Health Promotion International, 2025, **40**, daaf062
https://doi.org/10.1093/heapro/daaf062
Article

Article

'Are we getting through to them? And in what way?' Communicating physical activity with adolescents

Caera L. Grady[1,2], Elaine Murtagh[1,2], Kwok Ng[1,2,3,4], Enrique García Bengoechea[1,2], Catherine B. Woods[1,2,*]

[1]Physical Activity for Health Research Centre, Health Research Institute, University of Limerick, Limerick, V94 T9PX, Ireland
[2]Physical Education and Sport Sciences Department, Faculty of Education and Health Sciences, University of Limerick, Limerick, V94 T9PX, Ireland
[3]Faculty of Education, University of Turku, Rauma, FI-20014, Finland
[4]Institute of Sport Science and Innovations, Lithuanian Sports University, Sporto St. 6, Kaunas, LH-44221, Lithuania

[*]Corresponding author. Physical Education and Sport Sciences Department, Faculty of Education and Health Sciences, University of Limerick, Limerick, V94 T9PX, Ireland. E-mail: catherine.woods@ul.ie.

Abstract

The Active School Flag (ASF) is a multi-stage, multi-component, whole-of-school physical activity (PA) programme. This study explored relationships between Irish adolescents' health literacy, PA knowledge, beliefs and awareness and their efforts to communicate PA messages. Schools (n = 17) newly enrolled in the ASF programme were invited to participate in a mixed methods study. A questionnaire assessing adolescents' health literacy, PA knowledge and beliefs about the consequences of behaviour, and ASF programme awareness was completed in five schools. Statistical analysis involved a hierarchical multiple linear regression. Focus groups (n = 11) were conducted with ASF programme implementers in ten schools to understand current practices of communicating PA messages. Data were analysed using a reflexive thematic analysis. Males comprised 62.3% of the sample (N = 483), and 57.1% were junior students (1st–3rd year). The overall model significantly predicted adolescents' health literacy, $F(4, 464) = 56.241$, $P < .001$. Gender ($B = -1.09$, $P = .02$), knowledge of PA ($B = 0.4$, $P = .04$), and beliefs about the consequences of behaviour ($B = 2.3$, $P < .001$) were significant predictors of health literacy, accounting for 33.2% of the variance. Challenges included low awareness of, engagement with, and maximizing support for implementing ASF. The gap identified between the messages communicated and awareness of ASF requires further research to develop an effective, structured, and standardized PA communication plan for schools to facilitate policy and practice. Improving adolescents' knowledge and beliefs about the consequences of PA could improve overall health literacy levels. Therefore, providing support and guidance to whole-of-school programme implementers for communicating PA messages will help influence practice and policy.

Video Abstract

The playable video file is available in the online version of this article.

Keywords: health literacy; whole-school-programme; mixed methods; messaging; knowledge; physical activity

Contribution to Health Promotion

- Previous research notes that adolescents' health literacy, physical activity (PA) knowledge and awareness levels are low or, at best, satisfactory. Furthermore, the relationship between adolescents' health literacy and their knowledge, awareness, and beliefs about PA is unknown.
- The school is an ideal setting to promote PA. A whole-of-school approach to PA promotion is recommended. There is little research on the communication of PA messages with adolescents, particularly in the school setting.
- Adolescents who are female have strong knowledge and beliefs about PA are associated with higher health literacy levels. Efforts to communicate PA messages in ASF schools lack planning and need standardization to draw comparisons and determine what works.

INTRODUCTION

Adolescence is a period of rapid development where physical activity (PA) habits develop and track into adulthood (Hayes et al. 2019). Worldwide trends show that PA levels decline during the transition from childhood to adolescence (Guthold et al. 2020). Physical inactivity is a complex challenge that requires a whole-of-systems approach, including political, societal, cultural, economic, and scientific actions and solutions while taking a social-ecological perspective of the problem (Rutter et al. 2019). A large proportion of adolescents' waking day revolves around school; it is unique as it has such a large reach and influence for such an extended period of their lifespan (Dobbins et al. 2013). Fittingly, a whole-of-school approach to PA promotion is internationally recommended as one of the eight best investments; however, the application of a whole-of-systems approach within the school is not without challenge (Milton et al. 2021, Bengoechea et al. 2024). A whole-of-school approach has multiple components and involves prioritizing and promoting PA to the entire school community through supportive policies, environments, and opportunities (Milton et al. 2021).

The Active School Flag (ASF) programme in Ireland is a whole-of-school approach aiming to make more schools, more active, more often (www.activeschoolflag.ie). This multi-stage, multi-component, multi-level programme offers PA opportunities in the school and community by empowering student voice and leadership. While well established at the primary school (approx. 5–12-year-olds), the ASF ongoing implementation at the secondary school (approx. 12–18-year-olds) has challenges and facilitators (Belton et al. 2020, McHale et al. 2022). The ASF programme implementers include a school PA champion (ASF coordinating teacher), a member of school management, a staff team, and a designated class of peer leaders (ASF Transition Year class). Transition Year is a non-examinable 'gap' year, unique to the Irish secondary education system, located between the first and second set of state examinations, which aims to promote social and personal development in adolescents (Clerkin 2012). The ASF coordinating team facilitate the Transition Year class to plan, promote, and run ASF events and activities for the school (McHale et al. 2022).

