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PHYSICAL ACTIVITY, HEALTH AND EXERCISE

Exploring correlates of physical activity behaviour in UK children and their inter-relationships using a multidisciplinary approach: A concept mapping study

Mohammed Khudair [a], Gavin Daniel Tempest [a], Giancarlo Condello [b], Laura Capranica [c], Florentina Johanna Hettinga [a] and Fiona Chun Man Ling [a]

[a]Department of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK; [b]Department of Medicine and Surgery, University of Parma, Parma, Italy; [c]Department of Movement, Human and Health Sciences, University of Rome Foro Italico, Rome, Italy

ABSTRACT

It is still unknown which correlates of physical activity behaviour (PAB) may be effective and how they may influence PAB in UK children. The objective of the current study was to generate a conceptual analysis of the correlates of PAB in UK children (5–12 years) using the input of researchers in the field of physical activity (PA experts; PAE) and other fields (non-PA experts; non-PAE). A concept mapping approach was used to identify potential (new) correlates of PAB in children, assess their importance based on rating of potential modifiability and effect, and generate a concept map depicting the associations between them. In the first (brainstorming) stage ($n = 32$ experts) yielded 93 correlates, including 14 new correlates not identified in previous reviews. In the second (rating and sorting) stage ($n = 26$ experts), 32 correlates were rated as important and a four-cluster concept map was generated including themes related to Society/community, Home/social setting, Personal/social setting and Psychological/emotional correlates. Two additional concept maps were generated for PAE and non-PAE. From expert opinion, we identified new correlates of PAB that warrant further research and we highlight the need to consider the interaction between intrapersonal and external correlates when designing interventions to promote PA in UK children.

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Exercise; Youth; Cluster map; modifiable correlates; determinants; correlates

Introduction

Despite the substantial focus on physical activity (PA) promotion to mitigate physical inactivity among children, establishing long-lasting positive changes in PA behaviour (PAB) remains a challenge (Sallis et al., 2016). To achieve the known health benefits of PA, the Chief Medical Officers in the United Kingdom (UK) recommend children and adolescents aged 5–18 years to perform ≥60 min of moderate-to-vigorous PA daily (Department of Health and Social Care, 2019). However, only around half of children aged 7–8 years in England reach the recommended PA levels, and significant increases in inactivity are reported as children approach adolescence (Farooq et al., 2018; Griffiths et al., 2013; Guthold et al., 2020; Jago et al., 2017). Although systematic reviews examining PA interventions have identified correlates associated with PAB, little is known about how and to what extent they contribute to change in PAB, which is crucial for designing interventions fostering long-lasting PAB in children (Atkin et al., 2016; De Craemer et al., 2018; Sheeran et al., 2017). Correlates of PAB could mediate PAB both internally (e.g., psychologically and/or physiologically) and externally (e.g., in the immediate or the broader environment) and interact in different ways depending on the setting (e.g., school, home or sports clubs; Brug et al., 2017). Therefore, to examine correlates of PAB from a broad perspective and foster agenda setting and collective action to promote PAB in children, it is necessary to consider the opinion and knowledge of experts from a range of disciplines (e.g., education, health and social care, transport, urban planning, etc.; Donaldson et al., 2021).

Concept mapping represents the combined articulated thoughts and opinions of experts into a structured conceptualisation (Trochim, 1989). Concept mapping is a systems-based approach, used to combine the input of experts across disciplines to achieve consensus around settings-based approaches in health research, develop common cultures, establish collaboration processes and guide interventions (Geidne et al., 2019; Minkman et al., 2009; Rosas & Kane, 2012; Trochim & Kane, 2005). The concept mapping procedure is performed in stages with a mixed-methods approach, including brainstorming, rating, unstructured and opinion-based sorting of conceptual relatedness, rigorous multivariate statistical analyses and group interpretation (Trochim & Kane, 2005). As such, the concept mapping methodology can be used to complement and extend existing knowledge from primary (empirical studies) and secondary (systematic reviews) sources through input from experts (Burke et al., 2005). This approach has previously been adopted in PA research to translate available evidence to

CONTACT Mohammed Khudair mohammed2.khudair@northumbria.ac.uk Department of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK

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develop strategies for implementation of PA interventions (Kelly et al., 2007; Ries et al., 2008), develop research agendas (Brownson et al., 2008), better understand and contextualise the available evidence (Condello et al., 2016; Mâsse et al., 2017) and evaluating partnerships in health promotion through sport (Donaldson et al., 2021).

Condello and colleagues (Condello et al., 2016) generated a pan-European framework on the correlates of PAB, based on the perspectives of experts and stakeholders involved in relevant roles in sports, exercise and PA. A Europe-wide view of correlates of PAB across the life course (youth aged <19 years to older adults aged ≥65 years) was uncovered. Condello et al. (2016) provided insight into the key correlates of PAB and how they are related to help practitioners and policy-makers develop strategies and PA interventions for Europe-wide implementation. While the input from experts with roles relevant to PA may provide a homogenous PA knowledge base, experiences and interests of experts with diverse areas of expertise in children's behaviour, care and environments may uncover PA correlates, which may otherwise be overlooked, and contribute subject-specific knowledge from their respective roles (Hanson et al., 2013; Kane & Trochim, 2007). As such, a multidisciplinary approach may benefit the integration of expert input and provide a broader perspective to inform future interventions targeting PAB in children. Furthermore, focusing on opinions of researchers in the UK could uncover key correlates (barriers or facilitators) associated with PAB within the context of the UK as outlined by its economic situation, language, culture and geography, and indicate their interaction to mediate PAB. To the authors' knowledge, no studies have used the concept mapping approach to explore the correlates of PAB in children in the UK including children's experts in both PA and other fields. Therefore, the overall objective of the current study was to examine the correlates of PAB in children (aged 5–12 years) in the UK by identifying and evaluating correlates of PAB using the input of researchers with expertise relevant to PA (PA experts; PAE) and researchers holding a wide range of expertise in the child population in other areas (non-PA experts; non-PAE). Specifically, the current study aims to (1) identify potential correlates of PAB in children based on suggestions of experts and call to attention any of the suggested correlates not identified in the existing literature; (2) assess the importance of the identified correlates based on level of modifiability and effect, indicating priorities for future research; (3) generate a UK-relevant concept map of correlates of PAB in children based on perspectives from PA experts and from non-PA experts and evaluate their respective contributions.

Materials and methods

Ethical approval was obtained from the University's Ethics Review Board at Bournemouth University (reference: 21047). The recruitment and the study protocol were carried out online between March and July 2021. For each stage of the procedure, the participants were asked to complete the tasks within a four-week period. A summary of the study procedure is provided in Figure 1.

