

# Development and evaluation of a home-based physical activity intervention for adolescent girls – The HERizon Project

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A thesis submitted in partial fulfilment of the requirements of Liverpool John Moores  
University for the degree of Doctor of Philosophy

Funded by the University Alliance Bioscience DTA3/COFUND

January 2022

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## ABBREVIATIONS

<b>BMI</b>	Body mass index
<b>CON</b>	Control
<b>CONSORT</b>	Consolidated standards of reporting trials
<b>IMD</b>	Index of multiple deprivation
<b>LJMU</b>	Liverpool John Moores University
<b>LPA</b>	Light physical activity
<b>METs</b>	Metabolic equivalents
<b>mg</b>	Milligravity
<b>min</b>	Minutes
<b>MPA</b>	Moderate physical activity
<b>MRC</b>	Medical research council
<b>MVPA</b>	Moderate to vigorous physical activity
<b>PA</b>	Physical activity
<b>PE</b>	Physical education
<b>RCT</b>	Randomised controlled trial
<b>SB</b>	Sedentary behaviour
<b>SD</b>	Standard deviation
<b>SDT</b>	Self-determination theory
<b>SE</b>	Standard error
<b>SES</b>	Socioeconomic status
<b>T0</b>	Baseline data collection
<b>T1</b>	Postintervention data collection
<b>T2</b>	Follow-up data collection
<b>VPA</b>	Vigorous physical activity
<b>WHO</b>	World Health Organisation

## ABSTRACT

Approximately 80% of adolescent girls in the UK and Ireland are not meeting the minimum daily PA guidelines recommended to improve health and wellbeing. The majority of past interventions targeting this population have been school-based, but few have had sustained positive effects on physical activity (PA). As perceived low competence and fear of judgement by others are primary barriers to girls participation in PA, it is thought that interventions that are based in settings where the individual feels safe and comfortable, such as in the home, will likely lead to more effective improvements in PA. This thesis aimed to develop and assess a home-based intervention to increase PA in adolescent girls in accordance with the Medical Research Council guidance which involved the active involvement of adolescent girls in intervention design to improve its acceptability, feasibility, and enjoyability for this population.

**Study 1** explored adolescent girls perspectives of PA and the perceived influence of gender through 8 focus groups ( $n = 48$ ) in Ireland and the UK. Focus groups were thematically analysed and interpreted within a socioecological framework. Within the intrapersonal level, fear of judgement and changing priorities were identified as key barriers. Social pressure and having support from others were recognised as interpersonal factors affecting PA. Across all focus groups, gender inequality and social gender stereotyping were identified as major barriers preventing regular PA participation. The findings of this study directly informed the development of the HERizon Project and suggest that interventions targeting adolescent girls' PA should provide girls with independence to choose when and where they are physically active, encourage social support through online group communities and workout classes, and encourage girls to try new types of PA that have been traditionally categorised as 'male' activities, e.g., boxing and weightlifting.



**Study 2** was a randomised wait-list controlled trial that aimed to formatively evaluate the HERizon intervention. HERizon was a six week home-based multi-component PA intervention that was developed using self-determination theory and provided participants with behaviour change support through weekly Activity Mentor phone calls. Participants (mean 14.2 years, SD 1.1) were randomised into the HERizon intervention group ( $n = 22$ ) and a usual care waitlist control group ( $n = 20$ ). At post-intervention, there was no significant difference found in self-reported moderate to vigorous physical activity (MVPA) between groups, however the intervention group had significantly increased cardiorespiratory fitness, muscular endurance, intrinsic motivation, and body appreciation. There was high retention and adherence to the PA intervention. Qualitative results indicated that participants found HERizon to be enjoyable and acceptable. Future research was required to ascertain which components of the HERizon intervention were most effective and enjoyable, and a larger sample size using device-based measures of PA is needed to further evaluate the intervention's effectiveness on increasing adolescent girls PA.

**Study 3** involved a process evaluation of a mixed-methods, four-arm pilot randomised controlled trial of the HERizon intervention, aimed at increasing adolescent girls' PA. The 12 week study explored the reach, recruitment, fidelity, adherence and context of the remote intervention, as well as investigating mechanisms of impact and acceptability of intervention components. Participants were randomly allocated to one of four groups; PA programme group ( $n = 36$ ), behaviour change support group ( $n = 44$ ), combined group ( $n = 34$ ), and comparison group ( $n = 40$ ). Results found high fidelity for delivery and receipt, as well as high participant adherence and satisfaction across all intervention arms. For the PA programme and combined groups it was recommended that the online social media community be improved for a definitive future trial. Groups that received behaviour change support from an Activity Mentor were also found to have high satisfaction and engagement. Qualitative results from all intervention arms found autonomy,

accountability and routine to be facilitators to increasing girls' PA levels. This process evaluation provided insight into the acceptability and feasibility of implementing the HERizon intervention in a real-world setting. To assess HERizon's effectiveness, PA and secondary outcomes measures should be assessed in subsequent studies outside of the COVID-19 circumstance.

The findings of the studies included in this PhD give detailed insight into the many factors that influence adolescent girls' PA. It further provides support for remote PA interventions as the home was found to be an appropriate and effective setting in improving adolescent girls PA behaviours. Through detailed process evaluations, understanding has been gained on intervention fidelity which helped to provide greater meaning to quantitative results. By considering the context in which the interventions are being carried out, more appropriate and accurate conclusions could be made on intervention effectiveness, acceptability and appropriateness.

## DECLARATION

I declare that the work contained within this thesis is my own. No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

## Peer-reviewed publications

### *Publications resulting from this programme of research*

- Cowley E.S., Watson P.M., Foweather L., Belton S., Thompson A., Thijssen D. & Wagenmakers A. (2021) “Girls aren’t meant to exercise”: Perceived influence on physical activity among adolescent girls – The HERizon Project, *Children*, 8 (1), <https://doi.org/10.3390/children8010031>
- Cowley E.S., Watson P.M., Foweather L., Belton S., Mansfield C., Whitcomb-Khan G., Cacciatore I., Thompson A., Thijssen D. & Wagenmakers A. (2021) Formative evaluation of a home-based physical activity intervention for adolescent girls – The HERizon Project: A randomised controlled trial, *Children*, 8 (2), <https://dx.doi.org/10.3390%2Fchildren8020076>
- Cowley E.S., Foweather L., Watson P.M., Belton S., Thompson A., Thijssen D. & Wagenmakers A. (2022) What happened in ‘The HERizon Project’? – Process evaluation of a multi-arm remote physical activity intervention for adolescent girls, *International Journal of Environmental Research and Public Health*, 19 (2), <https://doi.org/10.3390/ijerph19020966>

### *Other publications completed by the candidate during the PhD tenure*

- Cowley E.S., Olenick A.A., McNulty K. & Ross E.Z. (2021) ‘Invisible Sportswomen’: The gender data gap in sport and exercise science research, *Women in Sport and Physical Activity Journal*, 29 (2), <https://doi.org/10.1123/wspaj.2021-0028>.
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- Parra-Soto S., Cowley E.S., Rezende L., Ferreccio C., Mathers J., Pell J., Ho F. & Celies-Morales C. (2021) Associations of six adiposity-related markers with incidence and mortality from 24 cancers – findings from the UK Biobank prospective cohort study, *BMC Medicine*, 19 (7), <http://dx.doi.org/10.1186/s12916-020-01848-8>.

## Conference communications

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021). The formative evaluation of The HERizon Project randomised controlled trial - a home-based physical activity intervention for adolescent girls. In *International Society of Physical Activity Health*, virtual, October 14 [oral]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021). An overview of The HERizon Project; a remote physical activity programme for adolescent girls. In *European College of Sport Science*, virtual, September 8 [Young Investigator Award poster presentation]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021). The formative evaluation of HERizon: a randomised controlled trial. In *International Society of Behavioural Nutrition and Physical Activity*, virtual, June 10 [oral]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021). The formative evaluation of a home-based physical activity programme for adolescent girls. In *Trinity Health Education conference*, virtual, March 10 [oral]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2020). Review of PhD to date and key scientific highlights. In *European Commission Mid-term Review (Doctoral Training Alliance)*, virtual, November 16 [oral]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2020). The HERizon Project – how it all began. In *Northeast Postgraduate Conference*, virtual, November 11 [oral]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2020). Talking to adolescent girls to inform the development of a novel HIIT intervention. In *UK Society of Behavioural Medicine*, Bath UK, January 16 [poster]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2019). Co-creating a HOME-based HIIT intervention with “inactive” adolescent girls from low socio-economic areas. In *Future Physiology*, Liverpool UK, December 17 [poster]

**Cowley ES.,** Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2019). The Development of a HOME-based HIIT intervention with “inactive” adolescent girls from low socio-economic areas. In *LJMU Institute for Health Research*, Liverpool UK, September 9 [oral and poster]

## DEDICATION

I would like to dedicate this thesis to my parents, Lisa and Derek

*Do shaol do thuras*

## ACKNOWLEDGEMENTS

*Feminist: the person who believes in the social, political, and economic equality of the sexes*

- Chimamanda Ngozi Adichie

There are so many people who have provided me with guidance and encouragement throughout this PhD journey. Firstly, thank you to my supervisory team Prof Anton Wagenmakers, Dr Paula Watson, Dr Lawrence Fowweather, Prof Dick Thijssen, Dr Andrew Thompson and Dr Sarahjane Belton. It has been such a privilege to learn from you and I am forever grateful for your time and feedback – I can only hope there will be an opportunity to work with you again in the future.

A special note to Paula and Loz. I struggle to find the words to get across how grateful I am for your mentorship, but please know the impact you have had on my development as both researcher and person. Sj, you took a chance on me and my ill-fitting blazer back in 2013 and without that I'm confident I would not be submitting this thesis today, so thank you.

Thank you to the PAEx staff and past/present postgrads (special shout to Alice and Hannah). As someone who was new to the university and to the city, you made me feel so welcome. I'll be sad to leave such a brilliant group of people.

These incredible past 3 years would not have been possible without the DTA/COFUND for providing me with the opportunity to carry out this PhD. Nor would it have been possible without the >250 girls across Ireland and the UK who took part in the studies. Thank you to the army of Activity Mentors, Chiara, Ella, Issie, Millie, Hannah, Amelia, Ellie, Jennifer, Nicole, Suzy, Payal and Abbie, it has been a highlight of my PhD getting to work with you all. Thank you so much for your dedication and effort, I shudder to think what HERizon would have been without you.

Lillian, thank you for our intercontinental Friday walks, I promise I will now shut up about this thesis. Annabel, thank you for keeping me caffeinated. Han, Bell and Isy, you are my world. Thank you for your unconditional love and support. Mum & dad, everything I do is to try make you proud. I understand how privileged I am to have a 3<sup>rd</sup> level education and that is all due to your unmatched hard work and the sacrifices you've made for your daughters.

Colin, my best friend, I love you and our life. Thank you for allowing me to follow my passions and your unwavering support. A bad day is always made better knowing I get to come home to you.

# **Chapter 1: INTRODUCTION**



## **1. Aim and objectives**

### Aim

The overarching aim of this PhD was to contribute to the scientific literature on adolescent girls' participation in PA, and address some of the current limitations, through the development and evaluation of The HERizon Project which was a home-based intervention aimed to increase the physical activity (PA) of adolescent girls. The PhD aimed to specifically explore the social and contextual determinants required to develop an effective, pragmatic intervention that facilitates girls' engagement in PA. Drawing on the Medical Research Council (MRC) phased framework for developing complex interventions (O'Cathain et al., 2019b, Skivington et al., 2021), the specific studies aimed to identify the problem and develop an intervention (chapter 2), assess the preliminary effectiveness, feasibility and acceptability of the intervention (chapter 3), and to evaluate the implementation of the intervention in a subsequent larger trial (chapter 4).

Specifically, the objectives of this PhD were;

- To identify the barriers and facilitators towards PA adoption, maintenance and drop-out of inactive adolescent girls (study 1, chapter 2).
- To assess the acceptability, appropriateness and preliminary effectiveness of a remote, multi-component PA intervention for adolescent girls (study 2, chapter 3).
- To conduct a process evaluation of a multi-arm remote PA intervention to assess implementation and ascertain which components are perceived to be most acceptable (study 3, chapter 4).
- Synthesise the main findings of studies in order to consider the wider implications of results and make suggestions for future practice and research.

## 2. Thesis structure

This is a PhD by published papers and the thesis is organised into five chapters. The current chapter (**chapter 1**) provides a background to the PhD, including primary aims, objectives, and a brief critical review of previous literature. Chapters 2, 3 and 4 are empirical research studies that form the main body of this PhD and are published in peer-reviewed journals. **Chapter 2** presents the first study of this PhD which was a qualitative exploration into adolescent girls' perceived barriers and facilitators towards PA. **Chapter 3** includes the second study of this thesis, which investigates the preliminary effectiveness and feasibility of a remote PA intervention for adolescent girls in comparison to a wait-list control. The final study of this thesis is detailed in **Chapter 4**. This concerns the detailed process evaluation of a pragmatic, multi-arm randomised-controlled trial. **Chapter 5** provides a discussion of the PhD main findings, conclusions, reflection of strengths and limitations and recommendations for future practice and research.

The thesis study map (Table 1) will be presented at the beginning of each chapter to illustrate the formative development of HERizon through studies one to three. The map will provide a brief overview of the objectives and key findings of the previous study, as well as briefly introduce the next study.

**Table 1.** Thesis study map

Study	Objectives & key findings
<b>Study 1 - “Girls Aren’t Meant to Exercise”:</b> Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Qualitatively explore; <ul style="list-style-type: none"> <li>○ girls understanding of PA</li> <li>○ girls experiences and perceptions of PA</li> <li>○ girls perceived barriers and facilitators towards PA</li> </ul> </li> </ul>
<b>Study 2 - Formative Evaluation of a Home-Based Physical Activity Intervention for Adolescent Girls—The HERizon Project: A Randomised Controlled Trial</b>	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Assess the acceptability, appropriateness and implementation of a remote PA intervention for adolescent girls.</li> <li>• Assess the intervention’s preliminary effectiveness of improving adolescent girls PA, physical fitness, and psychosocial health.</li> </ul>
<b>Study 3 - What happened in ‘The HERizon Project?’ – Process evaluation of a multi-arm remote physical activity intervention for adolescent girls</b>	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Investigate what intervention components (and their dose) were delivered in each intervention arm.</li> <li>• Explore what factors influenced the recruitment to and implementation of The HERizon Project.</li> <li>• Explore adolescent girls satisfaction and acceptability of the intervention.</li> </ul>

### 3. Original contribution to the thesis

My primary role was the lead researcher on all studies and I was the only PhD student involved in HERizon. I was supported by a multidisciplinary team of supervisors and advisors who met with me regularly to discuss my progress and provided guidance on

important decisions regarding the studies. Below outlines my specific contribution to the research, which is presented in this PhD thesis:

Chapter 2 (study 1). Study design, ethical approval, recruitment, conduction of focus groups, data collection and analysis, writing the study/ publication.

Chapter 3 (study 2). Study design, ethical approval, recruitment, coordination of intervention delivery arms (both intervention and control groups), provision of some elements of the intervention (live group workouts, weekly text messages, moderation of online group chat), data collection and analysis, writing the study/ publication.

Chapter 4 (study 3). Study design, ethical approval, recruitment, coordination and management of intervention delivery arms (three intervention and control groups), provision of some elements of the intervention (live group workouts, weekly text messages, moderation of online group chat), data collection and analysis, writing the study/ publication.

## **4. Brief literature review**

### **4.1. Adolescence**

Adolescence is the transitional period between childhood and adulthood that is marked by a series of major biological, psychological and social changes. The start and end of adolescence varies greatly and is dependent on culture, context and country. For example, The World Health Organisation (WHO) defines an adolescent as a person aged 10-19 years (WHO, 2015), however a recent Lancet publication proposes 10-24 years to be more appropriate age range in current times as more young people are remaining in full time education until the early twenties and remain reliant on parents (Sawyer et al., 2018). Puberty consists of a number of interlinked hormonal changes. 50% of girls experience initial breast development at 10 years, reach peak height velocity by 11 years, and

menarche by 12-13 years (Rosenfield et al., 2009). Other changes often experienced around this age include a growth spurt, weight gain, body hair and acne.

During this life stage, adolescents experience many social changes, including the transition from primary to secondary school, an increased number of peers, greater freedom and independence, and more time spent with friends than with family (Kessler et al., 2007). Adolescents are hypersensitive to avoiding social exclusion and are motivated by the reward of gaining social status (Andrews et al., 2020), and therefore their behaviour is particularly influenced by peers and is thought to peak around 15 years. High value is placed on peer feedback and social acceptance (Berndt, 1999) and this feedback is used by adolescents to make judgements about their own self-esteem, competence and worth (Birkeland et al., 2014), and helps them to understand new social norms. Peer influence can result in both prosocial (e.g., volunteering activities) and antisocial (e.g., drug and alcohol use) behaviours. These vulnerable adolescent years also coincide with an increased susceptibility to mental health problems such as anxiety and mood disorders (Kessler et al., 2007), with some researchers suggesting that increases in risky behaviours may be a coping mechanism to major life changes that occur during puberty (DiClemente et al., 1996).

#### 4.2. Physical activity

Physical activity (PA) is defined any bodily movement produced by skeletal muscles which requires energy expenditure (Caspersen et al., 1985). PA can be carried out in almost all environments (Ward et al., 2007), and may be planned or spontaneous e.g. structured exercise or play (Steinbeck, 2001). PA is carried out at different intensities which are classified based on the metabolic equivalent of the task (MET), that is the quantity of oxygen consumed by an individual at rest (typically assumed to be 3.5ml of oxygen per kilo of body mass per minute, 3.5mlO<sub>2</sub>.kg.min) (Melzer et al., 2016). Although there is some uncertainty in the accuracy of applying adult intensity

thresholds to youth (McMurray et al., 2014; Saint-Maurice et al., 2016), the most commonly applied thresholds based on METS are presented in table 2.

**Table 2.** MET based physical activity intensities and examples

PA intensity	METS	Examples
Sedentary behaviour (SB)	<1.5	Sitting in class or lying down reading
Light physical activity (LPA)	1.5 to <3	Making bed, setting the table, getting dressed
Moderate physical activity (MPA)	3 to <6	Brisk walking, vacuuming, leisurely bicycling
Vigorous physical activity (VPA)	>6	Playing football or other sports, running,

*SB* Sedentary behaviour, *LPA* Light physical activity, *MPA* Moderate physical activity, *VPA* Vigorous physical activity.

#### 4.3. Benefits of physical activity

Regular moderate to vigorous PA (MVPA) is associated with numerous positive health outcomes for adolescents such as improved cardiometabolic health (Cristi-Montero et al., 2019), cardiorespiratory fitness (Tarp et al., 2016), body weight management (Larson et al., 2018), psychological and social wellbeing (Shannon et al., 2018) and bone and muscle health (Smith et al., 2014). Further, increased levels of MVPA have a significant inverse association with risk of cardiovascular disease (Tarp et al., 2016) and type II diabetes (Liese et al., 2013). When investigating health issues that specifically affect females, or are more prevalent among females, PA has been found to have a positive impact on bone mineral density (Pinheiro et al., 2020), negative menstruation symptoms (D'souza et al., 2021; El Hajj et al., 2020), eating disorder treatment (Cook et al., 2016), breast cancer mortality (Spei et al., 2019), as well as having a reduced risk of complications during pregnancy (Dipietro et al., 2019).

Recent evidence suggests that VPA in particular is more strongly related to specific health outcomes in adolescents in comparison to low or moderate intensity PA (Owens et al., 2017). VPA is associated with a lower waist circumference, healthy BMI, improved systolic blood pressure and increased cardiorespiratory fitness, but these improvements were not seen with LPA (Hayes et al., 2019). VPA has also been shown to have a greater impact on positive affect (Costigan et al., 2018), as well as higher bone mineral density (Bielemann et al., 2019) in comparison to low or moderate intensity PA. Muscle and bone strengthening activities are vital for muscular fitness and endurance, improved motor skills, reduced fat mass, and a reduced risk of sarcopenia and other non-communicable diseases (Cox et al., 2019). Finally, guidelines encourage adolescents to reduce their sedentary time as large amounts of time spent sitting or lying, independent of PA, are associated with an increased risk of numerous chronic diseases such as type 2 diabetes and cardiovascular disease (Patterson et al., 2018). A recent dose-response analysis of the relationship between adolescent MVPA and cardiometabolic health found that any increase in MVPA is supportive of improved health, and that significant benefits were found at 90-150 minutes per week of MVPA compared to 0 minutes for girls' blood pressure and BMI (Sriram et al., 2021).

#### 4.4. Physical activity guidelines

WHO updated their PA guidelines in 2020 to recommend children and adolescents (5-17 years old) engage in at least 60 minutes per day of moderate-to-vigorous physical activity (MVPA), mostly aerobic, across the week (WHO, 2020). Further, vigorous intensity aerobic activities and activities that strengthen muscle and bones should be included on at least three days per week. It is recommended that sedentary behaviour (SB) be limited, especially time spent in recreational screen viewing. Both the UK and Ireland have their own set of national PA guidelines that are similar to WHO but with slight nuances. The UK Chief Medical Officers' PA Guidelines (2019)

extend the WHO guidelines in that they include children up to 18 years old, encourage SB to be broken up with regular bouts of LPA and recommend children to engage in a variety of activities that include those that develop movement skills. The Irish national guidelines (2009) are more reflective of the WHO 2009 PA recommendations, i.e., recommendation of children to engage in at least 60 minutes of MVPA every day. Further, the Irish guidelines recommend including activities that improve flexibility on at least three days per week.

#### 4.5. The prevalence of physical inactivity

Unfortunately, despite the multitude of benefits associated with regular MVPA, only 14.6% of adolescent girls in the UK and 19.5% of adolescent girls in Ireland meet the minimum PA guidelines (Guthold et al., 2020). Girls are significantly less active than boys across the life course. For example, at the age of 15 years, girls accumulate an average of 41 minutes of MVPA per day in comparison to 51 minutes for boys (Farooq et al., 2018). Further, engagement in MVPA declines when getting older, but this occurs more rapidly for girls than boys, with MVPA declining at an average of - 5.3% per year for girls, and - 3.5% for boys (Farooq et al., 2020). It is vital that researchers design effective interventions to increase the PA levels of adolescent girls as PA habits during childhood may impact health behaviours and health outcomes during adulthood (Hayes et al., 2019; Telama et al., 2005). For example, the diversity of sports girls participate in during adolescence predicts the amount of time they spend in leisure-time PA during adulthood (Mäkelä et al., 2017). Further, high levels of PA during childhood have been shown to be significantly associated with increased bone strength (Gabel et al., 2017), motor competence (Utesch et al., 2019), physical fitness (Utesch et al., 2019), fat-free mass (Janz and Mahoney, 1997), and greater left ventricular mass (Janz and Mahoney, 1997) in adulthood.



#### 4.6. Physical activity measurement

PA can be measured using a variety of methods including, but not limited to, self-report questionnaires and PA diaries, direct observation, pedometers and accelerometers. It is important to note that PA behaviour is complex and multi-dimensional. Therefore, the following methods can be used to estimate PA, but are unlikely to provide a complete picture of an individual's PA behaviour (e.g., PA frequency, intensity, type, context and domain).

##### *4.6.1. Self-report questionnaires and PA diaries/logs*

Self-report methods provide data on the participant's perception of how physically active they believe they are, including information on the domain and context of PA. Such measures are common in epidemiology research as they are relatively simple to administer, have low participant burden and are cost-effective, making them suitable for large samples (Loprinzi and Cardinal, 2011). There are many different types of questionnaires and recall logs now available for adolescents e.g., World Health Organisation Health Behaviours of School Children (HBSC) (WHO, 2016) and Previous Day Physical Activity Recall (PDPAR).

##### *4.6.2. Direct observation*

Direct observation usually involves a trained observer recording the free-living PA of an individual and coding their PA behaviour for a pre-determined length of time, usually in a natural setting, e.g., during a physical education (PE) class (Rachele et al., 2012). Direct observation is a valid and reliable objective measure of adolescents' PA type, duration, intensity (Cox et al., 2020; Tudor-Locke., 2002), and can also collect contextually rich data that takes into account the physical environment and social factors (Rachele et al., 2012). Commonly used methods to code children and adolescent PA include System for Observation Fitness Instruction Time (SOFIT)

(Honas et al., 2008) and System for Observation Play and Leisure Activity in Youth (SOPLAY) (McKenzie et al., 2000).

#### *4.6.3. Pedometers*

Pedometers are widely used as a gross measure of an individual's total PA volume over a given time period (Bassett et al., 2017). They are relatively simple to use, cost-effective and are non-invasive. Although there is some evidence to suggest pedometers can accurately estimate adolescent MVPA (Beets et al., 201; Clemes and Biddle, 2013; Tudor-Locke et al., 2004; Tudor-Locke et al., 2006), more research is needed.

#### *4.6.4. Accelerometers*

Accelerometers are one of the most commonly used reliable and valid (de Almeida Mendes et al., 2018; Esliger et al., 2011; Sirard and Pate, 2001) device-based measures of PA in free-living individuals (Bassett Jr et al., 2012; Warren et al., 2010), that provide data on PA duration, type, intensity and energy expenditure (Welk, 2002). Wrist-worn devices are found to have higher compliance among adolescents than hip-worn devices (Fairclough et al., 2016). Epoch length is the time interval PA is collected within, usually 3-15 seconds for children and adolescents (Cain et al., 2013; Migueles et al., 2017). Accelerometers should be worn for a long enough time period to reflect adolescents' habitual PA, but not too long that it results in low compliance due to high participant burden (Ridgers and Fairclough, 2011). At least 10 hours of wake time per day over a minimum of four days (Migueles et al., 2017; Trost et al., 2000), including at least one weekend day (Migueles et al., 2017; Montoye et al., 2018), is usually recommended. To classify the intensity of PA of a given timepoint, cut-points were developed for specific populations, e.g., children and adolescents (Okely et al., 2018; Trost et al., 2011; Hibbing et al., 2020). To facilitate easier comparison of data, analysis raw data (gravitational units), using open source statistical analysis packages such as

GGIR is becoming more common (Bakrania et al., 2016; van Hees et al., 2016). These data can then be used to assess different aspects of habitual PA, e.g., the time adolescents spend in various PA intensities (SB, LPA, MPA, MVPA, VPA), average acceleration and intensity gradient.

#### *4.6.5. Considerations of PA measurement*

PA measurement is complex and requires many decisions to be made by the researcher, e.g., the population (age), the context in which PA is being measured, the sample size, participant burden, the type of PA, resources available to the researcher, the desired outcome data and the time available for data collection and analysis (Kang et al., 2016).

Self-report PA questionnaires are one of the most commonly used measures however limitations include the dependence of reliability and validity on participants' accurate PA recall (Chinapaw et al., 2010), correction interpretation of questions, and social desirability (Loprinzi and Cardinal, 2011). Although direct observation has many advantages, it is very expensive (time intensive due to observer training, inter-rater reliability and analysis), highly intrusive for participants, and can often only be used with small sample sizes and during short data collection periods (Aparicio-Ugarriza et al., 2015). As pedometers estimate PA based on the number of steps an individual takes, typically no information can be gathered on intensity of PA, nor are they sensitive to certain forms of PA such as cycling. Lastly, although accelerometers might be considered the most objective form of PA measurement, they are not without their limitations. The location of where the device is worn may influence the type of PA it can collect, for example wrist worn devices are unlikely to register cycling (de Almeida Mendes et al., 2018). Further, they require specialised equipment, software and technical expertise to process and analyse device output. There is also a lack of consensus in methodology, e.g., decisions on epoch length, non-wear time, definition of valid days, wear location, brand and cut points (Migueles et al., 2017; Ridgers and

Fairclough, 2011). This is a major disadvantage as this variability introduces error into the data and can cause PA to be misclassified and makes direct comparison to previous literature difficult (Ridgers and Fairclough, 2011). To overcome these limitations, researchers will frequently employ a combination of methods in order to collect the desired data (Sylvia et al., 2014).

#### 4.7. Body image and adolescent girls

Body image includes positive and negative perceptions, emotions and behaviours regarding an individual's body appearance and function (Grogan, 2007). Both boys and girls experience heightened body image concerns during adolescence, however girls are typically more susceptible to focusing on physical attractiveness and negatively viewing their bodies in comparison to others (Fischetti et al., 2020; Slater and Tiggemann, 2011). Body satisfaction has been shown to be negatively associated with self-objectification and body shame, with girls who are motivated to exercise for appearance-related reasons, rather than health/enjoyment reasons, being more likely to experience low body satisfaction (Strelan et al., 2003). Furthermore, in a five year longitudinal study with over 2,500 adolescents, low body satisfaction was a positive predictor of low PA levels and unhealthy weight control behaviours in adolescent girls, even when body mass index (BMI) was controlled (Neumark-Sztainer et al., 2006). Conversely, girls who are regularly physically active are found to have higher self-concept and psychological wellbeing, illustrating the importance of finding a solution to stop girls' disengagement from PA during adolescence (Fernández-Bustos et al., 2019).

#### 4.8. Social media and adolescent girls

According to a 2018 report, 95% of adolescents own a smartphone, and almost half of teen participants reported they are online near-constantly (Anderson and Jiang, 2018). Further, a study of over 120,000 adolescents based in the UK reported spending approximately 4 hours per day on social media (Twenge and Martin, 2020), with

Instagram, Tik Tok and Snapchat being some of the most commonly visited platforms. Due to the wide reach and immediacy of social media, adolescent peer influence has been found to be amplified, with adolescents often mimicking their peers' social media activity (Nesi et al., 2018). For example, adolescents are more likely to post sexually suggestive photos, or photos alluding to alcohol use, if their peers are also posting this type of content (Nesi et al., 2018).

Long time periods spent on social media have been associated with low self-esteem, depressive symptoms, appearance comparison, and dietary restraint among adolescent girls (Raudsepp and Kais, 2019; Rodgers et al., 2020; Scully et al., 2020). This may be partly attributed to social media's provision of quantifiable (e.g., the number of likes and followers) and qualitative (e.g., comments) peer feedback, which individuals often use to compare against their peers' accounts. Adolescent girls place high value on this feedback, with a recent study finding that when insufficient or negative feedback is received on social media posts it can cause depressive symptoms, particularly in girls with low self-esteem (Yau and Reich, 2019). Furthermore, #fitspiration photos on Instagram (photos aimed to motivate health and wellbeing, but typically portray female beauty ideals with emphasis on appearance and objectifying particular body parts) were found to increase negative mood and body dissatisfaction in a group of older adolescents compared to viewing travel photos (Prichard et al., 2020).

Although social media clearly poses many potential dangers to adolescents, it remains clear that a growing proportion of girls are spending large amounts of time using it. Given the large amounts of time spent on these platforms, recent interventions are beginning to embed social media into health behaviour change interventions. For example, a 2021 review found social media use to be an effective strategy for disseminating health guidance, provided social and emotional support are provided and group discussion is encouraged (Ross et al., 2021). Recent interventions studies have also found positive outcomes for social media use with one study concluding that a Facebook group was a promising tool for increasing population level PA (Günther et al., 2021), and another

mobile app study found positive changes in girls' appearance esteem and self-compassion following a six-week trial (Rodgers et al., 2018). As social media is advancing at a rapid rate, more recent, up to date research is needed to understand the effect specific platforms have on girls' psychological wellbeing, and to investigate the potential effect it has on increasing adolescent PA levels.

## **5. Factors that influence adolescent girls' PA**

### **5.1. Organisation of factors using the Socioecological Model**

The socioecological model is a useful framework to help researchers understand the determinants of humans' complex behaviour, which in turn can help in the development of appropriate and effective behaviour change interventions and policies. The model proposes that there are four core principles of health behaviour (Sallis et al., 2015). Firstly, behaviour is influenced by a variety of multi-level factors, including intrapersonal (e.g., demographics, biology, psychology), interpersonal (e.g., the influence of parents, siblings, peers), organisational (e.g., availability of PA opportunities and facilities), and policy (e.g., school PE curriculum and government funding availability) factors. Secondly, these factors interact across levels and are interrelated. Third, the model should be behaviour specific (e.g., providing free fruit in schools is unlikely to have a direct impact on increasing PA), and should focus on the most influential factor(s) at each level. Fourth, behaviour change interventions that target behaviour at multiple levels are likely to be most effective e.g., a person who is motivated, socially supported, and who lives in an environment where social norms and policy supports their health choices is likely to maximise changing their behaviour (Araújo-Soares et al., 2009; Chatzisarantis and Hagger, 2009; Cooke et al., 2013; Dzewaltowski et al., 2009; Lubans and Sylva, 2009). Although some research has been conducted to explore what socioecological factors influence the PA of adolescents, very little have used this model specifically with adolescent girls (Casey et al., 2009; Craike et al., 2011; Eime et al., 2015; Mitchell et al., 2015b; Hull et al., 2018).

## 5.2. Barriers and facilitators to girls' PA

There are a range of factors positively correlated to adolescent girls' PA. Some of the strongest facilitators include the support of family (practical support e.g., providing transport to sport practice, and emotional support e.g., providing encouragement) (Laird et al., 2016; Shokrvash et al., 2013), high parental PA levels (Jaitner et al., 2020) and engagement in community, competitive and/or school sports (Biddle et al., 2011). One of the most commonly cited determinants of high PA participation among adolescent girls is enjoyment. Biddle found that as enjoyment increased, so too did PA participation (Biddle et al., 2005). Further, research has found that when adolescents feel competent and confident in their skills they perceive the activity to be fun (Humbert et al., 2008). Another facilitator of girls' PA is social support (Biddle et al., 2011; Woods et al., 2021). When PA is socially oriented, fun and intimate, with close and well-trusted friends, girls are more likely to engage and feel less self-conscious about their skills or abilities (Azzarito and Hill, 2013; Camacho-Minano et al., 2011). At the organisational level, the school environment can play a key role in supporting girls' PA. Schools that offer equal sporting/PA opportunities to girls and boys, promote autonomy within PE lessons, and facilitate supportive teacher-student relationships are found to have a positive impact on girls' participation in PA (Corr, 2019; McNamee et al., 2017, Mitchell et al., 2015a). Factors at the wider socio-cultural level significantly associated with increased adolescent MVPA include mass media campaigns promoting PA (Pate et al., 2011), national wealth (Viner et al., 2012; Weinberg et al., 2019), and national PE policies (Weinberg et al., 2019).

Conversely, there are numerous factors that are negatively correlated with girls' engagement in PA, perhaps the female gender being the most problematic barrier as it is found to be a consistent indicator of low PA levels (Woods et al., 2021; Sterdt et al., 2014; Miller et al., 2019). Other barriers associated with girls' PA participation include

increasing age, attending girls-only and/or disadvantaged schools (Woods et al., 2021), living in areas of low socioeconomic status (SES) (Stalsberg and Pedersen, 2010), and being of ethnic minority (Whitt-Glover et al., 2009). It is estimated that 26% of children under the age of 16 years in Ireland (Ireland, 2021) and 31% of children under the age of 18 years in England (Income, 2021) are living in poverty. In comparison to white adolescents from higher income families, adolescents from ethnic minorities and low income families spend less time in MVPA (Stalsberg and Pedersen, 2010; Armstrong et al., 2018; Norris T. et al., 2018) and a greater portion of their leisure time in screen time activities (Lord et al., 2015). Further, those living in low income families have a greater risk of non-communicable diseases (Mendenhall et al., 2017) and a decreased life expectancy of 2.1 years (Stringhini et al., 2017). For these reasons and more, it is imperative that girls, especially inactive girls from ethnic minorities and living in low SES areas, are specifically targeted in health interventions as they are currently under-represented in the research literature.

Some of the most commonly cited determinants negatively impacting adolescent girls' PA include perceived lack of time and competence, competition and gendered norms. As girls move from primary school into secondary school their workload, routines and priorities change. School is often perceived to be a time barrier as, not only do girls have greater academic pressures, they often have shorter lunch breaks, reduced timetabled PE classes and limited access to PA facilities in school (Slater and Tiggemann, 2010b). Perceived low competence and competition are commonly identified as negatively influencing girls' PA (Dwyer et al., 2006; Watson et al., 2015; Whitehead and Biddle, 2008; Yungblut, 2012). As girls enter adolescence there is a shift from PA being informal play with friends to a pressure to perform skills, which often results in girls who are not confident in their abilities choosing to disengage with PA for fear of being ridiculed by others (Corr, 2019). Lastly, gendered norms are shown to have a weighty impact on girls' desire to drop out of PA during adolescence (McSharry, 2017; Casey et al., 2009; Corr, 2019; Craike et al., 2011; Jonsson et al., 2017;



Yungblut, 2012). Feeling self-conscious due to sweating, being untidy or fears of developing too much muscle from sport are common reasons girls stop exercising during adolescence (Jonsson et al., 2017; Yungblut, 2012). This negative association many girls develop with PA is often exacerbated by male peers jeering their looks and abilities whilst exercising (Casey et al., 2009; Casey et al., 2016). Further, it is common for girls to feel that there are less PA support and opportunities available for them in the school and community in comparison to their male peers e.g., no senior girls' football team, reduced access to sporting facilities, less funding (Corr, 2019; Craike et al., 2011).

## **6. Previous PA interventions in adolescent girls**

The transition into adolescence is a pivotal point in ones' life as individuals experience a number of physical changes and begin to take a more active role in making decisions around ones' life and health choices (Casey et al., 2010). Interventions may be more successful in improving girls' PA behaviours during adolescence rather than during adulthood as these lifestyle behaviours are less well established and therefore interventions have a timely opportunity to have a positive impact on PA habits (Gillison et al., 2014; Cradock et al., 2017). For these reasons, it is important to engage girls in regular PA during youth.

Given that the majority of adolescents' waking time is spent in school, the school setting is an obvious choice, and one most commonly used, when designing PA interventions that target adolescent girls (Biddle et al., 2014; Messing et al., 2019; Pearson et al., 2015). Table 3 provides an overview of past school-based intervention involving adolescent girls. Evidence suggests that school-based interventions that are grounded in theory, girls-only, target younger age groups, and include multiple components (e.g., various sources of behaviour change support such as family and friends, educational resources and physical environmental changes) are most effective (Pearson et al., 2015).

Unfortunately however, even when interventions include all of these elements, their effectiveness is still found to be mixed, with few interventions having a sustained positive effect on PA at intervention follow up (Love et al., 2019a; Hynynen et al., 2016; Pearson et al., 2015). Further, a large proportion of school-based interventions that have shown significant increases in MVPA were assessed using self-report measures (Pearson et al., 2015) and thus, have limited validity (Chinapaw et al., 2010).

School-based interventions have the potential to be sustained following the end of an research trial as the key components are often delivered by the school staff and not an external deliverer. However, due to the differing priorities, capacities, and pedagogies of teachers, a large variability in teacher uptake has been found, making it difficult to standardise implementation and assess effectiveness. As schools are complex environments, involving multiple stakeholders such as teachers, management and students, there are a number of factors that likely influence intervention effectiveness, e.g., girls' experiences of school PA, teacher engagement with the intervention and the school culture. Often, not all intervention components are delivered (Harrington et al., 2019), components are not delivered as planned (Okely et al., 2017), or implementation of the intervention declines over the course of the school term (Gammon et al., 2019).

Recently, there is growing interest in interventions that take a whole school approach rather than targeting specific aspects of the school day, e.g., PE classes, active travel or extra-curricular PA. Such approaches have shown promising results (Heath et al., 2012; McMullen et al., 2015), however in order for successful implementation, certain conditions are required. Support is needed from the school principal, senior management and all teachers, not just the PE department (Tibbitts et al., 2021). Often this support is not available due to deprioritisation of PA within the school, lack of time and training, and lack of funding (Tibbitts et al., 2021). In order to cultivate a school ethos that is conducive

to increasing, and sustaining, adolescent girls' PA habits, there is a need to consolidate policies, practices and processes (Hunt et al., 2015), and for schools to prioritise student health and wellbeing (Heath et al., 2012). Therefore the effectiveness of school-based PA interventions may be limited by whether or not these specific conditions are attained. One solution to overcoming the reliance on school staff and policy is to implement PA programmes in new settings, such as the home, where there are fewer determining factors on the completeness of intervention delivery. However, there are no known home-based PA interventions currently discussed within the literature for adolescent girls.

**Table 3.** Study characteristics, and key findings of school-based intervention targeting adolescent girls.

Author	Design, setting & country	Underpinning theory	Sample	Intervention duration & measurement period	PA Measurement	Process evaluation	Key Findings
Carlin (2019) <i>WISH</i>	Cluster RCT School UK	Social cognitive theory	N = 199 11-13years	12 weeks - Baseline, postintervention & 4 month follow up	Accelerometer Waist	<ul style="list-style-type: none"> <li>Implementation delivery &amp; adherence</li> <li>Record of walk duration &amp; intensity, attendance log, observation</li> </ul>	Significant increase in school time MVPA in intervention group compared to control at postintervention. At follow up, all positive changes have disappeared, control more MVPA than intervention group.
Dudley (2010)	Pilot RCT School Australia	Social cognitive theory	N = 38 16-17years	12 weeks - Baseline & postintervention	Accelerometer Hip	<ul style="list-style-type: none"> <li>Satisfaction &amp; participant engagement</li> <li>Observation, attendance records, focus groups</li> </ul>	47% returned accelerometers at postintervention. No significant difference in MVPA between groups or at time points.
Dunton (2007)	NRCT School USA	Social cognitive theory	N = 79 14-17years	9 months - Baseline, mid-point & postintervention	PA recall	None	Significant increase in self-reported VPA for intervention group compared to control at all time points.
Harrington (2018) <i>Girls Active</i>	Cluster RCT School UK	Social cognitive theory	N = 1752 11-14years	14 months - Baseline, mid-point & postintervention	Accelerometer Wrist  Questionnaire	<ul style="list-style-type: none"> <li>Implementation fidelity, participant &amp; teacher satisfaction, contextual factors</li> <li>Economic analysis</li> <li>Focus groups, exit surveys &amp; attendance logs</li> </ul>	Significant increase in MVPA in intervention group at mid-point compared to control but no difference found at postintervention. No significant difference in MVPA at postintervention.
Huberty (2014) <i>Go Girl Go!</i>	Within subject repeated measures Afterschool club USA	Social cognitive theory	N = 182 5-13 years	5 months - Baseline, mid-point, postintervention & 3 month follow up	Accelerometer Hip	<ul style="list-style-type: none"> <li>Delivery fidelity</li> <li>Observation</li> </ul>	No change in MVPA on non-GGG days but significant increase on GGG days. Biggest increase in MVPA in the 8-10y group. At follow up, positive PA changes have returned to baseline.

Jamner (2004) <i>Project FAB</i>	RCT School USA	Self-determination theory	N = 58 15-16years	4 months - Baseline & postintervention	PA recall	None	Significant increase in self-reported LPA, MPA & total PA for intervention compared to control at postintervention.
Jenkinson (2012) <i>GLAMA</i>	NRCT School Australia	Social cognitive theory	N = 255 12-13years	8 weeks - Baseline & postintervention	PA recall	<ul style="list-style-type: none"> <li>• Use of REAIM</li> <li>• Questionnaires throughout intervention, group discussion</li> </ul>	No significant difference in self- reported MVPA between intervention & control groups at postintervention.
Lubans (2012) <i>NEAT girls</i>	Cluster RCT School Australia	Social cognitive theory	N = 357 12-14years	12 months - Baseline & postintervention	Accelerometer Hip	None	No significant difference in MVPA between intervention & control groups at postintervention (intervention group MVPA decreases in comparison to baseline).
Marks (2006)	RT Remote USA	Social cognitive theory Theory of reasoned action	N = 319 12 years	2 weeks - Baseline & postintervention	Questionnaire	<ul style="list-style-type: none"> <li>• Participant engagement &amp; exposure</li> <li>• Exit survey, attendance logbook</li> </ul>	Significant increase in self-reported PA for the print group in comparison to the web group at postintervention.
Neumark- Sztainer (2010) <i>New Moves</i>	Cluster RCT School USA	Social cognitive theory Transtheoretical model	N = 356 14-16years	9 months (1 school year) - Baseline, mid- point & postintervention	PA recall	<ul style="list-style-type: none"> <li>• Participant &amp; parent satisfaction</li> <li>• Exit survey</li> </ul>	No significant difference in MVPA between intervention & control groups at postintervention.
Okely (2017) <i>Girls in Sport</i>	Cluster RCT School Australia	Social cognitive theory	N = 1518 13-14years	18 months (2 academic years) - Baseline & postintervention	Accelerometer Hip	<ul style="list-style-type: none"> <li>• Delivery/ receipt fidelity, context</li> <li>• Interviews</li> </ul>	No significant difference in MVPA between intervention & control groups at postintervention.
Owen (2018) <i>G-PACT</i>	3-arm NRCT School UK	Social cognitive theory Self-determination theory	N = 206 13-14years	8 weeks - Baseline & postintervention	Accelerometer Wrist	None	Significant increase in MVPA for the 'class' group in comparison to the 'choice' & control groups at postintervention.

Pate (2005) <i>LEAP</i>	Cluster RCT School USA	None	N = 2744 13-14years	1 year - Baseline & postintervention	3DPAR	<ul style="list-style-type: none"> <li>• Delivery &amp; receipt fidelity, satisfaction</li> <li>• Observation, focus groups</li> </ul>	Significant increase in self-reported VPA for the intervention group in comparison to the control group at postintervention.
Robbins (2019) <i>Girls on the move</i>	Cluster RCT School USA	Self-determination theory	N = 1519 9-14 years	17 weeks - Baseline, postintervention & 9 month follow up	Accelerometer Hip	Reported elsewhere	No significant difference in MVPA between intervention & control groups at postintervention.
Schneider (2007)	NRCT School USA	None	N = 101 15-16years	9 months - Baseline, mid-point & postintervention	PA recall	None	Significant increase in self-reported VPA for the intervention group in comparison to the control group at postintervention.
Schofield (2005)	Cluster RCT School Australia	None	N = 68 16-18years	6 weeks - Baseline, postintervention & 6 week follow up	PA recall  Pedometer	None	No significant difference in self-reported PA between intervention & control groups at postintervention. Pedometer intervention group had significantly more steps than other groups at postintervention.
Marks (2006)	Cluster RCT School UK	Diffusion of Innovations Self-determination theory	N = 427 11-15years	9 months - Baseline, postintervention & 3 month follow up	Accelerometer Waist	Reported elsewhere	No difference in self-reported PA between intervention & control groups at postintervention. Intervention group had an additional 6 minutes MVPA at follow up in comparison to the control group.
Sebire (2018) <i>PLAN-A</i>	RCT School USA	Self-determination theory Theory of meanings of behaviour	N = 459 12-13years	5-7 days - Baseline & postintervention	PA recall	None	No significant difference in self-reported PA between intervention & control groups at postintervention.
Spruijt-Metz (2008) <i>Get Moving!</i>	RCT School Iran	Health promotion model Transtheoretical model	N = 161 14-15years	2 x 6 months - Baseline, postintervention & 6 month follow up	PA recall	None	Significant increase in self-reported PA for the intervention group in comparison to the control group at postintervention & follow up.

Taymoori (2008)	Case control School Belgium	None	N = 196 15 years	7 months - Baseline & postintervention	Questionnaire	<ul style="list-style-type: none"> <li>• Participant engagement, satisfaction, reach</li> <li>• Exit survey, focus group</li> </ul>	No significant difference in self-reported PA between intervention & control groups at postintervention, however girls in intervention group did have significant increase in extracurricular sport participation.
Verloigne (2017)	Cluster RCT School USA	Social cognitive theory Operant learning Organisational change Diffusion of innovations	N = 3504 11-14years	2 years - Baseline, postintervention & 12 month follow up	Accelerometer Hip	<ul style="list-style-type: none"> <li>• Delivery &amp; receipt fidelity, dose, reach, acceptability, attendance</li> <li>• Observation, questionnaires, interviews, attendance logs</li> </ul>	After 2 years, no significant change in MVPA between groups. After 3 years, the intervention group had more MVPA & total PA in comparison to control group. In control group, MVPA drops to 15% from 6 <sup>th</sup> to 8 <sup>th</sup> grade, in the intervention group it only drops 6%.
Webber (2008) TAAG	RCT School USA	Social action	N = 221 13-14years	8 months - Baseline & postintervention	PA recall	<ul style="list-style-type: none"> <li>• Intervention fidelity</li> <li>• Observation</li> </ul>	No significant difference in self-reported PA between intervention & control groups at postintervention. Significant increase in time spent in MVPA during PE class in intervention group compared to control at postintervention.
Young (2006)	Cluster RCT School UK	Social cognitive theory	N = 199 11-13years	12 weeks - Baseline, postintervention & 4 month follow up	Accelerometer Waist	<ul style="list-style-type: none"> <li>• Intervention fidelity, satisfaction, adherence</li> <li>• Observation, attendance records, focus groups</li> </ul>	Significant increase in school time MVPA in intervention group compared to control at postintervention. At follow up, all positive changes have disappeared, control more MVPA than intervention group.

*RCT* Randomised controlled trial, *NRCT* Non-randomised controlled trial, *USA* United States of American, *UK* United Kingdom

Randomised controlled trials usually assess outcome measures after a relatively short time period, e.g., a six to twelve week intervention, and although some interventions have yielded positive short-term effects in increasing PA, it is usually unknown if these positive changes are maintained after the intervention has ended. To investigate sustained intervention effects it is important for trials to include a long-term follow up, usually at least six months following the end of the intervention period (Llewellyn-Bennett et al., 2018). Unfortunately, in PA research this data is often lacking (Pearson et al., 2015; van Sluijs et al., 2007; Sims et al., 2015), which may be due to participant attrition, logistical barriers or financial restraints (Llewellyn-Bennett et al., 2018), for example of the 22 included studies in Table 3, only 7 studies have a follow-up data collection point ranging from 6 weeks to one year after the intervention has ended. Although pragmatic issues often restrict the collection of such follow-up time points, e.g., lack of time and funding, a recently published article has provided practical methods for developing a follow up data collection plan (Llewellyn-Bennett et al., 2018) which can support PA researchers in investigating the long-term health effects of an intervention. Suggested methods include having a combined data collection approach (e.g., in-person assessment and phone interviews), the use of online measures (e.g., online questionnaire), and accessing medical records or data linkage when possible as it was deemed the most cost-effective follow up data collection method (Llewellyn-Bennett et al., 2018).

Much of the past PA research have been RCTs and, based on the results of these trials, it is clear that many interventions have equivocal effects on girls' PA. Twelve of the 22 interventions included in Table 3 reported on at least one form of process evaluation (two studies reported detailed process evaluations in separate manuscripts (Sebire et al., 2018; Robbins et al., 2019), however only one study included a process evaluation framework, e.g. RE-AIM (Jenkinson et al., 2012) and one included an economic analysis (Harrington et al., 2018). The most common components evaluated in these studies include delivery



and receipt fidelity, satisfaction and context. Many studies included mixed method data sources to inform process evaluation, e.g., nine studies explored satisfaction through focus groups/interviews ( $n = 7$ ) and/or exit surveys ( $n = 4$ ), five investigated participant adherence via attendance logbooks (Harrington et al., 2018; Marks et al., 2006; Carlin et al., 2019; Dudley et al., 2010; Webber et al., 2008), and six employed direct observation to gather data on implementation fidelity (Carlin et al., 2019; Dudley et al., 2010; Webber et al., 2008; Young et al., 2006; Huberty et al., 2014; Pate et al., 2007). Only two studies collected information on participant satisfaction and engagement throughout the intervention (Jenkinson et al., 2012; Webber et al., 2008), with the majority collecting this data only at postintervention. Of the studies that did not include process evaluation data, only one resulted in significant increases in device-based MVPA (Owen et al., 2018). However, given that the majority of studies that include process outcomes remain to have a significant positive impact on adolescent PA, more comprehensive process evaluations are now needed to understand why an intervention was, or was not, successful.

## **7. Areas that show promise and future directions**

### **7.1. The importance of choice & control**

Human behaviour is complex and therefore it is often challenging to develop interventions that successfully change, and maintain, an individual's behaviour (Heino et al., 2021). The use of theoretical frameworks can assist researchers in understanding the determinants of behaviour, and interventions which have theory embedded are thought to have greater effectiveness in comparison to interventions not founded in theory (Dalgetty et al., 2019).

High motivation is a key factor that may positively influence adolescent girls' long-term participation in PA (Downs et al., 2013). One of the most common theories used to understand girls' PA motivation is Self-Determination Theory (SDT). Founded by Ryan and Deci (Ryan and Deci, 2000a), SDT assumes that optimal functioning,

wellbeing and social development can only be attained when three basic psychological needs are met; competence (perceived ability to carry out a task), relatedness (feeling connected to others), and autonomy (volition, perceived control). The SDT continuum (Figure 1) (Ryan and Deci, 2000a) illustrates the varying degrees of self-determined motivation, ranging from least to most autonomous. At the left is amotivation which is described as the lack of intention to carry out an action and may be due to not seeing value in the task or expected outcome, or not feeling sufficiently competent. At the right is intrinsic motivation, the most autonomous form of motivation. This occurs when an individual carries out an action for inherent enjoyment or interest. Between amotivation and intrinsic motivation lie four extrinsically motivated behaviours. External regulation is the most controlled form of motivation and involves a task being completed due to an external cause, such as a fear of punishment or desire for reward. Introjected regulation motivates behaviour through internal pressures e.g., in order to avoid feelings of guilt or shame or enhance one's ego. Both external regulation and introjected regulation are forms of controlled motivation which are typically categorised by individuals being motivated due to external rewards, punishments or feeling pressure or obligation to carry out a behaviour. Emotions associated with this type of motivation include feelings of tension and anxiety and usually people with controlled motivation will take the shortest route possible to reach their goal. Identified regulation, sometimes referred to as the threshold of autonomy, is a more self-determined category of motivation as an individual personally accepts the action and finds it important to herself. Lastly, the most self-determined category of external motivation is integrated regulation. This is similar to intrinsic motivation with the difference that the action is still being done in order to attain an outcome and not for inherent satisfaction. Identified regulation, integrated regulation and intrinsic motivation are all forms of autonomous motivation where the behaviour is self-directed and is being carried out because the individual wants to do it, compared to controlled motivation when the individual feels they 'have

to' do it. Autonomously motivated people typically have long-term improvements in performance, engagement and wellness.

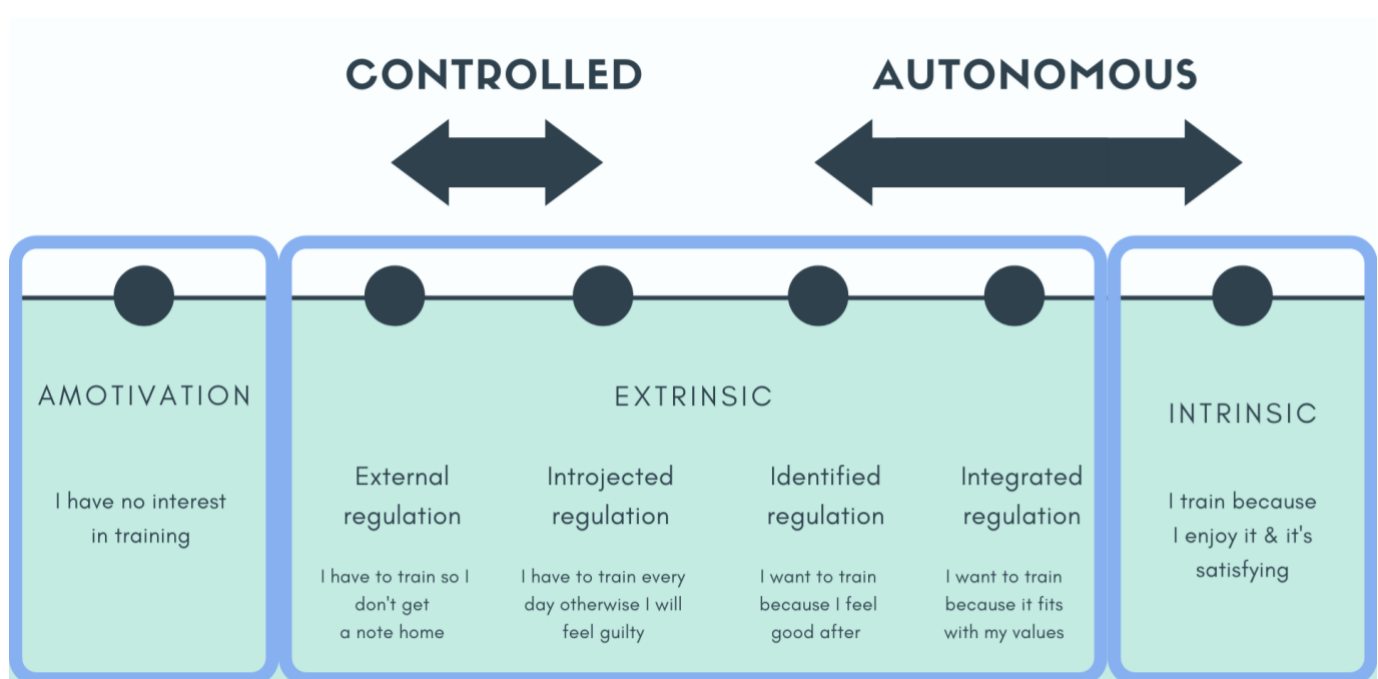


Figure 1. Adapted from Ryan & Deci Self-determination continuum (Ryan and Deci, 2000a)

There is a plethora of literature illustrating the association between SDT's main constructs (competency, relatedness, and autonomy) and an individual's PA behaviours (Kinnaick et al., 2014; Edmunds et al., 2008; Vierling et al., 2007; Schneider and Kwan, 2013). Adolescents have been found to be more committed to an intervention when they are provided with autonomy, choice and a sense of ownership, thus increasing the likelihood of intervention success (Martins et al., 2015). For example, a past intervention which allowed participants to self-select the type and intensity of their PA showed significant positive effects in adiposity and bone health in the intervention group in comparison to control (Staiano et al., 2017). Brooks and Magnusson (Brooks and Magnusson, 2007) found that girls perceptions of within-school PA and outside-school PA differed in that within-school PA was perceived to be more controlled, with greater focus on skill performance, and offered a limited

selection of activities that were predominantly traditional team based sports. It may be challenging for schools to provide a sufficient variety of enjoyable PA options that encourages currently inactive girls to become active as the variety of PA they can offer is likely limited by school facilities, national curriculum, teacher attitudes, and time (Green, 2000).

However, it is important to note that although some adolescent PA interventions have demonstrated that improved intrinsic motivation (Dishman et al., 2015), perceived competence (Timo et al., 2016), relatedness (Doré et al., 2020) and autonomy (Palmer et al., 2020) have a positive effect on actual PA levels, many other SDT-based interventions (Spruijt-Metz et al., 2008; Jamner et al., 2004; Owens et al., 2018; Sebire et al., 2018; Robins et al., 2019) did not have significant effects on increasing PA. This may be due to varied delivery implementation of theory facets, and therefore future interventions should assess theory fidelity through process evaluation (Owen et al., 2017).

## 7.2. Is it time to try new settings for PA interventions?

A study investigating adolescent and parent opinions on what makes a successful PA intervention found that promoting PA programmes within schools was perceived as being ‘uncool’ by adolescents, and that programmes based online were deemed acceptable to both the girls and parents (Van Kessel et al., 2016). Unfortunately, there is currently a dearth of home-based and remote PA interventions aimed at adolescent girls. Such settings may be a more ideal environment than the school as girls are likely to feel more comfortable exercising in the privacy and safety of home, away from the perceived judgemental eye of peers. Further, as lack of time is one of the most commonly cited barriers for girls’ engagement in PA, the home setting is more convenient and time efficient than travelling to extra-curricular activities. Although there are now countless resources available online to support home-based PA, e.g., YouTube ‘follow along

workout routines' or instructor-led Zoom exercise classes, perhaps interventions that do not prescribe one set location grant the greatest autonomy for adolescent girls, i.e., participants can choose to complete their PA at home, in after school sports, or in the local gym. However, there appears to be a balance between providing variety and choice in interventions, yet also having sufficient structure so that participants feel supported and understand what is being asked of them (Harrington et al., 2019). This may be accomplished by asking participants to complete a certain number of minutes PA each day and providing them with suggestions and resources of how they might engage in PA, e.g., details of local sports clubs or links to online workout videos. As adolescents spend 50% less time in MVPA during after school hours in comparison to hours spent in school (Strugnell et al., 2016), it is important for future interventions to consider alternative settings, and to capitalise on promoting PA during afternoon, evening and weekend time.

#### 7.2.1. Physical activity in the home setting

Although there is limited literature in the field of home-based PA interventions for adolescent girls, research conducted on other populations and health behaviours has found favourable results. For example, a 12-week home-based exercise programme, comprised of bodyweight exercises and individual support delivered via email and mobile application, significantly improved VO<sub>2</sub>peak and muscular strength in breast cancer survivors in comparison to a control group (Ochi et al., 2021). Another trial investigating the effects of six week home-based high intensity interval training and yoga programme found significant effects for improved mental health in adults in comparison to the waitlist control group during the COVID-19 pandemic, particularly in adults with depressive symptoms (Puterman et al., 2021). Further, there have been no significant differences found in improvements in cardiorespiratory fitness between home-based unsupervised exercise regimens and supervised laboratory-based regimens (Blackwell et

al., 2017). Home-based interventions targeting other aspects of adolescent girls' health have also shown promise. For example, a home-based intervention aimed to reduce adolescent pregnancy was found to be successful in young American women (Black et al., 2006), a home-based stretching intervention was effective in reducing menstrual symptoms in adolescent girls (Aboushady & El-Saidy, 2016), and a mixed primary care and home-based intervention was found to improve adolescent girls nutritional habits (Patrick et al., 2006). Further, recent systematic reviews assessing the effectiveness of school-based interventions found small to no effects on girls' PA and concluded that focus should be paid to alternative settings such as the home (Love et al., 2019; Pearson et al., 2015). Based on this collective evidence, and the high proportion of after school time adolescents spend sedentary (approximately 60%) (Arundell et al., 2016), it was hypothesised that a home-based intervention may be effective in increasing adolescent girls' PA behaviours.