This multi-component programme requires implementers to complete various activities such as gathering student voice through a whole-school survey, providing PA opportunities, e.g. whole-school events, and a 'did you know?' campaign to raise awareness about PA within the school (Ng et al. 2019). McHale and colleagues (2022) highlighted changes to improve ASF implementation, including introducing (i) a 'try-it-out' stage before schools committed to full programme implementation, (ii) support webinars for the ASF implementers, (iii) improved communication about ASF, and (iv) support for the 'did you know?' campaign. The ASF programme coordinators perceived a link between the poor communication about ASF and lack of support for the campaign, with the low awareness of the programme in the school (McHale et al. 2022). Consequently, guidelines for running the 'did you know?' campaign have changed; however, our understanding of the impact and operationalization of these revised campaign guidelines is limited. A recent scoping review that explored the communication of PA messages with adolescents confirmed that communications campaigns can positively impact whole-of-school programmes (Grady et al. 2025). Thus, it is worthwhile to investigate the ASF 'did you know?' campaign further.

Several theories and models suggest that knowledge is a precursor to behaviour change and a person's health literacy is linked to power gained through knowledge (Bandura 1986, Ajzen 1991, Atkins et al. 2017, Paakkari & George 2018). Health literacy is defined as the competence to 'gain access to, understand, and use information in ways which promote and maintain good health' (Nutbeam 1998). Although available evidence links higher health literacy to more PA, low levels of health literacy do not appear to moderate the effectiveness of PA promotion interventions (Buja et al. 2020). However, adolescents' health literacy levels, knowledge, and awareness of PA remain low or, at best, satisfactory (Roth & Stamatakis 2010, Best et al. 2017, Chen & Nam 2017, Jafari et al. 2021, Gandrieau et al. 2022, Moreno et al. 2023).

To the authors' knowledge, previous studies have not explored the possibility of a connection between adolescents' health literacy, PA knowledge, beliefs, and awareness, and the ongoing attempts to communicate PA within a whole-of-school PA-promoting programme. This study attempts to address the gap in our knowledge by, firstly, examining whether there is a relationship between the health literacy, PA knowledge, beliefs, and awareness of adolescents enrolled in a whole-of-school PA programme and secondly, how PA is communicated within a whole-of-school PA programme. Specifically, aims included determining if adolescents' health literacy is predicted by PA knowledge, beliefs about the consequences of PA, and awareness of ASF and exploring the link with the PA messages communicated within ASF.

MATERIALS AND METHODS

Following the Good Reporting of a Mixed Methods Study (GRAMMS) guidelines, a sequential explanatory mixed methods design was used to address the research questions (O'Cathain et al. 2008, Creswell & Creswell 2017) (Supplementary File A). Survey data were collected first to understand

the associations between the study variables. Subsequently, focus group data were collected to improve understanding of the issues of interest and assist with interpreting the survey results. Therefore, integration occurred during the connection between the quantitative and qualitative phases and was led by CG in consultation with the other study authors (Pluye et al. 2018).

This research received ethical approval from the University of Limerick Education and Health Sciences Research Ethics Committee [2018_10_18_EHS]. Before data collection, the coordinating teacher was issued with digital informed consent forms to distribute to all participants' parent or guardian. As data collection took place during COVID-19 restrictions, the process of gaining consent was aligned to the ethical and COVID-19 policies and procedures within each school.

Participants

Secondary schools ($N = 17$) new to the ASF programme (enrolled in September 2021) were invited to participate in this study at an online training and support webinar in which all schools were in attendance. A formal invitation was sent by CG via email to all school management and coordinators. The ASF coordinators in each school were asked to recruit one random class per year group to complete an online survey in November 2021. Similarly, four students were randomly recruited from the ASF Transition Year class to join an online semi-structured focus group in May 2022 (end of the school year). The ASF coordinators were also asked to participate in a semi-structured focus group to give their perspectives.

Procedure

Data were collected during the 2021–22 academic year. A parent or guardian provided consent. Participation was voluntary and assent was confirmed before participation. An online survey was completed during teacher-supervised class time and took approximately 30 minutes to complete.

Online semi-structured focus groups with the ASF Transition Year programme implementers took place during school hours and explored how PA messages were communicated within the programme. Coordinator focus groups included participants from several schools and took place after school. Student focus groups were confined within each school and took place during school hours. An interviewer and assistant moderator were present at each focus group; these were members of a larger research team who had varied experience with qualitative research (Supplementary File B).

Instruments

The questionnaire collected demographic information, including gender, grade, and socio-economic status. The dependent variable, health literacy, was measured by the valid and reliable 10-item health literacy for school-aged children instrument on knowledge and competencies to promote health (Paakkari et al. 2016).

Independent variables included PA knowledge, beliefs about the consequences of their behaviour, knowledge of the PA guidelines, and awareness of the ASF programme. Students' PA knowledge and beliefs about the consequences of their behaviour were assessed using two subscales from the Determinants of PA Questionnaire (Taylor et al. 2013). Each item was assessed using a seven-point scale ranging from one 'strongly disagree' to seven 'strongly agree'. An item assessing the PA guidelines knowledge adapted from Knox et al. (2015) asked students to select the correct 'recommended minimum amount of moderate-vigorous PA needed for children under 18 for a healthy lifestyle'. Finally, five items developed by the research team were included to determine the awareness of the ASF programme.

