the prevention of childhood obesity and the development of healthy behaviours in early childhood.[10–16] Approximately 60% of children under the age of 5 years attend non-parental childcare in North America and spend a significant amount of time in these settings.[17–19] Childcare settings are often classified as government-regulated centre-based childcare, licensed childcare homes, informal childcare (eg, relatives or

non-relatives) or parental care. Early childhood has been highlighted as a critical period for the establishment of health behaviours, many of which persist through the life course.[10–13 20] Research has shown that enriching environments, which encourage healthy eating habits, physical activity and social interaction have protective effects on health, including childhood obesity.[21–26]

In Canada, centre-based childcare environments are government regulated which provide daily programmes, learning activities, meals according to dietary guidelines and indoor and outdoor structured activities, and care is provided by licensed childcare professionals.[27–30] These regulations do not exist in informal or unlicensed childcare environments. Other countries have similar process and structural regulations in these settings and centre-based facilities are considered the most regulated type of childcare.[31–33] Studies have found that government-regulated childcare centres tend to be higher quality than other childcare settings.[34–37] Different characteristics of childcare settings including regulations and care oversight may influence growth[38–41] and higher levels of care provider education and training have been associated with positive care practices.[42] Knowledge about best practices to encourage healthy behaviours may vary by care provider training.[43–45] Childcare centres may promote healthy eating behaviours, activity and routines during a sensitive period of growth which may persist throughout the life course.[10 11 13 20 46 47]

Centre-based childcare has received attention as a practical environment for obesity prevention in the preschool years.[48–50] However, the effects of centre-based childcare on child obesity and growth are unclear.[51–53] Previous systematic reviews conducted in 2016[53] and 2017[52] explored associations between various childcare settings on child obesity suggesting that informal childcare is associated with a higher risk of obesity compared with parental care,[52 53] but mixed associations were found for centre-based childcare. However, these reviews did not focus on the role of centre-based childcare and potential complexities of the centre-based childcare exposure or perform meta-analysis.[51–53]

The overall objective of this systematic review and meta-analysis will be to evaluate the available evidence on the associations between centre-based childcare attendance in early childhood and child obesity.

OBJECTIVES

PICO framework

Population: early childhood defined as children aged≤5 years on enrolment in the study; *Intervention/exposure:* centre-based childcare attendance in early childhood (birth to ≤5 years) in middle-income and/or high-income countries; *Comparator:* other childcare settings (licensed home care, unlicensed home care or informal care (grandparents, relatives or non-relatives)) or parental care; and *Outcomes:* child body mass index z-score (zBMI) and overweight or obesity.

Primary objective

The primary objective was to evaluate the longitudinal associations between attendance to centre-based childcare in early childhood compared with other childcare settings or parental care and child zBMI.

Secondary objective

The secondary objective was to perform subgroup analyses to determine if socioeconomic factors and characteristics of the childcare exposure modify the relationships.

METHODS

A systematic review and meta-analysis of the literature will be conducted. This protocol is designed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols guidelines (PRISMA-P)[54] (see online supplemental file 1) and is registered with PROSPERO as a systematic review and meta-analysis (CRD42023436911).

Eligibility criteria

Types of studies

Studies will be included in the search if they are original works, published in peer-reviewed journals or unpublished studies (ie, conference abstracts or registered in clinicaltrials.gov). Longitudinal prospective cohort studies, retrospective cohort studies, case–control studies and intervention trials will be included in the search strategy. Studies will be included if they have at least one longitudinal outcome measurement timepoint. Cross-sectional studies and case series will be excluded. While we understand that observational study designs cannot confirm causality, restricting to longitudinal cohort studies and intervention trials (if available) may be a stronger indicator of evaluating potential causal relationships compared with cross-sectional data.[55] There will be no restriction on study language, and translation will be performed in Google Translate or by an individual who is able to provide translation to English language, as required. There will be no restrictions on date of publication or length of follow-up.

Participants

Studies that included healthy children aged birth to ≤5 years at the measurement of childcare exposure will be considered.

