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This Girl Can: An Ecological Approach to Investigating Physical Activity in Urban Females

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Abstract

Despite the widely documented physical, psychological and social benefits associated with physical activity, 86% of young females in the UK are insufficiently active (Sport England 2018). In order to improve physical activity levels among young females aged 14-25 in the London Borough of Lambeth, the local council partnered with five physical activity providers and our research team. Together we embarked on the *This Girl Can Lambeth* project which was inspired by the national campaign *This Girl Can*. Our role in the project was to evaluate its implementation and outcomes, and additionally to identify barriers and facilitators to participation for this population. We wanted to capture the intrapersonal and interpersonal factors that are often described in literature, but also the relevant environmental, organisational and legislative factors, therefore we used an ecological framework to guide our research. A systematic review of literature showed that the majority of interventions aimed at young females take place in educational settings and focus on either physiological or psychological intrapersonal factors. In an intervention study we compared a physical education program with a school-based intervention program, to investigate its effects on the behaviour and health of young females. Although the intervention program included multi-sports, and encouraged the building of rapport and a foundation for sustained participation in community-based exit routes, we found no clear benefit of the intervention program over physical education. In subsequent qualitative studies we investigated what was amiss. We conducted focus groups with young females who had participated in the intervention programs to understand what factors they perceived to influence their participation. The focus groups highlighted organisational and environmental factors as primary barriers to physical activity. Such factors are stable features of their lives making them difficult barriers to overcome. However, when we interviewed the physical activity providers, the barriers to participation that they perceived were quite different. They identified intrapersonal factors such as self-efficacy and body image as the main barriers to participation. The physical activity providers also discussed the influence of organisational, environmental and legislative factors. The findings from this project can inform interventions, research and policy to ensure *Girls* indeed *Can*.

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Introduction

Physical activity (PA) has been defined as any voluntary bodily movement produced by skeletal muscles that results in energy expenditure (Casperson, Powell & Christenson, 1985). The term is often used interchangeably with exercise: a planned, structured and repetitive subcategory of PA that aims to improve or maintain components of physical fitness. The current project is concerned with PA which includes activities pertaining to occupation (e.g., paper round), recreation (e.g., jogging), competition (e.g., sport), household (e.g., gardening) and transportation (e.g., cycling). Regular moderate intensity PA is associated with numerous physical benefits such as reduced blood pressure, lower cholesterol and reduced risk of coronary heart disease and can positively impact psychological well-being by reducing stress, anxiety and depressive symptoms (Corr, McSharry & Murtagh, 2018). Despite the strong evidence for the benefits of PA participation, physical inactivity is the fourth leading risk factor for causes of death in the world, making it a global public health issue (WHO, 2009).

The World Health Organisation estimates that over 3.2 million deaths per year can be attributed to insufficient PA, and a further 16.3 million deaths per year can be attributed to risk factors associated with physical inactivity (e.g. high blood pressure, obesity, and high cholesterol). Sedentarism is strongly associated with chronic diseases which are responsible for 60% of deaths around the world (WHO, 2009) and the burden of chronic diseases is rapidly increasing (Hamilton & Owen, 2012). Recognising opportunities to formulate and implement effective strategies to reduce death and disease burden has become a priority for a number of international public health and health promotion organisations (e.g. Centre for Disease Control and Prevention, British Heart Foundation, Health Canada, United States Department of Health and Human services). Europe is the region most affected by the major non-communicable diseases: diabetes, cancer, mental disorders, chronic respiratory diseases, and cardiovascular diseases. These diseases account for a startling 86% of deaths in the region and 77% of disease burden, which has led to the development of norms, guidance and public health tools to help countries implement effective strategies (WHO, 2018).

As PA habits develop from a young age, in the UK it is recommended that 5-18 year olds take part in at least 60 minutes of moderate to vigorous PA every day (NHS, 2011). Activities such as walking, cycling, dancing and swimming occurring at 1.5-2.9, 3.0-5.9 and ≥ 6.0 METs can be classified as light, moderate and vigorous PA respectively. Yet in two recent reports, it was found that very few young people meet the current Chief Medical Officer guidelines. In one report it was estimated that only 22% of children and adolescents in England meet PA recommendations (WHO, 2018). In a second report it was found

that only 17.5% of young people were sufficiently active; this drops to 14% in the 13-16 age group making it the least likely youth age group to be physically active. Further subgroup analyses reveal that for females in the 13-16 age group this drops to 10%, or even lower in ethnic minorities and low-income families (Sport England, 2018). Youth health behaviours are indicative of adult behaviours (Dobbins, Husson, DeCorby & LaRocca, 2013). Therefore, to reduce the burden of poor health associated with physical inactivity in later life, it is important to intervene early within target populations such as young females.

These concerns catalysed the national campaign *This Girl Can* which was developed by Sport England and funded by the National Lottery. This national multi-million pound campaign provides the backdrop for the current thesis. The campaign aims to raise PA levels among females of 14-40 years regardless of shape, size and ability. Its inception in January 2015 saw the use of television ads, outdoor media, and social media, to challenge the conventional ideas of what exercise looks like. The second wave of the campaign, *Phenomenal Woman* expanded the target age to 14-60 years, and the most recent wave in October 2018, *Fit Got Real* targeted females from lower income backgrounds. So far, the campaign has successfully reached 3 million females through community projects, PA content and partnerships with PA organisations and local authorities (This Girl Can, 2019).

This Girl Can Lambeth was a three-year programme which started in 2016. It was funded by Sport England's Community Activation Fund and Lambeth Council. The project was a partnership between the funders, local PA providers, a data management platform, a clinical commissioning group, and London South Bank University. The collaborative project aimed to implement PA into the lives of young females residing in the London Borough of Lambeth and evaluate the impact of the intervention. The evaluation element was undertaken as part of this thesis and aimed to gain an in-depth understanding of the PA behaviours of the young females in order to formulate recommendations for future PA interventions and PA provision. In order to conduct impactful research and take meaningful action, it was important to clearly define the problem and to build on previous work. In this case, despite efforts in terms of interventions, research and policy, the problem was persisting low levels of PA among young urban females. Urban populations can be characterised as multi-cultural communities, living in densely populated areas, which are often socio-economically deprived. Given this, it was important to gain a detailed and contextualised understanding of the factors that influence PA behaviour.

Several behaviour change models have been used to investigate the factors that influence PA. A meta-analysis of social-cognitive theories investigating their explanatory power regarding PA behaviours in adolescents was conducted by Plotnikoff and colleagues (Plotnikoff, Costigan, Karunamuni & Lubans,

2013). The 23 studies utilised five theories (Theory of Planned Behaviour, Self-determination Theory, Health Promotion Model, Social Cognitive Theory, Transtheoretical Model) and the review found that greater proportions of variance for PA intention (48%) was explained by the social cognitive models when compared with actual PA behaviour (38%). The authors concluded that Theory of Planned behaviour was the strongest theory for explaining PA behaviour in youth, however the majority of PA variance remained unexplained and further theoretical research is needed. Contrastingly, an experimental study investigating the mediators of behaviour change in two theoretically-grounded PA interventions aimed at adolescent Iranian girls found that a variety of intrapersonal factors were able to mediate PA behaviour change (Taymoori & Lubans, 2008). One intervention was based on the Health Promotion Model and the other was based on the Transtheoretical Model. Factors such as self-efficacy, commitment to planning, and perceived benefits and barriers were able to mediate PA behaviour while none of the interpersonal factors assessed in the study were able to (i.e. social support and interpersonal norms). The use of behaviour change models can facilitate the investigation of factors associated with PA engagement in this population, but they do not take into account external factors such as the physical environment. Therefore, models which account for different levels of external influences may be best-suited to explain variance in PA behaviour.

One framework that has proven instrumental in studying behavioural influences which take place at multiple levels, is that of ecological models of health behaviour (Sallis, Owen & Fisher, 2008). The original model was based on Bronfenbrenner's ecological systems theory (1977) which proposed five levels of external influence to explain how an individual and their environment interact to influence growth and development. The levels are arranged from the most intimate levels of influence to the broadest: Microsystem, Mesosystem, Exosystem, Macrosystem, and Chronosystem. Respectively, the levels pertain to the immediate environment (e.g. home), connections between microsystems (e.g. home and school), indirect environment (e.g. community), social and cultural values (e.g., religion) and changes over time (e.g. change in family structure). Inspired by Bronfenbrenner's model several authors have proposed ecological models of health behaviours which incorporate the multiple levels of influence that affect whether or not an individual participates in healthful behaviours. The levels are arranged from individual to broader levels of influence: Intrapersonal, Interpersonal, Environmental and organisational, and Policy and legislative levels. These emphasise the political and environmental contexts of behaviours, while integrating social, psychological and physiological influences (Sallis, Owen & Fisher, 2008). Respectively, the levels pertain to individual factors (e.g. physiological, psychological and demographic), relationships within the shared environment (e.g. coaches), environmental and

organisational involvement (e.g. culture and school), and policies and guidelines (e.g. local authorities and funding bodies).

Previous research has suggested that investigating multiple levels of influence on engagement would be a promising direction for future research. In behaviours such as smoking (Dawkins & McRobbie, 2017) and self-management of diabetes (Barrera et al., 2006), interventions appear to be most effective when they intervene at multiple and broader levels of influence (see review and meta-analysis by Cushing, Brannon, Suorsa & Wilson, 2014). However, there is currently a gap in research that explicitly takes a multi-level approach to investigating the PA behaviour of young urban females. In a longitudinal study trialling intervention efficacy in reducing the decline of PA in 11-14 year old females, an ecological model was used (Elder et al., 2006). The model incorporated relevant behaviour change theories at the different levels (i.e., operant learning theory, social cognitive theory, organisational change theory and the diffusion of innovation model). It targeted policy and organisational change in schools and community agencies for PA promotion, increased PA opportunities within schools and incorporated social facilitation of PA. This multi-level intervention saw positive changes in PA levels, body composition, and sedentary time, suggesting that long-term after-school programs are an effective way to intervene on declining PA levels in young females (NHLBI, 2011). The authors recognised that the lack of ecological work may be connected to its challenging nature; frameworks must be tailored to the behaviour and the population but empirical research to guide model development is limited. A cross-sectional study conducted in the UK investigated the correlates of PA from a socioecological perspective to identify factors that promote or discourage PA (Wilkie et al., 2018). The study used a mix of self-reported and objective measures and, through multi-level modelling, found that individual, home, school and environment factors played important roles in understanding the correlates of PA in young people. Combined, these studies provide a rationale for the growing body of literature that addresses individual factors alongside environmental determinants of PA behaviour. Most importantly, they provide support for the efficacy of ecological models in promoting PA and deepening the understanding of correlates such as barriers, benefits, and motivations that underpin PA behaviour (Roth et al., 2018). This holistic understanding behaviour may facilitate the development of more effective interventions.

The aim of this research was to understand the PA behaviours of urban females aged 14-25 years in the UK. To this end, we took an ecological approach to review the literature and conduct three experimental studies. The objective of Study 1, a narrative systematic review, was to synthesise all published interventions conducted in the UK with young females to understand the characteristics and factors which impact PA. The objective of Study 2, an intervention study, was to investigate the effects

of a school-based PA intervention led by community coaches on the intrapersonal characteristics of young females. The objective of Study 3, a focus group study, was to explore the impact of a PA intervention and identify factors that influence PA engagement from a participants' perspective. The objective of Study 4, an interview study, was to explore the factors that influence young females' PA behaviours from a PA provider perspective. The results of these studies are discussed and used to formulate recommendations for future interventions, for intervention research, and for policy which can ultimately reduce levels of female inactivity.

Study 1: An ecological approach to exploring PA interventions aimed at young UK-based females: A narrative systematic review

Hull, R., de Oliveira, R., & Zaidell, L. (2018). An ecological approach to exploring physical activity interventions aimed at young UK-based females: A narrative systematic review. *Psychology, 9*, 2795-2823.

Introduction

The plethora of benefits that PA imparts to health and wellbeing are well documented, however, physical inactivity remains a global public health concern stretching across high-, middle- and low-income countries (Heath et al., 2012). The World Health Organisation (WHO) estimates that 1.9 million deaths, 21-25% of breast and rectal cancer, 27% of diabetes and 30% of ischemic heart disease are attributable to physical inactivity. Additionally, at least 2.6 million deaths worldwide are a result of complications associated with being overweight or obese (WHO, 2018). A growing range of interventions have been developed and delivered to increase PA in various populations; their impact on behaviour however has often been small to moderate in effect and the longevity of this effect is inconsistent so further research is needed (Bauman et al., 2012).

Previous research has shown that a diverse range of personal and environmental factors influence PA. Therefore, the key to understanding PA across different populations and developing effective interventions is to identify and investigate the underlying factors which influence PA behaviours (Lubans, Foster, & Biddle, 2008). Further, it is important to distinguish between factors which serve as correlates, mediators and/or determinants of behaviour within specific groups (Biddle, Whitehead, O'Donovan, & Nevill, 2005). It follows that understanding the role of factors such as demographics, health status, self-efficacy, access, and socioeconomic status within smaller and more specific groups is an important prerequisite to effective intervention (Troost et al., 2002). Cross sectional research has also highlighted particular subgroups of society that are largely inactive. These groups include: ethnic minorities, lower socioeconomic groups, those with disabilities, adolescents, and females (Banks-Wallace, 2000).

Globally, females are less physically active than their male counterparts and therefore more susceptible to the health problems associated with sedentarism (Butcher, Sallis, Mayer, & Woodruff, 2008). Multiple disciplines claim that single-sex programs specially tailored to meet the unique needs of females are imperative yet inadequately researched (Wiese-Bjornstal & Lavoie, 2007). For example,

Biddle, Braithwaite and Pearson's (2014) meta-analysis investigating the effectiveness of interventions to increase PA among girls aged 5-11 concluded that interventions aimed at young females are most effective when they are single sex, multi-component (e.g. combine PA with diet education), relatively short, and atheoretical but of high quality. In particular, multi-component school-based interventions for young females have been most effective when they are supported by curriculum physical education (PE), as they specifically address the needs of young females and attenuate some of the common barriers they face (Camacho-Miñano, LaVoi, & Barr-Anderson, 2011). However, explicit consideration of how interventions attend to and measure influences which impact young females' participation in PA is lacking from literature.

Levels of physical inactivity within the female population vary, and age is considered a significant correlate in the prevalence of sufficient PA (Butcher et al., 2008; Pate et al., 2009). According to the UK Department of Health, individuals should engage in at least 60 minutes of moderate to vigorous PA every day up to the age of 18, whilst those 19-64 years old should engage in the equivalent of 30 minutes of moderate PA on at least 5 days a week (Department of Health, 2016). Pre-adolescent children (approx. 10-13 years) are reported to be the most active segment of society in the UK, with 34% of pre-adolescent girls meeting the recommended levels of PA. However, PA participation declines with age for young females, and strikingly, drops to 0% for adolescent females (Townsend et al., 2012). The decline found in PA is inclusive of competitive sports, and several studies report that by the age of fifteen the drop-out rate seen in young females is significantly higher than their male counter-parts (Engstrom, Skirstad, & Weiss, 1996; Fraser-Thomas, Côté, & Deakin, 2008; Enoksen, 2011). The NHS' National Clinical Director for Children, Young People and Transitions to Adulthood has emphasised the importance of supporting and providing services to young people up to the age of twenty-five, noting the transitions they experience until this age and the culmination of brain development (Cornish, 2015). The disparity between the recommended and actual PA levels, along with the more pronounced decline in PA among females, identifies young females as a high priority group for PA promotion and intervention. Furthermore, the age-related drop-off apparent by the age of fifteen as well as the developmental implications up to the age of twenty-five, highlights a crucial opportunity to intervene and establish long-term PA habits (Keating, Guan, Piñero & Bridges, 2005).

Early PA interventions have typically focused on intrapersonal factors as predictors of PA participation (Biddle et al., 2005; Giles-Corti, Timperio, Bull, & Pikora, 2005). Social psychological theories such as Theory of planned behaviour (Ajzen, 1985, 1991), Social cognitive theory (Bandura, 1986, 2004) and Self-determination theory (Deci & Ryan, 1985, 1991) provide an understanding of the individual-level factors that influence participation in PA (Craike, Symons & Zimmermann, 2009). Although such

approaches have proven useful in predicting and explaining human behavior and can contribute to the development of interventions that target changes beyond the intrapersonal level, their focus is understanding individual-level factors (Vohs & Baumeister, 2016). Differently, Bronfenbrenner's (1977) ecological systems theory is concerned with how individuals are influenced by multiple levels and systems of interaction. The theory consists of four levels: Microsystems which are concerned with the developing person, Mesosystems which are concerned with interrelations, Exosystems which are concerned with social structures and institutions, and Macrosystems which involve institutional structures such as political, legal and economic systems. Health and exercise research has begun to adopt a more multi-level approach, and also focus on the broader interaction between individuals and their social and physical environment to investigate the wider determinants that shape exercise behaviour (Bauman et al., 2012; Pan et al., 2009). Based on Bronfenbrenner's (1977) theory it has been suggested that participation in PA is influenced by the relationships within and between the intrapersonal, interpersonal, organisational/environmental, and policy and legislative levels (Pearson et al., 2014). These interactions have been shown to affect the impact of PA promotion (Biddle et al., 2014). The Ecological Model of Health Behaviour synthesises these and other interactions, and is concerned with understanding behavioural influences that take place at multiple levels, meaning it is able to inform the development of interventions that focus on these broader interactions (Banks-Wallace, 2000). It emphasises the policy and environmental contexts of behaviour, while incorporating social and psychological influences (Sallis, Owen, & Fisher 2008). Through explicit consideration of multi-level influences, the ecological model can guide the development of more comprehensive and context-specific interventions.

Interventions targeting health behaviours such as smoking or self-management of diseases (e.g. HIV) appear to be most effective when they influence several levels of the ecological framework (Wilson et al., 2012; Grau et al., 2017). Several PA reviews suggest that considering the multiple levels of influence would be a promising direction for further research (Pearson et al., 2014; Biddle et al., 2005; Biddle et al., 2014). For example, one study successfully engaged females in PA in a school setting with an intervention that took into account intrapersonal, interpersonal and environmental factors such as self-efficacy, teacher role and equipment (Goodyear, Casey & Kirk, 2014). There is currently a gap for a literature review, which collates intervention studies and investigates the factors and measures through a multi-level approach such as the ecological model.

Several reviews have summarized evidence regarding PA promotion in young people, and among various female populations (Salmon et al., 2007; Shaya, Flores, Gbarayor, & Wang, 2008; Van Sluijs, McMinn, & Griffin, 2007). Although PA intervention literature is abundant, it has been suggested that

further studies in the area must pay closer attention to factors that impact young females' participation in various settings (Cengiz & Ince, 2014). Some research has explored specific cultural factors (Sharma, 2008), and others have explored specific intervention settings (Shaya et al., 2008) and demographic factors (Pate et al., 2009). However, to understand the specific relationships between the factors influencing engagement and retention of young females in PA, a contextualised multi-level theoretical approach to reviewing the evidence is required, and the ecological model can provide a framework for this. Currently in the UK, increasing female PA is high on government agenda (Public Health England, 2018). A multi-million pound nationally funded campaign 'This girl can' has been developed by Sport England to encourage female participation and lessen the disparity between male and female participation. Therefore, in light of the ecological model of health behaviour, this review aims to synthesise the evidence pertaining to the characteristics of PA interventions aimed at UK-based females, to explore the factors used to evaluate intervention impact, and to make recommendations for future PA intervention research through an ecological perspective.

Method

The current study adopted the methodology of a narrative systematic review in order to answer a range of questions and include a range of evidence types (Snilstveit, Oliver, & Vojtkova, 2012). Qualitative synthesis in the form of thematic summaries was used to categorise studies in to relevant conceptual framework groupings (intrapersonal, interpersonal, organisational and environmental, and, policy and legislative). The Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines (PRISMA; Liberati et al., 2009) recommended for reliable methodology and clear reporting were adhered to where possible. The review was pre-registered in the national institute for health research's international database PROSPERO, this was to avoid duplication and help reduce reporting bias (registration number: CRD42018039427).

Search strategy

An electronic literature search was conducted using five databases: SPORTDiscus, Psycarticles®, Web of science™, Scopus®, and Medline® (complete search strategy for Scopus shown in Appendix 1). The search identified all peer-reviewed articles published up to May 2016. Given the research question, the search was built around three groups of key terms: population, behaviour and intervention. The following synonyms were then used to conduct the search: ['women' OR 'woman' OR 'girl' OR 'female'] AND ['physical activity' OR 'exercise' OR 'sport' OR 'fitness'] AND ['intervention' OR 'program' OR 'uptake' OR 'adherence']. The terms were entered into each database, filters were applied so that only peer-reviewed articles published in English remained, and where possible, a limiter for UK studies was

applied; 7584 articles were exported into the reference management program (Mendeley Ltd. v1.16.1) where duplicates were removed (see Figure 1 'identification').

Inclusion criteria

The following criteria were used for the inclusion of publications in the narrative systematic review: 1) study reported an intervention with at least two points of contact; 2) physical activity was included in the intervention, this included exercise which is a sub-set of PA (e.g., Caspersen et al., 1985; Aguilar-Cordero et al., 2018); 3) studies recruited participants free from chronic health conditions except for obesity; 4) participants were female only or the study presented an analysis segregated by gender; 5) the mean age reported fell within the range of 14 to 25 years; 6) the intervention was UK-based; 7) studies were reported in English language.

Identification of studies

Articles were selected by two independent reviewers (RH, RO) who screened potential articles by (i) title (ii) abstract (iii) and then reviewed whole texts and discussed discrepancies until they were in agreement as to whether articles met the inclusion criteria specified above (see figure 1). Prior to discussion of the discrepancies, the reviewers agreed on 81% of papers (17 out of 21). Where papers fit the inclusion criteria but the analysis did not separate males and females or the target age group, corresponding authors were contacted and asked for additional data. In one case, we received additional data, which allowed for the article's inclusion.

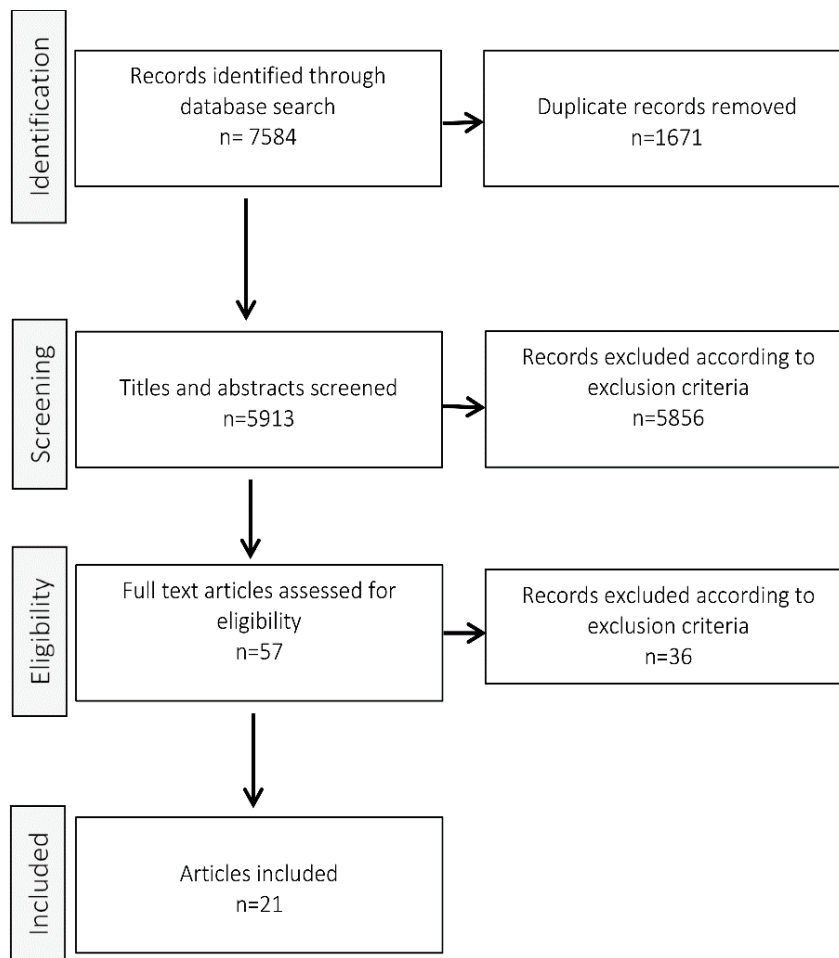


Figure 1. PRISMA flow chart of the study selection process. Each step was performed by two independent reviewers.

Study characteristics

A study characteristics table, with topics agreed upon by all four authors, was designed specifically for this study to extract relevant information from the articles included in the review. The table provides a summary of the characteristics of each article, and includes the following topics: references, theoretical framework where stated, recruitment details, participant details (e.g. age, gender), intervention details (e.g. setting, length, activity), outcome measures, design, main findings, and respective ecological level(s). The 21 individual studies included in this review were tabulated, analysed for differences, divergent findings and patterns, and then synthesised according to their corresponding ecological level(s) and therefore thematic group (see Table 1).

Table 1. Summary of studies included in the review.

Author (Year)	Participants	Intervention	Measures	Design	Main findings	Theory
1. Boreham, Kennedy, Murphy, Tully, Wallace & Young (2005)	Recruitment: V Setting: University Age: 18.8 (+- 0.7) Gender: F Area: Urban Adherence: 16.7% attrition	Intervention activity: Stair climbing Intervention period: 8 weeks, 5 days per week	Physiological	Quantitative Pre-Post Control group n=7 Intervention group n=8	17.1% increase on VO ₂ max for intervention group. 7.7% reduction in low-density lipoprotein cholesterol. No significant effect on BMI for intervention or control group.	Ecological levels: Intrapersonal
2. Boreham, Wallace & Nevill (2000)	Recruitment: V Setting: University Age: 18-22 Gender: F Area: NR Adherence: 12% attrition	Intervention activity: Stair climbing Intervention period: 7 weeks	Physiological	Quantitative Pre-Post Control group n=10 Intervention group n=12	Intervention group showed rise in HDL cholesterol concentration, and reduced total VO ₂ , HR and blood lactate during stair climbing bouts.	Ecological levels: Intrapersonal
3. Brock & Legg (1997)	Recruitment: C Setting: Workplace Age: 19.2 (+- 1.4) Gender: F Area: NR Adherence: NR	Intervention activity: Various Intervention period: 7 weeks 51x 40minute sessions	Physiological	Quantitative Pre-Post	Significant increases in mean VO ₂ , grip strength, mean body weight, maximal cycling time, dynamic strength and fat-free mass. Decreases in body fat %. No significant difference in isometric strength.	Ecological levels: Intrapersonal

4. Burgess, Grogan, & Burwitz (2006)	Recruitment: V Setting: School Age: 13.5 (+-0.3) Gender: F Area: NR Adherence: NR	Intervention activity: Dance & curriculum PE Intervention period: 12 weeks (6 weeks of each activity)	Psychological	Quantitative Pre-Mid-Post Control condition (cross-over design)	Reduced body dissatisfaction and enhanced physical self-perceptions (body attractiveness and physical self-worth). However, improvements were not sustained.	Ecological levels: Intrapersonal
5. Connolly, Quin & Redding (2011)	Recruitment: V & C (school-dependent) Setting: School Age: 14 Gender: F Area: Rural Adherence: 80% attendance required for inclusion	Intervention activity: Dance Intervention period: 5-12 hours of delivery in 1 hour intervals	Combined	Quantitative Pre-Post	Significant decrease in perceived exertion. Significant increases in self-esteem, aerobic capacity and handgrip. No change in intrinsic motivation or flexibility	Ecological levels: Intrapersonal
6. Engels, Bowen & Wirth (1995)	Recruitment: V Setting: College Age: 22 (+-3.9) Gender: F Area: NR Adherence: 15% attrition and 92% attendance	Intervention activity: Dance Intervention period: 10 weeks, 3 days per week	Physiological	Quantitative Pre-Post Control group n=9 Intervention group n=8	Significant overall reduction in body fat percentage and fat weight. Significant increase in VO _{2max} and fat free weight. No group differences between weight training group & no-weight training group. No change in body weight, respiratory exchange ratio or perceived exertion.	Ecological levels: Intrapersonal

7. Delextrat & Neupert (2016)	Recruitment: V Setting: Gym (universities & leisure centres) Age: 25.4 (+-4.3) Gender: F Area: NR Adherence: NR	Intervention activity: Zumba Intervention period: 3 weeks 3 x gym Zumba 3 x DVD Zumba	Physiological	Quantitative In-session monitoring Cross-over design	Zumba classes allowed greater energy expenditure. Women with a greater autonomy score showed a smaller difference between DVD and class. Greater differences were shown in women with greater interpersonal skills. Both modalities are suitable to maintain fitness.	Ecological levels: Intrapersonal
8. Hamlyn-Williams, Freeman & Parfitt (2014)	Recruitment: C Setting: School Age: 14.6 (+- 0.8) Gender: F Area: NR Adherence: NR	Intervention activity: Treadmill walking/running Intervention period: 3 x 20 minute sessions. (2x self-selected and 1x prescribed intensity)	Psychological	Quantitative In-session monitoring	No significant differences in intensity between prescribed and self-selected sessions. Affective responses were significantly more positive during the self-selected session and ratings of perceived exertion were significantly lower.	Ecological levels: Intrapersonal
9. Ho, Simmons, Ridgway, van Sluijs, Bamber, Goodyer, Dunn, Ekelund & Corder (2013)	Recruitment: V Setting: School Age: 14.5 (+-0.5) Gender: F/M Area: Rural Adherence: NR	Intervention activity: Walking/running Intervention period: 4 days	Physiological	Quantitative	Intervention group had higher counts per minute than control group. Pedometer wearing was associated with higher PA among girls but not boys and has implications for sex specific interventions. No significant change in BMI.	Ecological levels: Intrapersonal

10. McPhee, Williams, Degens & Jones (2010)	Recruitment: V Setting: NR Age: 21 (+-4) Gender: F Area: NR Adherence: 25.4% attrition	Intervention activity: Cycling (supervised endurance program) Intervention period: 6 weeks (3 x 45 minute sessions per week)	Physiological	Quantitative Pre-Post	Local leg-muscle aerobic capacity and ratio 1:2 vary from person to person and influences adaptation following cycling program. Setting training stimulus at a fixed percentage of VO_{2max} is not recommended to standardise the training stimulus to the leg muscles of different people.	Ecological levels: Intrapersonal
11. Stear, Prentice, Jones & Cole (2003)	Recruitment: V Setting: College Age: 17.3 (+-0.3) Gender: F Area: Rural Adherence: 8% attrition and 36% attendance	Intervention activity: Gym class Intervention period: 15.5 months 3x 45 minute classes per week	Physiological	Quantitative Pre-Post Control group n=56 Intervention group n=75	Calcium supplementation and exercise significantly enhanced bone mineral status in adolescent girls. Supplement taking adherence 70% (+-27). Exercise adherence 36% (+-25). Stronger effects with increased compliance.	Ecological levels: Intrapersonal
12. Tully & Cupples (2011)	Recruitment: V Setting: University Age: 21.6 (+-6.17) Gender: F/M Area: Urban Adherence: NR	Intervention activity: Walking Intervention period: 6 weeks	Physiological	Quantitative Pre-Post Control group n=4 Intervention group n=8	All intervention participants significantly increased their daily step count. No significant change in fitness or BMI. A daily target of 10,000 steps may be an appropriate intervention for sedentary university students.	Ecological levels: Intrapersonal

<p>13. Epton, Norman, Dadzie, Harris, Webb, Sheeran, Julious, Ciravegna, Brennan, Meier, Naughton, Petroczi, Kruger & Shah (2014)</p>	<p>Recruitment: V Setting: University Age: 19 Gender: F/M Area: Urban Adherence: 23.4% attrition</p>	<p>Intervention activity: Gym Intervention period: 6 months, October 2012-March 2013</p>	<p>Combined</p>	<p>Quantitative Pre-Post-Follow-up Control group n= 709 Intervention group n=736</p>	<p>Intervention reduced smoking rates. Small increase in fruit and vegetable intake, PA and alcohol consumption. No significant change in BMI for either group. Intervention engagement was slow.</p>	<p>Ecological levels: Intrapersonal Theoretical framework: Theory of planned behaviour</p>
<p>14. Hanson, Allin, Ellis & Dodd-Reynolds (2013)</p>	<p>Recruitment: V (referral) Setting: Gym Age: 16-24 Gender: F/M Area: Rural Adherence: 57.1% attrition</p>	<p>Intervention activity: Gym classes Intervention period: 24 weeks</p>	<p>Physiological</p>	<p>Quantitative Pre-Post</p>	<p>Significant increases in self-reported PA. BMI of 30+ at pre was a significant negative predictor of completion. Whole group-uptake was 81%, adherence 53.5%, completion 42.9%. 16-25 females Uptake- 66.7% Adherence- 28.1% Completers- 21.9%.</p>	<p>Ecological levels: Intrapersonal Theoretical framework: Transtheoretical model</p>
<p>15. Bray, Gyurcsik, Culos-Reed, Dawson & Martin (2001)</p>	<p>Recruitment: V Setting: University (students and staff) Age: 20.6 (+- 2.2) Gender: F Area: NR Adherence: 62.9% attendance</p>	<p>Intervention activity: Aerobics classes Intervention period: 10 weeks</p>	<p>Psychological</p>	<p>Quantitative Pre-Post</p>	<p>Positive correlations between self-efficacy variables and proxy-efficacy. Self-efficacy and proxy-efficacy accounted for 34% of the variance in exercise attendance for class initiates. Proxy efficacy perceptions are related to self-efficacy.</p>	<p>Ecological levels: Intrapersonal Interpersonal</p>

16. Beauchamp, Welch & Hulley (2007)	Recruitment: V Setting: University Age: 25.36 (+- 8.48) Gender: F Area: Urban Adherence: NR	Intervention activity: Gym classes Intervention period: 10 weeks	Psychological	Quantitative	Leadership style didn't affect experienced exercisers. For exercise initiates, contingent reward behaviours explained variation in scheduling and barrier efficacy, but not within-class self-efficacy. Exercise initiates had lower levels of self-efficacy in all 3 types.	Ecological levels: Intrapersonal Interpersonal
17. Chatzisarantis & Hagger (2009)	Recruitment: C Setting: School Age: 14.84 (+-0.48) Gender: F/M Area: NR Adherence: 8.5% attrition	Intervention activity: Various Intervention period: 10 weeks 5 x intervention 5 x independent exercise	Psychological	Quantitative Pre-Post-Follow-up Control schools n=5 Intervention schools n=5	Pupils taught by autonomy supportive teachers reported stronger intentions to exercise, and participated more frequently in PA than the control group. Autonomous motivation and intentions mediated intervention effects on self-reported PA behaviour. Self-determination theory is a useful framework for school-based interventions.	Ecological levels: Intrapersonal Interpersonal Theoretical framework: Self-determination theory
18. Brooks & Magnusson (2006)	Recruitment: V Setting: School Age: 14-15 Gender: M/F Area: NR Adherence: 15.5% attrition	Intervention activity: Modified PE programme Intervention period: 18 months	Psychological	Qualitative Thematic analysis	Girls experienced increased self-confidence, and acquired psychological resources to participate in community-based activities.	Ecological levels: Intrapersonal Interpersonal Organisational/ environmental

19. Cooke, Tully, Cupples, Gilliland & Gormley (2013)	Recruitment: V Setting: University Age: 22 Gender: F/M Area: Urban Adherence: NR	Intervention activity: Walking /running Intervention period: 4 weeks	Psychological	Mixed methods Pedometer: Controlgroup n=66 Intervention group n=70 Focus group: Control group n=13 Intervention group n=13	Mean change in daily step count was greater in intervention group. Scores for perceived behavioural control over PA counselling increased for both groups but more for intervention group. Five themes were identified in the focus groups: walking and exercise, barriers to PA, doctors as role models, confidence in counselling and primary care.	Ecological levels: Intrapersonal Interpersonal Organisational/ environmental Theoretical framework: Theory of planned behaviour
20. Goodyear, Casey & Kirk (2014)	Recruitment: C Setting: School Age: 14-15 Gender: F Area: Rural Adherence: NR	Intervention activity: Basketball Intervention period: 8 lessons	Psychological	Qualitative	Co-operative learning model promotes student engagement. Role of coach and camerawoman were pivotal to the girl's engagement.	Ecological levels: Intrapersonal Interpersonal Organisational/ environmental Theoretical framework: Co-operative learning model
21. Moon, Mullee, Rogers, Thompson, Speller & Roderick (1999)	Recruitment: V Setting: School Age: 11-16 Gender: F/M Area: Rural Adherence: NR	Intervention activity: Various Intervention period: 15 months	Psychological	Mixed methods Pre-Post (main design) Control schools n=5 Intervention schools n=11	All areas except PA and taking responsibility for health increased. Little improvement in healthy food, smoking and community links. No change in pupil's knowledge. Older girls made greater progress in all areas.	Ecological levels: Intrapersonal Interpersonal Organisational/ environmental Policy/ Legislation

NR = Not reported; V = Voluntary; C = Compulsory; M = male; F = female; VO2 max = maximal oxygen uptake capacity

Quality assessment

Table 2 shows the items used for the quality assessment of the studies. The National Heart, Lung and Blood Institute instrument designed especially for intervention studies was used (NHLBI, 2018). The instrument requires two independent assessors to assess each article based on 14 items (see Table 2). The articles were then rated good fair or poor (see Table 3).

