A Systematic Review of Methods to Measure Family Co-Participation in Physical Activity

Léonie Uijtdewilligen†*, Helen Elizabeth Brown‡, Falk Müller-Riemenschneider¹,³, Yee Wei Lim⁴, Soren Brage², Esther MF van Sluijs²

† Equal contribution

¹ Saw Swee Hock School of Public Health, National University of Singapore, Singapore

² UKCRC Centre for Diet and Activity Research (CEDAR) & MRC Epidemiology Unit, University of Cambridge, School of Clinical Medicine, Box 285 Institute of Metabolic Science, Cambridge Biomedical Campus, Cambridge CB2 0QQ, United Kingdom

³ Institute for Social Medicine, Epidemiology and Health Economics, Charite University Medical Centre Berlin, Germany

*Corresponding author

Dr Léonie Uijtdewilligen

Saw Swee Hock School of Public Health, National University of Singapore

Tahir Foundation Building, 12 Science Drive 2, #10-01, Singapore 117549

Phone: +65 66015006

Fax: +65 6779 1489

Email: leonie_uijtdewilligen@nuhs.edu.sg

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Abbreviations

PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; GPS, Global Positioning Systems; ICC, Intraclass Correlation Coefficient
ABSTRACT

The family environment is key in influencing children’s health behaviours. Encouraging family co-participation in physical activity may therefore be an effective approach to increasing children’s physical activity levels. Yet, little is known about how to best assess family co-participation in physical activity. This review summarizes methods to measure family co-participation in physical activity, which was defined as joint physical activities including at least 1 healthy child (0-18 years) and 1 other family member. Methods were identified through a systematic literature search, cross-referencing pre-selected reviews, and contacting research groups. Thirty-seven measurement methods were included. Questionnaires were the most common method used, with most assessing frequency of co-participation and few also assessing duration and type. Reliability and internal consistency of scales were often reported, but rarely specified for the item(s) relevant to co-participation. Other methods of measuring co-participation included diaries, event history calendars, direct observations, and accelerometry combined with diary, ecological momentary assessment, or Global Positioning Systems (GPS). Whilst a large number of measurement methods of family co-participation in physical activity exist, few are comprehensive and/or report acceptable psychometric properties. Future work should focus on reaching consensus in defining family co-participation in physical activity, and subsequently developing a reliable and valid measures.
INTRODUCTION

Despite the established health benefits of physical activity for children\textsuperscript{1,2,3,4,5,6}, data from several countries suggest that the majority of children are insufficiently active to enjoy these benefits\textsuperscript{7,8}. Further, levels of physical activity decline substantially throughout childhood and into adolescence\textsuperscript{9,10}. Understanding the determinants of physical activity in young people, and developing effective interventions to promote and maintain their activity levels, is therefore a public health priority\textsuperscript{11}.

The family is the primary unit of socialisation and organisation during childhood\textsuperscript{12}, and is therefore central in shaping engagement in health behaviours, including physical activity\textsuperscript{12,13,14}. There is also substantial evidence showing that parenting behaviours and family processes play a critical role in adolescent well-being\textsuperscript{15}. Family factors, such as logistical support (e.g., provision of transport or covering costs), co-participation, or encouragement, have been consistently and positively correlated with physical activity in children\textsuperscript{11,16,17}. Moreover, the addition of parent involvement (e.g. education sessions, co-participation) to school-based physical activity interventions has been found to be effective in promoting activity in children and adolescents\textsuperscript{18}.

The involvement of family members in physical activity-focused interventions may not just be advantageous for the targeted child. For example, recent qualitative research suggests that in addition to the potential health benefits of family physical activity, parents also valued the opportunity to enhance parent-child communication and social interactions among family members\textsuperscript{19}. Authors describing the intervention “A Family Affair” report that joint physical activities led to an improved daughter-mother relationship and as such, greater support for a healthier lifestyle\textsuperscript{20}. Co-participation is also a key feature of the Healthy Dads Healthy Kids...
intervention, which was shown to be effective in improving physical activity for fathers and their children. 

Healthy Dads Healthy Kids demonstrates that reciprocal reinforcement between parent (father) and child is particularly pertinent when adopting and refining health behaviours. Encouraging co-participation of family members (e.g., parents, siblings, other relatives) may therefore be an effective approach to increasing or maintaining children’s activity levels, and simultaneously improving engagement in physical activity in adults.

Given the growing interest in involving family members in the promotion of young people’s physical activity, an appraisal of methods to measure family co-participation in physical activity is timely and necessary. High quality exposure assessment is essential to identify causal associations with health and behavioural outcomes, to quantify the magnitude of any association, and to describe any dose-response relationships. Accurate measurement is also required to document patterns of, and changes in, family physical activity over time, and may be of particular importance for those assessing intervention effectiveness. Therefore, the aim of this study is to provide an overview of current methods used to measure family co-participation in physical activity.

METHODS

Search methods

This review was conducted and is reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Supplementary File 1). We identified measurement methods of family co-participation in physical activity through three different approaches: 1) a formal literature search in four electronic databases, 2) an informal, snowball search of cross-referencing pre-selected review articles, and 3) contacting research groups known to be conducting research into family-based physical activity.
activity. Research groups were identified by co-authors, who used their extensive networks
and attendance at conferences and key meetings to select 18 groups conducting relevant
research (e.g. examining correlates of child physical activity, developing/evaluating physical
activity interventions in family settings etc.).

The formal literature search was performed using computerized searches in PubMed, Scopus,
PsychInfo and ScienceDirect for articles published up to and including April 2017, with no
limit on earliest year of release. The search strategy consisted of three elements:\n(a) construct (e.g. physical activity, exercise), (b) population (e.g. family, parent) and (c)
instrument (e.g. questionnaire, observation). Terms referring to these three elements were
combined with AND terms and used as title words, abstract words, and/or keywords
depending on the respective electronic database. In addition, ‘Motor activity’, ‘Sports’,
‘Exercise’, ‘Family’, ‘Data collection’, ‘Accelerometry, and ‘Observation’ were added as
MESH headings in PubMed. As the term co-participation does not adequately fit in the
search term blocks described above, a simple additional search across all databases was
performed combining the terms co-participation/co-participation and physical activity (see
Supplementary File 2 for the detailed search strategy). References of included papers were
checked to identify further publications.