Within this body of work, the terms 'home-based' and 'remote' are used. 'Home-based' is used to describe the conditions of study 2 as this study was implemented during the initial strict lockdown restrictions of the COVID-19 pandemic. The public were advised to stay at home and all local gyms, sports clubs and exercise facilities were closed. Although participants could choose what type of PA they engaged in, given the lockdown restrictions, the only options available to them were activities that could be done in the home. 'Remote' is used when describing the context of study 3, as lockdown restrictions were beginning to ease some sports clubs and extracurricular clubs were reopening throughout the course of the 12-week intervention. Similar to study 2, participants had full flexibility in what physical activities they chose to take part in, and given the easing of restrictions throughout study 3, some participants may have had the opportunity to engage in activities outside of the home e.g., outdoor sport facilities reopened in Ireland in April 2021, week 8 of the intervention. In both home-based and remote studies, all intervention components and outcome assessments were

delivered/collected remotely and did not require the participants to attend the laboratory (e.g., components were delivered through online videocalls and text messages, and outcome measures were collected via parent/guardian supervised field-based fitness tests and online questionnaires).

Both Sport Ireland (2020) and Sport England (2021) have published reports on the impact COVID-19 restrictions had on population physical activity levels. The Sport England report found girls to have increased PA levels during the early stages of the pandemic (i.e., during school closure and the 'stay at home' phase). This increased PA participation was maintained even after restrictions eased. The authors hypothesised this maintenance was due to girls finding activities they enjoyed while at home, e.g., going for a walk or doing fitness activities at home. The Irish report found similar results as there were 5% more 15-24 year olds engaging in sport in comparison to 2019 data. During the 'stay at home phase' of restrictions in Ireland, there was a 28% increase in personal exercise (e.g., home exercise classes), and within the English context, gym and fitness activities were the most prevalent physical activities among adolescents. This suggests that a home-based PA intervention, including fitness activities, has the potential to be effective in increasing and maintaining adolescent PA, as well as being acceptable to this population.

This section has aimed to demonstrate the importance of PA for adolescent girls, the current state of PA in Ireland and the UK, as well as a summary of the benefits and drawbacks of common PA measurement tools. The use of the socioecological model is a useful way to understand the multi-level factors that influence girls' PA behaviours, with common barriers including perceived low competence, lack of time and gendered norms. Having support of family and friends, high enjoyment, and feelings of choice and autonomy are often identified as key facilitators to girls' engagement in PA. A brief overview of past interventions highlights the dominance of school-based interventions,

and the limited use of process evaluations, follow-up time points, or the use of other settings for PA interventions. To design interventions that better cater for the needs and desires of adolescent girls, it is vital to include them during development and assessment to ensure the programme is acceptable and appropriate for the target audience and their given contexts.

## **8. Complex intervention development and evaluation**

Complex interventions are interventions that have multiple interconnecting components (Campbell et al., 2000), for example an intervention that targets a number of behaviours, the requirement of a multidisciplinary delivery team with a range of skills and expertise, the number of groups and settings being targeted, and the flexibility of intervention delivery and receipt. For optimal intervention effectiveness, it is important for researchers to consider the complexity of the intervention components themselves, as well taking into account the interaction between the intervention and the context in which it is being embedded (Skivington et al., 2021).

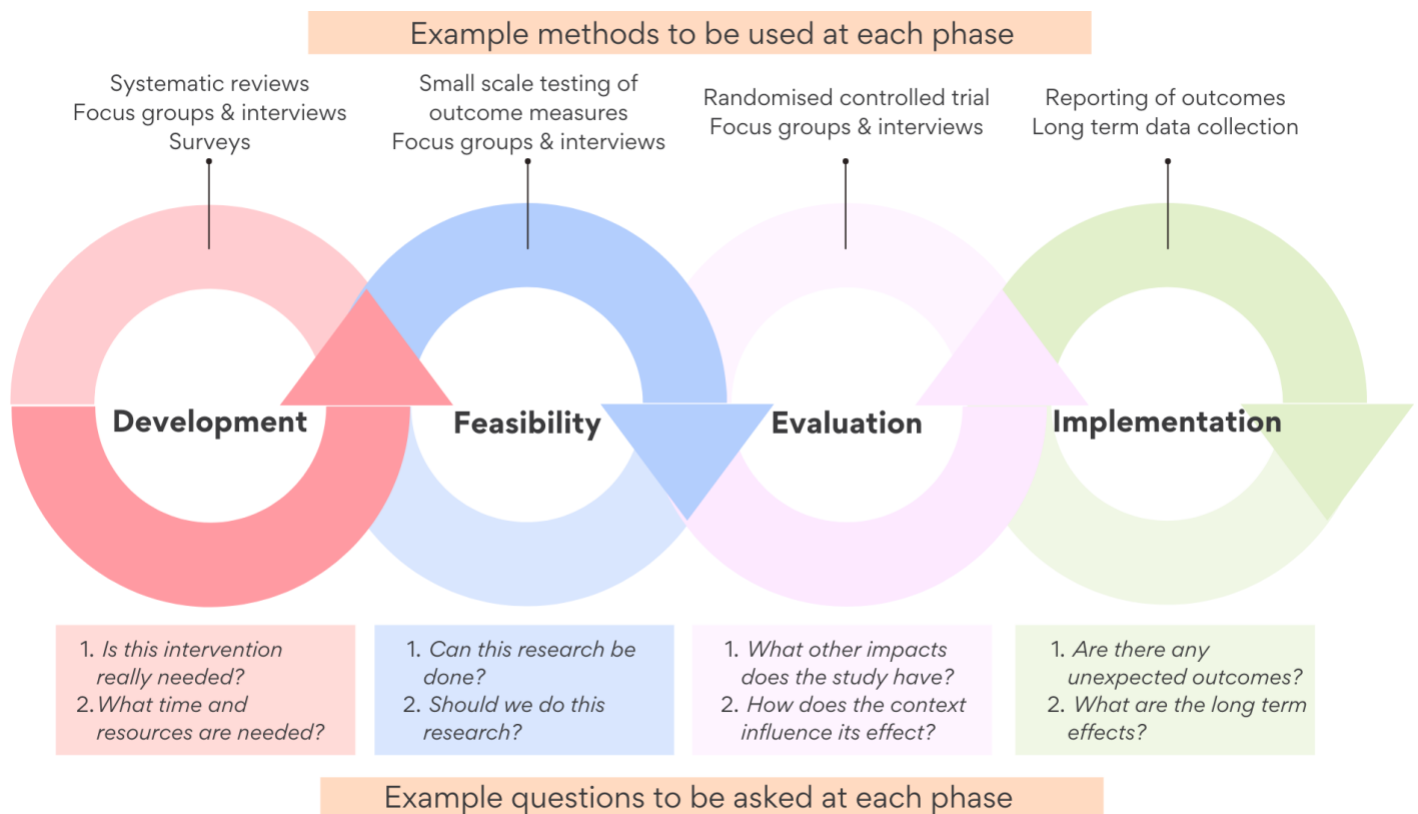
### **8.1. Phased iterative approach to intervention development**

Oftentimes complex interventions pose a number of challenges when researchers attempt to implement them into real world settings, this is highlighted by the stark finding that only 14% of scientific knowledge is translated into practice (Institute of Medicine Committee, 2008). Challenges include the limited funding available for long-term evaluation of intervention effectiveness, lack of responsiveness (i.e., initial studies often recruit volunteers based on inclusion criteria which hinders the generalisability of study results to the larger population), and lack of researcher understanding of the contextual factors that influence implementation in a real world setting (Gitlin, 2013). To overcome such challenges a phased intervention approach to development and evaluation is needed. Although this can be a lengthy process, it provides researchers and funders



greater confidence in the effectiveness of the intervention, and is likely to lead to improved study design, implementation and scalability (Campbell et al., 2000). Key principles to intervention development include iterative cycles of intervention design and refinement so that the intervention functions and is implemented the way it was intended (Kern et al., 2011), stakeholder input across all stages of development, the use of creativity alongside scientific methods, being open to failure and design changes, and transparently reporting on the intervention to ensure readers can logically link early intervention design decisions with outcomes (O'Cathain et al., 2019a).

The Medical Research Council (MRC) originally published guidance on the phased development and evaluation of complex interventions to support researchers in 2000 (Campbell et al., 2000), however since then there have been two updates (Skivington et al., 2021, Craig et al., 2006) and several other documents to support specific phases of the process (O'Cathain et al., 2019; Moore et al., 2015; Craig et al., 2018). The most recent guidelines stress the importance of repeating phases when there is any uncertainty before progressing to the next phase, that the process is not necessarily linear and phases will likely overlap, and that “strong and early engagement” (pg. 2) of stakeholders is essential (Skivington et al., 2021). The guidance outlines four phases of intervention development (Figure 2 outlines the iterative process with potential data collection methods and questions researchers should consider), however key components involved in all phases include the consideration of context, refinement of theory and intervention, identification of uncertainties, and economic considerations.



**Figure 2.** Adapted overview of the Medical Research Council guidance on the development and evaluation of complex interventions (Skivington et al., 2021).

*1. Development* – This phase includes all elements of intervention development from the initial design to later evaluation studies, and includes actions such as identifying and understanding the problem, considering who should be involved in the research/delivery team based on the required skills and expertise, and some primary mixed methods data collection (O’Cathain et al., 2019a). Before starting any kind of evaluation it is important that researchers have a reasonable expectation that the intervention will illicit some favourable effects, and this can be supported by reviewing the current literature base and developing theory. Theory can support intervention effect as it helps researchers in identifying the potential mechanisms of change and what conditions are needed to bring about the desired effect (Skivington et al., 2021). As the ultimate goal of a complex intervention is to implement a (cost-)effective, feasible and acceptable solution that addresses health concerns and user needs, it is critical to engage multiple stakeholders.

Qualitative methods can provide researchers with detailed information on user perspectives, preferences and capabilities, as well as individual needs and barriers (Bleijenberg et al., 2018). Modelling can be a useful method during intervention development to synthesise the gathered information and describe the predicted causal pathways of how the intervention will lead to short and long term effects (Baxter et al., 2014).

*2. Feasibility.* Pilot and feasibility studies allow for researchers to understand facilitators and barriers to intervention implementation in a range of settings, to gain stakeholder insight and feedback, and to refine and optimise the intervention design and methods before a larger definitive trial (Fletcher et al., 2016). Preliminary work is also important so that researchers can identify which intervention components are most effective at eliciting the desired outcome as some components may be adjusted, merged or removed before a larger trial (Campbell et al., 2000). Furthermore, feasibility and pilot testing can help to overcome issues such as low compliance, poor delivery, and smaller than expected effect size that often arise when an intervention moves directly from the development to evaluation phase (Skivington et al., 2021). Feasibility studies are small scale evaluations that can provide preliminary data on effectiveness, and can assist in sample size calculations. Caution should be used when interpreting these results as the effects of feasibility studies may be different in larger and more diverse populations/settings. Purposive sampling is recommended during this phase to ensure there is sufficient diversity within the participants in regards to factors that researchers have hypothesised affect feasibility, acceptability and casual mechanisms (Fletcher et al., 2016). It may be necessary to carry out multiple cycles of feasibility testing to refine the intervention design before a larger RCT. It is important for outcomes of feasibility trials to be reported in order provide information on how the intervention has been iteratively developed, as well as inform other researchers on the barriers, facilitators and contextual considerations of intervention design and implementation (Thabane et al., 2016). For complete and

transparent reporting, a framework such as The Consolidated Standards of Reporting Trials (CONSORT) should be used (Schulz et al., 2010).

*3. Evaluation.* During intervention evaluation it is important for researchers to consider the most appropriate research design given the research question, effect size, specific population etc. (Skivington et al., 2021). Randomisation, although not appropriate in all research designs, is important to reduce bias and various randomisation protocols, such as individual, cluster or step-wedge designs, can be implemented (Moore et al., 2015). Careful consideration is needed when deciding what the treatment group is being compared to as different types of control groups yield differences in effect size (Karlsson and Bergmark, 2014). When possible, a wait list controlled trial may be the most ethical comparison group (Karlsson and Bergmark, 2014). During the evaluation phase researchers, in consultation with stakeholders, should decide upon the intervention outcomes. Typically interventions have one primary outcome and a number of secondary outcomes, however although this is the most straightforward model for statistical analysis, it is not always the best use of data nor does this always illustrate the true effects of the intervention (Skivington et al., 2021). Outcome measures should be based on what is most important and appropriate, and should take into account the predicted timing of change and follow-up (Buono et al., 1991). Sub-group analyses should also be planned for to investigate variability within outcomes, for example between sexes or groups of different socioeconomic areas. Detailed process evaluation should be conducted at this phase (further information on process evaluation is provided in section 8.3), alongside economic evaluation to provide information on cost effectiveness to policy and decisionmakers.

*4. Implementation.* This phase is concerned with translating the evidence gained throughout intervention development and evaluation into practice. For this, it is

important that the information is reported in an accessible and understandable way for stakeholders and decisionmakers. Further, vague recommendations are found to be ineffective, and therefore recommendations should be specific (Shahsavari et al., 2020). As interventions become embedded into wider practice it is likely that the effect size will be smaller, more varied, and unanticipated consequences may emerge (Skivington et al., 2021). It is important to continue monitoring these effects through long term follow up to gain information on the generalisability of the intervention results. Further, long term follow up can assist researchers in understanding if the short term effects of an intervention persist over time. As many studies do not include long term follow up (for understandable reasons such as lack of time and funding), it is important to consider how this will be measured during intervention design and to speak with stakeholders about how best to collect this data, e.g., ensuring appropriate consent is sought during earlier iterations of the intervention (Shahsavari et al., 2020).

## 8.2. User centred design

Throughout intervention development and evaluation, the updated MRC guidelines call for researchers to work with those who are being targeted by the intervention in order to identify the key research questions, and to conduct research with a diversity of perspectives (Skivington et al., 2021). The active involvement of target audiences during the development of a policy or intervention is critical, however often audience views are overlooked (Hesketh et al., 2005). Directly engaging with adolescent girls can help to design an intervention that is more context appropriate and acceptable (Leask et al., 2017), which can increase the likelihood of participant engagement and adherence (Harden et al., 2017). Formative evaluations include the target audience from the initial stages of intervention design in order to gain a comprehensive understanding of target user beliefs, attitudes, perceived benefits, and perceived barriers towards PA (Eldredge et al., 2016). Having a 'bottom up', iterative approach to intervention development can help to ensure the intervention meets the

expectations of potential participants, and allows for the intervention to be refined based on user feedback to better suit the local context (Eldredge et al., 2016). There has been a limited use of formative evaluation in the development of interventions designed specifically for increasing the PA levels of adolescent girls, however those that have involved adolescents have shown favourable results (Owen et al., 2017; Young et al., 2006).

### 8.3. Process evaluation

MRC guidelines recommend for process evaluation to be conducted throughout all phases of complex intervention development (Skivington et al., 2021), as they have slightly different roles during the different phases. During feasibility and pilot testing, process evaluations provide explanation to quantitative outcome measures, information regarding implementation and feasibility, and insight into participants' satisfaction and acceptance of the intervention (Bellg et al., 2004; Borrelli, 2011; Dusenbury et al., 2003). Further, they are particularly important for understanding the contextual factors that might affect the implementation of an intervention as even if an intervention implementation is perfectly replicated in a new context, the outcomes still might differ (Glasgow et al., 2019). During the evaluation phase, process evaluation gives researchers greater confidence in their conclusions as it can provide information on if the intervention is ineffective, or if null-results are due to poor/varied implementation (Borrelli, 2011).

The updated MRC guidelines on process evaluations provide some recommendations on how to plan for and conduct comprehensive process evaluations as part of intervention design (Glasgow et al., 2019). It is advised that (i) a good quality relationship is harnessed between the intervention deliverers and the research team to ensure accurate reporting of implementation, (ii) the causal pathways of the hypothesised ways the intervention is expected to bring about change are identified, and appropriate research questions and

methods are selected, (iii) quantitative and qualitative data are integrated and analysed, and (iv) the relationship between process, outcome and economic evaluation is reported on. This final step (iv) is often challenging due to the lack of standardisation in process evaluation frameworks and wide variation in terminology (Fynn et al., 2020). Evaluation frameworks attempt to support researchers in conducting evaluations in a systematic way. This facilitates shared knowledge and comparison within the literature, and supports researchers in making decisions during intervention design and evaluation. One of the most commonly used frameworks is RE-AIM originally published in 1999 (Glasgow et al., 2019; Glasgow et al., 1999).

Although different components are included in different frameworks, there are several commonalities which will be briefly discussed.

- *Reach and recruitment.* Reach intends to investigate if the intervention is reaching the target audience (e.g., inactive adolescent girls), and how representative the participants are of the wider population (Glasgow et al., 1999). This information may be gained through school administration data on student demographics, census data and attendance logs. A common question researchers consider when exploring 'reach' is "what proportion of the target audience attend at least X% of intervention sessions, and is there variation in participant/setting characteristics for intervention enrolment and/or engagement?". Recruitment is concerned with understanding what strategies were used to attract individuals and groups to enrol, what were the barriers to recruitment, and what strategies were used to encourage continued involvement in the intervention (Steckler and Linnan, 2002). Recruitment logs can be used to investigate the number of individuals who were initially contacted, the number who enrolled and the number who were eligible, whilst questionnaires and interviews can be used to gain information on the reasons individuals join and drop out. A major challenge to reach and recruitment

is gaining information from individuals who do not enrol in the intervention, or who drop out of the intervention. This makes it difficult for researchers to gain a complete understanding of what characteristics facilitates enrolment and maintained involvement in the intervention.

- *Fidelity*. Fidelity is the extent to which the intervention is consistently delivered to participants, across settings, by deliverers (Glasgow et al., 2019). It can give researchers confidence in study outcomes by assessing if the intervention components were implemented as intended according to the study protocol (Steckler and Linnan, 2002). Four sub-categories of fidelity include fidelity of training, delivery, receipt and enactment (Bellg et al., 2004; Borrelli, 2011). **Fidelity of training** focuses on standardising the training provided to intervention deliverers and assessing deliverer skills throughout the intervention to minimise variation. Conducting roleplays prior to intervention implementation and having a set competence criteria that all deliverers need to meet can be used to assess training. **Fidelity of delivery** investigates if the intervention components are being delivered as intended and if the same component/dose is being given to all individuals and groups. Exit surveys and audiotaping of delivery can be used as data sources. **Fidelity of receipt** investigates if what has been delivered was actually received and understood by participants, e.g., all exercise classes might have been delivered during the intervention but the attendance was very low. Self-report logbooks can be used to assess participant receipt and comprehension. **Fidelity of enactment** is often difficult to assess as this is concerned with assessing participants' ability to perform behavioural skills developed during the intervention in real life settings. Questionnaires, self-monitoring logs and objective measures can provide researchers with some information on participants' use of skills in their day to day lives. Fidelity is often considered a difficult component to measure as many of the data sources are subjective and therefore open to bias (Dusenbury et al., 2003).



- *Dose.* **Dose delivered** is concerned with answering “to what extent were all intended intervention components delivered to participants?” (Steckler and Linnan, 2002). Data from intervention deliverer logbooks and direct observation can provide this data, e.g., 12 exercise classes were delivered throughout the 12 week intervention as one 30 minute exercise class was delivered every week. **Dose received** investigates exposure i.e., “to what extent were participants present/engaged with intervention components?” (Steckler and Linnan, 2002), and satisfaction i.e., “how satisfied were participants with the components they received?” (Rowbotham et al., 2019). Participant attendance log and focus groups can provide this information to researchers. By measuring dose in different ways it allows hypotheses on dose-response relationships to be formed, e.g., how outcomes are associated with the number of components delivered, participant attendance, completeness of deliverer training (Rowbotham et al., 2019).
- *Acceptability.* Acceptability is a vital component of any process evaluation as high acceptability is likely to increase intervention adherence and thus intervention benefits (Sekhon et al., 2017). Acceptability data is particularly important when it is collected throughout interventions during the feasibility phase (e.g., data collected at baseline, midpoint and postintervention) as it can inform intervention refinement. This data can be gathered through interviews, focus groups and questionnaires and may also be used to assist in understanding the intervention findings and attrition rates.
- *Context.* Given that pragmatic interventions are usually set in real world environments, it is important to consider aspects of the community and environment, such as physical, social and political factors, that are external to the intervention (Steckler and Linnan, 2002). These contextual factors influence how the intervention is implemented, as well as the outcomes of the intervention (Moore et al., 2015). Gaining information on context through stakeholder focus groups, observation and questionnaires can help researchers in understanding

intervention uptake, maintenance of participants, and adoption of the intervention into the practice and policy (Glasgow et al., 2019).

Of the limited process evaluations that have been conducted, the focus has primarily been on the relationships between participant/individual adherence and outcomes, rather than an exploration of broader factors, e.g., reach and recruitment, delivery fidelity, and context, that might impact the intervention implementation, and thus effectiveness. It is vital that more comprehensive process evaluations are conducted on real world setting interventions in order to better direct future research efforts, and to prevent the “shelving” of seemingly ineffective interventions which were in fact not delivered as intended (Naylor et al., 2015).

#### 8.4. Evaluation – mixed methods

This PhD thesis employed a combination of qualitative and quantitative research methodologies. Qualitative research, based on interpretivism and constructivism, assumes that there is no such thing as one reality, that instead we each understand and interpret the world in different ways based on our beliefs and experiences (Tariq and Woodman, 2013). Qualitative methods were used in all studies (1 to 3) through the use of focus groups and interviews which aimed to gather rich data on a specific small sample of purposefully selected participants. Through quantitative research, based on positivism, studies 2 and 3 aimed to analyse the association between the intervention and outcome measures in a value-free space (Denzin and Lincoln, 1994). To increase objectivity, highly detailed research protocols were implemented which included participant randomisation, recruitment of relatively large sample sizes, and deliverer blinding (Creswell, 2007).

As PA research is complex and multi-faceted, a mixed methods research approach was deemed most appropriate as it allowed for the research questions to be addressed in a more comprehensive way (Tariq and Woodman, 2013). Quantitative methods do not provide meaning or context to numerical results, and results of qualitative work often cannot be generalised to the wider population, thus limiting their direct impact on practice and policy. Mixed methods can help to overcome these barriers in multiple ways. Firstly, using a combined methodology the data obtained by one method can complement and corroborate the data from the other, drawing more robust conclusions (Tariq and Woodman, 2013). For example, using a logbook to monitor participant attendance to PA classes will provide some information on adherence to the intervention, but a more detailed understanding of participant engagement with the intervention might be gained through qualitative focus groups. Secondly, mixed methods research can assist in participant-centred intervention design, e.g., participants can provide feedback on the research design, including their opinions on proposed outcome measurement tools. Lastly, the strengths of one method can help to overcome the limitations of the other. For example, data obtained by self-report PA questionnaires alone is likely an insufficiently valid measure of participants actual PA levels, but when combined with accelerometer data, the data will reflect both objective and subjective PA levels and have greater context and meaning.

## **9. The current study**

### **9.1. Philosophical underpinning**

Pragmatism, in the light of this thesis, is concerned with providing practical solutions to current public health issues, such as adolescent girls' physical inactivity. It is not bound exclusively to one methodology, and instead chooses the methods that are best able to answer the research questions (Feilzer, 2010). As a pragmatic researcher, I acknowledge that human life is messy and unpredictable, and that a system's structures or individual's beliefs can change. Therefore the knowledge gained through research is not absolute and

that it is important to have a “commitment to uncertainty” (Feilzer, 2010) (p.14). As a pragmatist, I value flexibility and adaptability within research in order to best answer the research questions, especially given the real-world nature of this body of work, and the adolescent population who were the target audience.

## 9.2. Theoretical underpinning of PhD

The development and evaluation of HERizon aimed to follow the MRC guidance on developing complex interventions.

Development phase: The literature base of existing studies exploring adolescent girls’ PA habits were reviewed. Further data was gained through focus groups with the target audience in order to gain understanding of the problem in the specific context of Ireland and the UK. Various theories were used within intervention design and evaluation, for example self-determination theory was used as it was hypothesised that increasing adolescent girls’ intrinsic motivation towards PA would likely lead to increased PA engagement.

Feasibility phase: A study with a small sample size and short duration was implemented to gain information on feasibility and preliminary effectiveness. Mixed methods, including postintervention interviews, were used to assess process and outcome evaluation and this data were used to further refine the intervention design and delivery. Process evaluation was mapped onto the RE-AIM framework to provide greater meaning to quantitative outcome measures.

Evaluation: During the HERizon Project, the second study was a slightly larger RCT as it lasted a longer duration and recruited more participants. However, based on the MRC guidance, this is likely to be considered a further iteration of the feasibility phase as it was not powered sufficiently to evaluate effectiveness. During this phase, a multi-arm group design was used to gain further information on which intervention components were

likely to be active ingredients in behaviour change. A follow up time point was also included to assess the persistence of outcome measure three months following the end of the intervention. Postintervention exit surveys, focus groups and interviews were used to gain information of acceptability, appropriateness and engagement with the intervention. A comprehensive process evaluation was conducted to investigate intervention fidelity using a bespoke process evaluation framework.

Implementation: The findings of studies 1-3 were reported using various frameworks for greater transparency and assist in future replication, e.g., TiDier and CONSORT frameworks. All manuscripts were published in an open access journals and specific recommendations to future practice was provided following studies 2 and 3.

### 9.3. Context and timelines

#### 9.3.1. Impact of COVID

Although the development of a remote intervention was always the original aim of this PhD, the onset of COVID-19 led to several changes in the initial intervention protocol. Recruitment was originally planned to be conducted at school sites where I would have held an information evening with potential participants and parents/guardians to give details on the programme and answer any questions. Due to schools being closed in March 2020 this was no longer possible, instead participants were recruited using social media, and information sessions were held on Zoom. As this method of recruitment was successful, paid advertisements on social media were used when recruiting for study 3. As there was a larger sample size in study 3, information sessions were offered twice per week over a 6 week period, and a recorded version of the information session was uploaded to YouTube for anyone who was not able to join a live Zoom session. Consent forms for both studies 2 and 3 were signed by participants and parents/guardians electronically using HelloSign.com. Initially, an array of physiological outcome measures were planned to

be collected from participants in the school. These original measures included blood pressure, resting heart rate, height, weight, waist circumference and aerobic fitness (measured via the MetaMax, a portable spiroergometer which would have been used with a portable stationary exercise bike). As it was no longer possible to collect these measures due to school closures (and for schools that had reopened external visitors were not permitted), it was decided upon that all outcome measures would need to be collected remotely and therefore field-based fitness testing was employed, alongside online questionnaires and online qualitative interviews. Field-based fitness testing was found to be feasible and acceptable with participants and therefore was employed again for study 3. Before COVID-19, participants' MVPA was planned to be measured with accelerometers however due to the university closures it was not possible to access the devices. Therefore in order to assess MVPA participants completed online self-report questionnaires in study 2. As the university had reopened in time for study 3, accelerometers were obtained and posted to participants' home addresses to assess their MVPA levels.

A detailed overview of the PhD timeline and how the studies coincided with COVID-19 lockdown restrictions is illustrated in Figure 3. The PhD began at the end of March 2019, with study 1 taking place in September and October 2019. As this was pre-COVID, the research was conducted in-person in various schools and youth clubs in the UK and Ireland. As previously outlined, study 2 was originally intended to involve in-person outcome measures, as well as more involvement from secondary schools in Ireland and the UK. To ensure the PhD was not too delayed, it was decided to trial a fully remote PA intervention during the initial lockdown restrictions in April and May 2020. The restrictions began to ease, with retail reopening and social gatherings permitted, during postintervention data collection in June and July 2020. Following the successful implementation of a remote intervention, and the satisfaction of the participants, a larger trial was implemented during the lockdown restrictions of December 2020 and January 2021. A large proportion of participants' schools remained closed throughout the

majority of the intervention, with schools beginning a phased reopening in March 2021 (around the time of postintervention data collection). During the three month follow up data collection in July and August 2021, the majority of lockdown measures had been lifted, with some participants going on international travel abroad, and some having in-person school examinations.

**Fig 3.** Schematic overview of PhD studies and data collection in the context of COVID-19 national lockdown restrictions. PhD studies are mapped onto the MRC guidelines for the development and evaluation of complex interventions (Skivington et al., 2021).



The following chapters will discuss the phased development of The HERizon Project presented by three peer-reviewed publications. Study 1 aims to qualitatively explore girls perceived barriers and facilitators towards PA. Study 2 aims to assess the acceptability and preliminary effectiveness of a home-based PA intervention. Lastly, study 3 aims to conduct a comprehensive process evaluation of a subsequent larger trial of The HERizon intervention.

## Chapter 2: STUDY 1

Cowley ES., Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021) *“Girls Aren’t Meant to Exercise”: Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project*. *Children*, 8 (1). <https://doi.org/10.3390/children8010031>



### Thesis study map

Study	Objectives & key findings
<b>Study 1 - “Girls Aren’t Meant to Exercise”:</b> Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project	<b>Objectives:</b> Qualitatively explore; <ul style="list-style-type: none"> <li>• girls understanding of PA</li> <li>• girls experiences and perceptions of PA</li> <li>• girls perceived barriers and facilitators towards PA</li> </ul>
<b>Study 2 - Formative Evaluation of a Home-Based Physical Activity Intervention for Adolescent Girls—The HERizon Project:</b> A Randomised Controlled Trial	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Assess the acceptability, appropriateness and implementation of a remote PA intervention for adolescent girls.</li> <li>• Assess the intervention’s preliminary effectiveness of improving adolescent girls PA, physical fitness, and psychosocial health.</li> </ul>
<b>Study 3 - What happened in ‘The HERizon Project?’ –</b> Process evaluation of a multi-arm remote physical activity intervention for adolescent girls	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Investigate what intervention components (and their dose) were delivered in each intervention arm.</li> <li>• Explore what factors influenced the recruitment to and implementation of The HERizon Project.</li> <li>• Explore adolescent girls satisfaction and acceptability of the intervention.</li> </ul>

### Study context within thesis

Chapter 2 will discuss the first study of this PhD thesis, which was a qualitative exploration of adolescent girls perceived barriers and facilitators to PA. By speaking directly to the target audience, we aimed to gain an understanding of how girls

currently felt towards PA and use the study results to better design a PA intervention specially designed for their needs.

**Abstract:** Adolescent girls are less active than boys, with approximately 10% of girls in Ireland and the United Kingdom meeting the minimum recommended daily physical activity (PA) guidelines. This study investigated factors perceived to influence PA among adolescent girls from low socioeconomic areas in order to inform the design of a future intervention (The HERizon Project). A total of 48 adolescent girls (13–17 years) from low socioeconomic areas of the United Kingdom and Ireland participated in focus groups (n = 8), to explore perspectives of physical activity and the influence of gender within this. Focus groups were thematically analysed and interpreted within a socioecological framework. Most girls enjoyed PA and were aware of its benefits. They identified both barriers and facilitators to PA at intrapersonal (fear of judgement and changing priorities with age), interpersonal (changing social pressures and support from others) and organisational (delivery of PE) levels. Gender inequality was a multilevel factor, crossing all socioecological levels. Although many adolescent girls enjoy PA, their experiences appear to be limited by a fear of judgement and an overarching sense of gender inequality. Future interventions, such as the HERizon Project, should address influences at intrapersonal, interpersonal, and organizational levels to promote positive PA experiences for adolescent girls.

## **Introduction**

Regular physical activity (PA) is associated with numerous physical and psychological health benefits for adolescents, including improved cardiometabolic health (Cristi-Montero et al., 2019), healthy weight management (Larson et al., 2018), cognitive function (Biddle et al., 2019), psychosocial skills (Spruit et al., 2016) and mental wellbeing (Kleszczewska et al., 2019). A survey conducted with 1.6 million participants found that less than 15% of the global adolescent population are meeting

the recommended PA guidelines of at least 60 min moderate to vigorous PA (MVPA) per day across the week (Guthold et al., 2020). This report shows a gender disparity as adolescent females are less active than males, particularly females living in low socioeconomic areas (Guthold et al., 2020). This is of concern as the rate of obesity and type II diabetes are rising among adolescent girls, with the prevalence of severe obesity being four times higher in the most deprived areas versus least deprived areas (Hagell and Shah, 2019). If the current trends continue, the World Health Assembly global action plan of a 15% reduction in the prevalence of physical inactivity by 2030 will not be met. This issue is particularly prevalent among adolescent girls in the UK and Ireland, with approximately 90% of girls being insufficiently active (Woods et al., 2018; National Health Services, 2019). Accordingly, it is critical that more PA opportunities become available to meet the needs of adolescent girls, in order to attract and retain their participation during their development through adolescence into adulthood.

There is an extensive body of research exploring the factors that influence youth participation in PA (McSharry, 2017; Flintoff and Scraton, 2001; McEvoy et al., 2016). Results indicate that factors often differ by gender; for example, competition is a common facilitator for boys but often hinders girls' participation (Flintoff and Scraton, 2001), muscle gain is a common motivator for boys' exercise but is a barrier for girls (Casey et al., 2015), and boys engage in more team-based sports while girls typically partake in more individual sports (Eisenberg et al., 2012). Evidence suggests girls may experience more PA-related psychosocial issues than boys, with girls commonly citing low self-esteem, low perceived competence, and poor body image as deterrents to being active (Pawlowski et al., 2018). Past research argues that such issues may be borne from sport and physical education (PE) settings that traditionally celebrate stereotypical masculine characteristics (Yungblut, 2012), and undervalue girls' contributions, causing girls to feel marginalised (Azzarito and Solomon, 2005). These concerns are heightened for girls from low socioeconomic areas who, in a recent

survey of 6,500 adolescents, were found to have significantly lower wellbeing scores than girls from affluent areas (an association that was not found in boys) (Woods et al., 2021). Further, Irish boys from all-boys schools were found to be over twice as likely to meet the minimum recommended PE minutes per week in comparison to girls from all-girls schools, with girls from deprived areas receiving almost half the PE time of girls from non-deprived areas (Woods et al., 2021). Based on these marked gender and societal differences, future interventions need to consider the factors that specifically impact the target population whom they are targeting.

The socioecological model (Sallis et al., 2005) is a theory-based framework that has been used to better understand and categorise the various multilevel factors (intrapersonal, interpersonal, organisational, and environmental) influencing adolescent girls' PA (Elder et al., 2007). Previous research has found that adolescent girls often experience feelings of low body confidence and self-esteem (intrapersonal) (Craike et al., 201; Eime et al., 2010; Dwyer et al., 2006). In addition, peer pressure to conform to gender appropriate physical activities can lead to dropout of sport and exercise as peers become more influential (interpersonal) (Corr, 2019; Casey et al., 2009; Coen et al., 2018). PE classes are often centred around team-based sports that celebrate stereotypical masculine traits such as speed, strength, and competition (organisational level) (Biddle et al., 2019; Casey et al., 2015; Brooks and Magnusson, 2007). Furthermore, opportunities for girls to be physically active within the curriculum and in extracurricular activities frequently become less available (environmental) (Craike et al., 2011; Gavin et al., 2016; Fowlie et al., 2020). Although factors that influence adolescents' engagement with PA are emerging, recent reviews call for more qualitative research to be conducted with specific subgroups of adolescent girls (e.g., inactive or low socioeconomic groups) to truly understand their needs in order to create effective PA interventions (Corr, 2019; Knowles et al., 2011; Martins et al., 2015).

We established The HERizon Project as a programme of research in response to the aforementioned low PA levels of adolescent girls (Guthold et al., 2020) and given the physical, psychological and social consequences of physical inactivity (Ortega et al., 2018). Specifically, the HERizon project aimed to develop an effective intervention to increase the PA of adolescent girls in the United Kingdom and Ireland, particularly those who are inactive and from low socioeconomic backgrounds. Following the Medical Research Council guidance on the development of complex interventions (O'Cathain et al., 2019b), the first step of intervention design involved qualitative formative research with the target user. It is crucial that interventions reflect the needs, preferences and ideas of future service users (Leask et al., 2017), yet there is a paucity of qualitative research with adolescent girls who are most in need of intervention (i.e., those who are inactive and from low socioeconomic areas) (Jonsson et al., 2017). Formative research is critical in the development and implementation of effective behaviour change interventions as it allows detailed information to be gathered about the audience the intervention is being designed for (Gittelsohn et al., 1999). Collecting information on target user behaviours, interests and needs can help to improve recruitment and retention rates, as well as ensuring the intervention is culturally and geographically appropriate (Higgins et al., 1996). Formative work has been utilised in the development of many behaviour change interventions, including those based in the school (Gittelsohn et al., 1998) and community setting (Kraft et al., 2000). Therefore, this qualitative formative research study aimed to explore socioecological influences (Elder et al., 2007) on physical activity behaviours among adolescent girls in the UK and Ireland. These findings will be used to inform the development of The HERizon Project physical activity intervention targeting inactive girls from the United Kingdom and Ireland.

## **Methods**

### *Research design*

Qualitative focus groups were used to explore the factors that influence adolescent girls' PA. There is a need for researchers to move away from seeing themselves as the experts and to listen to the target audience in order to identify and respond to their needs (Oliver and Hamzeh, 2010). Focus groups gave participants an opportunity to share and compare their experiences of PA, allowed the research team to gather information on girls' collective views and has been used previously for exploring the determinants of girls' PA (Breen, 2006). Reporting of this study was guided by the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007) (Appendices: material for chapter 2, study 1). Ethical approval was granted by the University Ethics Committee (reference: 19/SPS/023), and informed written consent and assent was obtained from parents and participants prior to participation.

### *Recruitment*

Girls (13 to 17 years) were recruited from Government-funded, non-fee-paying secondary schools and youth clubs in a large metropolitan city with a high deprivation rate in Northwest England and from both rural and metropolitan areas of Ireland. Six schools and six youth club gatekeepers were invited to take part in the study. The final sample included five schools (N = 2 NW England, N = 4 Ireland), and two youth clubs (N = 2 NW England). The participants did not receive an incentive for taking part in the study. Information packs containing a participant information sheet, consent/assent forms and a 1-item screening questionnaire were distributed to potential participants. Participant information sheets stated that the study aimed to recruit inactive girls, and girls were able to self-assess their eligibility by ticking whichever of two statements on the screening questionnaire they felt best described their PA: "I am often active and enjoy sports/exercise" or "I am mostly inactive—if I can avoid sports/exercise I will!". This approach was taken as a means of encouraging participation from inactive girls, while not excluding girls who wanted to take part despite perceiving themselves as active.

## *Data Collection*

### Demographic Questionnaire

Prior to the focus group, participants completed a demographic questionnaire which captured information including date of birth, height, weight, ethnicity and the first three digits of their home postcode for deprivation level (Ministry of Housing, 2019; Haase and Pratschke, 2017).

### Focus Groups

Focus groups were used to capture data on the factors that influence adolescent girls' participation in PA. All focus groups were conducted by the first author (female Ph.D. candidate holding an MSc, trained and experienced in running focus groups), in secondary schools and youth clubs during opening hours. Participants had no prior relationship with the interviewer. Focus groups were predominantly conducted in a classroom where participants could be seen but not overheard (Hilland et al., 2018). A youth club coordinator sat in the room during one focus group, while all others were conducted with only the researcher and participants. A semi-structured interview guide was developed by the research team and informed by previous literature (Gavin et al., 2016). The questions were piloted with three adolescent girls to ensure that questions were understood and deemed appropriate for this age group. At the beginning of the focus group, participants were informed that "physical activity" included all sport, exercise, physical education (PE) and any other planned or non-planned bodily movement that elevated their heart rate. Questions focused on what participants enjoyed and did not enjoy about PA, what factors could potentially increase their participation in PA and participants' views of gender differences within PA (interview guide is available in 'chapter 2 materials' in the appendices). The questions asked during the focus groups and the PA definition used were purposely kept broad to capture what types of PA and settings were meaningful from the perspective of the participants. An ice-breaker activity was used to help participants to feel more comfortable speaking aloud within the group (Kraft et al., 2000).

Throughout the focus group, participants were encouraged to share information to the level at which they were comfortable and reminded there were no right or wrong answers and that it was okay if their views were different to those of other participants (Krueger and Casey, 2000). In order to maximise participation and group interaction, the researcher attempted to engage all participants by active listening, eye contact and paraphrasing to check for understanding (Kitzinger, 1994).

### *Data Analysis*

All focus groups were audio-recorded and transcribed verbatim. The transcripts were imported into NVivo 12.0 and analysed thematically using an inductive approach in order to encapsulate participants' shared views of PA and get an overall understanding of their PA experiences (Braun and Clarke, 2006). The analysis was conducted by the first author who became familiar with the data by reading and re-reading transcripts. Quotes that were considered to represent a similar meaning or pattern were clustered together into potential themes and subthemes. The second author acted as a "critical friend" by independently reviewing a subsample of transcripts and offering alternative interpretations of the data, encouraging reflection and challenging the initial thematic structure (Smith and McGannon, 2018). During this process, we recognised that themes were broadly reflective of the socioecological model (Elder et al., 2007) which has been used in past research to illustrate the influence different factors have on girls' participation in PA, i.e., intrapersonal, interpersonal and organisational factors (Casey et al., 2009). Themes were mapped to the socioecological model as appropriate. Throughout the coding process, regular meetings took place between E.C., P.M.W., L.F., A.J.M.W. to review, debate and refine themes.



## Results

### *Participant Demographics and Group Characteristics*

Forty-eight girls returned consent forms, completed demographic and PA questionnaires, and participated in focus groups (N = 26 Ireland, N = 22 England). As shown in Table 4, participants were female, aged between 13 and 17 years (mean 14.8, SD 1.29), and the majority were of white ethnicity (N = 42 white, N = 4 mixed, N = 2 Asian). According to the Pobal HP Deprivation Index (Haase and Pratschke, 2017), 81% of participants from Ireland lived in the most deprived tertile of Ireland. In total, 45% of English participants lived in the most deprived tertile, while 23% lived in the least deprived tertile of the UK according to the Index of Multiple Deprivations (Ministry of Housing, 2019). The majority of participants perceived themselves as inactive (71%).

**Table 4.** Focus group participant demographics

Group	N	Country	Setting	Type of school	Age (years)	Perceived PA status*
Total	48				13-17	34 inactive/ 14 active
1	4	England	Youth club	Mixed sex	13-15	2 inactive/ 2 active
2	4	England	Youth club	Mixed sex	13-16	2 inactive/ 2 active
3	9	Ireland	School	Mixed sex	14-17	7 inactive/ 2 active
4	10	Ireland	School	Mixed sex	13-15	6 inactive/ 4 active
5	5	Ireland	School	Girls Only	16-17	5 inactive
6	2	Ireland	School	Girls Only	17	2 active
7	7	England	School	Mixed sex	14-15	6 inactive/ 1 active
8	7	England	School	Mixed sex	15-16	6 inactive/ 1 active

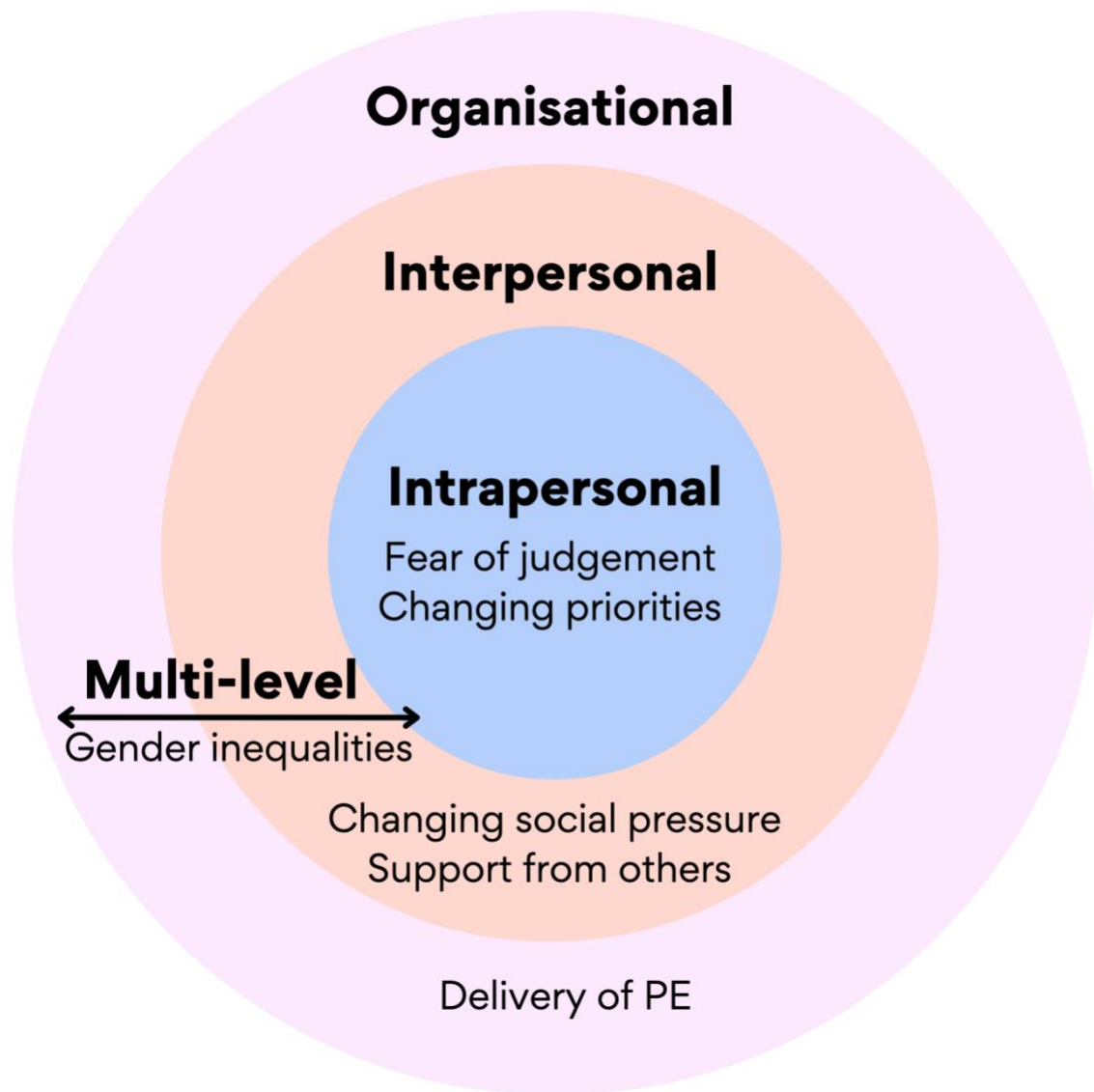
\*According to 1-item self-report screening questionnaire

Eight focus groups (N = 4 England, N = 4 Ireland) were conducted, ranging in size between 2 and 11 participants (see Table 4 for breakdown of characteristics of each focus group). Focus groups lasted 32 min on average (SD 7.4 min). There were no noticeable differences found between focus groups regardless of group size or

location, nor were differences found between participants who perceived themselves as active or inactive.

### *Factors Influencing PA*

Key themes were identified at the intrapersonal (fear of judgement and changing priorities), interpersonal (changing social pressures and support from others) and organisational level (delivery of PE). In addition, one factor was identified as a cross-level theme (gender inequality). Subthemes are identified below in italics. A visual overview of how the main themes map onto the socioecological model can be seen in Figure 4. Table 5 provides an overview of themes and subthemes with illustrative quotes.



**Fig 4.** Adapted socioecological model of health behaviour change (Sallis et al., 2006), including example factors of physical activity at each level. The model suggests that the health behaviour being targeted should be specific and that interventions should be designed using multiple levels.

**Table 5.** Factors influencing adolescent girls' participation in physical activity (PA).

Socioecological Model Level	Theme & Subtheme	Demonstrating quote
Intrapersonal	<b>Fear of judgement</b>	
	<i>Lack of confidence in skills</i>	Even if everyone thought you were good at [sport] you wouldn't think you were good at it ... you could feel like people are laughing at you (P15, FG3, perceived inactive).
	<i>Comparison with others</i>	You want to see [others] are skinnier than you... Others are better... you might feel like you are too old compared to the others (P32, FG5, perceived inactive).
	<i>Being alone</i>	People feel less insecure when they are with their friends, they feel more insecure if they are alone and people are staring at them (P5, FG2, perceived active).
	<i>Pressure to look good</i>	In PE you get loads of pressure when you do it in school... you always feel under pressure because you have some of the skilled people watching you [doing PE] and you need to be your best at everything and you can't screw up (P27, FG4, perceived inactive).
	<i>Body Image</i>	I know girls who dropped out of sport because they don't want to look all muscly... Imagine going home with a bright red face, sweat rolling off you and everything (P43, FG8, perceived inactive ).
	<b>Changing priorities</b>	
	<i>Make-up instead of sport</i>	It feels like girls are not meant to do exercise... rather exercise with their fingers doing their makeup (P3, FG1, perceived inactive).
	<i>Academic pressure</i>	They say during the [state exams] to "keep up your sports, keep up your sports" but then when you come into school they are like "study, study", (P34, FG6, perceived active).
Interpersonal	<b>Changing social pressures</b>	
	<i>Social influence</i>	[PA] kind of changes by your age, you want to do whatever your friends are doing so you stop whatever [PA] you were doing (P20, FG4, perceived inactive).

<b>Support from others</b>		Researcher: What would help you to be more active?
	<i>Accountability</i>	If you feel like you are getting support and you're getting pushed and someone is motivating you to do it. A group chat with all your mates [would be helpful] so you could say like "I'm going to the gym", like help me on this so I can get better at it (P36, FG7, perceived inactive).
	<i>Peer support</i>	On your own I don't think you would be doing [PA] as much as if you were with your friends, you'd be more motivated with your friends because they are doing it too (P3, FG1, perceived inactive).
<b>Organisational</b>	<b>Delivery of PE</b>	
	<i>Lack of autonomy</i>	Some people just aren't into running and they are getting forced to go out and do that when they would rather be in school doing team sports or something. I just think it shouldn't be compulsory to do certain things (P34, FG6, perceived active).
	<i>Not delivered in a 'fun' way</i>	It's the same stuff all the time... they say we can't be bothered but we just want to do something active and fun instead of doing rubbish stuff (P45, FG8, perceived active)
	<i>Timing</i>	We only get an hour to do sports... we have to be changed, put up the nets and we only have half an hour because we still have to do a warm-up... on top of that you have homework and getting your books... so it's kind of pointless to keep [PA] up (P29, FG5, perceived inactive).
	<i>Priority within timetable</i>	[We] should have more physical activity a week... most lads teams will get more training a week whereas in here it's like once a week (P5, FG2, perceived active).
	<i>Poor facilities</i>	We don't have really good facilities... our hall is half the size it's meant to be so it's hard to do actual sports because when you go to matches its completely different (P29, FG5, perceived inactive).

Multi-level	Gender inequalities	
	<i>Exclusion by boys</i>	[The boys] never pass you and the girls are just like in the way for them (P23, FG4, perceived active).
	<i>Less support for girls</i>	If the PE teacher's like "pick what game you want to play" and the girls say hurling and the guys say soccer they are going to go with the guys... they don't listen to what the girls have to say (P26, FG4, perceived inactive).
	<i>Lack of PA opportunities for girls</i>	[Schools] don't really have girls' stuff, they mostly have things to do with lads, they don't encourage the girls to go and do football, they are doing it for the boys (P4, FG1, perceived active).
		Researcher: Do most girls in your class take part in PE?
	<i>Girls 'sit out'</i>	No, no [girls] do [PE]. In our class there are 14 girls and like 5 of us that do [PE]. We all just sit in [the hall] at the sides and just refuse to do it (P45, FG8, perceived active).
	<i>Need for female-only PA opportunities</i>	Some people don't like to be with other gender and most facilities aren't enclosed (P5, FG2, perceived active).
	<i>Professional career</i>	[Girls doing sport] is frowned upon, even on TV, girls are paid less, and boys are paid more, there isn't enough media coverage (P6, FG2, perceived active).
	<i>Social stereotypes</i>	Boys can ride a bike when they're out, imagine one of us going around on a bike? Are you mad?... If a girl got seen driving a bike around here you would probably get robbed... it's not normal [to ride a bike if you're a girl]... if you were seen riding a bike at the age of 12 they'd come over and knock you off (P45, FG8, perceived active).

Quotes are assigned to participants on the basis of which focus group they were in and whether the girl perceived herself to be active or inactive (e.g. Participant 3 [P3], Focus Group 1 [FG1], inactive)

### Intrapersonal

**Fear of judgement.** One of the strongest factors that arose throughout all focus groups was participants' *lack of confidence in their PA skills*, which caused them to avoid attempting new activities or stop PA completely due to a fear of criticism. Participants explained that they would feel "ashamed" if they were to exercise in public and that they would be more comfortable exercising in the privacy of their homes. Many girls explained that they did not like to get involved in team activities, regardless of their sporting ability, as they felt too much pressure to perform well and that they were being *compared to others*. Older girls expressed interest in returning to sports in which they were involved at a younger age, but they were concerned that they would not be able to keep up with others who have more experience. Most participants stated that they would feel anxious *being alone* in a new PA environment and would be more inclined to go if they had a friend. Some girls stated that even if they were a regular member of a sporting club, they would be more likely to also miss the session if close friends were not attending training. Many girls said that they would only try new PA opportunities with close friends whom they trusted to not judge their abilities or bodies.

Each focus group raised issues of *body image* and explained that these insecurities often prevented them from taking part in PA. Physical insecurities included weight, height and shoe size. Many explained that they felt intimidated and uncomfortable attending PE classes and local gyms. The girls felt a *pressure to look good* when exercising, even when they were with fellow female peers. The issue of sweating, being flushed after vigorous exercise and the discomfort of wearing ill-fitting PE uniforms were highlighted as a serious barrier to participation, with some girls explaining that they would not engage in vigorous levels of PA for fear of sweating in front of others.

**Changing priorities.** Girls in all focus groups spoke of having a lack of free time since entering secondary school and recognised their priorities had changed since becoming

a teenager. Most girls explained they were actively involved in sports when they were younger but since reaching adolescence, they had dropped out so they could spend their free time with friends. There was a general acceptance among girls in all focus groups that *academic pressure* increased as the girls progressed into secondary education, especially in more senior year groups. Many girls felt they received conflicting messages from teachers as they encouraged students to stay physically active but also gave so much homework that there was insufficient time for girls to attend classes or team training. Further, there was a general lack of motivation toward PA, with many girls branding themselves “lazy”.

### Interpersonal

**Changing social pressures.** Some girls cited *social influence* to be the cause of dropping out of sports as their friends were no longer participating. Many girls spoke about being afraid of being excluded by peers and missing out on social events due to sporting commitments. Girls said that over time, they eventually prioritised spending time with friends and gave up their sports.

**Support from others.** Teachers who encourage adolescents to be active and who provide a source of *accountability* were identified as facilitators to maintaining PA. *Peers* had the potential to add to PA enjoyment, as well as diminish it. Participants felt most comfortable around peers that were of a similar skill level and in the company of people who could be trusted not to judge their abilities or appearance. Peers who were not within the participants’ close friend circle could often have the opposite effect and discouraged girls from being active, as they felt they were being judged and at risk of being ridiculed. Many participants discussed anxiety during *PE classes*, particularly in mixed gender classes as they did not feel comfortable exercising in front of boys. Girls also felt anxious when separated into groups without their friends and said that they tended to not fully engage in activities as they were afraid of criticism and judgement from others.



### Organisational

**Delivery of PE.** Adolescent girls in all focus groups identified that *lack of autonomy* in PE, including not having a say in what type of PA they engage in, when they do it and who they participate with, was as a key barrier to being physically active. Most participants expressed a strong resentment toward being forced to do activities, and when given the choice, they felt more respected and more inclined to engage. All focus groups said they felt *PE was not delivered in a “fun” way*, that it was repetitive and boring. The factors that make PE enjoyable were consistent across all focus groups and included activities being varied and informal. The *timing of PE* lessons was also seen as a barrier to girls’ participation. Most said that they were not given enough time after PE to shower and get changed. Further, if PE was timetabled in the morning/middle of the school day, the girls were unlikely to engage as they did not want to sit in other classes afterwards, as they felt uncomfortable without showering. Two girls spoke of *PE having little priority within the school timetable*; PE was often cancelled during exam times, and less PE scheduled for senior year groups. Girls within one focus group identified the school’s *poor facilities* as a major barrier to their participation in extracurricular activities.

### Multilevel (Crosses Interpersonal, Organisational/Environmental and Policy/Cultural)

**Gender inequalities.** Girls in mixed schools felt that *boys actively excluded* them from PE based on their gender. Due to this, girls felt that they were incompetent when it came to being physically active because they are female. When girls were included, the boys were perceived to be very rough, and a couple of girls reported being injured during mixed gender activities. Participants also highlighted their belief that schools and teachers offered *less support* to girls, and that girls are not encouraged to be active, nor are they celebrated for their sporting achievements in comparison to boys. Similarly, all girls highlighted the *lack of PA opportunities for girls*. Some of the older

girls reported that there were no senior teams for women for the sports they played. They felt that this lack of opportunity forced them out of the sport. In seven out of eight focus groups, there was a general consensus that *girls “sit out”* and do not participate in PE. Although this was not passively accepted by teachers, it was reported that some girls had never participated in PE and there was no repercussion for non-attendance.

A number of participants felt they would participate more and would feel more comfortable having *female-only* PA facilities, PE lessons and activities. Participants in one focus group also brought up the issue of religion and how this might impact their participation in PA if there were no single-sex PA opportunities. Participants explained that there are few female role models who have *professional sporting careers*. Most focus groups, regardless of participant age, identified how the gender pay gap (e.g., professional female athletes earning significantly less than males) caused them to feel unmotivated should they aspire to become a professional athlete. Participants felt there is a *social stereotype* of what is expected of girls in comparison to boys (e.g., spending free time playing with friends or going to team training is acceptable for boys, but for girls, they felt they were expected to prioritise studying in their spare time over being physically active). Most participants said they spent their leisure time with friends “hanging around”. When asked if they were active when out with their friends, they said it was not acceptable in their local areas for girls to be seen on bicycles or with footballs.

## **Discussion**

This study adds further insight into the factors that influence girls’ participation in PA; however, it is notable that these factors are reflective of those some two decades ago (Flintoff and Scraton, 2001; James, 2000; Sleap and Wormald, 2006; Gilbert, 2001). As far back as 1998, researchers were calling for the PE setting to be rejuvenated and

the curriculum reformed to address the gender gaps (Lawson, 1998), but based on current results, it appears this gap has merely been managed, not reduced. This is a significant issue as the negative experiences that girls have in PA, sport and PE can have a lasting effect on their engagement with PA across the lifespan (Azzarito and Solomon, 2005). In accordance with past studies, social support and autonomy were key facilitators to girls' PA (Holmberg et al., 2018). Numerous barriers were identified by participants at all levels of the socioecological model, including intrapersonal factors (e.g., the fear of being judged), interpersonal factors (e.g., negative experiences of PE) and multilevel factors (e.g., societal gender norms), which are consistent with past literature (Casey et al., 2015). These findings will be used to inform the development of a future intervention (The HERizon Project) which is aimed at increasing girls' PA participation.

#### *Intrapersonal Factors*

In a recent UK survey with 21,000 girls, one third said they did not take part in PA due to low self-confidence in their physical abilities, and a further third avoided PA because they felt their bodies were being scrutinised by others (Horn and Sinno, 2014). These intrapersonal issues were reflected in the current study as a fear of judgement was an overriding theme across all focus groups. Although being skilled can make PA participation easier (Yungblut, 2012), girls may still not engage due to fear of comparison with others (Flintoff and Scraton, 2001) or having low perceived competence (Laird et al., 2018). If girls feel insecure about their abilities, they are unlikely to participate in order to preserve an image of competency and to avoid any potential embarrassment (Knowles et al., 2011). By not taking opportunities to develop skills, they further diminish their confidence and compound their fear of being judged by others (Youth Sport Trust, 2018), which can impact their future PA (Stodden et al., 2008). This was seen in the current study as girls said that they would like to join sports clubs but felt they did not have the required skill level nor want to practice in front of others that are more experienced.

In a study with 524 girls from low socioeconomic areas, 72% were found to be dissatisfied with their body image, regardless of being in a “normal” BMI weight category (Duncan, 1993). Negative body image is a prominent barrier to girls’ PA (Elder et al., 2007) and has been found to start in girls as young as 7 years old (Horn and Sinno, 2014). Girls in the current study felt that PE was a costly risk that leaves their physical appearance open to jeering by peers in their class, especially boys, and therefore, they often chose to not participate. Boys’ perceptions of girls being active may exacerbate girls’ body concerns as in one qualitative study, boys admitted to calling girls “disgusting” and “nasty” if they sweat while exercising (Ganesan et al., 2018) (p. 87), and other work found that boys will intimidate girls who are overweight by teasing and excluding them (Casey et al., 2009). Boys were found to exclude girls who rivalled their strength, with one boy explaining she was “too big and too tall . . . she made most of the goals and made the girls beat the boys” (Oliver and Hamzeh, 2010) (p. 42). In this same study, another girl was excluded from playing by boys because she did not know how to run fast (Oliver and Hamzeh, 2010). Teachers in a recent study were also found to hold stereotypical gendered views of bodies as teachers described a fictional female student who wanted to take part in football over dance as someone with short hair, a tomboy and stronger and heavier than other girls (Gillison et al., 2012). In order to support the development of a healthy body image, it is important for professionals, such as PE teachers and community coordinators, to reflect on their own bodily gender biases, to educate girls on body appreciation and to support boys in increasing their knowledge and understanding of bodily related concerns and the relevance of their own behaviours within a PA context.