Table 2. Quality assessment items from National Heart, Lung, and Blood Institute (NHLBI, 2018). Studies were rated good, fair or poor based on the quality assessment items.

Quality assessment items
1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?
2. Was the method of randomization adequate (i.e., use of randomly generated assignment)?
3. Was the treatment allocation concealed (so that assignments could not be predicted)?
4. Were study participants and providers blinded to treatment group assignment?
5. Were the people assessing the outcomes blinded to the participants' group assignments?
6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?
7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?
8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?
9. Was there high adherence to the intervention protocols for each treatment group?
10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)?
11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?
13. Were outcomes reported or subgroups analyzed pre-specified (i.e., identified before analyses)?
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?

Results

Descriptive characteristics

The study selection process identified 21 studies, which met the inclusion criteria and were therefore included in this review. The publication period of the included articles spanned between 1995 and 2016. Of the 19 studies that took quantitative measures, 14 followed a pre-test and post-test within-subject design; two studies took measures of cardiorespiratory fitness (e.g. maximal oxygen uptake

capacity: VO_{2max}) and affective responses throughout the PA sessions; and three studies did not specify the timeline of their measurements. Only two studies conducted follow-up measurements (Chatzisarantis & Hagger, 2009; Epton et al., 2014). The average length of interventions was 19.4 weeks ($SD = 22.4$), however the median length was 10 weeks. The age range of participants was 11 to 25 years. Only three studies mentioned the ethnicity of their participants, which they reported as '*primarily white*' or '*all Caucasian*' samples (Brooks & Magnusson, 2006; Hamlyn-Williams, Freeman, & Parfitt, 2014; Goodyear, Casey, & Kirk, 2014). Although most studies reported no health conditions present within their population, one study was based on general practitioners' referrals with 65% of participants overweight (Hanson, Allin, Ellis, & Dodd-Reynolds, 2013). The average number of participants within each study was 187.6 ($SD = 372.7$), with a median of 54 and a large range of 10 to 892 participants. Of the 21 articles included in the review 11 did not state geographical location, however of those that did, five took place in rural areas and five took place in urban areas (see Table 1).

Quality assessment

The quality of the included studies were assessed as either good, fair or poor through a quality-rating tool proposed by NHLBI (2018). The majority of the studies were rated either good or fair (95%), of which 43% were deemed good. Of the 21 studies, 95% had valid, reliable and consistently implemented measures. One study did not use reliable measures and failed to report predicted outcomes before analysis, which was the only study included in this review that was considered to be of poor quality (Brooks and Magusson, 2006). Only 9% of included interventions reported a sample size that was sufficiently large enough to detect differences in their main outcomes, and only 4% of studies described a high adherence to intervention protocols across treatment groups.

Table 3. Quality assessment ratings for the included studies. Studies were discussed and rated ‘good’, ‘fair’ or ‘poor’ by two reviewers based on the articles fulfilment of the NHLBI quality assessment items.

Included interventions	1	2	3	4	5	6	Items		9	10	11	12	13	14	Rating
							7	8							
Beauchamp et al. (2007)	N	NA	NA	NA	NA	NR	NR	NA	NR	NR	Y	NR	N	NA	Fair
Boreham et al. (2005)	Y	CD	CD	NR	CD	Y	NR	NR	NR	Y	Y	NR	Y	Y	Good
Boreham et al. (2000)	Y	NR	NR	NR	NR	Y	Y	Y	NR	CD	Y	N	Y	Y	Good
Bray et al. (2001)	N	NA	NR	NR	NR	NR	NR	NA	NR	NR	Y	N	Y	NA	Fair
Brock and Legg (1997)	N	NA	N	N	N	NA	NR	NA	NR	NR	Y	NR	N	NA	Fair
Brooks & Magnusson (2006)	N	NA	N	N	NA	N	NR	NA	NA	NA	N	N	N	NA	Poor
Burgess et al. (2006)	Y	N	N	NR	N	Y	NR	NA	NR	N	Y	NR	Y	Y	Fair
Chatzisarantis & Hagger (2009)	Y	N	N	NR	N	Y	NR	NR	NR	NR	Y	N	Y	Y	Fair
Connolly et al. (2011)	N	NA	NR	NR	N	NR	CD	CD	Y	NR	Y	N	N	NA	Fair
Cooke et al. (2013)	Y	Y	NR	NR	N	Y	Y	Y	NR	N	Y	Y	Y	Y	Good
Delextrat & Neupert (2015)	N	NA	NR	N	N	NR	NR	NR	CD	NR	Y	N	Y	NA	Fair
Engels et al. (1995)	Y	NR	NR	NR	N	Y	CD	NR	CD	Y	Y	NR	Y	Y	Good
Epton et al. (2014)	Y	CD	Y	Y	N	Y	Y	N	CD	N	Y	Y	Y	Y	Good
Goodyear et al. (2014)	N	NA	NA	N	N	NR	CD	NA	NR	NA	Y	N	N	N	Fair
Hamlyn-Williams et al. (2014)	Y	Y	NR	N	N	CD	NR	NR	NR	NR	Y	NR	Y	Y	Good
Hanson et al. (2013)	N	NA	NR	NA	NA	NA	NR	CD	N	NR	Y	NR	Y	NA	Fair
Ho et al. (2013)	NR	NA	NR	N	NR	Y	NR	NR	NR	NR	Y	NR	Y	Y	Good
McPhee et al. (2010)	NA	NA	NA	NA	N	NA	CD	NR	CD	CD	Y	NR	Y	NA	Fair
Moon et al. (1999)	N	NA	NR	Y	NA	CD	CD	CD	CD	NR	Y	NR	Y	Y	Fair
Stear et al. (2002)	Y	Y	Y	Y	Y	Y	CD	CD	N	CD	Y	CD	Y	Y	Good
Tully & Cupples (2011)	Y	Y	NR	CD	Y	Y	NR	NR	CD	Y	Y	NR	Y	Y	Good

Note: Y=Yes, N=No, NR=Not reported, NA= Not applicable, CD=Cannot determine.

Reported methodologies

Out of the 21 studies, 19 used a variety of quantitative methods to evaluate their intervention outcome measures. Most frequently, these consisted of statistical analysis of VO_{2max} , heart rate, body composition and psychological measures using questionnaires (details provided later). Only four studies utilized qualitative methods (Moon et al., 1999; Cooke et al., 2013; Brooks & Magnusson, 2006; Goodyear et al., 2014). One study led focus groups with a purposive sample of 31 self-identified formerly PE-adverse individuals after a modified PE program. The students, recruited due to their withdrawal from curriculum PE, attributed their disengagement to the environment, perceiving it as one that placed an emphasis on winning, masculinity and physical prowess (Brooks & Magnusson, 2006). Two studies used mixed quantitative and qualitative methods (Moon et al., 1999; Cooke et al., 2013). Alongside self-administered questionnaires, which measured pupil's health-related knowledge, attitudes and behaviours, Moon et al. (1999) used semi-structured interviews to collate attitudes and perceptions of staff, parents and school governors from eleven intervention and five control schools. Cooke et al. (2013) recruited 136 medical students (control $n=66$) to wear pedometers for 4 weeks with the target of increasing their daily step count. Alongside statistical analysis of pedometer data, which found a greater mean change in the daily step count of the intervention group, 26 volunteers (13 control & 13 intervention) of the 136 then participated in mixed focus groups. Participants discussed their experiences regarding PA measurement and their views on health promotion. Five themes were identified: walking and exercise, barriers to PA, doctors as role models, confidence in counselling, and primary care.

Interventions

Most of the interventions (17 of 21) took place within educational institutions with seven set within universities, eight in schools, and two in colleges. Other settings for interventions were workplaces (Brock & Legg, 1997; Bray et al., 2001) and local gyms (Delextrat & Neupert, 2016; Hanson et al., 2013). All university and college-based interventions ($n=9$) recruited volunteers for study participation (Beauchamp, Welch, & Hulley, 2007; Boreham et al., 2005; Boreham, Wallace, & Nevill, 2000; Bray et al., 2001; Cooke et al., 2013; Engels, Bowen, & Wirth, 1995; Epton et al., 2014; Stear et al., 2003; Tully & Cupples, 2011). In contrast, the eight interventions that took place within school settings were generally compulsory programmes, in which schools partnered with external providers to target sub groups or individuals to substitute curriculum PE. A third strategy was used for a contemporary dance intervention. Classes were offered to nine high schools, which either made them mandatory or allowed students to choose between the dance intervention and traditional PE classes (Connolly, Quinn, &

Redding, 2011). Although the authors acknowledge this may have impacted measures such as intrinsic motivation, the two groups were not analysed separately to examine whether making the activity mandatory or a choice made a difference. School-based interventions included in this review, which were mostly mandatory, were more effective than university-based interventions, as five of eight school-based interventions reported significant increases in PA-related affect such as body image and self-esteem.

The type of activities used in this population has been limited, and within interventions, participants were generally not given the option to choose the activities in which they participated. Most of the interventions reported instructor-led PA such as gym and PE classes (n=7; Beauchamp et al., 2007; Bray et al., 2001; Brooks & Magnusson, 2006; Chatzisarantis & Hagger, 2009; Epton, et al., 2014; Hanson et al., 2013; Moon et al., 1999). Dance and exercise to music was also a frequent activity offered to this population (n=5; Burgess et al., 2006; Connolly et al., 2011; Delextrat & Neupert, 2016; Engels et al., 1995; Stear, Prentice, Jones & Cole, 2003). There were also some interventions using walking or running (n=4; Cooke et al., 2013; Hamlyn-Williams et al., 2014; Ho et al., 2013; Tully & Cupples, 2011), stair climbing (n=2; Boreham et al., 2005; Boreham et al., 2000), or basketball and cycling (n=2; Goodyear et al., 2014; McPhee, Williams, Degens, & Jones, 2010). Finally, Brock and Legg (1997) used a variety of physical activities as part of 6-week physical fitness programme for British female army recruits with mean age of 19.2 (*SD*= 1.4). It included a variety of compulsory activities: swimming, games, endurance training, personal training sessions and obstacle courses. Although participants were not given choice in the activity, the interventions which allowed other types of choices showed positive impacts on PA-related affect such as autonomy (Chatzisarantis & Hagger, 2009), affective responses measured by an affect valence scale (Hamlyn-Williams et al., 2014), and lower ratings of perceived exertion in the absence of intensity differences (Delextrat & Neupert, 2016). One study compared prescribed intensity versus self-selected intensity of running on a treadmill (Hamlyn-Williams et al., 2014). Another study compared energy expenditure during an instructor-led exercise classes versus when following an exercise DVD (Delextrat & Neupert, 2016). A third study compared students' intentions and self-reported exercise following autonomy-supportive sessions versus standard sessions (Chatzisarantis & Hagger, 2009).

Ecological levels

Only seven studies (33%) explored multiple levels of influence on PA participation (see Table 1). Three of these used measures to evaluate factors from both intrapersonal and interpersonal levels of the ecological model (Beauchamp et al., 2007; Bray et al., 2001; Chatzisarantis & Hagger, 2009). For example, Bray et al., (2001) investigated the relationship between self-efficacy, instructor-efficacy, and exercise attendance. They recruited 127 volunteers from a university campus and enrolled them in 10 weeks of structured group fitness classes. The study found that the combination of the intrapersonal and interpersonal level factors accounted for 34% of the variance in exercise class attendance with self-efficacy in relation to scheduling, barrier and exercise accounting for 22% and fitness instructor efficacy accounting for 12% of variance explained. Three articles looked at the intrapersonal, interpersonal, and organisation and environmental levels (Brook & Magnusson, 2006; Cooke et al., 2013; Goodyear et al., 2014), whilst one considered all four levels (Moon et al., 1999). These are explained in more detail later in this review when each level of the ecological model is explored (see figure 2 for adapted ecological model and overview of factors).

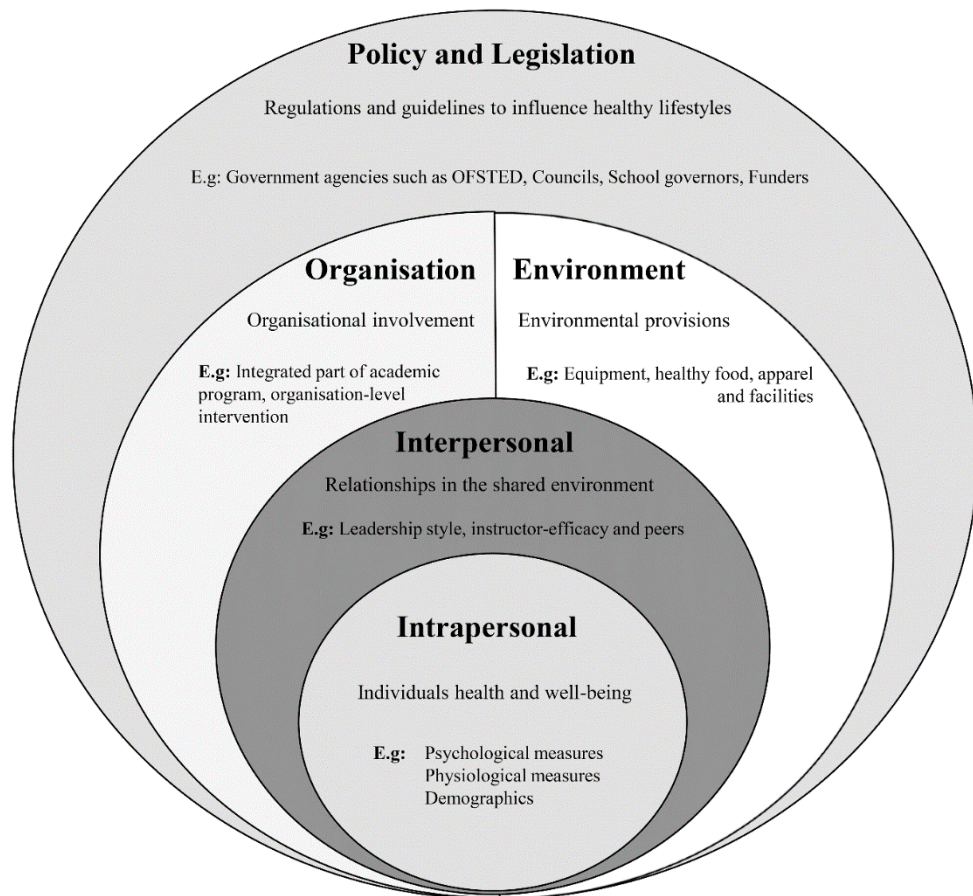


Figure 2. Illustration of ecological levels. Examples at each level are factors drawn from the results of this review. (Figure was designed by the authors and based on Bronfenbrenner's (1977) Ecological systems theory).

Intrapersonal. The most frequently investigated factors are from the intrapersonal level of the ecological model. All studies measured one or more intrapersonal factor, these included: aerobic fitness (n=9), measures of body composition (n=6), self-efficacy (n=5), intervention compliance (n=11) and self-reported PA levels (n=5). Some studies looked only at physiological (n=8) or psychological (n=10) changes. Only three studies investigated both the physiological and psychological impact of interventions (Connolly et al., 2011; Delextrat & Neupert, 2016; Epton et al., 2014).

The most frequently reported physiological and health-related measurement was aerobic fitness (n=9). Of these, seven studies used a variety of methods (e.g., VO₂ maximal tests, VO₂ sub-maximal tests, incremental running tests, NATO cycling tests) to assess aerobic fitness, while heart rate and oxygen uptake were used in two studies to monitor the physical intensity of sessions (Delextrat & Neupert, 2016; Hamlyn-Williams et al., 2014). Six interventions, which all took pre and post measurements,

showed a significant improvement of aerobic fitness (Boreham et al., 2005; Boreham et al., 2000; Brock & Legg, 1997; Connolly et al., 2011; Engles et al., 1995; McPhee et al., 2010). The remaining study, a 6-week walking intervention, which asked participants to accumulate 10,000 steps per day and report their pedometer step counts in a diary, saw no change between their pre and post aerobic fitness measured by a multi-stage shuttle run test (Tully & Cupples, 2011). The six interventions that reported favourable effects on aerobic fitness were comparatively more structured in delivery in that they paid close attention to intensity and timing of activities, ensured progression throughout the programme, and had supervised sessions.

Different measures of body composition were used in six studies. Although the interventions varied in length, components, activities and participant demographics, the four studies which used Body Mass Index (BMI) found no significant difference between pre and post intervention (Boreham et al., 2005; Epton et al., 2014; Ho et al., 2013; Tully & Cupples, 2011). The two studies that found a statistically significant increase in fat-free mass used more precise methods: skin folds (Brock & Legg, 1997) and underwater weighing accompanied with body fat estimation (Engles et al., 1995). It is important to note that BMI was considered a secondary outcome in the earlier four, which focussed on engagement, whilst body fat percentage in the latter two studies was considered a primary outcome measure. Both of these studies conclude that female recruit training in the British army and low impact aerobic dance are effective in terms of changing body composition of young females (Brock & Legg, 1997; Engles et al., 1995).

The most frequently reported psychological and behavioural measure was exercise-related self-efficacy (n=5). Validated questionnaires were used to identify and extract different types of self-efficacy. For example, Beauchamp et al. (2007) used a six-item in-class self-efficacy scale, a four-item barrier self-efficacy scale, and a ten-item scheduling self-efficacy scale to examine the relationship between leadership types and the self-efficacy of participants enrolled in a 10-week group exercise intervention. Similarly, Bray et al. (2001) used an exercise self-efficacy questionnaire alongside a scheduling efficacy questionnaire, to examine the relationship between self-efficacy, instructor-efficacy and exercise class attendance. Both studies concluded that leadership styles and instructor-efficacy had stronger correlations with self-efficacy for exercise initiates than experienced exercisers. The remaining three studies found that their various interventions increased the exercise-related self-efficacy of participants post intervention (Brooks & Magnusson, 2006; Burgess et al., 2006; Connolly et al., 2011).

About half of the studies reported measures of intervention compliance. Attendance, adherence, and/or attrition were reported by eleven studies (Boreham et al., 2005; Boreham et al., 2000; Bray et

al., 2001; Brock & Legg 1997; Chatzisarantis & Hagger, 2009; Engels et al., 1995; Epton et al., 2014; Hanson et al., 2013; McPhee et al., 2010; Stear et al., 2003; Tully & Cupples, 2011). Three studies reported attendance to intervention classes (Bray et al., 2001; Engels et al., 1995; Stear et al., 2003; 63%, 92%, 36%, respectively), but the high attendance rate in Engels et al. (1995) was calculated after removing three of the 20-participant sample because they had not met the attendance requirements. One pedometer-based study reported adherence as the percentage of days participants recorded data in their training diaries over 6 weeks (85%; Tully & Cupples, 2011). Nine studies reported attrition rates as how many participants were excluded from the analysis compared with how many had begun the intervention. Among those nine, there was a mean attrition of 20.2 (SD= 15.1; Boreham et al., 2005; Boreham et al., 2000; Brock & Legg 1997; Chatzisarantis & Hagger, 2009; Engels et al., 1995; Epton et al., 2014; Hanson et al., 2013; McPhee et al., 2010; Stear et al., 2003). Overall, the study with the highest level of attrition (57.1%, Hanson et al., 2013) and the study with the lowest class attendance (36%, Stear et al., 2003) were two of the longest running interventions, at 24 and 67 weeks respectively, compared with the 16.3 weeks (SD=20.3) of the remaining review sample.

Only three of the 21 interventions included a combination of physiological and psychological measures to evaluate their interventions (Connolly et al., 2011; Epton et al., 2014; Delextrat & Neupert, 2016). Connolly et al. (2011) measured self-esteem (Rosenberg scale) and intrinsic motivation (attitudes towards PA) as well as muscular strength (dynamometer), flexibility (sit and reach), and aerobic capacity (20m shuttle run). This study found an increase in self-esteem, aerobic capacity, and upper body strength following a dance intervention but found no significant differences in flexibility or intrinsic motivation. Epton et al. (2014) used the theory of planned behaviour in a multi-layered online intervention with three evaluation points. They looked at four different health behaviours: PA, fruit and vegetable consumption, alcohol consumption, and smoking status (alcohol and smoke consumption were evaluated through biochemical measures taken from a hair sample). They also looked at BMI, and social-cognitive variables for each health behaviour. After 6 months, there were significantly fewer smokers in the intervention group but no other intervention effects. Interventions included in this review had favourable effects on psychological factors more frequently than on physiological ones. Of the interventions that measured psychological factors, 92% reported an improvement in factors such as self-confidence, body image, physical self-perception and depressive symptoms, and of the interventions which measured physiological factors, 73% reported an improvement in factors such as increased aerobic capacity, fat free mass and strength.

Interpersonal. Seven studies (33%) utilized measures associated with the interpersonal level of the ecological model by investigating social and/or interactional factors such as: leadership styles,

perception of instructors, subjective norms and instructor-efficacy. Importantly, all seven of these studies investigated multiple levels of the ecological model. One study looked at all four levels of the ecological model (Moon et al., 1999), three looked at the intrapersonal, and organisational and environmental levels in addition to the interpersonal level (Brooks & Magnusson., 2006; Cooke et al., 2013; Goodyear et al., 2014), and a further three studies looked at the intrapersonal and interpersonal levels of the ecological model (Beauchamp et al., 2007; Bray et al., 2001; Chatzisarantis & Hagger et al., 2009). For example, Chatzisarantis and Hagger (2009) used an intervention where pupils were taught by autonomy-supportive teachers or controls. They measured learning climate, motivational orientations, and leisure time activity to investigate how this intervention based on self-determination theory affected self-reported leisure time activity. They reported stronger intentions to exercise, and more frequent participation in PA in the autonomy-supported group than in the control group.

Organisational and environmental. Only four studies investigated organisational and environmental level factors; these studies considered at least three of the four levels suggested by the ecological model (Brook & Magnusson, 2006; Cooke et al., 2013; Goodyear et al., 2014; Moon et al., 1999). Cooke et al. (2013) and Goodyear et al. (2014) are two of the five studies which utilized theoretical frameworks: Theory of planned behaviour and Cooperative learning theory, respectively. Cooke et al., (2013) enrolled fourth-year medical students to look at the effect of a pedometer and goal-setting intervention on PA behaviour, and intentions to promote PA in future practice. The intervention primarily addressed the organisational aspect of the level as it was integrated as part of a 4-week course in primary care. On the other hand, Goodyear et al. (2014) addressed mostly the environmental aspect of this level as the school which hosted the intervention held specialist sports college status. The study looked at how the teaching of PE could be reconceptualised to give young females responsibility and ownership of their learning by adapting the learning climate. The environment allowed the lead researcher, a teacher at the school, to pilot a Cooperative Model with the use of flip cameras and role-play in an eight-week block of basketball. The remaining two studies at this level were both organisational and environmental. In one study, eleven intervention schools made organisational changes to their environment in pursuit of the Wessex Healthy Schools Award (Moon et al., 1999). The schools took part in an audit which included a pupil's health questionnaire and semi-structured interviews with key members of the schooling community. In the other, a newly appointed head of PE, supported by the head teacher trained staff and introduced a modified PE program to encourage greater participation. Modifications were made to the form of provision by employing part-time staff and increasing activity options, investments were made in terms of equipment and decoration of the sports facilities, and students redesigned the PE uniform.

Policy and legislation. Only one study included in this review looked at factors within the policy and legislation level of the ecological model (Moon et al., 1999). Although more articles were identified in the selection process, only one met the inclusion criteria. Moon et al. (1999) considered all levels of the ecological model and was also one of the two studies which utilised mixed methods. The study was framed by the requirements of the Wessex Healthy Schools Award (WHSA), which is validated by the government agency OFSTED (Office for Standards in Education) and aimed to change health promotion policy and practice within intervention schools (intervention schools n=11; controls schools n=5). This mixed-gender study found that females aged 14-16 made the greatest progress in all aspects, including health-related knowledge, and behavioural attitude. The school audit also found an increase in widening the community, improvements in the environment and a 10% rise in respondents that felt well informed regarding the WHSA. These findings illustrate that multi-level approaches to intervention may have positive cumulative effects, which are observable at each level of the ecological model.

Discussion

The purpose of this review was to synthesise evidence pertaining to the characteristics of PA interventions aimed at UK-based females aged 14 -25, to explore the factors used to evaluate intervention impact, and to formulate recommendations for future PA intervention research through an ecological perspective. To our knowledge, this is the first study that has systematically reviewed interventions in this setting and population. The results generated several points of discussion, namely around the predominance of intrapersonal factors and quantitative methods in intervention research; and the setting, recruitment and activity options that constitute those interventions.

The results show that intervention effectiveness is predominantly assessed by factors that fall under the intrapersonal level of the ecological model. These factors are central to understanding how individuals or groups have been impacted physiologically and/or psychologically by an intervention. However, this approach provides very little insight into other effects or factors influencing the outcomes of the intervention. For example, interpersonal factors such as the influence of instructor-participant and participant-participant relationships, or environmental and organisational factors such as facilities and infrastructure, and their effects on PA adherence are not considered. A recent review agrees with this suggestion (Camacho-Miñano et al., 2011). It identified two high-quality comprehensive interventions developed in line with ecological approaches (Pate et al., 2005; Webber et al., 2008). Pate et al. (2005) increased levels of regular PA for high school-aged females through implementing a girls-only PE program. The intervention was accompanied by a supportive school

environment, school health services, staff health promotion and both family and community-based activities.

The vast majority of the studies included in this review used quantitative methods to assess the impact of interventions. Literature suggests that historically this has been the case, and these studies can successfully assess direction and strength of trends but are unable to explain uptake, maintenance and attrition (Allender, Cowburn & Foster, 2006). Importantly, this review also identified a lack of qualitative research, which has the potential to highlight the experiences of young UK-based females' engagement in PA interventions. A large number of systematic reviews which have focused on promoting PA in young female population have excluded qualitative studies (e.g. Biddle et al., 2014; Camacho-Minano et al., 2011; Pearson et al., 2014; Sallis et al., 2000), thus precluding the possibility to recognise the potential benefits of qualitative methodologies in understanding this population. Furthermore, the main focus has been on quantifying benefits in the short term (from pre to post intervention); but in order to produce sustainable behaviour change a holistic approach that includes mixed methods may be needed to capture PA habits over time (Bauman et al., 2012). As per our findings, mixed method studies are also sparse, but they are potentially a richer representation of intervention effects because quantitative results can be better explained with concomitant qualitative data. Also for this reason, these studies may be less likely to be unpublished due to lack of significant results (Rothstein, Sutton, & Borenstein, 2006).

A substantial proportion of interventions reviewed took place in education, which implies that research within other settings is lacking and female populations such as stay-at-home mums and young professionals are excluded. Universities and schools were the most common settings. There are almost 160,000 female university students in the UK aged 17-25 (Department of Education, 2016) making universities a good setting for evaluating interventions. However, these young females are also thought to be some of the most active people in society who are least affected by potential barriers to PA associated with young populations (Maas et al., 2006). On the other hand, schools have been acknowledged as an ideal setting for the promotion of positive health behaviours, and it is argued that schools should assume a leadership role in ensuring that young people engage in sufficient PA each day (Kahn et al., 2002; Pate et al., 2006). However, a dependency on the schools as primary providers of PA is likely to contribute to the dramatic drop reported in female participation rates when participation in PA moves from an adult-managed to a participant-led activity (Sallis et al., 2000). There has been a call for an increase in community-based interventions as opposed to school-based interventions. The main arguments are that, the reduction in PE curriculum time and the traditionally low importance attributed to PE may limit the potential of school-based interventions to influence students, and young females

in particular (Trudeau & Shepherd, 2005; Pate et al., 2007). Adequate PE in the way of time and resources, which attends to gender disparities, would attenuate the challenges that physical educators face in relation to girls' PA. Interventions consisting of modified PE programs have had positive effects on PE engagement, and should therefore be considered when attempting to tackle specific barriers faced by this population (e.g. Chatzisarantis & Hagger, 2009; Goodyear et al., 2014; Brook & Magnusson, 2006). Additional evidence suggests that school-based interventions have been successful in increasing factors such as self-confidence, which may be used as a platform to acquire the psychological resources needed to engage in community-based activities (Brooks & Magnusson, 2006).