Other search methods took place between May 2015 to October 2016. References of pre-
selected review articles were checked to identify further publications. Research groups were
asked whether they were using one or more measurement methods of family co-participation
in physical activity, and if yes, if they were able to share the following:

- A copy/description of original method(s) and scoring algorithm(s);
- Background information (how it was developed, what study it was used in, data on validity/reliability testing);
- Any publications that reported on the method.

Both published and unpublished measurement methods were eligible for inclusion. References obtained via research group contact are highlighted with an asterisk in the reference list of this paper.

**Inclusion criteria**

Measurement methods were included if they were described in English language references, were available in the English language (solely, or in addition to other languages) and assessed family co-participation in physical activity which was defined as ‘joint physical activities including at least 1 healthy child (aged 0-18 years) and 1 other ‘family member’ (we included all types of family, e.g. parent/guardians, siblings, cousins). Measurement methods were excluded if they referred to the assessment of family co-participation in physical activity only in very general terms but did not provide further details e.g. the methods section states that ‘frequency of family exercising with child’ was assessed, but no exact item description, and/or answer categories were provided. Qualitative methods such as interviews and focus group discussions were excluded due to their usual focus on psychological constructs such as behavioural attitudes and perceived control, rather than on the actual measurement of the behaviour at interest.

**Selection process**

Two independent reviewers (LU and HEB) performed title/abstract and full-text selection of articles generated from the electronic database searches (81% agreement for full-text inclusion). One reviewer (HEB) screened the references of relevant review articles, and
obtained published and unpublished references from relevant research groups. These were checked for eligibility by the second reviewer (LU). Disagreements on in/exclusion of references from all sources (electronic searches, review articles, and author contact) were discussed and resolved between the two reviewers.

**Data extraction**

Two reviewers (LU and HB) performed data extraction for a respective half of the obtained references. For each reference, data were extracted on a) the measurement method used to assess family co-participation in physical activity (e.g., questionnaire, diary), b) a description of the item text (if relevant), or a more detailed description of the method, c) method names, response scale or outcome, and d) the study population in which the method was used. If reported, information on psychometric properties (e.g., test-retest reliability, construct validity) was also extracted. For presentation purposes, references were grouped based on the ‘dimension’ of co-participation they assessed, i.e., existence, frequency, type or duration.

Methods assessing whether co-participation in physical activity generally occurred or had occurred in daily life were grouped under ‘existence’. Methods assessing how often in a given time frame (e.g., per week, per month) participant’s co-participated in physical activity, were grouped under ‘frequency’. Methods assessing co-participation in specific physical activities such as cycling or active play rather than in general physical activity, were grouped under ‘type’. Methods assessing time spent in co-participation in physical activity were grouped under ‘duration’. The primary dimension was determined depending on the available response options. If the method assessed other dimensions of co-participation, this was indicated in Table 1. Measurement methods were further grouped based on whether co-participation was assessed through the child or parent and similarity of methods (e.g., questionnaires versus accelerometry).
RESULTS

Figure 1 provides an overview of the different search methods. In total, we identified 37 measurement methods assessing family co-participation in physical activity among 97 references. Of the 97 included references, two were considered unpublished: one conference abstract \(^{35}\) and one PhD thesis \(^{36}\). Both were obtained via research group contact.

--- INSERT FIGURE 1 HERE ---

Method characteristics

Measurement methods of family co-participation in physical activity are summarized and described in Table 1. Measurement methods included both subjective (N=33) and objective methods (N=4), and were primarily used in the USA and Europe (specifically in the UK). The majority of methods assessed co-participation of primary school aged children (approximate age between 5 and 11 years) and their respective family members. The most commonly used method of assessment was through questionnaire items (N=28), either child-(N=10) or parent-reported (N=18). Frequency of co-participation was assessed most often as primary dimension of co-participation in physical activity, followed by existence, type and duration. Duration of co-participation was also assessed using device-based methods including a combination of accelerometry with diary, ecological momentary assessment, and Global Positioning Systems (GPS). In addition, the type of co-participation was assessed using child- and parent-reported event history calendar, and child- and parent reported diaries and direct observation.
Psychometric properties

Methods assessing the ‘existence’ and/or ‘frequency’ of family co-participation in physical activity were mostly one- or two-item questionnaires which were part of a more comprehensive multiple-item scale, e.g. social influences scale, instrumental support scale, social support scale, parental social support scale. Reliability and internal consistency of these scales were often reported and deemed acceptable, but rarely split out for the item(s) specific to co-participation. One of the exceptions are the studies by Singh et al., which reported reliability and validity figures for both child- and parent-reported items on the frequency of co-participation. They presented an intraclass correlation coefficient (ICC) of 0.47 with 47% agreement, and an ICC of 0.80 with 73% agreement to demonstrate test-retest reliability of the child- and parent reported item, respectively. Validity against interviews for the child- and parent reported items were reported as an ICC of 0.24 with 51% agreement, and an ICC of 0.56 with 57% agreement, respectively. The factor analysis performed by Loucaides and colleagues identified one specific factor for ‘parental physical activity with child’ (i.e., co-participation). They authors reported Cronbach’s alphas of .849 and .844 for weekdays and weekend days. Yet, no significant associations with pedometer-measured steps and diary-assessed time spent playing outside were found for this factor, which undermines the scale’s validity. Further, some of the ‘existence’ and ‘frequency’ measurement methods were modified from existing questionnaires, but provided references to reliability and validity information for the original format only.

Three of the seven measurement methods assessing the duration of family co-participation in physical activity used accelerometry; either in the form of identifying periods of simultaneous counts (using information provided in a complimentary activity diary), or in combination with ecological momentary assessment and GPS. To illustrate, in the case of combining
accelerometry and GPS, parent-child pairs were asked to wear accelerometers for seven continuous days, and a portable GPS device was attached to the accelerometer belt with recording interval matching those of the accelerometer. Co-participation in physical activity among the parent-child pairs was defined as activities of the same intensity (assessed by accelerometer) that occurred at the same time and in the same location (assessed by GPS device). From this data, the average daily minutes spend in moderate-to-vigorous physical activity performed together by parent-child pairs could be calculated; i.e., reflecting the duration of co-participation. For these ‘combination’ methods, no explicit information on reliability or validity were reported. Regarding the four questionnaires assessing ‘duration’ of co-participation, only Rhodes and colleagues provided test-retest ICCs from 0.25-0.59 to 0.41-0.86 at two different time points for several items, including the one assessing duration.

