

Parental perceptions on children's out-of-school physical activity and family-based physical activity interventions.

Robert J. Noonan¹, Lynne M. Boddy¹, Stuart J. Fairclough^{2,3}, Zoe R. Knowles¹

¹The Physical Activity Exchange, Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, 62 Great Crosshall Street, Liverpool, L3 2AT, UK.

²Department of Sport and Physical Activity, Edge Hill University, St Helens Road, Ormskirk, L39 4QP, UK.

³Department of Physical Education and Sport Sciences, University of Limerick, Ireland.

Corresponding author: Mr Robert J Noonan

The Physical Activity Exchange,

Research Institute for Sport and Exercise Sciences,

Liverpool John Moores University,

62 Great Crosshall Street,

Liverpool, L3 2AT,

UK.

Tel: 0151 231 5271

Email: R.J.Noonan@2010.ljmu.ac.uk

Running title: Children's out-of-school physical activity

Keywords: Physical activity; outdoor play; independent mobility; family; intervention

Word count: 7855

Abstract

This study explored parents' physical activity knowledge and perceptions of children's out-of-school physical activity to formatively contribute to a family-based intervention design. Parents were largely unaware of the UK child physical activity guidelines and whether their child achieved the guidelines daily. Physical activity for many parents was attributed to healthy weight status, and the neighbourhood environment was perceived as uncondusive to children's outdoor play which consequently increased the attractiveness of adult supervised organised activities. Family-based intervention engagement was considered as an important opportunity to increase physical activity knowledge, family time, and receive feedback on activity behaviours. Parental concerns related to intervention content and logistic and timing barriers. Consulting with parents in a formative sense prior to familial physical activity intervention facilitates intervention content to be aligned with family-specific perceptions and needs, and offers opportunities to communicate the relevance of programs to parents. This may aid subsequent intervention recruitment and engagement.

Introduction

Physical activity (PA) is an important modifiable factor in the improvement of children's cardiometabolic (Boddy et al. 2014), musculoskeletal (Janz, Thomas, Ford & Williams, 2015), and psychological health (Ahn & Fedewa, 2011), and supports cognitive (Carson et al. 2015) and fundamental movement skill development (Lubans, Morgan, Cliff, Barnett, & Okely, 2010). The UK Government recommends that children should accumulate at least one hour of moderate to vigorous intensity PA (MVPA) each day, and reduce time spent in sedentary behaviours (Department of Health. 2011). UK PA prevalence data however suggests that most children fail to achieve these guidelines (Craig, & Mindell, 2013). Childhood is an important developmental stage during which health behaviours including PA are established (Marmot, 2010). It is therefore essential that PA is promoted during childhood.

Thus far, PA interventions for children have generally been school based, targeting PA throughout the school day, with few demonstrating positive health effects (Lai et al. 2009; Metcalf, Henley, & Wilkin, 2012). The out-of-school period (e.g., weekends, evenings), represents a promising alternative, given the precipitous decline in activity levels during these periods (Brooke, Corder, Atkin, & van Sluijs, 2014). Further, targeting the out-of-school period provides opportunities for family involvement in such activity. Health promotion efforts targeting families could hold greater promise compared to traditional school-based approaches due to the strong socialising influence parents have on their children's PA (Beets, Cardinal, & Alderman, 2010). Parents are however a difficult group to engage with and support (O'Connor, Jago, & Baranowski, 2009). Aside from the challenges of recruiting families into health intervention, methodologically, little research exists on effective ways in which to engage parents in intervention design.

Socio-ecological models of health promotion such as the Youth Physical Activity Promotion Model (YPAPM) (Welk, 1999) postulate that children's health behaviours are shaped by the

setting in which they occur (Sallis, Owen, & Fisher, 2008). The home is a key environment that shapes children's health and lifestyle behaviours, particularly their PA (Crawford et al. 2010). Parents serve as 'choice architects' and PA gatekeepers, and as such, are in a unique position to promote behaviours that are conducive to children's health (Maitland, Stratton, Foster, Braham, & Rosenberg; Thaler & Sunstein, 2008). Amongst the many forms of parental influence, including role modelling (Madsen, McCulloch, & Crawford, 2009), parental PA attitudes (Zecevic, Tremblay, Lovsin, & Michel, 2010), and parenting styles (Davids & Roman, 2014); parental support (i.e., logistical support, verbal encouragement and praise) are amongst the most consistent correlates of child PA (Mitchell et al. 2012; Sterdt, Liersch, & Walter, 2014).

Neighbourhood environmental factors such as PA provision (Grow et al. 2008), proximity (D'Haese, De Meester, De Bourdeaudhuij, Deforche, & Cardon, 2011), traffic volume, and neighbourhood safety (Carver, Timperio, & Crawford, 2008) are also considered to be important influences on children's PA. Although time spent outdoors is consistently associated with higher daily PA in children (Gray et al. 2015; McMinn, Griffin, Jones, & van Sluijs, 2013), parents often limit children's outdoor play and independent mobility in response to heightened concerns over their safety (Lee et al. 2015). Recent studies have shown that children with greater independent mobility engage in greater PA (Noonan, Boddy, Knowles, & Fairclough. 2016a; Oliver et al. 2015b) and less sedentary time (Atkin et al. 2013). Therefore, from a public health perspective, efforts to promote children's independent mobility are important.

To date, studies investigating children's out-of-school PA have been quantitative in nature (Kurka et al. 2015; Oliver et al. 2015a; 2015b), and offered somewhat limited explanation of the factors that influence parents' decision making towards children's out-of-school PA and independent mobility. Qualitative methodologies allow for values, perceptions and attitudes to be explored and can present an effective way of understanding how parents participate in and

facilitate children's PA (Jago et al. 2012; Mackintosh, Knowles, Ridgers, & Fairclough, 2011). Recent UK qualitative findings on children's PA relate largely to young children (Kesten et al. 2015) and the perceptions of low income and/or ethnic minority parents (Eyre, Duncan, Birch, & Cox. 2014; Trigwell, Murphy, Cable, Stratton, & Watson, 2015). Aside from being unrepresentative of older children and those from more affluent neighbourhoods, these findings may also have been socially biased given the presence of parents. Compared to focus groups and face-to-face interviews, telephone interviews are a convenient method for parents, reduce the risk of socially desirable responses, and facilitate more open discussion around potentially sensitive topics such as parental engagement in children's PA (Sturges & Hanrahan, 2004).