This review found that school-based interventions are the most effective in influencing positive short-term (from pre- to post-intervention) psychological outcomes. However, the compulsory nature of enrolment and participation adopted within most schools may play a large role in influencing outcome and effectiveness measures but do not guarantee continuation. Psychological factors improved more frequently and strongly than physiological factors. On the one hand, interventions may not have been of sufficient frequency and duration for participants to accrue physiological benefits (Chatzisarantis & Hagger, 2009). On the other hand, the psychological benefits they did accrue, such as self-efficacy and intention to exercise, have been shown to be determinants of exercise adherence which over a period of time have the potential to produce physiological benefits (Biddle et al., 2005).

The activity options available to participants were not only very limited, but also largely restricted to one activity per intervention. A previous literature review suggests that interventions should increase choice and offer a wide range of non-competitive and innovative activities that promote enjoyment especially in females (Camacho-Miñano et al., 2011). Barbeau et al. (2007) add that in developing such interventions, the characteristics of the population must be carefully considered. Kasser and Lytle (2005) go further to suggest that inclusive PA has many benefits, especially within a community setting, and advocate for activities which appeal and engage participants of different ages and backgrounds as this is believed to foster a sense of community, belonging and acceptance. Most relevant to community-based interventions are factors such as religion, socio-economic status and race (Barbeau, et al., 2007). Culturally-tailored interventions should acknowledge, and be built upon cultural beliefs and practices that include culturally appropriate activities (Martinez, 2009). In sum, the focus' of the reviewed studies has made it difficult for the interventions to attend to factors across the levels of the ecological model. However, considering intrapersonal, interpersonal and environmental factors, exposure to a variety of activities for an intervention period with viable exit routes into community settings may be effective in causing long-term behavior change among females.

The ecological model has been successfully used to guide interventions in a variety of health behaviours including disease management, nutrition interventions and smoking cessation (Sallis, Owen, & Fisher, 2008). Although not extensively researched in the context of PA, several studies in the area have concluded that interventions benefit from the consideration of multi-level factors captured by the ecological model. For example, in a German preschool setting De Bock, Genser, Raat, Fischer and Renz-Polster (2013) found that community-based approaches led by parents were able to promote physical activity and reduce sedentary behaviours in pre-schoolers. Additionally, Brown et al.'s (2009) study of American pre-schoolers and Sallis, Bauman and Pratt's (1998) review of adults in industrialised countries concluded that environment and policy play an important role in increasing PA levels. Similarly, Wilbur, Chandler, Dancy, Choi and Plonczynski (2002) conducted focus groups with forty-eight women who identified policy and environmental factors as influential in their PA behaviours and decisions. Culture was also identified as important, and the authors concluded that environments and policies need to be culturally and socially sensitive to positively impact PA within specific female sub-groups. In combination, these studies demonstrate the successful implementation of interventions that consider factors across ecological levels, but they also illustrate the requisite for consideration of multi-level factors during intervention development and intervention research.

Limitations

The limitations of the current review must be acknowledged. Firstly, the variability within studies in terms of measures, duration, and intervention type made statistical comparisons and grouping challenging, but by opting for a narrative systematic review we were able to include more studies and extract patterns across different methodologies. Secondly, the decision to only include UK-based interventions in this population limits the generalisability of our findings. Many interventions were excluded because they did not segregate gender in their analyses, or because they took place outside the UK. However, it was important to define the context of the interventions because we were looking for patterns of methodology and results within each of the levels of the ecological model.

Recommendations

The current review offers a detailed analysis of UK-based PA interventions aimed at females aged 14-25 years old. We have been able to highlight some patterns in the literature and make meaningful suggestions for design of future interventions and research: (i) To gain detailed understanding of the factors involved in behaviour and lifestyle change, study designs should implement diverse strategies that correspond with multiple levels of the ecological model. (ii) More mixed methods, triangulation

studies, and longitudinal evaluations would provide better evidence and lead to understanding of sustained intervention effects. (iii) Future research should aim to investigate diverse female sub-groups including cultures and demographics so that interventions can be appropriately tailored. (iv) Interventions should offer a wider range of activities and enhance participant input to increase enjoyment, and potentiate adherence and long-term behaviour change.

Conclusion

In conclusion, PA interventions designed considering the influence and dynamic interplay of multi-level factors suggested by the ecological model are likely to be valuable in promoting sustainable PA; such interventions aimed at young females are currently lacking. Future research should employ a variety of methodologies to evaluate intervention effectiveness.

Study 2: The effects of a 9-month school-based physical activity intervention study on the intrapersonal characteristics of young females

Introduction

Regular physical activity (PA) is a vital component of a healthy lifestyle. Research has shown that it can improve a range of psychological and physiological conditions such as depression, obesity, cardiovascular disease and hypertension (e.g., Warburton, Nicol & Bredin, 2006). Although, the beneficial effects of PA on health are well-documented, physical inactivity remains the fourth leading risk factor for global mortality from non-communicable diseases (WHO, 2008). Up to 50 % of adults in the UK are insufficiently active and activity levels have been shown to decrease with age (NHS, 2018). These age-related decreases are especially observed in the transition from childhood to adolescence (Cooper et al., 2015) and, in females, results in extremely low levels of activity (Townsend et al., 2012). Therefore, decelerating the decline in PA participation and increasing participation rates in adolescent girls, have both become public health priorities (Okely et al., 2017). Researchers have addressed these priorities by investigating the effectiveness of PA interventions aimed at this population in attempts to establish a best practise intervention model.

Study 1 found that the majority of interventions aimed at young females in the UK took place in educational settings and focussed on intrapersonal factors (Hull, de Oliveira & Zaidell, 2018). Educational settings have been used for interventions and in research probably because this is where young females spend most of their days, as mentioned by Kriemler and colleagues (2011). In addition, the compulsory nature of education between the ages of 5 and 16 in the UK, make school-based interventions the most applicable. The vast majority of school-based interventions included in the Study 1 adopted the study design of either a randomised control trial or a pre-post group comparison study and all took the approach of modifying physical education (PE) programs to increase engagement. Modifications included collaborating with external PA providers to deliver sessions (Connolly, Quinn & Redding, 2011), making changes to the physical environment such as upgrading equipment and facilities (Moon et al., 1999), and increasing student input regarding provision and leadership (respectively, Chatzisarantis & Hagger, 2009; Goodyear, Casey & Kirk, 2014). Such interventions had promising results and suggest that successful intervention programmes encourage ownership of PA and involve adaptations to traditional provision (e.g., inclusion of external providers). However, studies

investigating the effectiveness of school-based interventions for increasing females' PA levels have produced inconsistent findings.

School-based intervention effectiveness was recently evaluated in two meta-analyses (Borde et al., 2017; Owen et al., 2017). Borde et al. (2017) investigated whether interventions increased PA in adolescents by pooling 12 randomised controlled trials. They found small and non-significant intervention effects between the control and intervention groups for both overall PA and moderate-to-vigorous PA (Cohen's $d = 0.02$ and 0.24 respectively¹). Similarly, Owen et al. (2017) investigated whether interventions increased PA in adolescent females by pooling the results of 17 studies. After removing an outlier, they found very small positive intervention effects which approached significance (number of studies = 16, Hedge's g effect size² = 0.07 , $p = .05$). Voskuil, Frambes and Robbins (2017) also investigated the effect of PA interventions on young females (aged 6-18) in different settings. Their systematic review synthesised 15 randomised control trials with objectively measured outcomes of PA, body mass index and percentage of body fat. They found limited statistically significant differences between intervention and control groups for the three measures. From the 12 studies that reported an effect size, all but one reported small effect sizes (Cohen's $d < 0.2$) and six of these were school-based. Small effect sizes for school-based interventions are consistent across the literature, this is understandable because studies designs have been similar and a vast majority of studies focus on either the physiological effects or the psychological effects of intervention.

The second finding of Study 1 was that all 21 studies focussed on intrapersonal factors to measure intervention effectiveness (Hull et al., 2018). Intrapersonal factors are those which are specific to the individual and can be demographic, physiological or psychological (Sallis, Owen & Fisher, 2015). Demographic factors of age and gender are known strong correlates of PA because from childhood to adolescence, PA decreases drastically in females (e.g., Biddle et al., 2011). Other factors such as non-white ethnicity and low socio-economic status negatively relate with PA (Biddle et al., 2005). Physiological factors have also been studied in this population. In addition to body mass index and percentage of body fat, aerobic fitness, upper body strength, and flexibility have been the most frequent physiological factors used to measure intervention effects. For example, Connolly et al. (2011) explored the impact of a dance intervention aimed at 14-year-old females. They found a significant increase in aerobic capacity and upper body strength and a trend for increased flexibility (10.5%, 6% and 2% respectively). Finally, a variety of psychological factors have also been studied. For example, DeBate et al. (2009) investigated the psychosocial impact of a running intervention focussed on positive emotional, social and mental development. The researchers assessed self-esteem, body size satisfaction, as well as commitment, values, attitudes and motivation towards PA in 1034 females aged

8-15. Results showed a significant positive effect of intervention for self-esteem and body size satisfaction (both $p < .001$). Although demographic, physiological and psychological factors have been investigated extensively, and understanding a range of factors is important in this population (Humbert et al., 2006), Study 1 found only three studies that investigated a combination of physiological and psychological effects as a result of PA intervention.

The Theory of Planned Behaviour (TPB; Ajzen, 1985) is one of the most frequently adopted models to explore the psychosocial factors involved in performing health behaviours (Johnston, French, Bonetti & Johnston 2004). A meta-analysis reviewing the use of the TPB has provided empirical support for its capacity to predict health behaviours such as smoking and healthy eating (Conner & Sparks, 2005). TPB is an extension of the Theory of Reasoned Action which was first proposed by Fishbein and Ajzen (1975; Ajzen & Fishbein, 1980). The Theory of Reasoned Action was developed to explain and predict behaviour through three constructs: behavioural attitude (BA), subjective norms (SN), and intention (INT). It was built on the premise that the intention to perform a particular behaviour is determined by the attitude towards the behaviour and the perception of subjective norms associated with the behaviour (Ajzen, 1985). Later, the concept of perceived behavioural control (PBC) was added to the model to account for an individual's belief that they have control over exhibiting a particular behaviour. This addition finally formed the TPB (Ajzen, 1991; see figure 1).

Despite the extensive and successful application of TPB in various adolescent populations, a large amount of variance in participants' PA behaviour have remained unexplained (e.g. Martin et al., 2005; Martin, Oliver & McCaughy, 2007; Plotnikoff et al., 2013). Several authors have attributed this to the limited nature of social-cognitive models which exclude multi-level ecological predictors (Gourlan et al., 2016, Rhodes et al., 2018). Further, these authors noted that there is a considerable overlap between some of the key social-cognitive models such as Protection Motivation Theory, Transtheoretical Model, Social Cognitive Theory and TPB. No particular social cognitive model has been more effective than another in producing PA behaviour change. However, Plotnikoff et al.'s meta-analysis of Self-Determination Theory, Health Promotion Model, Social Cognitive Theory, Transtheoretical Model and TPB found that TPB had the strongest explanatory power within adolescent populations. Researchers have investigated whether the inclusion of additional constructs would improve the predictive validity of TPB. For example, Conner and Armitage (1998) conducted a review of additional constructs which included belief salience, past behaviour, moral norms, self-identity, affect and perceived behaviour control / self-efficacy. They concluded that the addition of constructs often improved predictive validity and suggested that the addition of a construct to TPB would need to align with the nature of the behaviour. In another review, Hagger, Chatzisarantis and Biddle (2002) also

explored additional constructs of self-efficacy and past behaviour. They found that the TPB accounted for 27% of the variance in physical activity behaviour and that self-efficacy was a significant predictor of PA. With the addition of self-efficacy, the model accounted for 50.3% of the variance in intention and 29.1% of the variance in behaviour. The authors concluded that self-efficacy and past behaviour are important additions to the model. As it was important to this study to understand the proximal predictors of intentions and behaviour for young females rather than a motivational sequence in this chapter we use an extended version of TPB that includes self-efficacy and past physical activity (see figure 1).

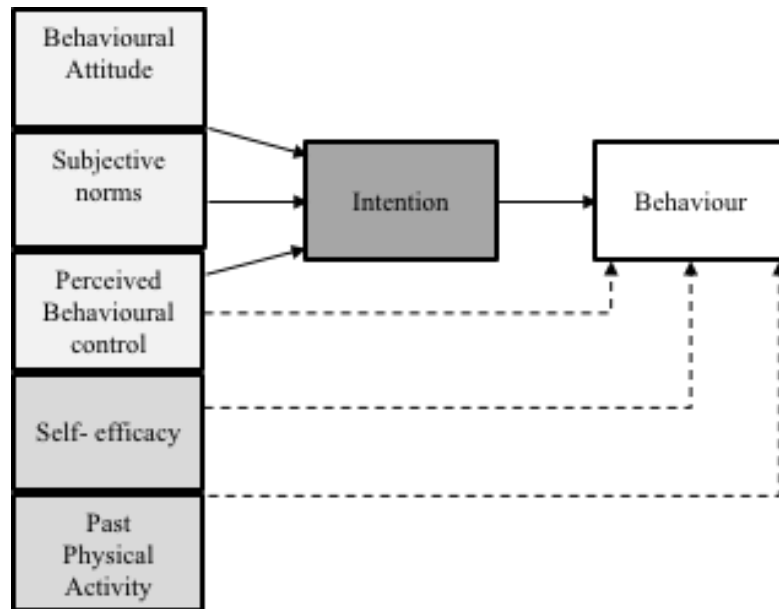


Figure 1. Extended theory of Planned Behaviour Model (Figure adapted from Ajzen, 1991). Behavioural attitude, Subjective norms and Perceived behavioural control constructs contribute to form Intention which has a direct relationship with Behaviour. Perceived Behavioural Control also has a direct relationship with Behaviour. Self-efficacy and Past Physical Activity have been added to form an extended version for the purpose of this study.

In summary, school-based interventions have been used to tackle low levels of PA in young females. Most interventions have been evaluated through intrapersonal factors though physiological and psychological factors have rarely been combined. Therefore, this study aims to evaluate the effects of two school-based programs on adolescent females aged 14-16 (one physical education and one PA intervention). We consider the dimensions that comprise the extended TPB and both the physiological and psychological components of the ecological model's intrapersonal level. We hypothesised that compared to the physical education program, the PA intervention program would be more effective in

improving psychological factors as measured by the extended TPB and physiological factors most frequently associated with health and fitness in young female populations (Study 1) measured by a series of health and fitness-related tests.

Method

Participants

Female students aged 14.2 (\pm .43) years old were recruited from two state schools in South East London, United Kingdom to take part in a prospective study approved by London South Bank University Ethics Committee (Ethics approval number SAS1554). Students from one school formed the intervention group ($n = 49$; 14.1 years \pm .38) and students from a neighbouring school formed the control group ($n = 41$; 14.3 years \pm .47). Each group consisted of two Year 10 female-only classes. Through physical education teachers, a total of 122 young females were approached and 90 participants took part in measurements at baseline and/or post-test and/or follow-up. At baseline 83 participants were recruited and took part in measurements, 74 participants took part in post-tests, and 46 participants took part at follow-up. Figure 2 shows the number of participants at each data collection point and the number of participants who participated in repeated measures. The majority of participants identified as an ethnic minority (91%) and on average participants spent 7.3 (\pm 6.1) hours a day sitting.

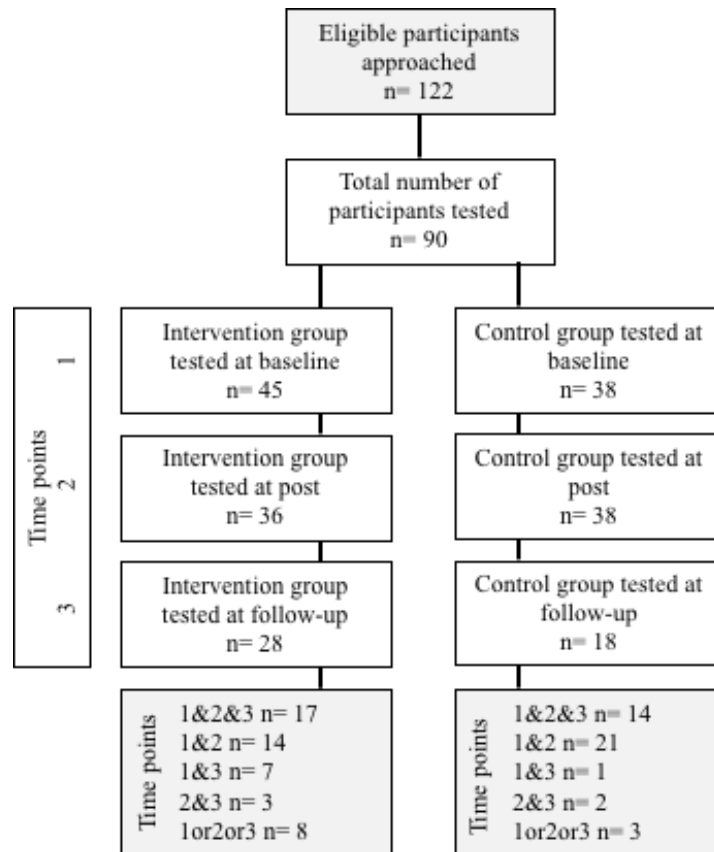


Figure 2. Flowchart of participant numbers at each data collection point (Time point 1 = pre, Time point 2 = post, Time point 3 = follow-up). The bottom grey boxes show the number of participants who were tested at a combination of time points. For each dependent variable, these numbers may differ slightly due to incomplete data.

Procedure

Following parental consent, sought through school physical education teachers, participants provided informed written consent to participate in the study. All participants visited the university sport centre to complete a series of behavioural questionnaires, and physical health and fitness tests, both before and after the program period (respectively, weeks 1 and 12). Only the questionnaires were completed again at week 40 (i.e., 9 months; See figure 3 for procedure details). At pre and post-program testing, trained study assistants conducted the physical health and fitness tests in two circuits, which the participants visited in small groups. The tests were performed in a specified order with sufficient rest between them (see Appendix 1 for details). During rest, participants were asked to complete the questionnaires individually under the supervision of the lead researcher (i.e., the author of this thesis). In total, the pre- and post-program testing sessions lasted 90 min each, and the follow-up session lasted 30 min. Between the pre and post-program testing, the intervention group participated in a 10-week

intervention program delivered by a local council-commissioned youth sports organisation (from October to December 2016). After post program testing, the students returned to national curriculum PE and the youth sports organisation delivered a workshop for the teachers to share some of their engagement strategies. The control group, from a neighbouring school, participated in compulsory national curriculum-based PE lessons and were tested before and after a 10-week period (from January to April 2017).

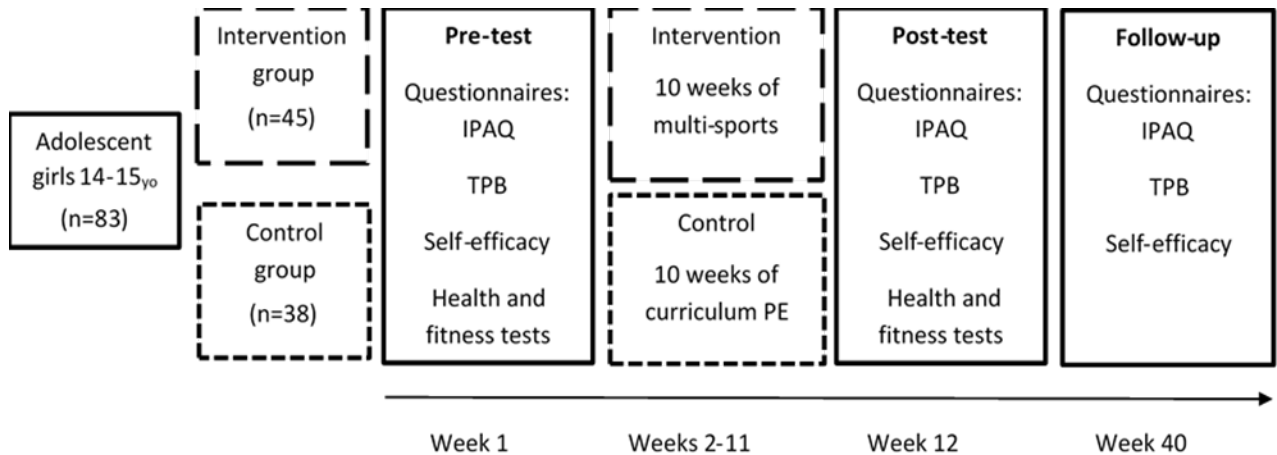


Figure 3. Schematic diagram for the study procedure including timeline of testing. Pre-programme testing was conducted at week 1, the program was delivered between weeks 2 and 11, the post-program testing was conducted at week 12 and the follow-up testing was conducted at week 40.

Programs

Control group program. The control group took part in curriculum-based PE classes. The national curriculum (Department for Education, 2013) requires PE lessons for pupils at Key Stage 4 (ages 14-16) to incorporate complex and demanding physical activities engaging them in a range of activities that develop personal fitness and promote a healthy and active lifestyle. A variety of individual, team, indoor, outdoor, school-based and community-based activities are recommended to fulfil these requirements. In the weeks between the pre- and post-program testing, the control group participated in four weeks of trampolining, four weeks of dance and on two weeks participants were offered the freedom to join in a variety of self-managed individual activities set-up around the gymnasium (e.g. netball shooting, trampolining, dancing, gymnastics; see Table 1). The teacher-led PE lessons took place once per week and lasted 120 min.

Intervention group program. The intervention group took part in the ‘This Girl Can Lambeth’ (TGCL) intervention program, which offered fitness-based and non-curriculum activities to young females, in place of their usual PE lessons throughout the London Borough of Lambeth (see table 1). The project,

funded by Sport England and influenced by their key performance indicators, aimed to expose young females (14+) to a variety of novel and engaging activities. Building rapport and a foundation for sustained participation in community-based exit routes was an important aim of the project. The deliverers and activities were taken from the local community making the program inherently tailored to the target population, accessible post-intervention and incorporable into an out-of-school active lifestyle. Additionally, to tackle common barriers to PA such as self-efficacy and body image the 10-week intervention program incorporated workshops and encouraged PA ownership by increasing participant input in each session (see Table 1). Community-based coaches delivered the sessions within schools to maximise contact, adherence and potential for sustained participation. In the weeks between the pre- and post-program testing, the intervention group participated in two workshops, and two sessions each of boxing, dodgeball, dance and basketball. A choice of activity was a part of all PA sessions to give participants the opportunity to create innovative group activities (e.g. combining elements of dodgeball and basketball to create a new game). The intervention sessions took place once per week and lasted 120 min.

Table 1. Intervention and PE programs completed by the two groups over a 10-week period. Both programs included choice of activity (intervention more than control) which consisted of group activities in the intervention group, and individual activities in the control group (see text for further detail).

Week	Intervention program	PE program
1	Pre-program testing	Pre-program testing
2	Empowerment workshop	Trampolining
3	Boxing and Choice of activity	Trampolining
4	Dodgeball and Choice of activity	Trampolining
5	Dance and Choice of activity	Trampolining
6	Basketball and Choice of activity	Choice of activity (Various)
7	Body image workshop	Dance
8	Boxing and Choice of activity	Dance
9	Dodgeball and Choice of activity	Dance
10	Dance and Choice of activity	Dance
11	Basketball and Choice of activity	Choice of activity (Various)
12	Post-program testing	Post-program testing

Outcome measures

The *primary outcome measures* were PA level, perceived behavioural control (PBC), subjective norms (SN), behavioural attitude (BA), intention (INT) and self-efficacy. The instruments used to collect these data are detailed in Table 2. PA level, TPB variables and self-efficacy (constructs from Figure 1) items were presented as a quiz on paper. This quiz was developed from the original three questionnaires to be interactive and engaging for this population. From the answers obtained from some of the questionnaire items participants could calculate a score. With this score they were matched with one of four popular British female athletes. On a handout, they could see the athletes and a short motivational message (See Appendix A). This quiz was piloted for ease, attractiveness and clarity, respectively with the PA providers, university students, and the target population. The *secondary outcome measures* for health were height, weight, body composition, blood pressure, resting heart rate, lung function (Circuit 1), and for fitness were grip strength, leg power, cardio-vascular fitness and hamstring and lower back flexibility (Circuit 2). These tests, administered in two circuits consisting of a series of tests, were piloted with first year sport science students in September 2016 (n = 18, aged 18-22 years, M = 18.9, SD = 1.2). The pilot study helped to develop the order and timings of circuit rotations so testing could be as efficient as possible and therefore more attractive to schools and participants. The pilot study also served the purpose of familiarising the study assistants with the testing procedures and the refinement of measurement instructions (See Appendix B). The secondary outcome measures chosen for the current study were included and administered in this way to deliberately cover a variety of health and fitness variables that are relevant for young developing bodies, but also to encourage short sharp periods of effort to keep the participants engaged and enthused. In the following sections, the primary and secondary outcome measures will be described in more detail (For overview see Table 3).

Primary outcome measures

Physical activity levels. Self-reported PA during the 7 days preceding the testing was recorded using the standardised short-form version of the international physical activity questionnaire (IPAQ, 2002). Participants reported the number of days and minutes per day that they performed vigorous physical activity, moderate physical activity and walking, along with the number of hours per day spent sitting. Physical activity level for each participant was calculated according to the IPAQ guidelines as an accumulation of time spent walking and participating in moderate or vigorous activity per week. Physical activity level scores were calculated according to the IPAQ guidelines and the calculation component score was the sum of ((walking METs 3.3 × min per day × days per week)+(moderate PA METs 4 × min per day × days per week)+(Vigorous PA METs 8 × min per day × days per week)) (IPAQ,

2004). IPAQ guidelines consider scores under 600 MET-min/week to be insufficiently active, scores between 600 and 3000 MET-min/week to be minimally active and scores above 3000 MET-min/week to be HEPA active (health enhancing physical activity).

Behaviour and attitude. The theory of planned behaviour questionnaire (Ajzen, 2013) was adapted prior to data collection to make it specific to the population and the intervention as instructed under the guidelines for constructing a theory of planned behaviour questionnaire. Specifically, the intervention duration and frequency was added to all questions, and ‘school’ and ‘parents’ were added to the following questions respectively *“Work and school cannot prevent me from exercising at least once per week for the next 12 weeks”* *“My parents think that I Should not: 1 2 3 4 5 :Should exercise at least once per week for the next 12 weeks”*. The TPB questionnaire included twelve questions regarding perceived behavioural control (n=3), subjective norms (n=4), behavioural attitudes towards PA (n=4) and intention (n=1). Participants were required to circle the extent to which they agreed with each item on a Likert scale from 1 to 5 (e.g. *“Most of my friends would find exercising at least once per week for the next 12 weeks; Unenjoyable: 1 2 3 4 5: Enjoyable”*).

Self-efficacy. Self-efficacy regarding exercise adherence was assessed through three items that asked participants how confident they were about maintaining exercise for specified lengths of time. We specified the lengths of time to capture the 12 week intervention period and subsequent periods up to one year (i.e., 3, 6 and 12 months) on a 10-point percentage scale from 0% (not at all confident) to 100% (highly confident). For example, *“How confident are you that you can participate in an activity once a week for 1 hour without quitting for 6 months”*.

Table 2. Overview of primary outcome measures. For questionnaire design, see Appendix A.

Primary outcome measure (Behavioural)	Instrument	Dimensions/Sub-scales
Physical activity levels	International physical activity questionnaire (short-form)	Vigorous Moderate Walking Sitting
Behaviour and attitude	Theory of planned behaviour questionnaire	Behavioural attitude Perceived behavioural control Subjective norms Intention
Self-efficacy	PA Self-efficacy questionnaire (adapted)	Different lengths of time: 3 months 6 months 12 months

Secondary outcome measures

Health. In the first circuit, participants performed a series of health-related tests (See Table 3 for measurement procedure). Height (cm) was recorded whilst participants stood upright and without shoes against a stadiometer (Leicester Height Measure, Invicta Plastics LTD, United Kingdom). Body mass (kg), body composition (percentage of fat mass and fat-free mass) and body mass index (BMI) were measured/calculated using a bioelectric impedance analyser (MC-980MA, Tanita, Netherlands) following the manufacturers recommended procedure while participants were in light clothing without shoes. Blood pressure (BP; mmHg) of the right brachial artery and resting heart rate (bpm) were measured following 10 min seated rest using a digital automatic blood pressure monitor (MX2, Omron, Japan). Two readings of the systolic BP, diastolic BP and resting HR were recorded with 60 s rest between each measurement. The lowest recorded systolic BP and lowest resting HR was used for analysis. Lung function (forced expiratory volume in 1 s; FEV1 in L) was measured using a handheld spirometer (MK1 MicroPlus, Care Fusion, United Kingdom). Following a demonstration by a study assistant, participants were instructed to inhale maximally and then forcefully exhale into the mouthpiece of the spirometer to empty the lungs as fast as possible. Participants repeated the lung function test three times with each test separated by 60 s, the largest recording was entered for analysis.

Fitness variables. In the second circuit, participants performed a series of fitness tests (see Table 3 for details). Grip strength (kg) was measured using a digital hand-held dynamometer (T.K.K.5401, Takei, Japan). Three attempts for the dominant hand were performed and the largest value was entered for analysis. Leg power was measured as the height (cm) of three maximal counter-movement jumps on a jump mat (Newtest, Powertimer 1.0, Finland). Each jump was separated by 5-7s rest. Hamstring and lumbar flexibility was measured using a stand-and-reach platform. Participants were given three attempts to bend at the hips and with straight legs reach as far as they could whilst pushing the attached digital ruler (cm; Flexmeter 1860, Takei, Japan). Finally, to evaluate cardio-vascular fitness participants performed a 3-min YMCA step test on a 30 cm aerobics step at a cadence of 96 steps per min. Heart rate was recorded with a heart rate monitor (bpm; Favor, Polar, Finland) immediately at the end of the step test and again following one minute of seated rest.

Table 3. Description of procedures for secondary outcome measures taken at pre and post testing

Secondary outcome measure (units) (H)= Health (F)= Fitness	Measurement procedure
Blood pressure (mmHg) (H)	Blood pressure of the brachial artery was taken twice for each participant using a digital automatic blood pressure monitor (MX2, Omron, Japan) after participants rested for 10 minutes. Blood pressure assessments were taken behind a secluded screen to limit environmental influences.
Resting, exercising & recovery heart rates (bpm) (H/F)	Resting heart rate was taken during blood pressure evaluation using the digital pulse display of the blood pressure monitor (MX2, Omron, Japan). Participants were fitted with a heart rate monitor (Favor, Polar, Finland) and performed a 3-minute YMCA step test on a 30cm aerobics step, and at a cadence of 96 steps per minute. Heart rate was recorded immediately at the end of the step test and again following one minute of seated rest.
Lung function (FEV1) (H)	After a demonstration by research staff, participants were instructed to inhale maximally and then forcefully exhale into the mouth-piece of the spirometer (MK1 MicroPlus, Care Fusion, United Kingdom) as fast and as long as possible to completely empty the lungs. The volume of air expelled within one second (forced expiratory volume in one second; FEV1) was recorded using the digital display. Participants repeated the lung function test 3 times with each test separated by 60 seconds
Height (cm) & Body composition (H)	Without shoes, each participant stood upright against the stadiometer (Leicester Height Measure, Invicta Plastics LTD, United Kingdom) and looked straight ahead. Participant height was recorded whilst they took an inward breath. Measurements were taken to 1 decimal place. Participant heights were then used for full body composition analysis using multi-frequency bio-impedance analysis (MC-980MA, Tanita, Netherlands); weight, fat percentage, fat free mass and BMI were measured and recorded.
Leg power (cm) (F)	Participants were asked to do three maximal counter-movement jumps on a jump mat (Newtest, Powertimer 1.0, Finland) with 5-7 s recovery in between. Jump height was recorded in cm.
Hamstring & lower back flexibility (cm) (F)	On a stand-and-reach platform, participants were asked bend at the hips with legs straight and reach as far as they could whilst pushing the attached digital ruler (Flexmeter 1860, Takei, Japan). Participants were given three attempts.
Grip strength (kg) (F)	Using a digital hand-dynamometer (T.K.K.5401, Takei, Japan), each participant was asked to extend their arm above their head and squeeze handle as they lowered their arm to their side. Force in kg was recorded for 3 attempts for both the left and right hand.