The overall aim of the semi-structured focus groups was to explore the implementation of the ASF programme (try-it-out stage) as a follow-up study to the previous version of the ASF programme (McHale et al. 2022). Interview script development was guided by an interview guide development tool (Damschroder et al. 2022). Reviewed by peers—experienced qualitative researchers ($N = 3$)—and piloted among the research team ($n = 6$), this led to broad over-arching questions with probes, which reduced both duplication and question numbers. Specific questions on the communication of PA messages within their school were developed to address gaps identified by McHale et al. (2022) and are highlighted in Supplementary File C. Data were collected by audiovisual recording and moderator note-taking for transcription purposes. Recordings were transcribed, cleaned, and pseudonymized by a research assistant.

Data analysis

Gender was initially grouped as 'male, female, or other'. However, the 'other' gender category had small cell counts ($n = 14$) that violated statistical assumptions for both the chi-square and multiple linear regression tests (Field 2017) and therefore, was excluded from analyses to ensure statistical robustness. School grade (1st–6th year) were grouped as junior (1st–3rd approx. 12–15 years) and senior (4th (Transition Year)–6th approx. 16–18 years). The family affluence scale III—developed for psychometrically valid for use with school-aged children—was used to measure students' self-reported socio-economic status (Torsheim et al. 2016). Scores were computed into low (lowest 20%), medium (middle 60%), and high (highest 20%) family affluence. A health literacy sum score was created, which was then recoded into three categories: low (10–25), medium (26–35), and high (36–40) health literacy levels. A sum score was created for both Determinants of PA Questionnaire subscales. A binary variable was created for the knowledge of PA guidelines questions for 0 'does not know' and 1 'knows the guidelines'. The awareness of ASF items was recoded into binary variables as 0 'no' or 1 'yes' for awareness; any 'do not know' responses were removed. A sum score was generated ranging from 0 'no awareness of ASF to 4 'aware of ASF'.

Survey data were analysed using SPSS (Version 29.0). Categorical and continuous variable data were summarized descriptively and expressed as a percentage of the total sample or by mean and standard deviation. Where data were not normally distributed, non-parametric tests were used. A Spearman's rank correlation test examined the strength and direction of the associations between students' health literacy scores and their PA knowledge, beliefs about the consequences of their behaviour, knowledge of the PA guidelines, and ASF programme awareness.

A chi-square test determined the relationship between males' and females' knowledge of the PA guidelines. A Mann–Whitney U test determined gender differences in health literacy scores, PA knowledge, beliefs about the consequences of behaviour, and awareness of ASF.

A hierarchical multiple linear regression analysis determined the factors predicting health literacy. The multicollinearity

assumption was not violated thus, all variables were included in the model. Demographic variables (gender, socio-economic status (FAS) and age (school grade)) were entered at the first stage of the model and the predictor variables of interest were included in the second stage.

Focus group data from students and teachers were entered into Nvivo version 1.6.2 and were analysed together. Data were analysed whereby the data set was approached with a specific research question i.e. 'how are PA messages communicated within ASF schools?'. A reflexive thematic analysis was chosen as it allows for an organic coding process to take place within the data without preconceived notions and due to its ability to minimally organize and describe the data in great detail (Braun & Clarke 2006). Reflexive thematic analysis was conducted following six phases: data familiarization and writing familiarization notes; systematic data coding; generating initial themes from coded and collated data; developing and reviewing themes; refining, defining, and naming themes; and writing the report (Braun & Clarke 2019, 2022). Data were analysed by the first author (CG), who was involved at each stage of the study. Familiarization involved listening to the recording, reading the transcript, and making notes in the margins with ideas to explore and reactions to unpick before analysis. Systematic data coding involved two phases whereby the data were thoroughly examined and labelled with initial codes and this process was repeated to ensure the data coded throughout received sufficient attention. Initial themes were generated through a process of collating codes and labelling subsequent categories. This was repeated to further develop and review the themes. When reporting the data, CG re-immersed herself in the data to understand and outline the details within each theme.

CG utilized her knowledge on the topic of communicating PA messages and was guided by the PA messaging framework to interpret the data and actively create themes (Braun & Clarke 2019, Williamson et al. 2021, Grady et al. 2025). CG maintained reflexivity through memo, taking notes, and consulting with 'critical friends' (CW, EM, KN, EGB) throughout analysis to broaden the coders perspectives of the various personal, interpersonal, methodological, and contextual issues within the (MacPhail et al. 2020, Olmos-Vega et al. 2023). A research team meeting was held to discuss and agree upon the final naming of themes and subthemes. Data were reported following the guidance for quality practice in reflexive thematic analysis (Braun & Clarke 2021).

RESULTS

The participants included in this study are described in Table 1. Eleven schools (64.7%, $N = 17$) engaged in this research, including four that completed both the survey and focus groups, six that engaged in focus groups only, and one that only completed the survey. Participating schools were mainly mixed-gender and located in rural areas. Over one-third of schools (36.4%) were part of the Delivering Equality of Opportunity in Schools (DEIS) initiative, i.e. having students at risk of educational disadvantage (socio-economically disadvantaged or rural area).