Family-based health programs generally struggle to recruit and retain families which often results in programs reaching a small proportion of the target group who are often those least in need of behaviour change (Mytton, Ingram, Manns, & Thomas, 2014). Exploring the attitudes, norms, and perceptions of families (i.e. children and parents), and consulting with them in a formative sense to that of intervention design, is central to a phased approach to complex intervention development (Craig et al. 2008), may help to overcome key intervention challenges including recruitment and engagement, and thus could improve intervention efficacy (Davison, Jurkowski, Li, Kranz, & Lawson. 2013; Jago et al. 2013). Although some studies have explored family-based PA intervention recruitment and retention strategies (Bentley et al. 2012; Brown, Schiff, & van Sluijs, 2015; Jago et al. 2012), little consideration has been given to parents' concurrent PA knowledge or perceptions which may also have important implications on perceived intervention relevance, uptake, and design.

This study compliments and extends two previous studies (Noonan et al. 2016a; Noonan, Boddy, Fairclough, & Knowles, 2016b) which firstly examined associations between home and neighbourhood environments and children's PA (Noonan et al. 2016a), and secondly, explored children's views, experiences and perceptions of out-of-school PA (Noonan et al.

2016b). This study will build upon previous research methodologies by triangulating data sources to explore parents' PA knowledge and perceptions of children's out-of-school PA to formatively contribute to a family-based intervention design.

Methods

Participants

Participants for this study were self-reported primary carers [referred to as parents herein] of Liverpool schoolchildren aged 10-11 years. Parents were eligible to take part in the study if they had previously completed a questionnaire investigating their neighbourhood perceptions and their child had completed prior anthropometry, cardiorespiratory fitness and PA assessments (Noonan et al. 2016a). The details of participant recruitment for the previous study have been reported elsewhere (Noonan et al. 2016b). Briefly, forty five parents (24.9% response rate) consented to take part in a telephone interview. A list was compiled indicating parent willingness to take part and a convenience sample was utilised for this study based on which parents could be contacted first. Ethical approval for this study was granted by Liverpool John Moores University Ethics Committee (ref 14/SPS/033) and data were collected throughout January and February 2015.

Procedures

Telephone interviews were arranged and conducted by the lead author and trained research assistants. Semi structured interview guides were used to ensure consistency across interviews, and questions were informed by the YPAPM (Welk, 1999). Example telephone interview questions included, “can you think of any barriers that prevent your child from doing more PA? What sorts of PA provision and activities are there for your child to do close to home in your neighbourhood?” The last author, an expert in the field and Chartered Psychologist, provided

feedback as regards question appropriateness and interview structure. Prior to data collection, consenting parents were sent an SMS message to inform them that they would be contacted in the evening from a withheld telephone number. Parents were given the option of a specific day or time to be contacted to carry out the interview. Only one participant chose a specific time to be contacted. All telephone interviews were recorded using a digital recorder and were transcribed verbatim for further analysis and anonymised. Parents received a £10 high street shopping voucher in return for their participation. In total, 11 (female n=8) (6.1% response rate) telephone interviews were conducted with consenting parents from across 3 primary schools lasting 10-20 (mean=15.4) minutes resulting in 125 pages of raw transcription data, Arial font, size 12, double spaced.

Demographic data

Trained researchers recorded each child's sex at school sites, and measures of waist circumference, body mass and stature were taken. Subsequent calculations of body mass index (BMI; kg/m²) BMI z-score (Cole, Freeman, & Preece, 1995), and weight status (Cole, Bellizzi, Flegal, & Dietz, 2000) were completed. PA was assessed using the Physical Activity Questionnaire for Older Children (PAQ-C) (Kowalski, Crocker, & Donen, 2004) and completed shuttles on the 20m multi-stage shuttle run test (20mSRT) was used as an estimate of cardio-respiratory fitness (CRF). Both measures are considered suitable tools for PA and CRF surveillance in children (Biddle, Gorely, Pearson, & Bull, 2011; Leger, Mercier, Gadoury, & Lambert, 1988). Children reported transport mode to school (walk, cycle, scooter, bus, car, train, taxi, other), which was dichotomised into two reference categories (active or passive transport).

Data on children's ethnicity, garden/backyard access, dog ownership, parent age, marital and educational status were parent reported. Parents completed the International Physical Activity Questionnaire (IPAQ) short form (www.ipaq.ki.se) and reported height and weight which were

used to calculate BMI (kg/m²) and weight status (i.e., healthy weight or overweight/obese) (World Health Organization, 2000). Parent reported home addresses were used to calculate the shortest route from school addresses to home addresses using Google maps online route planner <https://www.google.co.uk/maps> (Van Dyck, De Bourdeaudhuij, Cardon, & Deforche, 2010), and the GeoConvert application (MIMAS, 2008) was used to calculate area deprivation scores based on the 2010 Indices of Multiple Deprivation (IMD) (Department for Communities and Local Government, 2011). Average participant travel distance from home to school was 1.40 kilometres (Median = 0.90 kilometres; IQR = 1.15 kilometres). Means, standard deviations and percentages were calculated for continuous and categorical variables, respectively. All analyses were conducted using Microsoft Excel 2010 (Microsoft, Redmond, WA) and IBM SPSS Statistics v.22 (IBM, Armonk, NY).