For three of the eight measurement methods assessing the type of family co-participation in physical activity (e.g. active travel, after school activities), information on reliability or validity was presented. Danford and Martyn noted that the child- and parent-reported event history calendar they used, demonstrated good face validity and construct validity. In addition, they stated that the reliability of the event history calendar was investigated through assessing correlations between child and parent reported activities, but no further details on agreement were provided. An event history calendar is typically a tool that collects reflective data at one point in time, rather than involving daily entries. In this specific study, children and parents were asked to look back at the past 2 months and note down any physical activity they had engaged in together as a family and as such obtained information on the type of family co-participation in physical activity. Sääkslahti et al assessed the inter-observer reliability of their parent-reported diary among families of 19 children and found a correlation of $r=0.91$ for actively doing things together as parent and child. The authors also
stated that this method was ecologically valid because ‘children were able to live their normal life and seasonal variation was taken into account’ [page 169]. Finally, Patterson et al \textsuperscript{48} assessed the inter-observer reliability of direct observations of families at the zoo, which was maintained at >90\% during data collection. In this particular case, direct observation of families spending time in the zoo was used as an indicator of the family’s habitual physical activity whilst being together. For example, observers noted whether the family used the stairs or the elevator, and the duration of time they spent walking rather than seated.

--- INSERT TABLE 1 HERE ---

**DISCUSSION**

This review provides a comprehensive overview of methods used to measure family co-participation in physical activity, and demonstrates the heterogeneity in the constructs assessed and methodology employed. The information provided in this review may be used to inform researchers’ selection of an appropriate methods to assess family co-participation in physical activity and to describe this important context-specific behaviour.

In navigating measurement methods of family co-participation in physical activity, researchers may choose to work from either a narrow definition or a slightly broader framework; each of which may have different correlates and determinants, and may be influenced via different mechanisms. We suggest a narrow definition to include engaging in physical activity directly with the child (e.g. playing together in the garden), usually as a parent-child pair. We defined co-participation as ‘joint physical activities including at least 1 healthy child (aged 0-18 years) and 1 other ‘family member’. This has been the target behaviour of family-based physical activity interventions such as *Healthy Dads Healthy Kids*.
A looser characterisation of co-participation may also encompass habitual family activity (e.g. active family gatherings), which may be more difficult to capture with self-reported methods, as parents and/or children may not think to include such events. Identifying the behaviour of interest, and then determining the most accurate methods of measurement, is an important challenge for researchers looking to assess family co-participation in physical activity.

As highlighted in Table 1, measurement methods are available for a variety of dimensions of family co-participation in physical activity. We included 37 different methods of four different dimensions; frequency, duration, existence, and type. Frequency of co-participatory activities was most commonly assessed exclusively via questionnaire. These measures presented acceptable levels of reliability and sometimes validity, and given how short the items are, may be appropriate for inclusion in longer questionnaires without adding to participant burden. In addition, a large number of international studies have previously used such an item, offering the possibility to compare findings between countries.

We also identified both child- and parent-reported questionnaires with multiple questionnaire/survey items (as compared to 1-item scales) that may offer a more precise assessment of family co-participation in physical activity. Specifically, one study exploring family-based joint activities more broadly asked children to report on a range of physical activities that they might have participated in with family members (e.g. indoor games, going for a walk, or playing sports). Similarly, a few other studies asked parents to report on how often they/as a family engaged in any of a list of shared family activities. Such measures may help to offset some of the limitations of broad, less-precise, single-item
measures. Items which provide more detailed responses may allow for a greater understanding of specific behaviours that families enjoy together.

Objective measurement of family co-participation in physical activity was relatively uncommon (less than 10% of references included for review). Increasing the use of device-based assessment may further improve the accuracy of reporting family co-participation in physical activity, and reduce the impact of social desirability bias. Another important advantage of device-based assessment, specifically accelerometry, is the ability to measure intensity of family co-participation in physical activity. Many of the questionnaire items we identified focused only on moderate-to-vigorous physical activity, and were not able to capture other activity intensities. This may be important, as family activities of light intensity, for example, may have alternative psychological or social health benefits. However, simply simultaneously wearing objective physical activity monitors may not be sufficient, as additional information on location and/or social context is required. One example of this approach is identifying periods of simultaneous activity from accelerometer data using information from a supplementary diary, as was done in one study assessing family dog-walking behaviour. This approach also allowed the researchers to demonstrate that increases in family co-participation in physical activity led to physical activity compensation at other times, an important consideration when promoting specific types of activity.

Accelerometry has also been used alongside GPS devices to classify periods of family co-participation in physical activity, defined by a linear separation distance of less than 50m between parent and child. Issues of participant burden should be considered when combining methods of measurement; for example, researchers should look to use dual devices which track both activity and locations, or if asking participants to wear two devices,
these should be placed upon the same waist-worn belt. Another recent example is a study which validated Bluetooth-enabled accelerometers against detailed time-use diaries, for the purpose of proximity tagging between parents and children and hence assessing co-participation \(^{57,58}\). Other objective measurement methods used included ecological momentary assessment; electronic surveys assessed primary activity, social context, physical location, current mood, and enjoyment. This may be particularly useful for those researchers interested in understanding not only the duration or frequency of family co-participation in physical activity, but also the wider context within it occurs.

In general, we observed that most methods assessing family co-participation in physical activity do not include a definition of co-participation, or even use the word co-participation in their study. This construct seems generally overpowered by or clustered within more classical constructs such as modelling and encouragement. Subsequently, the methods used are not specifically designed to measure family co-participation in physical activity. They also often include different examples of ‘activities done together’ and hence obtain information that is difficult to compare across studies and settings, even if the same dimension, i.e., existence, frequency, duration or type is assessed. Further, there was limited information on the validity and/or reliability of measurement methods. This mirrors recent claims that there is a current lack of consensus about the best way to define, assess or apply concepts such as co-participation in physical activity and physical activity in general \(^{59}\).

We therefore strongly encourage researchers to first work towards consensus in defining family co-participation in physical activity, before developing a reliable and valid measure that:

- distinguishes between existence, frequency, duration, type, and intensity of activity,
allows respondents to report upon multiple activities,

- collects data from both the target child and relevant family members, including parents, siblings and other extended family;

- incorporates objective assessments, e.g., accelerometers in combination with an event history calendar or GPS.