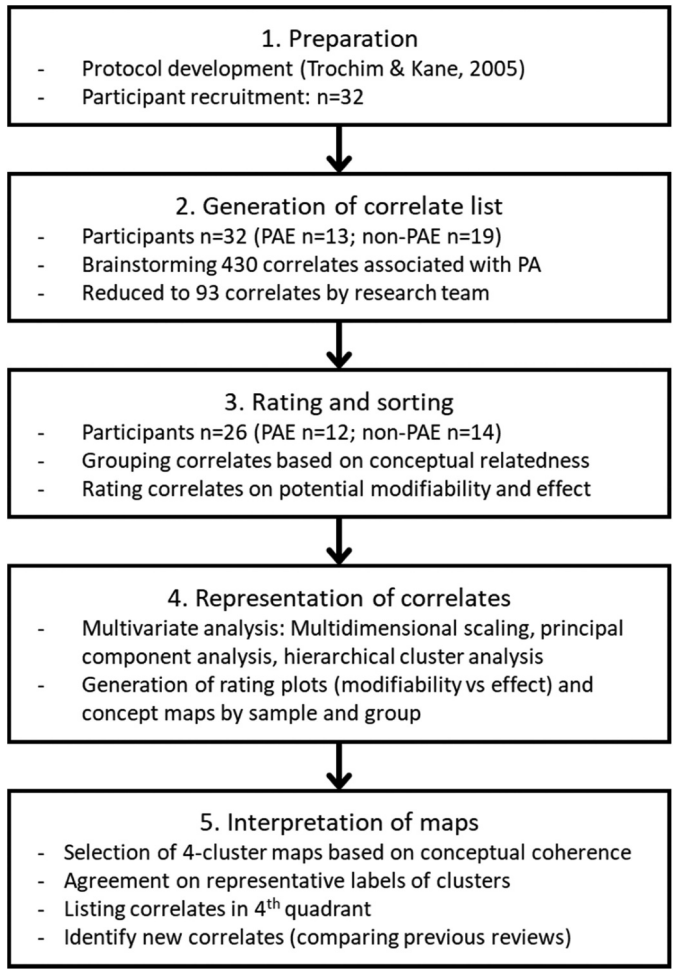

Figure 1. Concept mapping procedure as applied in the current study, adapted from the procedure described in Trochim (1989).

Participants

Experts were academics currently employed at UK universities with children aged 5–12 years as the main target population of their research. Two groups of academics were approached via email with information about the study aims and procedures and were asked to provide their informed consent before taking part in the study. As previously discussed, the input of experts in the sport, exercise and PA would likely be based on their knowledge of the literature (Condello et al., 2016). Therefore, a second group was recruited, the objective behind which was to achieve a wide variation in correlates of PA and opinions regarding their interrelations and levels of modifiability and effect. One group included academics with expertise relevant to sport, exercise and PA (PAE; $n = 554$) and whose research targeted the child population, and whose research profiles indicated extensive and recent engagement in PA research in children. The other group included academics holding a wide range of expertise relevant to the child population but not to sport, exercise and PA (non-PAE; $n = 194$). Participants were identified using www.thecompleteuniversityguide.co.uk to generate lists of UK Universities with sport/exercise science departments (and departments with sport-related subjects) for PAE and departments outside of PA research for

non-PAE (including Childhood Education, Child Care, Social Science, Developmental Psychology, Family and Child Law, Nursing, Dentistry, City and Built Environment, Nutrition, Physiology and Medicine and Linguistics) with the aim to include diverse expertise in children. Only UK-based academics were targeted in the current study to focus on correlates of PAB that are applicable to the UK context, to maintain a common terminology among participants, and to avoid variations in concepts related to culture, policy systems, schooling and infrastructure. To target correlates relevant for the general child population, academics who primarily focus on children's disabilities or specific medical conditions that may influence children's ability to participate in PA fully were not included as they may add correlates based on limited movement ability or too specific to certain conditions.

The brainstorming stage

Participants were asked to provide a list of correlates that they considered to be associated with PAB in UK children aged 5–12 years. They were asked to consider correlates in the existing literature but were also encouraged to go beyond the current evidence base to include potential correlates in any field/domain/context that may be relevant to PAB in children. For each correlate, participants were asked to provide (a) the correlate, named according to common terminology, (b) a brief definition of the correlate, including examples or context where possible and (c) a short description of how the correlate may be associated with PA. The correlates provided by the participants in the brainstorming stage were reduced to one list using NVIVO 12 (QSR International Pty Ltd, 2020) while maintaining the original ideas of the participants (Kane & Trochim, 2007). The list was coded by one author (MK) based on common themes. Another author (FCML) checked the coding and discussed any disagreements with MK to reach consensus. To maintain consistent understanding among the participants in the subsequent stages, the final list of correlates was supplemented with definitions and descriptions of the association to PA for all correlates.

The rating and sorting stage

The final list of correlates with accompanying definitions and descriptions was shared with the participants for rating and sorting in Minds2 (Severens, 2012), an online tool specific for concept mapping procedures and analyses. In the rating exercise, participants were asked to rate the correlates on two 5-point Likert scales – modifiability, referring to the extent to which the correlate can be modified in an intervention (1 = not modifiable, 5 = very modifiable) – and effect, referring to the effect that the correlate may have on PAB in children if it was intervened with (1 = no effect, 5 = very large effect). In the sorting exercise, participants were asked to group the correlates based on their own opinion on their associations within the settings that UK children commonly find themselves in (Trochim & Kane, 2005). Participants were also asked to provide representative labels to the groups they created.

The label agreement stage

Following the sorting exercise, the analyses yielded a concept map with clusters of correlates. The labels provided by the participants were combined and reduced to represent the overall theme of the correlates within each cluster. One author (MK) reduced the list of labels and discussed the suggested cluster labels with the remaining authors to reach an agreement. In the label agreement stage, participants were provided with a link to an online questionnaire (Qualtrics, 2005) containing the resulting concept map, the list of correlates in each cluster and the suggested cluster labels. Participants were asked to rate the extent to which they agreed that the label for each cluster was representative of its correlates on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree) and to provide any comments on the labelling and the resulting concept map.

Analyses

To address the first aim, identifying (new) potential correlates of PAB, the list of correlates was compared with identified correlates of PAB in children (around the age 5–12 years) in previous systematic reviews applicable to children in the UK without disabilities or medical conditions (Craggs et al., 2011; Ferreira et al., 2007; Hu et al., 2021; Marzi et al., 2018; Rhodes et al., 2020; Ridgers et al., 2012; Sallis et al., 2000; Stanley et al., 2012; Uijtdewilligen et al., 2011; Van Der Horst et al., 2007). Cronbach's alpha was calculated using the ratings of on modifiability and effect, with $\alpha = 0.91$ and $\alpha = 0.96$, respectively. To assess the added contribution of non-PAE, the correlates provided by the two groups in the brainstorming stage were compared.