### *Interpersonal Factors*

Interpersonal interaction is a commonly cited facilitator to girls’ PA (Elder et al., 2007), and although being active with friends can enhance enjoyment, and thus increase participation (Holmberg et al., 2018), this study found the relationship is nuanced and

complex. Girls in the current study explained that only specific close friends, whom they trust and feel comfortable around, have positive effects on their PA and that other friends and classmates can have the opposite effect, causing girls to be deterred from team-based activities and many preferring to exercise at home. This finding corresponds with past studies which indicate girls disengage from PA due to feeling anxious when asked to form groups in PE lessons (Laird et al., 2018), as a result of feeling pressure to not let teammates down (Yungblut, 2012) and because of general exclusion from other girls (Greene and Stewart-Withers, 2018). The peer contagion model illustrates how adolescents often mimic the health behaviours of their peers (Slater and Tiggemann, 2010a). Although in some scenarios, this can be beneficial (i.e., active girls often have active friends (Sawka et al., 2013), many girls in the current study said that they had dropped out of sports because their friends no longer did it, a trend well documented in past literature (Coleman et al., 2007). Girls feel under pressure to conform with what is viewed as gender appropriate by friends, and usually, this does not involve engaging in sport (Gillison et al., 2012). Girls that push against these stereotyped norms are at risk of being excluded and victimised by their peer group (Preece and Bullingham, 2020). Given the complexity of the influence social interaction has on girls' PA, it has been recommended that future PA interventions examine the factors that mediate the relationship between social support and PA participation (Holmberg et al., 2018).

#### *Organisational/Multilevel Factors*

Girls' PA behaviours are regulated by organisational factors including societal norms that scrutinise what activities girls should and should not engage in (Vu et al., 2006; Scraton, 2018; Plaza et al., 2017). It has been argued that it is not the sport or activities themselves that are the issue but instead how these environments are constructed that leads to girls' disengagement (Ennis, 1999) as PE and sport settings typically celebrate stereotypical masculine traits (Stauroskey, 2016) with boys' achievements and activities given higher status (Anderson and White, 2018). Girls in the current study felt their

PA participation was limited by the opportunities available to them and by the gender expectations of society. Researchers note that as society often portrays femininity as being incompatible with sport, many girls drop out (Ferry and Lund, 2018), and those that do not conform to these gender stereotypes often face exclusion and victimisation by peers (Hill and Azzarito, 2012). Although efforts have been made to bridge the PA gender gap (Sport England This Girl Can campaign and the Federation of Irish Sport 20/20 campaign), a divide still remains as girls are often marginalised and undervalued (Mulvey and Killen, 2015), and boys are perceived to have access to better facilities and support (McSharry, 2017; Hills and Croston, 2012; Pavlidis, 2018). Girls were pessimistic about the likelihood of becoming professional athletes. Marginalisation of females from recreational PA and elite sport contributes to female professional athletes being seen as outlying trailblazers rather than a normal occurrence (Bevan and Fane, 2017). As girls transition to secondary school, there are fewer opportunities for girls to engage in traditionally masculine activities, such as football and rugby (Watson et al., 2015). Even when such opportunities become available, many girls choose not to participate in order to avoid negative comments from peers (Hobin et al., 2012). Consequently, girls in the current study said they would feel more comfortable in female-only activities. This echoes past work which stated that there has been “nothing more constraining and alienating” for girls than a coeducation and multiactivity PE curriculum (Plaza et al., 2017) (p. 32). Women in mixed-gender gyms often receive unsolicited advice and attention from males, which leads to feelings of discomfort, and in some situations prevents them from exercising (Coen et al., 2018). To support girls, it has been recommended that women be given opportunities to engage in a range of flexible PA opportunities in a separate female-only space. This is contested by others who argue that gender segregation in PE is further reinforcing gender stereotypes and instead suggest creating a “homely” space that is social, intimate and emphasises acceptance (Azzarito and Hill, 2013) (p. 359). An environment that aims to normalise differences (Owen et al., 2019) and provides

opportunities for boys and girls to have positive PA experiences together can help to make either group more aware of each other's capabilities (Hill and Azzarito, 2012).

### *Implications for Intervention Development*

This study identifies some of the multilevel factors that influence adolescent girls' PA and can suggest practical recommendations to inform the development of future PA interventions, including the HERizon Project. In order to create effective and meaningful PA programmes, adolescent girls' voices should be at the core of their development so that their needs and interests at each socioecological level are catered for.

The findings support the necessity to provide PA opportunities that focus on intrapersonal development, including girls' perceived competence and reducing feelings of judgement from others. Providing girls with the autonomy to choose from a range of different fun and diverse activities, as well as giving them the independence to choose when and where they will be active, is important for increased participation. Fear of comparison can be reduced by providing PA opportunities that focus on self-progression through appropriate and attainable challenges and that are held in a safe, informal environment. As there is a lack of home-based interventions, further exploration of this setting may help to overcome some of the aforementioned barriers, as well as body-image-related concerns, such as avoiding vigorous exercise for fear of sweating in front of others.

Positive interpersonal experiences, such as socialising in an inclusive and diverse environment, may be more appealing to girls than competitive sports settings. Many girls spoke of being fearful of joining PA opportunities alone, and remote interventions may provide the space for girls to have the virtual support of friends yet remain shielded from judgement of their bodies and skills. Mentors were identified as

being facilitators who could provide encouragement and accountability for girls to develop and maintain PA habits. Mentors who cultivate a culture of acceptance and demonstrate an awareness of the pressures girls feel under to conform to societal gender norms may help girls to feel supported and nurture their PA participation. Segregating by gender in PE and other community sports may reinforce gender stereotypes. Instead, it is suggested that girls and boys be offered equitable PA opportunities in school and community settings, while also celebrating girls' sporting achievements and promoting female role models. Further, where possible, girls may feel more comfortable being instructed by females, especially in subgroups where religion may prevent them from taking part in certain activities.

Although the focus of this study was physical activity, many of the girls primarily spoke of school PE and their negative experiences. We must recognise the hard work many PE teachers are doing to create equal access and opportunities for young women and highlight the need for upper management, national curriculum developers and governing policies to support them in this ongoing battle. Within schools, PE should be prioritised in the timetable so that there is sufficient time to engage in activities and ample time after class to change back into school uniform. To overcome some of the cited issues, it is suggested that there be a more open dialogue within the PE setting as often the perception girls have of the opportunities available to them is markedly different to the perceptions of teachers (Sundar et al., 2018). Our past experiences lead to our own conscious and unconscious biases, and so, it is recommended that PE teachers reflect on their own prejudices that may be reinforcing the gender divide in the PE environment. By actively encouraging girls' participation in class and breaking away from traditional gender-appropriate activities, teachers can express their awareness of societal gender inequalities and support girls in challenging social expectations. Future interventions, including the HERizon Project, should offer a range of activities that include traditional "masculine" activities such as strength and



conditioning activities, as well as provide support and awareness of the gender barriers girls often feel constrained by.

### *Strengths and Limitations*

We were successful in recruiting girls from a number of geographical locations across the UK and Ireland. This helps in gaining a better understanding of PA determinants for adolescent girls and increases the generalisability of the study's findings. However, it must be acknowledged that the majority of girls were of white ethnicity, and no participants had physical disabilities. Therefore, future work should include a more diverse sample of participants to reflect the diversity of Irish and British cultures. Further, although the study aimed to recruit inactive girls from low socioeconomic areas, approximately a quarter of participants were considered active and were from affluent areas of the UK and Ireland. This may be due to issues with the recruitment strategy, including difficulties in obtaining returned consent forms and screening processes. Due to the purposeful attempt to recruit inactive girls, most active girls self-excluded from taking part in the study, and therefore, the findings may not generalise to more active groups of adolescent girls. Although the target sample size was reached, the number of participants in each focus groups ranged, with one group containing only two participants. Although the findings from this group were consistent with those of larger groups, it is acknowledged that discussion may have been limited due to the small number of participants. Participants predominantly spoke of PA in relation to school PE. This may have been due to many of the girls viewing themselves as inactive, and therefore, their main experience of PA was within the school PE setting. Another explanation is likely due to the majority of focus groups being conducted within the school building during class time. Future research should consider if another setting is more appropriate to capture girls' experiences of non-school-related PA, but researchers should be mindful of the pragmatic difficulties of recruitment in community settings, such as youth clubs, due to their unstructured nature, i.e., attendance is not compulsory, which may lead to

organisation issues. Although this research aimed to explore girls' PA experiences, it may have been beneficial to also speak with others involved in the provision of girls' PA, such as PE teachers and youth club coordinators. Given that adolescent girls' PA behaviour is complex, it is important to have a broad understanding of the issue, and speaking with other stakeholders may help to develop a more holistic view of the issue.

## **Conclusions**

The current formative research provides an insight into the multilevel factors that influence adolescent girls' participation in PA. These findings will be used to inform the development of the HERizon Project, an intervention targeting adolescent girls' physical inactivity. Adolescent girls experience numerous challenges that often deter their sustained participation in PA. Girls' PA levels were influenced by a fear of being judged, changing priorities and social pressures, support from others, the delivery of PE and gender inequality. Many of these factors have a negative influence of girls' PA and stem from gender-biased societal values. In order to increase PA participation for adolescent girls, interventions that are holistic and consider factors at each level of the socioecological model are needed. Interventions should be set in a location where girls feel comfortable, with a focus on enhancing wellbeing and enjoyment rather than competition and comparison with others.

# Bridging Chapter

## **1. The specific ways the results of study 1 influenced study 2.**

Numerous themes and subthemes that were identified in study 1 were used to develop the initial HERizon intervention. How these findings were specifically used are outlined below:

Less support for girls, lack PA opportunities, female-only facilities

- HERizon only recruited female participants, all intervention deliverers (Activity Mentors, live workout instructors) were women, and all imagery on intervention materials and social media pages depicted women.

Changing priorities, academic pressure

- HERizon attempted to overcome participants perceived lack of time by asking them to do 3 x 30 minute PA sessions each week (significantly less than the 60min.day national recommendations). Participants had full flexibility on when and where they did their PA sessions which was hoped to further overcome the barrier of participants' restrained timetables.

Lack of autonomy, no fun PA options

- To give participants full autonomy over their PA, they had the flexibility to choose any type of PA they wished throughout the intervention. To support them in

trying new types of PA, participants were provided with several suggested ways to be active at home e.g., dance, boxing, Pilates and yoga YouTube videos.

#### Gender inequalities, social stereotyping

- To overcome some of the gendered perceptions participants of study 1 had on what activities girls could/could not take part in, many of the suggested PA options provided to participants included traditionally male-dominated sports such as weight lifting, strength training, and boxing. This was done in an attempt to show participants that girls could take part in any activity they wished, regardless of societal gendered norms.

#### Fear of judgement, compared to others, lack confidence in PA skills.

- As girls were exercising at home (the majority exercised alone although some did workouts with a family member or went for family hikes), they did not have peers around them to compare their bodies or abilities against. Further, participants did their PA sessions in the safety and comfort of their homes and could practice their skills/gain confidence in their abilities without feeling judgement from others around them. As fitness testing was also carried out remotely, they were not aware of other participants' scores and could only compare their postintervention scores to their own baseline scores.

#### Body image, pressure to look good

- HERizon was entirely remote and participants were not required to exercise with others, or as part of a group. The majority of girls that joined live group workouts

did not turn on their cameras. The focus of the intervention was not on appearance, nor were any body measurements taken as outcome measures (e.g., weight, BMI). The key messages of HERizon (e.g., during behaviour change support calls, in non-reply text messages, and during live group workouts) were always based on the body's abilities (e.g., improvements in fitness, flexibility and strength), acceptance of our bodies, and the mental health benefits of PA.

#### Support from others, accountability, peers

- Accountability was provided through PA logbooks (i.e., participants recorded their PA sessions in PA logbooks each week), checking in with their Activity Mentor during weekly video calls, and through reminders sent each week as non-reply text messages. Social support was also provided through these mentor calls and text messages. Further, participants could interact with other girls on the programme during the weekly live group workouts (many spoke in the Zoom chat box about how they were finding the session), and in a private Instagram group chat. Instagram was the chosen platform for the group chat as WhatsApp would have revealed the girls' phone numbers to other members of the group, and during focus groups, girls said that they did not use Facebook but primarily spoke to friends on Instagram and Snapchat. As messages automatically disappear on Snapchat, Instagram was deemed the most suitable for the HERizon intervention.

**Table 6.** Description of the development of The HERizon Project using the GUIDED checklist (Duncan et al., 2020)

1	<b>The context for which the intervention was developed</b>	A home-based behaviour change intervention was developed to increase the physical activity levels of adolescent girls living in the UK and Ireland.
2	<b>The purpose of the intervention development process</b>	The aim of study 2 was to formatively evaluate the feasibility, acceptability and preliminary effectiveness of a multi-component home-based PA intervention.
3	<b>The target population for the intervention development process</b>	The intervention aimed to target inactive adolescent girls (those not currently meeting the national PA guidelines) aged 13 to 16 living in the UK or Ireland.
4	<b>How any published intervention development approach contributed to the development process</b>	The intervention development was based on the key activities outlined in Medical Research Council framework for the development and evaluation of complex interventions (as outlined on page 59). The first step involved reviewing the literature base of previous interventions that aimed to increase adolescent girls' PA. Second, focus groups (study 1) were conducted with the target audience to gain better understanding of the perceived barriers and facilitators associated with their engagement in PA. Third, theory was reviewed and developed to underpin the intervention and behaviour change techniques (BCTs) were identified (Table 7). Mechanisms of impact were hypothesised, as well as identifying what the outcome and process measures would be. Fourth, the intervention feasibility was assessed in a mixed methods study with a small group of participants (study 2).
5	<b>How evidence from different sources informed the intervention development process</b>	The information gained through reviewing the literature and from qualitative focus groups (study 1) was integrated and discussed within the research team (my PhD supervisors and myself). Based on this information, the intervention components were agreed upon (flexibility in PA sessions to support autonomy and competency; live group workouts led by a relatable female instructor to foster a social community; non-reply text messages as a source of support and accountability; 1-1 behaviour change support through activity mentors to provide accountability, and competence and social support; and access to an online group messaging platform to encourage social support and cohesion).

6	<b>How existing published theory informed the intervention development process</b>	<p>The intervention was developed using Ryan &amp; Deci's self-determination theory. This theory was used as it is one of the most commonly used theories in health behaviour change and was originally developed within the applied setting (e.g., in schools and the work place) and so it is relatively easily to operationalise within intervention development. The theory posits that individuals require three basic psychological needs in order to reach optimal wellbeing. These needs are autonomy (feeling of choice – identified as an important facilitator to girls' PA engagement in study 1), relatedness (feeling a sense of belonging – also identified as an important factors to girls' PA in study 1), and competence (feeling effective in one's activity – low self-competence in one's ability was identified as a barrier to girls PA in study 1).</p>
7	<b>The use of components from an existing intervention in the current intervention development process</b>	<p>NEAT girls (Lubans et al., 2012) – weekly text messaging to provide reminders, motivation and social support.</p> <p>New Moves (Flattum et al., 2011) - Individual counselling provided to girls as part of intervention. Sessions incorporated behaviour change techniques such as goal setting. Counselling was provided by registered dietitians and health educators.</p> <p>G-PACT (Owens et al., 2018) – Peer led mentoring model (undergraduate students acted as role models for year 9 project leaders, who then acted as dissemination agents to the wider year 9 student body). This intervention also employed group based fitness classes delivered by certified instructors.</p> <p>Chicas Fuertes study (Larsen et al., 2021) – use of Instagram as a platform to engage adolescent girl participants in an mHealth physical activity intervention.</p>
8	<b>Any guidance principles, people or factors that were prioritised when making decisions during the intervention development process</b>	<p>Due to COVID-19 lockdown restrictions, it was important that the study could be run remotely, without the need for participants to come to the laboratory. Delivering the intervention remotely also reduced cost, participant burden, increased flexibility in the types of PA participants engaged in, and allowed a wider pool of potential participants to sign up to the intervention (compared to only recruiting participants who were local to the university). Further, participants preferences (information gained through study 1) were prioritised within the</p>

		intervention design as it was hypothesised this would lead to greater recruitment, retainment and engagement.
9	<b>How stakeholders contributed to the intervention development process</b>	Participants voices were central to intervention design and development. Qualitative focus groups were used to gain participant insight in study 1, and the data gained through these qualitative approached informed the study in ways listed in section 1 of this bridging chapter.

The TIDieR guidance has been used to describe the developed intervention (Appendices: material for chapter 3, study 2).

## **2. Information on the role of Activity Mentors within HERizon**

Study 1 found that social interaction and accountability were two key facilitators of girls PA. I initially considered the route of using an online form as a way for participants to log their PA sessions each week and receive digital ‘feedback’ and support e.g., completion of a Google Form. However as one of my supervisors, Dr Paula Watson, who is a chartered psychologist and a supervisor to several Professional Doctorate sport and exercise psychology students, suggested that these students could provide 1-1 needs-supportive behaviour change support to participants. Professional Doctorate students are required to do a certain amount of applied practice hours as part of their qualification and therefore being involved in the HERizon programme was mutually beneficial. These trainees had the necessary police vetting to work with adolescents, as well as Bachelors and Masters level psychology degrees. Three Professional Doctorate students acted as Activity Mentors in study 2 and were each partnered with 5-7 participants with whom they had weekly 15-30 minute video calls with for the six week programme. Dr Paula Watson, the three Activity Mentors and I met on Zoom each week for a reflection meeting to discuss how the calls were progressing and if any changes were needed to be made to the intervention delivery. Activity Mentors kept a log of each call which included



recording the duration of the call and the quantity/type of PA each participant completed that week (the aim being 3 PA sessions each week). All calls were founded in self-determination theory and implemented a range of need-supportive behaviour change techniques that aimed to foster a sense of intrinsic motivation towards PA within the participants. An initial introduction call between the Activity Mentor and participant occurred one week prior to starting the intervention. On this call, the Activity Mentor informed the participant of what to expect from the programme and agreed upon a time for which the subsequent calls would take place. The focus of week one's call was familiarisation (getting to know each other), week two was goal-setting (creating a long term goal for the programme), week three was action planning (deciding on what three specific PA sessions the participant would do in the coming week), week four was coping strategies (reviewing the action plan and finding solutions to any potential barriers preventing them completing their three PA sessions), week five was "post HERizon" (discussing how the participant might continue PA after the programme), and week six focused on reflection (reviewing the original long term goal and action plan, and reviewing the coping strategies to help them overcome barriers that might arise after the programme ended).

### **3. Details of YouTube videos used in PA logbook**

To broaden girls understanding of what constitutes as PA (as study 1 found the majority of girls only considered school PE when discussing PA), participants were provided with a PA logbook with a range of different types of activities that could be done from home. It was important that these activities required minimal space and equipment given the strict home lockdown restrictions due to the global COVID-19 pandemic in April 2020. Activities in this logbook were not prescriptive, they were provided only as suggestions to encourage girls to try new types of PA (based on results of study 1 findings that girls wanted novel physical activities rather than traditional team-based sports). Resources

listed in the logbook included an array of verified YouTube channels which were chosen based on perceived popularity (channels that I was personally aware of and those channels trending on the YouTube 'explore' page). The suggested channels reflected the flexible nature of the intervention in that some options were high intensity (boxing and dance classes), some were focused on muscle strengthening exercises (strength and conditioning classes), and some were low intensity (yoga and Pilates classes). The majority of instructors were female (results in study 1 found girls were most comfortable with female instructors), however one male-led channel was included for inclusivity, The Body Coach.

#### **4. Details on live group workouts**

Group live workouts were led by me, and based on my experience and qualifications in strength and conditioning, the majority of these sessions were focused on developing girls' competency of fundamental movement patterns such as the squat, hip hinge (deadlift), horizontal pull (bent over row), horizontal push (push up), and core (crunches). As boredom of doing the same activities in school PE was identified as a barrier to girls' participation in PA in study 1, each of the live workouts were different and included different exercises, e.g., some workouts were predominantly leg exercises, some focused on cardiovascular fitness, and other were low intensity mobility sessions. Every session began with a 10 minute dynamic warm up to elevate heart rate, warm up joints and prepare muscles for the work out. The majority of sessions were run using an interval timer (rather than number of repetitions) to ensure that everyone in the virtual class was on the same exercise. In these sessions exercises were paired in couplets, exercise 1 was performed for 40 seconds, followed by a 20 second rest, followed by exercise 2, followed by a 20 seconds rest. This main phase of the live workouts lasted approximately 20 minutes, and the session ended with a 5 minute cool down composed of static stretched to slow the heart rate and breathing.

## **5. Details on field-based fitness testing**

As discussed in section 9.3.1, COVID-19 did not allow for participants to attend the laboratory for outcome measures to be taken within the school setting. Therefore, a range of field-based testing was employed to measure participants' cardiorespiratory fitness, muscular strength and muscular endurance. The Resistance Training for Teens mobile application was used to collect this data. This app was developed by Prof Dave Lubans research group at The University of Newcastle, Australia and participants were provided with a unique LJMU password to enter the application. This remote testing was found to be feasible and acceptable for adolescents and their parents/guardians. It is also hypothesised that conducting tests at home, although not the gold standard, is likely to have overcome many potential barriers for participants and prevented dropout, e.g., difficulties in getting to the university laboratory, and conducting maximal exercise tests in front of other people.

## Chapter 3: STUDY 2

Cowley ES., Watson PM., Foweather L., Belton, SJ., Mansfield C., Whitcomb-Khan G., Cacciatore I., Thompson A., Thijssen D. and Wagenmakers AJM. (2021) Formative evaluation of a home-based physical activity intervention for adolescent girls – The HERizon Project: a randomised controlled trial. *Children*, 8 (2). <https://dx.doi.org/10.3390%2Fchildren8020076>

# Thesis Study Map

Study	Objectives & key findings
<b>Study 1 - “Girls Aren’t Meant to Exercise”:</b> Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project	<b>Objectives:</b> Qualitatively explore; <ul style="list-style-type: none"> <li>girls understanding of PA</li> <li>girls experiences and perceptions of PA</li> <li>girls perceived barriers and facilitators towards PA</li> </ul> <b>Key findings:</b> <ul style="list-style-type: none"> <li>Girls identified barriers and facilitators to PA at all socioecological levels.</li> <li>Barriers include fear of judgement, changing priorities, social pressure, school PE and perceived gender inequality in school and society.</li> </ul>
<b>Study 2 -</b> Formative Evaluation of a Home-Based Physical Activity Intervention for Adolescent Girls—The HERizon Project: A Randomised Controlled Trial	<b>Objectives:</b> <ul style="list-style-type: none"> <li>Assess the acceptability, appropriateness and implementation of a remote PA intervention for adolescent girls.</li> <li>Assess the intervention’s preliminary effectiveness of improving adolescent girls PA, physical fitness, and psychosocial health.</li> </ul>
<b>Study 3 -</b> What happened in ‘The HERizon Project?’ – Process evaluation of a multi-arm remote physical activity	<b>Objectives:</b> <ul style="list-style-type: none"> <li>Investigate what intervention components (and their dose) were delivered in each intervention arm.</li> <li>Explore what factors influenced the recruitment to and implementation of The HERizon Project.</li> </ul>

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intervention for  
adolescent girls

- Explore adolescent girls satisfaction and acceptability of the intervention.
- 

### **Study context within thesis**

Chapter 3 will discuss the second study of this PhD thesis. This was the initial feasibility trial of The HERizon Project which aimed to assess the preliminary effectiveness of the trial in comparison to a wait-list control, as well as collect process evaluation information on the reach, implementation, adherence, and acceptability of the intervention. Trialling the first iteration of HERizon with a small sample size allowed for girls' feedback to be collected so that refinement could be made to the intervention to improve it for a subsequent future trial.

**Abstract:** This is a formative evaluation study of the HERizon Project, a home-based multi-component physical activity (PA) intervention for adolescent girls in the UK and Ireland. Although not intended, this study coincided with the initial COVID-19 lockdown restrictions. A total of 42 female participants, aged 13 to 16 years old (mean = 14.2, SD = 1.1), were randomly allocated to: (i) the HERizon group (n = 22) or (ii) the wait-list control group (n = 20). Participants in the six-week HERizon group were asked to complete three PA sessions each week and engage in weekly behaviour change support video calls. The primary outcome measure was self-reported habitual PA. Secondary outcomes measures included cardiorespiratory fitness (20 m shuttle run), muscular strength (standing long jump), muscular endurance (push up test), and psychosocial outcomes (Perceived Competence Scale, Body Appreciation Scale, Self-Esteem Questionnaire, Behavioural Regulation in Exercise Questionnaire). Quantitative and qualitative process evaluation data were also collected. Outcome measures were assessed at baseline and after the six-week intervention. There was no significant change in habitual PA between groups (LMM group\*time interaction:  $p = 0.767$ ). The HERizon group had significantly increased cardiorespiratory fitness ( $p =$

0.001), muscular endurance ( $p = 0.022$ ), intrinsic motivation ( $p = 0.037$ ), and body appreciation ( $p < 0.003$ ) in comparison to the wait-list control group. All participants in the intervention group completed the intervention and compliance to the intervention was high (participants completed  $18 \pm 2$  sessions). Although no change in PA was observed, HERizon resulted in improved physical fitness and psychosocial outcomes. These preliminary findings, alongside positive findings for feasibility and acceptability, highlight potential benefits from the home-based intervention, thus further investigation is warranted.

## **Introduction**

Physical activity (PA) is associated with multiple health benefits in childhood and adolescence (Biddle et al., 2019; Cristi-Montero et al., 2019; Kleszczewska et al., 2019), with the current guidelines recommending individuals under 18 years to engage in an average of 60 min of moderate-to-vigorous physical activity (MVPA) per day across the week (UK Chief Medical Officers, 2019). Independent of PA, there is a strong association between cardiorespiratory fitness and adolescent health, including improved metabolic health (Lang et al., 2020), reduced risk of cardiovascular disease in adulthood (Högström et al., 2014) and better mental health and academic achievement (Lubans et al., 2016a; Santana et al., 2017). The government guidelines further recommend children to incorporate activities that develop muscular fitness into their PA, as high levels of muscular fitness in adolescence are associated with improved body composition, self-esteem and skeletal health (Smith et al., 2014). Although traditional adolescent physical fitness research has primarily focused on cardiorespiratory fitness, there is a growing interest in assessing the associations between adolescent health and muscular fitness (Evaristo et al., 2019; García-Hermoso et al., 2019).

Physical inactivity is a global health concern, with less than 15% of adolescents worldwide meeting the minimum PA guidelines (at least 60 min moderate-to-vigorous physical activity (MVPA) per day) (Guthold et al., 2020). This issue is particularly prevalent among adolescent girls in the UK and Ireland, with only ~10% being sufficiently active (National Health Services, 2019; Woods et al., 2018). There are numerous interventions aiming to increase adolescent girls MVPA, with the majority being school-based (Harrington et al., 2019; Robbins et al., 2019; Verloigne et al., 2017). However, a recent pooled analysis of 17 school interventions found no evidence of improved MVPA, with authors recommending that other intervention contexts should be explored (Love et al., 2019a). There appears to be scope to target the home and community setting for PA interventions as girls typically acquire 50% less MVPA after school hours in comparison to during school (Strugnell et al., 2016). This seems especially pertinent in the current COVID-19 climate as adolescents face self-isolation restrictions and home confinement, alongside school closures and the cancellation of community sport provision (Ammar et al., 2020). Furthermore, a recent study investigating the effects of COVID-19 on PA levels found that individuals had lower vigorous, moderate and total PA, along with increased time spent sitting in comparison to before the pandemic (Ng et al., 2020; Xiang et al., 2020). Few studies have examined interventions to increase participation in MVPA among adolescent girls in home and community settings and further research is needed.

Formative research is a critical step in the design of behaviour change interventions (Cowley et al., 2021b). For example, preliminary qualitative research can optimise randomised controlled trials by improving recruitment rates, help in explaining trial findings and ensures that interventions meet the needs of the target users (O'Cathain et al., 2013). Therefore, the first step in the HERizon Project involved conducting formative research using qualitative focus groups with the target population in order to inform the design of a future intervention (Cowley et al., 2021b). The major results of this qualitative study included (1) the importance of having female instructors and



mentors, (2) allowing girls to choose from a range of fun physical activities, and (3) giving girls the opportunity to exercise in socially comfortable environment, reducing feelings of self-consciousness (Cowley et al., 2021b). We developed the HERizon Project with the aim of increasing MVPA among adolescent girls in the UK and Ireland. Multiple qualitative studies with adolescent girls have consolidated the above findings in that girls' perceived feelings of judgement about their bodies, poor self-esteem and low perceived competence are significant barriers to participation in PA (Corr, 2019; Yungblut, 2012), suggesting that a home-based intervention is a potentially safe and viable option for this population as it reduces the risk of unwanted attention or criticism. Further, recent systematic reviews concluded that interventions that are female only, multi-component and under-pinned by theory are shown to be most effective for increasing adolescent girls' participation in PA (Owen et al., 2017; Pearson et al., 2015). Therefore, this home-based multi-component PA intervention was created in an attempt to meet the above demands and to add value to this understudied gap in adolescent girls PA literature.

Self-determination theory (SDT; (Ryan and Deci, 2000a; Ryan and Deci., 2017) has been drawn upon to understand how to foster motivation towards PA in children and adolescents (Fin et al., 2017; Guagliano et al., 2019). SDT suggests that motivation exists on a continuum from amotivation (absence of motivation), to controlled regulation (motivation driven by internal or external pressures) to autonomous regulation (self-directed motivation characterised by volition and perceived choice). Controlled motivation involves either external regulation (e.g., engaging in PA for a reward or to avoid a punishment) or introjected regulation (e.g., engaging in PA to preserve the ego, or to avoid feelings of guilt). Autonomous motivation can be either extrinsically regulated (as in identified regulation, working towards a personally important goal; and integrated regulation, where PA is deemed congruent with personal values) or intrinsic in nature (characterised by interest and enjoyment), and is associated with enhanced PA adherence and positive psychological well-being

(Teixeira et al., 2012). SDT postulates that for optimal well-being and autonomous motivation, three basic psychological needs must be met—autonomy (the feeling that behaviour is volitional and self-directed), relatedness (a sense of belonging and connectedness to others) and competence (perceived capability of maintaining and enhancing current skills and achieving desired objectives) (Ryan and Deci., 2002). Past research has shown that adolescent PA can be improved when these basic needs are met (Maldonado et al., 2019; Sebire et al., 2013), thus the HERizon Project intervention was developed utilising the SDT framework.

The primary aim of this study was to conduct a formative evaluation of a home-based PA intervention for adolescent girls MVPA (HERizon Project), informed by previous qualitative work (Cowley et al., 2021b) and self-determination theory (Ryan and Deci, 2000a; Ryan and Deci., 2017). Formative evaluation is a deliberate assessment of factors that influence an intervention's progress and effectiveness (Stetler et al., 2006; Young et al., 2006) and can provide explanations to the success or failure of certain intervention components (Bauman and Nutbeam, 2013). The secondary aim was to assess the preliminary effectiveness of the intervention on physical fitness measures, motivation towards PA, self-esteem, body appreciation and competence. Following the Medical Research Council guidance for developing complex interventions (O'Cathain et al., 2019b), results of the current study will be used to refine the intervention design and inform delivery of a future larger scale trial.

## **Methods**

### *Trial design*

This mixed-methods study was the feasibility phase of a broader programme of research (The HERizon Project) that aims to develop a theory-based PA intervention targeting adolescent girls. The design was a two-arm randomised controlled trial, comprising (i) the HERizon six-week remote intervention arm and (ii) a wait-list

control arm. Block randomisation with country-level (UK and Ireland) stratification was used using Microsoft Excel to allocate the participants on entry. The primary outcome of this study was change in MVPA. Secondary outcomes included cardiorespiratory fitness, muscular strength and endurance, exercise motivation, perceived competence, self-esteem, and body appreciation. Assessments were conducted pre-intervention (April/May 2020) and repeated immediately post-intervention (June/July 2020). As this study ran during the COVID-19 pandemic, all participants began the intervention in full national lockdowns, with all local schools and amenities being closed. Restriction began to be lifted in the last week of June in Ireland and in the first week of July in the UK, with some local amenities opening and small outside group gathering being permitted. Due to the nature of this study, participants and project deliverers could not be blinded to the assigned intervention. Ethical approval was granted by the University Ethics Committee [reference: 20/SPS/016] and this study is registered with clinicaltrials.gov [reference: NCT04662775]. Reporting of this study was guided by the Consolidated Standards of Reporting Trials checklist (CONSORT; Available in the 'chapter 3 materials' section of the appendices) (Eldridge et al., 2016) and the template for intervention description and replication checklist (TIDieR; Available in the 'chapter 3 materials' section of the appendices) (Hoffmann et al., 2014).

### *Participants and recruitment*

This study aimed to recruit 40 participants, with equal distribution between groups. Adolescents were eligible to take part in this study if (a) they were female, (b) aged 13–16 years, and (c) lived in the UK or Ireland. Girls were excluded if they were pregnant at time of enrolment, were not able to engage in moderate intensity PA or had no access to a smartphone or computer. Parents and participants provided written informed consent/assent prior to randomisation or the collection of any study

measurements. Participants were recruited via social media advertisement which invited adolescent girls/parents to express interest.

### *The HERizon Project*

The six-week intervention had two central aims: (1) improve adolescent girls MVPA and physical fitness, and (2) to support participants to adopt and maintain positive physical active habits. The intervention deployed in this study had three components (outlined in Table 6); i. Exercise sessions: Participants were asked to complete three 30 min PA sessions each week and record their sessions using a self-report PA logbook. They were given the choice of different types of home-based virtual exercise, e.g., YouTube exercise channels and instructions to design their own workouts. A facilitator for girls' participation in PA is to have female exercise instructors and varied, yet challenging, exercises (Cowley et al., 2021b). Therefore, the first author hosted online live group exercise classes each week. This option allowed participants to engage in the social elements of PA but from the comfort and safety of their own homes. It was also thought that having a scheduled set time to join a class may increase motivation and improve adherence. ii. Behaviour change support calls: Each participant was allocated an "Activity Mentor" who supported them for the duration of the intervention. The team of 3 Activity Mentors, all trainee sport and exercise psychologists, was supervised by a Health Care Professions Council (HCPC) registered Sport and Exercise Psychologist (second author). Participants had seven weekly video calls (an introduction call lasting 30 min and the remaining six calls lasting approximately 10 min; call schedule can be found in 'chapter 3 materials' section of the appendices). Drawing on SDT, video calls employed motivation and behaviour change techniques aimed at fostering autonomy, competence, and relatedness in participants (Teixeira et al., 2020), e.g., showing unconditional regard, encouraging choice and helping set clear and concrete action plans. Each call was

based on a pre-planned session outline and was goal orientated, participant centred and focused on PA (motivation and behaviour change techniques used within the intervention are displayed in Table 6). iii. No reply SMS: Participants received three standardised text messages each week, aimed at providing PA-related facts, encouragement, and study information, e.g., “did you know physical activity can help improve energy, sleep and mood?” and “Live workouts this week are Monday at 6 pm. Below are sign in details”.

Participants in the wait-list control group were asked to continue their usual PA habits and received no additional contact from the research team outside of data collection points. Following post-intervention data collection, control group participants were invited to participate in the same intervention as described above.

#### *Outcome measures and procedures*

All outcome measures were collected by participants in their home setting due to COVID-19 restrictions. Prior to baseline measures, participants completed a physical activity readiness questionnaire. The first author had a video call with each participant and a parent/guardian to explain how to conduct all assessments. Parents were asked to supervise all physical fitness tests (cardiorespiratory fitness, muscular endurance, muscular strength) and to input scores into a free, password-protected mobile application (Resistance Training for Teens (Kennedy et al., 2019; Lubans et al., 2016b). This application provides visual and written instructions with audio prompts on how to set up, perform and record scores for each test. Parents were asked to verbally encourage participants to push themselves until they could not meet test requirements, e.g., reach the 20 m marker in time for the audio prompt during the 20 m shuttle run, or land on two feet during the standing long jump test. The ground on which participants performed the fitness tests varied between individuals, although within-participant repeat measurements were conducted on the same surface.

Participants completed psychosocial questionnaires online via Google Forms on a laptop or mobile device.

**Table 7.** Intervention components and behaviour change techniques.

Intervention component	Dose	Description	Basic psychological need(s) <sup>a</sup>	Motivation and behaviour change techniques <sup>b</sup>
PA menu	6 weeks	Participants were asked to complete 3x30min PA each week. Participants received a list of suggested PA options they could choose from, including weblinks to homebased YouTube videos and instructions on how to create their own workout plans.	<i>Autonomy</i>	MBCT5: Provide meaningful rationale MBCT6: Provide choice
Text messaging	3 x week (6 weeks)	Participants received three text messages per week that provided information on the live workout schedule, reminders to complete their PA logbooks, and general PA encouragement.	<i>Relatedness</i>	MBCT13: Providing opportunities for ongoing support
Live workout sessions	3 x 30 min x week (6 weeks)	Researcher-led live group workouts were offered but were not compulsory. Workouts were body weight circuit training requiring little space or equipment delivered via Zoom.	<i>Autonomy</i> <i>Relatedness</i> <i>Competence</i>	MBCT3: Use non-controlling information language MBCT6: Provide choice MBCT10: Show unconditional regard MBCT11: Show interest in the person MBCT17: Assist in setting optimal challenge
Individual support calls	1 x 30 min 6x 10 min	Participants received weekly video calls from their allocated Activity Mentor. These calls were aimed to be a source of behaviour change support and accountability. Calls were based on a pre-planned topic structure (found in supplementary material).	<i>Autonomy</i> <i>Relatedness</i>	MBCT1: Elicit perspectives on condition or behaviour MBCT2: Identification of sources of pressure for behaviour change MBCT3: Use non-controlling information language MBCT5: Provide meaningful rationale MBCT10: Show unconditional regard

Intervention component	Dose	Description	Basic psychological need(s) <sup>a</sup>	Motivation and behaviour change techniques <sup>b</sup>
			<i>Competence</i>	MBCT11: Show interest in the person MBCT12: Use empathic listening MBCT14: Prompt identification & seek available social support MBCT15: Address obstacles for change MBCT18: Offer constructive, clear & relevant feedback MBCT19: Help develop a clear & concrete plan of action
PA logbook	6 weeks	Participants were asked to keep a hard-copy log of their PA sessions each week and record what types of activity they did in each session. This was reviewed weekly by their Activity Mentor. Self-reported PA sessions recorded in the logbook were taken as a measure of participant adherence to the PA intervention.	<i>Autonomy</i>  <i>Competence</i>	MBCT6: Provide choice  MBCT0: Promote self-monitoring

<sup>a</sup>Although some strategies support multiple psychological needs, only the primary strategy/s are listed. <sup>b</sup>MBCT Motivation and behaviour change techniques (Teixeira et al., 2020)



### Demographic information

Participant demographic information was collected at baseline which included age, school year, sex, last three digits of their home postcode and ethnicity. Postcodes were mapped against indices of multiple deprivation to estimate socioeconomic status (Haase and Pratschke, 2017; Ministry of Housing, 2019).

### Pubertal status

A 1-item subscale of The World Health Organisation Health Behaviour in School aged Children (HBSC) (WHO, 2016) was used to collect menstruation status (“have you begun to menstruate (have periods)?” Yes/No).

### Physical activity and sedentary behaviour

MVPA was assessed using the 8-item subscale World Health Organisation HBSC (Booth et al., 2001) which has been validated with adolescents (Booth et al., 2001). This was used to collect self-reported PA and sedentary behaviour over the previous seven-day period at baseline and postintervention. A mobile phone-based pedometer app (Google Fit) was used to record participants’ steps for seven days at baseline and post-intervention. Steps for the seven days were averaged to calculate a mean daily step score. Girls were instructed to keep their mobile phone on their person as much as possible over the seven-day period, e.g., in their pocket. Mobile pedometers have been validated in adolescents (McNamara et al., 2010).

### Cardiorespiratory fitness

Due to national COVID-19 lockdown measures, a home-based measure of cardiorespiratory fitness that was accessible and easy to set up for participants and

parents/guardians was required. The 20 metre progressive shuttle run test (20 mSRT) was used to provide an estimate of cardiorespiratory fitness (Leger et al., 1988). Participants ran back and forth between two markers positioned 20 m apart measured by a tape measure, at a pace signalled by an audio file on the Resistance Training for Teens (RTT) app. The test starts at a pace of 8.5 kmph and gradually increases in 0.5 kmph increments as the levels progress (pace increases approximately every minute). The test ended when the participant could not make it to a line for two consecutive beeps and the final successful stage was recorded using the app. Parents were instructed to provide verbal encouragement throughout the test with the aim of girls reaching volatile exhaustion. This test has been validated with adolescents previously (Mayorga-Vega et al., 2015).

### Muscular endurance

A 90 degree push up test was used as a measure of upper body muscular endurance. Using an audio file on the RTT app, participants performed push ups at a cadence of 40 bpm. Participants began in a high plank position (hands positioned under the shoulders, toes touching the floor, back in a straight line) and lowered themselves to the ground in a controlled manner until their arms are at a 90-degree angle from which they then pushed back up and returned to a high plank position. Parents counted and recorded the number of push ups, and the test was terminated if participants could not maintain correct exercise form or voluntarily stopped. The push up test has been validated as a measure of muscular endurance with adolescents (Morrow et al., 2010).

### Muscular strength

A standing long jump test was used as a measure of lower body muscular strength. Participants began standing with their toes behind a starting marker and then performed a long jump, jumping from and landing on two feet. A parent/guardian

measured the distance travelled from starting marker to the participant's foot in the landing position using a tape measure. Participants completed this measure twice with the longest jump being recorded as the final score. The long jump test has been found to be a valid and reliable measure of adolescents' muscular strength (Castro-Pinero et al., 2010).

### Psychosocial questionnaires

Exercise motivation was measured using the Behavioural Regulation in Exercise Questionnaire 3 (BREQ-3) which combines 19-items from the BREQ-2 (Markland and Tobin, 2004), four additional integrated regulation items (validated by Wilson et al., 2006), and one additional introjected regulation item (Exercise motivation website). The questionnaire contains six subscales, ranging from amotivation, through controlled motivation (external regulation, introjected regulation) to autonomous motivation (identified regulation, integrated regulation, intrinsic motivation). Participants were scored using a five-point Likert scale ranging from "Not true (0)" to "True (4)". Cronbach's alpha was used to assess the internal consistency of the BREQ-3 subscales. With the exception of amotivation (0.61 to 0.70) and identified regulation (0.76 to 0.84), the internal consistency in our sample was poor (Cronbach's alpha between 0.45 and 0.59 for external regulation, 0.26 to 0.42 to introjected regulation, 0.14 to 0.47 for integrated regulation and 0.10 to 0.44 for intrinsic motivation).

Body image was measured by the 10-item Body Appreciation Scale (Avalos et al., 2005) which was also scored using a five-point Likert scale ranging from "Never (0)" to "Always (4)". Questions include statements such as "I respect my body" and "I feel love for my body". Higher scores reflect a higher level of body appreciation. Responses demonstrated excellent internal consistency (Cronbach's alpha between 0.94 and 0.95).

PA competence was measured by an adapted 4-item Perceived Competence Scale (Smith et al., 1995) which was scored using a seven-point Likert scale ranging from “Strongly disagree (1)” to “Strongly agree (7)”. Questions include “I am capable of being physically active regularly”. Higher scores indicate a higher perceived competence in PA. Responses within our sample demonstrated excellent internal consistency (Cronbach’s alpha between 0.85 and 0.91).

Finally, self-esteem was measured by the 12-item Adolescent Self-Esteem Questionnaire (Hafekost et al., 2017), which was scored using a five-point Likert scale ranging from “Almost all of the time (1)” to “Hardly ever (5)”. Questions include “I feel I can be myself around other people”. A higher score indicates a higher level of self-esteem. To generate an overall score for each questionnaire, questions were scored using the corresponding Likert scale and a mean score was then calculated. Responses within our sample demonstrated acceptable internal consistency (Cronbach’s alpha between 0.68 and 0.72).

### *Process evaluation*

Process evaluation took mixed-methods data from a number of different sources throughout the intervention to assess reach, implementation, adherence and acceptability (see Table 7). Data included screening questionnaires, participant PA logbooks, Activity Mentor call logbooks, semi-structured interviews, and pre/post-intervention outcome measures.

To measure implementation of planned intervention activities (dose delivered), the Activity Mentors kept a weekly log of all video calls, including tracking attendance and duration of calls. The exercise instructor for live workouts kept a record of all sessions provided, including date and time.

Adherence to physical activity sessions by participants was monitored using a hardcopy self-report logbook and through interviews. During weekly video calls with Activity Mentors, participants set an action plan of what PA sessions they would complete in the coming week by writing into their logbook what day, time, and type of activity they would do. Participants were instructed to tick off each session in their logbook once it had been completed. These logbooks had a dual purpose; as an intervention behaviour change strategy, as well as a research measure to collect participant adherence to PA sessions. Participants received a weekly text message reminder to complete their PA logbook. During the following video call with their Activity Mentor, participants would show their mentor their logbook and discuss their PA sessions. Mentors kept a record of how many sessions participants completed each week. PA sessions were summed at the end of the six-week intervention as a measure of participant adherence.

**Table 8.** Data sources used to assess the implementation of The HERizon Project.

Data source	Sample	Date of data collection	Implementation aspect assessed				
			Reach	Implementation	Adherence	Impact	Acceptability
Screening questionnaire	42 adolescents	Baseline	X				
Activity Mentor call logbook	3 mentors	Weekly		X	X		
Participants PA Logbook	42 adolescents	Weekly			X		
Live exercise session logbook	1 instructor	Weekly		X			
Interviews	10 adolescents	Post-intervention	X		X	X	X
Outcome measures	42 adolescents	Baseline and Post-intervention				X	X

Implementation of the intervention was assessed using a modified version of the RE-AIM framework (Glasgow et al., 2019). *PA* physical activity

### *Interviews*

Semi-structured phone interviews (n = 10) were conducted after post-intervention measures with a purposely selected subsample of participants from the intervention group of ranging adherence levels, identified from self-reported logbooks. Discussions lasted between 20 and 40 min and were focused on participants' perceptions of the intervention components, including recruitment processes, perceived benefits of the intervention and facilitators and barriers to intervention adherence (interview guide can be found in 'chapter 3 materials' section of the appendices). Interviews intervention conducted by the lead author (a female PhD candidate with MSc qualification and experience conducting qualitative studies), who also instructed the live group workout sessions.

### *Sample Size*

A sample size calculation for effectiveness is not applicable given this is a formative assessment. However, we do acknowledge the need to ensure we have enough participants in order to answer important questions about the feasibility of future investigations (e.g., recruitment and retention rates) and being able to provide statistical point estimates. A sample size of 40 would give acceptably precise estimates of the variability in changes in outcome variables. For example, for outcomes measured as a proportion, e.g., the 95% confidence interval (modified Wald method) for a drop-out rate of 20% would be 10% to 35%.

### *Data analysis*

Between-group differences at baseline were explored using independent t-tests for continuous variables and chi-square or Fisher's exact test for categorical variables Two factor (group\*time) linear mixed models were used to assess the effect of the six-week intervention between groups on outcome variables. Age and deprivation status were

entered into the models as covariates. The covariance structure for each model was determined using a chi-square distribution, with the selection determined by the most parsimonious structure that optimised model fit. The least significant difference approach to multiple testing was adopted given this was a feasibility study with a small sample size. Normality of residuals from the linear mixed models were assessed using Q-Q plots, and all variables satisfied this assumption except internet use, which was log10 transformed and reanalysed.

Descriptive statistics are presented as the mean  $\pm$  SD, unless stated otherwise, and outcomes of linear mixed models as the mean (95% CI). Statistical analysis was performed using SPSS for Mac (Version 26.0, SPSS, Chicago, IL, USA) and statistical significance was set at  $p < 0.05$ .

As outlined above, semi-structured interviews were used as a data source for the process evaluation aspects of the intervention (Table 7). Interviews were audio recorded and transcribed verbatim by the first author. Data were imported into NVivo 12.0 and a reflective thematic analysis was undertaken to identify themes falling within each of the a-priori process evaluation research question (Braun and Clarke, 2019). Preliminary analysis was conducted by the first author, who conducted the interviews, and to enhance rigor, three researchers (second, third and fourth authors) acted as 'critical friends' by reviewing sections of raw data and meeting regularly as a group to discuss and debate the initial thematic structure and provide alternative views of the data (Smith and McGannon, 2018).

## Results

### *Reach*

Sixty-two participants were invited to take part in this study and forty-two consented (68% response rate, Figure 5). Participants were recruited via social media advertising and subsequent “snowball” effects (i.e., sharing of information between friends).

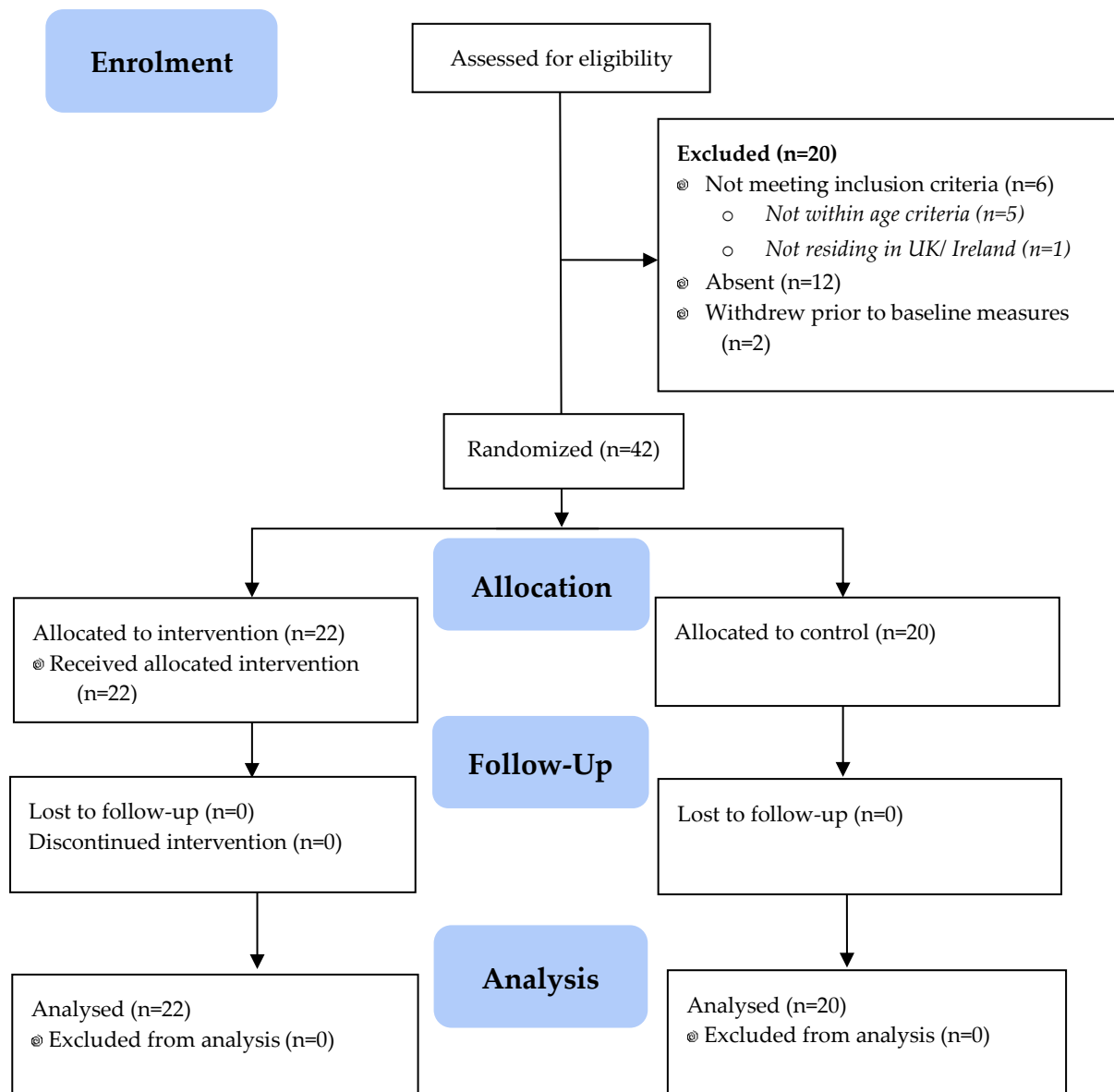
All 42 participants ( $n = 42$ ) provided complete data at baseline and post-intervention assessments (Figure 5). Descriptive and baseline characteristics for both groups are displayed in Table 8. There were no significant differences in demographic details between groups. Baseline fitness measures were generally similar between groups, although the intervention group had shorter long jump scores than the control group ( $162 \pm 23.0$  cm vs.  $171 \pm 40.5$  cm,  $p = 0.045$ ). PA and sedentary behaviours were also similar except the intervention group spent significantly more hours playing video games ( $0.95 \pm 0.2$  h vs.  $0.85 \pm 0.3$  h,  $p = 0.021$ ) and the control group engaged in significantly more vigorous PA per day ( $2.41 \pm 0.2$  h vs.  $0.85 \pm 0.4$  h,  $p = 0.044$ ).



**Table 9.** Baseline demographics of study participants by group.

Characteristics	Intervention ( <i>n</i> =22)	Control ( <i>n</i> =20)	<i>P</i> -value
Age, mean (SD), years	14.0 (1.2)	14.3 ± 0.9	0.484
School year (SD)	9 (1.4)	9 ± 1.0	0.330
Ethnicity, <i>n</i> (%)			
White	22 (100%)	19 (95%)	0.149
Reside in UK	17 (77%)	11 (55%)	0.126
Socioeconomic status, <i>n</i> (%) <sup>a</sup>			0.212
Tercile 1 (most deprived)	9 (41%)	11 (55%)	
Tercile 2	8 (36%)	8 (40%)	
Tercile 3 (least deprived)	5 (23%)	1 (5%)	
Menstruation status <sup>b</sup>			
Yes, %	18 (82%)	15 (79%)	0.817

t-tests were used to establish differences between groups for outcomes variables at baseline (significance set at  $p < 0.05$ ). *Abbreviations:* UK United Kingdom. a Socioeconomic status determined by population tercile using UK Index of Multiple Deprivations and The Pobal HP Deprivation Index based on home postcode (1 = most deprived, 2 = median deprived, 3 = least deprived). b One participant did not report menstrual status.



**Figure 5.** Flow chart of participants through the study based on the CONSORT 2010 flow diagram.

### *Outcome evaluation*

Participant MVPA, physical fitness and psychosocial questionnaire results are displayed in Table 9. No significant difference in MVPA was found between groups following the intervention ( $p = 0.767$ ). There were significantly greater improvements in 20mSRT (1.8 vs. 0.3 stages;  $p = 0.001$ ) and push up score (6.9 vs. 2.3 repetitions;  $p = 0.022$ ) in the intervention group compared to the control group. Intrinsic motivation

was significantly greater in the intervention group in comparison to the control group, where intrinsic motivation declined (0.16 vs. -0.16;  $p = 0.037$ ). Body appreciation scores were also significantly improved in the intervention group in comparison to the control group (0.44 vs. -0.11;  $p < 0.003$ ). No significant between group\*time effects were observed for long jump, daily mean step count, vigorous physical activity, sedentary behaviour, competence, self-esteem, amotivation or external, introjected, identified, or integrated regulation.

Interview data, which collected girls' perceived impacts of this study, align with these quantitative results (see Table 10 for participant illustrative quotes). Participants felt fitter after the six-week intervention and were proud to see improved 20mSRT scores. Participants also commented on feeling more confident and comfortable in their bodies and abilities, as well as enjoying physical activity more and engaging in it without pressure from parents.

**Table 10.** Outcomes for physical fitness, physical activity and psychosocial measures in the intervention and control groups.

Variable	Baseline (mean $\pm$ SD)		Post-intervention (mean $\pm$ SD)		Adjusted mean difference between time points (95%CI)		Group * Time P
	<i>Intervention</i>	<i>Control</i>	<i>Intervention</i>	<i>Control</i>	<i>Intervention</i>	<i>Control</i>	
<b>20m shuttle run, stages</b>	5.22 $\pm$ 2.6	7.04 $\pm$ 4.2	7.04 $\pm$ 3.3	7.34 $\pm$ 4.3	1.82 (1.20, 2.43)***	0.31 (-0.33, 0.96)	0.001 <sup>+</sup>
<b>Long jump, cm</b>	162 $\pm$ 23.0	171 $\pm$ 40.5	169 $\pm$ 30.2	170 $\pm$ 42.1	6.7 (-1.4, 14.8)	-1.0 (-9.5, 7.5)	0.193
<b>Push ups, repetitions,</b>	15 $\pm$ 11.3	15 $\pm$ 15.41	22 $\pm$ 12.5	15 $\pm$ 12.73	6.9 (4.3, 9.5)***	2.3 (-0.5, 5.2)	0.022 <sup>+</sup>
<b>MVPA, minutes</b>	3.62 $\pm$ 2.4	4.35 $\pm$ 1.76	3.91 $\pm$ 1.8	4.37 $\pm$ 1.92	0.25 (-0.70, 1.2)	0.50 (-0.96, 1.05)	0.767
<b>Steps</b>	4643 $\pm$ 3846	4477 $\pm$ 3225	6755 $\pm$ 3821	6597 $\pm$ 3333	2230 (1012, 3348)**	2085 (830, 3339)**	0.868
<b>VPAD, minutes</b>	2.41 $\pm$ 2.1	2.45 $\pm$ 1.2	2.36 $\pm$ 1.4	2.10 $\pm$ 2.0	-0.45 (-0.62, 0.52)	-0.35 (-0.95, 0.25)	0.460
<b>VPAH, minutes</b>	2.00 $\pm$ 1.2	2.20 $\pm$ 0.9	2.23 $\pm$ 0.9	2.45 $\pm$ 1.2	0.23 (-0.12, 0.58)	0.25 (-0.12, 0.62)	0.928
<b>TV viewing, hours</b>	0.33 $\pm$ 0.5	0.45 $\pm$ 0.5	0.5 $\pm$ 0.5	0.55 $\pm$ 0.5	0.18 (-0.70, 0.42)	0.17 (-0.16, 0.36)	0.672
<b>Video gaming, hours</b>	0.95 $\pm$ 0.2	0.85 $\pm$ 0.4	0.90 $\pm$ 0.3	0.90 $\pm$ 0.3	-0.05 (-0.21, 0.12)	0.05 (-0.12, 0.22)	0.402
<b>Internet use, hours</b>	0.41 $\pm$ 0.5	0.55 $\pm$ 0.5	0.52 $\pm$ 0.5	.40 $\pm$ 0.5	0.10 (-0.09, 0.30)	-0.15 (-0.35, 0.05)	0.079 <sup>a</sup>
<b>Competence</b>	5.53 $\pm$ 0.9	5.55 $\pm$ 1.1	5.97 $\pm$ 0.7	5.6 $\pm$ 1.4	0.43 (0.12, 0.74)**	0.50 (-0.26, 0.38)	0.093
<b>Amotivation</b>	2.27 $\pm$ 1.0	2.26 $\pm$ 0.9	2.34 $\pm$ 0.8	2.06 $\pm$ 1.2	0.68 (-0.27, 0.41)	-0.20 (-0.55, 0.15)	0.275

<b>External</b>	2.00 ± 0.5	1.77 ± 0.4	2.14 ± 0.4	1.83 ± 0.6	0.14 (-0.78, 0.35)	0.62 (-0.16, 0.29)	0.632
<b>Introjected</b>	1.83 ± 0.8	1.78 ± 0.6	2.14 ± 0.6	1.87 ± 0.8	0.31 (0.04, 0.58)*	0.87 (-0.20, 0.37)	0.264
<b>Identified</b>	1.38 ± 1.1	0.98 ± 0.9	1.48 ± 1.0	1.11 ± 1.0	0.10 (-0.22, 0.43)	0.13 (-0.21, 0.46)	0.923
<b>Integrated</b>	2.22 ± 0.6	2.15 ± 0.6	2.51 ± 0.6	2.11 ± 0.8	0.26 (0.02, 0.57)	-0.04 (-0.33, 0.25)	0.102
<b>Intrinsic</b>	2.23 ± 0.5	2.22 ± 0.5	2.39 ± 0.4	2.06 ± 0.9	0.16 (-0.38, 0.06)	-0.16 (-0.05, 0.37)	0.037 <sup>†</sup>
<b>Body appreciation</b>	3.25 ± 0.9	3.24 ± 1.0	3.69 ± 0.7	3.13 ± 1.1	0.44 (0.19, 0.66)	-0.11 (-0.36, 0.14)	0.003 <sup>†</sup>
<b>Self-esteem</b>	3.5 ± 0.5	3.33 ± 0.4	3.51 ± 0.4	3.33 ± 0.4	0.01 (-0.13, 0.15)	0.00 (-0.15, 0.15)	0.912

<sup>†</sup> Interaction term significant at  $P < 0.05$ . Within group difference between baseline and post-intervention significant at  $*P < 0.05$ ;

$**P < 0.01$ ;  $***P < 0.0001$ . <sup>a</sup> Outcome from analysis using log10 transformed data. Statistics from linear mixed models.