For those researchers looking to use an established method of measuring family co-participation in physical activity, a combination of accelerometry and GPS devices as per the work of Dunton and colleagues may be a good option \(^{44,56}\). This method allows for the recording of family members’ simultaneous physical activity, and hence provides an objective measure of frequency, duration, and intensity of co-participation, in addition to information about the geographical and social context (i.e. where and with which family members). If such devices are not available to researchers or do not fit within study logistics, the inclusion of multiple-item questionnaires could be considered, capturing at least the frequency of co-participation and type of activities done. In this respect, the items used by Zaborskis et al \(^{49}\) may serve as a model for other studies as they ask adolescents to list how often (‘frequency’) their families engage in a list of eight different activities (‘type’).

Researchers could refer to Corder et al \(^{50}\), Ghekiere et al \(^{51}\), McMinn et al \(^{52}\) and O’Connor et al \(^{53}\) for parent-reported equivalents. The inclusion of an additional option within such items to indicate the duration of co-participation through the e.g., reporting of minutes per week as free text, per the study of Hnatiuk et al \(^{127}\), may allow researchers to even more comprehensively assess the behaviour of interest. Further, for any study using questionnaires, it would be recommended to collect data from both child and other (extended) family members similar to the ENERGY study design \(^{77}\), so as to compare different perspectives of family co-participation in physical activity within family units.
In contrast, single-item methods, categorized as primarily assessing ‘existence’ of family co-participation in physical activity with a yes/no or disagree-agree answering format (see Table 1) may be of insufficient quality to adequately capture different dimensions of family co-participation in physical activity. Also, methods that do not distinguish between family members when asking about co-participation, e.g., items referring to ‘you or another adult in your household’, may not have enough distinctive value. Finally, direct observations of families may be useful when the interest is in specific activity types or locations, however they may not be regarded as representations of general family co-participation in physical activity.

Strengths and limitations

This is the first review to comprehensively summarize methods to measure family co-participation in physical activity. Its main strengths are the use of three different search strategies and the inclusion of unpublished measurement methods due to our contacts with relevant research groups. Although we employed an extensive search strategy, it is possible that relevant methods were missed in the selection process. The first in/exclusion of papers from the database searches was mostly based on the reviewers’ knowledge of the literature and common sense, as the methods we were looking for are often not reported on in the title or abstract of an article. Including other, broader search terms e.g., ‘instrument’, ‘assessment’, ‘method’) may also have yielded additional relevant articles and thus methods, but would have likely seriously affected the specificity of the database searches, and with that the feasibility of the work. Finally, only methods that were available in the English language were included. Considering the above, we would like to invite researchers who have assessed or will be assessing family co-participation in physical activity with different
instruments/yielding different outcomes than those summarized in Table 1, to contact the corresponding author of this paper.

CONCLUSION

This review demonstrates that whilst a large number of studies use methods to measure family co-participation in physical activity, only few do so using comprehensive assessments. Most methods are not specifically designed to measures family co-participation in physical activity, and detailed information on their psychometric properties is largely lacking. Individual items in existing questionnaires, and objective assessment methods, do however measure the existence, frequency, duration, and/or type of family co-participation. Researchers can use the information provided in this review to help them to select the most appropriate measure for their study. Future work should focus on developing a comprehensive, consistent and validated overall measurement of family co-participation in physical activity, which will help improve our understanding of family-based physical activity, its contribution to all family members’ activity levels, its determinants, and enable rigorous evaluation of family physical activity interventions.
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Table 1. Description of included measures of family co-participation in physical activity.

<table>
<thead>
<tr>
<th>Primary dimension of co-participation</th>
<th>Method</th>
<th>Example of item text or description*</th>
<th>Response scale</th>
<th>Study population in which method is used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existence</td>
<td>Child-reported; single-item in questionnaire</td>
<td>“In the last [period of time], did anyone in your family practice physical activities with you?”</td>
<td>Dichotomous; yes/no</td>
<td>4 studies; Brazil (^60), Hong Kong (^61) and USA (^37,62) Age range; 9-18 years - Pre-school ✓ Primary school ✓ Secondary school</td>
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<td></td>
<td></td>
<td>• Social Support for Exercise Scale (Brazilian-Portuguese) (^60)</td>
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<td></td>
<td></td>
<td>• Unnamed; scale assesses family support for physical activity (Chinese) (^61)</td>
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<tr>
<td></td>
<td></td>
<td>• Social Influences Scale (^37,62)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existence</td>
<td>Child-reported; single-item in</td>
<td>“I exercise with my parent”</td>
<td>5-point response scale; ranging from strongly</td>
<td>1 study; USA (^63) Age range; 9-12 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Healthy Lifestyle Behaviors Scale (^63)</td>
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</tbody>
</table>

*Example of item text or description is provided for illustration purposes only and may not reflect the exact wording used in the study.
<table>
<thead>
<tr>
<th>Existence</th>
<th>Child-reported:</th>
<th>“The adult(s) I live with on a week day / weekend day take part in physical activity with me”</th>
<th>4-point response scale; ranging from disagree a lot to agree a lot</th>
<th>1 study; UK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>two items in questionnaire</td>
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<td></td>
<td>Age range; 10-12 years</td>
</tr>
<tr>
<td></td>
<td>Primary school</td>
<td>Pre-school</td>
<td></td>
<td>Secondary school</td>
</tr>
<tr>
<td></td>
<td>Existence</td>
<td>Child-reported; “My parents or other adults who live with me, take part in physical activity with me during weekdays / weekend days”</td>
<td>4-point response scale; ranging from strongly disagree to strongly agree</td>
<td>1 study; Cyprus</td>
</tr>
<tr>
<td></td>
<td>two items in questionnaire</td>
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<td></td>
<td>Age range; 11-12 years</td>
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<td></td>
<td>Pre-school</td>
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<tr>
<td></td>
<td>Existence</td>
<td>Child-reported; “My [mother/father] and I do active things together (like walking, bike riding,</td>
<td></td>
<td>3 studies; USA</td>
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<tr>
<td></td>
<td>multiple items</td>
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in questionnaire playing sports) and “When my [mother/father] does something active [she/he] lets me do it with [her/him]”.

Also assesses frequency of co-participation with siblings and general familial support including the family using sport/physical activity as family recreation and the extent to which the family is active.

- Activity-Related Parenting Practices Scale

- The Activity Support Scale (ACTS)

- The Activity Support Scale for Multiple Groups (ACTS-MG)

Based on their initial response they were asked if the statement was “really” or “sort of” true/false.