To address the second aim, rating plots were created using the rating scores for modifiability and effect. The rating plots were scatter plots subdivided into four quadrants to isolate the correlates rated high (above the mean) and low (below the mean) on the respective scales (Trochim & Kane, 2005). For the subdivision, the mean rating on modifiability to divide the plots vertically (on the x-axis) and the mean rating on effect to divide the plots horizontally (on the y-axis). The correlates rated as both highly modifiable and highly effective are found in the upper-right (4^{th}) quadrant. The rating plots for PAE and non-PAE were combined to identify the agreed correlates considered to be the most modifiable and effective (Trochim & Kane, 2005). A series of non-parametric Kruskal–Wallis tests were performed in SPSS (IBM SPSS, 2020) to investigate the difference between PAE and non-PAE in the ratings of modifiability and effect on the list of correlates.

To address the third aim, a concept map was generated, consisting of clusters of correlates. A multivariate analysis was performed on the Minds21 online platform (Severens, 2012), using the outcomes of the sorting exercise. Minds21 created an individual matrix based on how correlates were sorted for each participant, indicated in the matrix using 1 (grouped together) and 0 (not grouped together). A similarity matrix was then created by overlaying the individual matrices of all the participants, indicating the frequency with which the correlates were grouped together (Severens, 2012; Trochim, 1989). Multidimensional scaling was used to yield the distances

between the statements on the similarity matrix. Principal component analysis was used to translate the distances between statements (which can also be considered correlations) into coordinates on a two-dimensional coordinate system. Hierarchical cluster analysis was used to generate clusters based on the distances between the correlates in a backward stepwise grouping of the correlates (Abdi & Williams, 2010; Severens, 2012; Trochim, 1989; Trochim & Kane, 2005). The authors selected the number of clusters based on the conceptual coherence among the correlates included within each cluster of the resultant concept map (Rosas & Kane, 2012; Trochim, 1989). To evaluate the contribution of the respective groups, two additional concept maps were generated, using the sorting of PAE and non-PAE, respectively. The same labels were applied to the additional concept maps.

Results

Out of the 554 non-PAE and the 194 PAE invited to participate, responses were obtained from 142 non-PAE (26%) and 64 PAE (33%). Participants did not take part either due to busy schedules or not considering their expertise relevant for the study. Agreement to participate in the study was obtained from 19 non-PAE and 13 PAE. The brainstorming stage included 32 participants (PAE $n = 13$; non-PAE $n = 19$) and resulted in a list of 430 correlates, which was subsequently reduced to 93. See Supplementary Table S1 for a list of the correlates and their descriptions. In the final list of correlates, 10 correlates were unique to non-PAE and 14 correlates were unique to PAE (Table 1). In comparison with previous systematic reviews on the correlates of PAB in children, 14 (15%) correlates did not appear (Table 2).

The rating and sorting stages, and the label agreement stage included 26 participants (PAE $n = 12$; non-PAE $n = 14$). The Kruskal–Wallis tests showed a significantly higher rating of modifiability by PAE for Competition ($p = 0.025$), Fundamental movement skills ($p = 0.002$), Influence from health risk behaviours ($p = 0.015$), Parental engagement in PA with child ($p = 0.009$), Parental instrumental support for PA ($p = 0.026$) and Policy of urban and built environment ($p = 0.018$). For effect, a significantly higher rating by PAE was found for Creativity – Own solutions, practice conditions, play ($p = 0.049$) and Personality traits ($p = 0.014$). See detailed results in Supplementary Table 2.

The combined rating plot (Figure 2) showed 41 (44%) correlates in the 4th quadrant and that 32 (34%) correlates were rated high for modifiability and high for effect by the two groups. The rating plot for PAE (Figure 3) showed 44 (47%) correlates were located in the 4th quadrant, whereas 36 (39%) correlates were located in the 4th quadrant of the rating plot for non-PAE (Figure 4).

Table 1. Correlates of physical activity behaviour provided at the brainstorming stage by either non-physical activity experts (non-PAE) or physical activity experts (PAE).

#	Provided by non-PAE only	#	Provided by PAE only
9.	Child autonomy in PA	20.	Engagement in different roles in PA activities
18.	Diversity in environment	27.	Fear of Injury
19.	Early exposure to PA	30.	Fear of physical discomfort during PA
23.	Experience of abuse	35.	Genetic predisposition – PA engagement
25.	Fear of abuse	39.	Implicit attention to activities and objects
34.	Genetic predisposition – Body composition	41.	Independence
44.	Intention	42.	Influence from health risk behaviours
45.	Mental wellbeing	47.	Music, rhythm
77.	Racial stereotypes	53.	Parental education level
88.	Sleep (lack of)	68.	Policy of housing
		69.	Policy of public health
		75.	Prior experiences in PA activity
		85.	Self-regulated learning and practice
		92.	Variation in PA activities

Non-PAE = non-physical activity experts; PAE = physical activity experts; # = correlate number.

Table 2. New potential correlates of physical activity behaviour in the current conceptual framework, not considered in the systematic reviews on the physical activity behaviour in children.

#	Not in previous reviews
8	Caring responsibilities
13	Coping with having to be more active
15	Creativity – Own solutions, practice conditions, play
20	Engagement in different roles in PA activities
23	Experience of abuse
25	Fear of abuse
30	Fear of physical discomfort during PA
39	Implicit attention to activities and objects
43	Intellectual impairment
47	Music, rhythm
52	Parental attitudes to PA
65	Physical impairment
73	Possibility for development into elite sports
86	Sensory function

PA = physical activity; # = correlate number.