Statistical analysis

Group comparisons at baseline were conducted for all primary and secondary outcome measures and are reported in Appendix C. There were group differences in that intention and systolic blood pressure showed better values for the intervention group, while exercising heart rate and recovery heart rate showed better values for the control group. The remaining 15 variables showed no group differences and therefore we proceeded with the planned analyses. To evaluate the long-term and short-term

effects of the intervention, we submitted the primary dependent variables to a 3×2 mixed ANOVA for effects of time (pre, post and follow-up) and group (intervention and control). Because considerably more participants were tested at pre and post, we also conducted a 2×2 mixed ANOVA for effects of time (pre and post) and group. To evaluate if the primary independent variables (TPB, self-efficacy and past PA levels) predicted the dependent variable (PA levels), we did a multiple linear regression using the Enter method (Model 1: TPB variables; Model 2: Model 1 and self-efficacy; Model 3: Model 2 and past PA levels; Model 4: Model 3 and Group). To evaluate the short-term effects of the intervention, we also submitted the secondary dependent variables to a 2×2 mixed ANOVA for effects of time (pre and post) and group. Where applicable data are presented as means and standard error with accuracy restricted to two decimal places. All variables were tested for normal distribution using the Shapiro-Wilks test of normality and non-parametric comparisons were used where appropriate. Significance level was set at $p < .05$. Where appropriate degrees of freedom were adjusted for violations of sphericity using the Huynh-Feldt correction. All statistical analyses were conducted using SPSS (IBM statistical software version 21, United States).

Reliability analysis was carried out on the behavioural attitude, subjective norms, perceived behavioural control and intention dimensions of the TPB questionnaire comprised of $n = 4$, $n = 4$, $n = 3$ and $n = 1$ item(s) respectively. Cronbach's alpha at pre, post and follow-up showed the questionnaire to reach acceptable reliability of $\alpha = .0.77$, $\alpha = 0.73$ and $\alpha = 0.84$ respectively. Similarly, for the three self-efficacy questions the Cronbach's alpha showed that the individual questions reached acceptable reliability ($\alpha = .0.81$, $\alpha = 0.75$ and $\alpha = 0.79$ respectively). We used the standardised IPAQ questionnaire and based on previous literature including a 12-country reliability and validity study, the questionnaire is very reliable with Spearman's ρ clustered values around 0.8 and an acceptable criterion validity median rho of about 0.30 (Craig et al., 2003). As we adapted the TPB and self-efficacy questionnaires, validity was established through a number of steps. Firstly, face validity was established by asking research colleagues ($n = 17$) how well they felt the questionnaires measured self-efficacy and the Theory of planned behaviour dimensions, secondly the questionnaires were piloted with university students ($n = 37$) and feedback was given on the clarity of the questions, thirdly the questionnaires were revised and finally they were piloted with a sample of the target population ($n = 29$) who also gave feedback on the questionnaires. Small revisions were made as a result of these pilots, but no further validity testing was conducted.

Results

Baseline population characteristics

At baseline there were no significant differences between the control and the intervention group for physical activity level, sitting time, weight or height. However, due to the testing schedule, the control group were two months older than the intervention group which was found to be significant (see Table 4).

Table 4. Baseline characteristics of intervention group and control group.

Group	Age (years)	BAME Ethnicity (%)	IPAQ (MET-min/ week)	Sitting time (min p/d)	Weight (kg)	Height (cm)
Intervention n=45	14.10 (SD=.38) n=39	90.4	3273.74 (SD=3278.8) n=35	471.09 (SD=347.63) n=33	60.06 (SD=16.51) n=40	161.94 (SD=6.75) n=44
Control n=38	14.31 (SD=.47) n=32	92.8	3029.32 (SD=3116.1) n=32	404.67 (SD=386.24) n=30	60.58 (SD=12.80) N=32	161.79 (SD=7.15) n=36
Group testing	U=498, p=.05	n/a	U=516, p=.51	U=370, p=.09	U=582, p=.51	t(78)=.10, p= .92

Note. Group testing was conducted using a *t*-test where data were normally distributed and a Mann-Whitney *U* test where data were not normally distributed.

Primary Outcome Measures

Long-term intervention effects

The following results include all participants that were tested despite not completing all points of data collection. There were 17 participants in the intervention group and 14 participants in the control group who participated in all data collection points. From pre, to post, to follow-up there were no significant effects within or between the groups for physical activity levels, behavioural attitude, subjective norms or self-efficacy (See Figure 4). The results showed the following effects for perceived behavioural control and intention.

Perceived behavioural control. There was a main effect of time on perceived behavioural control $F(2, 52) = 4.01, p = .02, \eta^2 = .13$, because scores improved from pre to post to follow-up (respectively: $M = 3.63, se = .16, M = 3.68, se = .14$ and $M = 4.12, se = .12$). There was no main effect of group, $F(1, 26) = .22, p = .65, \eta^2 = .01$. There was a trend for a Time \times Group interaction $F(2, 52) = 2.66, p = .08, \eta^2 = .09$, because for the intervention group scores worsened from pre to post and then improved at follow-up whereas the control group improved from pre to post to follow-up (See Figure 4).

Intention. There was no main effect of time on intention, $F(2, 52) = 0.94, p = .40, \eta^2 = .04$. There was a trend for a main effect of group, $F(1, 26) = 3.45, p = .07, \eta^2 = .12$, because the intervention group scored significantly higher on intention than the control group (respectively: $M = 4.06, se = .15$; $M = 3.64, se = .17$). There was no Time \times Group interaction $F(2, 52) = 1.09, p = .34, \eta^2 = .04$.

Physical activity levels. There was no main effect of time on PA levels, $F(2, 50) = .07, p = .93, \eta^2 = .00$. There was no main effect of group, $F(1, 25) = .56, p = .46, \eta^2 = .02$. There was no Time \times Group interaction $F(2, 50) = 1.08, p = .35, \eta^2 = .04$.

Behavioural attitude. There was no main effect of time on behavioural attitude, $F(2, 56) = 2.28, p = .112, \eta^2 = .08$. There was no main effect of group, $F(1, 28) = 1.01, p = .32, \eta^2 = .04$. There was no Time \times Group interaction $F(2, 56) = .69, p = .51, \eta^2 = .02$.

Subjective norms. There was no main effect of time on subjective norms, $F(2, 54) = 0.66, p = .52, \eta^2 = .02$. There was no main effect of group, $F(1, 27) = .41, p = .53, \eta^2 = .02$. There was no Time \times Group interaction $F(2, 54) = 1.07, p = .34, \eta^2 = .35$.

Self-efficacy. There was no main effect of time on self-efficacy, $F(2, 52) = .15, p = .86, \eta^2 = .01$. There was no main effect of group, $F(1, 26) = 3.45, p = .07, \eta^2 = .12$. There was no Time \times Group interaction $F(2, 52) = 1.18, p = .29, \eta^2 = .04$.

Short-term intervention effects

There were 31 participants in the intervention group and 35 participants in the control group who participated in data collection pre and post program. From pre, to post there were no significant effects within or between the groups for physical activity levels, subjective norms, perceived behavioural control or self-efficacy. The results showed the following effects for behavioural attitude and intention.

Behavioural attitude. There was a trend for a main effect of time on behavioural attitude, $F(1, 60) = 3.25, p = .08, \eta^2 = .05$, because scores improved from pre to post program (respectively: $M = 4.03, se = .10$; $M = 4.23, se = .09$). There was a main effect of group, $F(1, 60) = 5.53, p = .02, \eta^2 = .08$, because the intervention group had significantly better attitudes than the control group (respectively: $M = 4.31, se = .11$; $M = 3.96, se = .10$). There was no Time \times Group interaction, $F(1, 60) = .12, p = .73, \eta^2 < .01$.

Intention. There was no main effect of time on intention, $F(1, 58) = 2.13, p = .15, \eta^2 = .04$. There was a main effect of group, $F(1, 58) = 6.28, p = .02, \eta^2 = .10$, because the intervention group scored significantly higher on intention than the control group (respectively: $M = 4.00, se = .14$; $M = 3.52, se = .13$). There was a trend for a Time \times Group interaction, $F(1, 58) = 3.41, p = .07, \eta^2 = .06$, because scores

in the intervention group decreased from pre to post whilst scores in the control group increased (respectively: $M= 4.26$, $se= .19$ to $M= 3.74$, $se= .18$; $M= 3.49$, $se= .17$ to $M= 3.55$, $se= .16$).

Physical activity levels. There was no main effect of time on PA levels, $F(1, 53) = .03$, $p = .86$, $\eta^2 = .00$. There was no main effect of group, $F(1, 25) = .56$, $p = .46$, $\eta^2 = .02$. There was no Time \times Group interaction $F(1, 53) = .04$, $p = .83$, $\eta^2 = .00$.

Perceived behavioural control. There was no main effect of time on perceived behavioural control, $F(1, 59) = .05$, $p = .82$, $\eta^2 = .00$. There was no main effect of group, $F(1, 25) = .56$, $p = .46$, $\eta^2 = .02$. There was no Time \times Group interaction $F(1, 59) = .05$, $p = .83$, $\eta^2 = .00$.

Subjective norms. There was no main effect of time on subjective norms, $F(1, 60) = .01$, $p = .93$, $\eta^2 = .00$. There was no main effect of group, $F(1, 60) = .01$, $p = .94$, $\eta^2 = .00$. There was no Time \times Group interaction $F(1, 60) = 1.17$, $p = .28$, $\eta^2 = .02$.

Self-efficacy. There was no main effect of time on self-efficacy, $F(1, 55) = .01$, $p = .93$, $\eta^2 = .00$. There was no main effect of group, $F(1, 55) = 1.10$, $p = .30$, $\eta^2 = .02$. There was no Time \times Group interaction $F(1, 55) = .53$, $p = .47$, $\eta^2 = .01$.

Predictive value of primary variables

Long-term. In evaluating the predictive value of the independent variables (TPB, SE, past PA and group) on the primary outcome measure, PA level, the multiple linear regression models failed to explain the variance in PA levels at follow-up [Model 1: $F(4, 26) = .81$, $p = .53$, $R^2 = .01$, $R^2_{Adjusted} = -.03$; Model 2: $F(5, 25) = .89$, $p = .50$, $R^2 = .15$, $R^2_{Adjusted} = -.02$; Model 3: $F(6, 24) = .88$, $p = .52$, $R^2 = .18$, $R^2_{Adjusted} = -.02$; Model 4: $F(7, 23) = .79$, $p = .61$, $R^2 = .19$, $R^2_{Adjusted} = -.05$]. This result was also reflected in the group data. PA levels for the intervention group were 3729.89, 2852.86, 2975.14 MET-min/week at pre, post and follow-up, whereas for the control group they were 2976.42, 4446.69, 4283.00 MET-min/week. When looking at the individual contributions of the predictors none of independent variables were significant predictors of PA level (see appendix D).

Short-term. In evaluating the predictive value of the independent variables (TPB, SE, past PA and group) on the primary outcome measure, PA level, the multiple linear regression Model 1, which included all the TPB variables, failed to explain the variance in PA levels post intervention, $F(4, 45) = .81$, $p = .53$, $R^2 = .07$, $R^2_{Adjusted} = -.02$. Model 2, which also included self-efficacy, also failed to explain the variance in PA levels, $F(5, 44) = 1.43$, $p = .23$, $R^2 = .14$, $R^2_{Adjusted} = .04$. Model 3 however, which also included previous PA levels, explained 29% of the variance in PA levels, $F(6, 43) = 2.90$, $p = .02$, $R^2 = .29$, $R^2_{Adjusted} = .19$. Model 4, which included group, explained 33% of the variance in PA levels, $F(7, 42) = 2.97$, $p = .01$, $R^2 = .33$, $R^2_{Adjusted} = .19$.

Adjusted = .22. When looking at the individual contributions of the predictors, Model 3 and 4 showed that past PA level was the only significant predictor of PA level post intervention. Although Model 4 explained more of the variance in PA levels overall, group membership alone was not a significant predictor (see Appendix D).

When the multiple linear regression was conducted separately for each group, the models failed to explain PA levels variance for the intervention group [Model 1: $F(4, 18) = .46$, $p = .76$, $R^2 = .09$, $R^2_{Adjusted} = -.11$; Model 2: $F(5, 17) = .58$, $p = .71$, $R^2 = .15$, $R^2_{Adjusted} = -.11$; Model 3: $F(6, 16) = .80$, $p = .59$, $R^2 = .23$, $R^2_{Adjusted} = -.06$]. For the control group, while Model 1 failed to explain the variance in PA levels, $F(4, 22) = 1.00$, $p = .43$, $R^2 = .15$, $R^2_{Adjusted} = .00$, Model 2 showed a trend in explaining 38% of the variance, $F(5, 21) = 2.58$, $p = .06$, $R^2 = .38$, $R^2_{Adjusted} = .23$, and Model 3 significantly explained 57% of the variance, $F(6, 20) = 4.50$, $p = .01$, $R^2 = .57$, $R^2_{Adjusted} = .45$. PA levels for the intervention group were 3921.56 and 3285.16 at pre, and post, whereas for the control group they were 3004.47 and 3834.22.

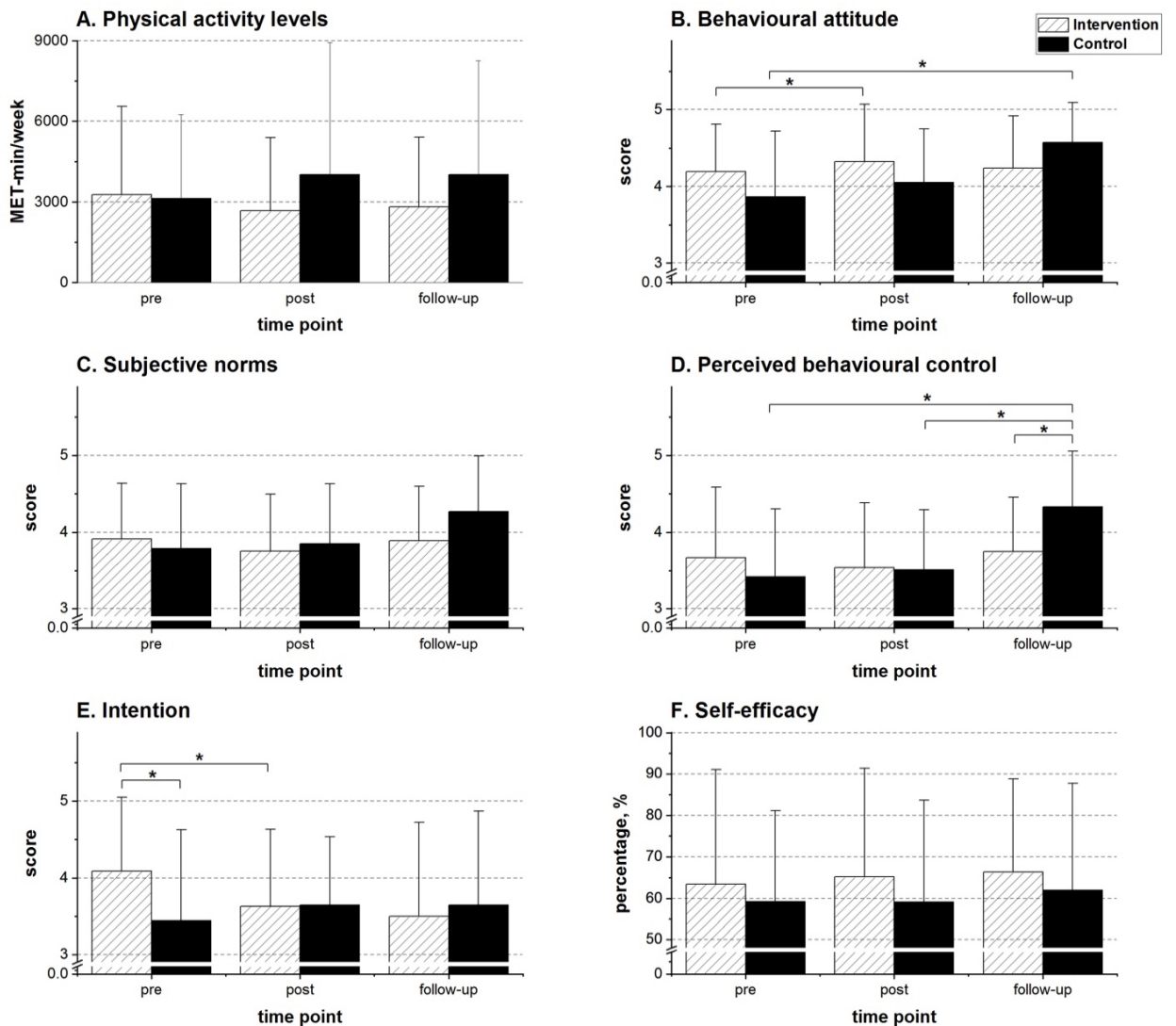


Figure 4. Short-term and long-term program effects for the primary measures. Population means \pm SD are depicted for intervention group and the control group. Error bars represent SD. PA level scores of 600-3000 MET-min/week represent minimal activity levels and scores above 3000 MET-min/week represent health-enhancing activity levels. Self-efficacy is given as a percentage where 0 is not confident at all and 100 is completely confident. The remaining four panels are TPB variables with scores varying from 1 to 5 with a score of 5 being the most desirable. Horizontal lines with asterisks represent statistically significant differences.

Secondary outcome measures

Short-term intervention effects

From pre, to post program there were no significant effects within or between the groups for diastolic blood pressure, lung function, and grip strength. Results for the remaining outcome measures are reported below (See Table 5).

Heart rates. There was no significant main effect of time on resting heart rate. There was a main effect of group, $F(1, 54) = 7.27$, $p = .01$, $\eta^2 = .12$, because heart rates were significantly lower in the control group than the intervention group. There was no Time \times Group interaction, $F(1, 54) = .29$, $p = .59$, $\eta^2 = .01$. There was a main effect of time on exercising heart rate, $F(1, 56) = 5.38$, $p < .05$, $\eta^2 = .09$, because measurements improved from pre to post. There was no group effect, $F(1, 56) = 1.97$, $p = .17$, $\eta^2 = .03$. There was a Time \times Group interaction, $F(1, 56) = 11.59$, $p < .05$, $\eta^2 = .17$, because the intervention group improved whilst heart rates in the control group worsened. There was a main effect of time on recovery heart rate, $F(1, 55) = 9.31$, $p < .05$, $\eta^2 = .15$, because measurements improved from pre to post. There was a main effect of group $F(1, 55) = 4.48$, $p = .04$, $\eta^2 = .08$, because recovery heart rates were significantly better for the control than the intervention group. There was a Time \times Group interaction, $F(1, 55) = 4.22$, $p < .05$, $\eta^2 = .07$, because heart rates in the intervention group improved more from pre to post than those in the control group.

Systolic blood pressure. There was a main effect of time, $F(1, 62) = 5.68$, $p < .05$, $\eta^2 = .08$, because measurements improved from pre to post program. There was no group effect, $F(1, 62) = .00$, $p = .97$, $\eta^2 = .00$. There was also an interaction between Time \times Group for systolic blood pressure, $F(1, 62) = 14.17$, $p < .05$, $\eta^2 = .19$, because blood pressure in the intervention group worsened slightly from pre to post whilst in the control group it improved.

Body composition. There was a significant effect of time on weight, $F(1, 54) = 9.50$, $p < .05$, $\eta^2 = .15$, because weight increased in both groups from pre to post. There were no significant effects of group,

$F(1, 54) = .13, p < .72, \eta^2 = .00$, or Time \times Group interaction, $F(1, 54) = .02, p < .90, \eta^2 = .00$. There was no significant effect of time or group on body fat percentage, respectively $F(1, 54) = .22, p < .64, \eta^2 = .00$ and $F(1, 54) = .94, p < .34, \eta^2 = .02$. There was a Time \times Group interaction, $F(1, 54) = 10.78, p < .05, \eta^2 = .17$, because fat percentage decreased more from pre to post in the control group than in the intervention group. There was a main effect of time on skeletal muscle mass, $F(1, 54) = 13.53, p < .05, \eta^2 = .20$, because measurements increased for both groups from pre to post. There was no main effect of group, $F(1, 54) = .03, p < .87, \eta^2 = .00$. There was a Time \times Group interaction for muscle mass $F(1, 54) = 5.87, p < .05, \eta^2 = .10$, because muscle mass increased more from pre to post in the control group than in the intervention group. There was a main effect of time on BMI, $F(1, 55) = 5.38, p < .05, \eta^2 = .09$, because it increased in both groups from pre to post. There were no significant group or Time \times Group effects, respectively $F(1, 55) = .72, p < .40, \eta^2 = .01$ and $F(1, 55) = .20, p < .66, \eta^2 = .00$.

Fitness. There was a trend for a main effect of time on leg power, $F(1, 50) = 3.21, p = .08, \eta^2 = .06$, because scores improved for both groups from pre to post. There were no significant group or Time \times Group effects, $F(1, 50) = 0.04, p = .84, \eta^2 < .01$ and $F(1, 50) = 1.62, p = .21, \eta^2 = .03$. There were no significant main effects of time or group on flexibility, respectively $F(1, 64) = 0.13, p = .72, \eta^2 < .01$ and $F(1, 64) = 0.64, p = .43, \eta^2 = .01$. There was a Time \times Group interaction, $F(1, 64) = 5.88, p < .05, \eta^2 = .08$, because scores decreased from pre to post in the intervention group whilst they increased in the control group.

Diastolic blood pressure. There was no main effect of time on diastolic blood pressure, $F(1, 62) = .22, p = .64, \eta^2 = .00$. There was no main effect of group, $F(1, 61) = .09, p = .76, \eta^2 = .00$. There was no Time \times Group interaction $F(1, 62) = .00, p = .95, \eta^2 = .00$.

Lung function. There was no main effect of time on lung function, $F(1, 60) = .04, p = .85, \eta^2 = .00$. There was no main effect of group, $F(1, 60) = .70, p = .41, \eta^2 = .01$. There was no Time \times Group interaction $F(1, 60) = .74, p = .39, \eta^2 = .01$.

Table 5. Scores for the secondary measures taken pre and post program (mean and SD). Measures were recorded at week 1 and week 12 only. Significant main and interactions effects are noted as T for Time, G for Group, and T×G for interaction and the direction of main effects are noted in the last column.

Measures (units)	Intervention group		Control group		2×2 ANOVA	Main effects
	Pre	Post	Pre	Post		
Systolic BP (mmHg)	110.27 (10.56)	111.77 (11.42)	114.44 (9.37)	107.76 (11.67)	T, T×G	pre<post
Diastolic BP (mmHg)	67.63 (7.47)	67.10 (10.96)	69.79 (8.59)	69.09 (11.01)	n/s	-
Lung function (FEV1)	2.42 (.41)	2.45 (.54)	2.55 (.48)	2.50 (.45)	n/s	-
Resting HR (bpm)	80.75 (14.84)	82.75 (14.10)	74.31 (8.80)	74.62 (8.85)	G	PE<PA
Exercising HR (bpm)	164.74 (20.05)	149.96 (21.08)	150.37 (17.22)	153.17 (13.50)	T, T×G	pre>post
Recovery HR (bpm)	123.73 (19.77)	110.55 (16.90)	109.74 (18.44)	107.17 (16.37)	T, T×G, G	pre>post PA>PE
Leg power (cm)	26.21 (5.77)	26.63 (5.57)	15.46 (6.60)	27.93 (5.16)	T	pre<post
Flexibility (cm)	8.68 (7.79)	7.31 (8.71)	9.04 (8.25)	10.06 (7.59)	T×G	-
Grip Strength (kg)	27.74 (5.53)	27.98 (4.76)	27.50 (5.23)	27.47 (5.04)	n/s	-
Weight (kg)	58.45 (13.12)	59.38 (13.07)	59.58 (9.35)	60.44 (9.57)	T	pre<post
Fat (%)	29.89 (7.49)	30.66 (7.19)	32.40 (4.98)	31.38 (5.44)	T×G	-
Muscle (kg)	38.17 (5.61)	38.41 (5.63)	37.95 (4.79)	39.08 (5.23)	T, T×G	pre<post
BMI (kg/m ²)	22.10 (4.42)	22.35 (4.36)	22.90 (3.20)	23.27 (3.33)	T	pre<post

Discussion

The aim of this study was to evaluate the effects of two school-based programs on adolescent females aged 14-16 (one physical education and one PA intervention). We considered the dimensions that comprise the extended TPB and both the physiological and psychological components of the ecological model's intrapersonal level. We hypothesised that compared to the physical education program, the PA intervention program would be more effective in improving psychological factors as measured by the extended TPB and physiological factors measured by a series of health and fitness-related tests. The main result showed that one program did not produce clear superior benefits over the other. However, both groups showed improvements on both psychological and physiological parameters of

health and fitness. These include improvements in perceived behavioural control, behavioural attitude, intention, cardiovascular health, body composition and leg power.

Behavioural measures

The current study provides some support for the efficacy of school-based PA interventions to improve psychosocial factors associated with PA. Perceived behaviour control, which was positive in both groups, increased continuously and significantly in the control group whereas small improvements in the intervention group were only visible at follow-up. The 10-week period was not sufficient to observe significant changes in perceived behavioural control for the intervention group. However, in the intervention group the longer-term implementation by the teachers may have been sufficient to effect change. This is an important result because perceived behavioural control, consisting of dimensions such as control beliefs and perceived facilitation, is thought to directly influence PA behaviour (Holzer & Elster, 2018). For example, having an input or choice of activity and perceiving social and structural support are thought to influence perceived behaviour control. This has been supported by recent studies including Wang and Zhang (2016) who concluded that while behavioural attitude, subjective norms, and perceived behaviour control predicted intention, perceived behaviour control rather than intention was a significant predictor of PA behaviour. Santina and colleagues' (2017) study of psychosocial determinants found perceived behaviour control to have a direct influence on both intention and PA behaviour of 276 schoolchildren living in an urbanised city in Lebanon. In our study, choice of activity was an important feature of the intervention program but it also featured in the control program which may be why there was an improvement in perceived behavioural control for both groups. The increase seen at follow-up may be linked with the maintenance of activity choice and perceived facilitation through teacher involvement post intervention in both groups (Holzer & Elster, 2018). In this connection, encouraging students input and increasing their perceptions of social and structural support may be an avenue to increase young female's engagement in PE and PA in general.

Behavioural attitudes were positive and also improved in both groups from pre to post. The intervention group significantly improved from pre to post and kept better attitudes towards PA than the control group throughout the intervention period. A further comparison revealed the control group improved from pre to follow-up. This means that both interventions were effective in improving attitudes, most likely through the inclusion of workshops and education about the benefits of PA. Multi-component interventions have received attention in the literature. A meta-analysis of 14 school-based multi-component interventions concluded there was limited evidence supporting the effectiveness of multi-component interventions which included an element of education (Russ et al., 2015). Overall they

only found small intervention effects in relation to multi-component interventions increasing PA levels ($d = 0.11$). However, several other reviews have shown support for multicomponent interventions within this population, finding intervention effects to be larger when the PA element was accompanied by an education element (e.g. Owen et al., 2017; Pearson, Braithwaite & Biddle, 2015; Sallis, Prochaska & Taylor 2000). The current study supports these findings as the intervention program included educational workshops, while the National curriculum PE program includes both practical and theoretical elements. This finding suggests that to increase intervention effectiveness and improve young female's attitudes towards PA it may be important to educate them about PA and its health benefits alongside getting them active.

The intentions of the intervention group were stronger than those of the control group at baseline but they decreased and became similar to the control group at post and follow-up. The difference at pre may have been caused by a level of anticipation or the novelty involved in being enrolled in the intervention program, however the intervention program was unable to maintain the high level of excitement. Creating a sense of excitement around changing behaviour through innovative programs has become a common intervention strategy. For example, Lin et al., (2006) investigated the effect of a social computer game which linked a player's daily step count to the growth and activity of an animated virtual character for 14 weeks. They concluded that the game served as a catalyst for improving attitudes towards PA and promoting exercise. However, similar to the intervention group in our study, the authors also observed an anticipation and excitement around the game that engaged participants but noted that most participant's enthusiasm in the game decreased after 2 weeks. This is an important finding as changes in behavioural intentions (an accumulation of BA, SN & PBC) have been found to significantly predict increases in PA (Jacobs et al., 2011). Despite strong intentions at pre, the current study saw no improvements in PA levels. This finding indicates that interventions with variety and novel activities throughout the whole period are likely to be more effective in increasing or maintaining intentions.

In this study the TPB variables were unable to predict PA behaviour. This is in line with some studies which concluded that additional constructs may be useful in increasing the explanatory capacity of the model (Hagger, Chatzisarantis & Biddle, 2001). The addition of self-efficacy improved the amount of variance explained but not significantly. It was only with the addition of past PA behaviour that the model significantly explained 29% of the post PA behaviour. A previous meta-analysis found 29% of variance explained with only the addition of self-efficacy to the TPB variables (Hagger et al., 2002). However, the population in the studies were both male and female and ranged in age from 8.2 to 71.5 years. Still, the addition of past PA behaviour was found to significantly improve the variance explained.

This was both because it influenced behaviour directly, and because it influenced it indirectly through the TPB constructs and self-efficacy. In the present study it was only past behaviour that predicted future behaviour. This is important because the intervention program forfeited some of the time allocated to PA in favour of targeting behavioural indicators and education. Our results suggest that this may not have been the best strategy in such a short intervention period.

No significant changes were observed in subjective norms, self-efficacy or PA levels. This finding suggests that across the 40-week study period both the intervention program and the PE program were effectively countering the acknowledged decline in PA levels usually seen among adolescent females. Dumith et al's., (2011) systematic review and pooled analysis of 26 longitudinal studies found a PA decline between the ages of 9 and 15 at the rate of around 7% per year. However more recent longitudinal research, including a study investigating the changes in PA participation for 729 adolescent females aged 11-18, and a review of 23 studies investigating the PA changes in 13-18 year olds (respectively, Eime et al., 2016; Kemp et al., 2018), concluded that rather than seeing large decrements in total PA, the mode and setting of participation changed over time. For example, school-based PA and competitive PA decreased over time, however non-competitive forms of PA increased such as active transport. This finding highlights a possible direction for future research. The categorisation of PA (organised, non-organised, competitive, non-competitive etc) may allow for individual modes and settings of PA to be assessed, potentially creating a more accurate picture of PA engagement which interventions can target.

Health and fitness measures

The current study provides considerable support for the efficacy of school-based PA interventions in improving health and fitness parameters associated with PA. Significant improvements were observed in exercising and recovery heart rates of the intervention group (respectively 9% decrease and 11% increase in HR). However, for the control group there was a slight increase (2%) in exercising- and decrease (2%) in recovery HR. This suggests that for the intervention group, the PA program was of sufficient intensity to improve cardiovascular fitness. The reduction in exercising heart rate indicates a greater capacity to perform aerobic activity likely due to a more efficient cardiovascular system and the body's ability to take in and utilise oxygen for energy-producing processes (Armstrong, 1998). The cardiovascular fitness of the control group pre-program may explain differences in the findings between groups over time. Overall, the control group had better indicators of cardio-vascular fitness from the onset of the study as measured by resting, exercising and recovery heart rates. When compared with the intervention group the control groups resting, exercising and recovery heart rates

were, 8%, 9% and 11% lower, respectively. A previous study has found that the average resting heart rate of 2789 Brazilian girls aged 16.5 (± 1.3) to be 81.1 bpm (Farah et al., 2015). Amongst European adolescents across nine countries the average resting heart rate for a healthy adolescent female (aged 14.7 \pm 1.2) was 81.3 bpm (Julián-Almárcegui et al., 2016). Within this context, resting heart rate for the control group (74.3 bpm) were lower than average, whilst the intervention group exhibited similar values (80.8 bpm) to those found in previous studies. Superior cardiovascular fitness of the control group at the onset of the programme may require greater intensities of PA to produce increases in cardiovascular fitness. Although the activities in the PE program should in principle be of sufficient intensity to improve fitness, intensity was not explicitly measured in the current study. However, the findings suggest that the intervention activities were effective in improving exercising and recovery HR, and therefore cardiovascular fitness, in participants with lower initial levels of fitness. The findings are in accordance with those of Boreham, Wallace and Neville (2000), who found that a 7-week stair climbing program significantly improved mean exercising heart rate in sedentary young females. This suggests that programmes of short duration may be effective for improving fitness in the target population.