A total of 483 students completed the survey, of which 62.3% were male, 57.1% were junior students (1st–3rd year), and most had moderate family affluence levels (63.6%), followed by low (21.5%). Thirty-one students (58% male) and seven teachers (57% male) participated in a focus group or one-to-one interview. The duration of focus groups ranged between 39-68 minutes.

Adolescents' health literacy, PA knowledge, awareness, and beliefs

The majority had moderate health literacy levels (66.2%), followed by high (17.6%). More females (22.1%) had high health literacy scores than males (14.9%) ($Z = -2.7$, $P = .01$) (Table 2). Almost one-third of participants (28.8%) had high levels of PA knowledge, and 62.4% had strong beliefs about the consequences of their PA behaviour. Only 7.1% were aware of all four ASF programme components. Almost half (48.9%) identified the correct number of minutes of PA per day as per the PA guidelines, with no statistically significant differences between males and females ($X^2 = 2.3$, $P = .129$) (Table 2). A Spearman's rank order correlation test revealed statistically significant positive monotonic relationships between health

Table 1. Descriptive information of the schools and participants included in this study.

School No	School type (gender)	School size	DÉIS status[a]	Location	Total students interviewed ($N = 31$)		Total staff interviewed ($N = 7$)		Total survey responses ($N = 483$)[b] % (Total N per school)	
					Female	Male	Female	Male	Female	Male
A	Mixed	Medium	DÉIS	Rural	2	2	–	–	–	–
B	Mixed	Medium	–	Rural	–	–	–	1	–	–
C	Mixed	Medium	–	Rural	3	1	1	–	–	–
D	Mixed	Large	–	Rural	2	1	–	1	48 (112)	52 (112)
E	Mixed	Medium	–	Rural	4	0	–	–	41 (68)	59 (68)
F	Mixed	Medium	–	Rural	–	–	1	–	–	–
G	Mixed	Small	DÉIS	Rural	1	3	1	–	44 (92)	57 (92)
H	Boys only	Large	–	Urban	0	4	–	1	–	–
I	Mixed	Large	DÉIS	Rural	–	–	–	-	49.6 (119)	50.4 (119)
J	Mixed	Large	–	Rural	1	3	–	1	1.1 (92)	98.9 (92)
K	Boys only	Small	DÉIS	Urban	0	4	–	–	–	–

[a]Small (< 300 students), Medium (300–800 students), Large (> 800 students) according to the Department of Education, Government of Ireland.
[b]After removal of other gender category

Table 2. Gender differences between health literacy, PA knowledge, beliefs about consequences of behaviour, and awareness of the ASF programme.

Variable	Total (*N* = 477)		Male (*N* = 296)		Female (*N* = 181)		Z	P
	M	SD	M	SD	M	SD		
Health literacy	30.0	6.0	29.5	6.0	31.1	5.4	−2.7	.01
Knowledge of PA	4.9	1.2	4.8	1.1	5.0	1.2	−2.8	.01
Beliefs about the consequences of behaviour	5.5	1.4	5.5	1.5	5.6	1.2	−0.8	.4
Awareness of ASF	1.9	0.9	1.9	0.9	2.0	0.9	−1.8	.08

Table 3. Multiple regression coefficients of health literacy.

Model		Std Beta	VIF	Adj R^2	*P*
1	Gender[1]	−0.1	1.1	0.017	.003
	Year group	0.0	1.0		.324
	FAS	0.0	1.1		.598
2	Gender	−0.1	1.1	0.33	.02
	Year group	0.0	1.0		.61
	FAS	0.0	1.1		.856
	Knowledge of PA	0.1	1.1		.044
	Beliefs about consequences	0.5	1.1		<.001
	Knowledge & awareness of ASF	0.0	1.1		.348
	Knowledge of PA guidelines	0.0	1.0		.936

1 Female (1) as the reference group.

literacy and Determinants of PA Questionnaire knowledge ($\rho = 0.282$, $P < .001$), Determinants of PA Questionnaire beliefs about consequences ($\rho = 0.467$, $P < .001$), and ASF awareness ($\rho = 0.094$, $P = .041$), but not with knowledge of the PA guidelines ($\rho = 0.064$, $P = .06$).

The first model in the multiple linear regression, only including demographic variables, explained 17% of the variance in health literacy, with only gender significantly predicting health literacy ($P = .003$) (Table 3). The full model accounted for 33.2% of the variance in health literacy with gender, specifically females ($B = -0.1$, $P = .02$), knowledge of PA ($B = 0.1$, $P = .044$), and beliefs about the consequences of behaviour *($B = 0.5$, $p < 0.001$)* significantly predicting health literacy (Table 3).

The communication of PA messages in ASF schools

Four themes and 16 subthemes were generated from the reflexive thematic analysis. Figure 1 presents the data in a thematic diagram and shows the links between the themes and subthemes. Additional supporting quotes for each theme are provided in Supplementary File D.

Theme 1: Challenges to communicating PA within ASF schools

The ASF implementers faced challenges with (i) needing more support to communicate PA better, (ii) low awareness and engagement with ASF, (iii) uncontrollable factors related to school policies, and (iv) the busy Transition Year schedule, which impacted their ability to communicate PA messages within their school.