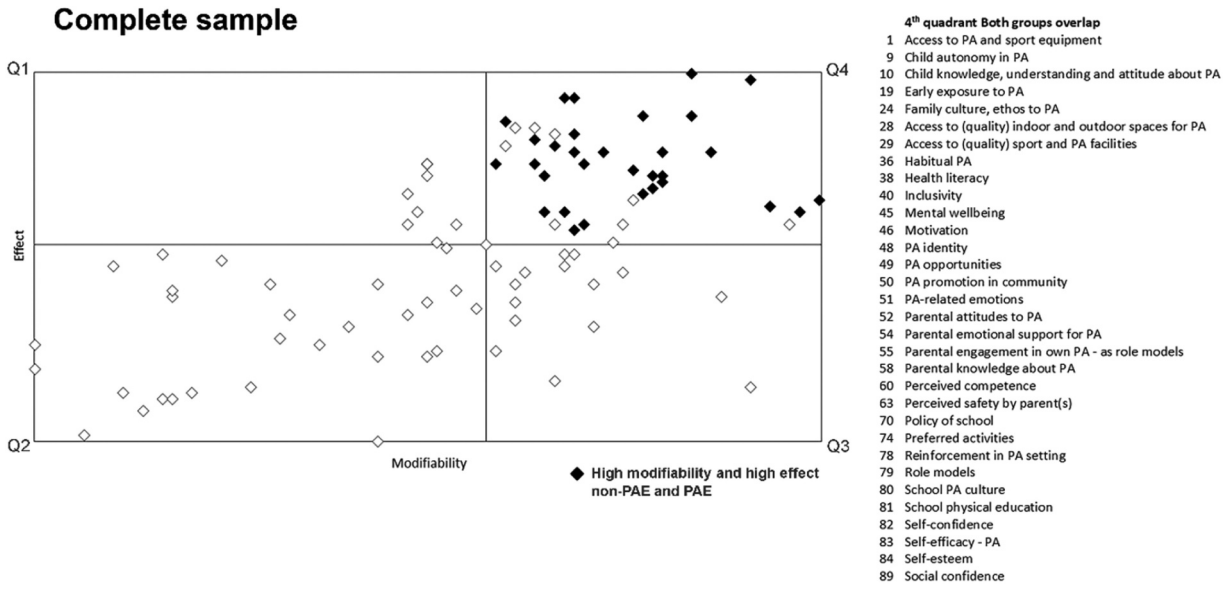

Figure 2. Plot of rating for modifiability vs effect by the complete sample. Quadrants divided using the mean rating for modifiability (vertical line) and the mean rating for effect (horizontal line). Black diamonds indicate the correlates in the 4th quadrant (rated higher than the mean for both modifiability and effect) according to the two groups, respectively.

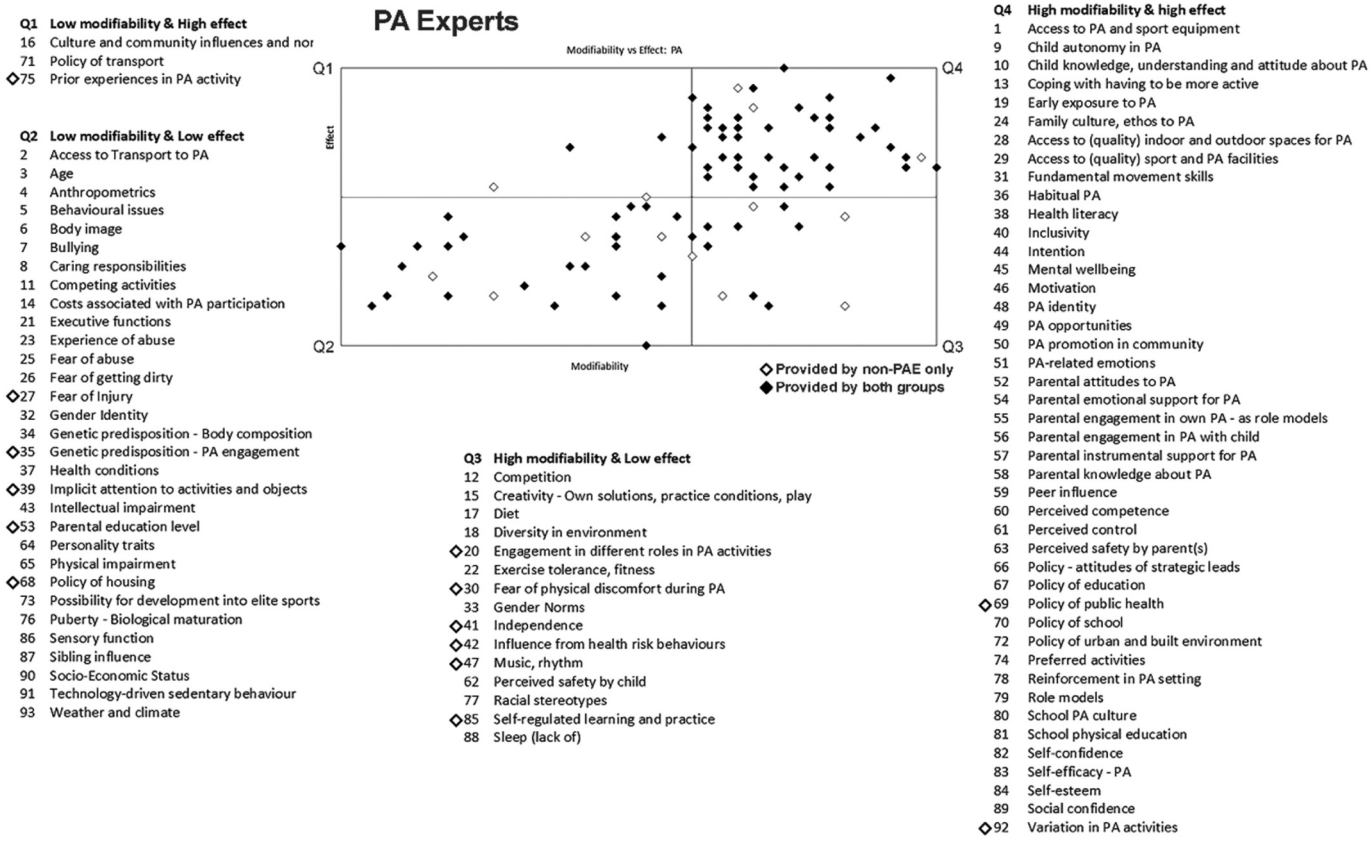

Figure 3. Plot of rating for modifiability vs effect by physical activity experts (PAE). Quadrants divided using the mean rating for modifiability (vertical line) and the mean rating for effect (horizontal line). Correlates of physical activity behaviour are listed by quadrant. Outlined diamonds indicate the correlates only provided by PAE in the brainstorming stage.

A four-cluster concept map was generated following the rating and sorting stage (Figure 5). The initial cluster labels were yielded from the rating and sorting stage, which were adjusted using the participant rating and feedback in the label agreement stage: (Cluster 1) Society and community correlates of PAB; (Cluster 2) Personal and social correlates of PAB and (Cluster 3) Psychological/emotional correlates of PAB; (Cluster 4) Home and social setting correlates of PAB. Two additional four-cluster concept maps were generated representing the sorting for PAE and non-PAE, respectively (Figures 6,7).