The significant improvement seen in systolic blood pressure from pre to post was due to the 6% decrease seen in the control group only. Previous research investigating cardiorespiratory fitness and cardiovascular health in 259 young females aged 14.7 (± 1.2) from 10 cities across Europe, reported an average systolic blood pressure of 113.2 (± 11.6) in adolescent females (Ruiz et al., 2015). Compared with adolescent girls across Europe, the systolic BP of both groups were already well within the expected range which is also a healthy range for this age (NHLBI, 2018). A recent review of 26 PA interventions aimed at 6-18-year olds found that school-based PA had very limited effects on both systolic and diastolic blood pressure, however studies with positive results tended to have shorter intervention periods (Dobbins et al., 2017). This indicates that overall intervention characteristics such as activity type, intensity, and frequency implemented in the school-based interventions may not have been sufficient to produce benefits to the circulatory system of adolescent females. One study in the review that had positive effects on systolic and diastolic blood pressure was an intervention program targeting cardio-vascular risk factors in urban girls (Bayne-Smith et al., 2004). The intervention integrated vigorous exercise, health and nutrition education and behaviour modification, and consisted of 30-minute classes (5-10 min education and discussion and 20-25 min vigorous activity) 5 days a week. It is likely that the frequency and intensity of the multi-component classes were a key factor in the interventions success. In the current study intensity was not monitored and although sessions were 120 min each they took place once per week. This comparison suggests that short, frequent and high

intensity sessions may be effective in improving blood pressure and cardiovascular health in this population.

Interestingly the current study found an increase of skeletal muscle mass in both groups despite there being no significant changes in PA levels for either group. Muscle mass and fat percentage improved more in the control group than in the intervention group. This indicates that the PE activities of trampolining and dance may be more effective in increasing muscle mass and reducing fat percentage than the activities included in the intervention program. This is an important finding as youth obesity is a public health concern due to its detrimental effects both physiologically and psychologically. Morrison et al., (2015) investigated the relationship between body composition and psychological well-being in 244 young people aged 8-17 upon their entry into a weight management program. The study found high rates of depression among participants (36%) and through multivariate analysis the extent body fat predicted both depression and low health-related quality of life. Studies using non-obese populations showed that weight and BMI increase with time until late adolescence (Berger et al., 2016), and therefore normal adolescent growth may have influenced the findings in the current study. Further, the increases in body weight and BMI seen may be attributed at least in part to increased muscle mass in both groups. The findings suggest that in addition to BMI it is useful to use additional measurements of body composition within this growing/developing population. Even with their increased BMIs the participants in this study are comparable to the BMIs of the 1231 adolescent females aged 12-17 years old included in the HELENA study (BMI: 21.2 ± 3.5 ; Julián-Almárcegui et al., 2016). This is encouraging because poorer dietary and PA habits ethnic minorities, who comprise over 90% of the population in our study, are at higher risk of cardio-vascular disease (Lurbe et al., 2016).

Increases in leg power were observed in both groups from pre to post; these improvements may be due to the leg-dominant activities included in both programs (e.g. dance and trampolining) and also support the above finding of increased muscle mass. Ivanshchenko et al's (2017) assessment of 85 girls aged 14-16 attributed the significant difference in arm and leg strength between the 14-year olds and 16-years olds at baseline to developmental differences. Similarly, growth may have contributed to the increased leg power seen across the groups between pre and post but it is possible that the activities included in the PA intervention and the PE program such as basketball, dodgeball, dance and trampolining were sufficient to increase both strength and speed. Previous research has associated explosiveness and dynamic strength with an overall increase in lower-body strength (Secomb et al., 2015) so it is possible that the programs increased lower-body strength in this population. The study also saw flexibility decrements in the intervention group while hamstring and lower back flexibility increased by 10% in the control group. This may be because the two activities that comprised the PE

program (trampolining and dance) are both activities that promote flexibility of the lower-body muscles (Seredynski & Polak, 2015). The findings are in accordance with a dance intervention aimed at adolescent athletes (aged 13.6) found that after 3 and 8 months of weekly dance classes' joint mobility, muscle flexibility, speed and agility had improved. This suggests that if sustained over a period of time activities such as dance have the potential to increase the flexibility of adolescents.

No significant improvements were observed in diastolic BP, lung function, or grip strength. All three of the variables remained stable in both groups. For diastolic blood pressure and lung function the group averages fell within healthy ranges (Julián-Almárcegui et al., 2016), and for grip strength the groups exceed the average grip values suggested by the instrument guidelines. This means participants already demonstrated good cardio-vascular/circulatory health and high levels of forearm and hand strength. This finding also suggests that neither program was sufficient to improve these parameters of health and fitness as there may have been little room for improvement. To achieve significant improvements in such parameters more targeted exercise programming may be required.

In summary, exercise has the potential to benefit health in young females and programs tailored to meet the needs of this population have produced increases in PA levels (Connolly et al., 2011; Hanson, Allin, Ellis & Dodd-Reynolds, 2013). Although the intervention program was designed to target psycho-social factors surrounding PA in young females, the anticipated positive changes in PA levels were not observed. In this case, it is difficult to draw firm conclusions regarding which program was more effective, as the extent and sustainability of the improvements seen, appear to vary between measures. Further, adherence and behaviour change are key factors for promoting PA participation and the intervention program was not necessarily more successful than the control program in achieving this. Biddle, Braithwaite & Pearson's (2014) meta-analysis found that interventions lasting 12 weeks or less are most effective, but the present findings suggest that an intervention period longer than 10-weeks may be necessary when targeting a variety of psycho-social and physiological factors. Still, it is worth emphasising that the values observed in the participants of this study were positive which may speak for the impact of national and local campaigns to get girls active.

Study limitations

The present study has several limitations which provide directions for future research. Firstly, self-report measures were used for physical activity levels. These measures may be subject to response bias, estimation error and peer influence, especially with adolescent populations; this may have skewed the strength of relationships between the girls' behaviour and the TPB variables. Pedometers and accelerometers may provide a more accurate and objective alternative. Secondly, although we used a

demographically similar sample, the groups showed some differences at baseline. The nature of school-based interventions means that the participants could not be randomised, however a larger sample and a lower attrition rate may have provided us with better quality data.

Conclusion

In conclusion, both curriculum PE and an exercise intervention tailored for young females within the school setting are able to improve intrapersonal psychological and physiological parameters of health, fitness and wellbeing. The PA intervention with its emphasis on self-efficacy, autonomy and enjoyment was not sufficient to produce clear superior benefits compared with curriculum PE. Qualitative research is required to gain a better understanding of what barriers and facilitators impact the PA levels in young urban females.

Appendix A: Questionnaire and Quiz

Code: _____

THIS GIRL CAN BE ACTIVE QUIZ

Vigorous

Vigorous activities require lots of physical effort, make you breathe much harder than normal and last for at least 10 minutes. E.g. **heavy lifting, sport, or fast cycling**

1. During the last 7 days, on how many days did you do vigorous physical activities?
 ___ days per week None (go to question 3)

2. On average, how long did you spend doing vigorous activities on each of those days?
 ___ hours ___ minutes per day

Moderate

Moderate activities require some physical effort, make you breathe slightly harder than normal and last at least 10 minutes. E.g. **Carrying light loads, steady cycling** (do not include walking)

3. During the last 7 days, on how many days did you do moderate physical activity?
 ___ days per week None (go to question 5)

4. On average, how long did you spend doing moderate physical activities on each of those days?
 ___ hours ___ minutes per day

DURING THE LAST 7 DAYS...

Walking

Think about the walking you have done in the last 7 days at school, work or home, walking from place to place, and **any walking** done for leisure, exercise or recreation

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
 ___ days per week None (go to question 7)

6. On average, how much time did you spend walking on each of those days?
 ___ hours ___ minutes per day

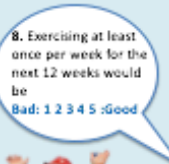
Sitting

Think about the time you have spent sitting down at **home, school and work** in the last 7 days.


7. During the last 7 days, on average how much time did you spend sitting on each day?
 ___ hours ___ minutes per day

YAY OR NAY?


PLEASE CIRCLE (1 2 3 4 OR 5)




8. Exercising at least once per week for the next 12 weeks would be
Bad: 1 2 3 4 5 :Good




9. The people in my life whose opinion I value would
Disapprove: 1 2 3 4 5 :Approve of me exercising at least once per week for the next 12 weeks




10. If I wanted to exercise at least once per week for the next 12 weeks I could
Definitely false: 1 2 3 4 5 :Definitely true




11. Exercising at least once per week for the next 12 weeks would improve my cardio vascular health
Strongly disagree: 1 2 3 4 5 :Strongly agree




12. My parents think that I should not
1 2 3 4 5 :Should exercise at least once per week for the next 12 weeks




13. I have
No control: 1 2 3 4 5 :Total control over exercising at least once per week for the next 12 weeks




14. Work & school cannot prevent me from exercising at least once per week the next 12 weeks
Strongly disagree: 1 2 3 4 5 :Strongly agree




15. To me, my emotional well being is
Unimportant: 1 2 3 4 5 :important




16. My family thinks that exercising at least once per week for the next 12 weeks is
Harmful: 1 2 3 4 5 :Beneficial



17. I will make time to exercise at least once per week for the next 12 weeks
Strongly disagree: 1 2 3 4 5 : Strongly agree



18. To me, managing a healthy weight and being fit is
Worthless: 1 2 3 4 5 :Valuable



19. Most of my friends would find exercising at least once per week for the next 12 weeks
Unenjoyable: 1 2 3 4 5 :Enjoyable

NOT AT ALL CONFIDENT
MODERATELY CONFIDENT
HIGHLY CONFIDENT

20. How confident are you that you can participate in an activity once a week for one hour without quitting for 12 weeks?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
21. How confident are you that you can participate in an activity once a week for one hour without quitting for 6 months?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
22. How confident are you that you can participate in an activity once a week for one hour without quitting for 1 year?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

67

Now the fun part....

Add together your answers from questions 1, 3, 5, 8, 10, 13, 14, 17 and 18 to find out which athlete you are most like!

QUESTION 1 ___ (days)

QUESTION 3 ___ (days)

QUESTION 5 ___ (days)

QUESTION 8 ___

QUESTION 10 ___

QUESTION 13 ___

QUESTION 14 ___

QUESTION 17 ___

QUESTION 18 ___

TOTAL _____

Thank you

Don't forget to collect your result!

Fold Here

THIS GIRL CAN BE ACTIVE

25 & UNDER



Tin-Tin Ho

You have some things in common with up and coming table tennis star Tin-Tin Ho. Exercise should be fun and social, right? It may be early days in your journey, and your exercise maybe in short and light bursts but you are doing a great job, keep it up. Think about inviting some friends to do a fun but fitness related activity.

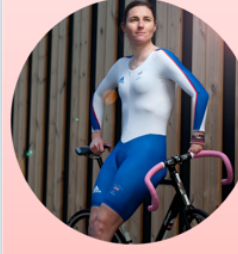
26 TO 35



Zoe Smith

You share some similarities with Olympian weightlifter Zoe Smith. You are both well on your way to being the best you can be, and open to trying new things! As you are already active and doing a fantastic job, maybe think about trying a new activity, sport or exercise regime and making it a weekly thing!

36 TO 45



Sarah Storey

You have been likened to 21 times world champion and Paralympic cyclist Sarah Storey! Being active and healthy is important to you and you always find a way to fit it all in. Your body and mind already feel the benefits, so keep going! Think about stepping up the intensity of your activities to get that little bit more from them.

46 & OVER



Christine Ohuruogu

You and Christine, Great Britain's Track and Field captain have much in common! You are both super active, highly motivated and you are leaders! As your journey is well on its way think about getting your friends and family involved in a group activity you can all enjoy and reap the health rewards of!

Appendix B: Circuit rotation

Circuit 1

Rotation	Questionnaire	Blood pressure	Spirometer	Stadiometer	Tanita
Equipment	Booklet, pencils, Stickers, clipboards	2x BP monitor Screens 2x chairs 1x table	2x spirometer 22x Mouth pieces	1x stadiometer	Tanita Camera USB
1	A, B, C, D, E V, W, X, Y, Z				
2	B, C, E W, X, Y	A/V		D/Y	
3	C/X	B/W	A/V	E/Z	D/Y
4	D/Y	C/X	B/W	A/V	E/Z
5	E/Z	D/Y	C/X	B/W	A/V
6	A/V	E/Z	D/Y	C/X	B/W
7	A, B, D V,W,Y		E/Z		C/X

Note: Letters from A to E pertain to the groupings in the intervention group and letters from V to Z pertain to the groupings in the control group. They were used for rotating through circuit station.

Circuit 2

Rotation	Balance & Ball	Step test & HR	Jump mat (max, rep, PE)	Stand & reach	Grip test	Questionnaire
Equipment	2x Stop watch 2x timer 3x tennis b Tape measure	4x steps HR monitors & straps 2x Speaker 2xmetronome	Jump mat PE scale (booklet)	2x instrument 1x step	2x grip tests	(booklet)
1	A/V		D/Y			
2	B/W	A/V	E/Z	D/Y		
3	C/X	B/W	A/V	E/Z	D/Y	
4		C/X	B/W	A/V	E/Z	
5	D/Y		C/X	B/W	A/V	
6	E/Z	D/Y		C/X	B/W	
7		E/Z			C/X	

Note: Letters from A to E pertain to the groupings in the intervention group and letters from V to Z pertain to the groupings in the control group. They were used for rotating through circuit station.

Appendix C: Group comparisons of primary and secondary measures at baseline.

Measures (units)	Intervention group	Control group	Group testing
Primary measures			
IPAQ	3491.96 (3459.24)	2832.02 (2421.39)	$U = 516.5, p = .59$
BA	4.15 (0.63)	4.0 (0.72)	$U = 481.5, p = .12$
SN	3.93 (0.74)	3.92 (0.71)	$t(68) = 0.65, p = .52$
PBC	3.69 (0.88)	3.50 (0.86)	$t(68) = 1.13, p = .26$
INT	4.10 (0.96)	3.59 (1.12)	$U = 423, p = .021^*$
Self-efficacy	63.89 (27.67)	57.24 (21.57)	$t(64) = 0.68, p = .50$
Secondary measures			
Systolic BP (mmHg)	110.27 (10.56)	114.44 (9.37)	$U = 559.0, p = .024^*$
Diastolic BP (mmHg)	67.63 (7.47)	69.79 (8.59)	$t(78) = 1.61, p = .11$
Lung function (FEV1)	2.42 (.41)	2.55 (.48)	$t(75) = 1.21, p = .23$
Resting HR (bpm)	80.75 (14.84)	74.31 (8.80)	$U = 441.0, p = .004^*$
Exercising HR (bpm)	164.74 (20.05)	150.37 (17.22)	$t(73) = 2.45, p = .02^*$
Recovery HR (bpm)	123.73 (19.77)	109.74 (18.44)	$t(72) = 3.05, p = .003^*$
Leg power (cm)	26.21 (5.77)	15.46 (6.60)	$t(68) = 1.42, p = .16$
Flexibility (cm)	8.68 (7.79)	9.04 (8.25)	$t(78) = 0.44, p = .66$
Grip Strength (kg)	27.74 (5.53)	27.50 (5.23)	$t(76) = 0.06, p = .95$
Weight (kg)	58.45 (13.12)	59.58 (9.35)	$U = 581.5, p = .51$
Fat (%)	29.89 (7.49)	32.40 (4.98)	$U = 510.0, p = .14$
Muscle (kg)	38.17 (5.61)	37.95 (4.79)	$U = 637.5, p = .98$
BMI (kg/m ²)	22.10 (4.42)	22.90 (3.20)	$U = 573.0, p = .45$

Note. Group testing was conducted using a t -test where data were normally distributed and a Mann-Whitney U test where data were not normally distributed. Significant group differences are denoted by *.

Appendix D: Contribution of individual predictors included in regression analysis

Long-term

Model	Variable	r	t	p
1	-	-	-.32	.75
	BA	.15	.69	.50
	SN	-.20	-.91	.37
	PBC	.00	.00	1.00
	INT	.33	1.37	.18
2	-	-	-.18	.86
	BA	.13	.61	.55
	SN	-.27	-1.17	.25
	PBC	.05	.21	.84
	INT	.50	1.74	.09
	SE	-.27	-1.09	.29
3	-	-	-.11	.92
	BA	.18	.81	.43
	SN	-.33	-1.39	.18
	PBC	.08	.31	.76
	INT	.45	1.53	.14
	SE	-.34	-1.33	.20
	Past PA	.21	.93	.36
4	-	-	-.33	.75
	BA	.21	.90	.38
	SN	-.38	-1.48	.15
	PBC	.04	.16	.87
	INT	.45	1.54	.14
	SE	-.28	-1.01	.33
	Past PA	.16	.61	.55
	Group	.14	.59	.56

Short-term

Model	Variable	r	t	p
1	-	-	-.09	.93
	BA	-.04	-.26	.80
	SN	.03	.18	.86
	PBC	.01	.07	.95
	INT	.25	1.40	.17
2	-	-	-.33	.74
	BA	-.03	-.15	.88
	SN	.08	.47	.64
	PBC	-.10	-.54	.59
	INT	.17	.93	.36
	SE	.31	1.93	.06
3	-	-	-.59	.56
	BA	-.03	-.18	.86
	SN	.11	.74	.47
	PBC	-.10	-.51	.61
	INT	.14	.86	.39
	SE	.15	.93	.36
	Past PA	.42	2.99	.01
4	-	-	-1.36	.18
	BA	-.01	-.03	.97
	SN	.08	.52	.60
	PBC	-.11	-.64	.52
	INT	.21	1.28	.21
	SE	.15	.94	.35
	Past PA	.46	3.28	.00
	Group	.22	1.65	.11

Study 3: An exploration of factors that influence PA participation in young females: A participants' perspective

Introduction

It is widely accepted that physical activity (PA) has the potential to impart a range of physiological and psychological benefits to the health of young females (Corr, McSharry & Murtagh, 2018). Yet interventions targeting this population have found it difficult to produce substantial health-enhancing effects (See Study 2). A systematic review examined fifteen objectively measured randomised control trials in 6-18 year-old females (school-based $n = 9$; Voskuil, Frambes & Robbins, 2017). Although the review included eight studies with positive effects on PA, or body mass index, or body fat percentage results were highly variable and the authors concluded that overall the evidence for interventions to increase objectively measured PA, and lower body mass index and body fat percentage was not well supported. A very recent review of school-based PA interventions examined twenty-five accelerometer-assessed randomised control trials (Love, Adams & van Sluijs, 2019). Seventeen trials were included in the meta-analysis but the results showed a very small pooled main effect for daily moderate to vigorous PA which was not statistically significant (standard mean difference = 0.02). The authors concluded that current school-based efforts do not positively impact PA in 6-18 year olds. The study by Voskuil and colleagues (2017) found more positive results partly because it assessed intervention effects on more outcome variables than the study by Love and colleagues (2019). Similar inconclusive results were found in a review of mother and daughter interventions targeting PA, fitness, nutrition and adiposity (Barnes, Young, Murtagh, Collins, Plotnikoff & Morgan, 2018). It assessed 14 studies for the effectiveness of community-based interventions that used parental influence, support and encouragement to positively change behaviour of females aged 3-19 years. The results showed that of the randomised control trials, only one was found to be effective in improving PA.

In the UK it is recommended that children and adolescents achieve a total of at least 60 minutes of moderate or vigorous intensity PA each day (NHS, 2018). Despite this, reports have consistently found that less than half of UK females aged 11-19 participate in 60 minutes of PA across 7 days. Current statistics show that the percentage of sufficiently active UK females drops to as low as 10% by the age of 16 years (Sport England, 2018). Further, studies utilising both objective and self-reported measurements of PA have consistently shown that boys are more active than girls (Brodersen, Steptoe, Boniface & Wardle, 2007; Nader et al., 2008; Troiano et al., 2008; Verloigne et al., 2012) and that PA

declines and sedentary time increases throughout adolescence (Dunmith, Gigante, Domingues & Kohl, 2011; Ortega Porcel et al., 2013; Telford et al., 2013). Previous research has also shown that prior to the ages of 11 and 12 years, a vast majority of children enjoy school physical education (PE) or taking part in PA (Whitehead & Biddle, 2008). However, more recent research has found that declines can be seen as young as 5 years old (Sport England, 2018), and the findings of a recently published longitudinal cohort study of children aged 7-15 in the UK supports this (Farooq et al., 2018). The authors found PA declines were already apparent from the age of 7. Together these findings highlight young females as a public health priority.

The majority of research investigating the PA behaviours of young females and the effects of interventions in this population has only used quantitative methods (Study 1). Study 1 found that of 21 studies included in the review, 19 (90.5%) used quantitative methods while only 4 utilised qualitative methods. However, a systematic review of qualitative studies (n = 24) pertaining to adolescent girls' perceptions of PA has very recently been published (Corr, McSharry, & Murtagh, 2018). The review included studies published in 2001-2016 that explored the views, opinions and perceptions of females aged 12-18 years. Through thematic analysis, the authors identified four overarching themes which relate with the levels of the ecological model described in the introduction to the thesis. Firstly, 'Gender bias in sport' included body-centred issues, societal pressures such as femininity stereotypes, and the influence of peer and teacher feedback. Secondly, 'Motivation and perceived competence', included the effects of low perceived skill and competition, and PA opportunities such as single-sex sessions and activities offered during PE. Thirdly, 'Competing priorities during adolescence' included the increase of schoolwork and home responsibilities, the influence of parental expectations, and changes in priorities regarding leisure activities. Finally, 'Meeting societal expectations' included the influence of peers, the influence of adults and the influence of the community and environment on adolescent girls' perceptions of PA. The authors concluded that it is important to introduce young females to alternative forms of PA that are not team-based and competitive in a variety of settings. They suggest that individuals working with this population should consider the role of perceived motor competence in participants and future research should investigate the potential impact that alternative PA programs have on adolescent females. One study examining the perceptions and motivations towards PA in 47 females aged 14-16 used focus groups and also identified similar multi-level themes (Whitehead & Biddle, 2008). They found that adolescent female PA participation is affected by: social influences and perceived societal norms; the deprioritising of PA; and a lack of motivation. The authors recommend fun, informal and social PA supplemented by parental support and peer mentoring. Together these findings indicate the importance of understanding adolescent female PA participation and the attitudes towards PA among this group.

Therefore, the aim of this study was to qualitatively explore the effect of a PA intervention on the multiple levels of the ecological model from the perspective of the young female participants.

Method

Philosophical assumptions

Upon reflection on the aim of our study to explore the effect of a PA intervention from a participant's perspective, we situated this research within an interpretative paradigm (Sparkes & Smith, 2014). We approached this study with the goal of capturing individual's experiences of being engaged in a tailored intervention aimed at young females and sought to understanding of the factors that influence their participation. This methodological perspective allowed us to capture the nuances of their personal experiences and environments. Informed by ontological relativism (the belief that there are multiple realities), epistemological constructivism (the belief that knowledge of reality is constructed through subjective experiences), and accepting that there is no separation between the knower and the known the lead researcher was able to facilitate a co-construction of meaning with participants (Smith, Caddick & Williams, 2015). This meant that the lead researcher (i.e., the author of this thesis) acted as reflexive 'instrument' to build dynamic knowledge and understanding with the participants of the focus groups. Specifically, our assumption was that humans subjectively construct the physical environment along with other external and intrinsic factors, which limits and or supports their attempts to undertake healthy behaviour (i.e., trying to participate in a community-based physical activity intervention).

Participants

Female participants ($n = 21$, aged 14-21 years, $M = 17.9$, $SD = 2.4$) were recruited from four charities commissioned by the Lambeth council for the *This Girl Can Lambeth* project to participate in the current study approved by London South Bank University ethics committee (SAS1621). Of the 21 females, six were attending secondary school, four were attending sixth form, five were attending college, three were attending university and three were in full-time employment. The charities were Fight 4 Change (boxing), Big Kid Foundation (multi-sports), St Matthews Project (football) and Streatham Youth and Community Trust (mixed martial arts). PA providers offered all new participants in January 2018 the opportunity to take part in the study. Through their PA provider volunteers were asked to take part in two focus groups each, one at the beginning of their participation in the program, and another after 10 weeks between February and May 2018. This was to explore whether different themes emerged before and after the intervention. Each focus group consisted of females from the same activity project provided by the charities: Boxing ($n=6$), multi-sports ($n=5$), Football ($n=4$) and Mixed Martial Arts ($n=6$).

All participants who volunteered were included in the focus groups. Participants all lived in London (85.7% of them identified as ethnic minorities) and signed-up for the female-only activities. Adherence to the study was very high (95%) as only one participant recruited at baseline did not attend the follow-up focus group. Four participants attended both focus groups but had only attended one PA session and one participant attended both focus groups but dropped out of the program after two sessions.

Procedure

Prior to data collection a pilot study was conducted with university students in January 2018 ($n = 5$; aged 19-21; $M = 20$; $SD = 0.7$). The pilot focus group was transcribed and analysed for preliminary themes, it also provided feedback in the way of task engagement, question clarity, recording procedure and timings. As a result of the pilot the number of questions was reduced and probe words were included in the guide so the lead researcher could evoke conversations around particular points. For example, in the final interview guide a question pertaining to which outlets would be effective in delivering health messages to young people included the probes of TV adverts, leaflets, posters, face-to-face and word-of-mouth. The focus groups were conducted in public places familiar to the participants such as clubhouses and quiet spaces in the activity venue. At points of data collection all study participants were provided with an information sheet and the opportunity to ask questions before written consent was sought. Participants were notified that names would be removed from the data and replaced with a code to ensure confidentiality. Participants then took part in a group discussion facilitated by the lead researcher (i.e., the author of this thesis) and a research intern. A dictaphone was used to record the focus groups which lasted between 60 and 90 min and included various group and individual tasks. For example, participants were asked to write down the first three words they could think of to describe PA, they participated in a brainstorming task about what made it harder to be physically active and what were the benefits of being physically active. These tasks served the purpose of evoking thoughts and feelings about PA, involving quieter participants, and more importantly keeping participants engaged in the discussion. Observations of PA sessions prior to data collection prompted the use of such tasks. The lead researcher felt by using a variety of data collection methods within the focus groups all participants would have the opportunity to engage and contribute. A semi-structured interview guide was used to investigate participants' experiences and perceptions while the research intern kept note of who was speaking in turn (See Appendix A & B for pre and post guides respectively). Focus groups are proposed to be particularly pertinent in situations where research is aiming to produce new ideas as the method can assist in encouraging participants to express their opinions (Greenbaun, 1998). Qualitative methods were deemed most appropriate to explore the

experiences of young females participating in PA interventions by gathering rich and detailed information on the participants' thoughts, feelings, behaviours and experiences in relation to PA.

The focus group questions, developed by the lead researcher, were predominantly open-ended to facilitate the process of gathering rich and comprehensive data, aimed at eliciting stories, experiences and perspectives of the participants (Sparkes & Smith, 2013). If the researcher wanted clarification or more detail participants were encouraged through probes to elaborate. Although a guide was used to cover similar topics within each group, the participants were encouraged to speak freely, discuss with one another and consider different perspectives or experiences from their own. Having this flexibility in how and when questions were asked allowed for greater depth in answers and better rapport. In the process of conducting the follow-up focus groups, it became apparent that the same themes were reoccurring and data saturation had been reached (Saunders, et al., 2018). Although we had initially expected different themes to emerge before and after the intervention, this was not the case. Therefore, the analysis will not report pre and post themes separately.

Data analysis

The focus groups recordings were transcribed verbatim and thematically analysed according to steps recommended by Braun and Clarke (2006). Although, researchers cannot free themselves of their pre-existing theoretical knowledge, an inductive approach was taken to code the data and generate themes. To avoid potential bias and increase inter-rater reliability, two researchers took a grounded approach to making initial codes and then discussed them (Smith, 2004). The agreed-upon initial codes were then grouped and categorised to form overarching themes and sub-themes. This process involved evaluating the coded extracts in relation to the themes and the validity of themes in relation to the data set. Following this, the themes were reviewed and deliberated. Subsequently, each individual theme and sub-theme was given a name for the final analysis. The themes were then categorised according to levels included in the ecological model. The final themes and sub-themes are reported and discussed in the following sections of this chapter (see Table 1). Throughout the thematic analysis process, the researchers discussed the interpretations of data to establish credibility and trustworthiness of the data (Jowett & Spray, 2013).

Table 1. Phases of thematic analysis used in this study (adapted from Braun & Clarke, 2006)

Phases	Description
1. Familiarisation	Listening to recordings, transcribing and re-reading transcripts
2. Initial codes	Descriptive and explorative codes made across the data set
3. Secondary codes	Interpretative layers added to draw preliminary links between data and concepts
4. Generating themes	Collate codes into potential themes, both overarching and sub-themes and relate these with the levels of the ecological model
5. Reviewing themes	Themes refined according to the data extracts and examined to ensure they reflect the whole data set
6. Defining and naming themes	Refine the overall story the analysis tells, then clearly define themes and name them
7. Writing-up	Continue interpretation and selection of pertinent extracts in relation to the research question and literature

Results and Discussion

In order to illuminate the experiences of female intervention participants and contextualise them in relation to the current body of literature, the findings are presented together with interpretations and discussion points. The themes are structured by levels of the ecological model: Intrapersonal, Interpersonal, Organisational, Environmental, and Policy and legislative. Sub-themes identified in the data are explored and used to formulate recommendations for future PA interventions and research (see Figure 1).

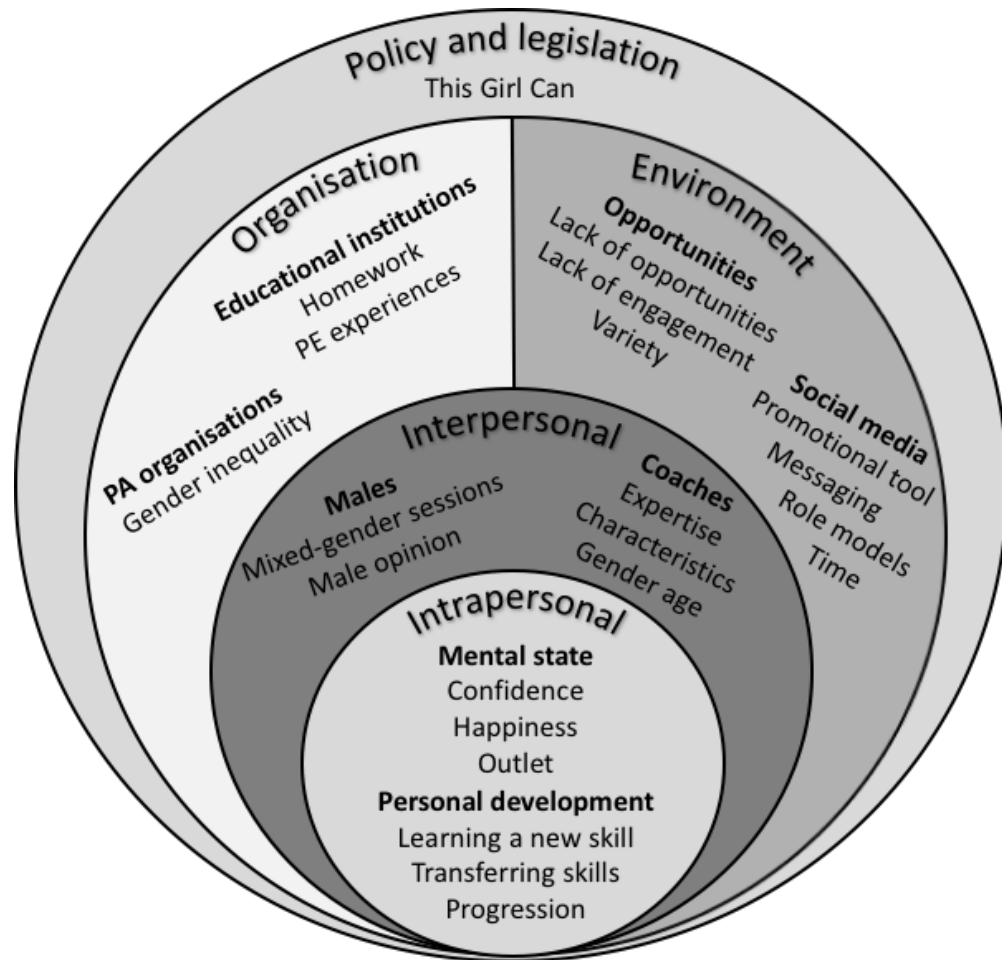


Figure 1. Depiction of results including ecological structure and themes.

Intrapersonal

Mental state. All participants associated psychological health with PA. Many of the participants felt that PA could positively enhance their “mood”, “improves your mental state and not just your physical state”, and these were reasons for their continuation in the *This Girl Can Lambeth* project. Some participants spoke about confidence as a benefit of the project; one said that it had improved her confidence in all areas of her life not just in PA, another stated:

I remember my first ever session I was like the little scared girl in the corner ‘cos I didn’t know anyone, and I wasn’t confident with anyone and it’s like now I go there and I’m a bit too comfortable with some people.