<table>
<thead>
<tr>
<th>Source</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-school</td>
<td>✓ Primary school</td>
</tr>
<tr>
<td>Pre-school/checkbld Primary school</td>
<td>✓ Secondary school</td>
</tr>
<tr>
<td>Pre-school/checkbld Secondary school</td>
<td>✓ Secondary school</td>
</tr>
</tbody>
</table>

World Obesity Journals
<table>
<thead>
<tr>
<th>Existence</th>
<th>Parent-reported;</th>
<th>“I exercise/am physically active with my child[ren]/family [on a regular basis]”</th>
<th>4 to 5-point response scale; ranging from strongly disagree to strongly agree</th>
<th>3 studies; Australia, USA</th>
<th>Age range; 5-15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>single-item in questionnaire</td>
<td>Healthy Lifestyle Behaviors Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Support Scale</td>
<td></td>
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</tr>
<tr>
<td>Existence</td>
<td>Parent-reported;</td>
<td>“My preschool child is active with his/her siblings (e.g. outdoor play, rough-and tumble)”</td>
<td>5-point response scale; ranging from strongly disagree to strongly agree</td>
<td>1 study; Australia</td>
<td>Age range; 3-5 years</td>
</tr>
<tr>
<td>single-item in questionnaire</td>
<td>Unnamed; scale assesses physical activity social interaction and support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existence</td>
<td>Parent-reported;</td>
<td>“I take part in physical activity with my child during weekdays / weekend days (e.g. walking, cycling)”</td>
<td>4-point response scale; ranging from strongly disagree to strongly agree</td>
<td>1 study; Cyprus</td>
<td>Age range; 11-12 years</td>
</tr>
<tr>
<td>two items in questionnaire</td>
<td>Adopted Parental Influence on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Physical Activity Scale (Turkish and/or Greek) ④³

Respondents identified with whom

- cls_5

Existence

Parent reported; multiple items in questionnaire

They often exercise from a list of enumerated family members.

- Unnamed; no specific construct reported (Spanish) ⑦¹

Depending on enumerated family members (tick yes/no)

1 study; USA ⑦¹

Age range; 5-18 years

- Pre-school

✓ Primary school

✓ Secondary school
Frequency of physical activity participation in childhood can be assessed through various tools, each with different characteristics and validation. A child-reported, single-item question, "In [period of time], how often does/did your mum or dad or a member of your household exercise, a physical activity or played sports together with you?" has been utilized (cont. from previous page). This question is scored on a 4 to 6-point response scale, ranging from none or never to every day, very often, daily or always.

- Unnamed; scale assesses the social environment at home (Dutch, Spanish) [72, 73, 74]
- Unnamed; scale assesses parent co-participation in physical activity (Dutch, Spanish) [73, 74]
- The Social Support for Exercise Scale for Adolescents (Brazilian-Portuguese) [39]
- Modified Parent Support Scale (French) [75]
- ENERGY-Child Questionnaire (Dutch, Greek, Hungarian, Norwegian, Spanish, Slovenian) [42, 76, 77]
- Perceived Social Support Scale (Danish, Estonian, Norwegian, Portuguese) [78]

Studies using these tools have been conducted in various countries, including Australia, Belgium, Brazil, Canada, Europe (multiple countries), Iran, Spain, UK, and USA. The age range of participants varies, but typically includes children aged 8-17 years. The tools can be used to explore different age groups, such as pre-school, primary school, and secondary school.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Child-reported; two items in questionnaire</th>
<th>“In the past month how often did your family members help you do a physical activity?” and “In the past month how often did your family members show you how to do a physical activity?”</th>
<th>5-point response scale; ranging from not at all to about every day</th>
<th>1 study; USA (^{38})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Age range; 11-12 years</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>- Pre-school</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Primary school</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>- Secondary school</td>
<td></td>
</tr>
</tbody>
</table>

(\textit{cont. from previous page})
Frequency | Child-reported; multiple items in questionnaire | Child reported how often they engaged in shared family activities including playing indoor games, going for a walk, playing sports, sitting and talking about things.** | 5-point response scale; ranging from never to every day | 1 study; Europe (multiple countries) | Age range; 13-15 years | Pre-school | Primary school | Secondary school
---|---|---|---|---|---|---|---|---

- The Health Behaviour in School-Aged Children Study Questionnaire (available in 36 languages)
Frequency | Parent-reported: “In [period of time], how often are you [and/or your partner/another parent/guardian/another member of your household/your child’s siblings] physically active/playing sports with your child?”
---|---
| single-item in questionnaire | 4 to 6-point response scale; ranging from never, none, not at all to daily, often or very often |
| 23 studies; Australia | Canada, Europe (multiple countries), USA, and UK |
| Age range; 2-18 years | ✓ Pre-school |
| ✓ Primary school |
| ✓ Secondary school |

- Unnamed; scale assessed physical activity social interaction and support
- Unnamed; scale assesses family co-participation in physical activity
- Unnamed; scale assesses social/family/parent support for physical activity
- Unnamed; scale assesses parent encouragement for physical activity
- Unnamed; scale assesses parental interaction in physical activity
- Adapted Activity-Related Parenting Practices Scale
- ENERGY-Child Questionnaire
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Parent-reported; single-item in questionnaire</th>
<th>“In [period of time], how many days did you or another adult in your household do any physical activities with child including things like active games, sports, or other physical activities, and so forth?”****</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7-point response scale to indicate number of days per week or free text option</td>
<td>6 studies; Australia(^{112,113,33}), Canada(^{114}), USA(^{115,116})</td>
</tr>
<tr>
<td></td>
<td>Age range; 4-15 years</td>
<td>Age range; 4-15 years</td>
</tr>
<tr>
<td></td>
<td>- Pre-school</td>
<td>- Pre-school</td>
</tr>
<tr>
<td></td>
<td>✓ Primary school</td>
<td>✓ Primary school</td>
</tr>
<tr>
<td></td>
<td>✓ Secondary school</td>
<td>✓ Secondary school</td>
</tr>
</tbody>
</table>