Data management and analysis

Regardless of the qualitative analytical approach used, for example, ‘cut and paste’, manual tagging or NVivo software, there appears to be no impact on study validity (Krane, Andersen, & Streaun, 1997). The pen profile approach has been used in recent child PA research (see Mackintosh et al. 2011 for detail) and presents findings from content analysis via a diagram of composite key emerging themes. For these reasons it is an appropriate and effective way of presenting data to researchers that have an affinity with both quantitative and qualitative approaches (Knowles, Parnell, Stratton, & Ridgers. 2013; Ridgers, Knowles, & Sayers, 2012). After listening to the interview recordings and reviewing the transcripts the first author generated a series of higher and lower order themes based on the aims of the study and the themes that emerged. Pen profiles were constructed to represent the higher and lower order themes using a manual approach, and verbatim quotations were subsequently used to expand the pen profiles, provide context and verify participant responses (Knowles et al. 2013). To ensure accuracy and allow for alternative interpretations of the data, the recordings and

transcripts were listened to by the second and third authors and were then cross-examined against the data in reverse, from the pen profiles to the transcripts. This process was repeated until a 90% agreement level had been reached by the group. Methodological rigor, credibility and transferability were achieved via verbatim transcription of data and triangular consensus procedures, and comparison of pen profiles with verbatim data accentuated dependability. Quotations are labelled by the participant's pseudonym, male (M) or female (F), and ID number. So as to offer a more comprehensive and detailed insight into parental PA perceptions, knowledge and family context beyond traditional qualitative analysis approaches, and to highlight the importance of exploring these factors pre-intervention, the research triangulated child and parent data and parent narratives, and family case studies were written. Ahead, demographic information in conjunction with narrative verbatim for contrasting family structures with alternative perspectives on children's out-of-school PA are presented alongside the pen profile data.

Results

Most of the parents interviewed were female (72.7%), parents to boys (81.8%), married (90.9%) and degree educated (81.8%). Their children were of white ethnic origin (100%), normal weight status (100%), and lived in higher than average SES neighbourhoods reflected by the low mean IMD score for the sample (19.63 compared to English average of 23.64) (Public Health England, 2014). Most of the children had access to a garden/backyard (81.8%), commuted actively to school (63.6%), and lived within one kilometre from school (63.6%). The self-reported PA levels ($3.53 \pm .62$ compared to 2.80) (Voss, Ogunleye, & Sandercock, 2013) and CRF scores (52.60 ± 23.16 compared to 29 shuttles) (Boddy et al. 2012) of the participants were higher than the English averages.

Pen profiles representing parental PA knowledge are presented in Figure 1, with three primary themes: PA health benefits, PA levels and PA guidelines, and eight secondary themes: physical (n=11), psychological (n=7), social (n=1), behaviour (n=2), know (yes n=4; no =7) and meet PA guidelines (yes n=6; no n=5). Positive and negative influences featured in parental knowledge secondary themes.

Factors influencing PA intervention engagement are presented in Figure 2, with three primary themes: delivery, benefits and timing, and ten secondary themes: content -ve (n=6), family focussed (n=4), tangible (n=3), content +ve (n=3), ideas and knowledge (n=8), family based time (n=8), health improvement (n=4), assessment/feedback (n=3), logistics (n=7), season (n=2). Positive and negative influences featured in intervention engagement secondary themes.

[Figure 1 near here]

[Figure 2 near here]

Reinforcing factors to PA are presented in Figure 3, with six primary themes: parental support, parental role models, parental restriction, parental time constraints, independent mobility, and peers, and eighteen secondary themes: parent attitudes (n=2), verbal encouragement (n=7), co-participation (n=7), enrol (n=2), parental role models (n=2), parental time constraints (n=7), road traffic fear (n=4), proximity +ve (n=2), neighbourhood connectedness (n=3), social norm (n=3), age (n=7), stranger danger (n=5), proximity (n=2), peer co-participation +ve (n=4), limited friends (n=2), peer co-participation -ve (n=2), sedentary behaviour +ve (n=2), sedentary behaviour -ve (n=2). Positive and negative influences featured in both reinforcing primary and secondary themes.

[Figure 3 near here]

Enabling factors to PA are presented in Figure 4. There were five primary themes: environmental factors, ability, cost, sedentary devices and dog ownership, and nine secondary

themes: weather (n=5), seasonality variation (n=5), proximity +ve (n=6), proximity -ve (n=2), provision +ve (n=6), garden +ve (n=6), garden -ve (n=3), illness and injury (n=2), (self-esteem (n=2). Positive and negative influences featured in both enabling primary and secondary themes.

[Figure 4 near here]

Discussion

The purpose of this study was to increase understanding of parental PA knowledge and perceptions of children's out-of-school PA, as to inform design of out-of-school family-targeted intervention strategies. Identifying factors that facilitate and inhibit children's out-of-school PA is deemed to be central to intervention design, but research featuring the knowledge and perceptions of parents who serve as gatekeepers to children's out-of-school PA is presently limited. This study compliments previous research (Noonan et al. 2016b) and provides new insights and understanding of the mechanisms by which parents' perceptions towards the neighbourhood environment, and their own behaviours influence children's out-of-school PA. Parents in this study were largely unaware of the UK PA guidelines for their child and were unsure whether their child met the guidelines on a regular basis. Moreover, PA for many parents was associated with a healthy weight status, and the neighbourhood environment was perceived as uncondusive to child outdoor play which consequently increased the attractiveness of adult supervised organised activities. Such findings have important implications for PA promotion messages and future out-of-school PA interventions targeting primary aged UK children and their families.

Parental knowledge

All parents in this study associated children's engagement in PA with physical health benefits principally maintaining healthy weight status. Parental PA perceptions and knowledge may

have important implications for PA promotional strategies and intervention recruitment. For example, parents that associate PA engagement with weight status and perceive their child to be of healthy weight status are unlikely to perceive their child to be insufficiently active or appreciate the relevance of public health messages advocating them to encourage their child to engage in additional PA (Corder et al. 2010). The findings presented here suggest that future PA promotion and intervention strategies may benefit from including information on the broad ranging health benefits of PA other than that of weight status and that have positive implications on other aspects of children's lives including cognition (Hillman, Erickson, & Kramer, 2008), concentration, (Silva et al. 2015), academic attainment (Singh, Uijtdewilligen, Twisk, Van Mechelen, & Chinapaw. 2012), and self-esteem (Ahn & Fedewa, 2011). Endorsing PA as an essential component to positive child development and wellness may be a more powerful and resonating message to communicate when promoting child PA, particularly to parents (Burdette & Whitaker, 2005).