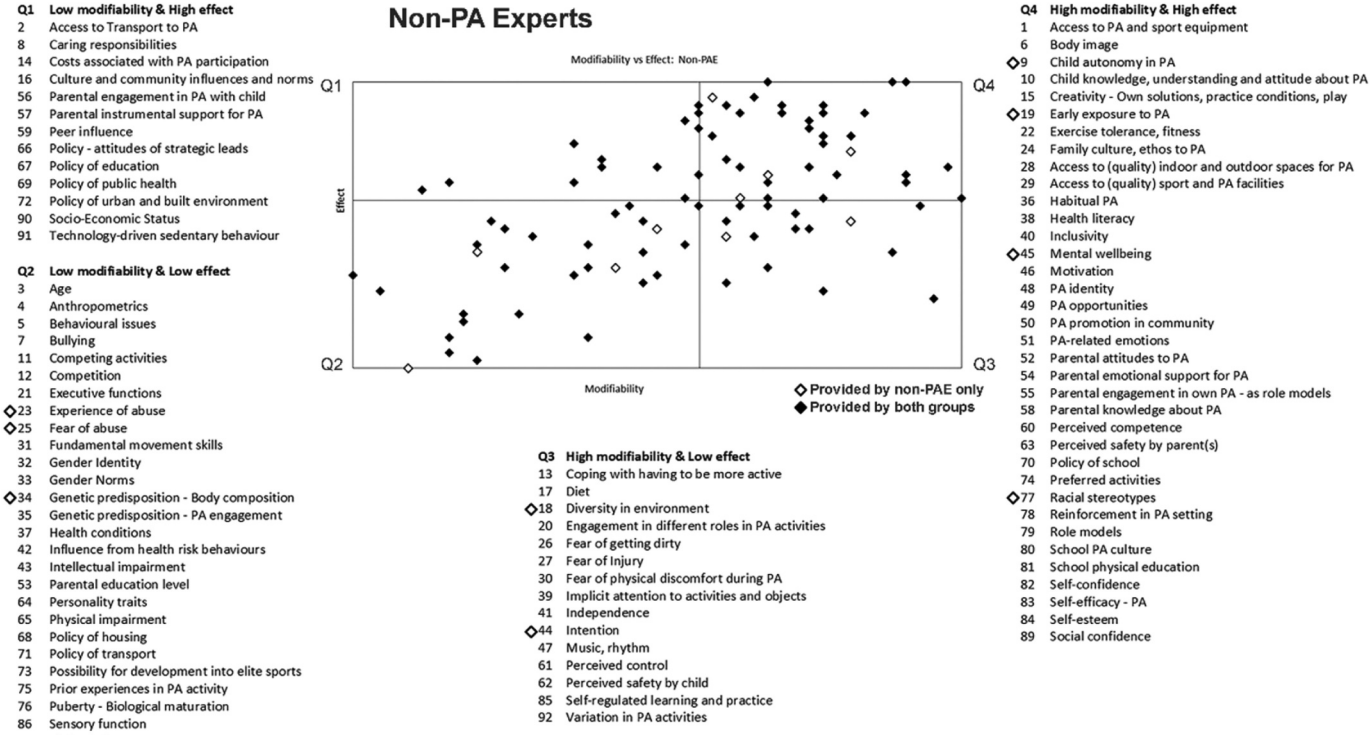

Figure 4. Plot of rating for modifiability vs effect by non-physical activity experts (non-PAE). Quadrants divided using the mean rating for modifiability (vertical line) and the mean rating for effect (horizontal line). Correlates of physical activity behaviour are listed by quadrant. Outlined diamonds indicate the correlates only provided by non-PAE in the brainstorming stage.

Two distinct themes could be identified on the concept map, one comprising society/community and home/social setting correlates, and one comprising personal/social and psychological/emotional correlates. A similar structure can be identified in the concept map for non-PAE. In the concept map for PAE, a different structure was found, as psychological/emotional correlates were more distanced from societal/community correlates and home/social setting correlates with personal/social correlates in between. A difference was found between PAE and non-PAE in the number of correlates in clusters 2 and 3 (Cluster 2: 46 correlates for non-PAE and 20 for PAE; Cluster 3: 9 correlates for non-PAE and 32 for PAE). All but two of the correlates found in cluster 3 for non-PAE were found in cluster 4 for PAE.

Discussion

The overall objective of the current study was to examine the correlates of PAB in children (aged 5–12 years) in the UK by identifying and evaluating correlates of PAB using the input of researchers with expertise relevant to PA (PA experts; PAE) and researchers holding a wide range of expertise in the child population in other areas (non-PA experts; non-PAE). In line with the specific aims of the current study, (1) we identified a list of 93 correlates, of which 14 correlates were considered new; (2) assessed the modifiability and effect of the identified correlates and found 32 correlates were rated as highly modifiable and effective and therefore are considered important for intervention development; (3) generated a concept map revealing two main themes (personal and societal), with some differences between PAE and non-PAE on the relatedness between psychological/emotional correlates and societal and social correlates. The strengths of the current study include the involvement of both PAE and non-PAE, offering a multidisciplinary perspective, and focus on the UK (i.e., one country to provide context-specific findings), of correlates of PAB that can be utilised to develop effective PA interventions.

Regarding the first aim, the brainstorming yielded 14 potential correlates not identified in previous systematic reviews on correlates of PAB in children. Several potential correlates that were not identified in previous reviews (Caring responsibilities, Parental attitudes to PA, Engagement in different roles in PA activities, Possibility for development into elite sports) relate to provision and facilitation by parents, coaches/practitioners and organisations of opportunities for PA participation (Li & Moosbrugger, 2021; Sutcliffe et al., 2021; Tessitore et al., 2021; Varga et al., 2021). These correlates resonate with aspects of self-determination theory, which suggests that opportunities to participate or engage in PA or the PA environment in different ways (e.g., different positions of play, refereeing, coaching) feed into need-support and increased motivation (Deci et al., 1996; Reeve et al., 2014). Several of the new potential correlates that have not previously been addressed (Coping with having to be more active, Experience of abuse, Fear of abuse, Fear of physical discomfort during PA, Implicit attention to activities and objects) relate to emotions that may implicitly (non-consciously and perhaps more directly) influence PAB and are predominantly barriers to PA (Gyurak et al., 2011; Klos et al., 2020; St Quinton & Brunton, 2017). Little research exists on the influence of such correlates on PAB in children, although these correlates have been identified in adolescents and adults (Brand & Ekkekakis,