- Maternal Parenting for Physical Activity Scale \(^{112}\)
- Unnamed; scale assesses co-physical activity/social support for physical activity \(^{113,35,114,114}\) (French \(^{114}\))
- Unnamed; no specific construct reported \(^{115}\)
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Parent-reported; single item in questionnaire</th>
<th>“How often does your family use sport/physical activity as a form of family recreation (e.g., going on bike rides, hiking, ice skating)?”</th>
<th>4-point response scale; ranging from rarely to frequently</th>
<th>5 studies; USA[^65][^117][^118], UK[^119], and Belgium[^120]</th>
<th>Age range; 6-12 years</th>
<th>Pre-school ✓ Primary school - Secondary school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity-Related Parenting Practices Scale[^65][^117][^118][^119][^120] (Dutch[^120])</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Parent-reported; single-item in questionnaire</th>
<th>“Do you ever do sports or exercise together with your child in 7th grade?”</th>
<th>5-point response scale; ranging from never to 4 times a week or more often</th>
<th>1 study; Norway[^92]</th>
<th>Age range; 13 years</th>
<th>Pre-school ✓ Primary school - Secondary school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unnamed; no specific construct reported (Norwegian)[^92]</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Parent-reported; “When we are at social gatherings (friends, family) children and adults are usually active together”</td>
<td></td>
<td></td>
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<td>-------------------------------------------------------------------------------------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-point response scale;</td>
<td>1 study; Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age range; 3-5 years</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Unnamed; scale assesses physical activity, social interaction, and support

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Parent-reported; “How often does your family do something active together?” and “How often would you do 30min or more of moderate to vigorous activity with your child?” ****</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-point response scale;</td>
<td>2 studies; Australia</td>
</tr>
<tr>
<td>Age range; 5-11 years</td>
<td></td>
</tr>
</tbody>
</table>

- Adapted Family Food Environment Scale and Food Involvement Scale

121,122
| Frequency | Parent-reported; | “My child participates in physical activities with parents/caregivers”, | 5-point response scale; | 1 study; USA[^123]  
|-----------|-----------------|---------------------------------------------------------------------|------------------------|------------------------  
| two items in questionnaire | and “I participate in physical activity with my child” | ranging from almost never to nearly always | Age range; 5-12 years | Pre-school  
| | | | ✔ Primary school |  
| | | | - Secondary school |  
| Family Health Behavior Scale[^123] | | | |  

| Frequency | Parent-reported; | Parents reported how often they/as a family engaged in shared family activities including going for bike rides, walk the dog, dance and/or play sports.** | 4 to 6-point response scale; | 4 studies; Australia[^51], UK[^50,52] and USA[^53]  
|-----------|-----------------|---------------------------------------------------------------------|------------------------|------------------------  
| multiple items in questionnaire | | ranging from never or don’t know/doesn’t apply to more than 4 times a week, always, daily | Age range; 3-12 years | Pre-school  
| (cont. from previous page) | | | ✔ Primary school |  
| | | | - Secondary school |  
| Unnamed; no specific construct reported[^51] | | | |  
| Unnamed; scale assesses family social support for physical activity[^50,52] | | | |  
| Preschooler Physical Activity Parenting Practices Scale[^53] | | | |  

[^123]: References or notes for the Family Health Behavior Scale.
| Frequency                  | Parent-reported; multiple items in questionnaire | Family-supported behaviors included the frequency of parents going to the park with the child, parents walking with the child, parents going to the playground with the child, and other family members taking the child to the park or playground or for a walk. **  
• Unnamed scale (Spanish)  
  | No complete response scale given, but described as ‘never, once a week, etc.’  
  | 1 study; USA  
  | Age range; 3-5 years  
| Duration                  | Parent-reported; single-item in questionnaire  
| “In a typical week, how many hours do you spend being physically active with your child (e.g., throwing a ball around, taking a walk or bike ride together)”?  
• Unnamed; ‘parental time spent being active with adolescent’ included in Families and Eating and Activity among Teens (F-EAT) survey  
| Hours per week; entered as free text  
| 1 study; USA  
| Age range; 11-14 years  
- Pre-school  
- Primary school  
✓ Secondary school |
<table>
<thead>
<tr>
<th>Duration</th>
<th>Parent-reported; single-item in questionnaire</th>
<th>Minutes per week; entered as free text</th>
<th>1 study; Australia</th>
<th>Age range; 4-19 months</th>
<th>Pre-school</th>
</tr>
</thead>
</table>
| **Mothers indicated the amount of time in the last week their infant spent in various physical activity behaviours, including being physically active with mum.**  
  • Unnamed; no specific construct reported  
  **126** | 126 | 126 | 4-19 months | Pre-school |

- **Primary school**  
- **Secondary school**

<table>
<thead>
<tr>
<th>Duration</th>
<th>Parent-reported; two items in questionnaire</th>
<th>Minutes per week; entered as free text</th>
<th>2 studies; Canada, USA</th>
<th>Age range; 4-15 years</th>
<th>Pre-school</th>
</tr>
</thead>
</table>
| **“How many days per week and how many minutes per day do [you and/or spouse/significant other] engage in physical activity together with your child?”**  
  • Adapted Godin Leisure-Time Exercise Questionnaire (GLTEQ), International Physical Activity Questionnaire and Behavioral Risk Factor Surveillance System Survey | 45, 115 | 45, 115 | 4-15 years | Pre-school |

- **Primary school**  
- **Secondary school**
Questionnaire

- Unnamed; no specific construct reported

<table>
<thead>
<tr>
<th>Duration</th>
<th>Parent-reported; multiple items in questionnaire</th>
<th>Minutes per week; entered as free text</th>
<th>2 studies; Australia</th>
<th>Age range; 1-3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child and parent-reported; ecological momentary assessment</td>
<td>Electronic surveys assessed primary activity (e.g. active play/sports/exercise), ecological physical location (e.g. home, outdoors), momentary social context (e.g. friends, alone), current mood (positive and negative</td>
<td>Possible responses; alone, class, friends, boy/girlfriend, family, teacher, stranger, or other adult.</td>
<td>2 studies; USA</td>
<td>Age range; 9-13 years</td>
</tr>
<tr>
<td>Parent</td>
<td>Mothers indicated the number of times and actual time per week during the morning, afternoon and evening, that they walked or cycled to/from places with their child and participated in active play with their child indoors/outdoors.</td>
<td>- Pre-school</td>
<td>- Pre-school</td>
<td>- Secondary school</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Pre-school</td>
<td>- Secondary school</td>
<td></td>
</tr>
</tbody>
</table>
(EMA) and accelerometry affect, and enjoyment,**

with your mom or dad, sister(s) or brother(s), other family members, friends, classmates, people you don’t know (yes/no). For this study, responses were time-

matched to the number of steps and minutes of moderate-to-vigorous physical activity (measured by accelerometer) in the 30 minutes before each survey.