Although all parents in this study demonstrated an awareness of the need for their child to engage in regular PA, fewer than half of the parents were specifically aware that the UK Government recommends children to accumulate at least one hour of MVPA each day. This is an important finding as parents that are unaware of PA guidelines are perhaps less likely to notice whether or not their child is sufficiently active which may in turn influence their decision to encourage them to engage in more PA (Sawyer et al. 2014).

[Figure 5 near here]

Only half of parents in this study were confident that their child met the recommended PA guidelines daily, with PA undertaken during the school day confusing many parents' judgement as to whether their child consistently achieves the daily PA target. Many of the children in this study (63.6%) travelled to school actively but very few parents (n=2) made reference to this. Parents perceived their child to be most active after-school rather than other periods of the

week as this was essentially when greater structured activity and sports club provision was available. Parents' principally recalled children's engagement in sport and organised activities, mainly team sports (i.e., football) (n=9), but also individual sports such as swimming and cross-country (n=6). The finding that children's out-of-school PA is principally comprised of sport and organised activities supports prior research (Skar & Krogh, 2009). Parents in this study were able to offer some insight in to why this may be suggesting that structured and organised activities are a 'safer' alternative compared to outdoor play.

Children's engagement in structured activity created logistical challenges for families and due to parental time constraints restricted children's regular participation. 'Fitting' children's structured activities into the family schedule was particularly challenging for families comprising several children and two working parents. The financial cost of structured PA served as another participation barrier to out-of-school PA. Although sport participation offers physical and psycho-social health benefits to children (Eime, Young, Harvey, Charity, & Payne, 2013), sport participation alone contributes a comparatively small proportion to children's overall PA (Payne, Townsend, & Foster, 2013). There is therefore a need to develop intervention strategies that engage children in other forms of PA such as active transportation and outdoor play.

Out-of-school facilitators and barriers

Parents in this study considered themselves as important influences on their children's PA. Although verbal encouragement was the most consistently reported form of PA support, parents also recalled experiences of engaging in PA with their children, acting as PA role models and exhibiting positive attitudes towards PA, all of which are consistent correlates of child PA (Beets et al. 2010; Mitchell et al. 2012). There was a consensus among parents that engaging in PA with their child presents the most promising way of increasing their child's PA by way of reinforcing an active lifestyle. Children also cited parent-child co-participation as a

key motivator for out-of-school PA in a recent UK study (Noonan et al. 2016b). The weekend period may be the most salient time to encourage PA between parents and children given the decline in children's activity levels and the shortage of structured PA opportunities during non-weekdays (Brooke et al. 2014; Eyre et al. 2014). Interestingly, some parents expressed a keenness to engage in more frequent family orientated activities with their children instead of simply watching their child participate in structured forms of PA, but stated that they were unaware of available provision or structured activities that allow children and parents to exercise together. As noted earlier, PA provision was solely linked to organised provision in this study. Outdoor recreational provision such as public parks can play an important role in facilitating family-based PA (i.e., play and leisure) (Cohen et al. 2007). Since park use was largely underreported in this study there may be strong potential for public parks to enhance family-based PA levels.

Parental safety concerns were the most consistent barrier to children's out-of-school PA. Almost all parents perceived the neighbourhood environment as uncondusive to their child's outdoor play, with many considering the risks posed by the social and built environment surpassing the health benefits of playing outdoors. This study extends the qualitative literature on children's independent mobility by offering insight into neighbourhood environment norms and community influences. Outdoor play was uncommon in almost all neighbourhoods in this study, and according to some parents, 'letting' children play outdoors was considered socially unacceptable among neighbourhood residents. The rarity of children playing outdoors unsupervised is likely to normalise supervised indoor play creating negative neighbourhood norms surrounding children's independent play outdoors, whereas the presence of other children playing outdoors will likely ease parents' safety concerns due to children not being alone (i.e., safety in numbers) (Holt, Lee, Millar, & Spence, 2015). Moreover, the absence of neighbourhood social cohesion was seen as another barrier to affording children independent

mobility. One parent (F/KD10) cited not knowing many neighbours in the neighbourhood despite living there for a relatively long time, and another (M/KD11) reported living in an unclosed neighbourhood. This finding complements previous quantitative research that found parents who perceived a high level of neighbourhood social cohesion were less fearful of their child playing outdoors and more willing to let them travel further away from home unsupervised (Schoeppe et al. 2015).

[Figure 6 near here]

Consistent with previous studies (Carver et al. 2008, Lee et al. 2015) parental safety concerns regarding children's outdoor play were principally driven by fears regarding stranger danger and traffic volume. Age played a key role in parents' decision to afford children autonomy over their outdoor play. Parents indicated that the end of primary school is a period when they start to afford their children independence to play outdoors unsupervised. Parents may become less worried about children's safety as they age due to increases in motor and traffic awareness skills (D'Haese et al. 2015). Alternatively, since outdoor play was considered unacceptable in some neighbourhoods in this study such an age could be socially driven. For example, affording children outdoor license prior to this age may be viewed in certain communities as 'bad parenting'. Further research is warranted to better understanding the intertwined relationship between perceived parental fear, child age and neighbourhood social norms.

For children that were restricted from playing outdoors the family garden appeared to be an important resource for their PA, especially among families with large gardens. The availability and proximity of public open spaces and recreational provision is consistently associated with child PA (Dunton, Almanza, Jerrett, Wolch, & Pentz, 2014; Sanders, Feng, Fahey, Lonsdale, & Astell-Burt. 2015). Parents in this study considered there to be a high level of provision in their surrounding neighbourhood, suggesting that the challenge to increasing children's PA is

not providing more parks and facilities but rather providing conditions that foster the use of existing resources.

Screen time was another barrier to children's out-of-school PA. Consistent with prior research (Bentley et al. 2012), parents suggested that children become attached to their console games and sometimes have a greater preference for video games rather than more active pursuits such as playing outdoors with friends. However, it is important to note that for some parents, computer gaming and TV viewing may serve as an attractive alternative to outdoor play in order to be confident of their child's whereabouts, particularly during the winter months when day light hours are reduced and perceived safety risks are heightened. Given that parental sedentary behaviour restriction had a positive effect on children's PA in this study with children opting to play outdoors in the garden or with friends, educating parents to encourage children to play outdoors more regularly with friends rather than confining them to the family home could be a low cost and effective means of increasing PA and reducing sedentary time during out-of-school hours. In this case, advocating play and emphasising outcomes such as positive social interaction and emotional well-being rather than obesity prevention, may resonate more strongly with parents when suggesting that their child be more active, particularly outdoors (Burdette, & Whitaker, 2005).