*Abbreviations:* VPAH hours spent in vigorous physical activity per week, VPAD days spent in vigorous physical activity per week

**Table 11.** Participant quotes from qualitative interviews.

Impact		
Physical benefits of the programme?		<i>The first set of [fitness tests] I couldn't run, I couldn't do anything, and so the bleep test felt so hard and then at the end I got further and it was easier. When you're doing it you don't feel like you are getting better but when you look at the scores from the start and the end it makes you think that you've actually gotten better at it. [P19]</i>
		<i>I have become a lot more used to exercising different types and my stamina has improved a lot and that has definitely helped my legs are more toned [P16]</i>
Psychological benefits of the programme?		<i>Doing [PA] more and more and more I gradually enjoyed it more and more...I definitely got more confident in myself I have definitely noticed a change in how I see myself and look at myself [P24]</i>
		<i>It made me less lazy and want to move more I would choose to walk the dog without being asked now [P29]</i>
Adherence		
What facilitated adhering to the programme?		<i>I found (the live workouts) really good, they were all different every time so it's not like they are repeating it's kind of like a surprise and it was really good with the timer your ears are ready, your muscles are getting tired and you are just waiting for that beep so you can collapse [P42]</i>
	<i>Live workouts</i>	<i>When we're watching [the live workout] you know it's real, we're looking the same, but on YouTube it's people who are fake, it looks so easy for them but they are probably doing it like stop recording, put their make-up back on and then do it again but when we do it it's like 100% real [P1]</i>

	<i>If it wasn't for (the programme) I wouldn't have done anything in lockdown at all but because of this my mum was forcing me to go out for a run and now I'm doing runs quite frequently [P19]</i>
Social support	<i>To know that there is people our own age doing the same thing and feel part of a community even if we don't know each other it's kind of a reassurance not everyone saying to themselves "oh no everyone is going to be looking at me" cause they're not, we're just doing our exercise [P42]</i>
Organisation and routine	<i>The wee table that you could put all your exercises on that definitely helped because I could be more organised and doing (exercise) more I gradually enjoyed it more [P24]</i> <i>I think I felt more motivated cause I'm keep scheduling and keep the same every week it was like I had something I needed to get done [P40]</i>
Autonomy	<i>I liked the independence it gave you ... All the exercises were really fun cause you could choose what exercises you want to do which again is really good [P42]</i> <i>In the beginning I picked all (the PA options) to try them all out and then after a couple of weeks I picked the ones I enjoyed most [P24]</i>
Activity Mentors	<i>I think if I didn't have that phone call or anyone to catch up with I would have just been like "meh" because of the call I stuck to everything I said I would do for that week [P25]</i>

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*Having (the activity mentor) there saying just do what you can it was good, it wasn't like you have to do these three options or else you were kicked off (the programme) it was more like just do what you can type thing [P19]*

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*The only times I didn't do (the PA sessions) was if I had period pains [P16]*

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*Maybe some more (PA options) because it sometimes felt like I was doing the same ones again if I didn't like one of them [P13]*

What were the barriers to adherence?

*I think make a point you don't need your camera on because I think if I hadn't of known that I didn't need my camera on then I wouldn't have done it [P13]*

*Maybe like different times (for the live workouts) probably earlier in the morning, it's a difficult time like 6pm is such a busy time at the end of the day [P1]*

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### *Implementation*

Activity Mentors hosted 154 behaviour change support video calls (seven calls per participant). Calls were planned to be 15 min each and actual delivered call durations were  $9 \pm 3.0$  min (mean duration for calls 1 to 6). Total mean duration of call time of  $69 \pm 22.2$  min per participant (mean call duration of  $18 \pm 5.4$  min for the first introduction call). 396 non-reply SMS messages were planned to be sent during the intervention (three messages per participant per week). This was accomplished. Eighteen live group exercise sessions were planned for (three per week) during the intervention and all sessions were delivered via password-protected Zoom link (<https://zoom.us>).

Participants enjoyed the structure of having calls with their Activity Mentor at the same time each week and thought that the short duration was convenient and acceptable.

*Activity Mentor calls were really good, they were really short and simple and the same every week and they were at a good time as well like 5pm on Mondays [P1].*

Some participants said that they did not receive any SMS as they did not check their text messages; for others, it was due to the research team using incorrect phone numbers. For girls who did receive messages, the content, timing and frequency was acceptable and many cited that they were helpful reminders.

*The texts were good because it wasn't like annoying or too many, it was more like just reminders and not all the time [P16].*

The girls who tried the live workouts expressed positive feedback and noted that having a set timetable for the sessions helped them to plan and adhere to their PA for the week. The short duration was also positively received by the participants.

*I liked the length of the live workouts like 20 to 30 min because it's not that long and you can do them anywhere like in your room which is good I liked that [P1].*

### *Adherence*

Participants were asked to complete 18 PA sessions during the six-week intervention. According to self-report logbooks, median and inter-quartile range for adherence was  $18 \pm 2$  sessions. Of the seven behaviour change support calls, mean attendance was  $6 \pm 0.3$ . All participants in the intervention group completed the six-week intervention. Table 10 outlines illustrative quotes of participants perceived barriers and facilitators towards intervention adherence.

Based on interviews, participants appear to have enjoyed the core components of the intervention and listed many facilitators to their adherence. For example, the live workouts were popular with many participants saying they enjoyed the variety and novelty of the exercises and even enjoyed that some were challenging. It was important to the girls that the sessions were not monotonous or boring and some also spoke of the importance of having a relatable instructor who they could see was also sweating and out of breath. Girls from all interviews commented on the importance of being given the choice in what type of PA they engaged with, and that having a weekly logbook to keep track of their PA sessions was helpful for creating a routine. Having support was a key facilitator to girls' adherence. Engagement was often helped by parents or siblings doing PA with them, and by knowing other girls in their age group were also taking part in the intervention. Activity Mentors played a vital role in support provision with many participants explaining that they would not have stuck to the intervention if it were not for their weekly calls. Some girls said that they felt the calls were a positive and encouraging environment as they were not told off for missing a PA session. As the intervention ran during the initial lockdown of 2020,

many of the girls commented that it was nice to have someone to speak to each week as they sometimes felt lonely/isolated being at home.

Barriers to adhering to three PA sessions each week included period pain and times of the live workouts not suiting participants' schedules. Many of the girls suggested adding more options to the PA menu and to make it clear for future participants that they are allowed to do activities not listed on the menu, e.g., cycling or gymnastics. Some participants said that they felt uncomfortable exercising as part of an online group where others would see them and therefore they avoided the live sessions. These participants all recommended making it clear to future participants that they can still join the group sessions whilst keeping their cameras turned off as this may increase attendance.

#### *Acceptability of outcome measures*

Participants reported that the field fitness tests were easy to set up and input on the Resistance Training for Teens mobile app. Questionnaires were completed by girls on their mobile phones and were found to be acceptable as they did not take too much time and did not require them to type, only to check boxes.

### **Discussion**

This study, which took place during the COVID-19 pandemic lockdown restrictions, aimed to assess the feasibility, acceptability and preliminary effectiveness of a six-week, home-based PA intervention for adolescent girls using a mixed-methods formative evaluation. Compared to a wait-list control group, the intervention group significantly improved in 20 m shuttle run test and push up scores, intrinsic motivation, and body appreciation scores. The findings of this formative evaluation add to the limited evidence base concerning adolescent girls PA interventions in the home and community settings.

### *Preliminary effectiveness*

Although there was a significant improvement in physical fitness scores and intrinsic motivation in the intervention group compared to the control group at post-intervention, there were no significant differences in MVPA compared to the control group. This may be due to multiple factors including the use of self-report questionnaires and the length of the intervention. Subjective measures of PA typically record participants perceived PA levels, rather than actual PA levels (LeBlanc and Janssen, 2010), with girls being more likely to overestimate their PA using self-report measures than boys (Corder et al., 2011). Other self-report inaccuracies may include recall issues (Shephard, 2003) and knowledge around what constitutes as PA, as many adolescents view physical activity as being synonymous only to sport and structured physical education lessons (Sundar et al., 2018). Both the intervention and the control group saw significant increases in daily step count (an increase of 2,230 steps for the intervention group and 2,085 steps for the control group). This further suggests that the self-report measure of PA is not capturing the changes in MVPA. Interventions lasting at least 12 weeks are found to have the greatest effect on adolescent girls MVPA (Mintjens et al., 2018; Owen et al., 2017). Other studies with medium- to long-term follow up have also seen further increases in MVPA and improvements in psychosocial measures (Ruiz et al., 2016). For example, one study found even greater improvements in MVPA, goal setting and self-efficacy at 9 month follow up in comparison to post-intervention (Neumark-Sztainer et al., 2010). While there was no change in physical activity, there was a significant change in the determinants of PA, such as intrinsic motivation, which may lead to changes in physical activity over the longer term. Therefore, future trials of HERizon should use objective measures of PA, be at least 12 weeks and have a follow-up data collection point.

High cardiorespiratory fitness in youth is associated with lower rates of obesity and prevalence of metabolic syndrome in adulthood (Mintjens et al., 2018). The intervention group showed significant improvements in cardiorespiratory fitness following the intervention, with a mean increase that was 1.5 stages greater in the shuttle run test compared with the control group. This converts to an estimated mean VO<sub>2</sub>max improvement of 6.9 (18.6%) for the intervention group and a 0.7 (1.9%) improvement for the control group. A meta-analysis of over 9,000 children reported that girls with a VO<sub>2</sub>max of less than 35 mL.kg.min had 3.6 times greater likelihood of having cardiovascular disease (Ruiz et al., 2016). This suggests that the intervention may have clinical benefits as baseline scores for the intervention group were 30 mL of O<sub>2</sub> per kg body weight per min but increased to 37.1 mL of O<sub>2</sub> per kg body weight per min following the six week intervention. During interviews, participants said that they enjoyed cardio-based exercise more following the intervention than when compared to baseline, with many explaining that this increased enjoyment was due to feeling fitter, making the exercise easier. A study conducted with female university students found similar results with participants perceived physical fitness being a significant predictor of exercise enjoyment and adherence (Plante et al., 2018). During interviews, many girls said that they intended on maintaining their fitness after the intervention by going on regular runs with a parent or friend, and some had even signed up to local 10 km races.

A recent meta-analysis concluded that muscular fitness during adolescence was negatively associated with obesity and cardiometabolic conditions in adulthood and positively associated with bone health (García-Hermoso et al., 2019). However, the literature lacks studies that include strength-based measures in adolescent interventions. Girls in the intervention group improved muscular endurance by 7 push up repetitions (31.8%) at post-intervention, with no change for control participants. Although the intervention was relatively short, some girls said that they saw positive improvements in their body composition, in particular increases in

muscle mass in the lower body and abdominals. Many girls also said that they felt stronger and were proud to see improvements in strength. Past qualitative work has found many girls do not want to develop muscle mass as they are fearful of being perceived as masculine and therefore, they often disengage with PA (Coen et al., 2018; Slater and Tiggemann, 2010b; Watson et al., 2015). Contrary to such literature, improvements in strength and muscle gain were seen as a positive outcome by participants in the current study. These results are reflective of the Project WONDER trial (Thompson et al., 2020), which found that both active and inactive adolescent girls perceived resistance training to be enjoyable, beneficial and something that helps to relieve stress. In the current study, there was a non-significant increase in the result of the long jump test (improvement of 7 cm for the intervention group, decrease of 1 cm for the control group,  $p = 0.193$ ) that was used as a measure of muscle strength in this home-based study. As the intervention included a wide range of physical activities varying in intensities, it is also difficult to conclude what specifically improved the fitness measures. The intervention group baseline 20 mSRT scores were reflective of the lower 5th percentile of the NHANES 1999–2002 study with over 3300 12–18 year olds (Eisenmann et al., 2011), suggesting that any form of PA may be beneficial in improving cardiorespiratory fitness in youth when baseline fitness is so low. Furthermore, statistical artefact created by regression to the mean needs to be considered in such situations. Push up scores are reflective of global average (Romain and Mahar, 2001). However, the significant improvement may be due to the majority of PA options having some element of resistance training, and therefore it is likely that individuals experienced more exposure to muscle strengthening activities during the intervention than at baseline.

Low self-worth and body dissatisfaction are common barriers to girls' participation in PA (Añez et al., 2018; Annesi et al., 2015) and given the high prevalence of negative body image among adolescents in the UK and Ireland (Body Image in Childhood report), the positive changes found in participants body appreciation scores following

the HERizon intervention are promising. Supportive and caring environments that foster a culture of acceptance of individual differences can reduce body dissatisfaction (Burnette et al., 2017), and the HERizon intervention aimed to create such an environment through giving girls the autonomy to choose the PA they participate in, providing them opportunities to engage with other girls on the intervention, and through individual needs-supportive mentoring. These components may have also helped to improve participants intrinsic motivation scores, which were significantly greater in the intervention group compared to the control at postintervention. During interviews, girls commented on enjoying the activities, not feeling pressured to be active and that they felt supported during weekly calls with their Activity Mentor. A recent SDT-based intervention for adolescent girls with overweight and obesity found that similar psychosocial support led to improvements in physical self-worth, body satisfaction and perceived physical conditioning (Watson et al., 2021). As girls with high body appreciation are more likely to engage with PA (Sabiston et al., 2019), it may be important to implement similar psychosocial supportive components in future trials with girls who are inactive.

### *Feasibility/Acceptability*

This intervention targeted adolescent girls PA habits by implementing a number of needs-supportive motivational and behaviour change techniques, as MVPA has been shown previously to be positively influenced by autonomous motivation (Wang, 2017). There was an extremely high retention rate to this study, with all participants, in both intervention and control groups, completing all baseline and post-intervention outcome measures. Participants in the intervention group also showed high adherence to the PA programme with self-report logs showing that girls completed 18 session over the six-week period (the target was 18 sessions, 3 sessions per week). Each participant was assigned an Activity Mentor who worked with them throughout the intervention, supporting their adherence to the intervention via weekly video calls

and by helping participants develop goal setting, action planning and coping skills. Previous mentoring interventions with adolescents have shown positive results, including improvements in MVPA (Sebire et al., 2013), self-confidence and self-efficacy (Corder et al., 2016; Jenkinson et al., 2018). Participants reported that the duration, content, and frequency of the calls were acceptable. Further, many girls noted that these regular catch-up calls were important for not only keeping them accountable, but also to help them feel connected to others by having someone to talk to each week. This seems particularly relevant given the intervention ran during the strict initial COVID-19 lockdown in the UK and Ireland when schools were closed. It is well documented that the support of peers, coaches, teachers and family can play a vital role in facilitating girls PA participation (Craike et al., 2011; Massie et al., 2015) and the Activity Mentors appear to have helped fulfil participants need for relatedness within the intervention.

Girls in the intervention group were asked to complete three PA sessions each week and were provided with a “Physical Activity Menu” of sample ways to be active at home, without requiring equipment or much space, which included links to YouTube exercise videos and instructions on how to create their own workout routines. From qualitative interviews, the participants responded positively to being given the independence to make their own PA choices. Typically, research studies require all participants to adhere to a uniform PA intervention (Barnes et al., 2015; Carlin et al., 2018; Farmer et al., 2020). However, results of the current study suggest that a more flexible approach has the potential to improve participants autonomy and intrinsic motivation.

The live workout sessions were received particularly well by participants who engaged with them (50% of participants in the intervention group took part in at least 1 of the live workout sessions). The sessions lasted approximately thirty minutes and consisted of various types of interval training, including strength-based exercises,



Pilates and high intensity interval training. Modifications were given for each exercise and girls were encouraged to assess their current skill, fitness and energy level and adapt exercises when necessary, further giving them an opportunity to be autonomous. During interviews, girls commented that they liked being challenged by the sessions, as well as the variety/novelty of exercises. Past studies that have used similar individual, non-team-based activities, with a focus on personal improvement rather than competition, resulted in significant improvements in MVPA (McNamee et al., 2017; Owen et al., 2018). Another potential reason for the popularity of the live sessions may be due to them providing an opportunity for girls to interact with others of their own age. Although girls were not physically together, and most kept their computer cameras turned off during the exercise, there were opportunities throughout the sessions for group interaction, e.g., during the warmup and via the chat box function. Past work investigating the effect of virtual group exercise in this population is limited. However, a Facebook mHealth intervention with adolescent cancer survivors found positive changes in social functioning following a 10 week remote intervention (Mendoza et al., 2017). Another virtual group exercise intervention with adults found significant improvements in life satisfaction, with social interaction being positively associated with group cohesion (Nikitina et al., 2018) suggesting that individuals do not necessarily need to be physically together to get social benefits from group exercise. The intensity of the workouts was a common topic of conversation during these live sessions, with some girls commenting during the post-intervention interviews that sweating alongside others their age and being able to relate to their struggles was a facilitator for their commitment to the intervention. When designing an ad campaign to promote PA to adolescents, it was found that it was not celebrities who were viewed as being the most influential to teenagers (Palmer-Keenan and Bair, 2019). Instead it was relatable people who share their struggles, e.g., body image concerns. Other recent qualitative research found that girls were not motivated to exercise by “air-brushed” role models and instead wanted to see the instructor out of breath and red faced too (Cowley et al., 2021b). Although

being untidy and sweaty is a commonly cited barrier for girls PA (Corr, 2019), the protection of exercising through a computer screen seems to overcome this.

### *Strength and limitations*

Due to the limited research conducted outside of the school setting, this multi-component intervention, with a robust and feasible study design, is novel in its remote home-based approach to increase adolescent girls PA. The intervention appears to be acceptable and feasible to this cohort as adherence to PA sessions and Activity Mentor calls were high (86% and 94% adherence respectively), with no participants dropping out of the intervention during the six weeks. This also highlights the potential value of collecting outcome measures remotely as compliance was high, with a complete data set at post-intervention, and participants had positive experiences of conducting measures at home, thus minimising participant burden of attending laboratories or difficulties collecting measures within a school setting. Furthermore, we have limited knowledge regarding PA engagement during epidemics, and this study provides initial insight for a group considered at high risk of both low PA and mental health concerns. Although the forced national lockdowns caused by COVID-19 are extreme, appropriate consideration needs to be given for maintaining health if such policies are enacted again for subsequent global events.

Despite the study strengths, several limitations must be acknowledged. The intervention had a relatively small sample size. However, it is acceptable given that this study's primary aim was to assess feasibility and explore preliminary effectiveness. While results are promising, a future definite trial is needed for confirmation of improvements in outcomes. Physical activity assessment was limited due to the subjective measure of self-report questionnaires which can often result in overreported physical activity and under-reported sedentary behaviour (Kang et al., 2016). It is also acknowledged that participants' daily step count may have been

inaccurate if they did not carry their phone on their person for the duration of the day. For a more objective evaluation of HERizon's potential impact on adolescent MVPA, accelerometers should be used in a future trial. Further, fitness measures were conducted remotely without the supervision of trained researchers and may have been completed in non-standardised conditions (Greenleaf et al., 2017). Other fitness test limitations include between-participant variation in the surfaces used for the 20mshuttle run test and standing long jump (Jastrzebski et al., 2014). However, individuals completed baseline and post-intervention measures on the same surface, thus the impact on within-subject variability and model estimates is likely to have been limited. Future trials should consider the use of the Chester Step Test (Sykes, 1995) as a home-based measure of cardiorespiratory fitness, as due to the lockdown restrictions at the time of the trial many participants found it difficult to find a suitable area to perform the 20 m shuttle run test. Although the 20 m shuttle run test is considered a gold-standard measure of cardiorespiratory fitness (Batista et al., 2017; Buono et al., 1991), the Chester Step Test has also been validated among adolescents (Maggio et al., 2017). Finally, the primary role of the first author was project management (including recruitment, collecting outcome measures and conducting qualitative interviews). However, she also conducted all live workout sessions. In recognising the potential influence this might have on interview data, we made efforts to ensure participants felt at ease and felt able to share any potential negative views. We also involved "critical friends" (who were not intervention deliverers) in the interview analysis to ensure different perspectives were considered.

## **Conclusion and future directions**

Results of this study provide evidence for the potential benefits of a home-based PA intervention on improving adolescent girls physical fitness, intrinsic motivation and body appreciation. Home-based outcome assessments were feasible and acceptable for participants, and although these improvements are promising, it must be

acknowledged that this study ran during an unprecedented time of the initial COVID-19 lockdown restrictions and therefore further investigation during more typical conditions is needed.

Integrating qualitative and quantitative data within process evaluation was valuable as it provided insight and further explanation to the successes and failures of intervention components. This has prompted reflection and refinement for future recruitment, delivery, and assessment strategies. Due to the intervention implementing multiple behaviour change strategies, e.g., live group workouts, participant logbooks, text messaging and mentorship, it will be important that future trials investigate the active intervention components and their corresponding effect on MVPA, physical fitness and psychosocial scores. Effectiveness can be more thoroughly assessed through a longer-duration intervention, with a larger sample size and a medium- to long-term follow up.

# Bridging Chapter

## **How the intervention changed in content and format from study 2**

*Location of behaviour change calls with Activity Mentors.* In an effort to employ high levels of child safeguarding in study 2, participants were asked to have weekly calls with their Activity Mentor in a public room of their home e.g., the sitting room or kitchen. Based on feedback from participants during these mentor calls and in post-intervention interviews, this was problematic as, due to COVID-19 lockdown restrictions, the home was usually busy with siblings being home-schooled and parents/guardians working from the home. Therefore, in Study 3 it was decided that girls could have the call in the privacy of their bedrooms provided consent was given by parents/guardians. On the first introduction call between the participant and Activity Mentor, if a parent/guardian joined the call and gave verbal consent to the mentor then the subsequent calls were permitted to be taken from the bedroom. Further details on this can be found in the appendices in 'Material for Study 3' section.

*Live workout changes.* In study 2, three live workouts were scheduled every week. As these sessions were not compulsory (they were provided as an additional PA option), some sessions were better attended by others, and on some occasions no participants attended the class. Therefore in study 3 only two sessions were provided every week, one on a Wednesday evening and one on a Saturday morning. Some participants in study 2 said in post-intervention interviews that they did not attend the sessions because the time did not suit them. Therefore in study 3, all the live sessions were recorded (only the instructor's camera) and were uploaded to a Google Drive folder where participants could access and re-play any workouts that they missed should they wish to.

*Move from self-report to device-measured PA.* As outlined in the bridging chapter of study 1 to study 2, it was not possible to access equipment during baseline data collection of study 2 due to COVID-19 university closures. As the university laboratories reopened prior to baseline testing of study 3, it was possible to measure participants' PA using accelerometers.

*Increase in intervention duration.* As study 2 was a feasibility trial to assess the appropriateness, acceptability and preliminary effectiveness of the intervention, a shorter duration was deemed appropriate (6 weeks). For study 3, as it was a pilot trial, assessing the intervention components and implementation on a smaller scale prior to a larger definitive trial, it was important for it to run at the full expected duration of 12 weeks. 12 weeks is suggested to be an appropriate duration for interventions that aim to change health behaviours (Samdal et al., 2017).

*Tapering of Activity Mentor support.* As the intervention in study 3 was longer in duration in comparison to study 2, it was hypothesised that 1-1 behaviour change support should be weaned away to foster independence within participants and avoid over-reliance on mentor support. It was also thought to be important so that participants felt capable of maintaining their PA levels following the end of the intervention. Calls were scheduled weekly from weeks 1-6 of the intervention in an attempt to build a foundation of skills, such as goal setting and learning to overcome barriers. In weeks 7-12, calls were reduced to once every three weeks (i.e., calls occurred on weeks 9 and 12) in order to give participants the opportunity to implement these new skills independently, yet still have the accountability of checking in with their mentor twice again before ending the intervention entirely.

*Change of comparison group.* Due to pragmatic reasons, it was not possible to offer the control group participants the intervention following the end of the 12 week study. Therefore a 'traditional' comparison group was required where participants only received a PA logbook and no other support or interaction with the research team outside of data collection time points.

## **Uncertainties at the end of study 2**

The intervention group in study 2 had all intervention components (a PA logbook, behaviour change support calls, live workouts, text messages and access to the Instagram group chat). Given that study 2 showed preliminary promising results, it was important to understand which components were most effective and acceptable. Therefore in study 3, components were separated out into four groups; a group that only had the PA logbook; a group that had behaviour change support calls; a group that had the live workouts, text messages and Instagram group access; and a group that had all components (equivalent to the intervention group in study 2). This would allow hypotheses to be drawn about what components should be included in a larger future definitive trial. It would also minimise waste of resources and potentially support scalability of the interventions if not all components were found to be effective.

## **Details of further intervention refinements.**

*Instagram as the social media platform of choice.* As outlined in the bridging chapter between studies 1 and 2, Instagram was the chosen social media platform. During post-intervention interviews, participants confirmed that this was the most suitable platform. Although not all participants used social media, those that did used Instagram most regularly to talk to their peers. The private group chat feature on Instagram gave girls the

opportunity to speak to other girls on the HERizon programme, whilst also keeping their personal account private if they so wished.

*Hiring process of Activity Mentors.* Due to the increased sample size of study 3, more Activity Mentors were required. Similar to Professional Doctorate candidates, sport and exercise M.Sc. students in Liverpool John Moores University are required to complete professional practise placement as part of their degree programme. Dr Paula Watson suggested offering HERizon as a practice placement as it would provide M.Sc. students with an opportunity to work 1-1 with participants, something that is not common within many of the M.Sc. placements. In this way the Activity Mentor system of HERizon was a 3-dimension model of teaching, learning and research, and provided all trainee sport and exercise psychologists consistent supervisor support and structure. A summary of the placement was provided to M.Sc. students (available in the appendices, 'materials for study 3'), as well as an online information session held by Dr Watson and me. Those students who were interested in applying were required to submit a letter of application outlining what interested them about the placement, and what skills and experience they would be able to offer HERizon. Students were then shortlisted and interviewed by Dr Watson and me.

*Development of an intervention manual.* As the team of Activity Mentors and sample size of participants increased, it was important to develop a manual to support the standardisation of intervention delivery. The manual was first written by me, and then reviewed by Dr Watson who wrote specific sections (needs-supportive delivery, safeguarding and confidentiality, child safeguarding, and mental health concerns). The intervention manual can be found in the appendices (material for study 3).



*Training for Activity Mentors.* A 2.5 day online training workshop was held in December 2020, led by Dr Watson, all senior Activity Mentors (mentors of study 2), and myself. This training included key information on adolescent PA, need-supportive counselling, behaviour change techniques, and a practical workshop. The practical session involved Activity Mentors practising communication strategies that support client autonomy, competence and relatedness. As a competency-based task, Mentors were partnered up and asked to record a role-play of a sample call and submit it for review by a Senior Activity Mentor. On the third training day, the Senior Mentor met with the partners and provided written and verbal feedback on their recorded role play. A timetable of the training is available in the appendices (material for study 3).

### **Important note**

This study was registered with [clinicaltrials.gov](https://clinicaltrials.gov) retrospectively.

## Chapter 4: STUDY 3

Cowley ES., Watson PM., Foweather L., Belton SJ., Thompson A., Thijssen D., and Wagenmakers AJM. (2021) What happened in 'The HERizon Project'? – Process evaluation of a multi-arm remote physical activity intervention for adolescent girls, *International Journal of Environmental Research and Public Health*, 19 (2), <https://doi.org/10.3390/ijerph19020966>

# Thesis Study Map

Study	Objectives & key findings
<b>Study 1 - “Girls Aren’t Meant to Exercise”:</b> Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project	<p><b>Objectives:</b></p> <p>Qualitatively explore;</p> <ul style="list-style-type: none"> <li>• girls understanding of PA</li> <li>• girls experiences and perceptions of PA</li> <li>• girls perceived barriers and facilitators towards PA</li> </ul> <p><b>Key findings:</b></p> <ul style="list-style-type: none"> <li>• Girls identified barriers and facilitators to PA at all socioecological levels.</li> <li>• Barriers include fear of judgement, changing priorities, social pressure, school PE and perceived gender inequality in school and society.</li> </ul>
<b>Study 2 - Formative Evaluation of a Home-Based Physical Activity Intervention for Adolescent Girls—The HERizon Project:</b> A Randomised Controlled Trial	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• Assess the acceptability, appropriateness and implementation of a remote PA intervention for adolescent girls.</li> <li>• Assess the intervention’s preliminary effectiveness of improving adolescent girls PA, physical fitness, and psychosocial health.</li> </ul> <p><b>Key findings:</b></p> <ul style="list-style-type: none"> <li>• No significant change in self-reported MVPA between groups at postintervention.</li> <li>• Significant improvements in cardiorespiratory fitness, muscle endurance, intrinsic motivation and body appreciation for the intervention group compared to control at postintervention.</li> <li>• The intervention had 0% attrition and 100% adherence to the programme.</li> </ul>

<b>Study 3 - What happened in ‘The HERizon Project?’ – Process evaluation of a multi-arm remote physical activity intervention for adolescent girls</b>	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Investigate what intervention components (and their dose) were delivered in each intervention arm.</li> <li>• Explore what factors influenced the recruitment to and implementation of The HERizon Project.</li> <li>• Explore adolescent girls satisfaction and acceptability of the intervention.</li> </ul>
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### Study context within thesis

Chapter 4 will discuss the third study of this PhD thesis. This was a subsequent larger, multi-arm trial. This study aimed to conduct a comprehensive process evaluation of the HERizon intervention. By including multiple arms within the trial we were better able to understand which intervention components were most well received by participants. Further, scale-up of the intervention could be assessed through a process evaluation by exploring the implementation of HERizon by a larger intervention delivery team.

**Abstract:** This mixed-methods process evaluation examines the reach, recruitment, fidelity, adherence, acceptability, mechanisms of impact and context of remote 12-week physical activity (PA) interventions for adolescent girls named The HERizon Project. The study comprised of four arms – a PA programme group, a behaviour change support group, a combined group and a comparison group. Data sources included intervention deliverer and participant logbooks (100% and 71% respective response rates, respectively), exit surveys (72% response rate), and semi-structured focus groups/interviews conducted with a random subsample of participants from each of the intervention arms ( $n = 34$ ). All intervention deliverers received standardised training and successfully completed pre-intervention competency tasks. Based on self-report logs, 99% of mentors adhered to the call guide, and 100% of calls and live workouts were offered. Participant adherence and intervention receipt were also high for all intervention arms. Participants were generally satisfied with the intervention components; however improvements were recommended for the online social media community within the PA programme and combined intervention arms. Autonomy, sense of accomplishment, accountability and routine were identified as factors facilitating participant willingness to adhere to the intervention across all intervention arms. Future remote intervention should consider structured group facilitation to encourage a genuine sense of community among participants.

## **Introduction**

Regular physical activity (PA) is associated with numerous physical (Janssen and LeBlanc, 2010), psychological (Eime et al., 2013b), cognitive (Bidzan-Bluma and Lipowska, 2018), and social (Pels and Kleinert, 2016) benefits for adolescents. Yet, a recent global report found that almost 85% of adolescent girls were not meeting the minimum PA guidelines (Guthold et al., 2020), with girls moderate-to-vigorous PA (MVPA) declining by 10% annually from the age of 9 years-old (Farooq et al., 2018).

The factors influencing adolescent girls' participation in PA are complex and multifaceted, with common barriers including fear of being judged by others (Cowley et al., 2021a), dislike of PA (Yungblut, 2012), and a perception that femininity is incompatible with being physically active (Cowley et al., 2021b; Preece and Bullingham, 2020).

In response to low PA participation, there has been an increase in interventions specifically targeting adolescent girls (Biddle et al., 2014; Camacho-Minano et al., 2011; Owen et al., 2017). Due to the inherent difficulty in changing an individual's health behaviours (Kelly and Barker, 2016), many PA interventions implement several interacting components, for example providing informational material, mentorship, group support and reward structures (Carlin et al., 2018; Farmer et al., 2020; Owen et al., 2018). Further, PA programmes are often set in schools and communities which exist within complex systems, where there are multiple contextual factors, often that cannot be controlled or accounted for by researchers (Geng et al., 2017; Hagger and Weed, 2019). Due to this complexity, understanding how PA interventions are implemented is crucial to having confidence in their effectiveness (Moore et al., 2015).

Traditionally, much of the focus in randomised controlled trials was placed on the effectiveness of an intervention, with little priority given to understanding why an intervention was or was not successful (Rowbotham et al., 2019). By conducting a comprehensive process evaluation to understand if an intervention has been delivered as intended, the internal and external validity can be improved, allowing the intervention to be replicated and applied to real-world settings (Borrelli, 2011). In this way, researchers can have greater confidence in an intervention's outcomes, as without investigating programme design and implementation, incorrect conclusions can be made about an intervention's effectiveness. For example, an intervention may be discarded due to nonsignificant results, however it is not known if the intervention itself is ineffective, or if null findings are due to some unknown factor (Glasgow and

Linnan, 2008). Further uses of process evaluation include assessing if the target audience has been recruited, how much of the intervention was delivered and received, refining the intervention to enhance its appropriateness, and scaling it up for larger populations or different settings (Moore et al., 2015).

Process evaluations are often guided by several frameworks (Bellg et al., 2004; Borrelli, 2011; Dusenbury et al., 2003; Glasgow et al., 2019; Linnan and Steckler., 2002; Moore et al., 2015; Proctor et al., 2011) and although there are commonalities across many frameworks (e.g., reach, dose, fidelity and context), there is no consensus on what components should be included in the evaluation, nor agreed upon definitions for these components. This often makes it difficult to implement the findings of process evaluations into practice as the terms used can have different meanings. The present article reports a process evaluation of an adolescent girls PA intervention study called The HERizon Project (described below). Using the data sources available, the process evaluation draws on elements from several frameworks, specifically; (i) reach and recruitment, how representative participants are of the target population and the methods used to approach participants (Linnan and Steckler., 2002), (ii) fidelity of delivery, the degree to which interventions have been implemented as intended (Dusenbury et al., 2003), (iii) participant receipt, engagement and enactment, the amount of the intervention received by participants, and the extent to which they understand the key components and can put this knowledge to use in everyday life (Borrelli, 2011), (iv) adherence, participant's compliance to the intervention's prescribed treatment (Borrelli, 2011), (v) acceptability, stakeholders perceived appropriateness and satisfaction of the intervention (Proctor et al., 2011), (vi) mechanisms of impact, understanding the ways in which the intervention brings about change (Moore et al., 2015), and (vii) context, consideration of any external factors that influence the implementation of an intervention (Moore et al., 2015).

**Table 12.** Details of intervention components and corresponding intervention arm.

Intervention Component	Description	PA <sup>1</sup> Programme Group	Behaviour Change Support Group	Combined Group	Comparison Group
PA <sup>1</sup> Logbook	This is a 25-page booklet that contains suggested PA <sup>1</sup> options and weekly optional worksheets to assist participants in setting goals and monitoring their progress. Participants were asked to record their weekly PA <sup>1</sup> in these logbooks.	X	X	X	X
Behaviour change support calls	Videocalls occurred on weeks 0, 1–6, 9, and 12 from their allocated Activity Mentor. Calls were based on a pre-planned session guide and aimed to support participants in becoming more physically active.		X	X	
Live group workouts	These sessions occurred twice per week for the duration of the intervention via an online video-conferencing software. Workouts were approximately 40 min and included a range of cardiovascular and resistance-based exercises.	X		X	
Text messaging	Using an online text messaging software, three standardised non-reply text messages were sent per week for the duration of the intervention. Messages provided reminders to live workouts, encouragement, and support.	X		X	
Private Instagram group chat	There were two Instagram groups, one for the PA <sup>1</sup> programme group and one for the combined group. The aim was to provide an opportunity for participants to interact with others in their group. The chat was moderated by a researcher and any messages that were sent by the researcher were replicated in both groups.	X		X	

<sup>1</sup> PA physical activity.

‘The HERizon Project’ was a randomised controlled trial (RCT) which aimed to evaluate the effect of remote PA interventions designed to increase PA levels of adolescent girls’ living in the UK and Ireland. Following on from previous formative work (Cowley et al., 2021a), the trial consisted of four arms; PA programme group,



behaviour change support group, combined PA programme group and behaviour change support group, and a comparison group (Table 11). This mixed method process evaluation aims to report on what components, and their dose, were implemented in each intervention arm, which factors influenced the trial recruitment and implementation, and participants' perceived acceptability and enjoyment. To reduce biased interpretation of data, this process evaluation of The HERizon Project was conducted prior to outcome analysis (Oakley et al., 2006). The results will provide prospective insights into the interventions effectiveness, and reasoning for its success or non-success (Moore et al., 2015).

## **Materials and Methods**

### *Study design*

Ethical approval for The HERizon Project was obtained from Liverpool John Moores Research Ethics Committee (20/SPS/042) and the study is registered with clinicaltrials.gov (reference: NCT04766372). The HERizon Project aimed to increase the PA levels of adolescent girls in the UK and Ireland. Knowledge gained from earlier formative work and a feasibility study was instrumental in the design of the current study (Cowley et al., 2021a; Cowley et al., 2021b). This RCT assessed whether three intervention arms: (i) PA programme group, (ii) behaviour change support group, (iii) combined PA programme and behaviour change support group, each delivered remotely for 12 weeks, increased MVPA, compared to a (iv) comparison group. Due to the nature of the intervention, it was not possible to blind participants or intervention deliverers. Data were collected remotely at baseline (T0 – December 2020 to January 2021), postintervention (T1 – March to April 2021) and 3 months following the end of the intervention (T2 – July to August 2021). After baseline measurements, participants were block randomised with country-level (UK and Ireland) stratification using Microsoft Excel (Version 16 for Mac, Microsoft Corporation, Washington, USA). Girls who enrolled with a sister/friend/classmate were considered a cluster and were

therefore cluster-randomised into the same intervention arm to minimise contamination. The primary outcome was objective MVPA, measured by 9 day wrist-worn accelerometer (GT9X and GT3X+ models, Actigraph, Florida, USA). Secondary outcomes included cardiorespiratory fitness, muscular strength and endurance, exercise motivation, perceived competence, self-esteem, and body appreciation. Intervention outcomes will be reported elsewhere. The present study focuses on the mixed methods process evaluation.

### *Participants and recruitment*

Based on the median sample sizes of feasibility trials within the UK Clinical Research Network database (Billingham et al., 2013), The HERizon Project feasibility trial aimed to recruit 160 participants, with equal distribution between study arms. Girls living in the UK or Ireland, aged between 13-16 years old, who wished for support in increasing their PA were eligible for inclusion. Exclusion criteria were: (a) condition that prevented them from engaging in moderate intensity PA, (b) pregnancy, and (c) not having access to a smart phone or computer. All participants and their parents/guardians provided written informed assent/consent prior to baseline measurements. Social media advertisements, and links with local schools and community groups, were used to recruit participants.

### *Interventions*

This study involved four groups; PA programme group, behaviour change support group, combined group and a comparison group. Participants in the comparison and all intervention arms were asked to complete three 30-minute PA sessions of their choosing each week for the duration of the intervention. All participants were sent a hardcopy 25-page PA logbook to their home address at the beginning of the 12 week intervention, as well as a digital copy to their nominated email address (Appendices: material for chapter 4, study 3). The logbook contained a range of suggested PA

options that could be conducted at home during COVID-19 restrictions, e.g., YouTube and Instagram video links to follow-along dance, Pilates, yoga, boxing and resistance training workouts. The logbook also contained optional worksheets on various topics that participants were invited to complete.

#### PA programme group

Participants allocated to the PA programme group received three standardised no-reply text messages each week which provided PA reminders (e.g., “Reminder – live workouts this week are Wednesday at 6.30pm and Saturday at 10am.”), encouragement (“Try not to get overwhelmed, remember that small steps lead to big changes!”) and support (e.g., “If you have any questions please send us an email to [researcher email address]). An online SMS service was used to schedule and send text messages each week on the same day/time. Participants also had access to two live group workouts each week led by the lead author (a certified personal trainer with experience leading group exercise classes). Each session lasted approximately 40 minutes and consisted of a dynamic warm up, followed by a series of bodyweight exercises including squats, push ups, lunges and cardiovascular exercises, and concluded with static stretching. To cater for participants who could not attend the live workouts, all sessions were recorded and uploaded to an online folder which allowed participants to take part in classes at a later time, or to repeat workouts that they particularly enjoyed. Participants were also invited to join a private Instagram group chat, moderated by a researcher, where they could communicate with other girls from their intervention arm.

#### Behaviour change support group

Participants in the behaviour change support group were paired with an ‘Activity Mentor’ whom they worked with for the duration of the intervention. All Activity Mentors ( $n = 12$ ) were MSc and professional doctorate trainee sport and exercise psychologists and were supervised by a Health and Care Professions Council (HCPC)

registered Sport and Exercise Psychologist (third author). To increase the likelihood of participants receiving similar behaviour change support, a standardised approach was used to recruit and train Activity Mentors. Prospective mentors submitted an application form and were interviewed by the first and third authors, using a pre-prepared question guide. Activity Mentors were hired based on their experience, qualifications, and characteristics. All Activity Mentors were asked to complete virtual training led by the third author and all resources used within the workshops were made available to mentors for future reference. Prior to the training, Activity Mentors received a 50-page intervention manual which included detailed information regarding needs-supportive delivery, as well as process and procedure documents to ensure arising issues were dealt with in a consistent manner, e.g., should safeguarding concerns arise and how to follow up with no-shows. Activity Mentors engaged in interactive competency tasks, such as roleplay, which were reviewed by a senior mentor who provided constructive feedback. Activity Mentors were assigned to participants based on matching availability and participants were then given a weekly time slot for when subsequent calls would occur. Introduction and week 12 videocalls were scheduled to last 30 minutes, with videocalls on weeks 1-6 and 9 scheduled to last approximately 15-minutes. To standardise videocalls, a pre-planned session guide was employed (Appendices: material for chapter 4, study 3). Sessions drew on self-determination theory (Ryan and Deci., 2017) and focused on fostering participant autonomy, competence and relatedness through the use of motivational and behaviour change techniques.

#### Combined PA programme and behaviour change support group

Participants in the combined group received all intervention components, i.e., PA logbook, three standardised no-reply text messages each week, access to two live group workouts each week and to a private Instagram group chat and were partnered with an Activity Mentor for videocalls on weeks 0, 1-6, 9 and 12.

### Comparison group

Participants in the comparison group received only the PA logbook component and no additional contact from the research team outside of data collection timepoints.

## 2.4. Process evaluation framework and data collection

This mixed methods process evaluation used a modified framework (Bellg et al., 2004; Borrelli, 2011; Dusenbury et al., 2003; Glasgow et al., 2019; Linnan and Steckler., 2002; Moore et al., 2015; Proctor et al., 2011). Our adapted framework specifically explored reach and recruitment, delivery fidelity, participant receipt and enactment, adherence, acceptability, mechanisms of impact and context (see Table 12).

### *Data sources*

#### Demographic data

Participants age, country, menstruation status, ethnicity, and home postcode were collected via an online form at baseline. The last three digits of participants home postcodes were used to estimate socioeconomic status by mapping against indices of multiple deprivation (Haase and Pratschke, 2017; Ministry of Housing, 2019).

#### PA logbooks

Using the logbook, participants were asked to record their PA each week, including details of the day they were active and the type of PA they did. Participants in the behaviour change support and combined groups discussed their logbook with their Activity Mentor during weekly videocalls and talked through the corresponding topic, e.g., Mentors supported participants in setting goals and developing strategies to overcome barriers that may stop them from reaching their goals.

#### Activity Mentor logbooks

Activity Mentors kept a weekly logbook for each participant they had been assigned, which included a record of call attendance (yes/no), call duration (minutes), number of sessions and type of PA completed by each participant (e.g., 3 PA sessions – jog, live workout and hike), and whether the session was delivered in accordance with pre-planned session guide (yes/no).

### Exit surveys

At the end of the intervention, all participants were asked to complete an anonymous online exit survey which gathered opinions on intervention content, delivery, perceived choice, perceived impact of the intervention and participants most/least favourite thing about taking part in HERizon (Appendices: material for chapter 4, study 3). Surveys contained a mix of open and closed questions and were tailored according to the intervention arm. Closed questions were scored using a 5-point Likert scale ranging from “Not at all” (1) to “Very much” (5). As a measure of engagement, participants from all intervention arms were asked how much they used the logbook to record their PA sessions, and if they used any of the suggested physical activities. To quantitatively assess participant comprehension and enactment of intervention components into their daily life, surveys asked participants “do you feel you understand the reasons for being physically active and their importance?” and “has the HERizon Project helped you improve your attitudes/behaviours towards PA?”. Questions regarding local COVID-19 restrictions were also identical across all surveys, e.g., “were non-essential shops open? e.g., retail stores”, however questions that related to specific intervention components (e.g., behaviour change support calls, live workouts, text messages and online Instagram group) differed by intervention arm.

**Table 13.** Process evaluation definitions and the components used to address research questions.

Process evaluation component	Definition and research question	Data source
Reach & Recruitment	<p>The degree to which the intended audience participates in the intervention, including maintenance of participants involvement in the intervention (322).</p> <p>The procedures used to approach and attract participants.</p> <ul style="list-style-type: none"> <li>- <i>Did the intervention reach its target population?</i></li> <li>- <i>What procedures were used to recruit adolescent girls to the intervention, and which were most effective?</i></li> <li>- <i>What explains the decline in participation throughout the intervention?</i></li> </ul>	<p># who expressed interest, # who consented, # who were eligible.</p> <p>Demographic &amp; outcome measures compared to census data. Dropout rates and reasons. Focus groups and interviews.</p>
Delivery fidelity	<p>The degree to which intervention deliverers implement the intervention as intended by the intervention developers (138).</p> <ul style="list-style-type: none"> <li>- <i>Was the intervention delivered as intended?</i></li> </ul>	<p>Mentor logbook</p> <p>Intervention manual</p> <p>Live workouts (frequency, content)</p> <p>Instagram group (frequency, content)</p> <p>Text messages (total, frequency)</p> <p>Number logbooks sent to participants</p>
Participant receipt, engagement & enactment	<p>The degree to which participants' understand, and apply the intervention principles (136).</p> <ul style="list-style-type: none"> <li>- <i>How responsive were participants to the intervention?</i></li> </ul>	<p>Focus groups &amp; interviews</p> <p>Exit survey</p>

Adherence	<p>A participant's compliance with an intervention's prescribed treatment (136).</p> <p>- <i>What percentage of participants completed three PA sessions each week for 12 weeks according to their PA logbook, and did this percentage change depending on the intervention arm?</i></p>	<p>PA logbook</p> <p>Focus groups &amp; interviews</p> <p>Exit survey</p> <p>Mentor logbook</p>
Acceptability	<p>The degree to which participants consider the intervention to be appropriate, based on anticipated or experiential cognitive and emotional responses to the intervention (333).</p> <p>- <i>To what extent was the intervention appropriate for participants?</i></p>	<p>Focus groups &amp; interviews</p> <p>Exit survey</p>
Mechanisms of impact	<p>Participant responses to and interaction with the intervention, mediators and unexpected pathways and consequences (329).</p> <p>- <i>What factors lead to positive/negative intervention effectiveness?</i></p>	<p>Focus groups &amp; interviews</p> <p>Exit survey</p>
Context	<p>Any aspect of the environment that may influence intervention implementation or study outcomes (329).</p> <p>- <i>What were the external factors that affected the implementation of the intervention?</i></p>	<p>Focus groups &amp; interviews</p> <p>Exit survey</p>



### Focus groups and interviews

Semi-structured focus groups and interviews took place with a randomly selected sub-sample of participants allocated to PA programme (n = 11), behaviour change support (n = 11) and combined groups (n = 12) after postintervention data collection. Participants were selected using the random number generator tool on Microsoft Excel (Version 16 for Mac, Microsoft Corporation, Washington, USA). All focus groups and interviews were conducted online using Microsoft Teams and lasted between 20 to 45 minutes. A pre-planned interview schedule, which consisted of open and closed questions, was used to facilitate discussion around intervention recruitment, delivery, perceived impact, and future recommendations (Appendices: material for chapter 4, study 3). Focus groups and interviews were conducted by the first author.

### *Data analyses*

Process evaluation findings are presented using both qualitative and quantitative data sources. Response rates and time points are outlined in Table 13.

### Analysis of quantitative data

Data on demographics, attrition, delivery fidelity, adherence, and quantitative responses to exit survey questions were analysed using descriptive statistics using Microsoft Excel and are presented as the mean  $\pm$  SD, unless otherwise stated. Analysis of variance (ANCOVA) and independent t-tests were conducted to investigate significant differences between groups. Statistical analysis was performed using SPSS for Mac (version 27, SPSS, Chicago, IL, USA), with a p-value of 0.05 used to denote statistical significance.

**Table 14.** - Data collected and response rates.

<b>Evaluation method</b>	<b>Process evaluation component</b>	<b>Data collection time frame</b>	<b>Number completed</b>	<b>Response rate</b>
Exit survey	Fidelity of receipt, enactment fidelity, adherence, acceptability, mechanisms of impact, context	Post intervention	<i>n</i> = 91	60.3% of 151 baseline participants
Focus groups and individual interviews	Recruitment, receipt fidelity, adherence, acceptability, mechanisms of impact, context	Post intervention	<i>n</i> = 34 (11 focus groups & 3 interviews)	22.5% of 151 baseline participants
Mentor logbooks	Fidelity of study design, delivery fidelity, receipt fidelity, adherence	From intervention start to end (12 weeks)	<i>n</i> = 12	100%
PA logbook	Receipt of fidelity, enactment of fidelity, adherence	From intervention start to end (12 weeks)	<i>n</i> = 107	70.9% of 151 baseline participants

### Analysis of qualitative data

Responses to open ended exit survey questions were recorded in Microsoft Excel and recurrent points were grouped into themes. Focus groups and interviews transcripts were uploaded to NVivo 12 and, following data familiarisation, themes were identified using reflective thematic analysis (Braun and Clarke, 2019). Initially, themes were identified in a deductive manner, using a-priori process evaluation questions as a start point. Following with an inductive approach was used to identify any further themes. The initial thematic structure was developed by the first author. To enhance rigor and ensure alternative perspectives of data were considered, sections of raw data was reviewed by the second, third and fourth authors (Smith and McGannon, 2018).

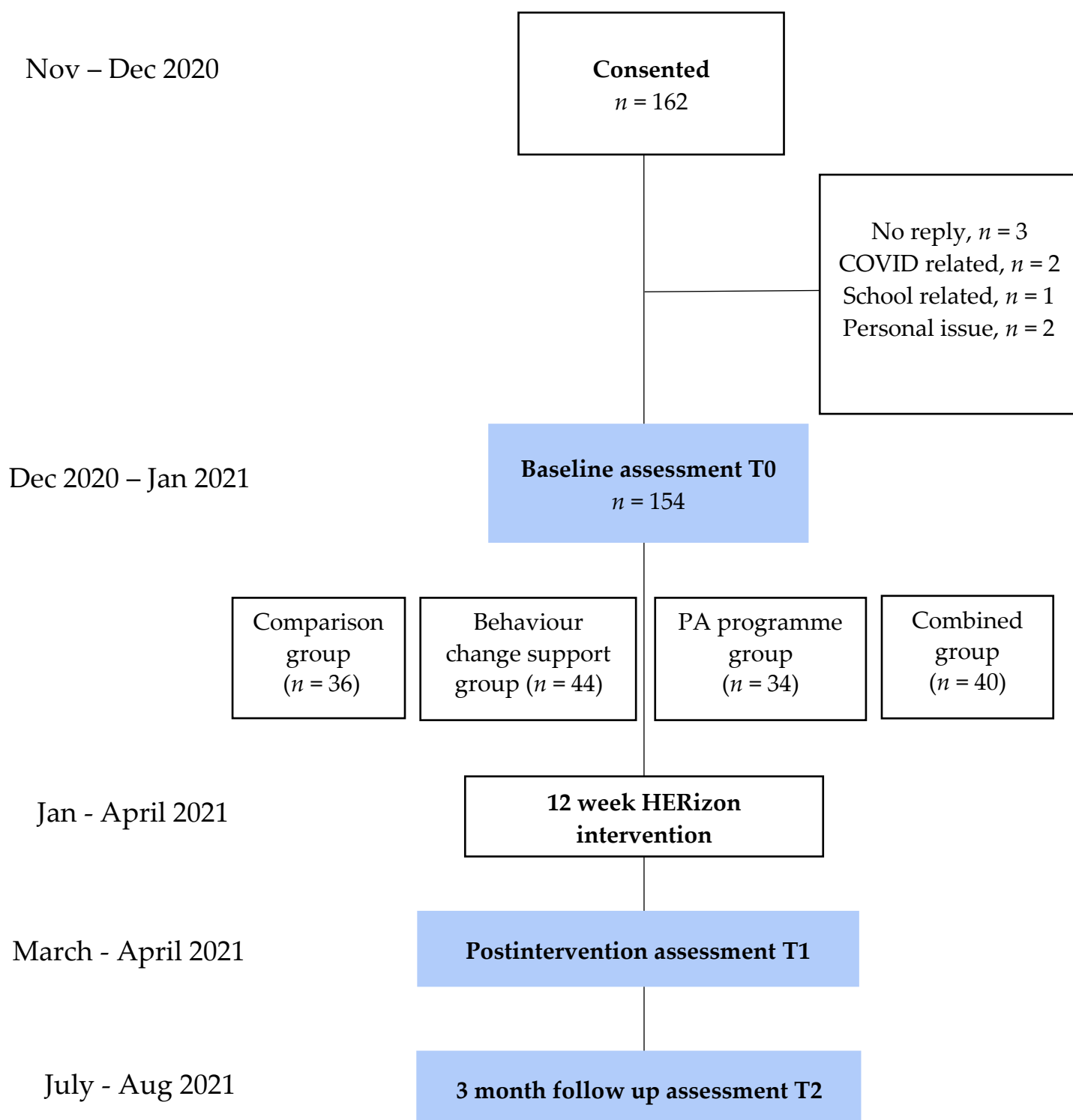
Due to the large volume of data collected, participant quotes that are considered most informative and important are used within the results section. Quotes are used to illustrate the process evaluation component being discussed and to provide richer meaning and context to the quantitative outcomes.

## **Results**

### *Participant descriptives*

189 participants expressed an interest in taking part in the study, of which 162 provided written informed consent (86% recruitment rate). As shown in Figure 6, the baseline measures were collected from 154 participants, and 111 participants completed all or some follow up measures (69% overall response rate). Reasons for drop out from consent to baseline assessment included unrelated injuries (n = 1), school stress (n = 3) and personal issues (n = 4). Descriptive characteristics are presented in Table 14. There were no significant differences in demographics or PA habits between groups.

Based on focus group and interview data, the use of paid advertisements on social media was the most successful recruitment method to the trial, with the majority of girls citing Instagram as the location where they found information on HERizon. Girls reported that the most common reasons for signing up to the study were, (i) boredom during COVID-19 lockdown restrictions, (ii) to become physically active and improve health habits, and (iii) felt motivated by the commitment of 12 weeks and access to an online community.



**Figure 6.** Overview of the HERizon study design.

**Table 15.** Descriptive data for participants.

Characteristics	PA programme group ( <i>n</i> = 36)	Behaviour change support group ( <i>n</i> = 44)	Combined group ( <i>n</i> = 34)	Comparison group ( <i>n</i> = 40)
Age, mean (SD), years	15.3 (1.0)	14.6 (1.3)	14.9 (1.1)	14.9 (1.2)
Reside in UK, <i>n</i> (%)	21 (58%)	20 (46%)	19 (56%)	15 (38%)
Ethnicity, <i>n</i> (%)				
White	29 (81%)	34 (77%)	28 (82%)	31 (78%)
Asian or Asian British/Irish	4 (11%)	3 (7%)	3 (9%)	5 (13%)
African/Black	1 (3%)	3 (7%)	1 (3%)	1 (3%)
Mixed ethnic groups	2 (5%)	2 (5%)	1 (3%)	1 (3%)
Caribbean or Black British/Irish	0	1 (3%)	1 (3%)	0
Socioeconomic status, <i>n</i> (%) <sup>a</sup>				
Tertile 1	10 (28%)	9 (20%)	9 (26%)	18 (45%)
Tertile 2	20 (56%)	25 (45%)	23 (68%)	15 (38%)
Tertile 3	5 (14%)	9 (20%)	2 (6%)	4 (10%)
PA, mean (SD), days	2.1 (1.5)	2.3 (1.6)	2.5 (1.6)	2.3 (1.9)

<sup>1</sup> UK United Kingdom, PA physical activity. <sup>a</sup> Socioeconomic status was determined based on home postcode using the Irish Pobal HP Deprivation Index and the UK Index of Multiple Deprivations (1 = most deprived, 2 = median deprived, 3 = least deprived).

#### *Reach and recruitment*

##### PA programme group

The mean age of girls in the PA programme group was 15.3 years, and the majority of participants were white (81%). 58% of participants lived in the UK, with over half of all the group's participants living in areas within the median deprivation tertile (56%). According to baseline self-report PA questionnaire, girls were physically active for 60 minutes for on average two days per week, and no participants met the government guidelines of 60 minutes of daily MVPA.

### Behaviour change support group

Girls in the behaviour change support group had a mean age of 14.6 years, and similar to the PA programme group, the majority were white (77%). 46% of girls lived in the UK and a large proportion lived in areas of median deprivation (45%), with an even proportion living in the most (20%) and least (20%) deprivation tertiles. Girls in this group reported, via baseline self-report PA questionnaires, to engage in the same amount of PA as girls in the PA programme group; 60 minutes for on average two days per week, and no participants met the government guidelines of 60 minutes of daily MVPA.

### Combined group

The mean age of girls in the combined group was 14.9 years, with 56% living in the UK. Similar to previous groups, the majority of participants were white (82%) and lived in the areas within the median deprivation tertile (68%). No participants met the government PA guidelines, and the mean number of days girls were physically active for 60 minutes was 2.5 days.

### *Delivery fidelity*

#### PA programme group

PA logbooks were sent to all participants in the PA programme group (n = 36) and all participants were invited to join the private Instagram group. Over the course of the twelve week intervention, three text messages were sent each week (n = 1,294). All planned live group workouts were delivered as intended on Wednesday evenings (n = 12) and Saturday mornings (n = 12). The minimum length of live group workouts was 30.1 minutes, maximum length was 37.4 minutes, and the average length was 34.1 minutes.

### Behaviour change support group

PA logbooks were sent to all participants in the behaviour change support group (n = 44). Based on Activity Mentors logbooks, all 9 videocalls were scheduled for each participant and mentors reported 100% adherence to the pre-planned call guide. One mentor, when asked about the key challenges of implementing the intervention, commented:

*'My main challenge was that some participants missed a number of their scheduled sessions. On my part this meant attempting to reschedule at a mutually convenient time, but sometimes it was hard work to even get a response from the girls!'*

### Combined PA programme and behaviour change support group

Similar to previous groups, all participants were sent a PA logbook (n = 34), were invited to join the private Instagram group, and all Activity Mentor videocalls were scheduled for each participant, with Mentors adhering to 99% of the pre-planned call guide. Three text messages were sent to each participant every week for the duration of the intervention (n = 1,224). All planned live group workouts were delivered as intended on Wednesday evenings (n = 12) and Saturday mornings (n = 12). Some participants could not attend these sessions as timings were inconvenient. When asked about the delivery of live group workouts, one participant said:

*'I work Saturdays so the Saturday morning never worked for me... so I would go back the following day into the [online folder] link and do the workouts then... I liked the flexibility'* (Combination group, 16, Ireland)

### *Participant receipt, engagement and enactment*

#### PA programme group

All participants received a PA logbook (n = 36) and 81% of participants reported using the logbook to record their weekly PA sessions. During focus groups, many

participants said they used the suggested PA resources in the logbook and enjoyed trying different types of exercise:

*'I tried a few of the videos and I liked some more than others but because you have such a variety it is really good because different people can try lots of different things'* (PA programme group, 14, UK)

71% of participants reported they took part in at least one live group workout, 24 participants joined the private Instagram group (70.5%) and 97% of text messages were delivered (all text messages to one participant failed to successfully deliver due to an incorrect phone number). Many of the girls spoke of finding the text messages to be good reminders to fill in their logbooks, as well as being sources of encouragement to complete their PA sessions:

*'I loved (the text messages) because they reminded me to fill in the logbook. They were also quite motivational to keep going like if you thought "I don't want to do this exercise today" so that was nice'* (PA programme group, 15, Ireland)

Exit surveys revealed that PA programme participants understanding of the reasons for being active were high ( $4.7 \pm 0.7$  out of 5). Further, participants reported a large improvement in attitudes and behaviours towards PA following the HERizon intervention ( $4.2 \pm 0.8$  out of 5), with one participant reporting a positive change in how she views PA:

*'My outlook on exercise has definitely changed I used to look at exercise as a chore but now it's something that I wake up and I really want to do so (HERizon) has definitely affected my mindset'* (PA programme group, 15, Ireland)

### Behaviour change support group

All participants received a PA logbook (n = 44) and 76% reported they used their logbooks to report their weekly PA. All participants were partnered with an Activity Mentor and the mean number of videocalls participants attended was 7 ( $\pm 2$ ).