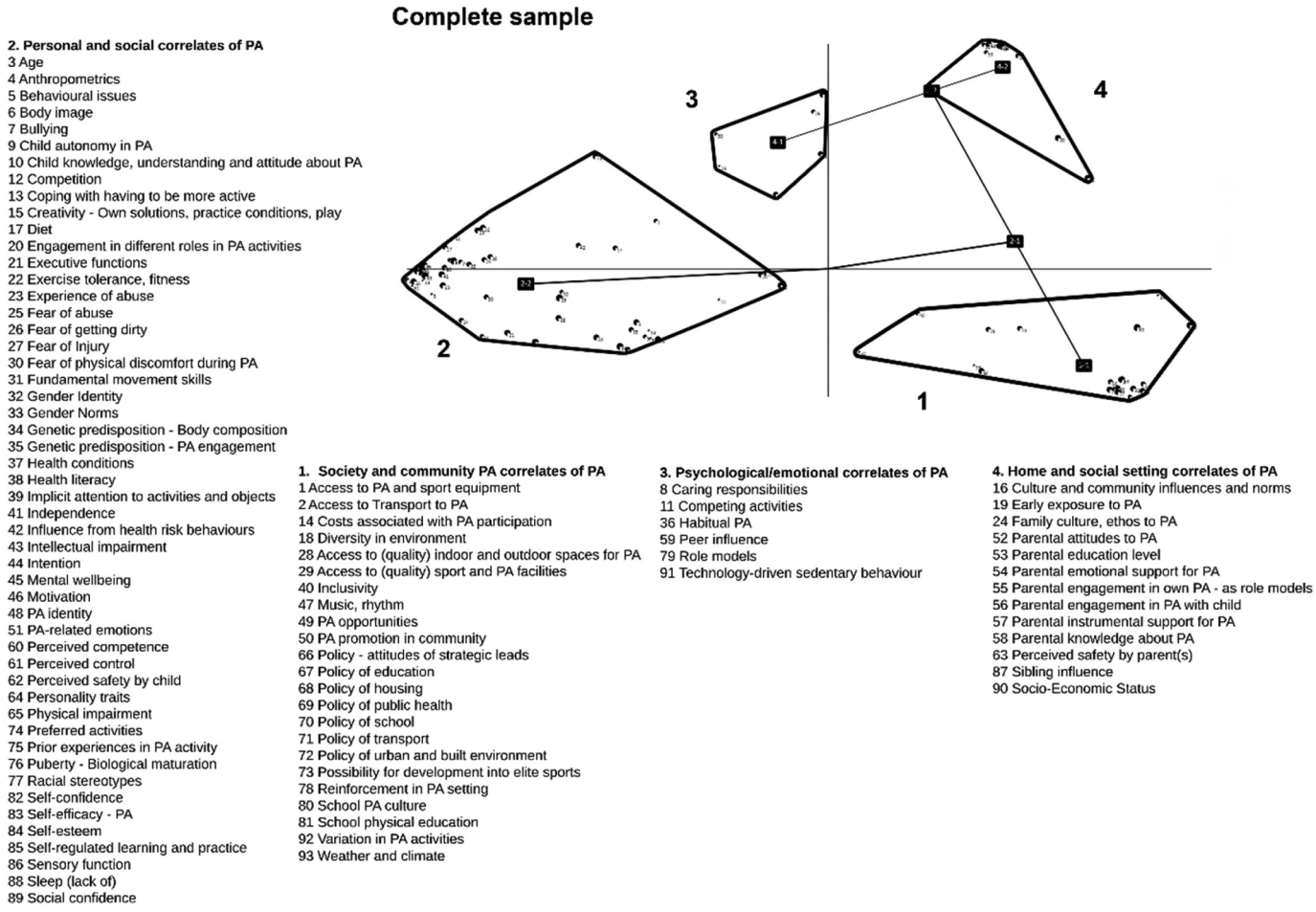

Figure 5. Concept map with cluster labels and list of correlates of physical activity (PA) behaviour by cluster for the complete sample. Cluster definitions: (cluster 1) society and community correlates of PA – the societal and community structure which moderate participation in physical activity PA, such as policy, culture and accessibility of PA; (cluster 2) personal and social correlates of PA and (cluster 3) Psychological/emotional correlates of PA – intrapersonal correlates that are both fixed (possibly non-modifiable) and dynamic (possibly modifiable), either personal characteristics or external social influencers which moderate the predisposition participation in PA; (cluster 4) home and social setting correlates of PA – the home environment, specifically the family and the social upbringing within the family.

2018; Cheval et al., 2018; Hollands et al., 2016; Sheeran et al., 2013). Although the current study aimed to generate new potential correlates which are specific to the UK, the 14 new correlates relate largely to intrapersonal processes, which may not be specific to geographical or cultural contexts like the UK but may be applicable to them. Further research is needed to understand the influence of the new correlates on PA behaviour in children in the UK, and elsewhere (Sheeran et al., 2017). Finally, both non-PAE and PAE contributed unique correlates, although PAE appear to have considered a more comprehensive approach to PA in children, by providing additional correlates related to parenting and policy in addition to psychological correlates compared to non-PAE.

Regarding the second aim, some differences were found between the expert groups in the rating on modifiability and effect. Of the 93 correlates, ratings for eight correlates were significantly different between the groups, all of which were rated higher on modifiability and effect by PAE. The seven correlates have been associated with PAB in children in previous research and in PA intervention studies (Li & Moosbrugger, 2021; Sutcliffe et al., 2021; Tessitore et al., 2021; Varga et al., 2021). Additionally, as found in the rating plots, there seems to be an overall agreement between PAE and non-PAE regarding the correlates found in the 4th quadrant, with 32 correlates considered highly modifiable and effective by both groups and, therefore, considered important for future research and interventions. Interestingly, the 32 correlates have been identified in previous reviews, but their influence on PAB in the long-term warrants further testing (Craggs et al., 2011; Ferreira et al., 2007; Hu et al., 2021; Marzi et al., 2018; Rhodes et al., 2020; Ridgers et al., 2012; Sallis et al., 2000; Stanley et al., 2012; Uijtdewilligen et al., 2011; Van Der Horst et al., 2007).

As found in the group rating plots, PAE placed higher importance on the influence of correlates related to policy and parenting on PAB than non-PAE. The role of parents in the promotion of PA in children has been regarded as one of the main micro-environment drivers to PAB (Craggs et al., 2011; Hu et al., 2021). The PAE group was likely aware of the increasing calls for the involvement of policy-makers in implementing evidence-based strategies to increase PA in children (Brug et al., 2017). These findings further echo the importance of including policy-makers in the development of a framework for the correlates of PAB in children as they can provide clearer perspectives regarding the role of policy in the conception and implementation of PA interventions. The rating plots reveal that correlates which have not been addressed in previous research