Intervention design

On the whole, most parents (n=9) in this study thought that engaging in a family-based PA intervention programme would have positive implications for their family, and perceived factors influencing their engagement were generally consistent with previous research (Bentley et al. 2012; Jago et al. 2012). Two parents considered both their children and family as very

active by definition of regular engagement in structured PA provision, and therefore viewed themselves as not the intended target audience. This finding demonstrates the importance of consulting with parents prior to familial intervention to build trust and communicate the relevance of programs for families as to aid subsequent intervention recruitment and engagement.

A common strategy used in family-based PA interventions has been to deliver activity sessions or workshops to families and examine whether PA and health related outcomes improve post intervention (Milton, Kelly, Bull, & Foster, 2011; Monteiro, Jancey, & Howat, 2014). Parental concerns regarding intervention engagement centred principally on practical barriers (i.e., transport, work schedules and competing demands on family time) and timing of delivery, suggesting that this may not be the most effective strategy to foster familial interest or engagement. Parents may instead prefer more flexible educational methods, such as online materials or activities that can be completed at home or in the neighbourhood with their children.

Parents in this study demonstrated intent to increase and maintain family PA but reported difficulties linking their intentions with action. Rhodes et al. (2010) shown that increases in parent planning and regulatory capabilities led to subsequent increases in PA. Future interventions should build on this research by supporting parents and families to link their intentions with PA support and family PA. Moreover, family-based intervention was viewed by most parents (n=8) as an important opportunity to spend additional time together as a family and receive feedback on current activity behaviours. Remotely delivered interventions comprising family PA goal tasks that children and parents complete together and receive feedback on may serve as a more practical and engaging method for families compared to traditional educational workshop approaches (Cohen et al. 2013; West, Sanders, Cleghorn, & Davies, 2010). Activity monitors such as pedometers provide feedback reflecting individual

activity behaviour and facilitate self-monitoring and personalised goal setting. In a recent family-based intervention study both maternal and paternal increases in step counts significantly predicted an increase in child step counts (Holm, Wyatt, Murphy, Hill, & Lorraine, 2012). Increasing child and parent self-efficacy by providing feedback about PA may facilitate and improve PA amongst families (Horne, Hardman, Lowe, & Rowlands, 2009). The methods presented here have uncovered new insights on potential important and relevant content to inform future out-of-school family-based interventions.

Strengths and limitations

This is the first study to triangulate quantitative and qualitative data sources to explore parental perceptions of children's out-of-school PA and family-based intervention design, with distinction between socio-demographic and neighbourhood environmental characteristics. In doing so, we extend beyond traditional methodologies and offer comprehensive alternative perspectives on parental PA perceptions, knowledge, and intervention design. The research presented here also builds on previous qualitative PA research by considering individual, social and environmental factors, including the influence of independent mobility, which provides new insights into an understudied area. Methodological strengths include the pen-profile analyses which provide an accurate and detailed illustration of the consistency of themes in the data, rather than over-representing minority parental views, and the supplementary verbatim quotations verified parental responses. Furthermore, the triangulation consensus of data between authors and methods provided credibility, transferability, and dependability. Limitations of this study relate to a small homogenous sample of parents living in affluent neighbourhoods of a highly deprived English City. Therefore, generalizing the results to other populations and locations should be done so with caution. Although opportunities to probe responses can be reduced during telephone interviews, they are a more convenient approach for parents compared to face-to-face interviews which may enhance study recruitment. Further,

unlike focus groups their design facilitates more honest and open discussion around personal views and familial topics which, as seen in this study, are important contributory factors to intervention familial design (Novick, 2008).

Conclusion

The findings of this study could be used to design interventions that seek to encourage parents to be more active with their children. Given the apparent family differences in attitudes highlighted in the family case studies it may be beneficial for future interventions and public health strategies promoting family-focussed PA to allow scope for family specific activity preference. We conclude that formative mixed methods research facilitates intervention content to be aligned with family-specific perceptions and needs, and offers opportunities to communicate the relevance of programs to parents. This may aid subsequent intervention recruitment and engagement.

Funding

This work was supported by Liverpool John Moores University.

Acknowledgements

We thank the children and parents for their participation.

Conflict of interest statement

None declared.

References

- Ahn, S., & Fedewa, A. L. (2011). A Meta-analysis of the Relationship Between Children's Physical Activity and Mental Health. *Journal of Pediatric Psychology*, 36(4), 385–397.
- Atkin, A. J., Corder, K., Ekelund, U., Wijndael, K., Griffin, S. J., & van Sluijs, E. M. F. (2013). Determinants of Change in Children's Sedentary Time. *PLOS ONE*, 8, 6.
- Beets, M. W., Cardinal, B. J. & Alderman, B. L. (2010). Parental Social Support and the Physical Activity – Related Behaviours of Youth: A Review. *Health Education and Behaviour*, 37(5), 621 – 644.
- Bentley, G. F., Goodred, J. K. Jago, R. Sebire, S. J. Lucas, P. J. Fox, K. R., ... Turner, K. M. (2012). Parents' views on child physical activity and their implications for physical activity parenting interventions: a qualitative study. *BMC Pediatrics*, 12, 180.
- Biddle, S. J. H., Gorely, T., Pearson, N., & Bull, F. C. (2011). An assessment of self-reported physical activity instruments in young people for population surveillance: Project ALPHA. *International Journal of Behavioral Nutrition and Physical Activity* 8, 1.
- Boddy, L. M., Murphy, M. H., Cunningham, C., Breslin, G., Fowweather, L., Gobbi, R., ... Stratton, G. (2014). Physical Activity, Cardiorespiratory Fitness, and Clustered Cardiometabolic Risk in 10- to 12-year-old School Children: The REACH Y6 Study. *American Journal of Human Biology*, 26, 446–451.
- Boddy, L. M., Thomas, N. E., Fairclough, S. J., Tolfrey, K., Brophy, S., Rees, A., ... Stratton, G. (2012). ROC Generated Thresholds for Field-Assessed Aerobic Fitness Related to Body Size and Cardiometabolic Risk in Schoolchildren. *PLoS One*, 7 (9): e45755.
- Brooke, H. L., Corder, K., Atkin, A. J. & van Sluijs, E. M. F. (2014). A Systematic Literature Review with Meta-Analyses of Within and Between-Day Differences in Objectively Measured Physical Activity in School-Aged Children. *Sports Medicine*, 44, 1427–1438.