Setting

Studies conducted in middle-income and high-income countries as classified by the World Bank will be included. The present systematic review and meta-analysis aims to provide contextual knowledge for childcare systems and policy. The review will be restricted to middle-income and high-income countries due to the differing environmental determinants of health, political and economic structures and healthcare and childcare systems in low-income countries.[56–58]

Exposure

The primary exposure will be attendance to centre-based childcare in early childhood between birth and ≤5 years of age. Classifications of centre-based childcare range by country and time period and will include 'childcare centres', 'early learning and childcare', 'centre-based care', 'daycare', 'nursery schools', 'preschools' or 'creche'. Studies will have had to compare centre-based childcare attendance to at least one other childcare setting or parental care (comparator) to be included.

Comparator

The comparator will be other childcare settings including home-based childcare (licensed or unlicensed), informal care (care by a relative (i.e. grandparent, aunt or family member) or care by a non-relative (i.e. babysitter or nanny)) or parental care.

Outcomes

We will extract outcome data measured at any age in childhood or beyond in the included studies but will conduct subgroup analyses to evaluate potential differences based on child age at the time of outcome measurement.

Primary outcome

The primary outcome will be child zBMI. zBMI is a validated proxy measure of underlying adiposity that is replicable, can track weight status in children and is a recommended clinical measurement to identify children with overweight and obesity.[59] zBMI is a feasible measure of growth status in children,[60] generally well correlated with direct measures of body fat.[59] Child zBMI is an age-standardised and sex-standardised measure of BMI.[61] Other secondary measures of adiposity that will be considered for extraction include BMI, weight-for-age, body fat mass, lean body mass, waist circumference, waist-to-hip ratio, body fat percentage, skinfold thickness and prevalence of overweight or obesity as defined by the WHO,[61] Centers for Disease Control and Prevention[62] or International Obesity Task Force[63] growth standards cut-offs. While differences in growth standards may contribute to heterogeneity, we are unable to account for it without individual level data from each study, which is not feasible and a limitation. Adiposity measures reported at any age will be collected from eligible studies.

Search methods

Information sources

Databases that will be searched include MEDLINE (Ovid), Embase (Ovid), Cumulative Index to Nursing and Allied Health Literature, the Cochrane Database (Cochrane Reviews, Cochrane Central Register of Controlled Trials (CENTRAL)) and Web of Science using medical subject headings and keywords. The databases will be searched from inception to November 2023. A search of the grey literature will also be performed to identify any unpublished studies or any published in non-commercial formats including clinicaltrials.gov. The reference lists of included studies or any relevant reviews will be hand searched.

Search strategy

A comprehensive search strategy was developed with a research librarian with expertise in systematic reviews (see online supplemental file 2). Examples of keywords used in the strategy include 'childcare', 'daycare', 'childcare centres', 'adiposity', 'body mass index' and 'obesity'. The search will be performed again in each database before final submission for publication to account for new studies that may meet eligibility criteria but were not captured in the initial search.

Data extraction and management

Study selection

To evaluate study eligibility, at least two reviewers will independently review study titles, abstracts and full texts. Both reviewers will apply inclusion and exclusion criteria to each study and disagreements will be examined and resolved by consensus. If consensus is not reached between the two reviewers, a third reviewer will be consulted. If clarification is needed or sufficient information is not available in the full-text publication, study authors will be contacted by email to obtain additional or missing data. At the full-text screening stage, reasons for exclusions will be documented and included in the final manuscript.

Data extraction

Data extraction will be completed independently by two reviewers using a form modified from standardised data extraction tables that will be piloted on five studies before use. The data extraction form will be adapted from the Cochrane Data Extraction Template.[64] If necessary, alterations will be made to ensure efficient and consistent use between reviewers. Data collected from each of the studies will include, but not be limited to: (a) *study information:* authors names, year of publication, citation, funding sources and conflicts of interest; (b) *study characteristics:* location (country, city), study design, dates, inclusion/exclusion criteria and statistical analysis; (c) *participants:* number of children (sample size), child age (mean and range), child biological sex and any baseline characteristics of the population provided (ethnicity, income level, birth weight, gestational age, parental characteristics (eg, education, employment, BMI) or lifestyle characteristics); (d) *exposure:* characteristics of the exposure (timing, duration and intensity), any details of the childcare programme (eg, specialised, quality metrics) and method of data collection; (e) *comparator:* characteristics of the comparator (setting, timing, duration and intensity) and method of data collection; (f) *outcomes:* adiposity measures, method of data collection and covariates adjusted for in analyses, if applicable; and (g) *results:* any data provided by individual studies for primary and secondary outcomes.