The ASF implementers suggested that they needed more support for programme delivery due to its infancy in their school (less than one year), which would have helped to communicate PA messages better. For example, one ASF coordinator felt *'it was very hard to know how to use them [other staff members… they all helped once I gave them specific jobs but it was very hard to know what specific job to give them'* (Female coordinator, focus group 1, school C). Likewise, students generally felt they would have benefitted from more guidance from ASF developers to develop new skills, such as public speaking, despite recognizing that *'no one is going to judge you really'* (Male Transition Year student, school J).

Low levels of awareness and engagement with ASF in the school was another perceived barrier to communicating PA within the schools. This included not knowing who was involved in ASF, the facilities available, and low engagement with the schools' social media and other platforms, such as the *'school app'* that *'no one was looking at'* (Male coordinator, focus group 1, school J). In the end, many questions were left unanswered for the coordinator, particularly concerning the '*cohort of students who do not exercise a lot. Are we getting through to them? And in what way?'* (Female coordinator, focus group 1, school C).

The uncontrollable school-related factors concerning school policies that hindered the communication of PA messages included students not having direct access to the school social media accounts, different lunchtimes within the school and the global COVID-19 pandemic. For example, schools with varying lunch times *'segregated'* students and missed opportunities *'to do like all of the years combined… the whole school into one activity'* (Male Transition Year student, school H). Furthermore, the COVID-19 pandemic hindered schools achieving key success criteria to progress to the next stage of the programme e.g. running *'three whole-school events'* (Female Coordinator, focus group 1, School C) was difficult and they struggled to *'promote their activities as well'* (Female coordinator, interview 1, School F).

The busy Transition Year schedule often negatively impacted the frequency that the ASF implementers met, which caused *'problems finding time to do…whole school activities since we are always busy ourselves'* (Male Transition Year student, school K).

Theme 2: Facilitators of communicating PA messages

There were three key facilitators of communicating PA messages: (i) sufficient support for the ASF programme, (ii) strategies to increase engagement with ASF and PA, and (iii) recognizing the value and importance of the ASF programme implementers at all levels.

The ASF implementers felt that having sufficient support, externally from the ASF developers and internally from the school community was important for the successful running of the programme and communication of PA messages. The ASF shared leadership component helped the implementers communicate PA messages, as the various teams in the class *'worked all together to promote and let people know about the activities'* run by ASF (Male Transition Year student, school K). A whole-of-school approach to PA was emphasized shifting away from the mindset of *'well, we teach French so that is obviously nothing to do with me'* (Male coordinator, focus group 2, school B) towards getting more people involved *'even something as simple as the IT teacher and the*

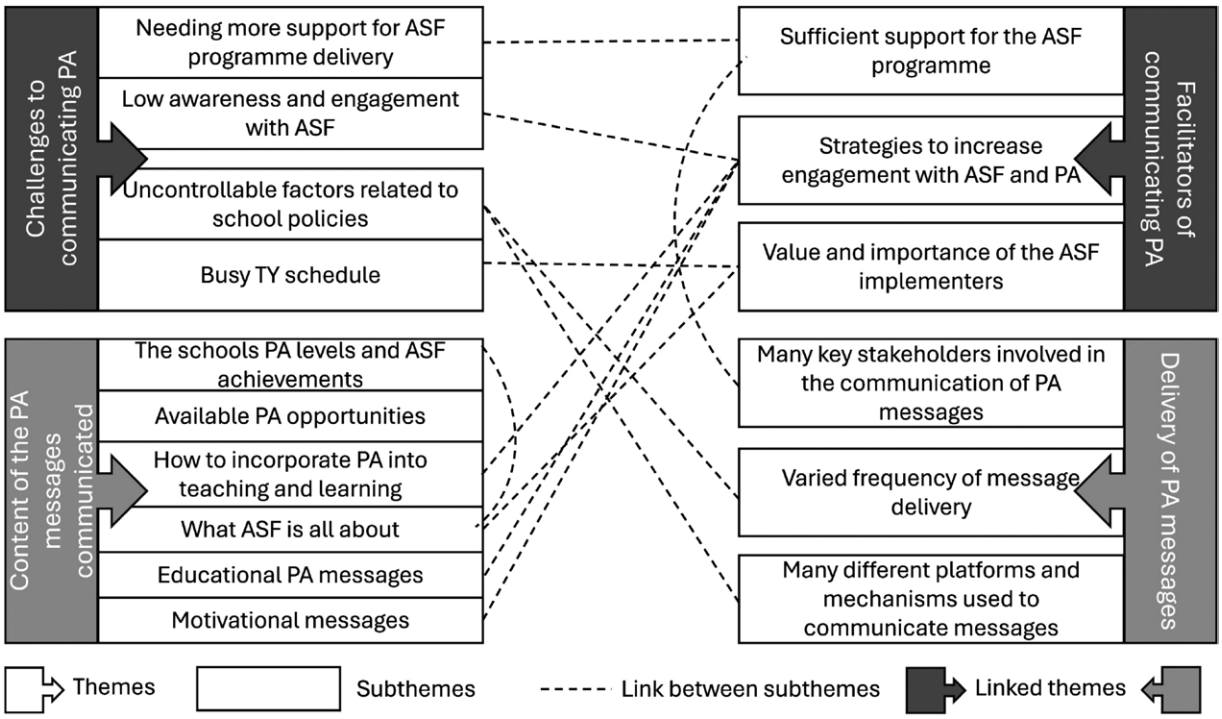

Figure 1. Thematic diagram of the findings from the focus groups with ASF programme implementers.

arts teacher doing posters and the PE teacher in terms of event management' (Male coordinator, focus group 2, school B).