Participants also identified PA as a source of happiness, a tool to manage stress and an “outlet” for negative feelings:

It switches my mood I don’t know, football just makes me (...) and I always say it to people whenever I’m annoyed I just wanna play football because it just makes me happy.

I started in year 10 like towards the end of year 10 and obviously in year 10 you're stressing about [exams] and then you get to year 11 and you're going crazy and now year 12 I feel I have like 10 breakdowns a day erm but football, it like picks me up and like all the stress about schoolwork or school goes away at the weekend I think I get time to go and do what I enjoy and play football. It makes me happy.

These findings illustrate that participants perceive PA to have a positive impact both inside and outside of the PA environment on psychological factors such as confidence, stress-levels and happiness. PA has been associated with happiness in the literature, and a study of 11,637 individuals in 15 European countries found that there was a positive dose-response association between PA levels and happiness (Richards et al., 2015). The study found that compared to inactive people, the adjusted odds of being happy were 20%, 29% and 52% higher for insufficiently, sufficiently and very active people respectively. Sub-group analyses revealed that 15-25 year olds were the happiest age group, however females were slightly less happy than males. A recent review of 23 studies also found that PA was able to increase levels of happiness. The authors suggested that future research is needed to explore the underpinning mechanisms and determine optimal types and doses of PA (Zhang & Chen, 2018). The current study found that the perception of the female participants supports the idea that PA is efficacious in improving psychological factors, and it offers some insight into the reasons why happiness is associated with PA. Specifically, young females use PA as an avenue to release stress. Therefore, it may be useful for PA sessions to integrate a moment of reflection and planning where participants can take a mindful approach to tackling their sources of stress.

Personal development. Personal development emerged as an important motivation and a valued outcome for females in the project. After the 10-week intervention period 75% of the participants said they were happy with their levels of PA, this was an increase of 35% when compared to the baseline focus groups. Although the females reported a broad range of ability and experience, many of them expressed benefits such as “learning a new skill”, “learning new things about [themselves]”, pushing themselves out of their “comfort zone” and focusing on “self-improvement” rather than comparing themselves to others. For example, one participant gave their reasons for continuing to attend the sessions:

More self-improvement and becoming a better version of myself...seeing myself compared to how I was prior to boxing erm it kind of motivates me to keep going forward and see how far I can really go.

When asked about motivational messaging and PA promotion aimed at females, other participants felt that it is “demotivating” when your aims are focused around meeting society’s expectations or standards rather than “bettering yourself and becoming the best version that you can be”. One of the older participants (20 years old) added:

Yeah looking at all these fit people can be demotivating thinking that I'll never get to that level but as long as you see progress and think about comparing yourself 6 months from now to where you started, that is quite motivating. You don't have to prove yourself to anyone else.

Other participants spoke about realising they are talented at a new activity and that "if [they] really wanted to, [they] could push themselves in that activity". Several participants also mentioned becoming qualified coaches through the training opportunities offered by the PA organisation. Most of the participants were not concerned with competing or pursuing their project activity as a career, but many of them expressed that they wanted to develop skills and see progress because "you're not wasting time like if we wanted to chat, we would just stay at home". One participant stated:

For me it's the skills and the fitness as well 'cos my friend she did [mixed martial arts] for a long time and it's just impressive cos she'll just grab you and just can break your arm in one little thing like it's just impressive to be able to do that and you would never guess that they're able to do that because they look so normal like it's just yeah it's the skill to be able to do that, obviously not to use it to just attack someone but if you ever need self-defence, you know you can defend yourself, I want that.

The positive outlook on self-improvement indicates that by engaging in PA participants have developed effective strategies for personal evaluation and individual goal setting within mixed ability groups. This suggests that the projects were able to encourage a growth mind-set among the females (Dweck, 1999). According to Warburton and Spray (2017) a growth mind-set refers to an individual's belief that attributes and behaviours are malleable, controllable and can be developed. This mind-set is favourable when compared to a fixed mind-set as individuals with a growth mind-set are characterised as persistent, more positive, and concerned with self-development. This has implications for the delivery of future PA interventions as motivation and adherence may increase in an atmosphere conducive to a growth mind-set. This can be encouraged in the sessions through tailored feedback and language which emphasise self-development and skill.

Interpersonal

Males. Males affected the participant's experiences within the PA environment in a variety of ways. Exercising with males, and male opinions regarding PA and females emerged most frequently. The females agreed that they had a "supportive" and "friendly" environment within their female-only sessions, but they had very mixed views on exercising with males. Some females felt that exercising with males would be "uncomfortable and "intimidating" and that males of a similar age may be "unsupportive". For example, one participant stated:

Yeah we'll feel like erm if we fumble they'll laugh or something like that so that's why it's good to have no boys. Especially cos we've got...some people that are like up here and then we've got others that are just not quite there so obviously if you're playing amongst girls then you're

not really gonna care what your performance is like 'cos you're amongst your own sort of thing. Whereas as soon as you get in front of boys you're like "I don't wanna play" yeah like "I can't control the ball", "I can't kick straight", "I dunno how to catch" or whatever. You start panicking obviously 'cos it gets from bad to worse

Another female said she had experience playing football with males and felt that they had "low expectations" but also did not give her the credit she was due:

They were all like 'ah she's good for a girl' and I hate hearing that. I hate hearing that so much, like what do you mean? So if I was a boy I wouldn't be good enough? It just really frustrates me.

Some females also expressed that they prefer to exercise in female only environments because they perceived the physical differences between males and females to give males an advantage in an exercise setting:

I think with a female-only group, it's a lot more healthier competition 'cos like...with males for example, you know your body strength and theirs are always gonna be different like you might be faster than someone but you're never really gonna be stronger in that sense. You can do the same training but a male will always come out stronger or gain muscle faster so the competition sometimes is unrealistic so it might put you down like they're excelling or whatever and you're not, but that's because it's unrealistic. Whereas with female-only groups it's more of a healthier competition because you're on the same level.

On the other hand, other females felt that exercising with males would be positive because it would motivate them, it would be challenging, and it would test their skills. For example:

Yeah 'cos if you're honest we are better than some of the boys but most of them are better than us so like if we're playing with people better than us it'll help us like strive to be better and like it will like help us like in the way we play so like for example we get more skilful and tactical and stuff like that 'cos most of them have a higher skill than us.

It'll definitely be harder because I think if the boys played against us they would make it their motive to win and if they didn't win they'd feel some type of way so it would be a challenge but it would be a good challenge.

Several females shared the view that male opinions regarding their ability and skill "held more weight" than the opinions of female peers:

I have male friends that saying "I like you playing football, continue" that makes me more happy than if a girl's saying it because it's like girls have to say it but if a man says it, it's like it's coming from their heart...Yeah 'cos I feel like girls in this generation shouldn't put each other down so they have to say "ah yeah continue with football, I like that". They say it because they're one of you but if a man says it then it kind of shows true meaning 'cos if they don't mean it they won't say it at all. If they say it you think they really like it and it motivates you a bit more.

I agree with [participant X]. When the boys at my school say I'm good at football, I think it hits me more than when girls say it.

These findings indicate that young females feel a significant influence from males in PA environments, and encouragement from males can be particularly powerful. Not many studies have explored gender-specific peer influence in this context but some studies looked at gender-specific parental influence. In a cross sectional study investigating children's PA and screen viewing behaviours, fifty mothers were interviewed. In their view, fathers play more of a role in the PA behaviours of children through encouragement, facilitation and co-participation (Zahra, Sebire & Jago, 2015). Some research has been conducted to explore the influence of fathers over their daughters' PA behaviours (e.g. Morgan et al., 2015; Zahra, Sebire & Jago, 2015; Young et al., 2019). An 8-week multi-component intervention (education, PA & home-based challenges) including 115 fathers and 153 daughters found a significant increase in PA levels for both fathers and daughters post intervention and sustained effects after 9 months (Morgan et al., 2018). The current study supports the findings of Morgan and colleagues (2018) and suggests that males across different ages and roles have the potential to successfully encourage and promote PA to young females. However, it might be even more important to address the narrative of male domination and importance in sport. PA organisations should aim to provide young females with inspiring female role models from within and outside the organisation who can illustrate female prowess in sport. Also a culture where the male and female participants support each other during competitions might provide an extra source of motivation.

Coaches. The females felt that the coaches within the project impacted their experiences. From their interaction with different coaches they described their preferences in terms of expertise, age and gender, as well as positive and negative characteristics. They stated that good coaches are "supportive", and "confident", "know what they're doing", create a "good connection" with the group and instil a level of seriousness. For example:

Them wanting you to progress [makes a good coach] cos when they want you to progress, then they take you seriously and they advise you... if they don't want you to progress, they don't really care if you do it right or do it wrong, they're just there to do whatever and then they go. But if a coach cares about your progression then they'll be a good coach...She [the coach] gives it the element of seriousness like we're coming here for a reason.

The participants identified "unorganised", "unconfident", "no communication, "not listening" and "not pushing you hard enough" as characteristics of bad coaches. For example:

Yeah like [coach X] came one time like he was so clueless. He was like "what do we do now? What are we supposed to do?" What do you mean what are we supposed to do? You're the coach.

The females discussed at length the gender of the coach. Some said they preferred a female while others suggested the standard of male coaches is higher. However, a large proportion of the females said they would be happy with either and could see the value in having a mixture. For example:

I think it should mix up sometimes like some weeks the [male coaches] do it, some weeks the [female coaches] do it cos like it just gives us a feel of both sides. If the same person is teaching all of the time it's kinda like... I just know what to do already like if it's changed I have to adapt...

Similarly, the females disagreed on the preferred age of the coach. For example, one participant who said she would prefer an older coach stated:

My gym trainer is 50 and I think it's weird, because she pushes me so much I wanna make her proud sometimes and I see her like erm an older woman kind of thing like mother figure kind of rather than someone young, so yeah I work differently with her like I wanna make her proud kind of thing.

A participant who would prefer a coach similar aged to themselves said:

[age affects the] relationship yeah because someone could be older but still be a very good coach but maybe you won't be as buddy buddy with them as you would with someone your age but I don't think it would make a difference that much. I prefer someone my age like similar age. 'Cos then they'd be kind of like a mentor.

The contrasting views regarding age and gender suggest that such considerations may not be as important as the expertise the coach possesses. The females placed most importance on having a confident and experienced coach with good communication skills. These findings are in line with a model presented by Rhind and Jowett (2012), which captures seven strategies coaches and athletes use to develop and maintain a good relationship. They suggest that conflict management, openness, motivation, assurance, preventing problems, support and social networks lead to relationships that are close, committed, complementary and co-orientated. These findings have implications for PA providers as they are responsible for employing and training coaches, they also have implications for coaching practice in terms of the strategies used in sessions with young female participants. PA organisations may benefit from employing a diverse pool of coaches and implementing a system where participants are exposed to a variety of coaches during the intervention period. However, the main factor mentioned by the females is coach expertise and this means that organisations must ensure their coaches are trained to high standards.

Environmental

Opportunities. The participants identified opportunities as a factor that impacts female participation. They stated that at the beginning of the project they perceived a lack of opportunities for young females especially for those who require cultural considerations such as Muslim women. For example:

There's a sports centre 2 minutes away from me but both genders go, mainly men. I'd like to feel comfortable there, I'd like to take off my hijab and be able to work out because it's not only a gym, they have a badminton centre and 5-a-side football. It's a whole centre that isn't even costly either but I can't go... and there's no women-only times.

For me personally, I don't think there's a lot of activities or sessions that cater to us so for example, I didn't mind playing football with the boys but now I don't really wanna play football with men so I think, where do I go to play? And I think this is the only session that is a women-only boxing session that is at a convenient time. Monday to Friday everyone has something going on, and most of the sessions are morning sessions mainly for mums after they've dropped their kids at school. So I think mainly the time of the sessions and the set-up is not always convenient.

As well as these issues the females described that fear of violence in public places and on public transport restricts their PA opportunities as they try to avoid "putting [themselves] in danger". Involvement in the project changed some of the female's views as the participants became aware of more PA opportunities and became more confident. The following is an exchange between three females who felt that low uptake among females can actually reduce the amount of opportunities available:

In [my gym] there is [female-only times]. There used to be 2 to 3 sessions but because of the actual amount of girls that used to go to the sessions wasn't enough. So they cut 2 of the sessions and now they just do the Sunday session. I think sometimes it is down to the amount of girls that want to go to the activities, sometimes it'll let the others down.

I feel the same as well. There is always someone that will take the job of set something up for girls only but then only 2 or 3 will come and obviously that's not gonna continue. It lets us girls down who wanna go.

That's my frustration. I've been going to the gym for 2 years and I've had about 7 different [female training] partners in that time. Thankfully I'm okay to do it on my own but I'm just saying sometimes females don't have that same level of commitment as men do.

Some females said they would be more physically active if they could find female-only times for a wider variety of activities such as weight lifting and swimming. Instead, they felt that activities tend to be limited to "girly" activities such as "legs bums and tums", "Pilates" and "Zumba". Some of the females also said that as a result of the project they had been offered new opportunities: "from me playing football at the school league, I came to this and then it escalated...I got scouted for [professional football club] but... I don't really want to do football as a thing, it's just a hobby".

Although participants perceived fewer PA opportunities for females than males in terms of activities on offer, and female-only provision, they also felt that when female-only opportunities were available they are not fully utilised. This was at least in part because PA and sport are not prioritised by young females. Several studies have found that during adolescence young females' priorities change and they have more competing priorities than their male counterparts (e.g. Whitehead & Biddle, 2008; Corr et al., 2018). These include, social life, relationships, household responsibilities and time spent on physical appearance. These findings have implications for health promotion campaigns, as they can target and normalise these competing priorities while raising the profile of PA in the lives of young females. For

example, increasing the visibility of females who manage competing priorities and who are physically active. Interventions can include an element of personal effectiveness where young females learn to balance their different commitments. Finally, it may also be useful for PA organisations to seek input from participants in regards to the activities they offer and the activities participants would like.

Social media. The participants stated that social media plays an important role in PA levels of young females and promotion of PA in this population. Many of the young females expressed that they spend lots of time on their phones and on social media which is a “distraction” and leaves them with little time to be physically active. Many of them saw the amount of time they spend on their phones and social media as excessive:

social media [is a barrier] because, I know it’s not just me, it’s everyone in this generation and they’re always on their phones 24/7. So no one is really bothered to say to their friends “let’s go here” or “let’s go to the park” or something.

After the 10-week period several of the females expressed that they had spent less time on social media. Partly because they had been busier due to PA but also because they felt that lots of the health and fitness content they were viewing was unrealistic and promoted “quick results” rather than promoting “patience”, realistic long-term health messages. The majority of the females felt that motivational messages were more powerful from “normal women who are getting up and doing it” as they are more relatable and trustworthy. In spite of this, they felt that social media applications such as Snapchat and Instagram could be particularly useful to promote PA among young female populations. They also stated that celebrities and social media influencers could do more on these platforms to promote realistic and healthy lifestyles:

Yeah usually they get surgery, then they’re talking about how much they exercise and you think “ugh come off it!” and it’s just fake.

I’d say celebrities in general [could promote health and fitness]...I think if you have that type of influence on people, you should try and use that platform to reach out to them and better their lives.

These findings show that although young females use social media frequently and this can result in more sedentary time; involvement in the project caused them to reprioritise their time and exposed them to real PA rather than what is presented on social media. The findings of the current study provide an alternative narrative to young females’ social media engagement as the participants in this study were conscious of making changes to the way they use and view social media content. Due to the popularity of performance metric watches and the health-promoting mobile applications, technology-based interventions have become an area of interest in the literature. A review of 27 studies investigating the efficacy of interventions that use apps to improve diet, PA and sedentary behaviour

concluded that although the use of apps is promising and in three studies app usage was associated with improved health outcomes, there is only modest evidence that app-based interventions improve diet, PA and sedentary behaviour (Schoeppe et al., 2016). The authors suggest that multi-component interventions may be more effective and future research is needed to optimise app features, behaviour change techniques and participant contact. An app that tracks PA, has a health education element and encourages a growth mind-set could be used alongside PA delivery as an effective strategy to engage females. Organisations could exploit the use of social media apps by having a presence and posting appealing and informative content.

Organisational

Educational institutions. Educational settings play a considerable role in young females PA behaviour. Young females spoke about their experiences in compulsory PE stating they had often “made excuses” about menstruation and injuries to avoid the “boring” and “embarrassing” nature of PE in secondary schools. After completing a task of writing down three words that describe PA, one female said: “I put down boring, hard and school. Usually anything to do with PE reminds me of school and is usually very repetitive and you do the same moves and it’s difficult”. Other females stated that, although they enjoyed PE at school and played in various teams, they felt PE was “limiting” for girls who were “not sporty or confident”. School sport was described as “unorganised” and the females felt that male engagement was prioritised over female engagement:

I wish I could say I did more football ‘cos in school it’s the same thing now like there’s boys matches every single day and the girls haven’t had a match since the start of the year. Apparently we’re out of the cup but we won all of our matches so I just don’t... apparently yeah apparently.

Several females mentioned that they felt university provision was more inclusive, “accessible” and enjoyable for young females. However, one female stated that her university is very sport-focussed and there is a lack of recreational PA. As a result of the *This Girl Can Project*, she has approached her university student union to enquire about starting a female-only boxing session:

I realised I’d probably exercise more if they offered different classes at uni, like more societies ‘cos in my university it’s usually just competitive sport and there’s nothing just social so if it offered more social classes then I’d probably go so I asked [coach X] if she would be up for it and now we are trying to get her into my uni to run sessions.

Females also described the way in which school workload increased from the age of 14 and affected their leisure time and energy levels leading to less PA. When asked to identify their three biggest barriers to PA “school” and “homework” were amongst the most frequent, for example:

I put school as the second one because there's just so much work, you do school work and then you get homework, so you're just stuck at home doing work, work, work. You don't get time to go out.

School and homework put together. It's just like I get so much and then every teacher and like I feel like they forget that I do other subjects and the amount of work they give me is ridiculous and I just have no time and plus I get no sleep zero sleep I get maybe like 4 hours... schoolwork during the day and then after school I'm in school doing school and then I get home, I shower, I eat, schoolwork, I sleep for a bit, wake up, schoolwork and then school.

For the females in the focus groups it is clear that educational institutions play a significant role both for school-aged and university-aged populations. Important factors appear to be a lack of time, energy and attractive provision but also negative PE experiences acted as barrier for these females. These findings are very similar to those found in a study that explored the perceptions of PA among 52 Caucasian females aged 16-17 (Sleap & Wormald, 2001). The study conducted focus groups and found that although most young females were aware of the benefits of PA they were deterred by their negative PE experiences at school. The females in the study had the perception that to achieve health benefits PA had to be strenuous and sweaty and teachers often favoured and paid more attention to students who were good at sports. The current study has implications for educational institutions and teachers to deliver National Curriculum in an inclusive and engaging way; this may provide students with good early experiences that can influence life-long PA. One obvious recommendation is to reduce the amount of homework given to young people so they have more leisure time to be physically active. Several countries where this has been implemented show a maintenance or improvement in school attainment and higher levels of PA (Vatterott, 2018).

PA organisations. The young females identified PA organisations as playing an influential role in their PA behaviours. Some females shared experiences of engagement with sport clubs, external organisations who delivered PA within the school setting and the organisations involved in the *This Girl Can Lambeth* project. One of the focus groups, whose activity also had a male-only group, had the overwhelming view that PA organisations favour males because they received better "opportunities", "coaches", "incentives", "rewards", "promotion" and "equipment". For example, one female described feeling a lack of support:

With [Coach X], he'll prioritise the boys so for example if we have a match you probably won't see him there until either the end or halfway through but I'm pretty sure with the boys he's always there and like erm the boys have more opportunities for example they went to like a residential... but we didn't get that and it's kinda like he puts the boys first.

As well as a lack of support and access to external opportunities, some females expressed that they perceive male sport to be taken more seriously because the level of professionalism and the potential earnings make it a viable career for males. The females said that within PA settings their efforts were

not rewarded in the same way as males and they found it demotivating. For example, the following exchange between three participants:

We know this is all we get so we don't put our 100% effort in because we feel like we feel like we don't need to.

Even if we work harder we're not gonna get rewarded for it.

You see the boys and they get free stuff from Nike or Adidas but then what do the girls get? They don't get nothing. We get [equipment] that the boys are allowed to use so really and truly we don't have none of our own equipment.

It is clear that although they are actively involved in the program, the females perceive a disparity between the way males and female are treated within PA organisations. This finding is in line with the findings of Corr and colleagues review (2018). The authors found that young females perceive various gender bias's in sport which included lack of support, attention and encouragement from instructors in comparison to males. Some females went further to say they had been discouraged by instructors through feedback and their stereotypical views of gendered sport. The current study suggests that organisations must ensure that they are fair in their treatment of female in comparison to male participants. For example, having an organisation representative attending competitions, rewarding male and female participants in similar ways, and providing females with their own facilities and equipment. These measures are likely to increase the females' sense of relatedness to the organisation and result in increased adherence and involvement.

Policy and Legislation

The focus groups with the young females explored the direct factors that influence their PA participation, therefore indirect influences such as funding and guidelines were not discussed. However, it is important to note that all of the young female participants were aware of the National Lottery Funded campaign, This Girl Can. In the focus groups the young females discussed the aims of the campaign, the marketing of it and its impact. Overall the females had very positive opinions of the campaign saying that it portrays a variety of women realistically and targets an important issue.

Conclusion

In conclusion, it is clear that the females perceived substantial benefits as a result of being involved in the *This Girl Can Lambeth* project. The intervention had positive effects on: intrapersonal factors such as confidence, stress relief and personal development; interpersonal factors such as rapport building with peers and coaches; and environmental factors such as increased awareness of PA opportunities and social media usage. It is also clear that young female's experiences within PA interventions are influenced by a multitude of personal, societal and environmental factors. The young females' perspective provides insight into how pertinent factors at each level influence their PA behaviour and provide a direction for designing future interventions with higher potential to promote, engage influence and retain positive PA behaviours. Future interventions should attempt to: employ relatable coaches and ensure they are trained to a high standard; use social media as a tool to promote PA and communicate healthful messages to young females; and facilitate support from a variety of agents. The young females' perspective provides particularly useful direction for agencies at the organisational level of the model such as educational institutions and PA organisations. Such organisations should aim to ensure that young females get good early experiences of PA (e.g. PE), are treated fairly in PA settings, and are encouraged to be active in out-of-school hours.

Appendix A: Focus group guide (pre)

Focus	Questions
<p>Introductions and warm up</p>	<p><i>Moderator to introduce themselves, LSBU, TGCL and subject matter</i></p> <ul style="list-style-type: none"> • <i>Explain ground rules (no phones, listen to each other, its ok to agree or disagree, might ask specific people, might ask more talkative participants to give others a chance)</i> • <i>Introduce research assistant</i> • <i>Reassure participants of confidentiality</i> • <i>Secure permission to record</i> <p>I'd like to begin by asking each of you to introduce yourself. Please share:</p> <ul style="list-style-type: none"> • Your first name • A little bit about you/what you like to do • What you would be doing if you weren't here
<p>Understanding of exercise v physical activity</p>	<p><i>Moderator to hand out "exercise" three words and visualization worksheets. Worksheets to ask participants to write first three words or phrases that come into their head when they imagine someone exercising and describe them –age, what do they look like, where are they, what are they doing etc. Moderator to ask participants to complete worksheets. Participants to share their answers with the room.</i></p> <ul style="list-style-type: none"> • What three words did you put down? <ul style="list-style-type: none"> ○ Why? • What sort of person did you visualise? • Is this someone like you? <ul style="list-style-type: none"> ○ Why / who not? • How does imagining this person make you feel? <ul style="list-style-type: none"> ○ Why do you say that? <p><i>Moderator to ask regarding "physical activity" three words and differences. Participants to share their answers with the room.</i></p> <ul style="list-style-type: none"> • How does a person doing physical activity compare with a person doing exercise? <ul style="list-style-type: none"> ○ In what ways are they similar?

	<ul style="list-style-type: none"> ○ And in what ways are they different? <p><i>Moderator to explain that for the rest of the session, when we talk about physical activity we will be using the following definition: “Any activity that gets you up and moving. This might include things like walking to the shops, gardening or doing the housework, as well as things like riding a bike, going for a swim or playing football.”</i></p>
<p>Understanding current levels of physical activity</p>	<p>How much physical activity do you currently do?</p> <ul style="list-style-type: none"> ● What form does this usually take? ● To what extent are you happy with your currently levels of activity? <ul style="list-style-type: none"> ○ Why do you say that? ● How, if at all, has this changed over the last 2 or 3 years? <ul style="list-style-type: none"> ○ Could you exercise more if you wanted to? <p><i>Whole group brainstorm, moderator to record answers on flip chart:</i></p> <ul style="list-style-type: none"> ● What, if anything, makes it harder for you to do physical activity? <ul style="list-style-type: none"> ○ Why do you say that? ● Anything else? <p><i>Whole group brainstorm, moderator to record answers on flip chart:</i></p> <ul style="list-style-type: none"> ● And what, if anything, do you think the benefits are of physical activity? <ul style="list-style-type: none"> ○ Why do you say that? ● Anything else?
<p>Message testing</p>	<p><i>Moderator to explain that we are now going to look at some TGC adverts that have been designed to encourage young women to become more physically active. Moderator to ensure messages are rotated between groups.</i></p> <p><i>Moderator to take each message in turn and for each one ask:</i></p> <ul style="list-style-type: none"> ○ What do you think of this message? <ul style="list-style-type: none"> ○ What does this make you think/feel? ○ Anything interesting/surprising in this? ○ Have you heard this point made before? By whom? ○ What does it make you feel about the impact of exercise for young women? <ul style="list-style-type: none"> ▪ Why do you say that? ○ Do you think it would be a good way of getting young women to do more physical activity?

	<ul style="list-style-type: none"> ▪ Why do you say that? <p><i>Throughout, moderator to probe for impact of different words / tone.</i></p> <p><i>Once the group have discussed all the messages, moderator to ask:</i></p> <ul style="list-style-type: none"> • Thinking of all the statements we have just seen, which stand out the most? Why? • Which one do you think would be most effective in encouraging young women to do more physical activity? <ul style="list-style-type: none"> ○ Why do you say that? • And which one do you think would be least effective? <ul style="list-style-type: none"> ○ Why do you say that? • What additional points might you want to make? <i>[Moderator to write these on additional cards]</i> <p><i>Moderator to hand out blank showcards and ask participants to write their own messages to encourage young females to exercise. Moderator to explain the task as follows: Imagine you were in charge of a campaign designed to encourage people young females to do more physical activity. Please write down the message that you think would be most likely to result in young females doing more activity. You can use the messages we have already discussed, or come up with something totally different.</i></p> <ul style="list-style-type: none"> • Participants to share their messages with the room. • Are there any words that should definitely be used if you are trying to encourage females to do more physical activity? • And are there any words that should definitely not be used?
Channels and spokespeople	<p><i>Moderator to explain that we're now going to think about how messages about increasing physical activity should be delivered.</i></p> <ul style="list-style-type: none"> • What mechanism do you think would be most effective for delivering messages about increasing physical activity amongst young females? <ul style="list-style-type: none"> ○ Probe on: <ul style="list-style-type: none"> ▪ TV adverts ▪ Leaflets ▪ Posters ▪ Face-to-face ▪ Word-of mouth ▪ Anything else? ○ Why do you say that?

	<p>And of these people, who do you think would be best to talk about increasing physical activity?</p> <ul style="list-style-type: none"> <i>Moderator to hold up showcards, to include: male coach, female coach, female athlete, male athletes, teachers, fellow young female, a GP, a friend or relative or community member; head of a national charity; a personal trainer</i>
<p>Conclusion</p>	<p><i>Moderator to hand out postcards. Participants to write down a message to themselves that they can open at the end of the 12 week intervention.</i></p> <p>Incentives Permission to re-contact</p> <p>Thank and close</p>

Appendix B: Focus group guide (post)

How did you find out about SMP? How did you get involved?
How do you get to sessions? How often?

Tell me a bit about your experiences of being in the project?
Best vs worst good vs bad

What do you get out of being in the project?
Fitter? Healthier? Look better?

How do you feel about the sessions being female only?
Are there any differences in the way that you are treated or seen differently to boys your age in SMP?
Sessions different? prospects and opportunities coaches treatment

BENEFITS TASK (choose important one and explain- anything to add/agree/disagree)

What do you think about the coaching with SMP?
makes a good coach and a bad coach?

Have your activity levels changed in the last 3 months?
Are you happy with your levels of PA? (Y, N, TM, TM)

What has affected your attendance?
Work school enjoyment

BARRIERS TASK (choose important one and explain- anything to add/agree/disagree)
BARRIERS QUESTIONNAIRES

What were your motivations to stay within the project?

Do you see yourself continuing and for how long?
What would make you stop participating?

What would improve the project?
Length sessions times locations coaches

What could be done to get more girls involved in this project?
Who should recruit them? Where from?

If you were Lambeth council or This girl can and had to design an intervention what would it be like
Activity? Time? Location? Duration? Frequency? Coach? Female only mixed gender? Attire? Aims of
project? Other?

GROUP INTERVENTION TASK

Study 4: A qualitative exploration of factors that influence PA participation in young females: A provider's perspective

Introduction

A considerable amount of research has focussed on identifying the correlates, determinants and mediators of physical activity (PA) engagement for young females (e.g. Sallis, Prochaska & Taylor, 2000; Biddle, Whitehead, O'Donovan & Neville, 2005; Lubans, Foster & Biddle, 2008; Craggs, Corder, Van Sluijs & Griffin, 2011). Reviews such as these have improved our understanding of intrapersonal factors that impact young females' PA behaviours, with self-efficacy, enjoyment and physical self-perception widely accepted to influence their PA participation. As a result, many interventions have been developed to target such factors in an attempt to tackle the low levels of participation observed among young females. However, discrepancies between male and female activity levels remain, with 20% of males aged 11-16 being physically active everyday compared with 13% of females, underscoring inactivity in young females as a public health issue (Sport England, 2018). Fewer studies, and therefore interventions, have focussed on the influence of policy and environment on the PA behaviour of young females. Ecological models capture such contexts which are thought to be significant predictors of behaviour and intervention impact (Thornton et al., 2017).

One very recent example of a study that followed published guidance, investigated the effect of a 17-week intervention on increasing moderate to vigorous PA in 1519 girls (aged 9-14 years old) attending urban public schools. The intervention included an after-school club three days per week, two motivational counselling sessions which were individually tailored, and an interactive internet-based session. Compared to an age-matched control group, the intervention group showed no significant improvement for time spent on moderate to vigorous PA post intervention or at 9-month follow-up. The authors concluded that limited success characterises many interventions aimed at this population and suggest that interventions are still needed which assist girls in maintaining adequate PA (Robbins et al., 2018). Study 2 compared the effects of a 10-week female-tailored intervention program and a national curriculum physical education program. Similarly to Robbins and colleagues (2018), we concluded that the PA intervention program, which included education and workshops to target psychosocial factors such as self-efficacy and physical self-perception, did not produce superior benefits or increase PA levels when compared with a physical education program. Both of these studies

quantitatively measured intervention effects and illustrated limited success of targeted interventions within this population. This suggests that new approaches to researching intervention effectiveness may be needed.

Research efforts have begun to include more explorative methods and a consideration of factors that influence PA participation at the different levels of the ecological model. In 2006 a review of 20 studies, which examined young peoples' (aged 11-16) views on the barriers and facilitators to PA, found a need for increased choice and facilities within the community and the inclusion of a social side to PA provision (Rees et al., 2006). For young females in particular, barriers were associated with the way in which PA is provided within schools. Young females identified highly structured traditional activities, physical education kit, changing and showering arrangements, and unrelatable and unsupportive leaders as barriers to PA engagement. A more recent review of 12 qualitative studies published in 2007-2014, also highlighted that adolescents perceive behavioural attitude, motivation, self-efficacy, physical self-perception, fun, friends, family, environmental opportunities and teachers to be the main factors that influence their participation (Martins, Marques, Sarmento & da Costa, 2015). These conclusions highlight the complex and multi-faceted nature of factors that impact young female participation in PA and suggest that deliverers, activities and session structure are important elements for PA providers to consider when designing PA interventions for young females. PA providers can play a critical role in the success of youth programs because they make decisions regarding design, structure, and delivery of these programs.