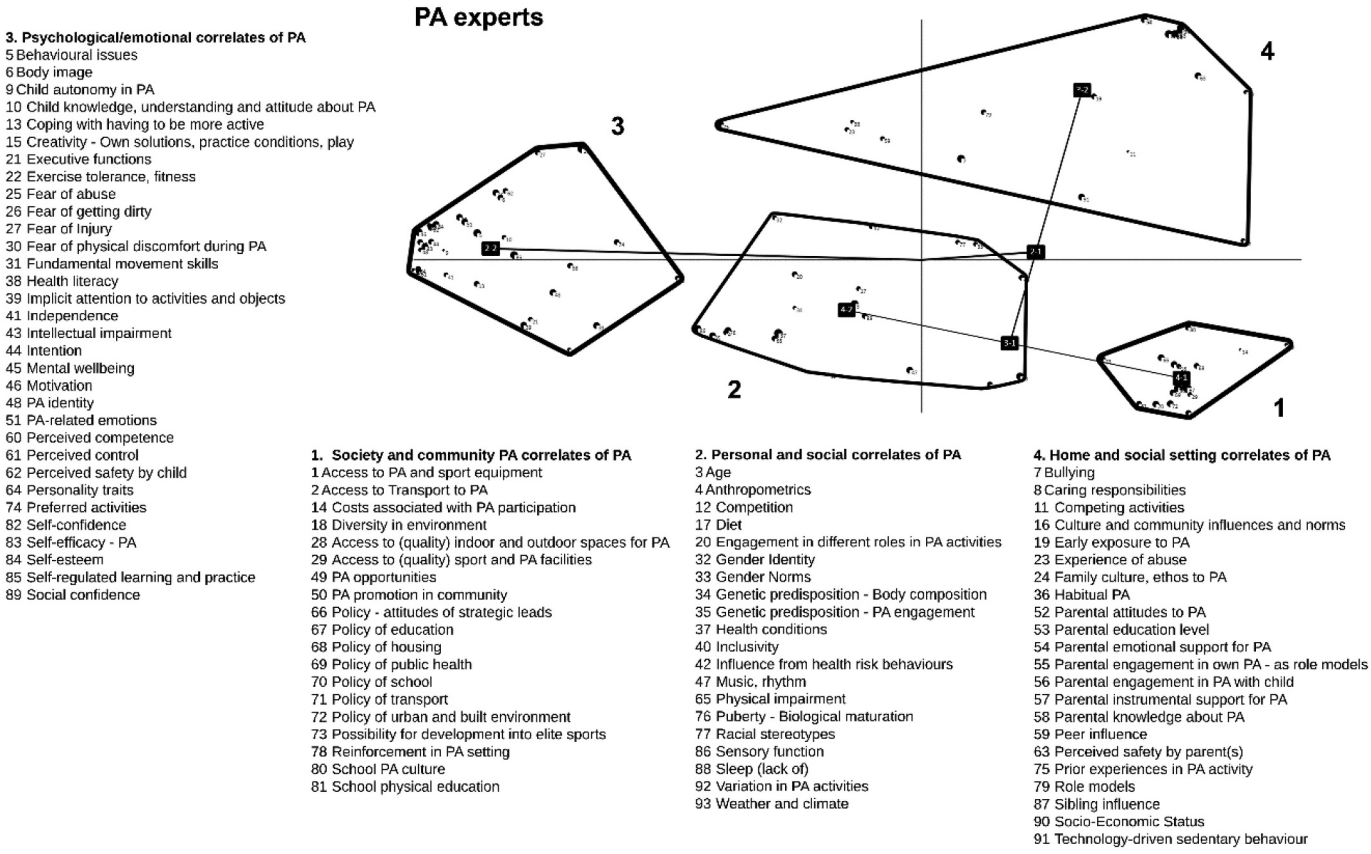

Figure 6. Concept map with cluster labels and list of correlates of physical activity (PA) behaviour by cluster for physical activity experts (PAE). Cluster definitions: (cluster 1) society and community correlates of PA – the societal and community structure which moderate participation in PA, such as policy, culture and accessibility of PA; (cluster 2) personal and social correlates of PA and (cluster 3) Psychological/emotional correlates of PA – intrapersonal correlates that are both fixed (possibly non-modifiable) and dynamic (possibly modifiable), either personal characteristics or external social influencers which moderate the predisposition participation in PA; (cluster 4) home and social setting correlates of PA – the home environment, specifically the family and the social upbringing within the family.

(e.g., correlates which implicitly influence PA participation in children) were generally rated as having low modifiability and/or effect. The lack of understanding of such correlates in the child population may have contributed to the low ratings, yet the mechanisms in which they influence PAB warrant further research attention. Future research should explore when, how and to what extent such correlates may influence PAB to provide a better understanding of them and potential avenues to address them in intervention studies (Sheeran et al., 2017).

Regarding the third aim, two overarching themes were identified in the concept map – the internal/personal and external/social correlates, which suggests that there are two systems underlying PAB in children. A similar structure was found by (Condello et al., 2016) who identified two core themes – Person, relating to personal characteristics and the person's interaction with others in the environment; and Society, relating to an interaction between the person and the environment with influence from political, social, economic, scientific, cultural and organisation correlates. Condello et al. (2016) suggested that the person is central to the promotion of PAB and that interventions should target individual responsibility, personal commitment and lifestyle choices for PAB, whereas society refers to the call for PA promotion on a policy level. The concept maps for each group were also explored to assess their respective contribution to the concept map of the complete sample. The concept map for PAE seems to suggest a disconnect between the psychological/emotional correlates and the societal/community and home/social setting correlates, which relate to the child–environment interaction at micro- and macro-levels. This possibly suggests that PAE consider the psychological/emotional correlates as a separate group of correlates from those relating to the child's interaction with the environment and that further distinction should be made within the person and society core themes in intervention studies. The location of the psychological/emotional correlates in the concept map for non-PAE seems to suggest that they are considered to have a stronger association with the societal/community and home/social setting correlates, potentially recognising an interaction among them. This may be the main contribution of non-PAE as they seem to have brought the intrapersonal correlates closer to the core of the concept map, an approach which has not been applied traditionally in children's PA research. Interestingly, it has been suggested that the approach adopted to address the obesity epidemic by policy-makers in the UK largely targets individual responsibility and agency to make a change rather than providing opportunities for regular engagement in PA in the public domain, such as provision of spaces for and promotion of active transport (Theis & White, 2021; Yesiltepe et al., 2022). The prevailing approach by UK policymakers does not integrate the individual-level correlates with the population-level correlates to account for the interaction that the societal/physical/social