The ASF implementers identified strategies to increase engagement with the programme and PA in the school. This ensured that the activities and events run within ASF were creative, inclusive, and well-promoted, incorporating student voice and peer support. For example, offering something for the *'students that don't play gaelic football, soccer, hurling rugby'* (Male coordinator, focus group 2, school H), ensuring facilities were wheelchair accessible and activities varied for different age groups, and *'listening to students as opposed to teachers telling them what to do'* (Male coordinator, focus group 2, school H). Other strategies reported included collaborating with other departments or initiatives (e.g. Green or Eco Schools) to reduce duplication, maximize resources within the school, and generate brand recognition for ASF within the school.

Recognizing the value and importance of the ASF programme implementers at all levels was the final enabler for communicating PA messages in the school. The ASF Transition Year class felt they had *'independence and responsibility'* (Female Transition Year student, school J). Coordinators emphasized that ASF student implementers needed to recognize the importance of, and be interested in, ASF, reminding them that as peer-leaders *'you are not actually playing sports, you are organising the events'* (Male coordinator, focus group 1, school J).

Theme 3: Content of the PA messages communicated

When asked what kind of PA messages were communicated within the school, the implementers painted a vivid picture of the PA information that was on display: (i) the schools' PA levels and ASF achievements, (ii) the available PA opportunities, (iii) how to incorporate PA into teaching and learning, (iv) what ASF is all about, (v) educational PA messages, and finally, (vi) motivational messages.

Messages were not necessarily guided by evidence-based practice, but rather pragmatic advice encouraging students to increase their PA gradually.

> *'My philosophy is I wouldn't tell people they have to be active for 60-minutes a day because I would rather say, well if you're doing 7-minutes now, do 8-minutes tomorrow or you know that kind of thing, if you tell people 60-minutes that's very intimidating'* (Male coordinator, focus group 2, school B).

Furthermore, both students and staff noted that it was just as important to communicate the ASF message so the rest of the school understands its purpose and goals.

> *'Why it is important and have emphasis on why we're doing it, not to make them go like oh it's just a subject to fill in for so I don't have to do two religion classes a week, have emphasis on like why it's important and why it's needed'* (Male Transition Year student, school G).

Theme 4: Message delivery

Many stakeholders played a role in delivering, receiving, and moderating PA messages in the school. Various platforms and mechanisms were used to communicate the PA messages, and the frequency of message delivery differed between schools.

Message deliverers included the ASF Transition Year class and coordinator. Peers were also important message communicators as *'everything is organised for them and if they weren't on board you know it would have flunked, it wouldn't have gone ahead, really it wouldn't have been good'* (Male

Transition Year student, school A) and *'if you see your friends doing something you would want to do it as well'* (Male Transition Year student, school K).

Message receivers included the whole school, from the wider staff team to the groups of students who were determined as easier or harder to reach by the ASF students. There were mixed feelings on whether junior or senior students were easier to influence. Some felt focussing on junior students (1st–3rd years) was a better investment because *'if they're getting active when they're older then they show the younger ones they should be active and just a roll on effect overtime'* (Male Transition Year student, school J). Another important cohort of students to target were those who are *'not as active as others… to try find something that appeals to them'* (Male Transition Year student, school H).

Moderators were those who helped get the message across to recipients, including school management, the PE department, and role models in the school that everyone knows and likes. The various platforms and mechanisms used to communicate PA messages included social media, posters around the school, verbal announcements, the schools' website or app and online workspaces such as Microsoft Teams.

Finally, the frequency of which PA messages were delivered varied between schools from 'every term' or 'every few weeks' to 'twice a week' or on a 'daily basis'.

DISCUSSION

This study explored two research questions: firstly, does PA knowledge, beliefs, and awareness predict adolescents' health literacy? Secondly, how were PA messages communicated within the ASF programme? We expected that adolescents with higher levels of knowledge, beliefs, and awareness about PA would have higher health literacy levels and that the efforts to communicate PA messages would explain the levels of health literacy, PA knowledge, awareness, and beliefs. The findings partially corroborated our expectations.

Higher health literacy levels were more commonly found in students who were female, had better knowledge about PA, and had stronger beliefs about the consequences of their behaviour. Higher health literacy levels in females have also been observed in other countries such as, Finland, Estonia, Macedonia, Poland, and Iran (Khajouei & Salehi 2017, Paakkari et al. 2017, 2020, Kleszczewska et al. 2021). There have been many reasons proposed for this, such as females having a greater interest in education in general and a better ability to self-regulate, allowing them to perform better academically, be disciplined, set goals, plan ahead, and deal with setbacks better than males (Duckworth & Seligman 2006, Kenney-Benson et al. 2006, Weis et al. 2013, OECD 2019). No significant differences between health literacy and age or socio-economic status were found. Although some studies show older students have significantly better health literacy levels (Paakkari et al. 2017, 2019, Jafari et al. 2021), others suggest that age was not associated with health literacy (Driessnack et al. 2014, Caldwell & Melton 2020). These inconsistencies were recognized by Fleary et al. (2018), who highlighted the need to consider the influence of age on health literacy during adolescence. The lack of association with indicators of socio-economic status conflicts with findings from the literature; however, the reasons for this difference are unclear (Fleary et al. 2018, Caldwell & Melton 2020, Paakkari et al. 2020, Jafari et al. 2021).