Introduction videocalls lasted 30 ( $\pm 6.6$ ) min, calls on weeks 1-6 and 9 lasted 13 ( $\pm 3.4$ ) min and the final call on week 12 lasted 23 ( $\pm 7.6$ ) min. The total mean call duration was 134 ( $\pm 40.5$ ) min per participant. Similar to the PA programme group, based on exit surveys, participants had a high understanding of the importance of being physically active ( $4.7 \pm 0.6$  out of 5) and many saw improvements in their attitudes and behaviours towards being PA as a result of taking part in HERizon ( $4.4 \pm 0.9$  out of 5) with one participant commenting:

*'I have got more confident now especially in PE in school because I used to not be very confident and really self-conscious but now I am like "oh ye I can do exercise"'* (Behaviour change group, 14, UK)

#### Combined PA programme and behaviour change support group

All participants received a PA logbook ( $n = 34$ ) and similar to the previous groups, a large proportion of participants (79%) reported they used the logbook to record their weekly PA sessions.

*'I thought (the logbook) was really useful, I found motivation from it and support and it helped me plan out the week like I got better at planning my exercise and it was nice to look back at it to see how much exercise you've done'* (Behaviour change support group, 16, Ireland)

99.5% of non-reply text messages were delivered (text messages from weeks 1 to 6 for one participant failed to successfully deliver due to an incorrect phone number) and, similarly to the PA programme group, 71% of participants said they tried at least one live group workout. 30 participants joined the private Instagram group (88%), however the majority of participants said during focus groups that they did not use the group much as they either did not use Instagram at all, or they did not feel comfortable putting messages into the group:

*'A lot of the time the group chat was just silent unless (the researcher) sent things in... our group didn't really talk but I'm not really sure how to fix that'* (Combined group, 15, Ireland)

All participants were partnered with an Activity Mentor and the mean number of videocalls participants attended was 8 ( $\pm 1$ ). Introduction videocalls lasted 28 ( $\pm 5.3$ ) min, calls on weeks 1-6 and 9 lasted 13 ( $\pm 2.3$ ) min and the final call on week 12 lasted 21 ( $\pm 6.6$ ) min. The total mean call duration was 138 ( $\pm 22.1$ ) min per participant. Reflecting scores of the previous groups, exit surveys revealed participants in the combined group had high understanding of the reasons for being physically active ( $4.5 \pm 0.7$  out of 5), and positive improvements in attitudes and behaviours towards PA ( $3.9 \pm 1.1$  out of 5). During focus groups, one participant commented on her increased determination during school PE:

*'I have such positivity now around exercise cause I never liked PE cause we do the same thing all the time and I'm not very sporty I have no coordination but last Thursday we were doing laps and before I would have given up but I was thinking "I can do it" I felt determination, motivation, and body positivity as well'* (Combined group, 16, Ireland)

#### *Adherence*

##### PA programme group

The average number of PA sessions completed by participants in the PA programme group was 34 ( $\pm 4$ ), with 78% of participants completing 3 PA sessions per week for 12 weeks. During focus groups, most girls said that three PA sessions per week was an achievable goal, even for those who were not active before the intervention:

*'I think (3 PA sessions) was perfect because it's not too many especially when you first start (exercising) it can be tough but with 3 it's easy, it is a small goal, like very achievable'* (PA programme group, 14, UK)

##### Behaviour change support group

The average number of PA sessions completed by participants in the behaviour change group throughout the intervention was 32 ( $\pm 8$ ), with 39% of participants completing 3 sessions per week for 12 weeks. During focus groups, some participants

commented that initially they found three PA sessions per week difficult but over time it got easier as PA became part of their routine:

*'At the start I really didn't want to do (PA) at all and I thought about dropping out but then I started actually enjoying it and I found that three times wasn't enough and wanted to do (PA) four times'* (Behaviour change support group, 16, UK)

### Combined PA programme and behaviour change support group

The average number of PA sessions completed by participants in the combined group was 33 ( $\pm 6$ ), with 47% of participants completing 3 sessions per week for 12 weeks. Similar to the behaviour change support group, girls in the combined group spoke of needing a couple of weeks to settle into the programme and their new routines:

*'On the 1st week I only did 2 (PA sessions) because I think we were all only getting into (the programme) and used to it but then I stuck to 3 sessions a week'* (Combined group, 15, Ireland)

### *Acceptability*

#### PA programme group

Participant's perspectives of live group workouts and text messages were mainly positive according to exit survey responses (89% of participants would recommend the HERizon programme to a friend, 87% enjoyed live group workouts, and all participants reported the frequency of non-reply text messages to be 'just right'). This was further supported by focus group and interview data:

*'I really liked the live classes like honestly I would pay for it and do them forever I really enjoyed the layout of them and how motivating it was not having to repeat the exercises and I enjoyed that you told us what part of the body you should be working that helped me really focus'* (PA programme group, 16, UK)

The private Instagram group scored the lowest as when participants were asked to rate their enjoyment of the group on a 5-point Likert scale (1 – I did not enjoy it at all, 5 – I really enjoyed it) the mean score was 3.31 ( $\pm 0.6$ ) out of 5. During focus groups,

participants spoke of not feeling comfortable initiating conversation in the group as they did not know the other participants:

*'I just felt like I was scared to speak there because no one was speaking... maybe more ice breakers could be a nice thing like questions (posed by the researcher) for next time'* (PA programme group,15, Ireland)

### Behaviour change support group

The PA logbook was positively received by participants in the behaviour change support group. During focus groups, a number of participants said they found the logbook to be a tool for self-reflection:

*'I thought (the logbook) was really useful, I found motivation from it and support and it helped me plan out the week like I got better at it, it was nice to look back at it to see how much exercise you've done'* (Behaviour change support group, 16, Ireland)

Participants reported high ratings when asked how comfortable they felt talking to their mentor (mean score of 4.47 out of 5, 1 – not comfortable at all, 5 - very comfortable), 87% of participants reported call length as being “just right” and 94% said they would want a mentor again if they took part in another HERizon programme. Responses to exit surveys found participants felt they could be honest with their mentor as they believed they would not be punished if they did not manage to complete all three PA sessions for that week, with one participant commenting “Calls made me feel better if I missed a (PA) session”. Participants also spoke of enjoying the weekly calls because it was an opportunity to speak with someone new. They said they enjoyed forming a relationship with someone outside of their family or school friend group and that they looked forward to the calls because they felt they were catching up with a friend. Another participant said her favourite part of having an Activity Mentor was having a space each week “to talk to someone about exercise and it not feel like a competition”. In focus groups, many of the participants felt the weekly calls acted as a source of accountability, with one participant commenting:

*'You felt like you kind of had to do (PA) because someone else was involved like you had to report back and you didn't want to be like "no I didn't do anything"' (Behaviour change support group, 16, UK)*

Mentor calls were weekly for the first six weeks of the intervention and then moved to once every three weeks for the remainder of the programme. Although participants generally spoke of enjoying the tapered support, as it gave them a sense of accomplishment when they completed their PA sessions without external monitoring, many struggled with the first break in calls as they found the removal of support too abrupt. During focus groups, participants suggested a more gradual weaning of support would be helpful, e.g., fortnightly calls or a text message in leu of the weekly call:

*'In the first break a text would have been beneficial but the second break it good to start building your routine because that is when I found my routine really started in the second break' (Behaviour change support group, 16, Ireland)*

### Combined PA programme and behaviour change support group

Based on exit surveys responses, acceptability for intervention components was high for the combined group (97% would recommend HERizon to a friend, 94% were satisfied with amount of help they received during Activity Mentor calls, and 92% enjoyed live group workouts). Similar to the PA programme group, enjoyment of the Instagram group scored the lowest ( $3.43 \pm 1.3$  out of 5), with many girls echoing similar viewpoints to those in the PA programme group in that they found it difficult to communicate easily with others in their intervention arm:

*'I think that the Instagram group was good but it is kind of hard to communicate through it but it was nice just to know that it was there so you could see that there are other people doing the project with you that you're not alone in it' (Combined group, 14, Ireland)*

Participants felt they had many PA options within the programme and exit surveys responses revealed high scores for perceived choice and autonomy ( $4.55 \pm 0.7$  out of 5). One participant in the combined group said she enjoyed the suggested PA options because she was able to try “so many different workouts that I wouldn't have ever done before”.

### *Mechanisms of impact*

#### Routine

Across all intervention arms, many participants showed an awareness of their procrastination around PA. Participants spoke of finding the rigidity of a set timetable for live group workouts particularly helpful as they felt it made them to commit to doing PA on a set day and time:

*‘I really liked the schedule of the workouts because even if I am tired I would be like “OK I am just going to do this and then I can be finished” so I wasn’t like dilly daddling, it was at a set time I couldn’t be like ‘Oh I’ll just do it in another hour’” (PA Programme group, 15 Ireland)*

One participant attended both live group workouts each week but did not do any other PA. When asked about this during an interview she said she would have completed three PA sessions had there have been a third live workout as she said she “feels like when I am pressured with time I do better”. A participant of the combined group said during focus groups that PA had become part of her weekly routine and therefore being physically active required less effort:

*‘I’m not as afraid of just starting doing physical activity now like it is part of my life but it’s not too big of a part it is just balanced and ye it’s just easy now’ (Combined group, 15, Ireland)*

#### Sense of accomplishment

There was a strong sense of accomplishment evident within the data at the end of the 12 weeks in all intervention arms. When participants were asked what their favourite

part of the programme was, one participant in the behaviour change support group responded “my favourite part of HERizon was achieving goals I set myself”. Another participant found looking back on the PA sessions she had completed in her logbook to be a great source of motivation:

*‘It gave me a big sense of accomplishment like looking over it and if I did quite a lot (of PA) that week it was good to be able to see what I had done each day... it gave me kind of motivation’* (Behaviour change support group, 15, UK)

Further, participants in the combined group expressed excitement regarding their accomplishments over the course of the intervention, with one participant saying:

*‘I definitely think I have become physically fitter I am definitely stronger like the first strength workout I did I was so sore I could hardly lift the little tin cans over my head but now it is really cool because now I can feel on my arms there is muscle definition’* (Combined group, 16, Ireland)

### Accountability

Participants who were partnered with an Activity Mentor (behaviour change support and combined groups) spoke about their weekly videocalls being a source of accountability. Knowing they would speak to their mentor, and talk through the PA logbook, motivated participants to complete their three PA sessions:

*‘I feel like since we had the mentor calls and we knew it had to happen every week it kind of motivated me to do more so I could tell her and not just be like “ye I sat down all day”* (Combined group, 14, UK)

Participants in the PA programme group commented on their PA logbook being a source of motivation and accountability. Many of the participants said they would plan their PA sessions out for the coming week and used the optional worksheets to reflect on their goals:

*‘I really liked the bit where you could plan (PA) out, it just makes it a lot easier to plan out what you’re going to do for the week and hold yourself*

*accountable, as well the little bit like the week by week topics I quite enjoyed that it was nice to check up on myself'* (PA programme group, 16, UK)

However, not all participants found the logbook useful. Some participants did not use any of the suggested PA options, and others created their own PA calendar using Google Docs and the Notion mobile application. One participant said she did not use the logbook for anything other than recording attendance at live workouts:

*'I didn't end up trying anything from the logbook, it just stayed in one position, I would just write in the live workout and then that logbook would be closed and far away from me'* (PA programme group, 16, UK)

### Discovery of preferred PA

Following the programme, many of the participants commented that their perception of what constitutes as PA had changed and that since finding an activity that they enjoy, they have become more physically active in their day to day life:

*'I am a lot more physically active now... I used to look at exercise like "Why would someone do that? That looks too hard and too boring", but now I really enjoy it because of all the options we had at the start and the different (physical activities) you can do'* (Behaviour change support group, 13, UK)

Further, as the programme progressed, it seems that PA became less of a task that needed to be done specifically for a research study, and more of something that was part of their everyday life:

*'It was more routine then feeling like I had to get up and do the project, it kind of felt like you were just doing your thing like on Monday's I just knew that I had a workout to do, it was routine, like motivation wasn't needed as much'* (Behaviour Change Support Group, 16, Ireland)

### *Context*

Given to the complex nature of the intervention, due its multiple components, different geographic locations, real-world setting, and implementation during the



COVID-19 pandemic, it was deemed important to consider the influence of the broader social and physical environments in which the intervention was carried out. Responses from exit surveys found no significant differences between intervention arms and therefore results are reported at the trial level. 91% of participants remained in strict COVID-19 lockdown restrictions during post intervention data collection (closure of non-essential retail and indoor restaurant dining, travel restrictions and prohibition of indoor social gatherings outside of an individual's "social bubbles"), with 78% of participants returning to in-person schooling from March 2021 (week 8 of the intervention). 59% of participants had no physical education (PE) during COVID-19 school closures. Of those who had remote PE, the main activities were teacher-led Zoom classes or self-led YouTube workout videos, with total PE time lasting on average 60 minutes to 120 minutes per week.

A large proportion of participants (75%) reported their weekly commitments had changed since returning to school, with the main commitments being an increase in schoolwork, extracurricular activities and part-time employment. 64% of participants also reported a change in their behaviour and motivation towards PA since returning to school with the re-opening of sports clubs being a key motivator, and lack of time and increased stressed listed as the primary drivers of lower motivation.

## **Discussion**

To the best of the authors knowledge, this investigation is the first multi-arm process evaluation of a PA intervention, and in order to address specific research questions, it was important to develop a bespoke process evaluation framework using elements of previously established frameworks (Bellg et al., 2004; Borrelli, 2011; Dusenbury et al., 2003; Glasgow et al., 2019; Linnan and Steckler., 2002; Moore et al., 2015; Proctor et al., 2011). This ensured the evaluation did not become a 'tick box' exercise and used the available data in the most meaningful and informative ways. Overall, results indicate

that trial recruitment strategies were successful (86% recruitment rate), implementation fidelity was high, as was intervention adherence. The majority of intervention components were positively received by participants, however the private Instagram group chat was weakly implemented, and had the least satisfaction and perceived use of all intervention components.

Findings suggest that the remote nature and flexibility of the intervention were important facilitators in its high implementation fidelity and adherence. Although the intervention commenced during COVID-19 lockdown restrictions, participants from all intervention arms commented during focus groups and in exit surveys that they liked the programme being online, separate from school, and recommended it stay in an online format, even after face-to-face activities resume. Although there is limited evidence for remote interventions with adolescents (Patrick et al., 2006), a previous intervention involving adults identified significant positive improvements in MVPA and intrinsic motivation (McDonough et al., 2021). Schools are an obvious site from which to base youth PA interventions, however several issues are commonly cited when working in the school environment, such as timetabling constraints (Jenkinson et al., 2012), inconsistencies in intervention implementation (Jong et al., 2020), varied availability of equipment and facilities (Åvitsland et al., 2020) and lack of teacher adoption (Casey et al., 2014). HERizon attempted to overcome such barriers as the intervention arms were not bound to a set location or weekly time slot. Instead, it gave participants the freedom to choose the type of physical activities that suited their schedule, interests and available space/equipment, and provided support through informational and encouraging communications. These facilitators to implementation align with those presented in a Cochrane review, which concluded that the most effective PA interventions allowed participants to choose the type of PA they participate in and used phone calls to provide participants with feedback and support (Foster et al., 2013). Irrespective of how the girls' chose to be physically active, or if they decided to avail of additional support (e.g., live workouts and the Instagram

group), all participants were encouraged to set goals and to develop action plans and coping strategies during the programme. Similarly to previous behaviour intervention (Fischer et al., 2020), these strategies were perceived as being integral to improving the girls' PA. Although intervention dose and content should be standardised between participants for fair evaluation, in line with previous studies, flexibility and adaptation, through participant autonomy, were identified as being vital for intervention adherence and satisfaction, without compromising the intervention's purpose (Åvitsland et al., 2020; Cline et al., 2021).

Social interaction has long been recognised as an important facilitator to girls' engagement in PA (Casey et al., 2009; Eime et al., 2013a; Elder et al., 2007; Holmberg et al., 2018), with peer relationships having a significant positive association with adolescents motivation and quality of life (Cox et al., 2009; Shen et al., 2012). HERizon provided participants opportunities for social interaction through Activity Mentor calls, live workouts and a private Instagram group chat. This opportunities to connect with others on the programme were deemed especially important during the period of implementation as the majority of participants were at home under strict COVID-19 lockdown restrictions. In a recent study it was found that connecting with friends online during the pandemic reduced feelings of loneliness (Ellis et al., 2020). Further, it has been shown that social media can have a positive impact on health behaviours, such as improved PA and body composition (Goodyear et al., 2021; Johns et al., 2017). Instagram was the chosen platform based on previous feedback from adolescent girls (Cowley et al., 2021a), and during focus groups participants confirmed that this was the most appropriate platform for the HERizon community as it was the social media they used most frequently (with Tik Tok and Discord being other recommended alternatives). Similar to Hutton and Robson (2019), participant exit survey responses demonstrate moderate satisfaction and perceived usefulness of the group chat, however during focus groups and interviews it was evident that the majority of girls did not use the chat as intended. Many girls reported feeling "awkward" or

uncomfortable putting messages in the chat and therefore it was predominantly the researcher who wrote into the group, e.g., reminding girls of upcoming live workouts. Much of the feedback received suggested that future iterations of HERizon should provide more opportunities for participants to introduce themselves and get to know one another better. Through researcher-facilitated group discussions, participants can begin to take ownership of the conversation and use the chat as a way to share interests and ideas (Cuthbertson and Falcone, 2014). However, it is acknowledged that building authentic, trusting relationships require much time and effort even in 'normal' face-to-face interactions (Greene and Stewart-Withers, 2018), and considerably more so in a remote setting (Palloff and Pratt, 2007). Therefore, it is possible that a remote 12-week intervention provides insufficient time to foster a genuine sense of community.

### *Strengths and limitations*

The comprehensiveness of our mixed-methods data provides detailed information on the reach, fidelity, adherence, acceptability, and context regarding the implementation of a remote PA intervention for adolescent girls. Triangulating information from several data sources allowed for several process evaluation questions to be investigated. Furthermore, this framework-guided process evaluation was completed prior to analysing outcome measurements. However, a number of limitations are recognised within this study. Although a no-treatment control group allows for the evaluation and comparison of intervention components between groups, this design may be suboptimal as it does not account for external factors nor participant expectancies (Carroll, 2001). Further, non-treatment control groups may be unethical given the well documented benefits of regular PA for adolescents. Future PA interventions should consider a wait-list controlled trial. Not all participants (60.3%) returned completed exit surveys, thus potentially biasing our results as participants with strong views may have been more likely to complete the form (Bethlehem, 2009). Moreover, participant feedback on the intervention was only collected at the end of

the programme, rather than throughout (Moore et al., 2015). Finally, the first author of this process evaluation was also involved in intervention delivery, which may be a source of bias. To minimise bias, data were collected from participant and Activity Mentor logbooks, focus group participants were selected randomly, and the return of participant exit surveys was not influenced by the research team.

## **Conclusion**

This process evaluation set out to gain insight into the reach and recruitment, delivery and receipt fidelity, adherence, acceptability, mechanisms of impact and context of a 12-week remote PA intervention for adolescent girls. Findings suggest a successful recruitment strategy as the target audience of adolescent girls from the UK and Ireland were enrolled into the study. There was a high level of fidelity as the majority of intervention components were delivered and received as intended. Participants in all intervention arms had good adherence to the PA protocol and participant satisfaction was high, however improvements can be made for the online group component of the intervention. Routine, sense of accomplishment and accountability were identified as key mechanisms of impact within the intervention, and contextual factors, such as school holidays and exams were noted as having an influence on intervention implementation.

Based on this study's results, the following recommendations are made to advance the quality of future evaluations:

- Context and its impact should not be undervalued when implementing a PA intervention in a real-world setting. Consideration should be given during intervention development to school terms, examination points and typical vacation periods.
- Paid advertisements on social media that emphasise the accountability and community aspects of the intervention should be considered.

- To foster a sense of community and belonging, providers should facilitate and encourage group discussion, e.g., ice-breaker tasks.
- Encouraging participant autonomy through choice and a flexible treatment design may increase long-term behaviour change and therefore should also be considered.

# Thesis Study Map

Study	Objectives & key findings
<b>Study 1 - “Girls Aren’t Meant to Exercise”:</b> Perceived Influences on Physical Activity among Adolescent Girls—The HERizon Project	<b>Objectives:</b> Qualitatively explore; <ul style="list-style-type: none"> <li>• girls understanding of PA</li> <li>• girls experiences and perceptions of PA</li> <li>• girls perceived barriers and facilitators towards PA</li> </ul> <b>Key findings:</b> <ul style="list-style-type: none"> <li>• Girls identified barriers and facilitators to PA at all socioecological levels.</li> <li>• Barriers include fear of judgement, changing priorities, social pressure, school PE and perceived gender inequality in school and society.</li> </ul>
<b>Study 2 -</b> Formative Evaluation of a Home-Based Physical Activity Intervention for Adolescent Girls—The HERizon Project: A Randomised Controlled Trial	<b>Objectives:</b> <ul style="list-style-type: none"> <li>• Assess the acceptability, appropriateness and implementation of a remote PA intervention for adolescent girls.</li> <li>• Assess the intervention’s preliminary effectiveness of improving adolescent girls PA, physical fitness, and psychosocial health.</li> </ul> <b>Key findings:</b> <ul style="list-style-type: none"> <li>• No significant change in self-reported MVPA between groups at postintervention.</li> <li>• Significant improvements in cardiorespiratory fitness, muscle endurance, intrinsic motivation and body appreciation for the intervention group compared to control at postintervention.</li> <li>• The intervention had 0% attrition and 100% adherence to the programme.</li> </ul>

**Study 3 - What happened in 'The HERizon Project?' – Process evaluation of a multi-arm remote physical activity intervention for adolescent girls**

**Objectives:**

- Investigate what intervention components (and their dose) were delivered in each intervention arm.
- Explore what factors influenced the recruitment to and implementation of The HERizon Project.
- Explore adolescent girls satisfaction and acceptability of the intervention.

**Key findings:**

- There was high delivery fidelity, participant adherence and intervention receipt across all intervention arms.
- Participants were satisfied with all components of HERizon however more group facilitation is required for the online social media group.
- Key facilitators to increasing PA, identified by participants during focus groups, include perceived autonomy and accomplishment, accountability and routine.



### **Learnings of study 3**

*Gaining continuous formative feedback.* Although having qualitative data post-intervention was helpful in understanding fidelity and in informing future intervention refinements, it would have been even more beneficial to collect these insights throughout the intervention period, rather than only at the end. Gaining 'real-time' feedback would have provided valuable data on if/how participant acceptability changed throughout the intervention period, and would have also allowed me to make small tweaks to the delivery to make the intervention run more optimally, e.g., in post-intervention focus groups some participants said the music in the live workouts was not loud enough. This would have been an easy thing to fix had I collected this information during the intervention period.

*Development of intervention policy documents.* The team of Activity Mentors, Dr Watson and myself met for weekly 1hr reflection meetings during the course of the 12 week intervention. In these meetings Activity Mentors discussed issues that they faced in regards to their behaviour change support calls, and based on these conversations policies were developed to (i) ensure that Mentors felt equipped to deal with these problems if they should arise again, and (ii) issues were dealt with in a consistent way. Common issues that arose included participants not showing up for calls or replying to text messages, and participants talking about weight loss. The policies that were developed are attached in the appendices material for study 3.

*Participant advisory group.* Using the results of each of the previous studies, girls voices were prioritised throughout intervention design and delivery. However, it would have been more participant-led had I created a participant advisory/steering group. This group of adolescent girls could have assisted in decision making throughout

intervention development e.g., what YouTube videos to include, piloting of intervention materials, and suggestions on what social media platform to use.

*Importance of ice-breakers.* Based on several comments from post-intervention focus groups, more formal ice-breakers were needed to stimulate conversation in the Instagram groups. I was hesitant to do this during the study as I wanted the group chat to be a space where girls could connect with others and be themselves, without feeling pressure to talk because I, as the researcher, asked questions. In hindsight, I think some general questions to encourage interaction initially would have been beneficial to allow the girls to become more comfortable putting messages into the group and talking between themselves. This is an important lesson that I will take forward in regards to the importance of structure when trying to cultivate a community environment.

*Online consent.* Had I the opportunity to redo this body of work, I would have used online consent within study 1 instead of traditional written paper forms. Due to the logistics of travelling to Ireland to conduct focus groups, the teacher had distributed information sheets and consent forms prior to the day of focus groups. In many schools, when I arrived the adolescent had only signed their assent form and did not have parent/guardian consent and therefore could not take part in the study. I think that had all information and forms been signed electronically there would have been more participants in these focus group discussions.

A report outlining the most common physical activities and qualitative comments from participants' parents/guardians are available in the appendices 'Material for study 3'.

## **Chapter 5: GENERAL DISCUSSION**

## **1. Chapter introduction**

This final chapter will summarise and draw together an overview of the key findings of the 3 empirical studies presented in chapter 2-4. This discussion will identify the relevance of the studies outcomes on future research and practice, as well as critically evaluate the strengths and weaknesses of the research. To close, a brief personal reflection on my personal PhD journey will be included.

Driven by the persistence of girls' low physical activity participation, this PhD aimed to add to the literature and address some current research gaps through the development and evaluation of a remote PA intervention – The HERizon Project. Through the use of mixed methodologies, the studies evaluated the preliminary effectiveness of The HERizon Project, and collected information on the feasibility and acceptability of implementing such an intervention in the real-world setting. Findings highlight the influence individual psychological factors (e.g., perceived competence and sense of accomplishment), social determinants (e.g., accountability to others), and the cultural context (e.g., gendered norms) have on girls' participation in PA, as well as finding the home to be an effective and acceptable setting for a girls PA intervention.

The specific aims of this PhD were:

1. To identify the barriers and facilitators towards PA adoption, maintenance and drop-out of inactive adolescent girls (study 1, chapter 2).
2. To assess the acceptability, appropriateness and preliminary effectiveness of a remote, multi-component PA intervention (HERizon) for adolescent girls (study 2, chapter 3).
3. To conduct a process evaluation of a multi-arm remote PA intervention (HERizon) to assess implementation and ascertain which components are perceived to be most acceptable (study 3, chapter 4).

4. Synthesise the main findings of studies in order to consider the wider implications of results and make suggestions for future practice and research (chapter 5).

## **2. Summary of findings**

**Study 1** was a qualitative study which set out to investigate the perceived barriers and facilitators of PA for inactive adolescent girls living in low socioeconomic areas of the UK and Ireland. Factors were mapped onto the socioecological model and included fear of judgement of others, influence of peers, the delivery of PE, and gender stereotypes. Gaining insight into what facilitates girls engagement with PA, such as enjoyment and accountability, was particularly important for the initial development of a PA intervention specifically targeted for this adolescent population.

**Study 2** involved the mixed methods formative evaluation of The HERizon Project in a six week randomised wait-list controlled trial. This study extended the findings of study 1 and builds upon previous work by exploring the importance psychological needs satisfaction has on increasing girls' PA behaviour. At postintervention, there were no significant changes in self-reported MVPA between groups. Significant improvements were found for cardiorespiratory, muscular fitness, body image and intrinsic motivation in the intervention group compared to the control. Furthermore, postintervention interviews found high acceptability and feasibility for implementing the PA intervention in the home setting.

**Study 3** involved the refinement of the HERizon intervention and subsequent implementation of a larger multi-arm randomised controlled trial. A bespoke process evaluation framework was used to assess the implementation of each active intervention component, and to investigate the acceptability of the programme for adolescent girls. The process evaluation results found high fidelity to the intervention protocol by intervention deliverers, high participant PA adherence, and high satisfaction across all intervention arms.

### **3. Impact of COVID-19**

Like much of the global population, the COVID-19 pandemic was not an anticipated factor when I was planning my PhD journey. The initial lockdown occurred one year into my studies, and, with some luck, quick adaptation, and creativity, I managed to adjust my studies rather than needing to resort to secondary data analysis. With this in mind, it is important to consider how the recruitment, retention, and adherence rates of studies 2 and 3 were impacted by these lockdown restrictions, and what these rates might be in 'normal' circumstances. As outlined in study 3, the most common reported reason for signing up to the programme was girls want to find something to keep busy during COVID-19. Therefore, this was an important facilitator in reaching the target sample size relatively quickly. In post-intervention focus groups, when asked if they would still have taken part in the study if COVID-19 had not been in existence, all participants said yes. The difficulty in this is that the girls had already experienced the full programme and most reported high levels of satisfaction, therefore they cannot comment unbiasedly if they would sign up to a 12-week programme in normal conditions without having experienced it first. In exit surveys girls reported they had more commitments since schools had started to reopen and that their schedules had changed. This mixed response requires a future trial to understand if recruitment of adolescent girls outside of COVID-19 lockdown restrictions would be more difficult when normal academic and social commitments, resume, and girls do not necessarily need additional activities to keep busy.

Adherence to Activity Mentor calls was high for both studies 2 and 3, however anecdotal data suggests that mentors needed to reschedule more calls with participants towards the end of the interventions, when students were on Easter and summer breaks from school (March/April and June/July). It is suspected that regardless of COVID-19, a similar trend would have been seen. A key facilitator in

studies 2 and 3 was 'routine' and, although most participants were being schooled at home, they still had a typical school routine with scheduled classes and lunch breaks. Many of the girls spoke about HERizon slotting into their weekly schedule and therefore 'knowing' they had a live workout or Mentor call on a specific day. When adolescents are on school breaks their schedule is harder to maintain and therefore it is thought adherence would drop during these periods outside of COVID-19 also. This is reflective of The Bristol Girls Dance Project (Jago et al., 2016) which found attendance declined as the intervention progressed. However, the average adherence within HERizon was considerably higher than Bristol Girls Dance as the average attendance to dance classes was 45%. Having a remote intervention may have facilitated the high attendance to mentor calls as they did not require the participant to travel, nor be in a specific location (i.e., the video call could be taken in a location most convenient for the participant).

Retention rates of study 2 were excellent, as no participant dropped out of the programme and I had a complete dataset, however in study 3 there was some attrition. Common reasons for drop out included school stress, personal issues, and injury unrelated to the intervention. Of the participants who dropped out, the majority did not give a reason for not continuing the study, with most not replying to researcher communication at postintervention data collection. Although not analysed within this thesis, attrition rates seem comparable, if not lower, to similar PA interventions within this population. A recent feasibility paper comparing a remote versus in-person exercise intervention for cancer survivors found that retention was significantly higher in the remote exercise classes in comparison to in-person (Winters-Stone et al., 2021). Perhaps given HERizon's remote nature, return to normal life post-COVID would not have a negative impact on retention. Instead, it may support retention by overcoming many barriers that are typically related to drop out, e.g., lack of time, lack of transport.

#### **4. Synthesis of findings and implications for future research**

This section will reflect on the body of work and discuss the overarching themes that arose from this PhD. As many of the findings identified within the individual studies are interconnected and in support of one another, I will present a discussion of the overarching themes, and provide suggested ways how these outcomes may implicate future PA research and practice.

##### *4.1. Psychological factors influencing girls participation in PA*

Individual psychological factors, such as feelings of self-consciousness, are frequently found to be associated with girls' PA levels (Corr, 2019). Across all studies included within this PhD, feelings of low body satisfaction, low perceived skill level and comparison to others were found to be key limiting factors to girls' participation in PA. Girls spoke of wanting to join new sports clubs and exercise classes, but felt they would be judged by others because they did not have the necessary skills, or the same skill level of others. This is echoed by past work that found girls chose to not engage in PA as they felt vulnerable to being singled out by their peers if they were to make a mistake (Yungblut, 2012). Study 1 results extend these findings as participants spoke of enjoying activities only when they were with specific friends whom they trusted not to judge or embarrass them.

Another individual psychological factor found to influence girl's PA was autonomy. Autonomy need satisfaction should be supported to promote PA internalisation (the process of PA behaviours becoming more autonomous) (Ryan and Deci, 2000b), and based on the findings of studies 1, 2 and 3, it is clear that autonomy and choice were key facilitators to girls participation and adherence in the HERizon interventions. This is in support of a large literature base that illustrates the positive effects perceived control and volition have on self-motivation (Brooks and Magnusson, 2007; Craike et al., 2011; Massie et al., 2015; Yungblut, 2012). Throughout the intervention, participants were exposed to



new types of PA, and were given the freedom to choose what activities they did for their 3 weekly PA sessions. Many girls spoke of trying different types of exercise in the initial weeks of the programme until they found an activity that they enjoyed most. These results add to the existing research which found that adolescent girls prioritise enjoyment over the health benefits of PA, and if an activity is not considered “fun” they will not take part (Craike et al., 2011; James et al., 2018). Further, girls recognise that people enjoy different types of exercise and therefore they value having a wide variety of PA options that they can choose from (Massie et al., 2015). In support of study 1, which found that mandatory PE uniforms and compulsory engagement in traditional team-based sports have a negative effect on girls PA, participants in studies 2 and 3 enjoyed having ownership of their PA schedule and having the independence to choose the type of PA, the setting and time. Having such ownership and flexibility within PA interventions has been shown to enhance participant adherence, maintain interest and prevent boredom (Massie et al., 2015; Corder et al., 2013; Steinbeck et al., 2009).

#### *4.2. Changing girls perceptions of what being physically active means*

It was found that irrespective of participant perceived PA levels, the majority of girls across studies had negative perceptions of sport and PA (i.e. PA is boring and uncomfortable), and had a narrow view of what constitutes as PA (e.g., traditional team based sports). For many girls, PE was their only experience of physical activity and PE was often discussed as being a negative experience, therefore having a salient effect on girls disengagement with PA. Expanding upon past literature (Corr, 2019; Stankov et al., 2012), the dominance of traditional team-based activities, enforcement of uncomfortable uniforms, and lack of control/choice during school-based PA were found to be detrimental to girls’ perception of PA. Girls’ limited exposure to different types of PA and limited knowledge of what constitutes as PA, is thought to have a negative effect on their engagement in PA (Araki et al., 2013; Craike et al., 2009; Greene and Stewart-Withers, 2018; Knowles et al., 2011). PA that provides girls with choice and experiences of new

types of PA (e.g., Pilates, yoga, and aerobic dance) are found to have a positive effect on MVPA, flexibility, cardiorespiratory fitness, and muscular strength (McNamee et al., 2017).

A sense of accomplishment was identified as a contributor to girls' adherence to the PA programmes. Girls said that as they became fitter and more confident in their physical capabilities over the course of the intervention, so too did their enjoyment of PA. These results confirm previous research which found that as girls perceived competence and confidence increased they were more likely to enjoy competition and became motivated to improve skills and reach personal goals (Corr, 2019; Craike et al., 2011; Eime et al., 2010). Elaborating on study 1 findings and other past literature which found that girls want to be active but feel external factors prevent them (Azzarito et al., 2006), during postintervention interviews in studies 2 and 3 participants spoke of feeling accomplished and enjoying the challenge of the live workouts which predominantly involved high intensity circuit training and weightlifting. This refutes much past literature which found that girls tend to avoid strenuous exercise in order to prevent them from sweating or becoming breathless (Jonsson et al., 2017; Yungblut, 2012), and many choose to not participate in typically male dominated exercises, e.g., weightlifting, for fear of gaining muscle (Beltrán-Carrillo et al., 2016; Hill and Azzarito, 2012; Coen et al., 2018). Exercising in the privacy of the home in a structured PA programme gave girls an opportunity to increase their perceived competency by developing skills without being fearful of others judging them. It is suggested that by allowing girls to exercise at home, they can experience non-conventional exercises and be who they want to be as they are sheltered from the gender boundaries typically evident in PE settings (Azzarito and Hill, 2013; Azzarito et al., 2006; Brooks and Magnusson, 2007).

#### *4.3. Girls' enjoyment of strength training*

Contrary to girls' fears of gaining muscle through exercise in study 1, many of the participants in study 2 and 3 who chose resistance training as their PA mode spoke about feeling excited when they saw an increase in muscle size and proud of their improved strength. This may be explained through Feminist Theory which suggests that when girls engage in activities that resist traditional gender norms (e.g., resistance training) they become empowered (Henderson and Gibson, 2013) and change their perception of what it means to be a "perfect girl" (p116) (Walters et al., 2020). Further, within the HERizon intervention, messaging was focused on strength and what our bodies can do rather than on what they look like aesthetically. As resistance training is typically an individual activity, that is focused on self-improvement, these findings are reflective of study 2 which found girls enjoyed challenging activities once they are not being compared against others. Although limited, there are some promising results for the effects resistance training programmes may have on adolescent health. Recent reviews have found resistance training to have a significant positive impact on youth physical strength (Collins et al., 2019), fundamental movement skills (Collins et al., 2019), and weight status (Collins et al., 2018). This has been supported by the Australian NEAT Girls intervention which resulted in positive improvements in BMI following a 12 month trial (Lubans et al., 2012). Adding to the potential physical benefits, resistance training has been shown to be associated with increased self-worth (Collins et al., 2019), which is further supported by the American Smart Fit Girls intervention which found that after a 10 week weightlifting programme girls were less critical of their bodies, and less concerned with other people's opinions of their bodies compared to baseline (Walters et al., 2020). Given that strength training appears to be enjoyable and acceptable to adolescent girls within this body of work, and is supported by the most recent PA guidelines (WHO, 2020), more research is recommended within this area to assess its effectiveness in improving adolescent physical and psychosocial health.

#### *4.4. The role of social support in girls' PA participation*

Many girls spoke of the influence other people and the wider pressures societal gender norms have on their activity levels, with girls explaining that although they wanted to be more physically active and understood the importance of PA, they felt limited by the support and PA options available to them within the family, community and school setting. Girls felt that as they got older there was an assumption from parents and teachers that they would prioritise schoolwork over sports. These barriers mirror those identified in the literature some 30 years ago (Lirgg and Feltz, 1989; Thomas and Thomas, 1988) and provide elaboration on past work that argued the ‘problem’ is not necessarily that girls need to change (Scruton, 2018), rather that others involved in supporting and developing PA opportunities for adolescent girls need change to address the differing needs of genders and to successfully increase and sustain girls PA engagement for lifelong health (James et al., 2018). Parental and sibling support and modelling are routinely cited as being a positive factor to girls PA (Casey et al., 2009; Craike et al., 2011; Eime et al., 2010). Recent studies involving pre-teens found that PA programmes involving dads and daughters resulted in increased PA, improved fundamental movement skills and high participant satisfaction (Morgan et al., 2019). Another intervention involving mums and daughters also resulted in positive changes in vigorous PA (Alhassan et al., 2018). Interestingly, during postintervention interviews participants did not identify family support as a facilitator to their PA during the HERizon programme. However, many girls spoke of joining the weekly live workout sessions with their parents or siblings, whilst others talked about going on family hikes or doing the ‘Couch to 5K’ with a parent. Therefore although parent support may not be an obvious facilitator to the girls themselves in regard to adherence with the intervention, their comments do suggest that family support played an important role.

Girls’ positive experiences of social support offered during the HERizon intervention are thought to be a contributing factor to the high adherence, and positive changes in preliminary outcome measures. Relatedness need satisfaction has been shown to be important for girls PA participation (Duffey et al., 2021; Corr, 2019; Laird et al., 2016). This

was reflected in qualitative results as girls spoke of the importance of feeling part of a community as they knew that other girls were involved in the programme and that their mentor would check in with them each week. Not being physically together did not seem to be a barrier for participants, as having a virtual connection via Zoom, SMS and social media providing sufficient opportunities to socially connect with others. Recent work has found that girls may feel more comfortable expressing themselves online and that this oftentimes facilitates supportive digital friendships with other girls (Lee and Borah, 2020; Mainardi, 2020; Tifferet, 2020). Supporting Elliot (2020), HERizon studies found that being part of an all-girls community, or ‘sisterhood’, where participants could relate to and support each other was important for relatedness needs satisfaction. Many qualitative interview comments across all studies were of girls explaining they felt reassured in their abilities when they saw that the exercise instructor and other girls were also out of breathe and red-faced during workouts. This confirms recent research that found unattainable airbrushed fitness media has a negative impact on females body satisfaction and mood (Prichard et al., 2018), with images of “real” bodies that focus on what the body can do rather than on the aesthetic condition having a positive effect on females motivation to exercise (Mulgrew et al., 2018).

#### *4.5. Accountability and habit formation*

Results from studies 2 and 3 indicated that having regular weekly videocalls with an Activity Mentor, accessing a weekly live workouts timetable, and scheduling future PA sessions using a logbook were seen as facilitators towards increasing PA as it gave girls a sense of routine and structure. At postintervention, girls spoke of how their three PA sessions became part of their normal week schedule so they “just knew” they had a PA session on particular evenings. Using the calendar sheet within the PA logbook to schedule PA sessions were found to assist girls in creating routines. Self-monitoring has been suggested to be an effective tool in promoting health behaviour change (Gillison et al., 2012), however more research is required on the use of tracking by adolescents.

Research concerned with habit formation has found that certain actions or contexts act as cues to trigger a specific behaviour (Gardner et al., 2012), e.g., knowing that on Saturday mornings they sign into the 10am live workout. Further supporting the importance of routine, Mota and colleagues (2007) illustrate that adolescent girls who make PA part of their weekly routine were more likely to have a habitually active. Study 3 participants commented on appreciating the clear structure of the intervention, regardless of whether they actually availed of the events that ran each week, e.g., live workouts and mentor calls. This demonstrates the importance girls place on consistency and feeling involved in the programme timetable (Hargreaves et al., 2021).

## **5. Recommendations to conducting research with young people**

For my undergraduate degree I studied PE and biology teaching, and during my training I had several school placements. Spending time in secondary schools, along with having a 15 year old sister, gave me some insights into the issues girls face on a day to day basis, including body image worries, gendered norms, stress around school, and feeling pressures to “fit in”. These experiences provided me with some awareness of the specific ethical considerations that were required when designing the home-based HERizon intervention for adolescent girls. Safety, confidentiality, consent and anonymity are priority within any research study, however I felt an almost greater sense of responsibility when working with adolescents. This section will briefly outline three of my most prominent reflections when considering the design and implementation of a research study with young girls.

Giving consent. Providing informed consent implies that the individual has the competency to consider the risks and potential benefits of a research study before deciding whether or not to take part. It is important that the research is fully explained in a way that is meaningful to participants. In the HERizon studies, this was done by

developing separate information sheets for adolescents and parents/guardians. Prior to dissemination, the adolescent sheet was piloted with a small group of adolescent girls to obtain feedback on the appropriateness of the language and imagery used.

As the HERizon interventions (studies 2 and 3) were advertised online, there were no traditional gatekeepers, e.g., teachers. As adolescents are considered to be a vulnerable population, even those aged 16 and older, required parental consent (alongside adolescent assent) to take part in the intervention. It was important for parents to be aware of their daughters' engagement in the study as personal information, including home address, was collected during baseline measures. However, in some circumstances, having a parental opt in method may have posed a barrier for girls. For example, if an adolescent wants to take part but a parent/guardian does not want her to take part, or does not return the consent form, if an adolescent is self-conscious of her PA levels and does not want her parent/guardian to know she is involved in a PA intervention, or if requiring parental consent would discourage the girl from taking part in the study (although this is likely more relevant to research exploring topics such as alcohol or drug use in adolescents). It was important to consider these various points when designing the intervention to ensure it best supported the adolescents' safety and welfare, rather than having a template consent process that may be more suitable to adults.

Privacy, confidentiality and safeguarding. Many components of HERizon required girls to engage in online videocalls, e.g., focus groups, interviews and for some, weekly calls with their Activity Mentor. It was important for girls to feel they could speak openly and honestly during these sessions, however it was equally important for girls to be aware of the limitations of confidentiality, i.e., should they disclose something that makes the research team believe they might be in harm (e.g., bullying, disordered eating, abuse), we would need to break confidentiality and inform the necessary people. Information on the HERizon confidentiality and safeguarding procedures were provided to participants and

parents/guardians during recruitment information sessions and in intervention information sheets. All Activity Mentors were trained in how to respond if such an issue arose, and had access to policy documents in the HERizon intervention manual.

Another privacy issue that required consideration was where the girls should be located when on videocalls. In study 2 it was outlined that videocalls should be taken in a 'communal' area of the house, e.g., the sitting room, however during postintervention interviews it was made apparent by participants that this was often not feasible as, due to COVID-19, these areas of the house were busy with parents remote working and siblings remote schooling. For the larger trial (study 3), it was decided that girls were allowed to have videocalls with their Mentors in their bedrooms provided the parent/guardian provided consent.

*Social media.* The use of social media raised an ethical concern when designing a remote intervention running during the COVID-19 pandemic. Although it was important to go where the participants are (i.e. online), it was also vital to do no harm (i.e. the types of posts being uploaded to the social media page, how the live workouts were delivered, how I presented myself as the instructor, subjecting girls to potentially more time spent on social media). To overcome this, rather than uploading group workouts to Instagram, workout classes were held on Zoom where girls could join live, and later the videos were uploaded to a Google Doc folder where girls could download the video to future offline use. Further, participating in the Instagram group chat was optional. Girls were invited to join should they wish but it was not compulsory. The researcher put on average two messages per week into the group to stimulate conversation among participants as this was thought to be an acceptable frequency without encouraging excessive time spent online.



## **6. Unique contribution of this thesis to the scientific literature**

Gaining insights into this particularly at-risk population, adolescent girls living within the UK and Ireland, adds to the current literature which has predominantly explored the factors that influence PA within Australian (Casey et al., 2009; Casey et al., 2015; Craike et al., 2011; Eime et al., 2010; Watson et al., 2015) and Northern American (Belanger et al., 2011; Dwyer, J. et al., 2006; Gavin et al., 2016; Humbert et al., 2008; Walia 2012; Yungblut, 2012) adolescents. To the best of my knowledge, HERizon is the first remote, behaviour change supported, PA intervention for adolescent girls. The iterative, phased approach allowed for participant feedback to directly guide the intervention development and refinement, from recruitment strategies, to data collection methods, to intervention components. Studies 2 and 3 demonstrate that a home-based intervention in the real-world setting show potential for improving adolescent girls' PA health behaviours.

The HERizon Project involved a multidisciplinary team, including PA experts, psychologists, physiologists and statisticians. Having a combined skillset allowed the research problem to be tackled from multiple viewpoints. Further, this was novel in its approach as it employed a 3-dimensional model of teaching, learning and research. This involved offering MSc and Professional Doctorate sport and exercise psychology students a practice placement as an Activity Mentor during studies 2 and 3. By working in a 1-2-1 capacity with participants, the Activity Mentors gained hands on experience, as well as completing course credit that was part of their qualifications.

Study 3 of HERizon involved, to the best of my knowledge, the first multi-arm process evaluation of a PA intervention designed for adolescent girls. This was vital in understanding the contextual factors that influenced the delivery and receipt of The HERizon Project, and to have a better understanding of the intervention outcomes in light of the context in which it was run. It also allowed for us to gain insight to the pragmatic issues involved in implementing research studies in real-world settings, as well as gain a more thorough view of what was implemented (e.g., dose delivered and received) in

order to make accurate conclusions regarding outcome measures, i.e., was what was intended to be delivered, actually delivered.

Although recent reviews have found the limited effect school-based interventions have on adolescent PA (Love et al., 2019b; Owen et al., 2017), it may be possible through process evaluation to understand if the interventions themselves are ineffective, or if other factors are negatively effecting the outcomes of the programme e.g., delivery fidelity, reach (Bellg et al., 2004; Borrelli, 2011; Moore et al., 2015). In order to scale interventions and support sustainability, it is vital for researchers to understand if the components being implemented are reflective of the intervention protocol, and to ascertain if the intervention participants are receiving is what is expected (Moore et al., 2015). A mixed methods approach is critical in gaining a deep understanding of how the programme has run in a real world setting as qualitative data provides further meaning to quantitative outcome measures (Creswell et al., 2006).

### *6.1. Surprising positives of an intervention during COVID-19*

The HERizon intervention studies took place during the COVID-19 pandemic and therefore required novel strategies to be employed. Studies 2 and 3 of this PhD bodies of work were conducted entirely remotely and although this was borne out of necessity to adapt to the global situation from 2020, given the success of many aspects of the intervention, there are particular implementation and evaluation elements that should be considered for future research in a post-COVID-19 era.

The use of social media and paid advertisement were great tools in participant recruitment. Girls or parents/guardians could get directly in contact with me, the researcher, for further information and weekly information sessions were held via Zoom where the full programme was explained in detail and questions were answered. This session was also recorded and emailed to interested participants and parents/guardians, along with an electronic Participant Information Sheet and online consent form. This

overcame many of the barriers faced in study 1, which required schools to coordinate and organise a suitable time for me to come into the class to present the study, as well as getting returned signed paper consent forms. Although similar recruitment strategies are recommended for future research studies, it must be acknowledged that due to the majority of participants having to restrict movements outside of the home and the closures of most extracurricular activities, it is possible that the uptake and adherence to the intervention was higher than it might be in “normal” circumstances pre-COVID-19. With this in mind, future research is needed to assess the effectiveness, adherence, and enjoyment of HERizon whilst girls have regular day-to-day commitments such as going to school, having extracurricular activities and socialising with friends during leisure time.

The remote nature of studies 2 and 3 drastically reduced participant burden as they were not required to attend the lab, nor after school testing sessions. Burden was further reduced as the programmes allowed for participants to carry out PA of their choosing, at a day and time most convenient, rather than needing to attend a specific PA class. Given the results of study 1, barriers such as perceived lack of time were overcome. Although a gold standard lab based VO<sub>2</sub>max test would have provided more robust cardiorespiratory fitness measurements, it was important to consider the overall aim of the study (increasing girls daily physical activity), the context in which it was being run (COVID-19 national lock downs), and the participants targeted (inactive adolescent girls). Limitations of remote testing are discussed in greater details below, however it is suggested that future research consider choosing the most appropriate methodology for the research question, rather than necessarily employing the traditional gold standard methods that may hinder participant recruitment and adherence.

## 7. Strengths and Limitations of this thesis

The individual strengths and limitations of each study have been discussed in detail in the relevant chapters, and therefore this section will discuss the general strengths and limitations of the overall body of work presented in this thesis.

Key strengths include the interdisciplinary nature of the research as studies included subjective psychosocial outcome measures (e.g., motivation, perceived competency and body image), objective measures (e.g., cardiorespiratory fitness, muscular strength and endurance), and process measures (e.g., delivery fidelity and adherence). Further, using a mixed methodology resulted a rich dataset, which provided greater meaning and context to both qualitative and quantitative results. HERizon was developed using a phased approach as the results of each study contributing to the design and refinement of the subsequent study. Using theories and frameworks (e.g., the Medical Research Council guidelines, Self-determination theory, the Socioecological model, the RE-AIM process evaluation framework, the TIDieR checklist, and the CONSORT framework) assisted in the design of the interventions, and in organising study results in a meaningful way. Lastly, seeking participant feedback at each stage of the intervention development (e.g., interviews, focus groups, and exit surveys), allowed the HERizon intervention to be modified and refined so as to better serve the target audience in future iterations.

Although there were several strengths to this thesis, it is important to consider the limitations when drawing conclusions to inform future research and practice.

*Reach.* As it is important to concentrate recruitment on individuals who are likely to benefit most from a given intervention (Moore et al., 2015), the studies included in this thesis aimed to specifically support inactive girls, particularly those from low socioeconomic areas, in becoming more physically active. By evaluating the reach of the studies, it is evident that a weakness of this PhD is the limited success in recruiting the target audience. For example, 30% of girls in study 1 classified themselves as being

‘active’ and, based on Activity Mentor reflection notes, a large proportion of girls in study 3 were engaging in competitive sports regularly throughout the week. It is assumed that the participants who enrolled in the studies had some degree of motivation towards PA as the majority of girls sought information on how to take part in HERizon of their own free will after seeing the intervention advertisement on social media. It is a difficult task to engage girls who are not motivated to be physically active to join a PA programme, and therefore future PA interventions should focus their efforts on engaging these hard to reach individuals, given they may benefit most. Further, the studies include a relatively homogenous sample as more than half the girls in study 2 lived in socially affluent areas and the majority of girls across all studies were of white ethnicity and do not have physical disabilities. Including a more diverse sample will be more representative of the adolescent population of the UK and Ireland, thus allowing study results to be more generalisable. A number of reviews have provided some recommendations of ways to recruit minority and ‘hard to reach’ populations, including snowball sampling, and social marketing (Bonevski et al., 2014; Mutrie et al., 2010; Shaghaghi et al., 2011). Future interventions should also aim to harness relationships with specific community groups where the target audience might frequent, e.g., local youth clubs.

*Remote testing.* Due to COVID-19 lockdown restrictions, study outcome measures were required to be completed at home. In an attempt to standardise fitness testing, participants and parents/guardians were briefed on how to conduct the tests, were provided with instructions (written and visual), and parents/guardians were asked to supervise and support girls during testing sessions. As they were completed without the researcher being present the standardisation cannot be confirmed. Further, conducting focus groups and interviews online may have hampered participants’ comfort, and therefore girls may have not been as open and honest during discussions in comparison to if we had met in person. It would be useful for future interventions to supervise participant fitness testing and to provide a standardised environment for participants to complete psychosocial questionnaires. Further, holding focus groups and interviews in

person may create a more supportive environment, where it is easier to conduct “ice-breaker” activities to build rapport between researcher and participants.

Although these are important limitations to consider, it must also be acknowledged that being “forced” to use such methods given the COVID-19 pandemic, has opened my own and my supervisors’ eyes to the potential strengths of remote data collection. Remote data collection is likely to have contributed to the successful recruitment of participants by greatly reducing the participant/parent/guardian/school burden of needing to travel to the university laboratory, as well as the added value of saving money and time.

*Long-term follow up.* A limitation of this thesis was the lack of long-term follow-up in study 3 as outcome measures were assessed only three months following the end of the intervention. Although the importance of sustained positive impacts following participation in PA interventions is supported (Gillis et al., 2013), there is currently limited data on such sustained effects as few interventions include long-term follow-up (Lai et al., 2014). Evidence shows the short-term positive effects PA interventions can have on improving adolescent health and behaviour, however many of these benefits are lost when the intervention comes to an end (Kriemler et al., 2011). Further, it may be possible that significant positive effects are only evident at long-term follow up, and not immediately postintervention (Goodman et al., 2014). Therefore, to assess the full degree of effect an intervention may have on PA behaviour, it is vital to include long-term follow-up data collection points. Future work should seek to assess girls’ PA levels and behaviours towards PA at least six months after the intervention has ended to evaluate the sustained intervention effect.

## **8. Implications for future practice**

The studies included in this thesis have provided key insights into the current barriers facing adolescent girls engagement in PA, as well as highlighting promising new avenues that may ameliorate their participation. By implementing these findings into the

development and delivery of future PA programmes ran by schools and communities, we may aid the fight in reducing adolescent girls inactivity levels by 15% in support of the Global Action Plan 2030 (WHO, 2018). A summary of key findings and associated implications for future practice are outlined in table 15.

**Table 16.** Summary of thesis key findings & associated implications for future practice

Key finding	Implication for practice
Fun, varied and non-traditional PA options are vital for girls' engagement in physical activity	School and community settings should focus on providing non-team based PA options that are informal and focus on enjoyment over competition or performance. Examples include strength and conditioning, Pilates, yoga and dancing.
Improvements in physical fitness and strength were associated with increases in perceived confidence and competence	Short-term targets should be set to allow girls to feel a sense of accomplishment. Activities should focus on self-improvement and PA intensity (e.g., distance, vigorousness, weight, flexibility) should be gradually increased to maintain a sense of challenge.
Home group workout classes are an enjoyable and acceptable PA option for adolescent girls	Live workout classes led by a female that include minimal equipment/space should be provided. Classes should provide modifications for differing fitness levels, be short in duration (<35 minutes), and should include a combination of different types of exercise types (e.g., cardiovascular exercises and resistance training).
Low body image and fears of comparison/judgement prevent girls engagement in PA	Provision of education around body image and body changes around puberty is needed. Further information should be provided on holistic benefits of PA and not solely aesthetic changes exercise may bring. Creation of a supportive and open environment where girls feel comfortable to exercise without feeling embarrassed and the focus is placed on what the body can do, not what they look like.
Accountability and family support were identified as strong facilitators towards girls' adherence to PA	Parents/guardians should encourage girls by doing PA with them (e.g., walks or doing workouts together). Teachers/ coaches/ parents should provide accountability by checking in with girls to ask if they have completed the PA targets they have set for themselves each week, but without putting pressure on them. The use of a PA logbook or calendar can also assist in feelings of accountability.
Autonomy is essential for girls sustained participation in PA	Girls should have the autonomy to make choices in regard to their PA. Schools and community settings should provide PA options where possible, e.g., type of PA, the setting, the time/day, as well as providing non-judgemental support without pressure.
Societal gendered norms negatively impact girls' perception of PA	Active exploration of the community and school culture is needed to address how local gender biases and stereotypes undermine gender equality. To create a true supportive environment for girls' PA all stakeholders should reflect on current beliefs and practices.



## 9. Recommendations for future research

- A larger, definitive trial is needed to assess the effectiveness of the HERizon intervention in time in which adolescents have returned to school and their typical school/social commitments. A subsequent analysis of study 3 is currently underway to analyse outcome measures of this pilot trial.
- It is recommended that future interventions designed for inactive girls should focus on new settings where girls feel supported and comfortable in breaking gender boundaries and social stereotypes. As fear of comparison is a prevalent barrier to girls' engagement in PA, the home setting may be an optimal space as it is family oriented and shields girls from the perceived judgement of others.
- To increase recruitment and engagement of adolescent girls, it is suggested that future PA interventions provide participants with a wide range of physical activities that they can freely choose from. In particular, more research is required into the physical and psychosocial effects resistance training has on girls' health, as well as exploring girls' perceptions on being involved in a typically male dominated activity like weightlifting.
- To better understand how interventions run in a real world setting, more mixed methods process evaluations are needed prior to concluding the effectiveness of the intervention. Qualitative research and surveys should be included in intervention design to better understand what participants find acceptable and appropriate. Though girls involved in the HERizon studies reported that edited editorial style fitness imagery did not motivate them to exercise, it is unknown if other adolescent cohorts have similar motivators and therefore they should be consulted during intervention development, and throughout/after intervention implementation.
- More research is required to explore the nuanced influence social relationships have on girls' PA, and to investigate what conditions are required to create a physical or virtual community which is conducive to girls' PA participation.

- For sustained improvements, future research should focus on the exploration of stakeholder (e.g., teachers, parents, and peers) beliefs and biases surrounding girls involvement in PA in order to better inform the implementation and delivery of PA interventions. To better equip PE teachers in engaging all students, it may be important to explore the impact of including information on gender/social class/racial PA differences during teacher training on class participation.

## **10. Thesis conclusions and personal reflections**

This PhD aimed to gain a deeper understanding of adolescent girls' perceived barriers and facilitators to PA, and to use these insights to develop an enjoyable and acceptable PA intervention (The HERizon Project) for this population. Through conducting a formative assessment and process evaluation of HERizon, information was gained on the intervention's implementation and preliminary effectiveness which can be used to further refine, and potentially scale, the programme. Conducting a larger trial with multiple arms allowed for the exploration of intervention components and for hypotheses to be generated regarding which components are most effective in increasing girls' MVPA.

In support of previous literature, it is clear that girls' relationship with PA and exercise is complex and multi-faceted. This thesis provides support for the use of alternative settings, outside of the school, for PA research. Autonomy, relatedness and competence need satisfaction were found to be prominent facilitators to girls' perception and engagement in PA, however other external societal factors are found to be significant barriers. Perhaps an alternative view to girls "drop out" of PA is needed. Maybe instead, girls feel as though they are being "pushed out" of PA and sport, therefore it is important for future work to consider the effects of gender stereotypes and biased norms when developing PA interventions/programmes for adolescent girls.

### *9.1 Personal reflections of my PhD journey*

My PhD journey has challenged and changed me academically, professionally and personally. My subject knowledge has improved ten-fold since starting, however now I'm at the end of a degree I had once only dreamed of, I realise this is only the tip of the iceberg. But this is exciting to me now, and I hope to spend the rest of my career furthering my understanding of girls and their PA behaviours. Upon reflecting on my PhD journey, seven key lessons are at the forefront of my mind:

- **The SUPERvisory team.** I have been incredibly lucky to be supervised by a large multidisciplinary team including physiologists, psychologists, physical activity experts and statisticians. This has given me opportunities to learn a wide range of outcome and process measures including focus groups, field based fitness testing and physical activity measurement. I have developed a more comprehensive understanding on intervention development, implementation and evaluation, and an appreciation of different perspectives of the intervention design process.
- **The Perils of Publishing.** Getting some experience of the publishing world during my PhD has been a highlight. It has been very challenging at times, learning to write to that standard and having work peer-reviewed, but to have the HERizon work accepted for publication is a great honour. All that comes with submitting a manuscript (the review process, the desk rejection, open access fees, my first citation) has been a huge learning for me and I am grateful of having that experience as I feel better prepared going into the next stage of my research career.
- **Stand and Deliver.** I am an introvert by nature and presenting my work was a big fear of mine. I had plenty of opportunities to attend conferences in person and online throughout my PhD where I have been able to present my studies, and I have gained so much through the audience questions and discussion after the presentations. I have also learned that people really can't read size 10 font on slides, nor can I get through 20 slides in a 7 minute presentation. I've also had the opportunity to support

lecturers at LJMU which has also been a great teaching experience and understanding the learning needs of third level students. Leading the weekly live workout classes during HERizon has also been critical to developing my oral communication. Talking to a group of teenage girls may in fact be more intimidating than a group of academics!