<table>
<thead>
<tr>
<th>Duration</th>
<th>Child and parent; child-reported diary</th>
<th>Family dog-walking behaviour assessed by ActiGraph data from parent, child, and dog. Periods of simultaneous activity and identified from child-dog walking</th>
<th>Accelerometer counts 1 study; UK **</th>
<th>Age range; 9-11 years - Pre-school ✓ Primary school</th>
</tr>
</thead>
</table>

(continues from previous page)
<table>
<thead>
<tr>
<th>Duration</th>
<th>Child and parent; global positioning systems (GPS) and accelerometry for the same 7-day period. Joint behaviour was defined by a linear separation distance of less than 50m between parent and child.</th>
<th>Accelerometer counts, conditioned on GPS-based proximity</th>
<th>- Secondary school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Child-reported; single-item in questionnaire</td>
<td>Children indicated how they usually travelled to school and with whom. Possible responses; by car; bus/train; bicycle; or on foot; alone; with a brother/sister; a parent/other adult; a friend; another person</td>
<td>1 study; UK</td>
</tr>
<tr>
<td></td>
<td>- Unnamed; no specific construct reported</td>
<td></td>
<td>Age range; 9-11 years</td>
</tr>
<tr>
<td>Type</td>
<td>Parent-reported; two items in</td>
<td>Parents report the number of times they were physically active with their child Not reported</td>
<td>1 study; USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Age range; 5-10 years</td>
</tr>
</tbody>
</table>
questionnaire over the past week and then selected the type of physical activity they participated in with their child from a list of 22 types of activities.***

- Unnamed; scale assesses parent physical activity with child

<table>
<thead>
<tr>
<th>Type</th>
<th>Child-reported;</th>
<th>Children completed a one day recall diary for three school days. In addition to the start and end time of after school activities, they selected who they were with for each activity.***</th>
<th>Possible responses;</th>
<th>1 study; UK</th>
<th>Age range; 10-11 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-school</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Primary school</td>
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<tr>
<td>Secondary school</td>
<td></td>
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</tr>
</tbody>
</table>
| Type | Child-reported; | Children filled in a diary relating to the time that they spent outside the house playing. They also noted with whom they spent each day outside playing.*** **** | Possible responses; alone, brothers or sisters, friend(s), parents, or other adult. | 1 study; Cyprus

Adopted Parental Influence on Physical Activity Scale (Turkish and/or Greek)  

| Type | Child and parent-reported | Each participant was provided with a calendar format paper-based diary on which they manually record their own physical activity at the end of each day. They could indicate the type and duration of physical activity, and with whom the activity was undertaken.*** **** | Free text | 1 study; UK

Age range; 9-11

- Pre-school

✓ Primary school

- Secondary school

| Type | Child and parent-reported; | Both parents and children were asked to report on the type of activities they had | Not applicable | 1 study; USA

Age range; 7-14 years |
event history engaged in as a family over the past two months (may include non-active time). Also answered, “what does your family do to play or be active?” as free text question.

<table>
<thead>
<tr>
<th>Type</th>
<th>Parent-reported; diary</th>
<th>Parents observed their children in their home environment and filled in a diary using five-min time units and nine activity categories; of which one was parent-child interaction (i.e. doing active things together). Diaries filled for one weekend in April and one weekend in September during the years 1995, 1996, and 1997.***</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Pre-school</td>
<td>- Pre-school</td>
<td>- Pre-school</td>
</tr>
<tr>
<td>✓ Primary school</td>
<td>✓ Primary school</td>
<td>✓ Primary school</td>
</tr>
<tr>
<td>✓ Secondary school</td>
<td>✓ Secondary school</td>
<td>✓ Secondary school</td>
</tr>
</tbody>
</table>

1 study; Finland  

Age range: 4-7.5 years  

Page 57 of 72
Type | Direct observations | Families were observed for 1 hour during a visit at the zoo through momentary time sampling (every 30 seconds). Total distance travelled, percentage of intervals being physically active, and use of escalators was assessed for all family members.****
---|---|---
| | | Not applicable

3 studies; USA 48,132,133
Age range; 10-12 years

- Pre-school
- Primary school
- Secondary school

GPS, Global Positioning System; EMA, Ecological Momentary Assessment, EHC, Event History Calendar

* Note: similar items have been grouped.

** Also assesses type as sub-dimension of co-participation in physical activity

*** Also assesses frequency as sub-dimension of co-participation in physical activity

**** Also assesses duration as sub-dimension of co-participation in physical activity

a General familial support was not assessed in Lampard et al (2014)

b Morrisey et al (2015) reported that all questionnaire items were answered on a 5-point scale ranging from 1 (disagree a lot) to 5 (agree a lot)

c The item used by Schoeppe et al (2015) also included ‘play outside with child’ as an example of co-participation in physical activity
For the measure used by Tandon et al (2012) no response scale was reported. Outcomes in mean/days week.
Figure 1. Flow chart for selection of references