Multiple reports of the same data (ie, analyses of the same cohort or trial) will be identified through study

characteristics including author names, location, population, name of cohort, survey and database. If uncertainty remains, author(s) will be contacted. Data will be collected from each study report. The most comprehensive version of the data will be selected, and the decision will factor in study quality, completeness of reporting (ie, entire sample) and relevance of the methodology to the research question.

Data management

Studies extracted from each database will be transferred to Endnote desktop separately and uploaded to the Covidence software where duplicates will be removed before screening. The Covidence software will be used for study selection and data extraction and to resolve discrepancies between reviewers.[65] Screening questions and criteria will be developed and piloted based on the eligibility criteria. Extracted data will be downloaded from Covidence and managed in an electronic file, which will be archived and available for access by reviewers.

Risk of bias assessment

The Risk Of Bias In Non-randomized Studies - of Exposure (ROBINS-E) tool is an appropriate choice as most of the evidence is expected to be observational studies evaluating the effects of centre-based childcare as an exposure, as randomisation to childcare is challenging and often not feasible.[66] ROBINS-E includes seven domains of bias (confounding, measurement of exposure, selection of participants, postexposure interventions, missing data, measurement of the outcome and selection of the reported result) that will be individually assessed using signalling questions ('yes', 'probably yes', 'probably no', 'no' and 'no information') and expresses the risk of bias as low, some concerns, high or very high.[66] Three judgements will be made in the assessment of risk of bias including: (1) the risk of bias, (2) the predicted direction of bias and (3) if the risk of bias threatens conclusions about whether the exposure has an important effect on the outcome.[66] If clinical trials are included, the Cochrane risk of bias (RoB V.2) tool will be used which includes five domains of bias (randomisation, deviations from intended interventions, missing outcome data, measurement of outcome and selection of the reported result).[67] However, no randomised clinical trials are anticipated to be identified or eligible. The risk of bias for each included study will be assessed independently by two reviewers for each outcome. Disagreements will be examined and resolved by consensus. If consensus is not reached between the two reviewers, a third reviewer will be consulted. Studies will not be excluded based on the risk of bias. Risk of bias assessment will be displayed for each study and cumulatively across the domains to inform the evaluations of the findings.

Quality of evidence assessment

The quality of evidence will be evaluated using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach.[68] This approach will evaluate the evidence by deciding whether to decrease the level of certainty in five domains: (1) risk of bias, (2) inconsistency, (3) indirectness, (4) imprecision and (5) publication bias. The approach will also allow for increasing the level of certainty in three domains: (1) large magnitude of effect, (2) dose–response gradient and (3) whether all residual confounding would decrease the magnitude of effect. A minimal clinically important difference of 0.25 for child zBMI will be used for the evaluation of effect size and clinical relevance. Intervention studies for preventing childhood obesity have suggested that this difference may be clinically meaningful.[69–71] This approach will provide an assessment of the certainty of evidence as high, moderate, low or very low and will be presented for each outcome within a summary table. The quality of evidence will be assessed independently by two reviewers. Furthermore, the Credibility of Effect Modification Analyses instrument will be used to assess the credibility of results from subgroup analyses.[72] If deemed credible, a GRADE assessment will be performed to evaluate the quality of evidence by each subgroup separately.

Data synthesis

For each included study, participant information, methods and results will be summarised in descriptive tables to provide study characteristics. Studies included in the analysis will be described according to a standardised coding system that captures key elements of each study.

We will conduct a separate meta-analysis for each outcome if there are at least two studies with comparable exposure and outcome variables. If meta-analysis is not possible due to a lack of comparable studies, a narrative summary will be conducted. A random effects model using the DerSimonian and Laird's method will be used due to expected heterogeneity between studies.[73] Sensitivity analyses will be performed using the Knapp and Hartung's method.[74 75] Each study will be included as a random effect to account for between-study variation in this model. Heterogeneity across included studies will be estimated using the I^2 statistic and Cochran's Q test.[76 77] Heterogeneity will be considered as low (0%–40%), moderate (30%–60%), substantial (50%–90%) and considerable (75%–100%).[76] Meta-biases for publication bias will be assessed using funnel plots and Egger test.[78] If funnel plot asymmetry or a significant Egger's test is found, we will explore the potential bias, perform sensitivity analysis and provide interpretation. Forest plots will be presented to represent results from the meta-analysis. The Review Manager (RevMan V.5.4.1) software and R Project for Statistical Computing (metafor or meta package) will be used to perform all analyses.[79 80]