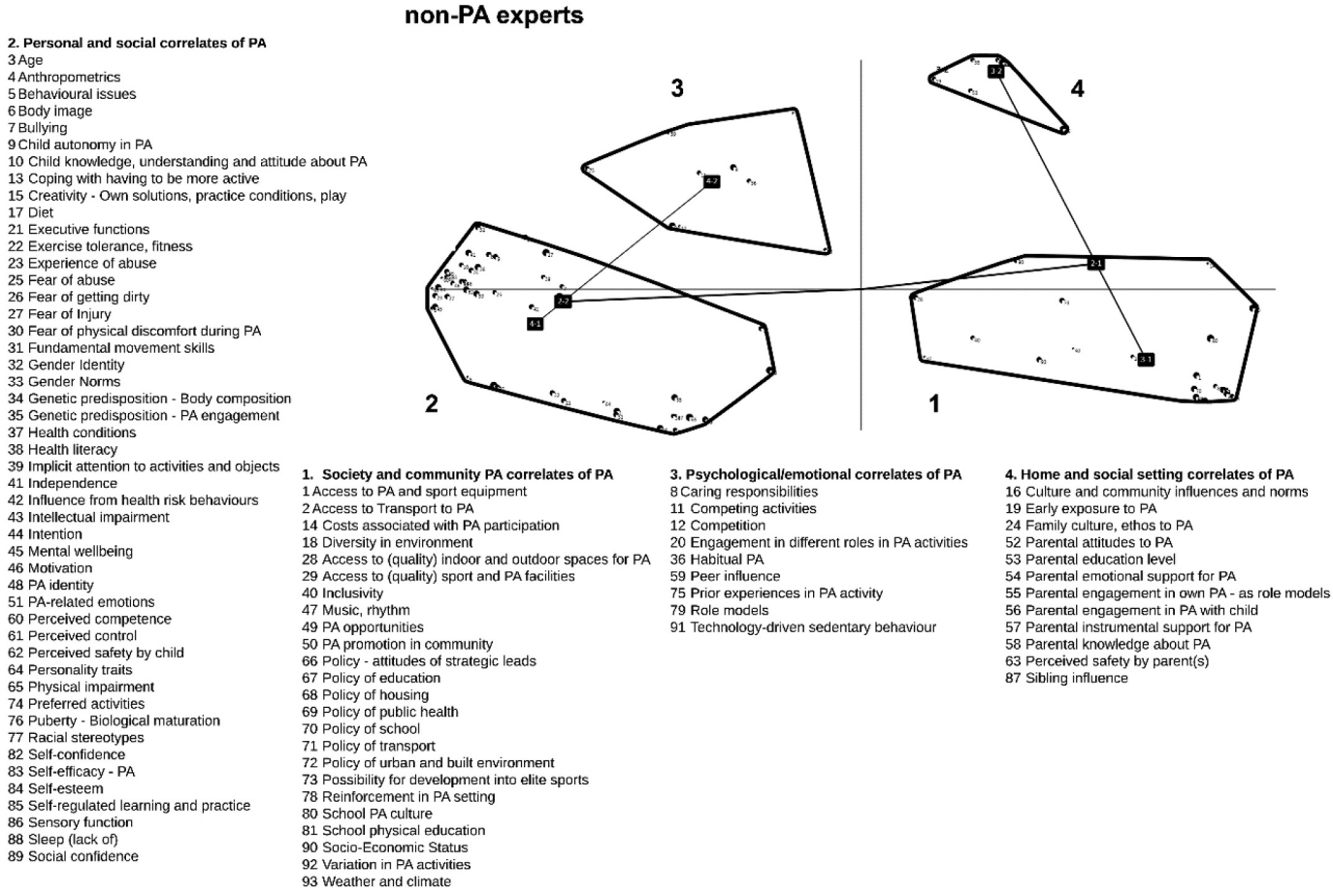

Figure 7. Concept map with cluster labels and list of correlates of physical activity (PA) behaviour by cluster for non-physical activity experts (non-PAE). Cluster definitions: (cluster 1) society and community correlates of PA – the societal and community structure which moderate participation in PA, such as policy, culture and accessibility of PA; (cluster 2) personal and social correlates of PA and (cluster 3) Psychological/emotional correlates of PA – intrapersonal correlates that are both fixed (possibly non-modifiable) and dynamic (possibly modifiable), either personal characteristics or external social influencers which moderate the predisposition participation in PA; (cluster 4) home and social setting correlates of PA – the home environment, specifically the family and the social upbringing within the family.

environments have with individual correlates (Theis & White, 2021). The findings of the current study suggest that future interventions could consider both intrapersonal and external correlates in conjunction to investigate the level and effect of the interaction between them on PAB, linking the two overall themes of correlates found in the current study as well as Condello et al. (2016).

The current study included both PAE and non-PAE to assess the potential input of non-PAE. The selection of participants into the study was purposeful in that PAE made up the expert group, which has the in-depth knowledge about sport, exercise and PA in children, while non-PAE included a wide variation in expertise around children and was selected to maximise this variation. The inclusion of non-PAE was a particular benefit to the current exploratory study as it helped uncover the views of children's experts beyond what has been the focus in the PA field (Condello et al., 2016). Whilst a consistency between the groups relating to the correlate rating on modifiability and effect emerged, the non-PAE, indicated different correlates at the brainstorming and different concept map structures, whereby the psychological/emotional correlates were considered closer to the external correlates. The findings of the current study affirm that the cooperation between different partners could provide a more comprehensive approach towards awareness of PAB, the mobilisation of actors for the implementation of PA promotion initiatives and intervention programmes, and the advancement of cross-sectional studies tackling facilitators and barriers for active lifestyles in childhood and adolescence (Geidne et al., 2019; Johnson et al., 2020).

A limitation of the current study relates to the sample size. Although a sample of 20–30 participants was recommended for ensuring robustness of the results (Tullis et al., 2004; Wood & Wood, 2008) our sample may just fall short of the recommendation. Nonetheless, our results have provided preliminary insight into the correlates considered important to PAB in UK children. Our findings could be extended in future research with a larger sample. Additionally, future studies are needed to triangulate the perspectives of different stakeholders in different countries to advance this area of research.

Conclusion

In encompassing the view of PAE and non-PAE, the current study has provided a conceptual overview of the correlates of PAB for PA promotion in the UK. The identification of new

potential correlates of PAB relating to emotional and implicit behaviour regulation (Coping with having to be more active, Experience of abuse, Fear of abuse, Fear of physical discomfort during PA, Implicit attention to activities and objects) calls for further investigation to understand how and to what extent these correlates influence PAB. Furthermore, 32 correlates were rated as both highly modifiable and effective, suggesting that they are potentially important and should be studied further to understand their implementation and context challenges in interventions in children. Despite the present concept maps yielded the person- and environment-related themes already highlighted in previous research, the different findings between PAE and non-PAE for the psychological/emotional and the societal/social correlates warrant integration of cross-sectoral partnerships to promote the child's PA entourages and environments. Finally, the contribution of non-PAE has also highlighted the importance of including a wide variety of expertise, which could be expanded in future studies to include stakeholders as well as policy-makers and practitioners.

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ORCID

Mohammed Khudair http://orcid.org/0000-0002-8164-6406
Gavin Daniel Tempest http://orcid.org/0000-0002-8550-523X
Giancarlo Condello http://orcid.org/0000-0001-5092-3258
Laura Capranica http://orcid.org/0000-0003-3073-7655
Florentina Johanna Hettinga http://orcid.org/0000-0002-7027-8126
Fiona Chun Man Ling http://orcid.org/0000-0003-2357-3779

Data availability statement

The data that support the findings of this study are openly available in Figshare at https://figshare.com/s/a12f6d37996bf441471d [Private link for peer review].

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