- **Get Up and Do Something.** A PhD is undoubtedly a mountain of work that needs to be picked away at each day. This academic journey has taught me the importance of discipline and proactivity, as ultimately writing and running all the studies were my responsibility as the PhD candidate. I have learnt that if I am facing issues or need support, it is up to me to ask for help. Further, my PhD is *my* entire world, but it is only a *very small* snippet of my supervisors'. Therefore, to get the most out of supervisory meetings, being organised and prepared was vital to communicate clearly what support I needed.
- **Participants are people.** Working with adolescents in a real-world setting, outside of a controlled lab environment, has given me an appreciation of the many considerations that are required to ensure accurate data is collected, e.g., making data collection as easy as possible for the participants, such as online questionnaires, <60 min interviews and recorded live workouts for playback. I also now appreciate that having girls' input into intervention design is critical for intervention uptake and enjoyment, e.g., I learnt that only "dinosaurs" use Facebook and that Instagram/Tik Tok is where the girls spend their time!
- **Fears of Feedback.** I have learnt to love getting feedback on my work. In the beginning of my PhD, getting a document back with reels of comments was a little daunting, and often times disheartening. However I now realise these negative feelings were due to my perception of what feedback means. I now see it as a way that helps me to improve my work and I have developed processes to help me deal with large amounts of feedback to avoid feeling overwhelmed (i.e., read through the

feedback and then close the document. Come back to it with fresh eyes after a day and things don't look so scary!).

- **This is a (privileged) Choice.** This has been one of the most important lesson to me to always remember that doing a PhD is ultimately a choice. Both my mum and dad left school before they were 15 and, although this was somewhat common in the early 80's, it is important for me acknowledge the effort and sacrifice they have put in over the years to provide me with financial means and work ethic to continue through third level education. Keeping this in mind has also helped me to see the bigger picture when I sometimes got caught up in HERizon. I am not being forced to do this. How luck am I to be able to leave if I want to. I am incredibly grateful to be given the opportunity to carry out the research that I love. I know that pursuing a PhD is a great honour, but it is also important to remember, when I thought the world was going to fall apart because my accelerometer GGIR analysis failed or someone didn't return their online questionnaire, that there is in fact much more to life than my three studies.

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# APPENDICES

## MATERIAL FOR CHAPTER 2 (STUDY 1)



### LIVERPOOL JOHN MOORES UNIVERSITY PARTICIPANT INFORMATION SHEET

**Title of Project:** Using qualitative research to inform the development a home-based HIIT intervention for adolescent girls'.

**Name of Researchers and School/Faculty:**

Researcher:	Miss Emma Cowley
Research team members:	Prof Anton Wagenmakers & Dr Paula Watson
School/Faculty:	Research Institute for Sports and Exercise Sciences (RISES) School of Sport and Exercise Sciences Faculty of Science

You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. Ask us if there is anything that is not clear or if you would like more information. Please take the time to decide if you want to take part or not.

#### 1. What is the purpose of the study?

The aim of this study is to discuss what helps and hinders teenage girls to exercise, to find out what extra supports you feel you might need to help you stick to a more active lifestyle and to get your feedback on an example home exercise programme.

#### 2. Who can take part?

We are interested in talking to **girls aged 13-18 years** who are **not very active, and tend to avoid sport/exercise**. If this is you, you may take part. You have been invited to partake in this study because your school/ youth club has expressed interest in being involved.

#### 3. Do I have to take part?

No. It is up to you to decide if you would like to participate or not. If you do decide to participate you will be asked to sign a consent form. You will still be free to withdraw from the study at any time and without giving a reason. A decision to withdraw will not affect your legal rights. If more consent forms are returned to the research team than expected, not everyone will be asked to participate. If this happens we will contact you to let you know whether or not you have been selected to participate.

#### 4. What will happen to me if I take part?

If you consent to taking part in this study, you will first be asked to complete the attached demographic and physical activity questionnaire. The information from this questionnaire will be anonymised and stored for a maximum of 5 years by LJMU. You don't have to answer any questions that you do not want to. Following this, if you are selected, you will take part in a group discussion that will last between 30-45 minutes. This will be take place in your school/ youth club building during opening hours. The discussion will have of approximately 5 other students from your school/ club. During the discussion, you will be asked your views, attitudes and beliefs about exercise and physical activity, information on what helps you to do exercise and things that might stop you from exercising. We will also ask for your opinion on a home-based exercise programme which we will show you by video. The researcher will ask some specific questions to help keep the discussion focused but it will be flexible so that more time can be spent on certain topics if needed. The interviews will be audio-recorded. All data collected during the focus groups will be anonymised and securely stored for 5 years on LJMU premises.

#### 5. Are there any risks / benefits involved?

There are no known risks or benefits to taking part in the research. The information you share will be used to help other girls be active so that they can improve their health.

#### 6. Will my taking part in the study be kept confidential?

Findings of this study will be shared in scientific journals and presented at conferences. Before any results are published, names and any identifiable information will be removed. This means that no-one reading about the study will be able to tell who took part or who said what.

The researcher will treat everything you tell her during the focus group with confidentiality. The only circumstance in which the researcher would share anything you say with anyone outside the research team, would be if they are concerned you or someone else might be in harm. If this happens she will talk with you after the focus group and put you in touch with someone who can help you.

The other thing to be aware of is that there will be other girls in the focus group, so we cannot ensure full confidentiality of what is said, as it is possible other girls will talk about the focus group afterwards. We will however encourage all girls to keep the conversation confidential to those who are present.

**This study has received ethical approval from Liverpool John Moores Ethics committee - 19/SPS/023**

**Contact Details of Researcher**

Miss Emma Cowley  
[E.S.Cowley@ljmu.ac.uk](mailto:E.S.Cowley@ljmu.ac.uk)

**Please see data protection information below.**

**Data protection notice**

Liverpool John Moores University is the sponsor for this study based in the United Kingdom. We will be using information from you in order to undertake this study and will act as the data controller for this study. This means that we are responsible for looking after your information and using it properly. Liverpool John Moores University will process your personal data for the purpose of research. Research is a task that we perform in the public interest. Liverpool John Moores University will keep identifiable information about you for 5 years after the study has finished and then it will be destroyed through confidential waste services.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. However, all data already collected will be anonymised.

You can find out more about how we use your information at by contacting [secretariat@ljmu.ac.uk](mailto:secretariat@ljmu.ac.uk).

If you are concerned about how your personal data is being processed, please contact LJMU in the first instance at [secretariat@ljmu.ac.uk](mailto:secretariat@ljmu.ac.uk). If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: <https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/>

**If you have any concerns regarding your involvement in this research, please discuss these with the researcher in the first instance. If you wish to make a complaint, please contact [researchethics@ljmu.ac.uk](mailto:researchethics@ljmu.ac.uk) and your communication will be re-directed to an independent person as appropriate.**



## LIVERPOOL JOHN MOORES UNIVERSITY CONSENT FORM

**Title of Project:** Using qualitative research to inform the development a home-based HIIT intervention for adolescent girls.

**Name of Researchers**

Researcher: Miss Emma Cowley

Research team members: Prof Anton Wagenmakers, Dr Paula Watson, Prof Dick Thijssen, Dr Rob Noonan.

School/ Faculty: Research Institute for Sports and Exercise Sciences (RISES)  
School of Sport and Exercise Science Faculty  
of Science

I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.

I understand that any personal information collected during the study will be anonymised and remain confidential.

I agree to take part in the above study.

I agree for the interview to be audio recorded and the information to be anonymously stored and analysed at a later time.

I agree to be contacted again by the LJMU research team in relation to being invited to participate in a future study on home-based HIIT.

Name of Participant: Date: Signature:

Name of Researcher: Date: Signature:

## Participant Demographic and Physical Activity Questionnaire

Q1. Please give your date of birth (DD/MM/YYYY): .....

Q2. What is your height? \_\_\_\_\_

Q3. What is your weight? \_\_\_\_\_

Q4. Which do you feel best describes your ethnic group or background (Tick one):

White		Mixed or multiple ethnic groups	
Asian or Asian British		African or Black	
Caribbean or Black British		Other ethnic group	

Q5. Please write the first three digits of your home postcode, if you know it?

.....

Q6. Which statement do you feel describes you best?

Remember there is no right or wrong answer! Just be as honest as possible.

"I am often active and enjoy sports/ exercise"

☐

"I am mostly inactive – if I can avoid sports/ exercise I will!"

☐

## Youth Activity Profile physical activity questionnaire

### Activity Levels – at School

These questions ask about your physical activity **at school**. This includes physical education, but you may also be active on your way to school, during playtime/break, or at lunch. **Answer the questions based on your physical activity at school in the last 7 days.** Put an X next to the response that best refers to you.

**1. Activity to School:** How many days did you **walk or bike to school**? *(If you can't remember, try to estimate)*

0 days (never)	
1 day	
2 days	
3 days	
4-5 days (most every day)	

**2. Activity during Physical Education Class:** During **physical education**, how often were you running and moving as part of the planned games or activities? *(If you didn't have PE, choose "I didn't have physical education")*

I didn't have physical education	
Almost none of the time	
A little bit of the time	
A moderate amount of time	
A lot of the time	
Almost all of the time	

**3. Activity During Playtime:** During **playtime**, how often were you playing sports, walking, running, or playing active games? *(If you didn't have a break at school, choose "I didn't have recess")*

I didn't have playtime	
Almost none of the time	
A little bit of the time	
A moderate amount of time	
A lot of the time	
Almost all of the time	

**4. Activity During Lunch:** During **lunch break**, how often were you moving around, walking or playing? *(If you didn't have a break at school, choose "I didn't have lunch breaks")*

I didn't have lunch breaks	
Almost none of the time	
A little bit of the time	
A moderate amount of time	
A lot of the time	
Almost all of the time	

**5. Activity From School:** How many days did you **walk or bike from school**? *(If you can't remember, try to estimate)*

0 days (never)	
1 day	
2 days	
3 days	
4-5 days (most every day)	



### Activity Levels – at Home

These questions ask about your physical activity **out of school**. This includes activities that you do before and after-school and on weekend days. **Answer the questions based on your physical activity at school in the last 7 days.** Put an X next to the response that best refers to you.

**6. Activity before School:** How many days **before school (6:00-8:00 am)** did you do some form of physical activity for at least 10 minutes? *(This includes activity at home NOT walking or biking to school)*

0 days	
1 day	
2 days	
3 days	
4 to 5 days	

**7. Activity after School:** How many days **after school (between 3:00 - 6:00 pm)** did you do some form of physical activity for at least 10 minutes? (This can include playing with your friends/family, team practices or classes involving physical activity but **NOT walking or biking home from school**)

0 days	
1 day	
2 days	
3 days	
4 to 5 days	

**8. Activity on Weeknights:** How many **school evenings (6:00 - 10:00 pm)** did you do some form of physical activity for at least 10 minutes? (This can include playing with your friends/family, team practices or classes involving physical activity but **NOT walking or biking home from school**)

0 days	
1 day	
2 days	
3 days	
4 to 5 days	

**9. Activity on Saturday:** How much physical activity did you do last **Saturday**? *(This could be for exercise, work/chores, family outings, sports, dance, or play. If you don't remember, try to estimate)*

No activity (0 minutes)	
Small amount of activity (1 to 30 minutes)	
Small to Moderate amount activity (31 to 60 minutes)	
Moderate to Large amount of activity (1 to 2 hours)	
Large amount of activity (more than 2 hours)	

**10. Activity on Sunday:** How much physical activity did you do last **Sunday**? *(This could be for exercise, work/chores, family outings, sports, dance, or play. If you don't remember, try to estimate)*

No activity (0 minutes)	
Small amount of activity (1 to 30 minutes)	
Small to Moderate amount activity (31 to 60 minutes)	
Moderate to Large amount of activity (1 to 2 hours)	
Large amount of activity (more than 2 hours)	

### Sedentary Behaviour

These questions ask about your **non-physical activities**. This includes activities that you do in your free time such as watching TV, playing video games and using your mobile phone. **Answer the questions based on your sedentary behaviour in the last 7 days.** Put an X next to the response that best refers to you.

**11. TV Time:** How much time did you spend **watching TV** outside of school time *(This includes time spent watching movies or sports but NOT time spent playing video games)*

I didn't watch TV at all	
I watched less than 1 hour per day	
I watched 1 to 2 hours per day	
I watched 2 to 3 hours per day	
I watched more than 3 hours per day	

**12. Video Game Time:** How much time did you spend **playing video games** outside of school time? *(This includes games on Nintendo DS, Wii, Xbox, PlayStation, iTouch, iPad, or games on your phone)*

I didn't really play at all	
I played less than 1 hour per day	
I played 1 to 2 hours per day	
I played 2 to 3 hours per day	
I played more than 3 hours per day	

**13. Computer Time:** How much time did you spend using **computers** outside of school time? *(This doesn't include home work time but includes time on Facebook as well as time spent surfing the internet, instant messaging, playing computer games)*

I didn't really use the computer at all	
I used a computer less than 1 hour per day	
I used a computer 1 to 2 hours per day	
I used a computer 2 to 3 hours per day	
I used a computer more than 3 hours per day	

**14. Phone Time:** How much time did you spend using your **mobile phone** after school? *(This includes time spent talking, texting, or using social media like Facebook, or Instagram).*

I didn't really use a mobile phone	
I used a phone less than 1 hour per day	
I used a phone 1 to 2 hours per day	
I used a phone 2 to 3 hours per day	
I used a phone more than 3 hours per day	

**15. Overall Sedentary Habits:** Which of the following best describes your **typical** sedentary habits at home? *(Try to think about a typical week and not just last week)*

I spent almost none of my free time sitting	
I spent little time sitting during my free time	
I spent a moderate amount of time sitting during my free time	
I spent a lot of time sitting during my free time	
I spent almost all of my free time sitting	

*Thank you for completing the survey!*

### Focus group question guide

Young people are advised to be active for 60 minutes every day. Would you say that you are a physically active person? Do you think that you meet this guideline?

What are your favourite types of exercise?

What do you think are the benefits of regular exercise?

How do you think we could help more adolescent girls be active/engage with exercise?

Can you tell me some reasons that girls stop playing sports or other physical activities?

Do you know what High Intensity Interval Training is?

Based on this exercise example (show short video of sample HIIT workout);

- Tell me anything you like about this idea?
- Tell me anything you don't like?
- How would you feel about doing this workout at home?
- To have benefits it would be important to do this workout regularly, what do you think would increase the chances of you doing this?
- How could we make this workout more enjoyable for you? Could you give me your opinion and feedback?

Is there any thoughts or ideas that you would like to share that hasn't been covered in today's discussion?

## MATERIAL FOR CHAPTER 3 (STUDY 2)



# Information for Teenagers

Before you decide if you wish to take part, please make sure that you understand:

1. Why the research is being done
2. What your involvement in the project will be
3. Although we would be delighted to have you participate, it is ENTIRELY up to you. If you decide you would not like to take part that is absolutely OK, and it will not affect your statutory rights.

Take your time to read through this information sheet before you decide if you wish to take part. Ask as many questions as you wish.



My name is Emma and I work as a researcher at the Liverpool John Moores University. I would like to invite you to take part in our research study looking at investigating if a physical activity programme is enjoyable and effective for teenage girls.

### Why are you Doing this Research?

More than 84% of teenage girls in the UK are not meeting the national guidelines of 60 minutes physical activity per day. Physical activity is SO important for our physical, mental and social health and therefore we hope that this programme will help to encourage more teenage girls to be active.

#### What is the Purpose of this Research?

The aim of our research is to keep girls physically active during this very unsettling time and to understand what types of home-based exercise you enjoy/ don't enjoy.

84%

OF UK GIRLS ARE INACTIVE

## Am I Able to Take Part?

You are able to take part if: 1) you are a girl!, 2) you are aged 13-16 and 3) you currently live in the UK or Ireland.



## How do you know if the Programme Works?

A good way to test if something works is to compare it against 'normal life'. To do this, we will ask some girls to do the physical activity programme (we call this the *intervention group*) and we will ask the other girls to continue on as normal for comparison (we call this the *control group*). Both groups are really important for the study, without the control group we won't know if the programme has increased physical activity in comparison to normal everyday life.

## Will I get the physical activity programme or be in the control group?

Everyone will eventually get the programme; however, some girls will start the programme right away and others will be asked to wait six weeks. We choose who goes into what group randomly, the same as tossing a coin, so that it is as fair as possible. Therefore, you have a 50/50 chance of being in the group that starts first. Once we have your consent forms back, we will randomly allocate you to a group. The programme will then start immediately. If you are in the control group, we will just come back and take measurements at the times below. After six weeks you will then start your exercise programme!

## What Would I Be Asked to Do if I Take Part?

*BOTH intervention & control schools*

Because of the Corona virus everything will be remote – meaning you won't have to come into a lab for any part of the study. Exercise will be done in your house/ garden; however you may need to use a green space outside for the 20m shuttle run test if you decide to take part. Assessments at the beginning and the end of the programme will take about 1 hour each.

If you want to take part, we will ask that you volunteer to take part in the following tasks:

- Physical activity levels - to measure how much physical activity you do in one week.
- Aerobic fitness- you will jog back and forth between two lines before you hear a bleep sound. As the levels go on, the speed will increase and so you will need to run faster after each level in order to keep up with the beeps. The test will stop once you don't make it back to the line in time for the beep. You will use a mobile app to guide you through this assessment.



- Muscular endurance – you be asked to use the same app to complete a push up assessment. You will listen to an audio file that tell you when to do a push up. If you would prefer to do push ups form your knees that is absolutely fine.



- Strength/ power – you will be asked to use the same app for this last assessment. You will start standing still and jump as far forward as you can. After you have marked where you landed, you will measure the distance you jumped and record it in your app.



- Online questionnaires – these will help us to investigate if physical activity affects your psychosocial wellbeing. Questionnaire topics will include your motivation to be physically active (“I exercise because it’s fun”), need satisfaction (“I perform really well at all kinds of sport OR I don’t feel that I am very good when it comes to sport”), body image (“I respect my body”), self-esteem (“I feel like I fit in well with others”) and psychological wellbeing (“Do you feel fit & well?”).



- Phone interview - you may be invited to take part in an individual discussion to talk about your experience of the programme. Questions will include: “Can you tell me anything you have liked about the programme so far?, Can you tell me anything you don’t like?, How could we make this programme more enjoyable for you?”. If you are selected to take part, you are free to decline. These discussions will be recorded and anonymised so that no one can be identified from them.



- Personal questions will ask – One of the questionnaires you will be asked to complete if you decide to take part will ask you some personal information. This will include your name, age, school year, first three digits of your home postcode, ethnicity and if you have started to have periods. This information is sensitive and therefore it will not be shared with anyone else outside the research team. This information is important as it helps us to get a better idea about different factors that might affect how physically active you are or how you are feeling.

#### **If I am in the Intervention group, what does the Physical Activity Programme Involve?**

**Exercise sessions.** You will be able to choose from different types of home-based physical activities (e.g. virtual exercise classes or design your own) and you can change your selection over the course of the programme. We suggest that you do 3 pre-planned physical activity sessions per week, however you can exercise more or less without it affecting your participation in the study. We also encourage you to schedule these sessions for every other day, however we understand that sometimes this is not possible.

**Behaviour change consultations.** You will have weekly 15-20-minute consultations with a researcher over the course of the 6-week programme. These will be via phone call or video call (whatever you prefer). The aim of these consultations is to help you develop your motivation towards physical activity, confidence in your abilities and to support you in making any changes to your physical activity.

**Support messages.** These messages will be sent to your mobile by one of the researchers twice per week for six weeks. They will be focused on providing you additional support and reminders.

### **Do I have to Take Part?**

It is completely up to you if you wish to take part in the study. Make sure you think carefully and consider all the information contained in this sheet before you decide.

After you have decided you will be asked to sign an assent form that shows you understand and agree to take part in the research. Your parent/guardian will also need to sign a consent form to agree for you to take part.

#### **What if I Change my Mind?**

You are free to withdraw from the study at any point without having to give a reason. If you decide to withdraw any data already collected will be used in the final analysis. Please remember that your data will be anonymised, and you will not be identified in any way.



**NO**



### **How long is the study?**

The study will take 6 months to complete.

### **Where will the study take place?**

In your own home.

### **Are there any possible disadvantages from taking part?**

- If you are not frequently physically active, you may feel tired after the exercise tests and physical activity sessions. This usually only lasts a couple of days and will occur less the more frequently you exercise. Performing a good warm up and cool down routine will also help to minimise this feeling.
- As with any physical activity, there is a small risk of injury. If you are in the intervention group, the level of risk will depend on what physical activity you choose, e.g. if you decide to join a rugby team there may be higher risk of injury in comparison to a Pilates class!
- During vigorous exercise there is a very minimal risk of unforeseen heart failure. Unfortunately, there is very little data about the risk of cardiac event during/ following high intensity training in healthy young people like you. However, in people with heart disease the risk of a cardiovascular event during/ following high intensity exercise is the same as for traditional moderate intensity exercise, with the overall risk being low. As you are a healthy participant this risk is extremely low.

If at any point during the physical activity programme you feel comfortable or unable to continue, please stop immediately. Tell your parent/ guardian first and then the researcher.

### **Will my information be kept private? Will anyone else know that I am taking part?**

The information you provide as part of the study is the **study data**. Any study data from which you can be identified (e.g. from identifiers such as your name, age, school year, audio recording etc.), is known as **personal data**. This includes more sensitive categories of personal data (**sensitive data**) such as your race; ethnic origin; politics; religion; trade union membership; genetics; biometrics (where used for ID purposes); health; sex life; or sexual orientation. When you agree to take part in a study, we will use your personal data in the ways needed to conduct and analyse the study and if necessary, to verify and defend, when required, the process and outcomes of the study. Personal data will be accessible to the study team. In addition, responsible members of Liverpool John Moores University be given access to personal data for monitoring and/or audit of the study to ensure that the study is complying with applicable regulations. When we do not need to use personal data, it will be deleted or identifiers will be removed. Personal data does not include data that cannot be identified to an individual (e.g. data collected anonymously or where identifiers have been removed). However, your consent form, contact details, audio recordings etc. will be retained for 10 years.



#### **Who is organising and approving the research?**

The research is being sponsored by the University Alliance Doctoral Training Alliance and Liverpool John Moores University. The research has also been approved by Liverpool John Moores University Research Ethics Committee, a group of people who work to protect your safety, rights, wellbeing and dignity (Reference number: 20/SPS/TBC).

#### **Who should I ask if I have further questions?**

If you have any questions relating to the information contained in this sheet, please let me know:

Researcher: Emma Cowley – [e.s.cowley@ljmu.ac.uk](mailto:e.s.cowley@ljmu.ac.uk)

Research Supervisor: Prof Anton Wagenmakers – [a.j.wagenmakers@ljmu.ac.uk](mailto:a.j.wagenmakers@ljmu.ac.uk)





## CONSENT FORM FOR ADOLESCENTS

(to be completed by the adolescent and parent/guardian)

**Researcher:** Emma Cowley, PhD candidate

**Research Team:** Dr Paula Watson, Professor Dick Thijssen, Dr Lawrence Fowweather, Dr Sarahjane Belton, Dr Andrew Thompson and Professor Anton Wagenmakers.

**School/Faculty:** Research Institute for Sports and Exercise Sciences (RISES), School of Sport & Exercise Science, Faculty of Science, Liverpool John Moores University.

*Please tick/ cross the relevant boxes below:*

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

1

2. I understand that my participation in the project is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.

2

3. I understand that any personal information collected during the study will be anonymised and remain confidential.

3

4. I give permission for the research team to ask for my mobile number and email address for the sole purpose of behaviour change support calls (weekly) and SMS (twice per week).

5

5. I give permission to be involved in a phone interview during post-intervention assessments should I be randomly selected.

6

6. I agree to take part in the above study.

7

**ADOLESCENT** - If you want to take part, you can write your name below

**Your name:** \_\_\_\_\_

**Sign:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**RESEARCHER** -The researcher who explained this project to you

**Print Name:** EMMA COWLEY

**Sign:**

**Date:** 14<sup>th</sup> April, 2020

### Participant contact information

- Q1. Participant code: .....
- Q2. What is your phone number? .....
- Q3. What is your email address? .....
- Q4. What is your emergency contacts name? .....
- Q5. What is your emergency contacts relationship to you? .....
- Q6. What is your emergency contacts mobile number? .....

### Participant demographic questionnaire

- Q1. Name: .....
- Q2. Please give your age (years): .....
- Q2. What is school year are you currently in? .....
- Q3. What is the first three digits of your home postcode? .....
- Q4. What is your phone number? .....
- Q5. What is your email address? .....
- Q6. Which do you feel best describes your ethnic group or background (Tick one):

White		Mixed or multiple ethnic groups	
Asian or Asian British		African or Black	
Caribbean or Black British		Other ethnic group	

- Q7. What is your emergency contacts name? .....
- Q8. What is your emergency contacts relationship to you? .....
- Q9. What is your emergency contacts mobile number? .....

### Pubertal status questionnaire

Have you begun to menstruate (have periods)?

<input type="radio"/>	No, I have not yet begun to menstruate
<input type="radio"/>	Yes, I began at the age of ____ years and ____ months.

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor? Y ☐ N ☐
2. Do you ever experience chest pain during physical activity? Y ☐ N ☐
3. Do you ever lose balance because of dizziness or do you ever lose consciousness? Y ☐ N ☐
4. Do you have a history of epilepsy or seizures? Y ☐ N ☐
5. Do you have a bone or joint problem that could be made worse by a change in your physical activity participation? Y ☐ N ☐
6. Is your doctor currently prescribing you any medication? Y ☐ N ☐
7. Do you know of any other reasons why you should not undergo physical activity? This might include diabetes, a recent injury, or a serious illness. Y ☐ N ☐

If you answered **“YES”** to any of the above questions, medical clearance from your doctor is required. Please give details of the above questions answered with **“YES”** here:

## Physical Activity Questionnaire

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

*Although we would prefer for you to fill in all the sections, you do not have to! If you want to skip any parts you are free to do so.*

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Some examples of physical activity are running, walking quickly, cycling, dancing, skateboarding, swimming, football, and gymnastics.

1. Over the **past 7 days**, on how many days were you physically active for a total of at least 60 minutes per day?

0 days	1 day	2 days	3 days	4 days	5 days	6 days	7 days
--------	-------	--------	--------	--------	--------	--------	--------

2. **Outside school hours:** how **often** do you usually exercise in your free time so much that you get out of breath or sweat?

Every day	4-6 times per week	2-3 times per week	Once a week	Once a month	Less than once a month	Never
-----------	--------------------	--------------------	-------------	--------------	------------------------	-------

3. **Outside school hours:** How many **hours a week** do you usually exercise in your free time so much that you get out of breath or sweat?

None	About half an hour	About 1 hour	About 2-3 hours	About 4-6 hours	7 hours +
------	--------------------	--------------	-----------------	-----------------	-----------

4. On a typical day is the **main** part of your journey **to** school made by...

Walking	Bicycle	Bus, train, tram, underground or boat	Car, motorcycle, moped	Others
---------	---------	---------------------------------------	------------------------	--------

5. How long does it usually take you to travel to school from your home?

Less than 5 minutes	5-15 minutes	15-30 minutes	30 minutes to 1 hour	1 hour +
---------------------	--------------	---------------	----------------------	----------

6. About how many **hours PER DAY** do you usually watch TV (including videos and DVDs) in your free time? Weekdays and weekend.

None at all	About half an hour	About 1 hour	About 2 hours	About 3 hours	About 4 hours	About 5 hours	About 6 hours	About 7 hours or more
-------------	--------------------	--------------	---------------	---------------	---------------	---------------	---------------	-----------------------

7. About how many **hours PER DAY** do you usually play games on a computer or games console (PlayStation, Xbox, GameCube etc.) in your free time. Weekdays and weekend.

None at all	About half an hour	About 1 hour	About 2 hours	About 3 hours	About 4 hours	About 5 hours	About 6 hours	About 7 hours or more
-------------	--------------------	--------------	---------------	---------------	---------------	---------------	---------------	-----------------------

8. About how many **hours PER DAY** do you usually use a computer for chatting online, internet, emailing, homework etc. in your free time? Weekdays and weekend.

None at all	About half an hour	About 1 hour	About 2 hours	About 3 hours	About 4 hours	About 5 hours	About 6 hours	About 7 hours or more
-------------	--------------------	--------------	---------------	---------------	---------------	---------------	---------------	-----------------------

## Perceived Competence Scale

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

*Although we would prefer for you to fill in all the sections, you do not have to! If you want to skip any parts you are free to do so.*

		Not true at all		Somewhat true		Very true		
		1	2	3	4	5	6	7
1	I feel confident in my ability to be physically active regularly.							
2	I now feel capable of being physically active regularly.							
3	I am able to be physically active over the long term.							
4	I am able to meet the challenge of being physically active regularly.							

## Body Appreciation Scale

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

*Although we would prefer for you to fill in all the sections, you do not have to! If you want to skip any parts you are free to do so.*

Directions: Please indicate whether the question is true about you never, seldom, sometimes, often, or always.

	Never	Seldom	Sometimes	Often	Always
1. I respect my body					
2. I feel good about my body					
3. I feel that my body has at least some good qualities					
4. I take a positive attitude towards my body					
5. I am attentive to my body's needs					
6. I feel love for my body					
7. I appreciate the different and unique characteristics of my body					
8. My behaviour reveal my positive attitude towards my body; for example, I hold my head high and smile					
9. I am comfortable in my body					
10. I feel like I am beautiful even if I am different from media images of attractive people (e.g. models, actresses).					

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

*Although we would prefer for you to fill in all the sections, you do not have to! If you want to skip any parts you are free to do so.*

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you.

Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel. Your responses will be held in confidence and only used for our research purposes.

		<b>Not true for me</b>		<b>Sometimes true for me</b>		<b>Very true for me</b>
1	I exercise because other people say I should	0	1	2	3	4
2	I feel guilty when I don't exercise	0	1	2	3	4
3	I value the benefits of exercise	0	1	2	3	4
4	I exercise because it is consistent with life goals	0	1	2	3	4
5	I exercise because it's fun	0	1	2	3	4
6	I don't see why I should have to exercise	0	1	2	3	4
7	I take part in exercise because my friends/family/partner say I should	0	1	2	3	4
8	I feel ashamed when I miss an exercise session	0	1	2	3	4
9	I consider exercise to be part of my identity	0	1	2	3	4
10	It's important to me to exercise regularly	0	1	2	3	4
11	I can't see why I should bother exercising	0	1	2	3	4

		Not true for me		Sometimes true for me		Very true for me
12	I enjoy my exercise sessions	0	1	2	3	4
13	I exercise because others will not be pleased with me if I don't	0	1	2	3	4
14	I consider exercise a fundamental part of who I am	0	1	2	3	4
15	I don't see the point in exercising	0	1	2	3	4
16	I feel like a failure when I haven't exercised in a while	0	1	2	3	4
17	I think it is important to make the effort to exercise regularly	0	1	2	3	4
18	I find exercise a pleasurable activity	0	1	2	3	4
19	I feel under pressure from my friends/family to exercise	0	1	2	3	4
20	I get restless if I don't exercise regularly	0	1	2	3	4
21	I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
22	I think exercising is a waste of time	0	1	2	3	4
23	I consider exercise consistent with my values	0	1	2	3	4
24	I feel under pressure from my friends/family to exercise.	0	1	2	3	4

## SELF-ESTEEM QUESTIONNAIRE

**Participant code:** \_\_\_\_\_

Do you consent to completing this questionnaire? Yes/ No

*Although we would prefer for you to fill in all the sections, you do not have to! If you want to skip any parts you are free to do so.*

	Almost all of the time	A lot of the time	Some of the time	A little of the time	Hardly ever
1. I am able to stand up for myself and what I believe in					
2. How I feel about myself depends on what others think of me					
3. I feel I can be myself around other people.					
4. <u>Overall</u> , I feel good about my abilities compared to others (e.g. at school, playing sport, or socially)					
5. If I make an innocent mistake, I let it get me down					
6. I feel useless					
	<b>Strongly agree</b>	<b>Agree</b>	<b>Neither agree nor disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
7. Overall, I like who I am					
8. I am a good person who has a lot to offer					
9. I feel that I am a valuable person who is at least equal to other people					
10. How I feel about my body makes me less confident					
11. I feel confident in my abilities to achieve the things I set my mind to					
12. I think other people like me					



### Focus group question guide

Can you tell me anything you have liked about the programme so far?

Can you tell me anything you don't like?

What do you think would increase the chances of you sticking to the programme? I.e. doing your 3 exercise sessions per week.

Tell me what you think of the weekly texts and calls

How could we make this programme more enjoyable for you? Could you give me your opinion and feedback?

Tell me your thoughts on the assessments? I.e. questionnaires and fitness tests.

Description of the development of The HERizon Project in accordance with the TIDieR checklist.

Item number	Item	Where is it located
1	<b>Brief name</b> Provide the name or phrase that describes the intervention.	1
2	<b>Why</b> Describe the rational, theory, or goal or the elements essential to the intervention.	1
3	<b>What</b> <i>Materials:</i> describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (online appendix, URL).	13
4	<i>Procedures:</i> describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	6
5	<b>Who provided</b> For each category of intervention provider (e.g. psychologist, nursing assistance), describe their expertise, background and any specific training given.	5
6	<b>How</b> Describe the models of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	5
7	<b>Where</b> Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	5
8	<b>When and how much</b> Describe the number of times the intervention was delivered and over what time period including the number of sessions, their schedule and their duration, intensity or dose.	5
9	<b>Tailoring</b> If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when and how.	3
10	<b>Modifications:</b> If the intervention was modified during the course of the study, describe the changes (what, why, when and how).	NA
11	<b>How well</b> <i>Planned:</i> if intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.	13



12      **How well** *Actual:* if intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned. 13

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## MATERIAL FOR CHAPTER 4 (STUDY 3)

### CONSENT FORM

(to be completed by the adolescent and parent/guardian)

*Researcher:* Emma Cowley, PhD candidate  
*Research Team:* Dr Paula Watson, Professor Dick Thijssen, Dr Lawrence Foweather, Dr Andrew Thompson and Professor Anton Wagenmakers.  
*School/Faculty:* Research Institute for Sports and Exercise Sciences (RISES), School of Sport & Exercise Science, Faculty of Science, Liverpool John Moores University.

*Please tick/ cross the relevant boxes below:*

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

1

2. I understand that my child's participation in the research is voluntary and that I am free to withdraw her at any time, without giving a reason and that this will not affect my legal rights. My child can also withdraw consent should she wish to.

2

3. I understand that any personal information collected during the study will be anonymised and remain confidential.

3

4. I give permission for photographs/video to be taken of my child during the project, which may be used for subsequent academic/promotional purposes associated with LJMU.

4

5. I give permission for the research team to ask my child for her mobile number, home address and email address for the sole purpose of reminders to wear the physical activity monitors (**all groups**).

5

6. I give permission for the research team to ask my child for her mobile number and email address for the sole purpose of behaviour change support monthly calls & weekly messages (**intervention groups**).

5

7. I give permission for my child to be involved in an online interview, during post-intervention and follow up data collection should they be randomly selected (**intervention groups**).

6

8. Should my daughter be in a group receiving behaviour change support calls, I give permission for a sub-sample of these calls to be transcribed & reviewed as a quality assurance measure.

7

9. Should my daughter be in an intervention group, I give permission for her to be invited to join the private Instagram group.

7

10. I agree for my child to take part in the above study.

7

**PARENT-** If you are happy for your daughter to take part in the project.

Print Name \_\_\_\_\_

Daughter Name \_\_\_\_\_

Sign \_\_\_\_\_

Date \_\_\_\_\_



## Youth Physical Activity Readiness Questionnaire

To be completed by parent/ guardian

Today's Date: \_\_\_\_\_ Daughter/ Participant name: \_\_\_\_\_

	Yes	No
1. Has your daughter's doctor ever said she has a heart condition and that she should only do physical activity recommended by a doctor?		
1. Has your daughter ever complained of chest pain during physical activity		
2.		
3. Does your daughter ever lose balance because of dizziness or ever lose consciousness?		
4. Does your daughter have a history or epilepsy or seizures?		
5. Does your daughter have a bone or joint problem that could be made worse by a change in her physical activity participation?		
6. Is your doctor currently prescribing your daughter any medication?		
7. Do you know of any other medical reasons why your daughter should not undergo physical activity? This might include diabetes, a recent injury or serious illness.		
8. Do you have any concerns about your daughter's mental health that might affect her participation in the study? This might include depression, anxiety, body-related concerns or disordered eating.		

If you have answered "YES" to any of questions 1-7 – please give further details in the box below.  
Medical clearance from a GP will be required before starting the programme.

If you have answered “YES” to question 8 – please give further details in the box below. A member of the research team will be in contact with you to discuss your concerns and whether you feel participation in the study is appropriate.



### **Contact Information Questionnaire**

1. What is the participant's mobile number? This is the number that the researcher can call you on and send text messages to.
  
  
  
  
  
  
  
  
  
  
2. What is the participants 'email address? This is so we can send you the documentation she needs to participate in this programme.
  
  
  
  
  
  
  
  
  
  
3. What is your home address? We need this in order to send you the physical activity monitor and booklet.
  
  
  
  
  
  
  
  
  
  
4. What is your parent/guardian's name?

5. What is your parent/guardian's mobile number?

6. What is your parent/guardian's email address?



## CONSENT FORM FOR ADOLESCENTS (to be completed by the adolescent and parent/guardian)

**Researcher:** Emma Cowley, PhD candidate

**Research Team:** Dr Paula Watson, Professor Dick Thijssen, Dr Lawrence Foweather, Dr Andrew Thompson and Professor Anton Wagenmakers.

**School/Faculty:** Research Institute for Sports and Exercise Sciences (RISES), School of Sport & Exercise Science, Faculty of Science, Liverpool John Moores University.

*Please tick/ cross the relevant boxes below:*

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

1

2. I understand that my participation in the project is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.

2

3. I understand that any personal information collected during the study will be anonymised and remain confidential.

3

4. I give permission for photographs/video to be taken of me during the project, which may be used for subsequent academic/promotional purposes associated with LJMU.

4

5. I give permission for the research team to ask for my mobile number, home address and email address for the sole purpose of reminders to wear the physical activity monitors (**all groups**).

5

6. I give permission for the research team to ask for my mobile number and email address for the sole purpose of behaviour change support monthly calls, weekly messages (**intervention groups**).

5

7. I give permission to be involved in online interviews, at post-intervention & follow-up measurement points, should I be randomly selected (**intervention groups**).

6

8. Should I be in a group receiving behaviour change support calls, I give permission for calls to be recorded for safeguarding reasons and, if randomly selected, for a sub-sample of these calls to be transcribed & reviewed as a quality assurance measure.

7

9. Should I be in an intervention group, I give permission to be invited to join the private Instagram group.

7

10. I agree to take part in the above study.

**ADOLESCENT** - If you want to take part, you can write your name below

Your name \_\_\_\_\_

Sign \_\_\_\_\_

Date \_\_\_\_\_

### Example standardised text messages

Looks like it has been a great week (NAME) and you completed all your exercise sessions – unreal work! If you have any questions or queries just let me know and here's to smashing week 2.

Hi \_\_\_\_\_, it looks like you made some great progress this week. We missed a couple sessions, is everything OK? It's really important we try and complete our 3 physical activity sessions each week so if there is anything I can help with please let me know, that's what I'm here for.

### Focus group question guide

Can you tell me anything you have liked about the programme so far?

Can you tell me anything you don't like?

What do you think would increase the chances of you sticking to the programme? i.e., doing your 3 exercise sessions per week.

Tell me what you think of the weekly texts and monthly calls

How could we make this programme more enjoyable for you? Could you give me your opinion and feedback?

Tell me about your thoughts on the measures that we take? E.g., fitness tests.

## Recruitment letter for MSc placement Activity Mentors on

### MSc Professional Practice in Sport Psychology – HERizon

1. **Title:** HERizon (**applied placement – female students only**)
2. **Hours:** 40 hours
3. **Time-scale:** November 2020 – July 2021
4. **Reporting to:** **Placement supervisor:** Paula Watson, Senior Lecturer in Exercise and Health Psychology  
[p.m.watson@ljmu.ac.uk](mailto:p.m.watson@ljmu.ac.uk)  
  
**HERizon coordinator:** Emma Cowley, PhD researcher  
[e.s.cowley@ljmu.ac.uk](mailto:e.s.cowley@ljmu.ac.uk)
5. **Placement venue:** Remote working (Liverpool John Moores University)
6. **Placement summary:** Delivering 1-to-1 behaviour change support (via remote video call) for adolescent girls who wish to improve their physical activity levels. You will be working as part of the psychology delivery team for the “HERizon” intervention (under the supervision of Dr Paula Watson), which is an LJMU research project aimed at engaging adolescent girls with physical activity. The project is grounded in Self-Determination Theory and aimed at fostering girls’ autonomous motivation to promote sustainable engagement with physical activity.  
**Important notes**  
**This is a bespoke “early start” placement that is being offered in addition to the January 2021 options. If you apply for this and are not successful, you will still be able to apply for two alternative placements in January 2021.**  
**As the HERizon intervention supports adolescent girls who may experience high levels of self-consciousness, this opportunity is open only to female students.**
7. **Responsibilities to include:** - Completion of pre-placement training (needs supportive counselling; safeguarding and mental health awareness; programme specifics)



- Commitment to deliver 1-to-1 behaviour change support for allocated participants for the full HERizon programme (12-weeks per participant, but this will be staggered)
- Reading and abiding by the HERizon intervention handbook
- Adherence with reporting requirements, confidentiality, safeguarding and ethics protocols
- Attendance and contribution to team reflective meetings
- Communication with HERizon coordinator and placement supervisor in case of any issues
- Engagement in individual reflective practice
- Engagement in individual supervision

**8. Pre-placement Requirements:**

CV and letter of application to Paula Watson ([p.m.watson@ljmu.ac.uk](mailto:p.m.watson@ljmu.ac.uk)) by 5pm, Monday 26<sup>th</sup> October 2020

**Interviews will be held week commencing 2<sup>nd</sup> November**

**9. LJMU Requirements:**

Compliance with LJMU pre-placement paperwork inclusive of completed Placement Provider Form and confirmation of Employer's Liability insurance.

Liaison with the Placement Learning Support Unit  
Liverpool John Moores University  
Faculty of Science  
Room 144, James Parsons Building  
Byrom Street, Liverpool, L3 3AF

Email: [sciencePLSU@ljmu.ac.uk](mailto:sciencePLSU@ljmu.ac.uk)

**10. University placement tutor:** Paula Watson / [p.m.watson@ljmu.ac.uk](mailto:p.m.watson@ljmu.ac.uk)

To book a tutorial for an informal chat about this placement: <https://seemytutor.ljmu.ac.uk/>

**Further information**

**There is an information session about this placement being held on Wednesday 14<sup>th</sup> October 3.30-4.30pm (please see Zoom link on Canvas).** In this session Paula and Emma will provide you with more specific details and answer any questions you have.

**HERizon Instagram:** @herizonproj

**HERizon Twitter:** @HERizonpro

This is an applied placement that would be suited to students who are interested in one or all of the following:

- physical activity motivation and behaviour change
- working with young people
- gaining 1-to-1 (supervised) experience of applied exercise psychology

**In your letter of application, please make clear what interests you about this placement and what skills and experience you will be able to offer the placement provider.**

**There are up to 6 individual placements available (female students only).**



## ACTIVITY MONITOR GUIDE

### Where do I wear the monitor?

- The device can be worn like a watch.
- It should be worn on your 'non-dominant' wrist. For example, if you are right handed, you should wear it on your left wrist.
- Ensure that the strap is adjusted for a snug and comfortable fit.



### When do I wear it?

- **All the time you are awake for the next 9 days**
- Put it on first thing in the morning and take it off just before you go to bed
- You should be wearing the monitor for *at least* 10 hours each day
- **Please do not** wear the monitor during water-based activities, such as swimming, showering or bathing

### When and how do I give the monitors back?

- When you receive your monitor in the post, there will be a pre-paid return envelope. Simply pop your monitor back into the envelope after each data collection time point and return it via Post. This will be done at 3 time

points: before you start your programme, at the end of the 12 week programme and again after another 3 months. Emma will email you before each time point to remind you.

## WEAR TIME AND SCHOOL TIME DIARY

Your Name: \_\_\_\_\_

Please use the table below to record A) The time you start and stop school each day; B) The time you put the monitor on and take it off each day

Date	Day	Time you put the monitor on in the morning (HH:MM)	Any time you took the monitor off during the day (and reason where possible)	The time you put it back on (HH:MM)	Time you took the monitor off at the end of the day (HH:MM)
(EXAMPLE) 4 <sup>th</sup> May	Monday	07:30	17:45 (swimming)	16:30	23:30
	Monday				
	Tuesday				
	Wednesday				
	Thursday				
	Friday				
	Saturday				
	Sunday				

**If you have any questions please contact:** Emma Cowley : [e.s.cowley@ljmu.ac.uk](mailto:e.s.cowley@ljmu.ac.uk)

## **HERizon training December 2020**

**Facilitators:** Ella Whitcomb-Khan, Chiara Mansfield, Izzie Cacciatore, Emma Cowley, Paula Watson

### **DAY 1 - Thursday 3<sup>rd</sup> December: 9.30am – 4.30pm**

<b>Setting the scene</b>		
9.30am	Intros and active ice-breaker	Paula
10.00am	HERizon overview (intervention, timescales, your roles as activity mentors)	Emma
<b>10.45 – 11.00am BREAK</b>		
<b>What does the evidence say?</b> <i>This first session will provide key background information about physical activity and health, and encourage mentors to reflect on psychological issues faced by adolescent girls in particular.</i>		
11.00am	Physical activity and health	Ella
11.30am	Adolescence, girls & physical activity	Chiara
12.00pm	Body image and physical activity	Izzie
12.30pm	Q&A	Paula / all
<b>12.45 – 1.30pm LUNCH</b>		
<b>Needs-supportive counselling</b> <i>This afternoon will focus on the communication strategies that we can apply to support participants' autonomy, competence and relatedness. The first session will focus on the theoretical underpinning, understanding the strategies and provide examples of these in practice. The second session will be a practical workshop for mentors to try these strategies out.</i>		
1.30pm	SDT & needs-supportive counselling	Paula
<b>3.00-3.15pm BREAK</b>		
3.15pm	Practical workshop – needs-supportive counselling	Paula
4.15pm	Q&A	Paula / all
4.30pm	Close	

### **DAY 2 - Friday 4<sup>th</sup> December: 9.30am – 4.30pm**

<b>Behaviour change techniques (BCTs) and session plans</b> <i>These sessions will introduce key BCTs that will be used within HERizon, and go through the weekly sessions (including role plays) so mentors understand how these fit in. The focus throughout will be on delivering these in a needs-supportive style (building on the content from Thursday afternoon).</i>		
9.30am	<b>BCTs:</b> Goal setting, action planning and self-monitoring <b>Session plans:</b> weeks 0 and 1	Chiara
<b>11.00-11.15am BREAK</b>		
11.15am	<b>BCTs:</b> Barrier identification and coping planning <b>Session plans:</b> weeks 2 through 6 (plus follow-ups)	Ella
12.30pm	Home-task information (see below for suggested pairs)	Ella and Chiara
<b>12.45-1.30pm LUNCH</b>		
<b>Roles and responsibilities</b> <i>These sessions will cover key information that is important for activity mentors to deliver in a safe and effective manner, finishing with a reflective practice (RP) workshop that focusses on the relevance of RP for personal and professional development.</i>		
1.30pm	Record-keeping	Emma
2.00pm	Mental health awareness & safeguarding	Paula
<b>3.00-3.15pm BREAK</b>		
3.15pm	Reflective practice	Izzie
4.15pm	Q&A	Paula / all
4.30pm	Close	

### **DAY 3 - Thursday 10<sup>th</sup> December**

**Individual sessions 9.30-11am (see times below); group session 11.15-1.00pm**

<b>Reflections on home-task</b> <i>1-to-1s with Senior Activity Mentors to reflect on home-task</i>			
<b>Time</b>	<b>Zoom room 1 (Chiara)</b>	<b>Zoom room 2 (Ella)</b>	<b>Zoom room 3 (Izzie)</b>

9.30am	Suzy	Nicole	Abbie
10.00am	Ellie	Jennifer	Amelia M
10.30am	Amelia S	Payal	Hannah
<b>11.00-11.15 BREAK</b>			
11.15am	Group reflection on week 1 task		Chiara
11.45am	Group reflection on week 2 task		Ella
12.15pm	Summary, FAQs and next steps		Paula / all
1.00pm	Close		

## Talking about weight policy

### **Talking about weight (and related problems) during HERizon**

This sheet provides guidance for having conversations around weight should the need arise during your HERizon consultations.

Whilst there are circumstances where it will be appropriate (and helpful) to have an open conversation about weight with your mentee, it is important to remain clear of your professional and ethical boundaries, and report any concerns to Paula as soon as possible afterwards (however small).

Please read this in conjunction with Section 4.3 (mental health concerns) in the HERizon intervention manual.

### Staying prepared / up-to-date

Whilst you cannot foresee all situations and these things may come up when you're least expecting it, you can prepare yourself by staying on top of protocols, policies and developing your knowledge and understanding in areas that might come up. This will help you feel better able to respond in the moment, and more sure about what steps to take.

### **Key HERizon documents to revise in relation to talking about weight include:**

1. This document
2. Intervention Manual - Section 4.3 (Mental health concerns), p.36
3. Participant log book – Strategies for staying confident, p.16 **NB** the link to Young Minds in the participant log book isn't quite right. It takes you to an insecure page. So if going through this page with a mentee, please highlight this to her. The correct link is: <https://youngminds.org.uk>

### Talking about weight with a mentee

**If your mentee brings up anything to do with weight, body image or eating habits, follow the guidance below then inform Paula about the conversation ASAP (07944 385051 if any urgent concerns or if you need immediate support). We can then make a note of this and Paula can support you in deciding the best course of action.** Something may not seem like a concern when it is a one off, but over repeat sessions we may begin to see a pattern. This is why it is so important to keep Paula informed early, so we can record any interactions you have with your mentee regarding weight from that point.



There may not be any need to talk about weight during the HERizon sessions, because the focus is on physical activity, enjoyment and its broader benefits. But there may be situations where your mentee says something about her weight, body, appearance or about her eating habits. Examples might include:

- “I know I need to lose weight”
- “I wish I wasn’t so wobbly”
- “It’s not fair, all my friends have got such amazing bodies”
- “I’ve been trying not to eat any sugar”
- “I’m annoyed with myself because I keep eating”
- “I’ve been trying to lose weight so stopped eating breakfast”

Some mentees may also ask you questions related to food or weight, such as:

- “How many calories do you burn off in a 30-minute run?”
- “Is it possible to lose weight without changing your diet?”
- “What type of exercise is best for losing weight?”

When these situations arise, it is important you respect, listen and do your best to help your mentee **whilst at the same time** maintaining awareness of your professional boundaries. Listening and having some conversation around the issue is important in building/maintaining trust – if your mentee is opening up it is an indication that she trusts and feels comfortable with you, and it is important not to compromise that. Yet at the same time, it is important you do not offer advice that goes beyond your remit.

### So what should you do if a mentee brings something up, or asks a question related to weight?

Don’t be afraid of having an open conversation about weight if it comes up through what you’re talking about. Listen to your mentee’s concerns, take her seriously, and help her understand about a healthy approach to weight management, exercise and eating.

The following guidance might help in doing this:

- Help her see herself as a whole person and recognise her many strengths (why others value her etc.), rather than defining herself by her weight – the confidence-building activities on p.16 of the log book may help with this.
- Help her see the value of focussing on the behaviours we can control (i.e. healthy eating and PA) and on staying healthy inside (rather than focussing on weight). Whilst it’s important to consider both for weight management, there are also many benefits to being active – and to eating healthily – that go far beyond weight, and are actually more important than weight. E.g. if it feels appropriate you could tell her that research shows that people who are

overweight but are more active are actually healthier than people who are slim but inactive. So use this as a way of helping her feel good about what she is achieving and how she has progressed since the start.

- Help her understand about a healthy balanced diet . You might find it helpful to look through the NHS healthy eating for teens link to familiarise yourself with what is advised: [Healthy eating for teens - NHS \(www.nhs.uk\)](https://www.nhs.uk/healthy-eating-for-teens/). If it links to your discussions, may also share the NHS link with your participant. However, **there is just something you need to be aware of when signposting her to this page.** Under the “fad diets” heading you’ll see there is a link to losing weight the healthy way: [Start losing weight - NHS \(www.nhs.uk\)](https://www.nhs.uk/losing-weight-the-healthy-way/) The information on this might be helpful, but from what I can see this is written for adults. Therefore the BMI calculator, calorie recommendations and guidance on how much weight to lose etc. may not be appropriate for teenagers, whose bodies are still developing. So if you share this link with a mentee who you are aware wants to lose weight, please point this out to your mentee and help her understand weight management as a young person is different from an adult – still growing etc. If losing weight is a legitimate concern for her, encourage her to see her GP who will help her lose weight in a healthy way for her.
- If she’s aware of what constitutes a healthy diet but struggles to stick to it, you could encourage/remind her that she can try some of the same strategies she’s learning for the exercise to help her. E.g. setting goals, action plans, self-monitoring.
- If a mentee is overweight and has legitimate concerns about this, help her understand that if she eats a healthy balanced diet (following the guidance on the link above), and if she increases her activity as she is doing with HERizon, she may naturally begin to lose weight. You can also explain (if appropriate) about “weight” per se not being the best measure as it doesn’t take into account the amount of muscle she has in her body, which weighs more than fat and will be increasing as she gets more active. Therefore a better way of telling if her body is changing is to measure her waist, or how her clothes fit. I would encourage her not to focus on this though, and remind her if she focuses on her behaviours and staying healthy inside, this will have the greatest impact on how she feels about herself.
- Talk about the relationship between physical activity and food, and how the healthiest approach is to enjoy both in moderation. If she’s beating herself up for over-eating or seems to be seeing food as a pleasure & exercise as a means of punishment, this blog I wrote about learning to love exercise might be helpful (you can share with her if you think it might help her): [Learn to Love Exercise \(during as well as after\) - Made Up to Move](#) Look at the “why do I struggle to enjoy exercise” section in particular, as this talks about why we develop these kind of thoughts and might help her understand it’s not her fault and it’s perfectly normal to think how she is – but she also can change this.
- Help her focus on body functionality (i.e. what it can do) rather than appearance (i.e. what it looks like). It might be helpful to read p.16 of the

participant log book (about staying confident) so you are ready to go through this with her if appropriate. Also look at the [Young Minds website](https://youngminds.org.uk) and the information about body image (find help – feelings and symptoms – body image) so you feel comfortable in how to encourage a positive body image. **NB the link to Young Minds in the participant log book isn't quite right. It takes you to an insecure page. So if going through this page with a mentee, please highlight this to her. The correct link is: <https://youngminds.org.uk>**

- If overweight and actively trying to lose weight, ask if she's ever had any support to try and manage her weight (e.g. from a doctor, dietitian, her mum, other weight loss support group)? Then chat about what it involved, what happened and what she learned / where she is at now with it.
- If she is actively trying to lose weight – or wants to – encourage her to seek advice from her GP and to talk to her mum about it. You could ask her if she'd like us to talk to her mum about it, or explain that your supervisor (Paula) has a lot of experience in working with young people living with overweight so ask if they'd like Paula to give them a call for a chat.
- Throughout - use permission statements, gauge how she is responding and don't press her or ask questions that might feel intrusive.

## What to do if a mentee is not responding policy

### **1. WITHIN FIRST 5 MIN OF YOUR CALL –**

Text/email the mentee to say you are on the call now and resend her the link (if applicable).

*“Hi (NAME), I am online now for our weekly 15 minute call. Here is the link in case you need it” OR “Hi (NAME), I have tried to call but there was no answer so I will try again in 2 minutes. Hope to speak soon, (YOUR NAME).”*

### **2. AFTER THE SCHEDULED CALL –**

If the mentee replies to point 1 or after the call with a genuine reason for missing or asking to reschedule her call please acknowledge her explanation and follow point A or B below.

(a) Follow up to say that she has missed the call and confirm call for next week:

*“Hi (NAME), I’m sorry you missed our call this evening and I hope that you are OK? I encourage you to still plan out your 3 activity sessions this week and look through your logbook on page XX for what we had planned to discuss on your call. Can you please confirm that \_\_\_ o’clock on \_\_\_ is OK for our call next week? Thanks, (YOUR NAME).”*

(b) If you want to reschedule the call rather than miss it:

*“Hi (NAME), I hope you are OK as you missed our call this evening. Please let me know if \_\_\_ o’clock on \_\_\_ suits to catch up instead? Thanks, (YOUR NAME)”*

(i) If you don’t hear back within 24 hours please send a variation of text A:

*“Hi (NAME), I’m sorry you missed our call this week. I encourage you to still plan out your 3 activity sessions and look through your logbook on page XX for what we had planned to discuss on your call this week. Can you please confirm that \_\_\_ o’clock on \_\_\_ is OK for our call next week? Thanks, (YOUR NAME)”*

### **3. IF SHE DOESN’T CONFIRM/ SHOW UP FOR NEXT CALL -**

Please send her the 5 minute text from point 1. If she doesn’t show up for 2<sup>nd</sup> time with no communication in between to explain or if she keeps cancelling for different/ questionable reasons / seems to be putting calls off:

*“Hi (NAME), You have missed 2 calls now and I am just checking in to see if you are OK. Would you still like to have these calls? It is OK if you don’t but I am here to support you if you change your mind. Please let me know if you would like to schedule our call for next week? (YOUR NAME).”*

o If she is in **Group A** and replies to say she doesn’t want the calls then you need to 1<sup>st</sup> ask her would she like to continue with **both** the live workouts/ Instagram group, and then ask her if she would like to continue to take part in the research project.

If she is in **Group B** and says she no longer wants the calls then you will need to ask her if she would like to continue to take part in the research project.

- o Please let Emma know if there are changes in regards to her participation (i.e. dropping out entirely or to certain aspects of the programme).
- o If she **doesn't reply at all** then don't schedule a call for the following week & please let Emma know.

# THE HERIZON PROJECT

INTERVENTION MANUAL



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## [Link to Main HERizon Google Docs](#)

(please note, you will store participant information in your own individual Google Docs folder that only you, Emma & Paula will have access to)



# Section 1

## Overview of HERizon

## 1.1 Overview of HERizon research project

### ***1.1.1 What's the issue & why is the project needed?***

Regular physical activity (PA) is vital for our physical, mental and social wellbeing. Long spells of sedentary behaviour (sitting or lying) can lead to problems with cardiometabolic health, weight management, cognitive function, psychosocial skills and mental wellbeing.

Often people have a narrow view of what constitutes PA but it is important to note that PA does not only include traditional team sports and jogging. It might instead be a brisk walk with the dog, stair climbing or gardening.

Unfortunately girls across all age groups are significantly less active than our male counterparts. Less than 15% of the global adolescent population are meeting the minimum PA guidelines (60 minutes of physical activity on average across the week). We see a steep drop out of sport and unplanned PA once girls hit puberty and transition from primary into secondary school. Some of the key factors influencing girls participation in PA are outlined below in "Study 1".

Our health habits during youth often track into adulthood and therefore it is vital that we change girls' perceptions of PA now before poor habits are permanently formed. HERizon aims to give girls opportunities to try different types of PA and be supported in their efforts to become more physically active.

### ***1.1.2 Aim of overall PhD***

The PhD aims to develop a programme designed for adolescent girls, especially those who are inactive, to help support them in improving their relationship with PA to create sustained participation in an activity that they enjoy. The programme has been developed based on discussions with this target audience, and has been trialled in a feasibility study to develop and refine any initial "teething" issues. It is hoped the end product of the PhD will be a programme that can be delivered in the "real world" that is sustainable and scalable. The supervisory team is comprised of experts from multiple disciplines, including physical activity, exercise psychology, cardiovascular health, biochemistry and statistics.

### ***1.1.3 Study 1 (Cowley et al., 2020a – under review)***

48 girls from Ireland and the UK took part in focus groups in schools and local youth clubs. Girls were between 13 and 17 years and there was a mix of physically active and inactive girls. These focus groups highlighted that multiple factors influence whether or not the girls take part in PA. The results are summarised in table 1.1.

Table 1.1 Factors perceived to influence adolescent girls' PA participation (Cowley et al., 2020a – under review)

Intrapersonal	<i>Fear of judgement</i>	<ul style="list-style-type: none"> <li>• Lack of confidence in skills</li> <li>• Comparing themselves to others</li> <li>• Afraid of being active without friends</li> <li>• Pressure to look good</li> <li>• Body image</li> </ul>
Interpersonal	<i>Changing social pressure</i>	<ul style="list-style-type: none"> <li>• Academic pressure</li> <li>• Pressure to socialise with friends</li> </ul>
	<i>Support from others</i>	<ul style="list-style-type: none"> <li>• Accountability is helpful</li> <li>• Peer support</li> </ul>
Organisational	<i>Delivery of PE</i>	<ul style="list-style-type: none"> <li>• Lack of autonomy</li> <li>• Not delivered in a “fun” way</li> <li>• Lack of time</li> <li>• Lack of priority in timetable</li> <li>• Poor facilities</li> </ul>
Multi-level	<i>Gender inequalities</i>	<ul style="list-style-type: none"> <li>• Excluded by boys</li> <li>• Less support for girls</li> <li>• Less PA opportunities for girls</li> <li>• Girls “sit out” of PE</li> <li>• Need for female-only PA opportunities</li> <li>• Lack female sport role models</li> <li>• Social stereotypes</li> </ul>

#### 1.1.4 Study 2 (Cowley et al., 2020b – under review)

We ran a 6-week feasibility study during lock down in April 2020. 42 girls participated in the study and were randomly allocated into the intervention or the control group.