Effect measures

The primary analysis will evaluate child zBMI as a continuous outcome. The secondary analysis will evaluate child zBMI as a dichotomous outcome (overweight or obesity). For child zBMI evaluated as a continuous variable, data

will be presented as a mean difference (MD) and 95% CIs.[81] If different measurement scales of the outcome are used between studies, a standardised MD and 95% CIs will be presented.[76] For child zBMI evaluated as a categorical variable, counts and percentages for overweight or obesity among children who attended centre-based childcare compared with children who attended other childcare settings or parental care will be extracted. If the effect estimate is reported as crude or adjusted ORs or risk ratios (RRs), we will collect adjusted estimates and descriptively present the covariates adjusted for in each study. The effect estimates are anticipated to be reported as ORs, and RRs will be converted to ORs. The data will be included in the meta-analysis (using the generic inverse variance method), if the estimate is accompanied by a SE, 95% CI or exact p value.[81]

Subgroup analysis

Subgroup analyses for various characteristics are planned but will be performed only if the data are available in the included studies and if there are at least four studies for each subgroup. These will be used to determine if the effect estimates are different, by including an interaction term in the models to evaluate: (1) location (ie, middle-income vs high-income country and if possible, by each country as childcare centre regulations may differ), (2) childcare comparator group (ie, parental vs other childcare setting), (3) income level of study population (ie, low vs high), (4) age of child at childcare exposure (i.e. birth to 2.5 years vs >3 to <6 years) and outcome measurement (i.e. early childhood (<5 years) vs later childhood (≥5 years)) and (5) childcare duration and intensity (ie, part-time vs full-time attendance). If data was collected prior to the year of 2000, we will conduct a sensitivity analysis to determine the impact of the timing of data collection on our findings due to the evolving nature of the childcare landscape. If trials are identified, a subgroup analysis by study design (ie, trials vs observational study designs) will be explored.

Amendments to protocol

Any amendments to this protocol will be registered with PROSPERO as they occur and will be reported in the final publication.

Ethics and dissemination

Ethical approval is not required as individual patient data is not included. The results will be published in a peer-reviewed journal and reported according to the PRISMA statement. Results will also be shared with researchers, clinicians and childcare policy makers through academic conferences and non-academic meetings.

Patient and public involvement

Patients were involved as research partners in identifying the research topic as a priority. Patient partners will be involved in the dissemination of findings.

DISCUSSION

Many countries are implementing policies or programmes to support accessible, affordable and quality government-regulated childcare for families.[82–87] The positive impacts of centre-based childcare for child development are often highlighted, but the impact on other important child health outcomes is relatively unknown. As efforts continue, more children will likely receive care in these environments, which highlights the importance of understanding the effects on child growth and obesity. This systematic review aims to address knowledge gaps and synthesise the evidence to inform parents, healthcare professionals and policy makers about the potential of government-regulated childcare centres to act as an early intervention to support healthy growth in children. Finally, it will provide evidence that may guide future research, guide interventions in centre-based childcare settings, inform childcare and public health policy and help ensure optimal health outcomes for children.

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Contributors MK and JLM drafted the manuscript, conceptualised the review and developed the methodology. CB provided expertise in child obesity. MP provided expertise in early learning and childcare systems. CDGK-S contributed to the data synthesis methodology and informed the statistical analysis. CB, MP, CDGK-S and JP contributed to the development of the methodology and read, provided feedback and approved the final protocol manuscript. JLM is the guarantor.

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Competing interests JLM has received research funding from the Canadian Institutes of Health Research, Physician Services and Ontario SPOR Support Unit; an unrestricted research grant for a completed investigator-initiated study from the Dairy Farmers of Canada (2011–2012); and Ddrops provided non-financial support (vitamin D supplements) for an investigator-initiated study on vitamin D and respiratory tract infections (2011–2015). CB has received research funding from the Canadian Institute for Health Research, Heart and Stroke Foundation of Canada, Physician Services, Leong Center at the University of Toronto and Centre for Addictions and Mental Health; Ontario Child Health Support Unit Impact Child Health Award; and a Walmart Community Grant through the SickKids Foundation for a study on food insecurity in the inpatient hospital setting. MK, MP, JP and CDGK-S have no conflicts of interest to disclose.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

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