190x338mm (96 x 96 DPI)
<table>
<thead>
<tr>
<th>Section/topic</th>
<th>#</th>
<th>Checklist item</th>
<th>Reported on page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>1</td>
<td>Identify the report as a systematic review, meta-analysis, or both.</td>
<td>1</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structured summary</td>
<td>2</td>
<td>Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.</td>
<td>3</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rationale</td>
<td>3</td>
<td>Describe the rationale for the review in the context of what is already known.</td>
<td>4-5</td>
</tr>
<tr>
<td>Objectives</td>
<td>4</td>
<td>Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).</td>
<td>5</td>
</tr>
<tr>
<td>METHODS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol and registration</td>
<td>5</td>
<td>Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.</td>
<td>NA</td>
</tr>
<tr>
<td>Eligibility criteria</td>
<td>6</td>
<td>Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.</td>
<td>7-8</td>
</tr>
<tr>
<td>Information sources</td>
<td>7</td>
<td>Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.</td>
<td>5-7</td>
</tr>
<tr>
<td>Search</td>
<td>8</td>
<td>Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.</td>
<td>Supp.</td>
</tr>
<tr>
<td>Study selection</td>
<td>9</td>
<td>State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).</td>
<td>6-8</td>
</tr>
<tr>
<td>Data collection process</td>
<td>10</td>
<td>Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.</td>
<td>8</td>
</tr>
<tr>
<td>Data items</td>
<td>11</td>
<td>List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.</td>
<td>6</td>
</tr>
<tr>
<td>Risk of bias in individual studies</td>
<td>12</td>
<td>Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.</td>
<td>NA</td>
</tr>
<tr>
<td>Summary measures</td>
<td>13</td>
<td>State the principal summary measures (e.g., risk ratio, difference in means).</td>
<td>8</td>
</tr>
<tr>
<td>Synthesis of results</td>
<td>14</td>
<td>Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis.</td>
<td>8</td>
</tr>
<tr>
<td>Section/topic</td>
<td>#</td>
<td>Checklist item</td>
<td>Reported on page #</td>
</tr>
<tr>
<td>-------------------------------</td>
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<td>---------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Risk of bias across studies</td>
<td>15</td>
<td>Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).</td>
<td>NA</td>
</tr>
<tr>
<td>Additional analyses</td>
<td>16</td>
<td>Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.</td>
<td>NA</td>
</tr>
<tr>
<td><strong>RESULTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study selection</td>
<td>17</td>
<td>Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.</td>
<td>9</td>
</tr>
<tr>
<td>Study characteristics</td>
<td>18</td>
<td>For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.</td>
<td>9-11</td>
</tr>
<tr>
<td>Risk of bias within studies</td>
<td>19</td>
<td>Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).</td>
<td>NA</td>
</tr>
<tr>
<td>Results of individual studies</td>
<td>20</td>
<td>For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.</td>
<td>9-12</td>
</tr>
<tr>
<td>Synthesis of results</td>
<td>21</td>
<td>Present results of each meta-analysis done, including confidence intervals and measures of consistency.</td>
<td>NA</td>
</tr>
<tr>
<td>Risk of bias across studies</td>
<td>22</td>
<td>Present results of any assessment of risk of bias across studies (see Item 15).</td>
<td>NA</td>
</tr>
<tr>
<td>Additional analysis</td>
<td>23</td>
<td>Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).</td>
<td>9-12</td>
</tr>
<tr>
<td><strong>DISCUSSION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary of evidence</td>
<td>24</td>
<td>Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).</td>
<td>12-15</td>
</tr>
<tr>
<td>Limitations</td>
<td>25</td>
<td>Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).</td>
<td>16-17</td>
</tr>
<tr>
<td>Conclusions</td>
<td>26</td>
<td>Provide a general interpretation of the results in the context of other evidence, and implications for future research.</td>
<td>17-18</td>
</tr>
<tr>
<td><strong>FUNDING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>27</td>
<td>Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.</td>
<td>NA</td>
</tr>
</tbody>
</table>


For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

Page 2 of 2
World Obesity Journals
A Systematic Review of Methods to Measure Family Co-Participation in Physical Activity

Léonie Uijtdewilligen†*, Helen Elizabeth Brown‡, Falk Müller-Riemenschneider§,

Yee Wei Lim§, Soren Brage∥, Esther MF van Sluijs∥

† Equal contribution

1 Saw Swee Hock School of Public Health, National University of Singapore, Singapore, Singapore

2 UKCRC Centre for Diet and Activity Research (CEDAR) & MRC Epidemiology Unit, University of Cambridge, School of Clinical Medicine, Box 285 Institute of Metabolic Science, Cambridge Biomedical Campus, Cambridge CB2 0QQ, United Kingdom

3 Institute for Social Medicine, Epidemiology and Health Economics, Charite University Medical Centre Berlin, Germany

*Corresponding author

Dr Léonie Uijtdewilligen

Saw Swee Hock School of Public Health, National University of Singapore

Tahir Foundation Building, 12 Science Drive 2, #10-01, Singapore 117549

Phone: +65 66015006

Fax: +65 6779 1489

Email: leonie_uijtdewilligen@nuhs.edu.sg
Supplementary File 1. Details of search strategy for databases

The search strategy consists of 3 different search term blocks:

<table>
<thead>
<tr>
<th>#1 Construct</th>
<th>Physical activity OR exercise OR energy expenditure OR sport OR active travel OR walking OR cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2 Population</td>
<td>Family OR family-based OR parent OR mother OR father OR primary caregiver OR guardian OR sibling OR brother OR sister OR aunt OR uncle OR cousin</td>
</tr>
<tr>
<td>#3 Instrument</td>
<td>Questionnaire OR accelerometer OR proxy-report OR parent-report OR child-report OR observation OR pedometer</td>
</tr>
</tbody>
</table>

#1, #2 and #3 are combined with AND terms in the respective databases.

To illustrate, the following search was performed in PubMed:

Search ((((((((("motor activity"[MeSH Terms]) OR "sports"[MeSH Terms]) OR "exercise"[MeSH Terms]) OR physical activity[Title/Abstract]) OR exercise[Title/Abstract]) OR energy expenditure[Title/Abstract]) OR sport[Title/Abstract]) OR active travel[Title/Abstract]) OR walking[Title/Abstract] OR cycling[Title/Abstract]))))

AND (((((((((((((("family"[MeSH Terms]) OR famil*[Title/Abstract]) OR family-based[Title/Abstract]) OR parent[Title/Abstract]) OR mother[Title/Abstract]) OR father[Title/Abstract]) OR primary caregiver[Title/Abstract]) OR guardian[Title/Abstract]) OR sibling[Title/Abstract]) OR brother[Title/Abstract]) OR sister[Title/Abstract]) OR aunt[Title/Abstract]) OR uncle[Title/Abstract]) OR cousin[Title/Abstract]))

AND ((((((((("data collection"[MeSH Terms]) OR "accelerometry"[MeSH Terms]) OR "observation"[MeSH Terms]) OR questionnaire[Title/Abstract]) OR accelerometer[Title/Abstract]) OR proxy-report[Title/Abstract]) OR parent-report[Title/Abstract]) OR child-report[Title/Abstract]) OR observation[Title/Abstract] OR pedometer[Title/Abstract])))
Co-participation in physical activity is the main focus of the review, but the term co-participation does not adequately fit in the search term blocks described above. Therefore, in addition to the comprehensive search, a simple search across all databases was performed combining the terms co-participation/cooparticipation and physical activity.

To illustrate, the following search was performed in PubMed:

Search (((co-participation[Title/Abstract]) OR coparticipation[Title/Abstract])) AND physical activity[Title/Abstract]

The full search strategy for all databases can be obtained upon request from the first author.
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