Adolescents who had better knowledge and beliefs about the consequences of PA were associated with higher health literacy levels in this study. Researchers should explore the association between adolescents' health literacy and their knowledge and beliefs about PA in different contexts to compare and discuss further. However, given that a persons' health literacy is linked to the power gained through knowledge, it is not surprising that improving adolescents' knowledge and helping them understand the beliefs about the consequences of their behaviour could lead to better health literacy (Bandura 1986, Ajzen 1991, Atkins et al. 2017, Paakkari & George 2018).

Finally, ASF awareness and knowledge of the PA guidelines were not associated with health literacy levels. This was explained in the focus group data as it was clear that little educational information about PA was shared by the programme implementers thus, it is possible that students gained their health information from other sources (Paakkari et al. 2017).

Focus group findings confirmed that ASF implementers were the main communicators of PA messages, which mainly highlighted the PA opportunities within the school and provided some educational information about PA. These findings also highlighted overlapping barriers and facilitators to communicating PA messages, including low engagement with or awareness of ASF and finding effective strategies to increase engagement.

Health-promoting interventions that use an educational approach can prompt behaviour change regardless of an individuals' health literacy level (Buja et al. 2020). A recent scoping review highlighted an array of methods to frame PA messages with adolescents, such as targeting psychosocial, motivational, educational, or behavioural change components (Grady et al. 2025). The low levels of health literacy, PA knowledge, beliefs, and awareness among the adolescent sample were also acknowledged by the programme implementers as a challenge to communicating PA. They noted the low engagement with the communication platforms used to share the messages. This could be explained by the lack of evidence-based content for PA messages suggesting that the current practices within the programme may be insufficient to create change and ultimately improve these low levels over time.

Despite the lack of evidence-based message content, the various platforms and mechanisms used to deliver PA messages within the ASF programme comply with the best approach to reach today's adolescent population about being physically active as identified in the literature (Grady et al. 2025). This study found that the ASF implementers were the main people responsible for PA message delivery. In a recent scoping review by our research team, exploring studies that communicated PA messages with adolescents, the most common communicators of PA messages were researchers; and teachers and peers were utilized less frequently (Grady et al. 2025). However, Grady et al. (2025) recommend considering more end-user communication in the design of interventions i.e. peer-to-peer, role models, and teachers to ensure successful scale-up and implementation of these interventions. In this current study, we highlight the importance of an additional communicator i.e. PA message moderators or key influential people to help deliver the message such as peers, teachers, and school management. To the best of our knowledge, this has not been identified elsewhere. The importance of having

(or not having) these moderators was identified as facilitators of or challenges to communicating PA messages, respectively, such moderators provide support for implementation and ASF engagement and awareness. Similar facilitators and challenges were identified by McHale et al.(2022) when assessing barriers to and facilitators of implementing ASF. This suggests that a change in the wording of the guidelines for running the 'did you know?' campaign is insufficient to create change in practice therefore, further support and intervention are required from researchers and service providers to improve the communication of PA messages in ASF schools.

In sum, the low levels of health literacy among adolescents in ASF schools could be partially explained by the lack of planning and support for communicating PA messages within schools. Furthermore, the relationship between health literacy and knowledge of PA and the beliefs about the consequences of behaviour among adolescents could be positively influenced by the successful implementation of an effective PA communication plan and potentially lead to improved health literacy levels. Future research should look to design, implement, and evaluate an effective PA communication strategy for secondary schools. Although there have been attempts to improve the PA messaging context, more work is required to translate this research into practice and improve the communication of PA messages in school (Williamson et al. 2021, Murtagh et al. 2024). Such developments would greatly benefit schools with existing whole-of-school PA programmes. In addition, other whole-of-school PA-promoting programmes should strive to examine their own practices for communicating PA messages using the framework provided by Williamson et al. (2021) and implement recommendations from the recent scoping review which summarizes what works when communicating PA messages with adolescents (Grady et al. 2025).

Strengths and limitations

This study provides a novel approach to understand the associations between health literacy and PA knowledge, beliefs about the consequences of behaviour and awareness of the ASF. The mixed methods approach used provides a comprehensive perspective of adolescents' health literacy, PA knowledge and awareness and the contribution of the efforts to communicate PA messages within the ASF programme. Including findings from the programme implementers and those in receipt of the intervention provides a nuanced, holistic perspective.

The larger proportion of male participants in both the survey and focus groups is largely due to the pragmatic nature of this research. Pragmatic research is conducted in 'real-world' scenarios where decisions need to be made with limited time and resources available (Johnstone et al. 2017). In this study, schools were asked to volunteer to participate, which resulted in two boys-only and no girls-only schools participating thus, limiting the generalisability of these findings. The Determinants of PA Questionnaire PA knowledge and beliefs about the consequences of PA subscales were not previously validated in an adolescent population and further work is needed to psychometrically test these items.

CONCLUSION

We observed significant associations in expected directions between health literacy, PA knowledge, and beliefs about the consequences of behaviour. The gender differences in health literacy are comparable to similar previous research findings; however, the lack of association with socio-economic status was unexpected. In this study, the current practices of communicating PA messages in ASF schools were identified and schools adopting a whole-of-school approach to PA promotion would benefit from guidance and support for their PA communication efforts. Working with adolescents and other school stakeholders to identify, develop and implement the supports needed to improve the communication of PA messages in schools is needed.