##### The intervention group:

1. Girls were asked to do 3 x 30 minute sessions of PA per week. They were given a list of example YouTube channels to try and instructions on how they could make their own workouts.
2. Girls had weekly behaviour change support calls with their Activity Mentor.
3. Emma put on 3 x 30 minute Zoom workouts each week.
4. They received 3 standardised support text messages every week.

##### Results:

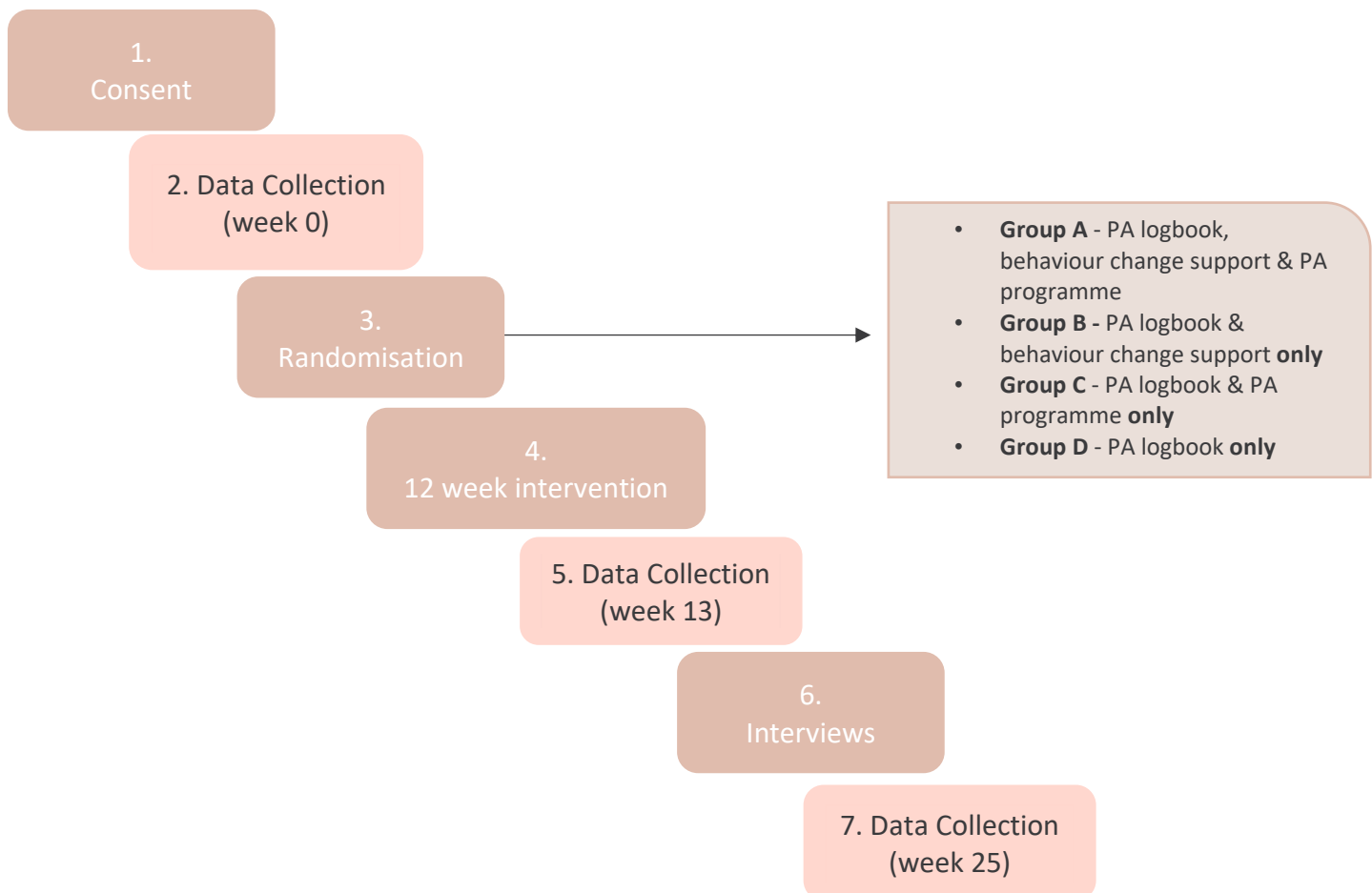
- Girls in intervention group had greater improvement in 20m shuttle run, push ups, intrinsic motivation and body appreciation, in comparison to the control group.
- We also conducted 10 qualitative interviews with the girls to get their feedback on the programme. The following are some broad themes that we identified:
  - *Study design* – recruit through Instagram, fitness tests easy and fun, PA logbook was useful for motivation.
  - *Social support* – like idea of exercising with family or friends, enjoyed having the Activity Mentor to chat to each week, parents are important support.

- PA and PA menu – liked trying different exercise, surprised when it was easier than they expected originally.
- Facilitators – making PA part of routine, seeing improvement, having the choice to decide what PA they do, relate to other girls also on the programme.

## 1.2 The current research project (study 3)

Building on what we learned through study 2, we are now conducting a larger-scale randomised controlled trial of an expanded 12-week programme. We are aiming to recruit 160 girls who will be randomly allocated into 1 of 4 groups (~40 girls in each group). Girls will complete fitness tests and psychosocial questionnaires before they start, at the end of the 12 week programme and again 3 months after the end of the study (see figure 1.1).

Half of the girls (across all four groups) will take part in the intervention between January 2021 and April 2021. The other half of girls will take part between February 2021 and May 2021.



**Figure 1.1 Overview of the current research study (study 3 of Emma Cowley's PhD)**

### 1.2.1 Getting started

Figure 1.2 shows the process girls and their parents will go through before starting their PA sessions and weekly calls.

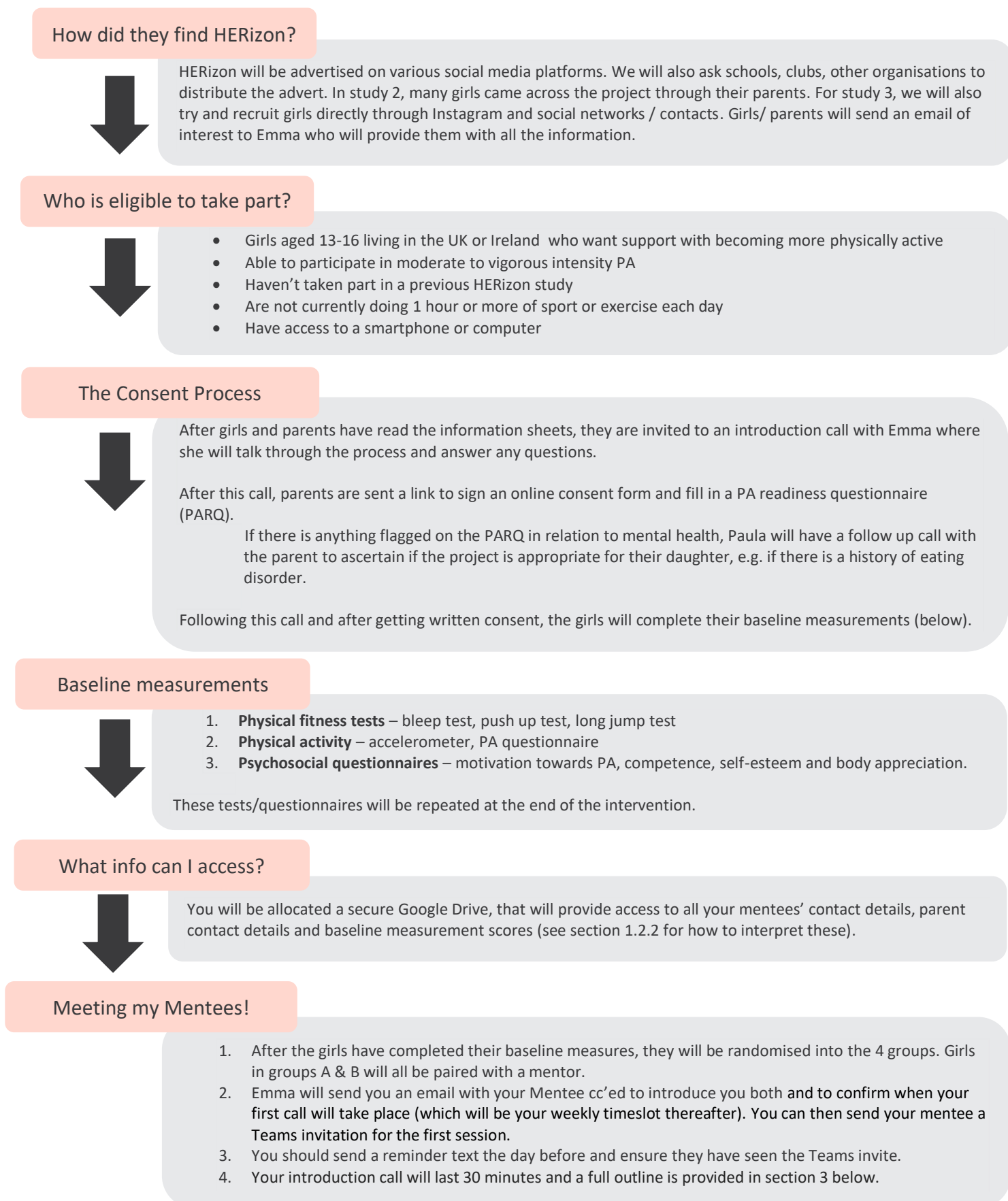


Figure 1.2. Recruitment and consent process for HERizon study 3

### 1.2.2 How to interpret baseline measurements

Variable	Measurement unit	What it means
<b>Demographics</b>		
Location	UK or IRE	Is the girl living in the UK or Ireland
Age	Years	How old the girl is
Menstruation status	Yes or No	Has the girl began to have periods yet
<b>Fitness tests</b>		
Push up	Number repetitions How many reps she got in her push up test.	The pilot average was: <b>15</b> Norm referenced for their age group is: 11 to 15
Long jump	Centimetres How many reps she got in her push up test.	The pilot average was: <b>160cm</b> Norm referenced for their age group is: 165cm
Bleep test	Level achieved How many reps she got in her push up test.	The pilot average was: <b>level 5</b> Norm referenced for their age group is: 6.5 to 7.5 is average for 14 to 15 year olds.
<b>Physical activity</b>		
By accelerometer	Minutes	Likely you will not receive this data as I won't have it analysed in time for the intro call!
By self-report questionnaire	Minutes - Physical activity - Watching TV - On the internet - Playing video games  Do they meet the government guidelines of: - 60min of activity on average every day - Less than 2 hours sedentary behaviour per day	<b>7/42</b> girls did 60 minutes of PA on average every day of the week  <b>27/42</b> spent more than 2 hours in sedentary behaviour – majority on internet & tv, few spent time on video games
<b>Psychosocial questionnaires</b>		
Perceived competence	- Scored out of 7 - Higher the score, higher the perceived competence	The pilot average was: <b>5.5 / 7</b>
Self-esteem	- Scored out of 5 - Higher the score, higher the self-esteem	The pilot average was: <b>3.5 / 5</b>
Body appreciation	- Scored out of 5	The pilot average was: <b>3.2 / 5</b>

	- Higher the score, higher the body appreciation	
Motivation towards physical activity	<ul style="list-style-type: none"> <li>- Each sub-scale scored out of 4</li> <li>- Higher the score, the higher that particular type of motivation</li> </ul>	<p>The pilot average was:</p> <p>Amotivation - <b>2.2 / 4</b></p> <p>External - <b>2 / 4</b></p> <p>Introjected - <b>1.8 / 4</b></p> <p>Identified - <b>1.4 / 4</b></p> <p>Integrated - <b>2.2 / 4</b></p> <p>Intrinsic - <b>2.3 / 4</b></p>

## Section 2

### The HERizon Intervention



## 2.1 Aims and objectives

### 2.1.1 Aim of HERizon

To support girls to gradually lead more physically active lives, by participating in activities that they enjoy and can stick to for the long term.

### 2.1.2 Key messages behind HERizon

1

The HERizon programme is a judgement free zone. Some weeks girls are going to do no PA and that is OK, we all slip back into old habits. We are here to encourage, support and motivate them to gradually change their behaviour and set up coping strategies to deal with slip ups.

2

There are no right or wrong physical activities. The programme encourages girls to try different types of activities so that they can (hopefully) find something that they really enjoy and can stick to. We aim to tear down the walls of “gender-specific” activities and urge girls to not be afraid to try activities traditionally seen as masculine.

3

Although exercise can change our physical bodies, we want to emphasise all the other many benefits of leading a physically active life. PA can improve our mood, concentration, breathing, fitness, strength, discipline, socialisation skills and help us to sleep better. We want to focus on all benefits and not hold the aesthetic changes on a pedestal.

### 2.1.3 What changes do we hope to see in adolescents completing HERizon

- Improved cardiorespiratory health, muscular strength, muscular endurance.
- More minutes per week spent in moderate-to-vigorous PA and less in sedentary behaviour.
- Transition to more autonomous (and hopefully intrinsic) motivation.
- Improved self-esteem, competence and body appreciation.

### 2.1.4 Physical activity

#### *What is physical activity (PA)?*

- PA is any bodily movement that increases your heart rate above resting. It includes light (e.g. gentle yoga), moderate (brisk walk) or vigorous intensity (playing a football match) activities. PA also includes day-to-day tasks like climbing stairs, gardening or carrying shopping from the car.

#### *How much physical activity should the girls be doing?*

- The current global guidelines recommend that children and adolescents should do at least, on average, 60 minutes of moderate to vigorous intensity PA per day across the week. Most of the PA should be aerobic. Vigorous intensity PA, as well as PA that strengthens muscle and bone, should be incorporated at least 3 days per week. The 60 minutes doesn't need to all be done in one block, e.g. could do 15 minute brisk walk to school, 30 minute vigorous PE class and 15 min brisk walk home from school.

#### *How much physical activity are girls in the UK and Ireland actually doing?*

- A 2020 global study found that 85% of adolescent girls in the UK and 80% of girls in Ireland are not sufficiently active.

### 2.1.4 How much physical activity are we asking girls to do during HERizon?

Girls in the HERizon Project are asked to do 3 sessions of PA each week, each lasting approximately 30 minutes (e.g. really vigorous exercise might be shorter but a football training session might be longer). Girls are given suggestions on activities they might want to try but are free to move away from this list.

Table 2.1 provides some guidance for promoting PA, based on learnings from the pilot project.

Table 2.1 Tips for promoting PA during HERizon

<b>Matching PA to goals</b>	<p>If a girl has a particular goal, try to match them with a corresponding PA option.</p> <ul style="list-style-type: none"> <li>• For example, to improve their bleep test score then cardio based workouts might be a good option.</li> <li>• If they want to improve their push up score then Pilates or the strength workouts would be beneficial.</li> </ul>
<b>DOMS (Delayed Onset Muscle Soreness)</b>	<p>Some girls will complain or worry about aches and pains after they start working out. This is usually “delayed onset of muscle soreness” (DOMS).</p> <ul style="list-style-type: none"> <li>• Remind them that this is normal and that when we start exercising, or doing a new types of exercise, our bodies can be sore for up to a week.</li> <li>• Encourage them to do a good warm up and cool down.</li> </ul>
<b>Importance of Rest</b>	<p>People who are new to exercising may have a tendency to go from 1 to 100 really quickly and want to workout every day.</p> <ul style="list-style-type: none"> <li>• Encourage them to start slowly and to take sufficient rest, e.g. having a rest day between workouts.</li> </ul>
<b>Encourage “discomfort”</b>	<p>Although we want them to start easy, if you find that they are sticking to only low intensity exercise because they find it easy, encourage them to try something new that might push them a little.</p> <ul style="list-style-type: none"> <li>• Not all 3 sessions need to be vigorous but all 3 sessions shouldn’t be very low intensity either, e.g. not all Pilates.</li> </ul>
<b>Family/ friend support</b>	<p>Parents, siblings and friends are more than welcome to join the live workouts and we encourage girls to get active with someone else.</p> <ul style="list-style-type: none"> <li>• Suggesting girls develop a routine, like a weekly walk with a friend or parent.</li> <li>• Join the live workouts with family/ friends.</li> </ul>

## 2.2 HERizon intervention components

There are three components to the HERizon programme:

1. PA logbook
2. PA programme (live workouts, social media group and standardised text messages)
3. Behaviour change support

Each of the 4 intervention groups will receive a different combination of these:

Group A – all three components

Group B – components 1 & 3 only

Group C – components 1 & 2 only

Group D – component 1 only (control group)

Groups A & B are the two groups that will receive individual behaviour change support with PA mentors (i.e. component 3). But for group A, this will also include the PA programme. It is therefore important before every call that you remind yourself which group your mentee is in.

<b>Group A</b> PA logbook PA programme Behaviour change support	<b>Group B</b> PA logbook Behaviour change support
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### 2.2.1 PA logbook

All girls will receive a PA logbook. This is central to the support you will deliver, as each behaviour change call will be structured around an activity within this logbook (whereas for girls who are in groups C & D, they will be able to work through the tasks on their own). The logbook contains some general information about PA, a PA calendar for them to log their activity, and reflective activities to go alongside weeks 0 to 7, week 6 and week 9 (which is when the behaviour change calls will take place). Within the logbook there is something called a “physical activity menu” that lists some example ways to exercise at home. The menu is designed to give girls suggestions but is not compulsory, i.e. if they hate everything we have suggested and want to instead do rock climbing or paddle boarding that is absolutely fine and encouraged. The emphasis is on helping them to find a sport/ exercise that they enjoy and something they will stick to.

The PA menu contains suggestions in 4 different areas;

- Yoga & Pilates
- High intensity interval training
- Strength
- Sport specific (e.g. soccer, football, dance and running).

### 2.2.2 PA programme

The PA programme contains three elements: live workouts, a social media group, and standardised text messages. [Group A will have access to this, but Group B will not.](#)

**2.2.2.1 Live workouts.** Girls are invited to take part in live workouts twice a week. These workouts are held on Zoom and last ~40 minutes. Girls are texted the Zoom meeting link weekly.

The first live workout is compulsory for the girls and we encourage all Activity Mentors to join this first session also (this will occur during Week 1 of the programme, after your introductory call). Please tell girls about this 1<sup>st</sup> workout during your introduction call and arrange to “see” them there.

Workouts can be done with little space and no equipment is needed. Girls are encouraged to turn their cameras on for the first couple of minutes to get to know the other participants but then can turn cameras off once we start the warm up. Example structure:

- ~5minute catch up/ice breaker with everyone
- ~5 minute warm up
- 20 minute work out
- ~5 minute cool down

**2.2.2.2 Social media group.** Girls are invited to join a private Instagram group chat. It is not mandatory and they will be asked if they want to become a member before they are sent an invite. They are also free to leave at any time. Using this group, girls are encouraged to ask questions, communicate with each other and Emma can provide the group with any updates or information over the 12 week period.

**2.2.2.3 Weekly standardised text messages.** Girls will be sent 3 standardised text messages each week from a no-reply messaging service. The text sender will be shown as “HERizon Project” on their phones. The first message of the week will be the live workout link, the second a general support/ info message to encourage them to keep going and the third a reminder to fill in their activity logbooks.

### 2.2.3 Behaviour change support

Girls in groups A & B will each be assigned an activity mentor, who will provide them with individualised behaviour change support. This will include weekly sessions from weeks 0 to 6, then follow up sessions at weeks 9 and 12. The first (week 0) and last (week 12) sessions will be 30 minutes, all other sessions will be 15 minutes.

The purpose of these sessions will be to foster autonomous motivation in girls through supporting their needs for autonomy, competence and relatedness. Each session will involve working through an activity within the PA logbook and will focus on helping girls set and achieve realistic action plans. Further detail about needs-supportive delivery, the behaviour change techniques used, and full session plans are provided in section 3.

## Section 3

### Behaviour Change Calls

### 3.1 Behaviour change calls – delivery framework

You will be assigned a number of participants to work with for the duration of the 12-week intervention. As outlined in section 2, each participant will be in one of two groups:

**Group A: Behaviour change calls, PA logbook and PA programme** (includes live exercise sessions with Emma, participation in the HERizon Instagram group, and standardized text updates from Emma)

**Group B: Behaviour change calls and PA logbook only**


You will be informed by Emma which group each of your participants is in. It is important you take note of this and tailor your calls accordingly (e.g. for group A it is good to encourage them to attend the live exercise sessions, but it is equally important you don't mention these live exercise sessions to group B).

Table 3.1 outlines the framework for the behaviour change calls you will deliver. This will be the same for participants in groups A and B.

**Weeks 0 to 6.** For the first six weeks you will have weekly calls with each participant. This is actually seven calls, as the first one takes place at the start, there are then six weeks of activity with a call at the end of each.

**Weeks 7 to 12.** After the first six weeks, your call frequency will reduce. So you will only speak with your participants in week 9 (three weeks after your last call) then again in week 12. *NB For group A, the PA programme will continue throughout this time (even though your calls will reduce).*

Table 3.1 Overview of 12-week delivery framework for behaviour change calls

	Description of session	
Week 0 (30 mins)	Intro - rapport building and goal setting	
Week 1	Setting action plans	
Week 2	Barrier identification	Review/adjust action plan 
Week 3	Action plan review (no specific topic)	
Week 4	Action plan review (no specific topic)	
Week 5	Coping planning	
Week 6	Reflect on achievements	
Week 9	Coping planning	
Week 12 (30 mins)	Reflect on achievements Coping planning	

### ***3.1.1 Call duration and content***

The first and final calls will last approximately 30 minutes, all other calls will be 15 minutes. A key element to the calls will involve introducing participants to the BCTs (discussed further in section 3.2.2.1 below). Once each participant has set some personal goals for the intervention, the weekly support will revolve around collaborative and progressive action planning to help the participant achieve their goals. In some weeks, additional BCTs will be introduced to help with this.

[There is a specific session plan for each week in the Appendix.](#) These are to be used alongside the PA logbook, which contains activities to help you integrate the BCTs into your delivery.

### ***3.1.2 What do we mean by standardization and why do we need it?***

We have called the plan in table 3.1 a “delivery framework” as there are standardized elements we ask all activity mentors to stick to, yet there is also freedom within this to tailor to each participant’s needs. As well as the plan in table 3.1, the other important aspect that is standardized is your delivery style. For this, all activity mentors are asked to deliver in a “needs-supportive style” consistent with Self Determination Theory (SDT), as outlined in section 3.2 below. It might help to think of table 3.1 as **what** you will cover, but the needs-supportive strategies in section 3.2 as **how** you will do this.

As this is an applied research project, this standardized delivery is important for us to assess the impact of SDT-informed behaviour change support. Standardized delivery also ensures we interpret the results appropriately and gives us more insight for future interventions. E.g. if we see a lot of success in the behaviour change calls, we know what needs to be delivered next time to achieve that success again (or vice-versa, if we don’t!).

However, it is equally important to highlight – standardization does not mean robotization!! Although there are some standardized elements to the calls, there is no “script” to follow. The aim is to achieve free-flowing conversation that allows you to develop rapport with each participant you work with. You are encouraged to bring your personality into your sessions, and remember there is freedom within the structure for you to get to know your mentee and to tailor calls to individual participants’ needs (which is of course important in supporting their autonomy, competence and relatedness).

So in summary, stick to the plan and be needs-supportive – but remember to be yourself!

### ***3.1.3 Audio-recording calls***

We will be audio-recording a sample of the behaviour change calls to better understand what is being delivered and to explore if activity mentors are implementing the needs-supportive strategies as intended. This isn’t to audit your practice, so please don’t let this worry you – it is for the purposes of research, so that we can assess the “intervention fidelity” (i.e. the extent to which HERizon is being delivered as intended) and so that we can make sure any conclusions



we draw are accurate. You might also like to use your audio-recording to reflect on your own practice with your placement, prof doc, or SEPAR supervisor.

We will inform you which calls to record, how to explain this to your participant and where to store the recording securely.

### 3.1.4 Logging your calls and collecting research data

As this is a research study, there are certain details that need to be collected during each call. This data will allow us to understand if the intervention is effective at increasing teenage girls' PA and improving their psychosocial wellbeing. The data we ask you to collect is outlined below:

1. Number PA sessions	During your call, your mentee should show you her PA logbook. This is where she should have written down what PA sessions she did the week before. Please record how many sessions she completed, e.g. 3 sessions, 0 sessions.
2. Type of PA	Please record what type of PA she did. E.g. if she did 3 sessions, 1 might be Pilates, 1 Joe Wicks and 1 live workout.
3. Call duration	After each call, please record its duration (you can round to the nearest minute), e.g. 14 minutes.

You will be invited to a Google Doc account that only you, Emma and Paula can access. In here you will have access to a spreadsheet which is a live document that you can have open during your calls and update as you go. An example of the spreadsheet is below and the same format will be repeated for call 2, call 3 and so on. It is vital for the study to collect the above 3 pieces of information from each call on the spreadsheet so that Emma can access.

Call 1				
Did the call happen				Space for notes:
Call duration				
<b>LOGBOOK</b> - Did you talk through the Reflection section?				
	<b>Session 1</b>	<b>Session 2</b>	<b>Session 3</b>	
(Example)	Yoga (45 minutes)	No exercise session	Live workout (40 minutes)	
What 3 PA sessions did they do <b>this</b> week?				
What 3 PA sessions are planned for <b>next</b> week?				

## 3.2 Needs-supportive delivery

### 3.2.1 What are the basic psychological needs and why do they matter?

The HERizon intervention is grounded in Self-Determination Theory (SDT, Ryan & Deci, 2000). SDT is a theory of motivation that proposes humans have three fundamental psychological needs. These needs are:

**Autonomy** – feeling like you have choice over your behaviour, you are acting on your own will and engaging in activities that have personal meaning

**Competence** – feeling like you have a sense of “optimal” challenge in your life, and have the necessary resources to meet this challenge

**Relatedness** – feeling connected, and feeling like others care about you

In general life, research suggests these needs are important for optimal functioning, motivation and for mental wellbeing. If these needs are frustrated, people may suffer psychologically and lack motivation.

In a PA context, these needs relate to how autonomous, competent and related someone feels in relation to their PA behaviour (e.g. Do they feel they have choice and find personal meaning in their PA? Do they feel competent to be active? Do they feel connected to others they are active with?). If someone’s needs for autonomy, competence and relatedness are satisfied they are more likely to develop an *autonomous motivation* for PA.

**Autonomous motivation** is considered to be a “high quality” motivation that comes from within (e.g. if someone wants to exercise because it makes them feel good, or because they enjoy it). This is contrasted with **controlled motivation** which is a “lower quality” motivation where individuals feel pressured or forced to engage in a behaviour (e.g. if someone feels pressured by others to exercise).

The most autonomous form of motivation is considered to be **intrinsic motivation**, which is when somebody engages with a behaviour because they enjoy it or for the experience itself (rather than focusing on some kind of outcome). We know that people who are more intrinsically motivated are more likely to stay physically active in the long-term.

Intrinsic motivation for PA is evident in children’s spontaneous play – they run, skip, and jump simply for the joy of moving. Sadly however, as children grow older and face more extrinsic pressures (e.g. other priorities, concerns about physical appearance, gender norms), many lose this intrinsic desire to be active.

As activity mentors, your aim is to help adolescent girls re-gain the intrinsic motivation for PA they were born with. One way you can do this is by delivering in a way that supports the autonomy, competence and relatedness of each participant.

### 3.2.2 How can activity mentors support the basic psychological needs of participants?

Activity mentors can support participants' basic psychological needs both through specific behaviour change techniques (BCTs) embedded into session outlines (table 3.2), and through your style of communication throughout the sessions (table 3.3). The strategies used have all been shown in research to be effective in supporting health behaviour change.

**3.2.2.1 Behaviour Change Techniques (BCTs).** During HERizon you will introduce girls to some key BCTs, and help them understand how to implement these strategies themselves. These BCTs will be embedded into the session outlines (and PA logbook) to ensure consistent delivery across all participants. The intervention focusses around six BCTs in particular, taken from Michie et al.'s (2011) CALOR-E taxonomy (see table 3.2 for further information about each technique):

1. Goal setting (outcome)
2. Goal setting (process)
3. Action planning
4. Self-monitoring
5. Barrier identification
6. Coping planning

Table 3.2. Behaviour change techniques used in HERizon, with explanation of how they support the needs of autonomy, competence and relatedness

Name of BCT <sup>1</sup>	What does this involve?	How does this support basic psychological needs? <sup>2</sup>
Goal setting (outcome) #6	Setting a personal goal for what they would like to get out of the intervention (e.g. to get fitter, or to feel better about themselves). Where possible, outcome goals should be SMART (Specific, Measurable, Achievable, Relevant, Time-bound).	<b>Autonomy</b> – helps give personal meaning to the PA they are taking part in.
Goal setting (behaviour) #5	Setting a behavioural resolution for how they will reach the desired outcome (this may simply be “taking part in HERizon”, but it could also be something like make sure I do	<b>Autonomy</b> – the idea of setting themselves a “challenge” may help them feel ownership of their behaviour.  <b>Competence</b> – by thinking about “how” they are going to achieve their outcome, the

<sup>1</sup> Numbers refer to the corresponding BCT in Michie et al.'s (2011) CALO-RE taxonomy.

<sup>2</sup> This column explains the primary mechanisms of action only. It is important to note BCTs can support several basic psychological needs simultaneously, particularly if delivered in a needs-supportive manner as outlined in table 3.2 (e.g. if delivered in a collaborative manner, action planning may also support autonomy through providing choice and helping participants feel ownership of their PA).

Name of BCT <sup>1</sup>	What does this involve?	How does this support basic psychological needs? <sup>2</sup>
	some movement every day, or make sure I stick to my three exercise sessions).	outcome becomes more within their grasp and their perceived competence may increase.
Action planning #7	Setting <i>specific</i> PA plans for the week (e.g. what they are going to do, what days and how they plan to fit it in)	<b>Competence</b> – helps turn intentions into behaviour and makes PA seem more “doable” by fitting it around personal schedules. Can also plan for progression.
Self-monitoring #16	Keeping a record of what PA they have done during the week (either by hand or electronically)	<b>Competence</b> – provides evidence of achievement and progress, which helps them believe they can do it.
Barrier identification #8	Identifying what might get in the way of the PA routine and thinking of ways to prevent / overcome these barriers	<b>Autonomy</b> – helps come from the participant’s perspective and allows the plan to be tailored to their needs.  <b>Competence</b> – by acknowledging barriers and identifying solutions, PA seems more “doable”
Coping planning #35	Once someone is already active, thinking of what might present challenges for them (e.g. when the intervention finishes) and developing plans for what they will do if this happens	<b>Competence</b> – being realistic about what might get in the way, and putting plans in place to increase likelihood of success. Might draw on past successful experiences of “what has worked” to help participant believe they can do it.

**3.2.2.2 Needs-supportive communication strategies.** Whilst we can think of the BCTs as “what” you will do to support participants to change their PA behaviour, the needs-supportive strategies provide a framework for “how” you will do this. The way you interact with participants is central to how supported they will feel. Table 3.3 outlines strategies, based on Teixeira et al.’s (2020) Motivation and Behaviour Change Techniques (MBCTs)<sup>3</sup>, that can be used to support the basic psychological needs of HERizon participants throughout the behaviour change calls. Rather than being embedded into session outlines, these communication strategies can be adopted throughout to ensure participants feel a sense of autonomy, competence and relatedness in their interactions with you.

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<sup>3</sup> NB The strategies in table 3.2 often combine more than one of the Motivation and Behaviour Change Techniques listed in the Teixeira et al. (2020) article. They are grouped together where they would naturally co-occur as a means of facilitating the training and delivery process.

Table 3.3. Needs-supportive communication strategies that can be used throughout the HERizon behaviour change calls to support participant needs of autonomy, competence and relatedness

Strategy <sup>4</sup>	Example/s	How does this support basic psychological needs? <sup>5</sup>
Ask open questions to explore participant's perspective #1 #16	Asking questions about participant behaviours (e.g. tell me about the activities you've done this week), feelings (e.g. how are you feeling about starting HERizon?), barriers (e.g. what do you think has stopped you?) and facilitators (e.g. what was it that helped you do that?). Exploring what is important to them and aligning goals/support with this.	<b>Autonomy</b> – helps come from the participant's perspective so the mentor can demonstrate empathy and the sessions can be tailored to their needs (which can help participants feel less pressure).  <b>Relatedness</b> – helps build rapport by showing interest in the participant and getting to know them better.
Listen empathically, without judgement #8 #10 #12	Being attentive to participant's responses and using empathic listening techniques such as reflections (e.g. to acknowledge the participant's perspective or feelings), and permission statements (e.g. asking permission to talk about something sensitive). Resisting any temptation to argue back or judge participants' comments.	<b>Autonomy</b> – helps participants feel understood, and less pressured. If they haven't done all the PA they had hoped, helps them understand this is ok and they won't be judged for it (which in turn increases trust and the chances they will be honest and open up).  <b>Relatedness</b> – helps build a connection by showing the participant they are valued and cared about.
Show interest and care for the participant #11	Showing interest in the participant's wider life (e.g. school, family), and being responsive to their emotions and feelings (e.g. noticing if a participant seems tired or doesn't seem sure about something, and checking with them if they are ok or would like you to go over it again)	<b>Relatedness</b> – helps build a connection through showing they are cared for.
Provide a meaningful rationale #5	Explaining to a participant how setting an action plan will help them achieve their goals.	<b>Autonomy</b> – helps draw the link between the behaviour and the outcome, which can help participants believe in PA and take ownership.  <b>Competence</b> – if they can understand why they are doing something, they are more likely to retain the

<sup>4</sup> Numbers refer to the MBCTs each strategy maps on to within the Teixeira et al. (2020) paper.

<sup>5</sup> As above, this column outlines the primary mechanisms of action only. Many of these strategies will support autonomy, competence and relatedness simultaneously, so there may be additional mechanisms of action that are not mentioned.

Strategy <sup>4</sup>	Example/s	How does this support basic psychological needs? <sup>5</sup>
		information and feel capable of repeating it.
Encourage choice & self-initiation #3 #6 #7	Giving participants a range of options and asking them to choose which they'd like to do. Using language that encourages ownership and conveys freedom to choose.	<b>Autonomy</b> – helps participants tailor their PA programme to suit them, and feel ownership of their PA. Reduces pressure to undertake activities they have no interest in.  <b>Competence</b> – if participants are able to choose activities they feel capable of doing, this will enhance their perceived competence.
Help to ensure action plans are realistic and achievable #15 #17 #19 #20	Guiding participants when discussing action plans to help them tailor it to their current ability and available time. Encourage small steps to build sustainable change. This may include gently “pulling” participants back if they try and go from “nothing to all” in the first week, for instance. Barrier identification and self-monitoring will also help with this.	<b>Competence</b> – helps participants experience success and embed progression into their programmes (which in turn gives them a sense of achievement, and reduces the risk of feeling like they have failed).
Offer clear, relevant and constructive feedback #18	Explaining to a participant how well they have done to stick to their action plan, and being specific about why it worked well. May also include explaining why something is perhaps not working well, and making constructive suggestions for doing things differently.	<b>Competence</b> – helps participants learn the skills to continue with their PA independently. Being specific is important so they understand what it is they are doing well (and hence know what to repeat next time).
Discuss options for social support #14	Asking participants how their family and/or friends might be able to help them with becoming more PA.	<b>Competence</b> – helps participants identify ways those around them can help make PA easier, which might in turn make them feel PA is more “doable”.  <b>Relatedness</b> – helps participants feel supported by others around them.
Explore ways of dealing with pressure #2 #21	Helping participants identify how “contingencies” place pressure on their PA (e.g. negative feedback from others or self, exercising purely for a reward) and developing healthy ways of managing this.	<b>Autonomy</b> – encourages participants to develop a relationship with PA that isn't dependent on extrinsic rewards.  <b>Competence</b> – helps participants feel able to cope with pressures, and more capable of sustaining their PA when these occur.

Strategy <sup>4</sup>	Example/s	How does this support basic psychological needs? <sup>5</sup>
Provide opportunities for questions and ongoing support #9 #13	Checking participants understand what you are saying and giving them opportunities to ask you questions at several points in each consultation. Ensuring participants know how they can contact the HERizon team outside of sessions.	<p><b>Autonomy</b> – provides participants with an opportunity to “shape” the conversation, and to go at their own pace.</p> <p><b>Competence</b> – helps participants understand processes and ask about any concerns they have.</p> <p><b>Relatedness</b> – helps participants know they are cared for, and you have time to listen to them.</p>

## Section 4

### Delivery Considerations



## 4.1 Practical considerations

### 4.1.1 *How do I arrange calls with my mentees?*

- During your introduction call, you will agree on a day/ time for you to have your calls each week, e.g. 4.30pm on Tuesdays. **Please let Emma know if this changes from the time she set up for you.**
- Agree how you will communicate, this might be text, WhatsApp or email. Mentors have found WhatsApp best in the past as many of the girls did not use their email and so would be slow to reply.
  - Please note that more than 50% of the girls are based in Ireland and so will have Irish phone numbers, therefore it may be best to use WhatsApp to avoid extra charges. The prefix for Ireland is 00353, example: 0851794139 will convert to 00353851794139.
- Agree on which platform you will have your weekly calls. We recommend Microsoft Teams, but if this is inconvenient for the mentee you can use Zoom or Facetime (or similar if not using an iPhone).
- The day before your call, send a standardised reminder text/email to all your mentees. E.g. "Hi X, reminder that we have our call tomorrow at Xpm. Here is the Teams link again and remember to fill in your PA log. See you tomorrow!".

### 4.1.2 *What do I do if a participant misses a call?*

If your mentee does not show up for a call, she simply missed that week - you do not need to reschedule.

Send her a message to:

- say that she has missed her call but that you encourage her to still complete her PA logbook for that week (the tasks you would have done together on your call).
- ask her to send you a photo of her PA calendar, i.e. how many PA sessions she did that week so that you can record it on your spreadsheet.
- Confirm when your next call is

### 4.1.3 *My mentee isn't replying to my messages – what do I do?*

If you are using email as a communication method, try to reach her by text/WhatsApp as she may not check her emails.

If she is not responding to texts and hasn't shown up for your call please let Emma know and she can get in touch with a parent to make sure all is OK and check that she still wants to be involved in the project.

### 4.1.4 *What do I do if connectivity is bad?*

If connection is bad, try to turn off your camera and have an audio call only.

If this is an on-going issue, even without camera, please let Emma know and it may be possible to get you phone credit to call your mentee on a normal call without having to use WIFI/ 4G etc.

#### ***4.1.5 What do I do if my mentee is taking a call from her bedroom?***

During an initial phone call with Emma, she will discuss the location of where in the weekly calls should happen within the home. Parents and the girls will be able to decide what suits them best and during your first introduction call, the parent should tell the activity mentor if they are happy for calls to take place within the bedroom.

If a girl is taking a call within the bedroom and her parent hasn't given consent:  
Ask them if there are any other spaces in the house that they can speak  
If it is a continuous issue, let Emma know and she can get in touch with the parent

#### ***4.1.6 What information do I need to record during the calls?***

We need you to collect information about what PA your mentee did the previous week (how much and what type), how long your call lasted and what you covered in the call. Please see section 3.1.4 for full details.

#### ***4.1.7 A girl seems very fixated on weight loss and I am concerned. What should I do?***

It is important to speak to Paula if you have any concerns about your mentee's mental health or wellbeing. Please see section 4.3 for full details.

#### ***4.1.8 A girl wants to drop out of the programme. What do I do?***

We would love for girls to complete all 12 weeks but understand that things can come up. If a girl has decided she would like to drop out, please let Emma know and she will get in contact with her.

If you feel appropriate, encourage her to reflect on why she wants to drop out and ask if there is anything we could do to support her more.

## 4.2 Safeguarding and confidentiality

### 4.2.1 Confidentiality of participant data

As an activity mentor, you are responsible for ensuring the confidentiality of your participant's personal data. Personal data refers to anything that is identifiable – this includes your participants name, contact details, date of birth etc.

Please read the following sections carefully and ensure you adhere to these processes. If you have any questions, please speak to Paula.

Whilst these steps are simple to follow, human error does occur. **Therefore, if you make a mistake or become aware of a breach of confidentiality please inform Paula immediately.**

**4.2.1.1. Confidentiality of participant information shared during behaviour change calls.** It is important you create a safe psychological environment for your participant, in which they feel comfortable to open up with you. This entails keeping what you speak about confidential, and only sharing it with Emma (for research purposes) and Paula (for supervision purposes).

**Please adhere to the following:**

- a) Make sure you conduct your behaviour change calls in a private space. Ensure no-one in your household (or the general public / students if in a public or university space) can see over your shoulder. If it is possible others might be able to hear your conversation, wear ear/headphones so they cannot hear what your mentee is saying.
- b) Do not share details of your conversations with your mentee's parent/s or family members, without their explicit permission.
- c) In whole team reflective meetings, do not refer to your participants by name. During the meetings you may discuss and reflect on what has come up in your conversations (indeed, it is important to do so), but try to do so anonymously (e.g. "one of my mentees").
- d) If you are writing a case study for your MSc, prof doc or SEPAR qualification, please use pseudonyms (fictitious names) or anonymous participant identifiers (e.g. mentee 1, mentee 2) to protect your mentee's confidentiality.

The one exception to the above is if you are concerned either your mentee or another young person is at risk of harm. In this situation you have a duty of care to take necessary action to keep them safe. Please see sections 4.2.3 and 4.3.3 for what to do if you have any concerns about your mentee's safety or wellbeing.

**4.2.1.2 Explaining confidentiality to your mentee.** During your first call with your mentee, please remind them of the information in section 4.2.1.1. You might say something such as:

*“Everything we talk about during these calls will be kept confidential. This means that I won’t share it with your parents/mum/dad and the only people I may talk to about it are the other researchers and my supervisor. The one time where I would have to tell someone what you have said is if I am worried you are in any danger or I am worried about your wellbeing. If this happens I would tell you that I need to talk to someone about this. Does that sound ok to you - would you like to ask me any questions about this?”*

**4.2.1.3. Storing and transferring personal data.** When writing up notes about your participants, please adhere to the following to ensure their data is stored securely and no-one unauthorised can access it:

- a) Make sure no-one can look over your shoulder while you’re writing up participant data. Avoid doing this on public transport or any public space where a lot of people are walking past.
- b) You will be asked to upload your call notes to a shared Google Drive that only you, Emma and Paula have access to. If you also wish to keep a copy of these notes, please store them on a secure drive that only you can access. If you are an LJMU student, we recommend saving any personal data on your LJMU OneDrive.
- c) If you do need to temporarily store any personal data on your laptop, move this to the LJMU OneDrive and delete it from your laptop as soon as possible.
- d) Use a personal Gmail address to access the Google Drive. Make sure this e-mail address is used by you only (e.g. not shared with your partner or anyone else in your household).
- e) Set up strong passwords for your Gmail, laptop and LJMU OneDrive and do not write these down anywhere. Using mnemonics can be a good way of helping you remember complex passwords. For example, you might think of a phrase and have your password as the first letter in each word: “NPFTHP#3” might be remembered by “new password for the HERizon project #3”.
- f) Never e-mail or WhatsApp your mentee’s personal data to anyone. If you do need to transfer something to Emma or Paula, either:
  - i. Upload to your personal Google Drive (that only Emma & Paula can access); or
  - ii. Send it in a password protected file via e-mail, and WhatsApp them the password separately.

**NB** Your participant has a right to ask to see any notes written about them. Therefore, when writing up notes from your behaviour change calls, make sure you use objective language and keep your statements factual. Avoid making judgements or using emotive or inappropriate language.

## 4.2.2 Child safeguarding

As a volunteer on HERizon, you have a duty of care to protect the young people you are working with by preventing abuse and safeguarding their welfare. This means keeping your eyes and ears open for anything that might indicate your mentee – or another young person they tell you about – is currently, has been or is at potential risk of abuse.

**Abuse of a child or young person involves either inflicting harm or failing to act to prevent harm.** This can occur in any area of the young person's life – home, school, sport or exercise, or social settings.

It is important to be aware also that the nature of competitive sports environments may place children and young people in particularly vulnerable situations (due to the power imbalance between coaches and players, changing rooms etc.).

All volunteers at HERizon undergo a DBS check before starting.

### 4.2.2.1 Types of abuse.

The NSPCC outline many different forms in which abuse of children might occur.

These can be grouped into five over-arching categories, outlined in table 4.1 below (along with signs and symptoms to look out for). You can read further information about types of abuse on the NSPCC learning website: [Child abuse and neglect | NSPCC Learning](#)

Table 4.1 Types of abuse

	Description	Potential signs and symptoms
<b>Physical abuse</b>	When someone physically hurts or harms a child on purpose. It may include hitting, kicking, shaking, throwing, poisoning, biting/scratching, burning/scalding, breaking bones, drowning, suffocating.	<ul style="list-style-type: none"> <li>• Regular injuries, a pattern of injuries, or explanations don't match injuries (e.g. bruising, bite marks, fractured/ broken bones)</li> <li>• Withdrawn/quiet behaviour</li> <li>• Extreme anxiety, nervousness or "jumpiness"</li> <li>• Self-harm or aggressive behaviour</li> </ul>
<b>Sexual abuse</b>	Forcing or enticing a child to take part in sexual activities (whether or not the child is aware of what is happening). May involve physical contact (e.g. rape) or be non-contact (e.g. producing or watching pornographic material).	<ul style="list-style-type: none"> <li>• Physical symptoms such as bruising, bleeding, pain or soreness</li> <li>• Overly sexualised behaviour or language</li> <li>• Frequent urinary tract infections or sexually transmitted diseases</li> </ul>

	Description	Potential signs and symptoms
		<ul style="list-style-type: none"> <li>• Sudden changes in behaviour or school/college performance</li> <li>• Withdrawn/quiet behaviour</li> <li>• Drug or alcohol misuse</li> <li>• Fear of a particular individual</li> </ul>
<b>Emotional abuse</b>	Persistent emotional maltreatment of a child, e.g. conveying they are worthless/inadequate, or only valued if they meet certain needs of others. May also involve placing developmentally inappropriate expectations on children. All types of abuse involve some emotional element, but it may also occur alone.	<ul style="list-style-type: none"> <li>• Lack of self-esteem/confidence</li> <li>• Self-harming</li> <li>• Drug or alcohol abuse</li> <li>• Lack of social skills, or empathy</li> <li>• Struggle to make or maintain relationships</li> </ul>
<b>Neglect</b>	Persistent failure to meet a child's basic physical and/or psychological needs. E.g. not providing food, clothing or shelter, failing to protect a child from physical harm/danger, failing to access appropriate medical care.	<ul style="list-style-type: none"> <li>• Poor personal hygiene</li> <li>• Inadequate clothing</li> <li>• Excessive hunger or tiredness</li> <li>• Untreated medical problems</li> <li>• Psychological issues such as low self-esteem, anxiety, withdrawn</li> <li>• Behaviour may be clingy or aggressive</li> <li>• Drug or alcohol misuse</li> </ul>
<b>Bullying or cyber-bullying</b>	When individuals or groups seek to harm, intimidate or coerce someone perceived to be vulnerable. Can occur in-person (bullying) or online (cyber-bullying). Can be verbal, physical, emotional, or online. Examples of cyber-bullying including "trolling" (menacing or upsetting messages on social media), voting against people in online abusive polls, setting up fake accounts, excluding people from online activities or friendship groups.	<ul style="list-style-type: none"> <li>• Reluctance to go to school</li> <li>• Problems eating / sleeping</li> <li>• Losing confidence or becoming withdrawn</li> <li>• Signs of physical injuries</li> <li>• Changes in behaviour or performance at school</li> </ul>

**4.2.2.2 Protecting yourself.** Child safeguarding is not only about protecting children and young people from the harms of others, but also involves taking steps to protect yourself against unfounded or malicious allegations. At HERizon, we take certain precautions to assure your protection, such as ensuring we have parental consent if a participant wishes to take calls from her bedroom. Please note it is also your responsibility to ensure you do not place yourself at undue risk of potential safeguarding concerns. For example, if you are in university accommodation and your bedroom is your only private space, make sure you arrange the call so it is the “office” section of the room that is visible. Alternatively, you could blur your background or set a neutral background. **If you have any concerns that something you or the young person have said or done might place you at risk, please speak to Paula immediately.**

#### **4.2.2.3. Further information.**

- For a more in-depth understanding of child abuse and how to protect children you are encouraged to visit the NSPCC learning website: [NSPCC Learning home](#). The website includes a wealth of free information, plus a range of online safeguarding courses at a reasonable cost (~£25).
- BPS Safeguarding Guide: [Safeguarding Children and Young People: Every Psychologist's Responsibility | BPS](#)

#### **4.2.3 HERizon safeguarding protocol – what to do if you are concerned**

As you can see from the signs and symptoms in table 4.1, there are many ways children may respond to abuse. There are also many alternative explanations for the majority of signs and symptoms in the table. This can sometimes deter people from reporting, or might lead them to fear the consequences if they do report and their concern turns out to be unfounded.

**It is very important that you remember your duty of care, and you report anything at all that concerns you – however small.**

It is only by not reporting that you place yourself at risk.

Figure 4.2 outlines the protocol to follow if you have any concerns about a young person you are working with.

The key thing to remember is:

**If you have any concerns at all – however small or insignificant you perceive them to be – talk to Paula**

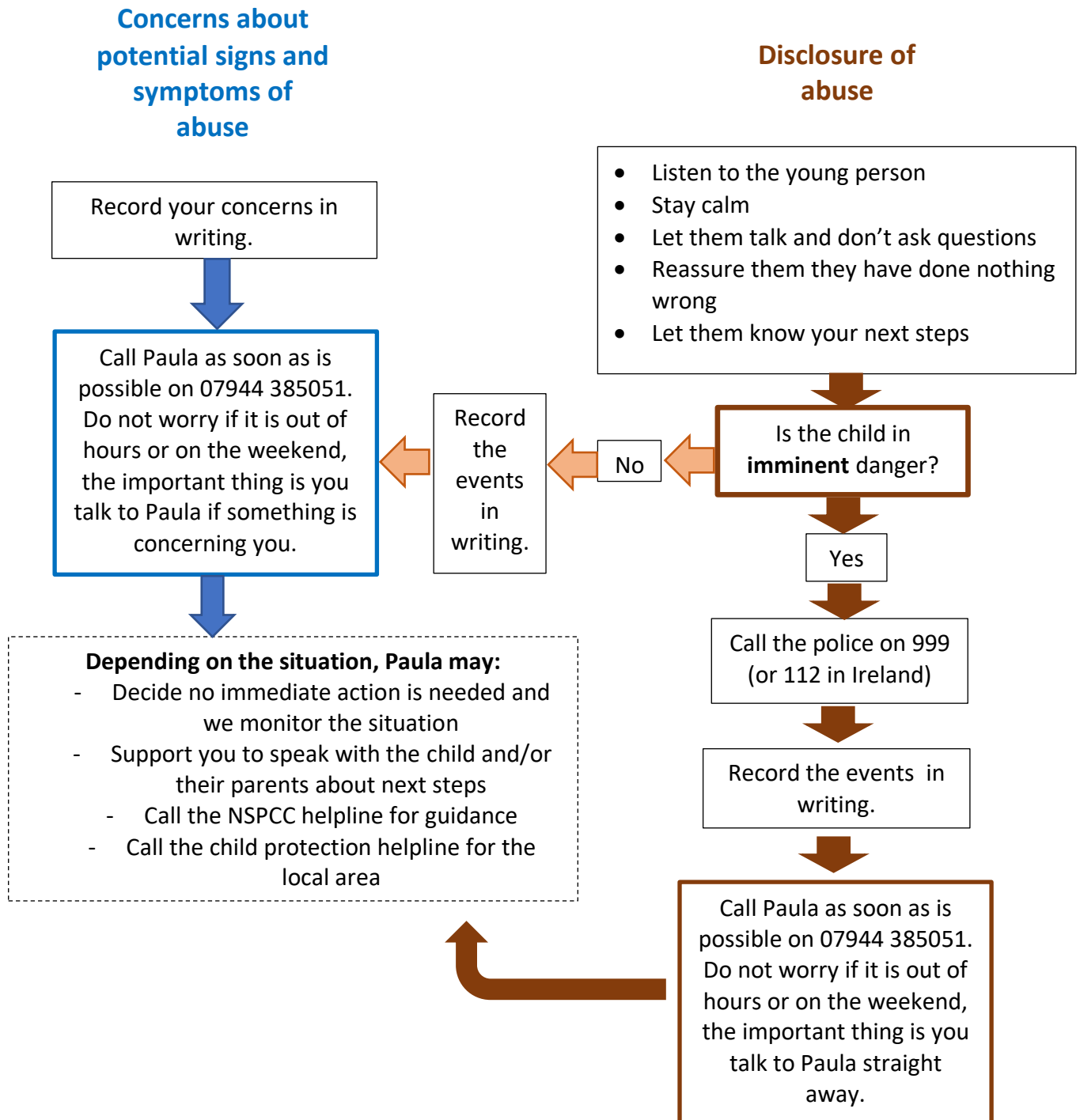


Figure 4.2 What to do if you have a child safeguarding concern



## 4.3 Mental health concerns

### 4.3.1 *Your boundaries when providing behaviour change support*

Your role as a HERizon activity mentor is to support girls in changing their PA behaviours. However, when we're delivering in a needs-supportive manner, conversations may cover a range of topics as you get to know your mentees and you might be faced with situations that go beyond your remit as an activity mentor. Such situations might include:

- **If your mentee asks advice about other lifestyle behaviours**, such as sleep or diet. In this situation, it may be appropriate to share NHS health guidance with your mentee (for example, sleep: [Sleep tips for teenagers - NHS \(www.nhs.uk\)](https://www.nhs.uk) or healthy eating: [Healthy eating for teens - NHS \(www.nhs.uk\)](https://www.nhs.uk)). It is not however appropriate to provide advice that goes beyond what you are trained/qualified to do. In this situation, you can explain this to your mentee, say you will try and find out where she might get support for this, and speak to Paula or Emma for further guidance.
- **If your mentee displays symptoms of a mental health problem** (e.g. depression, disordered eating, exercise dependence), or you have concerns that the HERizon programme is having a negative effect on her mental health. In this situation, it is important you report your concerns to Paula who will help you agree an appropriate way forward (see sections 4.3.2 and 4.3.3 below).

### 4.3.2 *Adolescent mental health – what to look out for*

The HERizon project is based on healthy lifestyle advice that is widely available in the public domain. As such, we hope it will benefit girls who take part and have a positive effect on their mental health.

**4.3.2.1 Mental health screening process.** Given the low risk involved, we have taken an inclusive approach to the HERizon project, and have not excluded any girls on the basis of mental health problems such as anxiety or depression. Instead we ask all parents to indicate before starting the project whether they have any concerns about their daughters' mental health that might affect participation in the project. Where a parent does have concerns, they are referred to Paula who has a conversation with the parent to ensure we don't feel participation in HERizon will put their daughter at additional risk. In the majority of cases, this results in the girl taking part and we remain mindful of how she is as we go through. Any girls who come through this pathway will be allocated to a senior activity mentor.

**4.3.2.2 Distinguishing "normal" from "clinical".** Adolescent girls often suffer psychological concerns, such as low self-esteem, bodily-related concerns or anxiety. It is important to distinguish between "sub-clinical" issues of this nature and "clinical" issues that require professional support. Therefore, in your role as activity mentor it will be important to stay

aware of how your mentees are, and remain mindful of what might be considered normal for adolescent girls and what might raise cause for concern. Table 4.2 provides links to information about anxiety, depression and eating disorders in teenagers and outlines some signs that indicate the problem might require clinical support.

**Table 4.2 Mental health problems in teenagers**

	Information	Signs that should raise concerns
Anxiety	<a href="https://www.youngminds.org.uk">Anxiety (youngminds.org.uk)</a>	<ul style="list-style-type: none"> <li>• If experiencing symptoms in the absence of obvious stressors</li> <li>• If symptoms are persistent or getting worse</li> <li>• If symptoms affecting everyday life</li> </ul>
Depression	<a href="https://www.youngminds.org.uk">Depression (youngminds.org.uk)</a>	<ul style="list-style-type: none"> <li>• If feeling down all the time or symptoms are very severe</li> <li>• If symptoms are persistent or getting worse</li> <li>• If symptoms affecting everyday life</li> </ul>
Eating disorders	<a href="https://www.youngminds.org.uk">Anorexia (youngminds.org.uk)</a> <a href="https://www.youngminds.org.uk">Bulimia (youngminds.org.uk)</a>	<ul style="list-style-type: none"> <li>• Cutting meals or eating less</li> <li>• Binging or making themselves sick</li> <li>• Obsession with weight or body image</li> <li>• Exercising too much</li> </ul>

**4.3.2.3. Further information.** For further information about young people's mental health go to: [YoungMinds - children and young people's mental health charity](https://www.youngminds.org.uk). This site contains a wealth of information about feelings and symptoms, and how to go about supporting young people with mental health concerns. Girls are also signposted to the Young Minds website in their PA logbook.

### **4.3.3 HERizon mental health protocol – what to do if you are concerned**

It is possible we might have some girls on the HERizon programme who are seeking or awaiting treatment for mental health issues, or for whom a mental health issue arises during the programme. It is important to remember two things:

1. It is not within the remit of activity mentors to treat mental health issues, nor are you qualified to do so.

2. If at any time you feel HERizon is having a negative effect on your mentee, or you feel your mentee requires support that is beyond your remit speak to Paula ASAP on 07944 385051.

**4.3.3.1. If you have concerns about your mentee's mental health.** Most situations will not be urgent and the action you should take is to record the facts in writing, then call Paula at the earliest opportunity (07944 385051) to discuss your concerns. Do not worry if it is out of hours or during the weekend, it is important you speak to Paula as soon as possible to discuss the best way forward. Next steps may involve:

- Deciding no immediate action is needed and we will monitor the situation
- Paula supporting you to speak to the child about your concerns and why it is important to speak with their parent
- Paula supporting you to speak with the child and parent together about potential referral options (e.g. local GP, or signposting to [YoungMinds - children and young people's mental health charity](#) for guidance)

**If the child is in imminent danger and you feel a delay could put their life at risk (e.g. self-harm, suicidal ideation)** – Call the CAMHS Crisis helpline for the local area (you can find this by googling) or, if in doubt, call the police on 999 (or 112 for Ireland). As soon as possible afterwards, write down what happened and call Paula on 07944 385051.

## References

Cowley, E.S., Watson, P.M., Fowweather, L., Belton, S., Thompson, A., Thijssen, D., & Wagenmakers, A.J.M. (2020a – under review). “Girls aren’t meant to exercise”: perceived influences on physical activity among adolescent girls – the HERizon project.

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Michie, S., Ashford, S., Sniehotta, F. F., Dombrowski, S. U., Bishop, A., & French, D. P. (2011). A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy. *Psychology and Health*, 26(11), 1479-1498.