These decisions impact different levels of the ecological model. For example, in a study exploring the delivery of a PA youth development program, the influence of youth leaders (aged 12-17) on younger program participants (aged 9-12) was investigated (Shaikh & Forneris, 2018). Thematic analysis of 31 interviews with both the youth leaders and the participants identified four positive themes pertaining to the interpersonal influences of youth-to youth leadership: learning and building skills, enjoyment, relatability and receiving support. The authors concluded that the integration of youth leaders rather than adult leaders can enhance relatability through shared experiences and interests. This leads to strengthened practises of teaching, mentoring, and support, which in turn can lead to positive outcomes of enjoyment and development of life skills. In another example, providers needed to make important decisions in designing their intervention to meet the cultural needs of Iranian adolescent females (Taymoori & Lubans, 2008). Their program targeted cognitive, interpersonal and behavioural mediators through education, counselling and support and was tailored very specifically to the target population. For example, the intervention involved mothers because family bonds are central to Iranian culture, added culture-related questions to self-efficacy and barrier questionnaires, private facilities

were hired to protect modesty for religious reasons, Persian-speaking facilitators were employed, mothers and teachers were educated to provide role models and social support, and a mountaineering trip was organised as it is a popular past time in Iran. Decisions in this study influenced the intrapersonal, interpersonal, organisational and environmental levels of the ecological model. Together these studies speak to the direct and impactful influence that PA providers have on young people's PA, however neither study considers indirect influences such as policy and funding that provide context for behaviour.

Despite the importance of this subject, surprisingly little is known about how PA providers make decisions regarding design and structure of programs (including activity type, location, staff and funding). Further, research has been limited in the way of investigating providers' perspective on the factors that influence PA. Therefore, the aim of this study was to explore the perspective of the PA providers regarding the factors that influence PA participation in young females at the multiple levels of the ecological framework with a view to informing future interventions.

Method

Philosophical assumptions

Upon reflection on the aim of our qualitative study to explore the perspectives of PA providers views on young females' PA participation, we situated this research within an interpretative paradigm (Sparkes & Smith, 2014). We approached this research with the goal of capturing individual's experiences of engaging young females in PA and to gain an understanding of the barriers and facilitators they perceive for their target population. This methodological perspective allowed me to capture the nuances of their personal experiences and individual projects. Our approach was underpinned by ontological relativism (the belief that there are multiple realities) and epistemological constructivism (the belief that knowledge of reality is constructed through subjective experiences). By accepting there is no separation between the knower and the known we were able to facilitate a co-construction of meaning with participants (Smith, Caddick & Williams, 2015). This meant that the lead researcher acted as reflexive 'instrument' to build knowledge and understanding with the participants.

Participants

Four of the five PA providers (2 females and 2 males), commissioned as part of the This Girl Can Lambeth initiative, were recruited for the current study. The participants provide a variety of physical activities through their respective charities in the London Borough of Lambeth. There was a provider

from each of the following charities: Fight4Change, Big Kid Foundation, St Matthews' Project and Streatham Youth and Community Trust. Three of the providers founded their respective charities and the fourth leads the physical activity element of a multi-service charity. The providers' role within their respective charities is to develop and implement community PA from an organisational level which includes logistical planning, designing PA programs and the employment and training of staff. The mean age of the participants was 40.3 years (SD = 12.5), they had 15.3 (SD = 5) years of coaching experience and 7 (SD = 2.9) years of experience as PA providers. The study procedures were approved by London South Bank University's ethics committee (SAS1719a).

Fight4Change Charity. Fight4Change is a boxing charity that aims to inspire young marginalised people to make positive changes in their lives and provides them with opportunities and the tools to progress. As part of the This Girl Can Lambeth project, the charity uses empowerment days, positive role modelling and a variety of workshops to engage females in boxing and multi-sports. Their program emphasises participant input and making physical activity enjoyable.

Bigkid Foundation. Bigkid Foundation is a community charity that aims to equip young people at risk of social exclusion and youth violence to take control of their lives, and find, develop and act on their own potential. As part of the This Girl Can Lambeth project, the charity uses football, a multi-sport program and a leadership program to engage and mentor young females. Their program emphasises developing long-term participation and providing a sense of belonging to those from areas of deprivation.

St Matthews' Project. St Matthews's Project is a football charity that aims to provide a safe and encouraging environment for the young people of Lambeth to enjoy structured sports while improving their well-being and acquiring key life skills. As part of the This Girl Can Lambeth project, the charity provides football coaching and a school football league for young females. Their program emphasises the creation of community role models, developing transferable life skills and gang prevention.

Streatham Youth and Community Trust. Streatham Youth and Community Trust is a community charity that provides a variety of youth engagement services and facilities such as art, cooking, training and sports. As part of the This Girl Can Lambeth project, the charity provides multi-sport with a focus on martial arts such as taekwondo, fencing and Suntukan. Their program emphasises the provision of novel activities, expanding social circles and interaction between new people and places.

Procedure

All five PA providers involved in the project were asked to take part in interviews with the lead researcher six months prior to data collection. The four participants volunteered to participate in a semi-structured interview to share their experiences after 2.5 years in the This Girl Can Lambeth project. The interviews took place at a time and location convenient for the participants and started with a brief on the purpose, the risks and the benefits of the study. As the interview site itself embodies spatial associations and meaning which construct power and rapport relations (Elwood & Martin, 2000), the participants chose a location for the interview to take place. This was designed to empower participants and make them feel comfortable to share a range of experiences more freely. On arriving at each interview ethical issues informing the process were discussed, in particular the issue of anonymity. For Tilley and Woodthorpe (2011) anonymity is specifically removing or obscuring the names of participants, and not including information that might lead participants to be identified. In the current study this meant that no names or pseudonyms could be used in identifying the quotes. We have included some quotes which could identify the provider where the quote is considered innocuous.

Data Collection

Data were collected via a semi-structured interview, which is particularly useful for gaining a detailed picture of a respondent's beliefs, perceptions or account of a particular topic (Smith, 1995). A semi-structured guide was developed, informed by current literature and the results of study 3 (see Chapter 4). Study 3 showed that multiple levels of influence, categorised by the ecological framework, were impacting young female participation. As a result, the interview guide for the current study included questions pertaining to all levels of the ecological framework with an aim of capturing the providers perspectives on similar topics. The interview guide consisted of open-ended questions on areas of interest, and prompts designed to evoke rich and detailed accounts of the participants' experiences (Smith, Sparkes & Caddick, 2014; See appendix A). Drafts of the interview guide were piloted with PA providers, and the interview guide was refined to improve clarity and order of questions. Questions such as, "Can you tell me about your experience as part of the This Girl Can Lambeth project?" were asked to generate broad and extended accounts and were followed-up by questions such as "what have been some of the positives/negatives?" and "if you had the chance to do the project again what would you do differently?". Taking this approach allowed topics to arise and participants the freedom to share information they felt was most relevant to their experiences (Smith, 1995). Each interview lasted between 42 and 82 minutes and yielded a total of 4.3 hours of recorded data which was

transcribed verbatim. Participants were provided with copies of their transcripts and asked to validate the content and add any comments they felt necessary, but no issues were found. Ensuring that the participants recognised their own experiences within the transcribed data was an important measure to take before thematic analysis began. Knowledge obtained by an outsider in fieldwork is different to the knowledge gained by an insider. Therefore, the researcher not being part of a PA-providing organisation might have affected what participants shared. However, previous collaboration within the This Girl Can Lambeth project between the researcher and the providers facilitated the development of sufficient rapport during interviews. Importantly, there were no co-dependencies between providers and the research team.

Data Analysis

The data was subjected to rigorous thematic analysis adapted from Braun and Clarke's guidelines (2006). Riessman (2008) noted that thematic analysis focuses exclusively on the content of what is said, rather than how something is said, to whom, and for what purpose. Thematic analysis therefore allows a broad and under-researched area such as this, to be explored systematically. It was used to collate the complex and individual experiences of PA providers in the project and assist the identification of themes. Once the data was transcribed verbatim, MAX-QDA 11 software (VERBI GmbH, 2017) was used to collate the data which allowed the lead researcher (i.e., the author of this thesis) to analyse it in a number of phases described in Table 1. After familiarisation with the content of the interviews (phase 1), initial descriptive codes were made (phase 2) followed by interpretative and conceptual codes (phase 3). The data was then examined for potential themes and thematic maps were made to visualise the preliminary overarching themes and sub-themes, these themes were categorised in accordance with the ecological model (phase 4). Themes were then reviewed according to data extracts, preliminary codes were kept, collated, separated or discarded where necessary (phase 5). Once the themes were finalised they were defined and named (phase 6). Finally, the results were written-up and discussed, this involved selecting illustrative extracts and continued analysis of data in relation to literature.

Table 1. Phases of thematic analysis used in this study (adapted from Braun & Clarke, 2006)

Phases	Description
1. Familiarising	Listening to recordings, transcribing and re-reading transcripts
2. Initial coding	Descriptive and explorative codes made across the data set
3. Secondary coding	Interpretative layers added to draw preliminary links between data and concepts
4. Generating themes	Collate codes into potential themes, both overarching and sub-themes and relate these with the levels of the ecological model
5. Reviewing themes	Themes refined according to the data extracts and examined to ensure they reflect the whole data set
6. Defining and naming themes	Refine the overall story the analysis tells, then clearly define themes and name them
7. Writing-up	Continue interpretation and selection of pertinent extracts in relation to the research question and literature

Results and Discussion

To critically analyse the providers' perspectives and theoretically contextualise them in relation to the wider body of literature, the findings are presented together with interpretations and discussion points. The themes are structured according to the levels featured in the ecological model which are Intrapersonal, Interpersonal, Organisational, Environmental, and Policy and legislative. Sub-themes identified in the interviews are explored as both a barrier and a facilitator to PA (see figure one).

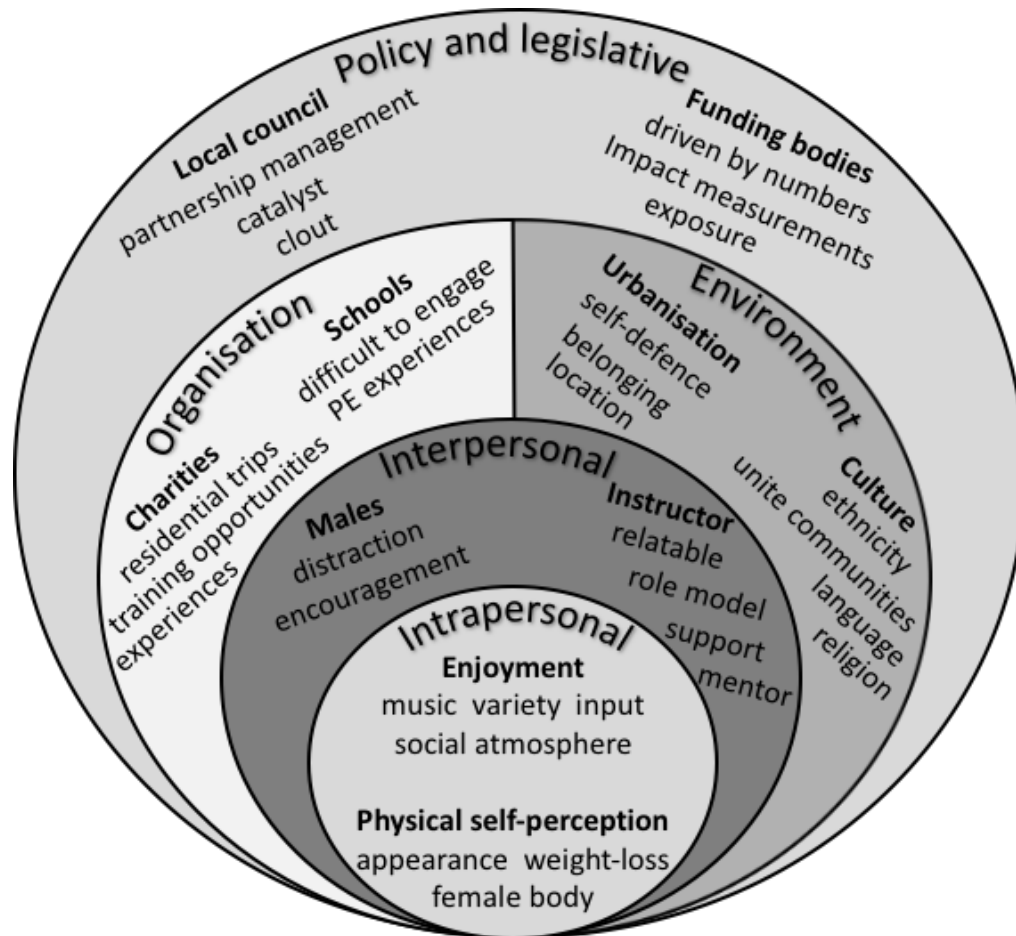


Figure 1. Depiction of results including ecological structure and themes.

Intrapersonal

Enjoyment. All four providers identified enjoyment as a factor that influences young females PA level and long-term engagement. The providers described the positive role enjoyment plays and ways to promote or undermine it. Music, variety, input, and creating a social atmosphere were identified as ways to promote enjoyment among young females. They felt that creating a fun and social environment was a key way to engage young females as PA is not a priority to them. One provider said: “I don’t think they think ‘I want to go and be physically active today’. I think it’s what’s put in front of them and whether they enjoy it when it’s there in front of them”. This perspective is reflected in previous research which found lack of enjoyment to be a mediator of PA intervention effectiveness (e.g., Motl et al., 2001) or a key reason for withdrawal (e.g., Bengoechea, Streat & Williams, 2004). One provider stated that the integration of music was one way to achieve a fun environment and engage some of the most disengaged females as this is a very different approach to those taken in traditional physical education: “Like a girl sitting out and as soon as she hears our music is on, everyone else is having fun, they’ll get involved”. Another strategy for engaging this population was to include variety and make

the activity as “novel and tailored” as possible increase enjoyment and program adherence. All providers emphasised the need to promote a social environment. One provider stated that this can be achieved by designating time for the young females to socialise with one another in between activities or drills:

They do a bit, they sit out, they have a little chat and then I go “do you wanna do some pads?” “oh yeah yeah, I like pads” and then they’ll go in and do some pads again, and then they’ll sit back down again and have a little chat and then I’ll go “come on then let’s finish off with skipping”.

These findings show that the PA providers are adapting traditional delivery of PA to cater to the needs of the females in the *This Girl Can Lambeth* project. The providers adaptations align with the recommendations made by Rees et al.’s review (2006) which found that less structured activities with an emphasis on socialising were most attractive to youth between the ages of 11 and 16. One provider said that starting a female-only program made his organisation realise there was “lots to learn” about female-specific delivery so they sought input from the young females to tailor the activities they were providing and saw positive results:

The girls you know we tried that [the same approach they took with boys] and it just didn’t work, it fell on its face. They were like “nope, no. We’re not doing it, we’re not doing laps.” “no but you have to do it.” “I don’t have to do anything.” So we thought: alright let’s stop and let’s assess this and then so that’s when we started to engage them and asked “okay, how do you want the session to run? What are you guys interested in? Are you interested in fitness? Are you interested in winning matches?”.

On the other hand, the providers identified ways in which enjoyment can be undermined. They believed that competition and self-efficacy were the main barriers to enjoyment. Factors such as “fear of embarrassment” and not having the “necessary skills” or physical attributes to be ‘good’ at activity served were also identified as a deterrent:

Not being good enough, I think is the main thing which is why you have to make a session fun and enjoyable rather than competitive because if it’s competitive and she knows she’s not very good at something, then it makes it that much harder. But if it’s fun and enjoyment then it’s like “oh don’t worry about it” ...as soon as you put competition on anything, it can go the wrong way so I think it’s gotta be fun and it’s gotta be something they enjoy.

The provider’s perspectives allude to a mutually exclusive relationship between enjoyment and competition. This has important implications for PA providers, their coaching staff and their intervention structure, as a program with no competition may not be as engaging for young females who find competitive PA enjoyable. In the literature fun and enjoyment have received considerable attention partly because of their subjective definitions and scope (Bengochea, Stren & Williams,

2004). Studies have found that coaches and parents perceptions of fun and enjoyment, which are more learning focussed, differ from the perceptions of youth participants who mostly enjoyed game play to improve skill (e.g., Jones, 2002). This has implications for PA providers as it may be important to include some competitive elements in PA programs to engage a variety of females, but it may also be important to consider the skill level and the goals of participants.

Physical self-perception. All four PA providers identified appearance as a factor that influences young female PA participation. While they all recognised that appearance can be a barrier and several providers identified “a need for body image workshops”, they also stated ways in which appearance can be a motivation for young females. Providers stated that improving their appearance and weight-loss act as strong influencers for some females. Three of the providers identified weight management as a motivation, “[you] are doing it because you realise there’s benefit of weight loss and maybe you’re an overweight girl”. One provider also stated that young females may be motivated to tone and sculpt their bodies with the intention of improving their appearance: “some of them just wanna get their beach bodies ready”.

However, concerns about appearance and negative body image can also hinder PA engagement. Some of the providers spoke about how young female bodies are changing and how this made them uncomfortable and less active: “We noticed how conscious girls were particularly in mixed gender schools...they felt conscious in their P.E. kit and they didn’t want to jump up and down”. Other providers stated that some young females are also concerned that PA and sport would change their bodies negatively: “there’s that image of being butch players, and that’s not for them. They think “I don’t want to look like that... if I play football, that’s what people will think” at that age they are conscious of being feminine”.

The provider’s views illustrate that PA is both a means of improving physical self-perception, and a concern regarding femininity during and after PA for young females. In line with the providers perspective, previous research has shown that participating in PA can improve physical self-perception for adolescent females. For example, a 6-week aerobic dance intervention study found that for 50 British girls aged 13-14 body image dissatisfaction decreased (attractiveness, feeling fat, salience, and strength and fitness) and physical self-perceptions were enhanced (body attractiveness and physical self-worth; Burgess, Grogan & Burwitz, 2006). However, these improvements were not sustained after 6 weeks. This suggest that dance interventions have the potential to improve physical self-perceptions among this population which might be sustainable with longer intervention periods. A review including 28 articles pertaining to gender norms, nutrition and PA in adolescent girls identified five major themes:

girls relationships with PA are complex and require negotiating gender roles; literature focuses on dieting rather nutrition; appearance and perceptions influence behaviours; 'body'-focussed discourse is significant to girls experiences; social influences, institutions and environments are influential and may offer opportunity for future research and action (Spencer, Rehman & Kirk, 2015). They conclude that young females' health behaviours are affected by gender norms and feminine ideals through complex negotiations, perceptions, body centred discourse and societal influences. As a result, the authors suggest that focus should be placed on engaging young females and encouraging healthful behaviours rather than focusing on obesity as a public health issue and dieting as a solution. These findings have implications for policy makers, public health campaigns and those working directly with young females, as the problematisation of bodies could contribute to the issue. Future campaigns should focus on promoting a variety of activities and the benefits of PA rather than the appearance of young female bodies.

Interpersonal

Males. All four of the PA providers identified males as a factor that influences young females PA participation, agreeing that in adolescence females become more influenced by males. Importantly, all of the providers identified instances when they have perceived males to have both a positive and negative effect. To this end, one provider stated: "A lot of girls at that age become interested or fascinated by boys but that can bring some of them to our sessions". Some providers felt that male encouragement and endorsement can directly increase female participation:

They're gonna go where the boys are, that's a given. But then actually if [the boys] said "we're gonna go down to play basketball, do you wanna play basketball?" They would go and play basketball wouldn't they?

It's the brothers bringing the sisters and then they [females] are bringing whoever, like the guys are really good. The guys want the girls to get active... I've got one that's bringing his mum.

Other providers added that, although female-only sessions do have their place, mixed gender sessions can be crucial in development and supplying individuals with a wider variety of experiences to refine their skill. One provider said "The best female players we traditionally see, play football with boys".

Another provider stated:

In terms of looking at a specific sport like boxing there's no need for it to be female only. If you spar, you spar females but when you train there's males within that, and I think you need that within that context and within that setting because you're always learning about different shapes and different sizes and different abilities. And our mixed sessions here probably get thirty-forty percent females. So it's a nice mixture.

At the same time, the providers all recalled difficulties in engaging females during mixed sessions. For example, one provider described it as a “headache”, another provider said:

If boys are in the same vicinity as them, they tend to not perform as well as they can...they're more likely to get more involved, more stuck in [if males are absent]. Erm they're more likely to enjoy it, they're more likely to come back the next week.

A different provider said:

where we've had the two together, the boys started acting up cos they're trying to impress the girls...and then the girls, if there are boys around, start acting up, they stop training hard and everything is for show. So you kind of lose focus.

Some providers went further to say they felt sessions decreased in value when they are mixed gender. Rather than being able to provide engaging sessions “it just turns the session into more of a kind of erm you know classroom situation where now you're disciplining kids”. Some providers felt these difficulties increased with age, “the under 12's, you can mix them and we have done and it's been fine. Erm certainly when they get older it's a lot more difficult. It's not impossible but it's a lot more difficult”.

In summary the providers' perspectives demonstrate a complex relationship between males and females within PA settings with no consensus as to whether it has a positive or negative influence on the PA behaviour of young females. A previous study assessing social physique anxiety among adults found that the presence of males in exercise settings increased social physique anxiety for women, but this was not the case for men. The authors also found that women tended to shorten their exercise sessions if men were present (Kruisselbrink, Dodge, Swanburg & Macleod, 2004). These findings support the providers' views that males have a large influence over females in a PA setting but these findings also suggest that such influence is still experienced in adulthood. The difficulties the providers have encountered in delivering mixed gender sessions and creating progressive sessions with mixed groups supports the rationale for national curriculum physical education to be separate. A study comparing young females experiences of girls-only PE and mixed-gender PE in adolescent females aged 13-16 found that girls in the mixed-gender group felt pressure to be both feminine and good at sport (Evans, 2006). The complex nature of the influence of males on young females' PA participation warrants further study. Mixed-gender interventions may be more successful when the emphasis is on fun rather than competition or traditional sports skills.

Instructors. The providers described the important role that the PA instructors play in influencing PA engagement for young females. All interviewees agreed that PA instructors can have a large impact on the enjoyment and long-term maintenance of PA and it is therefore crucial that instructors are carefully chosen. Two of the providers stated that they felt community coaches were better placed

than PE teachers to increase PA levels in young females due to relatability and playing a unique role in their development:

you're still their teacher but you're not their school teacher. And that's where they look at you a little bit differently and that gives you that upper hand. It's kinda like their normal P.E. teacher wouldn't be like "here's my phone, here, take a selfie". Whereas I come in and they're like "oh miss, you're so cool, you let me take a selfie on your phone".

When asked to describe the role of coaches in their respective organisations, all providers felt that the role involves more than just organising and delivering physical activity. They emphasised the importance of being a "role model", "mentor" and providing "support". One provider felt that building a rapport with young participants was more important than the actual coaching: "I'm not necessarily worried about them teaching them or being an excellent coach or teaching them the fundamentals... [coaches should] get to know the young people and act as a kind of mentor". Mentoring is said to occur when a teacher or coach invests time into the personal development of a student or athlete, when a trusting relationship evolves, needs and interests are fulfilled and imitation of behaviour takes place (Bloom, Bush, Schinke & Salmela, 1998). Literature suggests that if these needs can be met in the relationship between young females and those leading PA it can be an effective and instrumental relationship not only for learning a new skill and increasing PA but also for personal development and long-term behaviour change (Felton & Jowett, 2014). Several providers identified care as another significant influencer in female engagement. One provider believes their female engagement is growing "because they [the girls] know that we care, that we give a toss, really". Another provider perceived a lack of care from PE teachers and they believe that such negative experiences within school can lead to female inactivity:

One of our schools in the league, they make their own way to [session location], they're not even accompanied, you know, and in the first season, the teacher rang me and asked "are they there yet?" or "Do you mind if I just send them down to you?" It's from a [local] school but it's still quite a way, at least half a mile. Well I said "if that's in your safeguarding policy, then yeah". They got the attitude of it doesn't really matter.

These findings illustrate that providers perceive relationship and rapport to play a role in engagement. In a study of PE teachers, Beauchamp, Barling & Morton (2011) investigated the effects of transformational teaching on adolescents' self-determined motivation, self-efficacy and intention. The study found that teachers fostering an empowering, inspiring and challenging leadership style had a positive effect on self-determined motivation, self-efficacy and intention to be physically active. Another study mentioned earlier (Shaikh & Forneris, 2018) also emphasised relatedness through shared experiences and interests, mentoring, and support. Such findings have implications for both teachers and coaches, as they suggest that leadership style rather than role, may be important in the

PA experiences of young females. Interventions aimed at young females may be more successful in promoting PA when they are delivered by qualified community-based instructors who engage in mentorship within their role.

Organisational

Charities. All providers recognised charities, such as their own, as organisations that can impact female participation in PA. They said that as non-profit organisations they are able to provide “unique” services to young females and identified multi-component projects, training opportunities and residential trips as positive ways their organisations are able to encourage female PA. One provider gave an example of a multi-component PA project, where young females attained coaching and English teaching qualifications, and fundraised for a residential trip abroad:

[young leaders] came up with the idea to go abroad and do a residential somewhere else and help teach kids English and then they fundraised it all on their own with the help of one of our trustees who works for [a bank]. Basically, whatever they raised erm she was gonna double it. And we ended up doing an overnight sports event from seven at night to seven in the morning... They went to Sri Lanka, they taught English everyday, helped them [Sri Lankan children] with their schoolwork, sport and they had their free time on the beach and stuff like that.

Another provider stated, “These are young people with issues, from around the local community that we’ve mentored, trained up ourselves, we get them accredited, we get them trained”. However, all of the providers also recognised that as charitable organisations they rely on external funding and therefore face difficulties in the way of sustainability, staffing and capacity:

‘cos we’re such a small organisation, there’s only two of us, I think if there was more of us we would engage with more people, simple as. And we’d have more projects and more projects at our sites and a lot more of the school projects to have a lot more pathways. But right now we’re kind of just dealing with what we can.

These findings support previous work suggesting that charities are well positioned to provide young people with a variety of skills, opportunities and experiences that can enhance their attitudes and prospects (e.g. Mirabella, 2014). For example, having a diverse board of trustees will contribute to network contacts and access to resources (Pfeffer & Salancik, 1978), expertise and experience (Eisendardt & Bougeois, 1988), decision making (Carpenter & Westphal, 2001) and opportunity taking (Griscombe & Mattis, 2002). A recent analysis of 211 charities found that out of age, race, ethnicity and tenure diversity of charity board members, the latter was the only significant predictor of financial sustainability (Cheuk, Nichol, Tinggi & Hla, 2018). Several studies suggest that charities’ dependency on financial support from others for sustainability can result in a number of issues. For example, pressures such as capacity building (Cairns, Harris, Young, 2005), accountability and transparency (Polonsky &

Grau, 2011) have led to the adoption of a more business-like approach. This diverts attention and resources away from the organisations' social missions and beneficiaries. This has implications for funding bodies and the way that impact is measured in the voluntary and non-profit sector (discussed later).

Schools. The providers described the ways in which they believe schools impact young females PA participation. All four of them agreed that the schools play an influential role in the PA experiences of young females and have the power to either provide them with good early experiences or in contrast contribute to low participation rates among females. The providers stated that "schools have got a hard job because they have to teach in a specific format" therefore collaborating with schools and intervening in that setting is key to increasing female PA levels. Schools provide a familiar setting with potential young female participants which PA providers can engage and "through schools you can provide a pathway" to long-term or community-based PA.

One provider stated that school involvement has been a long-term goal of their organisation and *This Girl Can Lambeth* was instrumental in creating such partnerships:

we gotta get the schools involved, I was banging on about that for years until this came along (...) this funding. I said straight away, I said to [local council commissioner] "this is what we want, to get the schools involved". So we started running the school leagues and straight away we were getting girls

Three providers felt that within the school setting, enthusiastic teachers are important to the partnership as they can promote and encourage young females to engage with the providers:

if there's a really good teacher within the school (...) I find that [teacher X] is quite proactive like that. If she's got the time she'll actually sit down with the group and get them all together and remind them (...) what I do find is a lot of the teachers won't but [teacher X] is really good. She can be quite disorganised a lot of the time but when she's on it she'll go "right, you lot, meet me outside here" I'll send a youth worker down and I'll know she's arranged for them girls to be there.

All four providers shared the view that schools are difficult to engage with, one stated:

We've always thought schools were hard work, I mean they are hard work schools, they are. They're shocking. If I ran [our organization] like some of their P.E. departments we wouldn't exist. They're just (...) it's just shocking correspondence you know, it's terrible. Terrible. Erm but they're under a lot of pressure, teachers. Who'd be a teacher, you know what I mean?

These findings illustrate the importance of schools, but overall the providers perceived a lack of engagement and enthusiasm for physical education and PA. This has resulted in difficulties creating and maintaining partnerships with schools. A very recent paper examined the policies, implications and role

of schools in PE in the UK (Griggs & Randall 2018). The authors suggest that policy and funding changes over the last two decades have led to a shift from specialist to generalist training, and outsourcing of PE to sports coaches. In the literature this has raised concerns regarding the extent to which PA providers and coaches lack appropriate teaching qualifications, prioritise activities and sporting objectives over educational goals and lack class management skills (Blair & Capel, 2011). Also, outsourcing has removed responsibility for the delivery of PE from teachers, resulting in them becoming progressively and further deskilled (Keay & Spence 2012). This has implications for the role of PE subject leaders, the sustainability of outsourcing and the education funding review which will take place in 2020 (Griggs & Randall, 2018). It is important that schools provide young females with good early experiences of physical education and therefore PA. Therefore an effective strategy for instilling healthy habits and attitudes toward PA may be to upskill PE teachers and broaden delivery by supplementing curriculum activities with externally-provided provision.

Environmental

Culture. All four providers identified culture as a factor that heavily influences PA participation among young females. The providers spoke about cultural factors such language, religion, and ethnicity. Although all the providers identified culture as a barrier to participation in this population, two providers stated that the *This Girl Can Lambeth* project has “shown [them] how powerful sport is in kind of bringing communities together”. One provider shared an example:

we decided to run a community engagement program with the kids so we’ve got ten young people, five of them were boys and five of them were girls; all Portuguese speaking, and we said to them “...what are the themes that are important to you guys?” ...So we decided to, or the kids anyway, they decided “right the best way to engage this community is to have a Portuguese speaking festival; a football festival” ... The problem is that you have Angolans, Mozambicans, Brazilians you know erm Portuguese; Madeirans, and they don’t talk to each other. They’ve all got inner beef right? they all speak the same language but they’ve all got beef ... that’s parent level. On the kids level they’re all cool because ... they engage with all different cultures. Their parents don’t. ...so they put on this tournament and it was a really successful tournament; we got local press involved... so the parents cooked the food, delivered the food and erm got to see their kids playing, and then we had a local counsellor come and speak and he’s Portuguese himself and was speaking about trying to unite everyone. And it was just a really powerful event that was youth-led to engage a really sensitive topic within this culture that’s actually affecting the young people now in terms of them coming to sessions and you know really participating in what we’re trying to do.

The providers identified Afro-Caribbean, Muslim and Hispanic girls as the main groups who they perceive experience cultural barriers in relation to being physical active. They felt that these cultures are “strict cultures” where “you’re gonna be a doctor... you’re gonna be a lawyer like there’s no time for sport cos it’s not putting food on the table” or “more is required of them in the home” regarding

“house work” and “babysitting”. Alongside providing female coaches and indoor facilities for Muslim females, one provider shared an example of cultural barriers imposed by parents:

we have a girl right now who couldn't play for us for a year erm because the dad just wouldn't let her come and she's one of the most talented girls we've ever seen. We met her at a school program... because that's at school and the dad doesn't know. And we were like “come to the community stuff because then you get to play matches, you get to do all of this stuff” and she's like “I can't, my dad doesn't want me to”. So we got [coach X] to start calling the mum, to start calling the dad, and it was a year's worth of engagement before she started coming.

These findings show that within urban populations culture influences PA participation for young females. However, the providers in the current study have found ways to attenuate the cultural differences and barriers by creating inclusive community projects and increasing outreach efforts. These findings support previous literature which suggests there is a need for culturally-appropriate and community-based interventions to tackle the more pronounced drop in PA levels seen among minority females (Barr-Anderson et al., 2017). In a study comparing the PA attitudes, preferences and practises in 80 African-American, Hispanic and Caucasian girls aged 11-13, the authors only found slight differences in favoured activities. They concluded that factors other than ethnicity contribute to girls PA preferences and distinct interventions may not be needed (Grieser et al., 2006). Future PA projects should aim to develop culturally-considered but inclusive projects through collaboration with beneficiaries.