Brown, H. E., Schiff, A., & van Sluijs, E. M. F. (2015). Engaging families in physical activity research: a family-based focus group study. *BMC Public Health, 15*, 1178.

Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting Free Play in Young Children Looking Beyond Fitness and Fatness to Attention, Affiliation, and Affect. *Archives of Pediatrics & Adolescent Medicine, 159*, 46-50.

Carson, V., Hunter, S., Kuzik, N., Wiebe, S. A., Spence, J. C., Friedman, A., ... Hinkley, T. (2015). Systematic review of physical activity and cognitive development in early childhood. *Journal of Science and Medicine in Sport*, doi:<http://dx.doi.org/10.1016/j.jsams.2015.07.011>.

Carver, A., Timperio, A., & Crawford, D. (2008). Playing it safe: The influence of neighbourhood safety on children's physical activity—A review. *Health Place, 14*, 217–227.

Cohen, T. R., Hazell, T. J., Vanstone, C. A., Plourde, H., Rodd, C. J., & Weiler, H. A. (2013). A family-centered lifestyle intervention to improve body composition and bone mass in overweight and obese children 6 through 8 years: a randomized controlled trial study protocol. *BMC Public Health, 13*, 383.

Cohen, D. A., McKenzie, T. L., Sehgal, A., Williamson, S., Golinelli, D., & Lurie, N. (2007). Contribution of Public Parks to Physical Activity. *American Journal of Public Health, 97*(3), 509–514.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal, 320*, 1240–1243.

Cole, T. J., Freeman, J. V., & Preece, M. A. (1995). Body mass index reference curves for the UK, 1990. *Archives of Disease in Childhood, 73*, 25-29.

Corder, K., van Sluijs, E. M. F., McMinn, A. M., Ekelund, U., Cassidy, A., & Griffin, S. J. (2010). Perception Versus Reality: Awareness of Physical Activity Levels of British Children. *American Journal of Preventive Medicine*, 38(1), 1– 8.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal*, 337, a1655.

Craig, R., & Mindell, J. (2013). *Health Survey for England 2012*. London: The Health and Social Care Information Centre.

Crawford, D., Cleland, V., Timperio, A., Salmon, J., Andrianopoulos, N., Roberts, R., ... Ball, K. (2010). The longitudinal influence of home and neighbourhood environments on children's body mass index and physical activity over 5 years: the CLAN study. *International Journal of Obesity*, 34, 1177–1187.

Davids, E. L., & Roman, N. V. (2014). A systematic review of the relationship between parenting styles and children's physical activity. *African Journal for Physical, Health Education, Recreation and Dance*, 2(1), 228-246.

Davison, K. K., Jurkowski, J. M., Li, K., Kranz, S., & Lawson, H. A. (2013). A childhood obesity intervention developed by families for families: results from a pilot study. *International Journal of Behavioral Nutrition and Physical Activity*, 10, 3.

Department for Communities and Local Government. (2011). *The English Indices of Deprivation 2010*. Wetherby: Communities and Local Government Publications.

Department of Health. (2011). *Start Active, Stay Active – A report on physical activity for health from the four home countries*. London: Department of Health.

D'Haese, S., DeMeester, F., Cardon, G., De Bourdeaudhuij, I., Deforche, B., and Van Dyck, D. (2015). Changes in the perceived neighbourhood environment in relation to changes in

physical activity: A longitudinal study from childhood into adolescence. *Health & Place*, 33, 132–141.

D'Haese, S., De Meester, F., De Bourdeaudhuij, I., Deforche, B., & Cardon, G. (2011). Criterion distances and environmental correlates of active commuting to school in children. *International Journal of Behavioral Nutrition and Physical Activity*, 8: 88.

Dunton, G. F., Almanza, E., Jerrett, M., Wolch, J., & Pentz, M. A. (2014). Neighborhood Park Use by Children Use of Accelerometry and Global Positioning Systems. *American Journal of Preventive Medicine*, 46(2), 136–142.

Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *International Journal of Behavioral Nutrition and Physical Activity*, 10, 98.

Eyre, E. L. J., Duncan, M. J., Birch, S. L., & Cox, V. M., (2014). Low socio-economic environmental determinants of children's physical activity in Coventry, UK: A Qualitative study in parents. *Preventive Medicine Reports*, 1, 32–42.

Gray, C., Gibbons, R., Larouche, R., Sandseter, E. B. H., Bienenstock, A., Brussoni, M., ... Tremblay, M. S. (2015). What Is the Relationship between Outdoor Time and Physical Activity, Sedentary Behaviour, and Physical Fitness in Children? A Systematic Review. *International Journal of Environmental Research and Public Health*, 12, 6455-6474.

Grow, H. M., Saelens, B. E., Kerr, J., Durant, N. H., Norman, G. J., & Sallis, J. F. (2008). Where Are Youth Active? Roles of Proximity, Active Transport, and Built Environment. *Medicine & Science in Sports & Exercise*, 40(12), 2071–2079.

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: Exercise effects on brain and cognition. *Nature Reviews Neuroscience*, 9, 58–65.

Holm, K., Wyatt, H., Murphy, J., Hill, J., & Lorraine, O. (2012). Parental Influence on Child Change in Physical Activity During a Family-Based Intervention for Child Weight Gain Prevention. *Journal of Physical Activity and Health, 9*, 661-669.

Holt, N. L., Lee, H., Millar, C. A., & Spence, J. C. (2015). 'Eyes on where children play': a retrospective study of active free play. *Children's Geographies, 13*(1), 73-88.