Teixeira, P.J., Marques, M.M., Silva, M.N., Brunet, J., Duda, J.L., Haerens, L., La Guardia, J., Lindwall, M., Lonsdale, C., Markland, D., Michie, S., Moller, A.C., Ntoumanis, N., Patrick, H., Reeve, J., Ryan, R.M., Sebire, S.J., Standage, M., Vansteenkiste, M.,...Hagger, M.S. (2020). A classification of motivation and behavior change techniques used in self-determination theory-based interventions in health contexts. *Motivation Science*. Advance online publication. <https://doi.org/10.1037/mot0000172>

# Appendix (session plans)

Week 0 – introduction (30 minutes)		
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To explain how the behaviour change calls will work</li> <li>To build rapport and get to know participant</li> <li>To set personal goals for programme</li> </ul>		
	Log pages	book
<b>Introductions and role of the activity mentor (~10 mins)</b> <ul style="list-style-type: none"> <li>Tell participant about yourself and ask about them</li> <li>Explain how behaviour change calls will work (e.g. times, expectations, activity mentor's role) <ul style="list-style-type: none"> <li><i>If in group A, explain about the live sessions, Instagram group and text messages.</i> <ul style="list-style-type: none"> <li>Tell them that the 1<sup>st</sup> live workout is “compulsory” and arrange to “meet them” there (ideally, all activity mentors will also join this session).</li> </ul> </li> </ul> </li> <li>Talk through logbook and ask to bring it each week (explain why this is important). Show sections so your mentee is familiar with how it will be used and what info it contains (could screen share and ask them to look at hard copy simultaneously)</li> </ul>		Whole log book
<b>Participant perspectives on PA (~10 mins)</b> <ul style="list-style-type: none"> <li>Ask participant how she is feeling about joining HERizon, how she heard about it, whose idea it was etc.</li> <li>Discuss relationship with PA – previous involvement, what she enjoys/doesn't, family/friends' PA, knowledge of benefits etc. – use pages in log book to support discussion</li> <li>Reflect on baseline measures (e.g. fitness, motivation, body satisfaction) and how she feels about these</li> </ul>		PA info Pages 1-2
<b>Goal setting (~10 mins)</b> <ul style="list-style-type: none"> <li><b>What (outcome)</b> - Ask participant what she would like to achieve from HERizon and complete SMART goal 1 worksheet to set an outcome goal for the 12 weeks (or 6 weeks if she prefers - use preceding conversation to offer guided choice if she needs help)</li> <li><b>How (process)</b> - Then use the PA logbook to discuss different types of activity and think about how she would like to achieve this (no need for this process goal to be SMART). Ask her to write her ideas on her worksheet.</li> </ul> <p><i>NB there is no requirement this week to set a specific action plan – just try and reach the point where the participant has come up with a meaningful goal (i.e. outcome) and some ideas for how they will go about this (i.e. process).</i></p>		SMART goal worksheet (Page 13)  PA menu (pages 3-7)
<b>Home task: Write down all the PA she does over the next week</b> (explain this is important to help remember what she does, and which things she likes / doesn't like – writing things down can also give you a good sense of achievement)		PA calendar (pages 10-11)

*NB no need to go through action planning this week, just ask the participant to write down whatever activity she does. The aim of this is to introduce her to self-monitoring and allow her to have a go at whatever she chooses, without pressure.*

## Week 1 – setting action plans (15 minutes)

### Objectives of session:

- To reflect on the first week's PA
- To introduce the concept of action planning – what, why and how to do it
- To set an action plan for the coming week

	Log book pages
<b>Reflections on week 1 (~5 mins)</b> <ul style="list-style-type: none"> <li>• Complete reflections on week 1 worksheet and ask your mentee to write answers down, i.e. how she is feeling and how she has got on, what has gone well / not gone well (&amp; why), what did she enjoy (&amp; why), and how did these activities make her feel? <ul style="list-style-type: none"> <li>◦ <i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> <li>• Ask her to show you last week's log book calendar</li> </ul>	<a href="#">PA calendar (page 11)</a>  <a href="#">Reflections on week 1 worksheet (page 14)</a>
<b>Action planning (~5 mins)</b> <ul style="list-style-type: none"> <li>• Explain what action planning is and why it is important (i.e. more likely to turn intentions into behaviour)</li> <li>• Explain how you do it (note that writing down is a key part of it, and explain how we'll use the log book to do this)</li> <li>• Think about how action planning might apply in other areas of her life (e.g. school) – e.g. could plan in diary, or on calendar on phone.</li> </ul>	<a href="#">PA calendar example (page 10)</a>
<b>Set action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>• Help your participant set a specific action plan for week 1 and write this in the log book calendar (draw on the earlier conversation about likes / dislikes and re-visit the PA menu if necessary to help her). <ul style="list-style-type: none"> <li>◦ <i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	<a href="#">PA calendar (page 11)</a>
<b>Home task: Follow her action plan and tick off the sessions she does</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	<a href="#">PA calendar (page 11)</a>

Week 2 – barrier identification (15 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on the previous week's PA</li> <li>To discuss potential barriers and how to overcome them</li> <li>To review and adjust the action plan for the coming week (as appropriate)</li> </ul>	
	Log book pages
<b>Reflections on week 2 (~5 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on this week (ask her to show you last week's log book calendar)</li> <li>Reflect on what she feels has gone well / hasn't gone well (&amp; why)</li> <li>Reflect on which activities she enjoyed (&amp; why) – how did these activities make her feel? <ul style="list-style-type: none"> <li><i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> </ul>	<a href="#">PA calendar (page 11)</a>
<b>Barrier identification (~5 mins)</b> <ul style="list-style-type: none"> <li>Explain what barriers are and why it is important to consider them (i.e. because then we can plan how to overcome them, so they're less likely to stop us)</li> <li>Go through the barrier activity in the logbook to identify what might get in the way of the participant becoming more active and how she might overcome this</li> </ul>	<a href="#">Identifying barriers worksheet (page 15)</a>
<b>Review and adjust action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss her action plan for the coming week – would she like to keep the same as last time, change anything, make anything easier or harder? Encourage her to write this in the logbook calendar. <ul style="list-style-type: none"> <li><i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	<a href="#">PA calendar (page 11)</a>
<b>Home task: Follow her action plan and tick off the sessions she does</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	<a href="#">PA calendar (page 11)</a>



Weeks 3 & 4 – action plan reviews (15 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on how participant feels things are going (both PA and the calls)</li> <li>To discuss any issues relevant to the individual participant</li> <li>To review and adjust the action plan for the coming week (as appropriate)</li> </ul>	
	Logbook pages
<b>Reflections on previous week (~5 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on this week (ask her to show you last week's logbook calendar)</li> <li>Reflect on what she feels has gone well / hasn't gone well (&amp; why) – if applicable, did she manage to put her plans for overcoming barriers into action?</li> <li>Reflect on which activities she enjoyed (&amp; why) – how did these activities make her feel? <ul style="list-style-type: none"> <li><i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> <li>Discuss how she feels the calls with you are going – e.g what's good/bad about them, does the time still work for her, and is there anything she'd like you to do differently?</li> </ul>	PA calendar (page 11)
<b>Tailored discussion for participant (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss anything you feel would be beneficial to help the participant with her behaviour change. Examples may include: <ul style="list-style-type: none"> <li>Continuation of the reflections on the previous week, perhaps going into more depth about certain aspects</li> <li>Discussion of strategies to stay confident (e.g. healthy body image, positive self-talk) or motivated (e.g. using prompts/cues, imagery, family/friends) – focusing particularly on anything that might be relevant for her</li> <li>Discussion of something she is finding challenging and helping her identify potential solutions to these</li> <li>Discussion of the benefits she is experiencing, and imagining what it would feel like to keep it up</li> </ul> </li> </ul>	Staying on track (pages 16-18) (optional – use as appropriate)
<b>Review and adjust action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss her action plan for the coming week – would she like to keep the same as last time, change anything, make anything easier or harder? Encourage her to write this in the logbook calendar. <ul style="list-style-type: none"> <li><i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	PA calendar (page 11)
<b>Home task: Follow her action plan and tick off the sessions she does</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	PA calendar (page 11)

Week 5 – coping planning (15 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on the previous week's PA</li> <li>To think about when the behaviour change calls reduce, and develop coping plans</li> <li>To review and adjust the action plan for the coming week (as appropriate)</li> </ul>	
	Logbook pages
<b>Reflections on previous week (~5 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on this week (ask her to show you last week's logbook calendar)</li> <li>Reflect on what she feels has gone well / hasn't gone well (&amp; why)</li> <li>Reflect on which activities she enjoyed (&amp; why) – how did these activities make her feel? <ul style="list-style-type: none"> <li><i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> </ul>	PA calendar (page 11)
<b>Coping planning (~5 mins)</b> <ul style="list-style-type: none"> <li>Introduce coping planning and why it is important (i.e. similar to barrier identification, but now she has become more active, coping planning is about thinking about how she can keep this up).</li> <li>Go through the coping planning worksheet to put plans in place for the coming six weeks – i.e. what could be challenging about not having weekly calls, and what can she do to help herself with this? Could she start any of this now so she finds it easier when the time comes?</li> <li>Examples might include: <ul style="list-style-type: none"> <li>○ How will she remember to set her action plan each week?</li> <li>○ How will she make sure she keeps ticking off her activity?</li> <li>○ How will she stay motivated?</li> </ul> </li> </ul>	Coping planning worksheet 1 (page 19)
<b>Review and adjust action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss her action plan for the coming week – would she like to keep the same as last time, change anything, make anything easier or harder? Encourage her to write this in the logbook calendar. <ul style="list-style-type: none"> <li><i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	PA calendar (page 11)
<b>Home task: Follow her action plan and tick off the sessions she does</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	PA calendar (page 11)

Week 6 – reflect on achievements (15 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on the previous six weeks</li> <li>To go over last week's coping plan in preparation for the coming weeks</li> <li>To review and adjust the action plan for the coming three weeks (as appropriate)</li> </ul>	
	Logbook pages
<b>Reflections on previous six weeks (~5 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on this week (ask her to show you last week's logbook calendar)</li> <li>Talk through mid-point reflection worksheet and ask participant to write her answers down. Give meaningful praise for her achievements, and think about how she is progressing towards her outcome goal. Would she like to adjust this at all for the coming six weeks?               <ul style="list-style-type: none"> <li><i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> </ul>	<a href="#">PA calendar (page 11)</a>  <a href="#">Mid-point reflection worksheet (page 20)</a>
<b>Review coping plans (~5 mins)</b> <ul style="list-style-type: none"> <li>Look again at last week's coping plan and talk through any concerns she has for the next three weeks, and what she might do about these.</li> </ul>	<a href="#">Last week's completed coping planning worksheet 1 (page 19)</a>
<b>Review and adjust action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss her action plan for the coming three weeks – would she like to keep the same as last time, change anything, make anything easier or harder? Encourage her to write the first week in the logbook calendar, and discuss how she will remember to write the second and third weeks in (or she could do this now if she prefers).               <ul style="list-style-type: none"> <li><i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	<a href="#">PA calendar (page 11)</a>
<b>Home task: Follow her action plan and tick off the sessions she does – and remember her coping plans!</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	<a href="#">PA calendar (page 11)</a>

Week 9 – follow up 1 (15 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on the previous three weeks</li> <li>To discuss any challenges of having fewer weekly calls and make coping plans for when they stop altogether</li> <li>To review and adjust the action plan for the coming three weeks (as appropriate)</li> </ul>	
	Logbook pages
<b>Reflections on previous three weeks (~5 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on these last three weeks (ask her to show you her logbook calendar)</li> <li>Reflect on what she feels has gone well / hasn't gone well (&amp; why)</li> <li>Reflect on which activities she enjoyed (&amp; why) – how did these activities make her feel? <ul style="list-style-type: none"> <li><i>If in group A, also ask about the live sessions, Instagram group and text messages</i></li> </ul> </li> </ul>	PA calendar (page 11)
<b>Review coping plans (~5 mins)</b> <ul style="list-style-type: none"> <li>Complete coping planning worksheet 2 together, i.e. what does she think will be challenging when the weekly calls stop, and what could she do to overcome this?</li> </ul>	Coping planning worksheet 2 (page 21)
<b>Review and adjust action plan (~5 mins)</b> <ul style="list-style-type: none"> <li>Discuss her action plan for the coming three weeks – would she like to keep the same as last time, change anything, make anything easier or harder? Encourage her to write the first week in the logbook calendar, and discuss how she will remember to write the second and third weeks in (or she could do this now if she prefers). <ul style="list-style-type: none"> <li><i>If in group A – consider integrating some of the live sessions into the action plan</i></li> </ul> </li> </ul>	PA calendar (page 11)
<b>Home task: Follow her action plan and tick off the sessions she does – and remember her coping plans!</b> (but note to her if she misses a session or decides to change a session, this is fine – just move things around and write down whatever she ends up doing)	PA calendar (page 11)

Week 12 – follow up 2 (30 minutes)	
<b>Objectives of session:</b> <ul style="list-style-type: none"> <li>To reflect on the previous twelve weeks</li> <li>To discuss next steps and potential goals</li> <li>To review coping plans for staying active</li> </ul>	
	Logbook pages
<b>Reflections on previous twelve weeks (~10 mins)</b> <ul style="list-style-type: none"> <li>Ask how participant is feeling and how she has got on these last three weeks (ask her to show you her logbook calendar)</li> <li>Talk through final reflection worksheet and ask participant to write her answers down. Give meaningful praise for her achievements, focusing on what she has achieved since starting, how PA makes her feel, and how she has progressed towards her outcome goal. Also reflect on what she learned about the types of PA she enjoys, about her own capabilities, and about how PA helps her. How is she different now from when she started?</li> </ul>	<a href="#">PA calendar (page 11)</a>  <a href="#">Final reflection worksheet (page 22)</a>
<b>Discuss next steps and potential goals (~10 mins)</b> <ul style="list-style-type: none"> <li>Reflect on the participant's progress towards her first goal. If she has achieved her first goal, think about where she might go from here – does she want to set herself a new challenge (this could involve a new activity from the PA menu, or it could involve progressing her existing activities)? If so, support her to set another SMART goal.</li> <li>If she hasn't achieved her first goal, discuss if this is still important to her (and if so, what she could do to achieve it?); if it's no longer relevant, discuss how she might change her goal.</li> </ul>	<a href="#">SMART goal worksheet (page 13)</a>  <a href="#">Additional SMART goal worksheet</a> (available below if you need this to support you - could share screen or send to mentee)
<b>Discuss coping plans (~10 mins)</b> <ul style="list-style-type: none"> <li>Think about how she is going to stay active now HERizon is finished. What has she learned during HERizon that might help her? E.g. action planning, self-monitoring - could she create a new 12-week calendar for herself, or would she prefer to log another way?</li> <li>Refer to logbook to help with this if appropriate</li> </ul>	<a href="#">Additional coping planning worksheet</a> (available below to guide this conversation - could share screen or send to mentee)  Could also look at staying on track (pages 16-18) if appropriate
<b>Home task:</b> Keep up the great work, stay active and keep believing in herself!	

## SMART goals (additional worksheet)

**S**pecific  
**M**easurable  
**A**chievable  
**R**elevant  
**T**imebound

At the start of HERizon, you set yourself a SMART goal.

Have you achieved your goal? **YES** (go to part A) / **NO** (go to part B)

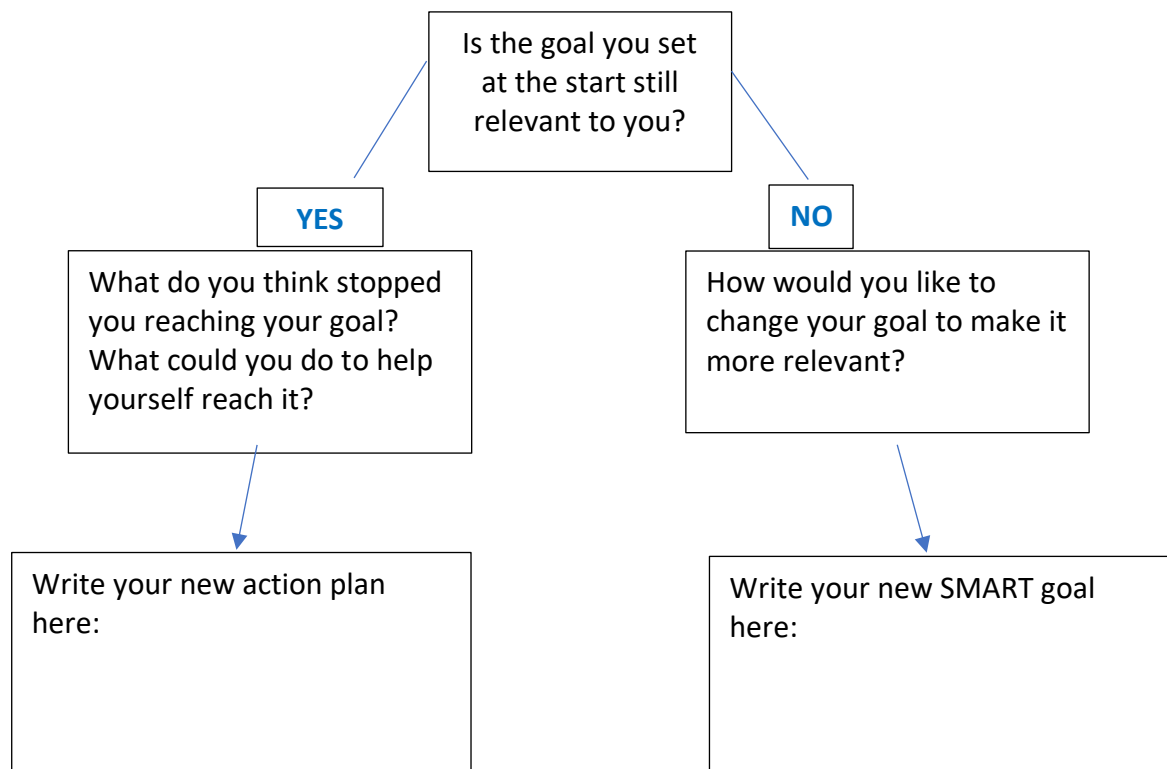
### Part A. If you have achieved your goal – congratulations!

The next step is to consider how you will keep yourself motivated to continue with your physical activity. Setting another SMART goal can be a good way to do this. So perhaps think of how you can challenge yourself to reach the next level (e.g. if your first goal was to run 5k, perhaps you could set a goal to run 10k).

Write your new SMART goal here:

**Part B.** If you haven't achieved your goal – don't worry, you have achieved many other things (for evidence of this look at your previous worksheet!).

Use this flow chart to help you move forward:



## Coping planning (additional worksheet)

From what you have learned at HERizon, write down:

Two things you will do to help you stay active:

- 1.
- 2.

Two strategies you will use to help you stay motivated:

- 1.
- 2.

Two things you will do to stay confident and believe in yourself:

- 1.
- 2.

- THE HERIZON PROJECT -

# PHYSICAL ACTIVITY LOGBOOK





# What is Physical Activity & how much should I do?



## WHAT IS PHYSICAL ACTIVITY?

It is any activity that makes you breathe faster, feel warmer and raises your heart rate. Not all your activity needs to be super sweaty!



## AT LEAST 60 MINUTES EVERYDAY

This doesn't need to be done in one go, break it up into smaller chunks. E.g. a 15 minute walk to & from school



## LOUNGING

Try to reduce the amount of time you spend sitting or lying and instead move more. Go for a walk with friends rather than sitting at home together



## ISN'T IT JUST SPORT?

- **Exercise** – planned activity with the aim of improving fitness (e.g. going to the gym).
- **Sport** – Involves individuals or a team competing against each other (e.g. football).
- **Physical Activity** – ANYTHING that increases your heart rate, e.g. walking to school or taking the stairs



## GENERAL

Improves fitness  
Improves sleep  
Improves concentration & learning  
Builds confidence & social skills



## PHYSICAL

Increases flexibility  
Maintains healthy weight  
Develops coordination  
Strengthens muscles & bones



## BIOLOGICAL

Improves metabolic rate  
Improves immune system  
Improves lung function  
Improves energy levels



## MENTAL HEALTH

Makes you feel accomplished  
Improves self-esteem  
Reduces stress  
Improves body appreciation

# BENEFITS OF PHYSICAL ACTIVITY.

-THE HORIZON PROJECT -

# ACTIVITY MENU

**YT** - YOUTUBE  
**IGTV** - INSTAGRAM  
**WEB** - WEBSITE

## **YOGA**

Combination of physical exercises, mental meditation, & breathing techniques to strengthen the muscles & relieve stress.

## **PILATES**

Combination of low-impact flexibility, muscular strength & endurance movements. It emphasises correct posture, core strength & muscle balance

## **HIGH INTENSITY INTERVAL TRAINING**

Lots of different cardio & strengthening exercises that alternate ~40sec of hard work, with ~20 sec of rest. Challenging but lot of fun!!

## **STRENGTH**

Focuses on learning new techniques that build, tone & define muscle. Do not worry, you won't get "big" or "bulky". Usually focus on a particular muscle group/body part, e.g. legs, abs, arms.

# YOGA & PILATES



## CORE POWER-YT

- MIX OF MALE & FEMALE INSTRUCTORS
- 20-60 MINUTE WORKOUTS
- BEGINNER TO ADVANCED
- YOGA, MEDITATION, FLEXIBILITY
- SOME 'TONING' WORKOUTS TOO

## YOGA WITH ADRIENE-YT

- AMERICAN GIRL
- LOTS OF 30 DAY CHALLENGES
- 10-60 MINUTE WORKOUTS
- BEGINNER TO ADVANCED
- YOGA, MEDITATION, TONING
- I LOVE THIS CHANNEL!!!

## MOVE WITH NICOLE-YT

- AUSTRALIAN GIRL
- 15-60 MINUTE WORKOUTS
- BEGINNER TO ADVANCED
- MAINLY PILATES
- SOME CARDIO, DANCE AND ABS
- HER INSTA IS SO IMPRESSIVE

## BLOGILATES - YT

- AMERICAN GIRL
- 10-60 MINUTE WORKOUTS
- OVER 5 MILLION SUBSCRIBERS
- LOTS OF SPECIFIC WORKOUTS, E.G. ARMS, ABS, BOTTOM
- SHE'S ALSO ON TIKTOK

## TALILLA HENCHOZ -IGTV

- ENGLISH GIRL
- FOCUS SELF-LOVE & SUPPORT
- WORKOUTS ON HER IGTV OR CATCH THEM LIVE X2 WEEKLY
- SOME STRENGTH & STRETCHING

## RUMBLE-IGTV

- MIX MEN AND WOMEN TRAINERS
- SUPER FUN AND VARIED WORKOUTS
- MAINLY BOXING STYLE HIIT
- NO EQUIPMENT
- ALSO HAVE A GYM IN LONDON

## BODYROCK.TV-YT

- MIX MEN AND WOMEN TRAINERS
- SOME USE EQUIPMENT BUT YOU CAN MODIFY
- SOME WORKOUTS QUITE ADVANCED
- WORKOUTS VERY DIVERSE & VARIED

## THE BODY COACH-YT

- SUPER FAMOUS MALE TRAINER
- 5 - 60 MINUTE WORKOUTS
- RANGE OF FULL BODY & LOW IMPACT WORKOUTS
- SOME WORKOUTS USE EQUIPMENT



HIGH INTENSITY  
INTERVAL TRAINING



# STRENGTH

## LAURA BICEPS-IGTV

- ENGLISH GIRL
- YOU WILL NEED SOME CANS OF BEANS, WATER BOTTLE OR SET OF DUMBBELS.
- REALLY FOCUSED ON DEVELOPING WOMEN'S STRENGTH

## CHLOE TING-YT

- AMERICAN GIRL
- SHE WAS ADDED TO THE MENU BECAUSE GIRLS IN THE LAST GROUP LOVED HER!
- 10-20 MINUTE BODY WEIGHT WORKOUTS
- ON INSTA AND TICTOK ALSO

## MADFIT-YT

- AUSTRALIAN GIRL
- LOTS OF REAL TIME WORKOUTS SO YOU CAN FOLLOW ALONG
- LEARN LOTS OF COMPOUND EXERCISES
- 10-30 MINUTES

## TONE IT UP!-YT

- AMERICAN GIRLS
- RANGE OF DIFFERENT TRAINERS
- LOTS OF BODYWEIGHT OR WEIGHT BASED WORKOUTS
- ALSO SOME HIIT AND PILATES

## SOCCERCISE-WEB

- DEVELOPED BY THE FA
- HOME-BASED SOCCER WORKOUTS
- 45-60 MINUTE WORKOUTS
- YOU NEED A BALL!
- DOWNLOAD A PDF OF THE PROGRAM ON THEIR WEBSITE



## ENGLAND BOXING-WEB

- DEVELOPED BY ENGLAND BOXING
- HOME-BASED BOXING WORKOUTS
- LOTS OF DIFFERENT RESOURCES, SOME VIDEOS AND SOME PDFS
- THEY ALSO HAVE ARMY WOKROUTS

## DANCE 305 FITNESS-YT

- LOTS OF DIFFERENT TRAINERS
- 15-45 MINUTE WORKOUTS
- LEARN A FULL DANCE ROUTINE TO POPULAR SONGS
- DON'T NEED ANY EQUIPMENT

## NIKE RUN CLUB-WEB

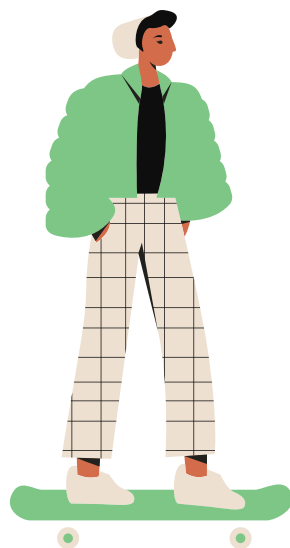
- PERSONALISED RUNNING PROGRAMME
- SUITABLE FOR BEGINNERS
- APP FOR YOUR PHONE
- RECORDS YOUR RUNS

SPORT SPECIFIC

# ACTIVITY LOGBOOK

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- In the calendar below, plan your 3 activity sessions each week.
- Once you complete your session, tick it off!







# HOW TO USE THIS BOOKLET

Using the calendar below, you will plan your activity sessions to help you develop a physical activity routine.

1. Using the calendar, plan your 3 physical activity sessions. e.g what day you will exercise, what time and what type of activity.
2. When you complete a session, tick it off.
3. Each week complete your reflection page. This is just for you! You don't have to return this booklet so we encourage you to use it like a diary and to be honest with your answers

## IMPORTANT!

*We know that sometimes it's hard to keep up with your physical activity. If you don't manage all 3 sessions or forget to tick your sessions off, don't worry! We are here to support you, so just pick up where you left off and stay positive. We can talk through issues or questions you have, just shoot us an email at [e.s.cowley@ljmu.ac.uk](mailto:e.s.cowley@ljmu.ac.uk)*

	MON	TUES	WED	THUR	FRI	SAT	SUN
WEEK 1	Yoga 8am ✓		Live 6pm ✓			Jog 11am ✓	
WEEK 2	Walk 8am ✓		Pilates 8am ✓		Boxing 8am ✓		
WEEK 3		Jog 8am ✓	Yog a ✓			Live 8am ✓	
WEEK 4			8am Walk 8am ✓	Dance 8am ✓			Yog a ✓ 8am
WEEK 5	HIIT 8am ✓		Live 8am ✓		Live 8am ✓		
WEEK 6							
WEEK 7							
WEEK 8							
WEEK 9							
WEEK 10							
WEEK 11							
WEEK 12							10

	MON	TUES	WED	THUR	FRI	SAT	SUN
WEEK 1							
WEEK 2							
WEEK 3							
WEEK 4							
WEEK 5							
WEEK 6							
WEEK 7							
WEEK 8							
WEEK 9							
WEEK 10							
WEEK 11							
WEEK 12							



# REFLECTIVE WORKSHEETS

We would love for you to take some time each week to reflect on your progress and track your activity.

---

Even though becoming more active can be fun – it isn't always easy. We've provided some worksheets to help you reflect on your achievements and develop plans to help you succeed. You can think about these things any time, but you might find it most useful to complete them on the suggested weeks.



When setting yourself a goal, it is helpful if it is SMART. This means it is:

- S Specific** – you say exactly what you want to achieve
- M Measurable** – It is possible to measure when you have achieved it
- A Achievable** – It is something that is realistic for you to achieve
- R Relevant** – It is something YOU want to achieve & feel it important
- T Timebound** – You say when you will achieve it by



Felicity is currently inactive and wants to become more active. Which of the following goals do you think is SMART?

	SMART	Not-SMART	Reasons (why did you answer as you did)
Run a marathon in 2 months			
Gradually build up to run 5km in 12 weeks			
Able to run up 12 flights of stairs without being out of breath			

Think about your own physical activity. What would you like to achieve in the next 12 weeks?

Now turn this into a SMART goal and write it here:

Write some ideas for how you are going to acheive this goal:

ANS: 1. Not SMART (not achievable); 2. SMART; 3. Not SMART (not timebound)

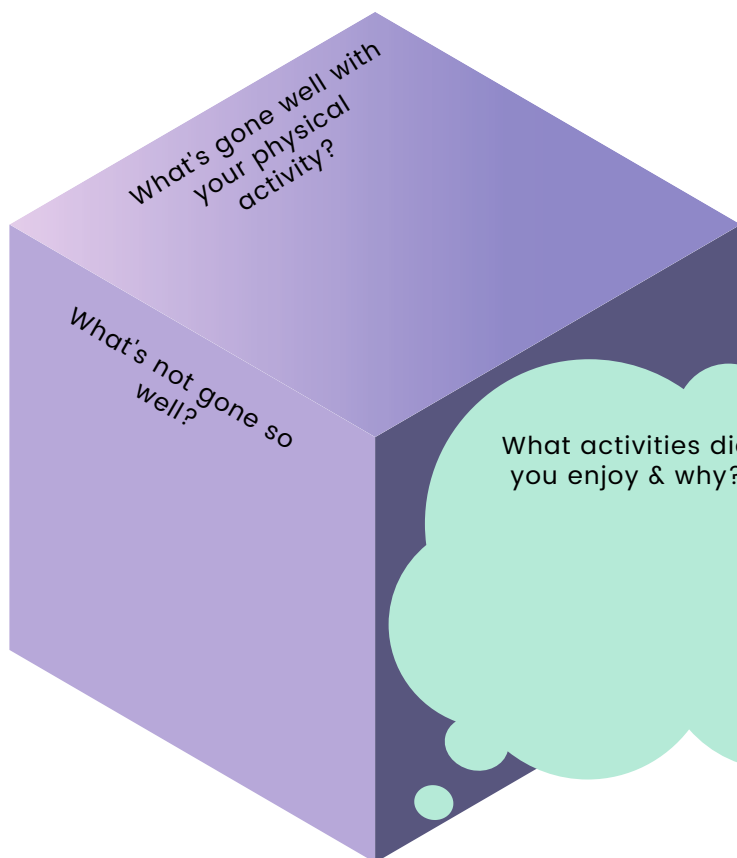
# REFLECTIONS WEEK 1

## How are you feeling this week?

Place a line across the point that represents how you're feeling

1  
Rubbish!

10  
Amazing!



# WEEK 2

## IDENTIFYING BARRIERS



A barrier is something that makes it more challenging for you to do what you'd like to (think of a "barrier" in the road that stops you going past). Common barriers to physical activity include lack of time, weather, lack of motivation or lack of available activities.

Use the space on the left to write down some of your barriers to physical activity.

Then use the space on the right to write down something that could help you overcome each of these barriers.

When you're doing the activity, try and think about people around you (e.g. your friends and family) and how they might be able to help.



**How might you overcome these barriers?**

EXAMPLE:

1. Write my weekly plan on the kitchen calendar

**What might stop you achieving your physical activity goals?**

EXAMPLE:

1. I might forget to do my exercise sessions

## Strategies for Staying Confident

Many teenage girls worry about how they look or feel self-conscious when they exercise. This can lead you to feel low in confidence and prevent you from wanting to be active. Below are some strategies you could try to help you feel good about your body and help increase your confidence.

1

**Be kind to yourself.** Take some time every evening to write down

- a) something you like about yourself,
- b) something you did to help someone else during the day,
- c) something you have achieved during the day (however small!). If you struggle to think of things yourself, ask a friend or family member to help you (and write down what they say so you remember).

2

**Remember your body is amazing.** During your next exercise session think about what your body is doing as you move. Notice how your muscles contract to make your bones move, how your heart rate and breathing increase to keep enough blood flowing and oxygen coming in, and notice how you feel after the activity. Do this every week and see what you notice – do you feel stronger? Do you feel less out of breath? Can you keep going for longer?

3

**Believe you can and you will.** Practice saying positive things to yourself before exercise, during exercise and after exercise (either in your head or out loud). Some examples could be “come on girl, you’ve got this!” or “you did amazing there” or “you can do this”. Then next time you feel negative thoughts creeping in, try and use the positive self-talk you have practiced to help yourself believe you can do it

4

**Concentrate on self-improvement rather than comparing yourself with others.** It doesn’t matter how many push-ups you can do, or how far you can run. There will always be someone who is stronger, or someone who is faster (unless you’re an Olympian!) – so comparing ourselves with others does little for our self-esteem. Instead, try writing down your starting point, and setting yourself an action plan to improve on that. Write down the small steps you make and give yourself a pat on the back. Before you know it you will realise you have achieved things you never thought possible!



# Strategies for staying motivated.

---

It's all well and good saying you want to get more active, but even adults find this difficult to do in practice. So if you're lacking motivation, try the following strategies to help you keep going.

## **Use imagery**

Try closing your eyes and thinking how it will feel to reach your goal. How does it feel to achieve your goal? What emotions, thoughts and feelings are going through your mind? What is different about you then compared with now? This same activity can be applied to a workout by imagining yourself doing the workout, thinking about how that feels then imagining that “feel good” feeling you will get once you’ve done it.

## **Seek support from family & friends**

Physical activity is much easier when those around us provide encouragement, or take part with us. Perhaps you could ask a parent or sibling to do your workouts with you, talk to a family member about how great you are doing with your physical activity, or meet a friend for a walk in the park?

## **Put prompts around the house**

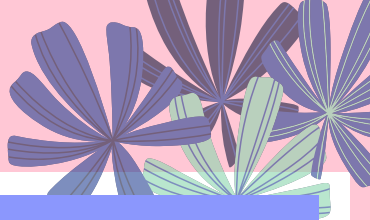
Sometimes putting motivational prompts around the house can be helpful. For example, this could be reminders to yourself, positive messages to boost your confidence (see the point above about self-talk!) or perhaps getting your workout clothes out ready. Even putting your trainers and kit on can help you feel more motivated. So if you're lacking energy – try getting changed and you might find this gives you the energy boost you need!

## **Take the pressure off**

When you're feeling pressured to do something it can have the reverse effect and make you not want to do it. Pressure can come from many places – such as social media, family or friends, or even from yourself. If you are feeling pressured, try "letting go" and thinking "it's ok if I go a bit slower, or if I miss a day". This will help you begin to enjoy the activity again and before you know it you'll feel a lot more motivated.

## **Make space to be active**

Being active at home can be difficult if the living room is cluttered, and you've got a lot of people competing for the same spaces. Try and make a space in your house or garden where you can do your physical activity freely, without having to spend time removing clutter or worry about others interrupting you. For example, could you clear a space in your bedroom, or change the living room layout?



Now you have made a start with your active lifestyle, it is important to think about how you will keep this going.

A good way of doing this is to think about what might get in the way, then set a plan for what you will do to stay active if that happens.

Use the table below to make some coping plans for your own physical activity.

If....	Then....
EXAMPLE: If I am starting to forget my workouts	EXAMPLE: I will plan my activity at the start of the week & write it on the calendar

Here are some “ifs” you could think about: -

- If you have exams
- If you are on school holidays (so your routine changes)
- If you are lacking motivation
- If you are feeling body conscious
- If you need support from others



Now you are half-way through the 12-week programme, it is good to reflect back on how far you have come.

Use the boxes below to help you do this.

Think about your physical activity, what is different now from 6 weeks ago?

How is being more physically active helping you?

Think back to the goal you set yourself in week 0 – are you on track to achieve this?

If not, what could you do differently to help you with this?

Is there anything your family or friends could do to help you?



Now another few weeks have passed, you might have more ideas about the “if” things that could get in the way of your physical activity.

If anything has changed since you filled this in during week 5, add some further ideas in the table below.

If....	Then....
EXAMPLE: If I have a lot of school work on	EXAMPLE: I will remember how important physical activity is and schedule it into my week

Here are some “ifs” you could think about: -

- If you have exams
- If you are on school holidays (so your routine changes)
- If you are lacking motivation
- If you are feeling body conscious
- If you need support from others



Well done on completing 12 weeks of the HERizon programme!

Reflect on the questions below to congratulate yourself on how far you have come. And don't worry if you haven't achieved as much as you'd like – this is just the start of your physically active lifestyle.

You have plenty of time to build on the skills you have learned during HERizon to help you stay active from now.

Write 3 new things you have achieved during HERizon:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Write 3 new skills you have learnt during HERizon:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Write 3 new things you have learnt about yourself during HERizon:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



## **DO I HAVE TO CHOOSE AN ACTIVITY FROM THE PHYSICAL ACTIVITY MENU?**

No, they are just suggestions. Feel free to try other activities.

## **IS IT NORMAL TO BE SORE AFTER A WORKOUT?**

Yes, this is called Delayed Onset of Muscle Soreness. As your body becomes more used to exercising, you will experience less aches and pains. Try to have enough rest between sessions and a good warm up and cool down.

## **CAN I DO WORKOUT WITH A FRIEND/ FAMILY MEMBER?**

Yes! The more the merrier.

## **WILL I BE IN TROUBLE IF I DON'T DO ALL 3 ACTIVITY SESSIONS?**

No!! We are here to support and encourage you, not to give out. Things happens and some weeks we don't manage to meet our target. There is always next week.

## **WHAT DO I DO IF I DON'T WANT TO DO THE PROGRAMME ANYMORE?**

We understand that circumstances change. If you decide you don't want to take part any more, please let Emma or your Activity Mentor know. All we ask if that you return your accelerometer by post.

## **WHO DO I CONTACT IF I HAVE ANY QUESTIONS?**

If you or your parent have any questions, please email Emma at [e.s.cowley@ljmu.ac.uk](mailto:e.s.cowley@ljmu.ac.uk)

# CONGRATULATIONS

Well done for completing the HERizon Project!

We wish you a happy, health and active future and hope that you keep in touch.

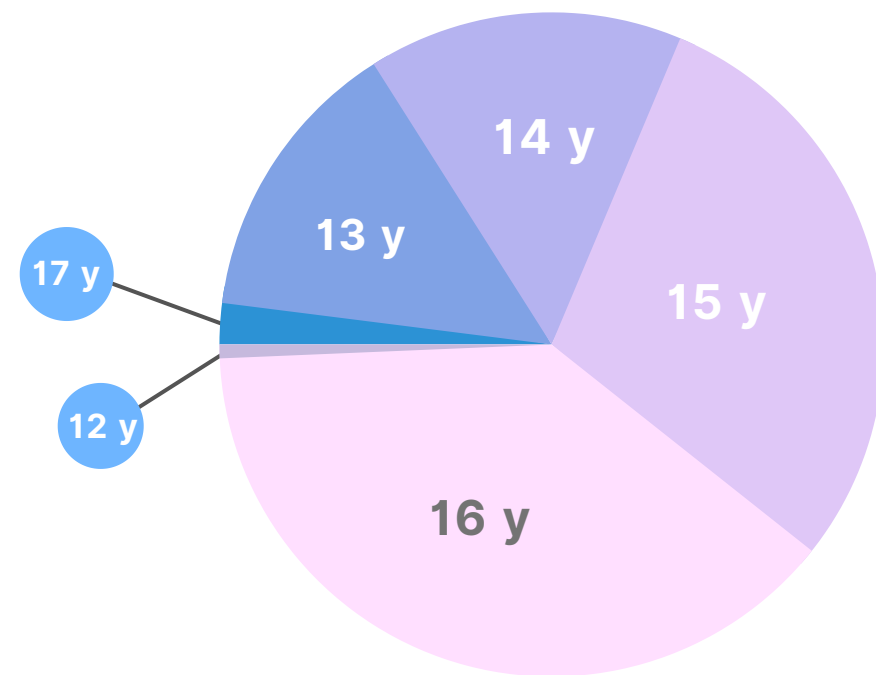
If you have found this logbook helpful, why not continue tracking your activity?



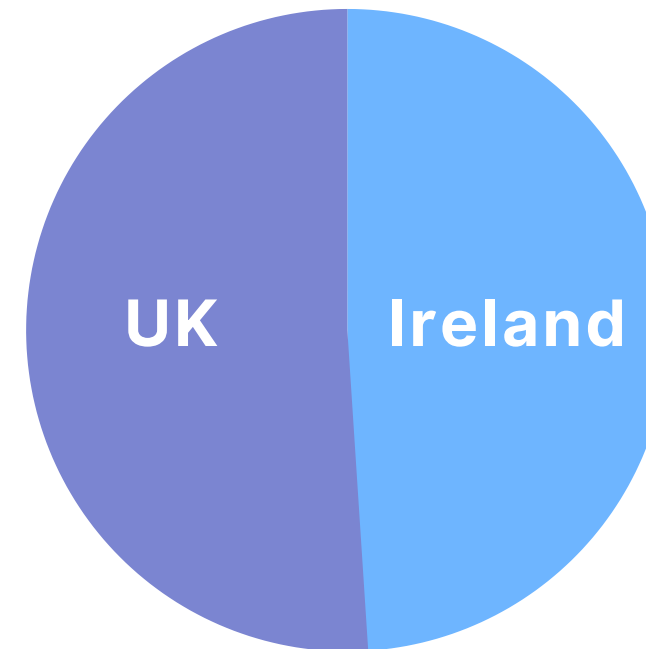
# THE HERIZON COMMUNITY



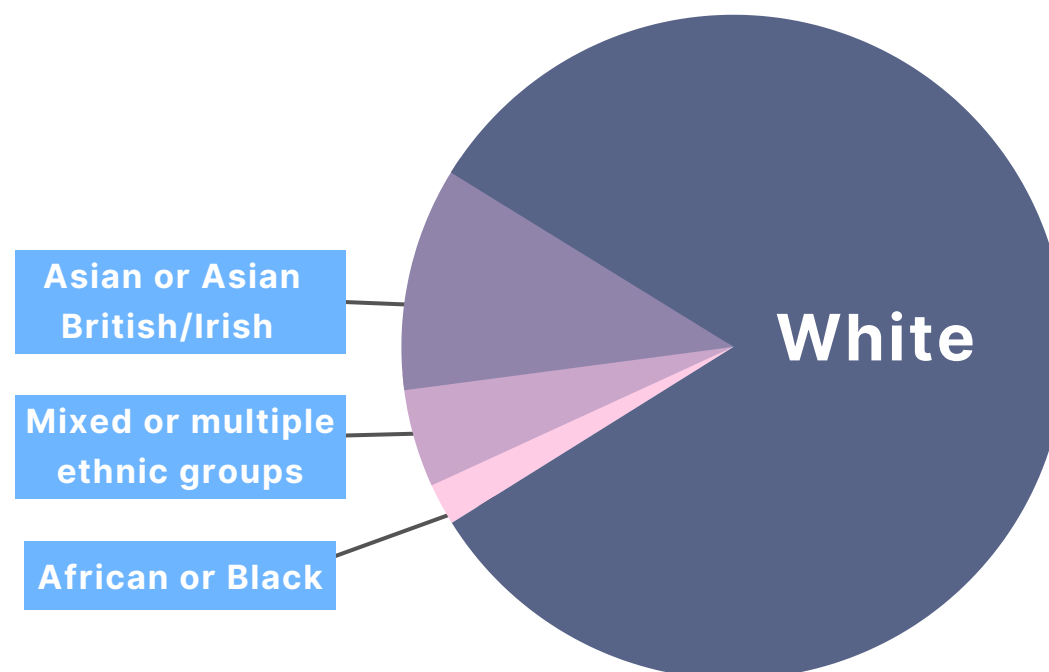
## AGE



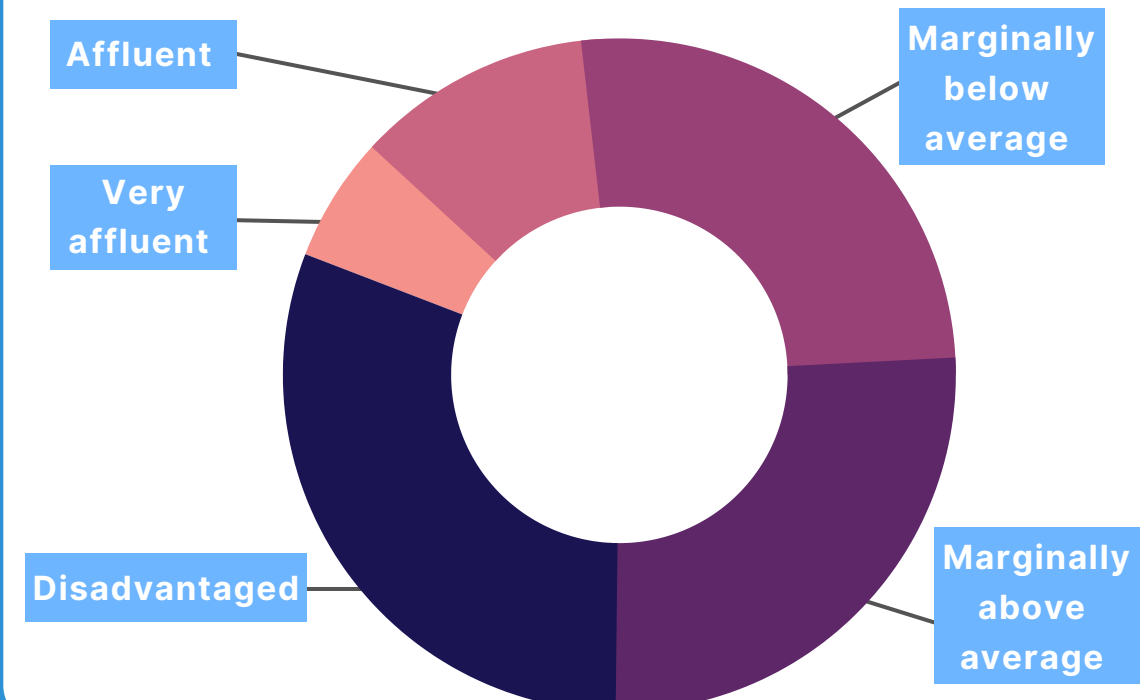
## COUNTRY



## ETHNICITY



## SOCIO-ECONOMIC STATUS



# WHAT WAS YOUR FAVOURITE PART OF HERIZON?



A word cloud of responses to the question 'WHAT WAS YOUR FAVOURITE PART OF HERIZON?'. The words are arranged in a circular pattern, with 'Reaching my goals' being the largest and most central. Other prominent words include 'Exercise testing', 'Mentor calls', 'Live workouts', 'Routine', 'Sense of community', 'Increased', 'Schedule', 'More motivated', 'The challenge', 'Variety', 'Part of research', 'Instagram', 'Feeling refreshed', 'More energised', 'More confidence', 'Trying new exercises', 'The reminders', 'Everything', 'Sense of accomplishment', 'Accountability', and 'Having routine'. The words are in various colors including blue, orange, purple, and teal.

Reaching my goals

Exercise testing

Mentor calls

Live workouts

Routine

Sense of community

Increased

Schedule

More motivated

The challenge

Variety

Part of research

Instagram

Feeling refreshed

More energised

More confidence

Trying new exercises

The reminders

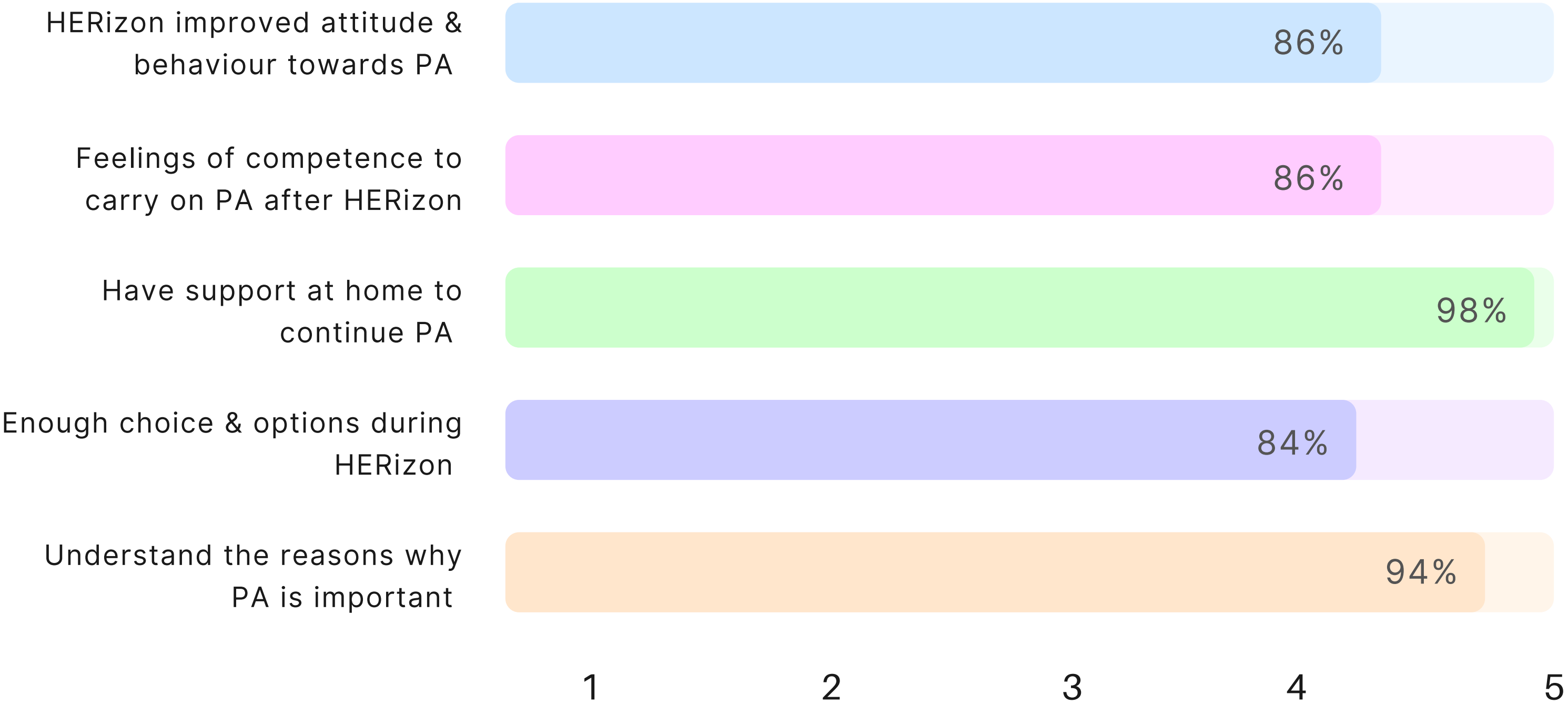
Everything

Sense of accomplishment

Accountability

Having routine

# HERIZON EFFECT ON PHYSICAL ACTIVITY



# MOST COMMONLY REPORTED PHYSICAL ACTIVITIES



# HERIZON LIVE WORKOUTS

94% enjoyed the sessions

The variety of  
exercises was my  
favourite part of them

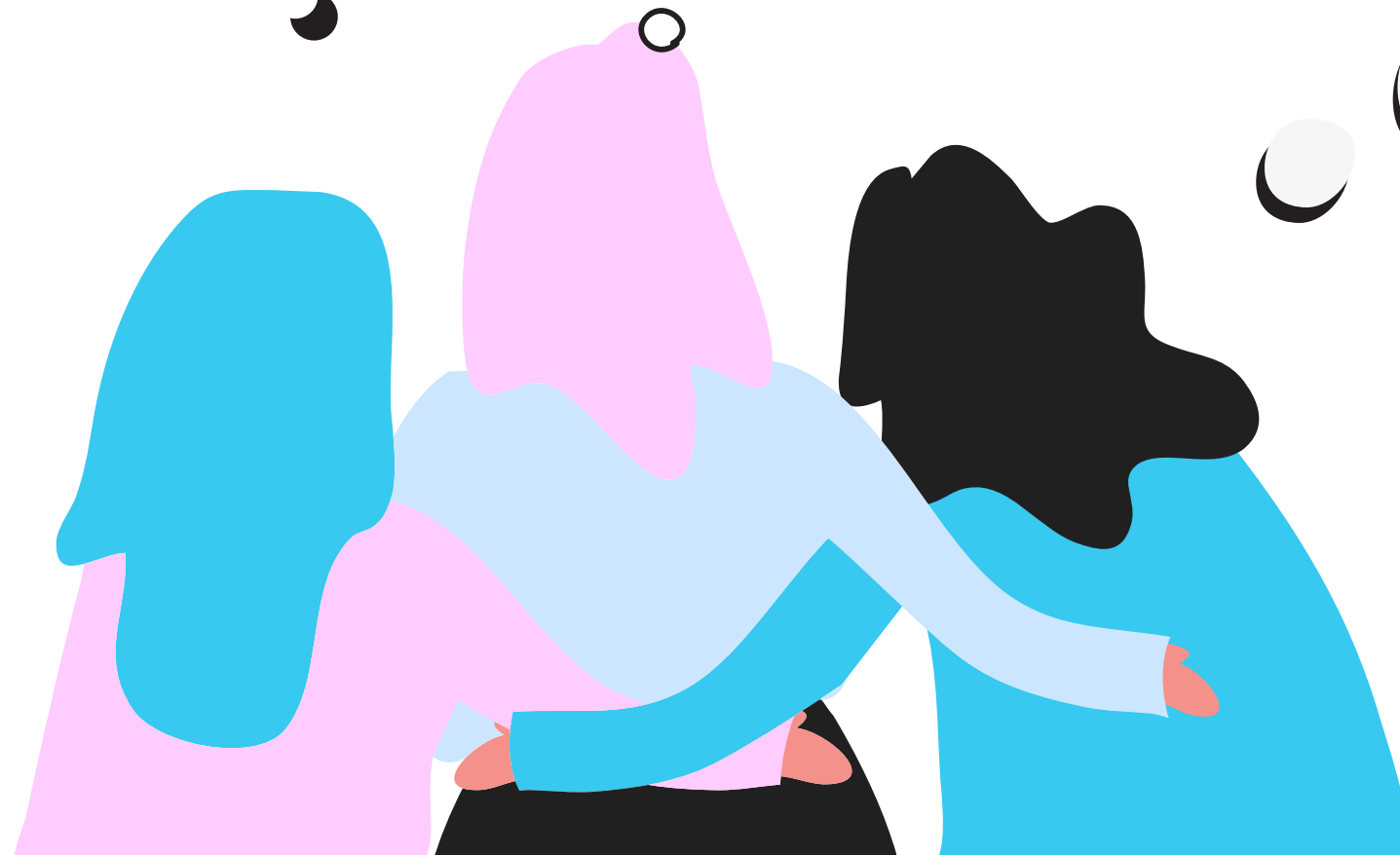
The  
rotation  
of  
exercises  
kept it  
interesting

The intensity was really  
good, I had enough time  
to rest & catch my breath  
between exercises

Emma is very  
motivational and genuine  
so it was like workign  
out with a friend

The fact it  
was live  
encouraged  
me to keep  
going

Knowing there were  
other girls joining &  
that I wasn't alone



# WHAT THE GIRLS SAID ABOUT THEIR CALLS



She was very approachable and friendly - I was quite nervous at first but she made me feel immediately at ease.

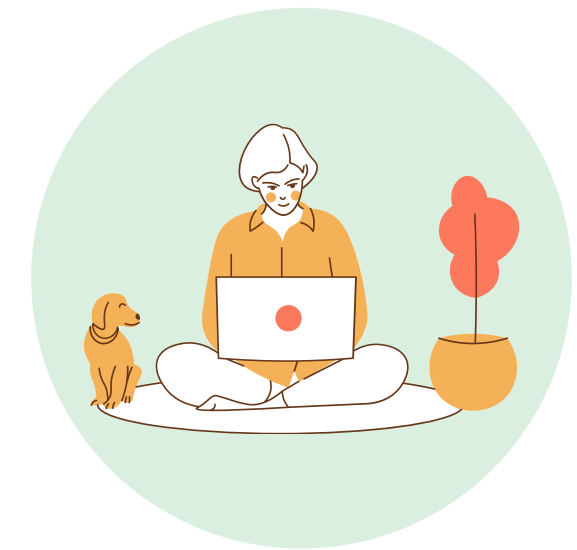
She always asked me did I need help or have questions & she always listened to me very well. She praised me a lot which made me motivated to do her proud.



She was very kind, welcoming & supportive. When I was feeling less motivated she was able to remind me of why I was doing the activities & motivate me. She was always supporting me with positive attitude & understanding.

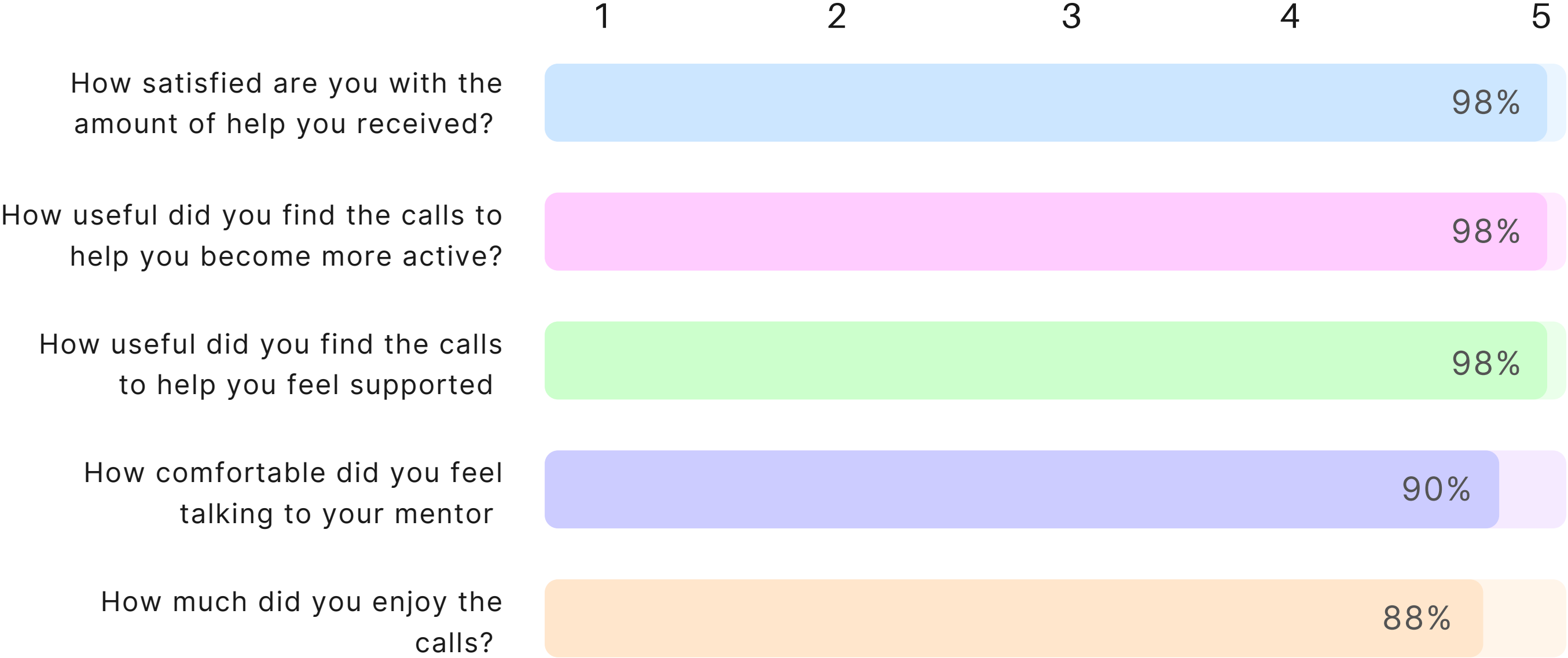


I enjoyed them because I had someone that was supportive & nonjudgemental to talk about my activities. At the very start it was useful to be able ask questions because I was just starting out.



She helped me find solutions to working around schoolwork and gave me advice - like journalling about how I found physical activity. Also she didn't make me feel bad about not doing exercise & was very supportive.

# MENTOR CALLS



33 sessions

AVG AMOUNT OF PA SESSIONS DURING HERIZON

133 minutes

AVG TOTAL MINUTES SPENT ON CALLS

8 calls

AVG AMOUNT OF CALLS DURING HERIZON



# WHAT THE PARENTS SAID ABOUT HERIZON



I would like to thank you so much for all you've done for Sarah. A massive change was noticed by us all in her behaviour, her motivation & her great sense of humour was back. She felt so energised and no problem at all in being motivated to do it, even on a Saturday morning!

”

I have definitely noticed that my daughter Ilona has made a huge effort to fit in some activity into her daily routine. It was a huge bonus when homeschooling as the hours spent online in her room was a concern but she was very keen and enthusiastic.

”

Herizon was just brilliant for Anna - she thoroughly enjoyed it, and she looked forward to all of the sessions. It improved her confidence, and her strength and her enjoyment of exercise - thanks so much.

”

I noticed a huge change during the study...she went from not doing much exercise bar walking the dog and her dance class to doing exercise almost every day. Every Wednesday we both did your class and she seemed to really enjoy that!

”

Lauren loved every minute of this experience. I have noticed that she is alot more toned in her body. Her clothes that were a bit tight fit better. Plus she has me and her younger brother doing a bit more exercise which was no harm.

”

It put her into a routine for working out and continues to work out most evenings following different programs, and on nights when she swims she gets up early to workout before school! She is definitely more confident with her workouts and generally.

”

# SOME THINGS THE GIRLS HAD TO SAY



**"I loved my sessions with my mentor..."**

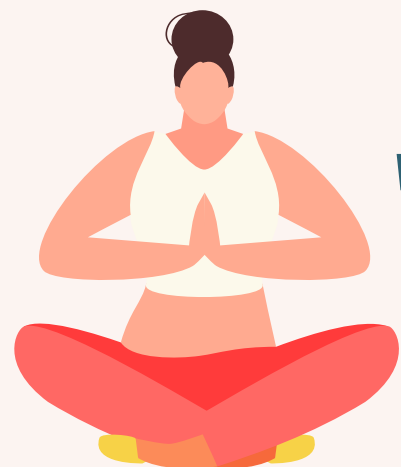
...they were so good, you looked forward to them, you could talk about anything in them"

*Age 16, Cambridge*

"Honestly if I had a choice I would continue HERizon forever because it's motivational and it's actually a commitment and the way you do it..."

**... it makes you want to do exercise"**

*Age 15, Glasgow*



**"I loved the scheduled workouts as well and the motivational reminders"**

*Age 16, Galway*

"I think having the calls were really helpful because we discovered loads of different ways to help me get to sleep and..."

**... just having someone there to talk to was really helpful"**

*Age 15, Nottingham*



**"I saw a definite positive impact on my mental health..."**

...I get panic attacks and with lockdown it has been even worse but I saw a huge improvement in that since starting the programme"

*Age 15, Devon*



"The programme changed the way I look at getting active..."

**...exercise wasn't a chore anymore"**



**"The whole way you look at things is different..."**

... when you start getting active your routine starts to change you begin to start sleeping more and physically you feel better and it boosts your confidence at the same time"

"I'm not afraid of just starting doing physical activity now like it is part of my life but it's not too big of a part it is just balanced and ye..."

**...it's just easy now"**