Urbanisation. The providers identified a variety of factors associated with urbanisation that they felt influence young females PA participation. All four providers viewed their PA projects as “gang prevention” or avenues to increase safety in the local community. They believe that urban environments exacerbate societal issues and young females may be attracted to PA to seek safety through “belonging” or acquire self-defence skills. One provider said that this is the main reason for the growth of their organisation:

... a young man I was mentoring got stabbed to death in North London and that's when I decided to come on full time because I was like: actually we are impacting these people. Erm, I think we could do a lot more you know, if I came on full time.

Several providers stated that they target “gangs” and use “their tie” as a strategy to engage them. The providers felt that “deprivation” in densely populated areas was a significant cause of gang culture and PA serves as a “hook” to rehabilitate these young people. Two of the providers deliver martial arts and the other two advocate for its efficacy in young female populations as they believe martial arts are “empowering” to females because of “life experiences”. One provider stated that when offering a female PA program “the amount of schools that are asking for boxing now just says it all”. On the other

hand, urbanisation can be a barrier to PA for young females. Providers identified “locations of youth centres” and gang territories as deterrents. One provider stated:

where we are, it's quite like, it's a dead end and it's either side of a footpath, and an underpass so if you don't know the area you wouldn't wanna go there...I think erm obviously there's quite a few gangs around the area as well, people hear about that so that's another barrier.

These findings support previous research that suggests environmental factors linked to urbanisation can discourage young females from being active through avoiding crime in outdoor areas, fear of violence, and location of PA facilities (WHO, 2018). Although the current study suggests it can encourage young females to be active in the providers view this is only a minority of females. A previous intervention has used PA as a tool for development and tackling violence. For example, a study of an urban settlement in Columbia used sport and art to tackle social issues of security, freedom of speech, feeling of belonging and equal access. The authors concluded that peacebuilding was strengthened through sport however other context-specific development tools are needed to tackle determinants (Sobotova, Safarikova & Gonzalez, 2016). This has implications for the PA providers' gang prevention programs, as it suggests that a tailored approach may be useful to effectively tackle issues within a particular environment or population. In this case interventions need to specially target barriers faced by young urban females and mediators of health enhancing PA participation.

Policy and Legislative

Local Council. The providers identified the local council as influential in the issue of female inactivity. They identified them as having “clout” and influence to instigate partnerships between organisations and schools, and as a “catalyst” and cause for the growth of their female programs. One provider stated that being part of this local council project provided them with valuable experience and they are “gonna continue [female engagement] beyond the funding of this program”. Another provider stated:

when [local council commissioner] sent 'round an email about the girls league, because it came from the council, we got an instant response. Yeah, we got the buy-in then and now a lot of those girls come to our Saturday session and now we've got an actual football team out of it playing in a league. That's all through this. The council's got that clout.

These findings show that local councils have been instrumental in helping these organisations engage females through dedicated funding and facilitating networks. However, the providers do not feel that the local council “did their research” in terms of choosing the charities involved, effectively managed the partnering organisations or had a long-term plan for sustainability of PA provision for young females. Rather, they felt that the local council lacked strategy and took the approach of “oh there's a bit of money we'll do a girls project”. One provider stated:

It's not a bad idea and that's why we signed up to it, because it's a good thing but its just you know, the management of the whole thing hasn't been great...I think getting buy-in from partners in the beginning is really key and not just buying in to delivering a program, but buying into working together and having a joint approach...it's a partnership in name which is a shame because I think it could have had legs.

Another provider said:

I think it would be nice that when this finishes, something grows out of it. I think it would be a shame if it just (...) that's the end of it, that was the 3 years, that was fun, see you later. I think Lambeth should take it on.

The findings illustrate the benefits of local council involvement in the delivery of community PA, but overall the providers reported meagre management of the project which indirectly impacts young female participation. A review of community wide interventions for increasing PA found that 22 of 25 included studies involved a component of building partnerships with local governments or non-governmental organisations (Baker et al., 2015). The studies utilised local government platforms, networks and funding to increase reach and impact of their interventions. However, the review concluded that the effects reported across the studies were inconsistent. Previous health and PA intervention research supported these findings, reporting that research and strategies that focus broader level factors are much less common (Booth et al., 2001). Together these indicate that further research regarding the involvement of local government in physical activity intervention is needed.

Funding bodies. The providers felt that, similarly to the local council, funding bodies are a crucial and instrumental element that indirectly impacts the participation of females in PA projects. In *the This Girl Can Lambeth* project the providers viewed Sport England as a "silent partner" who were valued because of the funding and exposure they provided, however they felt that there is a significant disparity between the funding body's policies and what "goes on on the ground". A provider stated:

Funders are what make these things happen ultimately, but the time scale needed to be bigger than three years...the age bracket should have been broken down across the three years and I would have started younger as well.

All the providers felt the project was driven by numbers rather than quality of engagement and they felt that without this pressure "there could have been more positives". For example, one provider stated:

In the first year I felt like, it was just like "deliver this project, get the numbers" and then that was it. We wouldn't engage with those people again, and actually they wanted to engage with us... I've learnt that, you can still get your numbers or whatever but the value of the sessions is more important.

The providers expressed issues with how funding bodies measure impact and participation. One provider stated:

Then the other thing is measuring as well, it should be more than participation. I think participation is whack 'cos you know I can go into a school every single day this week, between me and [coach X], and we can deliver to every single year group, a football session. At the end of the year I've delivered to 300,000 young people this year which sounds amazing but when we look at the impact, will those young people remember us this time next year? They probably won't because we only came in for an hour. So measuring participation doesn't (...) it's not great... Measuring impact is more ... it allows organisations to focus on delivery rather than on numbers, and when you take away that pressure to hit numbers people start doing quality and effective work.

Another provider stated:

I mean what is a success criteria...how am I ever going to measure regular participation because everyone measures it differently. London Sport they measure it six out of eight sessions. At the Mayor's Office they measure it as ten out of twelve sessions.

These findings illustrate the providers' frustration with the lack of agreement, structure and understanding demonstrated by funding bodies. The providers' views suggest that the influence of funding bodies hampers the provision they can provide and therefore the engagement of young females. An article exploring four approaches to assessing the social impact of charitable organisations states that the reporting of measurements to multiple bodies adds to managerial activities and costs which are unrelated to the direct delivering of services, and distract the charity from its core focus (Polonsky & Grau, 2011). The authors propose that there are three important questions in determining a performance measurement approach: "Who is our audience?"; "what evaluation measures are important to the organisation?"; and "what evaluation measures are best for the organisation?". They conclude, similarly to the providers, that a collaborative development of evaluation criteria is needed. The findings of the current study also suggest that the time frame and structure of the funding should be agreed upon between collaborative partners and reflect the scope of the project (e.g., age and aims).

Summary and Conclusion

From the providers' perspective, young females prefer partaking in PA that is enjoyable with an emphasis on socialising rather than sport-like competition. Mixed-gender programmes can be beneficial in some instances, especially where males are encouraging of females however, females may experience an added pressure to impress males which can serve as a distraction. Interventions led by community-based coaches are deemed more beneficial than teacher-led ones due to their capacious role, yet schools play an important role in facilitating outsourced provision and providing pathways into

community-based PA. Uptake and adherence to community-based PA will be boosted if it is contextualised and considers environmental factors associated with the target population. The providers' perspective also suggests that indirect influences from the policy and legislative level need to become better aligned with the applied aspects of providing PA to young urban females.

In conclusion, the findings show that there are an array of factors spanning across the levels of the ecological model that influence PA participation in young females. Important factors to consider include: enjoyment, instructor, schools, culture, location and sustainability. Although the study's findings are limited to provision for females aged 14-25 living in urban areas in the UK, the factors identified in this study provide potential considerations for future PA interventions and research in different populations.

Appendix A: Interview Guide

1. Ok, could you start by telling me a little bit about your organisation?

Name Type of org (charity) Background Aims Staff (no., qualifications, coach's role)

2. Could you tell me about the physical activity that you provide?

Target pop Activities Locations Numbers of participant's length of projects

3. How do you decide what activities to provide and to whom?

What considerations do you make for female programs?

4. What are your views on female specific sessions?

5. Could you sum up your experiences of providing activities to the young females in Lambeth?

6. What do you think motivates young females that engage? (5 examples- tried/not tried)

7. What barriers do you think young females face when they are deciding whether to begin?

(5 examples)

8. What do you think affects adherence to a programme and the maintenance?

Schools? Long term projects? How do you separate athlete from participant?

9. Can you tell me how you go about developing an intervention for this population?

If a school approached you to design a project from scratch.... (Adaptat for 18-25 age group?)

10. Can you tell me about your experiences of being a PA provider in this project/partnership?

Positives Difficulties Met expectations? What would you do differently?

11. What impact do you think your program is having on the girls that you engage?

USP? Reached aims?

12. What do you think you could do within your program to make more girls engage?

13. Have your views on increasing PA in young females changed since the beginning of the project?

If so how? If not, what have you learnt? More difficult or easier? Do different?

14. If you were a politician/governor is there anything you would implement to encourage PA in young girls?

As a provider how can you influence/contribute to change (policy/legislative level)

16. Anything to add?

General discussion

Synopsis of main findings

In this thesis we take an ecological approach to reporting results and insights from a series of four studies pertaining to the physical activity (PA) behaviour of 14-25 year-old females based in the UK. In Study 1 we reviewed all UK-based PA interventions published up to 2016 that were aimed at this population. We found that most interventions were based in educational institutions and focussed on either psychological or physiological intrapersonal factors to measure effectiveness. Therefore, in Study 2 we used both psychological and physiological intrapersonal measures to evaluate the effectiveness of a school-based PA intervention. The intervention was developed and delivered by external providers and aimed to increase the PA levels of females aged 14-16. We found no clear benefit of the PA intervention program in comparison to curriculum-based physical education. This motivated the next two qualitative studies. In Study 3 we used focus groups to investigate the impact of the intervention and the factors that influence engagement from the participants' perspective. In Study 4 we used interviews to investigate the development of the interventions and the factors that influence young female engagement from the providers' perspective. Together, the findings of these studies highlight the misalignment between the different stakeholders but reveal promising avenues for improvement at the different levels of the ecological model.

Intrapersonal

Young female participants, PA providers, and researchers in the literature have conflicting views regarding the most prominent factors that influence PA participation at this level (Study 3 and 4). For example, self-efficacy and physical self-perception, which have frequently been investigated (Study 1) and targeted before (including in Study 2), were not perceived as influential by the participants themselves. Despite improving for the interventions group, Study 2 found that self-efficacy was not a significant predictor of PA behaviour for young urban females aged 14-16. In contrast, in Study 3 the young females identified the benefits PA can impart on mental state and personal development as the most influential intrapersonal factors in their PA decisions. It is plausible that this discrepancy influenced the decreases in intention to exercise seen in the intervention participants of Study 2, as the intervention did not target their most important intrapersonal factors. This may also explain why several previous interventions did not find improvements in self-efficacy (Beets, Pitetti & Forlaw, 2007). The *This Girl Can* campaign, which specifically targets females, was well known and well received among the participants (Study 3) and had been launched three years prior to data collection. Therefore, it is possible that the campaign's focus on diverse body-types and physical abilities has

caused a shift in the perceptions of the young females, and that their involvement in the program is a result of them having already overcome such barriers. On the other hand, body image may be a sensitive topic for young females which may have affected disclosure within the focus group setting in Study 3. One point of agreement between participants, providers and previous research is the importance of enjoyment (e.g., Budd et al., 2018). Enjoyment has been associated with higher levels of adherence and therefore health, our results in Study 2 suggest a weak link between the enjoyment, encouraged through the intervention, and physiological effects. Ultimately, our findings suggest that to be impactful on the PA behaviours of young females, interventions must strike a balance between enjoyment and skill development.

Interpersonal

There was a good level of agreement on the most prominent factors which influence PA participation at this level. Both the young females in Study 3 and the providers in Study 4 identified that coaches and male peers play the most important role in influencing young females PA behaviour. While they agreed that coaches are influential in engagement and retention through providing support, being relatable and serving as a mentor, the females and the providers disagreed in regard to coaches' competence and expertise. The participants placed emphasis on high quality coaching whereas the providers placed emphasis on employing coaches that can be role models with relatable and engaging personalities. Study 1 had already identified instructor-efficacy as a variable considered in measuring intervention effectiveness (Bray et al., 2001). This suggests that organisations should continue to consider relatability when employing coaches, but it is also important to ensure coaches are trained and qualified to a high standard not least because proxy-efficacy perceptions have been positively correlated with self-efficacy and adherence (Bray et al., 2001). The focus on mentoring and relatability rather than expertise and skill may in part explain why we found no significant increases in self-efficacy for the intervention group in Study 2. It is therefore important to the PA-related confidence of young females that they perceive coaches and instructors to be experienced and capable.

Participants and providers agreed that male peers, coaches and relatives play an important role within PA settings and in encouraging young females through feedback. While male peers are a source of distraction, male encouragement and support is directly related to enhanced female engagement (Studies 3 and 4). It is not clear whether gender or expertise is the determinant factor although Study 3 alluded that males have greater expertise in sport, making their opinions and encouragement more valued. On the whole, support from males appeared to be important to the

young females. Therefore, the involvement of fathers, male coaches but also male peers may be a beneficial feature in PA interventions. However, a more systemic solution might be to increase the visibility and encouragement of female role models who are experts in their sport as well as relatable role models. The findings of Study 3 indicate that perceived support is more important than perceived norms, which was not a significant predictor of PA levels in Study 2. Support is related to subjective norms but the Theory of Planned Behaviour (TPB) variable does not capture the perception of norms among those who are supportive of PA but not physically active themselves. Overall, the findings point to the providers having a good understanding of the overarching factors that young females perceive on an interpersonal level, however their agreement on the underpinning mechanisms is limited.

Environmental

Lack of opportunity linked to physical environment (e.g. safety), and culture (e.g. religion) were reported in Study 3 as the most influential environmental factors, yet exploration of such factors was notably missing from the articles included in Study 1. Although the providers did not perceive a lack of opportunity, they did identify urbanisation and culture as influential factors in Study 4 and reported contextual considerations their organisations had made in attempts to provide opportunities for young females. In Study 2, perceived behavioural control and PA levels remained very stable for the young females, which may be because the greatest barriers they face are external or environmental (i.e. not under their control). Such environmental-level factors have been suggested to strongly determine successful approaches to behaviour change. For example, previous research in childhood obesity has attributed failures to effectively respond to the epidemic to taking a narrow approach in tackling the problem (Maziak, Ward & Stockton, 2008). The authors recommend focussing on distal modifiable factors rather than individual-level determinants, and suggested that an evidence-driven multi-level approach would be the best to regulate public health issues. The primary environmental factors identified in the current project (Study 3) appear to be related to the urban environment where the females under study reside, indicating that context is an essential consideration in PA behaviour.

Organisational

All studies in the present project found that educational institutions, especially schools, play an enormous role in the PA experiences of young females. They are the most common setting for PA interventions aimed at young females (Studies 1 and 2), they provide young females early experiences of PA which are often negative (Studies 3 and 4), and they are the gatekeepers for

external provision (Studies 2 and 4). These findings have several implications. Intervention research conducted in education institutions is likely to capture a more active portion of 14-25 year old females, meaning that the problem may actually be considerably larger. In this connection, research pertaining to the PA behaviour of females aged 14-25 who are home-schooled, young mothers, not attending PE or young professionals is notably missing from the literature. Lastly, dependency on educational institutions may contribute to the drop-off points seen at 14 and 16 when PE is no longer compulsory (Sallis, Prochaska & Taylor, 2000). One aspect that seems to be working (Study 3) in sustaining female engagement is that educational institutions partner with external PA providers to provide young females with PA exit routes and viable pathways to life-long PA. Studies 3 and 4 underscore the influence that school and homework have on the leisure time of young females. If it is important that students engage in homework tasks it may be beneficial to the psychological and physiological health of young females if these tasks are active and engaging. For example, for geography, students may be tasked with collecting three samples of soil from three different local parks. Innovative approaches such as this enforced from the organisational level can create a more active culture among young people.

Policy and Legislative

The over-arching finding pertaining to the policy and legislative level was that agents at this level (e.g. local council and funding bodies) have a lack of practical understanding regarding provision, engagement and impact (Study 4). Study 1 identified a lack of consideration for influences at the policy and legislative level in intervention research. Study 4 found that the measures of impact, which are tied in to funding and influence PA provision, are inadequate for the long-term goal of increased female engagement. These findings have implications for the collaborative nature of projects that target health behaviours such as PA and may partially explain the inconsistent findings of Study 2. It is important that the aims and strategies of all organisations and bodies are aligned and agreed upon to ensure that maximum resources and efforts can be pointed at solving the problem. To this end, it may be useful for funders to issue initial funds to develop the ground-work for interventions which is informed by research and potential participants, and to then issue further funding for the implementation and continuation of interventions. Our findings point to the importance of collaboration between government agencies, funding bodies and PA professionals to develop, evaluate and sustain projects. Further research is needed to understand the indirect influence that funding and government bodies have on young females PA levels.

Methodological considerations

Conducting the experimental studies that comprise this thesis required a number of decisions to be made regarding experimental design. It is important to address such methodological issues as they are central to the findings of the current project. An evaluation project with multiple components such as this required an eclectic approach, and this was reflected in the selection of participants, methods and measures.

Participants

The decision to recruit young females and PA providers as participants in focus groups and interviews allowed us to gain a multi-dimensional view of young females PA and the factors that influence it. The young females provided both quantitative and qualitative data that allowed us to evaluate the effects of the *This Girl Can Lambeth* intervention in relation to other interventions and gain an in-depth understanding of their experiences which is far less frequent in the literature body. The prevailing narrative is that the 'truth' of any human phenomena is held by the population of interest (Little, 1995). It was therefore imperative to the project to gain the perspectives of the young females being targeted by PA intervention projects. The age bracket of the young females was chosen to capture the adolescent drop-off identified in previous research and the culmination of brain development. It is also a target age group identified as a public health priority by Sport England's Active Lives Survey (2014). The providers perspective on female PA was also important for two reasons. Firstly, to gain a detailed understanding of the interventions they deliver and secondly, to examine whether their interventions aimed to attenuate the barriers that actually exist for young females. Many studies have gained the perspective of deliverers (e.g. coaches and teachers) however, to our knowledge this is the first study reporting the perspectives of intervention developers. Based on the wealth of evidence we were able to obtain especially in Studies 3 and 4, we can conclude that the participants recruited for the studies included in the thesis were appropriate. Also, they were key stakeholders and beneficiaries of efforts to improve female PA engagement, however there may have been confounding variables that warrant consideration. The females in these studies were recruited from schools but participant behaviour and class dynamic were not taken into account. However, schools clearly separate classes based on academic attainment and/or behaviour which in turn affect both intervention impact and research findings. Study 1 included no articles that reported such variables, but these should be considered in future.

Multi-methods

In this thesis we triangulated quantitative and qualitative methods in Studies 2, 3, and 4 to both gain insight into the intervention effects and explore possible factors associated with them. This was important to understanding young females' PA behaviours. The triangulation of methods, defined as the combination of methodologies in the study of the same phenomenon (Deniz, 1978), can be used for cross-validation when two or more distinct methods are found to be congruent and yield comparable data. We also made the decision to conduct focus groups with the young females and interviews with the providers, in order to account for the different relationship dynamics. The young females already spend time together as part of a group and could discuss their various perspectives and experiences of the same intervention. On the other hand, the providers had less rapport with each other, work independently of one another and an in-depth understanding of each of their organisations was required from the data. It may have been useful to conduct focus groups with a subset of young females who took part in Study 2 to more closely understand the effects of the intervention within that group. However, it was important to gather a variety of experiences in the project not just experiences of one group of girls from one school whose behaviour may have been affected by our continued involvement. It may also have been useful to conduct focus groups with a number of coaches from each charity. This would have added another perspective and therefore an additional layer of understanding to the contribution of the current thesis. The nature of Studies 3 and 4 means that the lead researcher's background informed data collection and interpretation in a number of ways. The lead researcher is an urban female of mixed heritage in her mid-twenties and has a background in competitive sport where she remains active. As a researcher with experience and a strong interest in cultural sport psychology undertaking a project concerned with female PA, the research was heavily influenced by feminist thought. Regarding data collection, there was also a perceived level of mutual understanding around experiences and the use of colloquial language which helped the researcher guide the discussion and influence its direction. Regarding data interpretation, the background of the researcher may have also influenced how data was coded and the formulation of women-centred recommendations, but this was mitigated by having two researchers code the data and by discussing interpretations among the research team.

Measures

Study 1 found that intrapersonal level factors are the most commonly targeted by interventions and therefore intervention effectiveness is often measured at this level only. Although intrapersonal factors are central to determining behaviour and understanding how participants are impacted at an individual level, the results of this thesis argue that this approach is reductionist. The current research

supports previous literature which has found that behaviour cannot fully be explained by factors, characteristics or dimensions featured only at this level (Armitage & Conner, 2000; Rhodes et al., 2018).

It was important to the rigor and breadth of the project to collect measurements pertaining to both psychological and physiological health as this created a more complete picture of participants on an intrapersonal level. In hindsight, even though Study 2 did not show considerable physiological results it was useful in showing the PA interventions did not superior to PE and also that the intervention period may have not been sufficient to produce sizeable results. Study 1 found that a vast majority of intervention research evaluates intervention effectiveness on their capacity to positively impact intrapersonal factors, however most studies attended to either physiological or psychological factors. By combining the two the current project made an important contribution to the literature and helps to create a more complete picture of female PA. This also facilitated the overall interpretations of our results and allowed us to make more definitive recommendations and conclusions.

Theoretical implications

The findings of the preceding studies in this thesis have theoretical implications for future research. The ecological model used throughout this thesis proved useful in categorising factors into levels of influence, but can also be used in future research to categorise theoretical models that investigate behaviour change at the different levels. This would allow research to use quantitative methods to predict behaviour while keeping a holistic approach to the phenomenon of PA engagement in young females. A previous study has used this strategy to develop their intervention and found positive changes in PA levels, body composition and sedentary time (Elder et al., 2006; NHLBI, 2011). The ecological model's flexibility and all-encompassing nature means it can be applied to different populations and behaviours to structure and evaluate interventions. For example, having an ecological framework when designing an intervention raises questions of how the policy level is aligned with environmental and organisational aspects. In evaluating such interventions, the framework would raise the question of how impact can be measured at the different levels. Contrastingly, more individualistic approaches such as social-cognitive theories, humanistic frameworks and dual-process models respectively focus on key constructs linked to PA, explaining and intervening on behaviour, and the influence of non-conscious and hedonic determinants on motivation (Rhodes, McEwan & Rebar, 2018). Such approaches do not consider the role of the physical environment or broader social and political contexts. For these reasons we suggest that the

ecological framework may be instrumental in understanding an array of influences and in shaping public health policy.

In Study 2 we extended the TPB by adding self-efficacy and past PA behaviour to the model to investigate attitudes and behaviours of young females. The results of this study were further enlightened by the subsequent studies. Based on our experience of using this model, it appears that the 'subjective norms' subscale featured in the TPB is too narrow to capture perceived social support from those who are not interested in participating themselves. Future research should aim to extend or supplement the TPB questionnaires with measures of social support. The findings of Studies 2, 3 and 4 combined suggest that further research is required to understand the relationship between self-efficacy and behaviour when the skills involved are not particularly challenging. Self-efficacy was not a significant factor in any way that we investigated it, however previous studies have produced strong evidence for the inclusion of self-efficacy in models such as the TPB. We propose that the providers' focus on enjoyment and unstructured activity may have meant that the intervention in Study 2 did not challenge the young females' capabilities enough to impact their self-efficacy. Therefore, self-efficacy may not be a valuable addition unless the intervention purpose is to improve skill level.

Although there is a drive for quantitative research our present results argue for the use of mixed-methods which can provide context and depth to the investigation. Our suggestion is that theory development should be aided by using explorative qualitative methods with relevant stakeholders to refine future theoretical approaches.

Practical recommendations

In a thesis about engaging young females in PA, it would be amiss to leave practical implications of our results unaddressed. Here we specify readily applicable suggestions at each level of influence.

At the intrapersonal level, interventions should target both personal development and progressive skill development. This recommendation, linked with the quality of coaching practise, will influence self-efficacy and enjoyment. Enhancing PA skill level, increasing PA enjoyment and PA-related self-efficacy would allow the target population to reap the psychological and physiological benefits of PA and encourage maintenance. At the interpersonal level, PA providers should train and educate relatable coaches to a high standard. This would equip them with skills to engage with and teach young people but also to create a positive and fulfilling environment. For example, coaches would be able to create an ethos of mutual encouragement and support between different genders and levels

of expertise, male peers could be encouraging spectators at female events and coaches would be able to tailor sessions that are progressive for all. At an organisational level, it is important to expand opportunities in the way of choice and variety, and allow young females' participation to grow and stabilise over time when female-only groups are created. Low numbers are not necessarily indicative of interest, as uptake to community-based projects may be slow and fluctuate due to the variety of factors that influence participation and attendance in young female populations. For example, if a project is created to target Muslim females, initially it may take a while for word-of-mouth to spread and for numbers to grow then during religious periods such as Ramadan attendance may vary. At an environmental level, attenuating barriers such as safety will make the environment more conducive to the uptake and maintenance of PA. For example, arranging meeting points for participants on well-lit and accessible roads might solve the problem of unsafely located facilities. This will elevate some of the participants' and guardians' concerns regarding crime and infrastructure. At the policy and legislative level, it is important that agencies align the aims of their agenda with their strategy, the needs of their target populations and the approaches of their collaborative partners. For example, in determining how impact should be measured collaborating organisations should develop evaluation strategies that are practical for PA organisations and their resources.

The *This Girl Can* campaign has already shown an impact in the PA levels of females and in inspiring the collaborative project that underpins the present thesis. To further its impact, we presented some of the practical implications and recommendations that were deduced from our findings and in Table 1 we present three readily applicable recommendations at each level of influence.

Table 1. Practical recommendations at each level of the ecological model with reference to evidence from this thesis.

Ecological level	Practical recommendation	Evidence
Intrapersonal	Both physical health and mental well-being should be considered in PA intervention development	<u>Study 1</u> showed few articles considered both physiological and psychological benefits of PA. <u>Study 2</u> showed some improvements in both physiological and psychological factors (See figure 4 and Table 5). <u>Study 3</u> participants perceived psychological and physiological benefits (See “mental state”).
	PA sessions should be enjoyable and progressive	<u>Study 1</u> included several studies which found enjoyment was a crucial factor. <u>Study 3</u> participants said they wanted both enjoyable sessions and skill development (See “skill development”). <u>Study 4</u> providers said enjoyment was the main focus of their sessions with females (See “enjoyment”).
	Participants ability, input and goals should influence delivery of interventions	<u>Study 1</u> included some studies which found choice and autonomy-supportive environments beneficial to engagement. <u>Study 3</u> participants expressed various goals based on ability and criticised delivery when it did not meet their needs (See “personal development” and “coaches”). <u>Study 4</u> providers felt that participant input was crucial and should drive delivery (See “charities” and “culture”).
Interpersonal	Coaches should be highly trained, relatable and diverse	<u>Study 3</u> participants said that expertise, mentoring and a diverse coaching team were important to them (See “coaches”). <u>Study 4</u> providers felt that mentoring was just as important as coaching and encouraged participants to engage with training opportunities to become community-coaches (See “instructor” and “charities”).
	Male and female PA groups should be encouraged to support each other	<u>Study 3</u> participants felt that sport is male dominated and therefore valued male support and opinion (See “males”). <u>Study 4</u> providers said that young females are heavily influenced by males therefore males can be an instrumental source of support and encouragement (See “males”).
	Mixed-gender PA should focus on fun	<u>Study 3</u> participants felt that a focus on fun rather competition between males and females could improve mixed-gender sessions (See “males”). <u>Study 4</u> providers said that it was difficult to stay on task during mixed-gender sessions but also that mixed gender sessions are valuable (See “males”).
Organisational	Schools should assign active homework and discourage sedentary time	<u>Study 2</u> found that past PA levels were a significant predictor of PA levels suggesting that PA levels in school-aged females may influence PA levels later in life (See “predictive value of primary variables” and “Appendix D”). <u>Study 3</u> participants said that homework provided a significant barrier to PA and active leisure time (See “educational institutions”).
	Males and females should be treated fairly within PA settings and both male and female role models should be visible	<u>Study 3</u> participants stated that males receive preferential treatment over females within PA organisations and PE, they also perceived a lack of female role models in sport (See “PA organisations” “educational institutions” and “social media”). <u>Study 4</u> providers identified that relatable

		role models are important in engaging young females in PA and sport (See “instructors”).
	PE teachers should be up-skilled, and PE should be supplemented with PA interventions which have community-based exit routes	<u>Study 2</u> showed that PE and PA can positively affect both physiological and psychological factors (See figure 4 and Table 5). <u>Study 3</u> participants said that PE was repetitive and embarrassing, but PA intervention built their confidence and was enjoyable (See “educational institutions” and “mental state”). <u>Study 4</u> providers perceived a lack of care and enthusiasm from PE teachers and felt that interventions should lead to long-term community programs (See “schools” “charities” and “funding bodies”).
Environmental	Female PA opportunities should be increased and diversified	<u>Study 1</u> found that intervention activities were very limited. <u>Study 3</u> participants said that opportunities to take part in various or novel activities were difficult to find, often discontinued and required participants to travel considerable distances (See “opportunities”).
	Social media and mobile phone apps should be used to engage, educate and retain young females	<u>Study 3</u> participants said social media is a good tool to promote PA and create positive role models (See “social media”). <u>Study 4</u> providers spoke about their use of social media to engage young females and how social media can exacerbate body image issues (See “instructor” and “physical self-perception”).
	Location, culture and physical infrastructure should be considered in PA intervention development	<u>Study 3</u> participants stated that PA venues, religion, culture and transport all influence their PA participation and attendance (See “opportunities”). <u>Study 4</u> providers perceived environmental issues around safety, language and religion for young females (See “urbanisation “culture”).
Policy and legislative	Project evaluation criteria should be developed and include both quantitative impact and case studies	<u>Study 1</u> showed few articles used mixed-methods to measure intervention effectiveness. <u>Study 4</u> providers felt that differing measures of impact drained their resources and funding bodies evaluate projects based on the number of participants they engage rather than the effect the project has on participants (See “funding bodies”).
	PA campaign marketing should be representative and inclusive, and focus on the benefits of PA	<u>Study 3</u> participants praised the diversity and inclusivity of the TGC campaign and identified psychological benefits and personal development as their main motivations (See “TGC” “mental state” and “personal development”).
	Agents at the policy and legislation level should collaborate closely with agents at each level to effectively manage strategies and resources	<u>Study 1</u> only one article considered all ecological levels and this study had positive effects at each level (See Moon et al., 1999). <u>Study 4</u> providers said that bodies at the policy and legislation level play a significant role in the reach and impact of their projects but perceive incongruence between the various agents at each level (See “local council” and “funding bodies”).

Conclusion

In the present thesis we have studied which multi-level factors influence the participation of young urban females in PA. Taking a multi-method approach, we found that views surrounding influential factors are often not aligned between researchers, funders, schools, providers and participants. Interestingly, we found that physical self-perception and socialisation were not determining barriers to PA for young females. Instead, factors related to urbanisation and restraints on their leisure time seemed to pose the greatest barriers. We discussed how these findings have broader theoretical and practical implications in this area of public health to ensure Girls indeed *Can*.

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Notes

Throughout this thesis the pronoun “we” is used when referring to the lead researcher (i.e., Reisha Hull), who completed all parts of the work reported, and her supervisory team, who advised and the work reported. The pronoun “I” is used in the quotes from participants reported in chapters 3 and 4.

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Publications & Presentations

Presentations

Hull, R., de Oliveira, R., Mileva, K., & Zaidell, L. (2018). This Girl Can: A mixed-method research project. *LIU Guest Lecture Series 2018, Brooklyn, New York, October 2018.*

Hull, R., & Papatomas, A. (2015) Are religion and sport compatible? An exploration of elite Muslim athletes' experiences of Ramadan. *LIU Guest Lecture Series 2018, Brooklyn, New York, October 2018.*

Hull, R., de Oliveira, R., & Zaidell, L. (2018). An ecological approach to exploring physical activity interventions aimed at young UK-based females: A narrative systematic review. *BASES student Conference 2018, Northumbria, United Kingdom, April 2018.*

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Publications

Hull, R., de Oliveira, R., & Zaidell, L. (2018). An ecological approach to exploring physical activity interventions aimed at young UK-based females: A narrative systematic review. *Psychology, 9, 2795-2823.*

Hull, R., de Oliveira, R., & Zaidell, L. (2018). An ecological approach to exploring physical activity interventions aimed at young UK-based females: A narrative systematic review. *BASES student Conference 2018 - Graduate Journal of Sport, Exercise & Physical Education Research (2018) Vol. 8, Suppl.1: S1-S135*