Horne, P. J., Hardman, C. A., Lowe, C. F., & Rowlands, A. V. (2009). Increasing children's physical activity: a peer modelling, rewards and pedometer-based intervention. *European Journal of Clinical Nutrition, 63*, 191-198.

Jago, R., Sebire, S. J., Bentley, G. F., Turner, K. M., Goodred, J. K., Fox, K. R., ... Lucas, P. J. (2013). Process evaluation of the Teamplay parenting intervention pilot: implications for recruitment, retention and course refinement. *BMC Public Health, 13*, 1102.

Jago, R., Steeds, J. K., Bentley, G. F., Sebire, S. J., Lucas, P. J., Fox, K. R., ... Turner, K. M. (2012). Designing a physical activity parenting course: Parental views on recruitment, content and delivery. *BMC Public Health, 12*, 356.

Janz, K. F., Thomas, D. Q., Ford, M. A., & Williams, S. M. (2015). Top 10 Research Questions Related to Physical Activity and Bone Health in Children and Adolescents *Research Quarterly for Exercise and Sport, 86*(1), 5-12.

Kesten, J. M., Jago, R., Sebire, S. J., Edwards, M. J., Pool, L., Zahra, J., & Thompson, J. L. (2015). Understanding the Accuracy of Parental Perceptions of Child Physical Activity: A Mixed Methods Analysis. *Journal of Physical Activity & Health* [Epub ahead of print].

Knowles, Z. R., Parnell, D., Stratton, G., & Ridgers, N. D. (2013). Learning From the Experts: Exploring Playground Experience and Activities Using a Write and Draw Technique. *Journal of Physical Activity & Health, 10*, 406-415.

Kowalski, K. C., Crocker, P. R. E., & Donen, R. M. (2004). *The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual*. Saskatoon, Canada: University of Saskatchewan.

Krane, V., Andersen, M. B., & Streaan, W. B. (1997). Issues of qualitative research methods and presentation. *Journal of Sport & Exercise Psychology, 19*, 213-218.

Kurka, J. M., Adams, M. A., Todd, M., Colburn, T., Sallis, J. F., Cain, K. L., ... Saelens, B. E. (2015). Patterns of neighbourhood environment attributes in relation to children's physical activity. *Health & Place, 34*, 164–170.

Lai, S. K., Costigan, S. A., Morgan, P. J., Lubans, D. R., Stodden, D. F., Salmon, J., & Barnett, L. M. (2014). Do School-Based Interventions Focusing on Physical Activity, Fitness, or Fundamental Movement Skill Competency Produce a Sustained Impact in These Outcomes in Children and Adolescents? A Systematic Review of Follow-Up Studies. *Sports Medicine, 44*, 67–79.

Lee, H., Tamminen, K. A., Clark, A. M., Slater, L., Spence, J. C., & Holt, N. L. (2015). A meta-study of qualitative research examining determinants of children's independent active free play. *International Journal of Behavioral Nutrition and Physical Activity, 12*, 5.

Leger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (1988). The multistage 20 metre shuttle run test for aerobic fitness. *Journal of Sports Sciences, 6*, 93-101.

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents: review of associated health benefits. *Sports Medicine, 40*(12), 1019-1035.

Mackintosh, K. A., Knowles, Z. R., Ridgers, N. D., & S. J. Fairclough, S. J. (2011). Using Formative Research to Develop CHANGE!: A Curriculum-based Physical Activity Promoting Intervention. *BMC Public Health, 11*: 831.

- Madsen, K. A., McCulloch, C., & Crawford, P. B. (2009). Parent Modeling: Perceptions of Parents' Physical Activity Predict Girls' Activity throughout Adolescence. *Journal of Pediatrics, 154*(2), 278–283.
- Maitland, C., Stratton, G., Foster, S., Braham, R., & Rosenberg, M. (2013). A place for play? The influence of the home physical environment on children's physical activity and sedentary behaviour. *International Journal of Behavioral Nutrition and Physical Activity, 10*, 99.
- Marmot, M. (2010). *Fair Society, Healthy Lives. The Marmot Review. Strategic Review of Health Inequalities in England post 2010*. London: The Marmot Review.
- McMinn, A. M., Griffin, S. J., Jones, A. P., & van Sluijs, E. M. F. (2013). Family and home influences on children's after-school and weekend physical activity. *The European Journal of Public Health, 23*(5), 805-810.
- Metcalf, B., Henley, W., & Wilkin, T. (2012). Effectiveness of intervention on physical activity of children: systematic review and meta-analysis of controlled trials with objectively measured outcomes (EarlyBird 54). *BMJ, 345*, e5888.
- Milton, K., Kelly, P., Bull, F., & Foster, C. (2011). A formative evaluation of a family-based walking intervention-Furness Families Walk4Life. *BMC Public Health, 11*, 614.
- MIMAS. (2008). "Welcome to GeoConvert." Accessed 10 October 2015. <http://geoconvert.mimas.ac.uk/>.
- Mitchell, J., Skouteris, H., McCabe, M., Ricciardelli, L. A., Milgrom, J., Baur, L. A., ... Dwyer, G. (2012). Physical activity in young children: a systematic review of parental influences. *Early Child Development and Care, 182*(11), 1411-1437.
- Monteiro, S. M. D. R., Jancey, J., & Howat, P. (2014). Physical activity and nutrition intervention for mothers of young children: Process evaluation. *Health, 6*(3), 223-230.

Mytton, J., Ingram, J., Manns, S., & Thomas, J. 2014. Facilitators and barriers to engagement in parenting programs: a qualitative systematic review. *Health Education & Behavior*, 41(2), 127–137.

Noonan, R. J., Boddy, L. M., Knowles, Z. R., & Fairclough, S. J. (2016a). Cross-sectional associations between high deprivation home and neighbourhood environments and health-related variables amongst Liverpool children. *BMJ Open*, 6, e008693.

Noonan, R. J., Boddy, L. M., Fairclough, S. J., & Knowles, Z. R. (2016b). Write, draw, show, and tell: A child-centred dual methodology to explore perceptions of out-of-school physical activity. *BMC Public Health*. Manuscript accepted for publication.

Novick, G. (2008). Is There a Bias Against Telephone Interviews In Qualitative Research? *Research in Nursing & Health*, 31(4), 391–398.

O'Connor, T. M., Jago, R., & Baranowski, T. (2009). Engaging parents to increase youth physical activity a systematic review. *American Journal of Preventive Medicine*, 37, 141–149.

Oliver, M., Mavoa, S., Badland, H., Parker, K., Donovan, P., Kearns, R. A., ... Witten, K. (2015a). Associations between the neighbourhood built environment and out of school physical activity and active travel: An examination from the Kids in the City study. *Health & Place*, 36, 57–64.

Oliver, M., Parker, K., Witten, K., Mavoa, S., Badland, H. M., Donovan, P., ... Kearns, R. (2015b). Children's Out-of-School Independently Mobile Trips, Active Travel, and Physical Activity: A Cross-sectional Examination From the Kids in the City Study. *Journal of Physical Activity & Health* [Epub ahead of print].

Payne, S., Townsend, N., & Foster, C. (2013). The Physical Activity Profile of Active Children in England. *International Journal of Behavioral Nutrition and Physical Activity*, 10, 136.

Public Health England. (2014). *Liverpool Health Profile 2014*. London: Public Health England.

Ridgers, N. D., Knowles, Z. R., & Sayers, J. (2012). Play in the natural environment: a child focused evaluation of forest school. *Children's Geographies, 10*, 55–71.

Rhodes, R. E., Naylor, P. J., & McKay, H. A. (2010). Pilot study of a family physical activity planning intervention among parents and their children. *Journal of Behavioral Medicine, 33*, 91–100.

Sallis, J. F, Owen, N., & Fisher, E. B. (2008). Ecological Models of Health Behavior. In K. Glanz, B. Rimer, & K. Vismanath (Eds.), *Health behavior and health education: theory, research, and practice*, (pp. 464–485). 4th edn. San Francisco: Jossey-Bass.

Sanders, T., Feng, X., Fahey, P. P., Lonsdale, C., & Astell-Burt, T. (2015). The influence of neighbourhood green space on children's physical activity and screen time: findings from the longitudinal study of Australian children. *International Journal of Behavioral Nutrition and Physical Activity, 12*, 126.

Sawyer, A., Smith, L., Schrepft, S., van Jaarsveld, C. H. M., Wardle, J., & Fisher, A. (2014). Primary caregiver knowledge of paediatric physical activity recommendations in the United Kingdom and its association with caregiver behaviour: an observational study *BMC Public Health, 14*, 795.

Schoeppe, S., Duncan, M. J., Badland, H. M., Alley, S., Williams, S., Rebar, A. L. & Vandelanotte, C. (2015). Socio-demographic factors and neighbourhood social cohesion influence adults' willingness to grant children greater independent mobility: A cross-sectional study. *BMC Public Health, 15*, 690.

Silva, A. P., Prado, S. O. S., Scardovelli, T. A., Boschi, S. R. M. S., Campos, L. C., & Frère, A. F. 2015. Measurement of the Effect of Physical Exercise on the Concentration of Individuals with ADHD. *PLoS ONE, 10*(3): e0122119.

- Singh, A., Uijtdewilligen, L. Twisk, J. W., Van Mechelen, W., & Chinapaw, M. J. (2012). Physical activity and performance at school: a systematic review of the literature including a methodological quality assesment. *Archives of Pediatrics and Adolescent Medicine*, 166(1), 49-55.
- Skar, M., & Krogh, E. (2009). Changes in children's nature-based experiences near home: from spontaneous play to adult-controlled, planned and organised activities. *Children's Geographies*, 7(3), 339–354.
- Sterdt, E., Liersch, S., & Walter, U. (2014). Correlates of physical activity of children and adolescents: A systematic review of reviews. *Health Education Journal*, 73(1), 72–89.
- Sturges, J. E., & Hanrahan, K. J. (2004). Comparing telephone and face-to-face qualitative interviewing: A research note. *Qualitative Research*, 4, 107-118.
- Thaler, R. H., and Sunstein, C. R. (2008). *Nudge. Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.
- Trigwell, J., Murphy, R. C., Cable, N. T., Stratton, G., & Watson, P. M. (2015). Parental views of children's physical activity: a qualitative study with parents from multi-ethnic backgrounds living in England. *BMC Public Health*, 15, 1005.
- Van Dyck, D., De Bourdeaudhuij, I., Cardon, G., & Deforche, B. (2010). Criterion distances and correlates of active transportation to school in Belgian older adolescents. *International Journal of Behavioral Nutrition and Physical Activity*, 7, 87.
- Voss, C., Ogunleye, A. A., & Sandercock, G. R. H. (2013). Physical Activity Questionnaire for children and adolescents: English norms and cut-off points. *Pediatrics International*, 55, 498–507.
- Welk, G. J. (1999). The Youth Physical Activity Promotion Model: A Conceptual Bridge between Theory and Practice. *Quest*, 51, 5–23.

West, F., Sanders, M. R., Cleghorn, G. J., & Davies, P. S. W. (2010). Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. *Behaviour Research and Therapy*, *48*, 1170-1179.

World Health Organization. (2000). *Obesity: Preventing and Managing the Global Epidemic: Report of a WHO Consultation*. Geneva, Switzerland.

Zecevic, C. A., Tremblay, L., Lovsin, T., & Michel, L. (2010). Parental influence on young children's physical activity. *International Journal of Pediatrics* vol. 2010, Article ID 468526, 9 pages, 2010. doi:10.1155/2010/468526.

Figure captions

Figure 1. Parental PA knowledge. +ve = positive. -ve = negative. M = Male. F = Female

Figure 2. Factors influencing PA intervention engagement. +ve = positive. -ve = negative. M = Male. F = Female

Figure 3. Reinforcing factors to PA. +ve = positive. -ve = negative. M = Male. F = Female

Figure 4. Enabling factors to PA. +ve = positive. -ve = negative. M = Male. F = Female

Figure 5. Family case study for participant KD19

Figure 6. Family case study for participant KD40