Supplementary data

Supplementary data is available at *Health Promotion International* online.

Acknowledgements

The authors would like to acknowledge the contribution of the Active School Flag research team Fiona McHale, PhD, Maeve Conneely, MRes, MSc, Joanna Clifford, BSc, Kathleen McNally, BSc, research assistants Niamh Doherty, BSc, Dr Javier Rodrigo Sanjoaquín, PhD, and Niamh O'Loughlin, BSc, who were involved with interview script development and data collection. We would also like to recognize the contribution of qualitative experts Joey Murphy, PhD, and Dylan Scanlon, PhD, for the support provided to the research team. Finally, we would like to recognize the Active School Flag programme leads Karen Cotter and Carol O'Donnell for supporting this research and the funding institutions Mayo Education Centre and the Irish Research Council Government of Ireland Postgraduate Scholarship.

Author contributions

C.G. was involved in the conceptualization of the study, data collection, analysis and writing original draft of the manuscript. E.M. is the secondary supervisor of C.G., provided feedback on the data analysis and the reviewing and editing of the manuscript. K.N. was responsible for study conceptualization, support for data analysis and reviewing and editing the manuscript. E.G.B. was responsible for support with data analysis, consulting on mixed methods expertise and reviewing and editing of the manuscript. C.W. is the primary supervisor of C.G. and was responsible for conceptualization of the study, support with data analysis and reviewing and editing of the manuscript.

Conflict of interest

The authors have no conflicts to declare.

Funding

This research was supported by funding from the Mayo Education Centre, Healthy Ireland Fund and Taighde Éireann-Research Ireland under grant number GOIPG/2022/78.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process* 1991;**50**:179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Atkins L, Francis J, Islam R *et al*. A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implement Sci* 2017;**12**:77. https://doi.org/10.1186/s13012-017-0605-9

Bandura, A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1986.

Belton S, Britton U, Murtagh E *et al*. Ten years of 'flying the flag': an overview and retrospective consideration of the active school flag physical activity initiative for children—design, development & evaluation. *Children* 2020;**7**:300. https://doi.org/10.3390/children7120300

Bengoechea EG, Woods CB, Murtagh E *et al*. rethinking schools as a setting for physical activity promotion in the 21st century – a position paper of the working group of the 2PASS 4Health project. *Quest* 2024;**76**:269–88. https://doi.org/10.1080/00336297.2024.2318772

Best P, Tully MA, Corepal R *et al*. Time to 're-think' physical activity promotion for young people? Results from a repeated cross-sectional study. *BMC Public Health* 2017;**17**:208. https://doi.org/10.1186/s12889-017-4136-8

Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101. https://doi.org/10.1191/1478088706qp063oa

Braun V, Clarke V. Reflecting on reflexive thematic analysis. *Qual Res Sport Exerc Health* 2019;**11**:589–97. https://doi.org/10.1080/2159676x.2019.1628806

Braun V, Clarke V. One size fits all? what counts as quality practice in (reflexive) thematic analysis? *Qual Res Psychol* 2021;**18**:328–52. https://doi.org/10.1080/14780887.2020.1769238

Braun V, Clarke V. Toward good practice in thematic analysis: avoiding common problems and be(com)ing a knowing researcher. *Int J Transgender Health* 2022;**24**:1–6. https://doi.org/10.1080/26895269.2022.2129597

Buja A, Rabensteiner A, Sperotto M *et al*. Health literacy and physical activity: a systematic review. *J Phys Act Health* 2020;**17**:1259–74. https://doi.org/10.1123/jpah.2020-0161

Caldwell EP, Melton K. Health literacy of adolescents. *J Pediatr Nurs* 2020;**55**:116–9. https://doi.org/10.1016/j.pedn.2020.08.020

Chen S, Nam YH. Energy balance education in schools: the role of student knowledge. *Eur Phys Educ Rev* 2017;**23**:157–70. https://doi.org/10.1177/1356336x16641661

Clerkin A. Personal development in secondary education: the Irish transition year. *Educ Policy Anal Arch* 2012;**20**:38–18. https://doi.org/10.14507/epaa.v20n38.2012

Creswell JW, Creswell JD. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. 4th edn. Sage, Los Angeles, 2017.

Damschroder LJ, Reardon CM, Widerquist MAO *et al*. The updated consolidated framework for implementation research based on user feedback. *Implement Sci* 2022;**17**:75. https://doi.org/10.1186/s13012-022-01245-0

Dobbins M, Husson H, DeCorby K *et al*. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. *Cochrane Database Syst Rev* 2013;**2013**:CD007651. https://doi.org/10.1002/14651858.CD007651.pub2

Driessnack M, Chung S, Perkhounkova E *et al*. Using the 'newest vital sign' to assess health literacy in children. *J Pediatr Health Care* 2014;**28**:165–71. https://doi.org/10.1016/j.pedhc.2013.05.005

Duckworth AL, Seligman M. Self-discipline gives girls the edge: gender in self-discipline, grades, and achievement test scores. *J Educ Psychol* 2006;**98**:198–208. https://doi.org/10.1037/0022-0663.98.1.198

Field, A. *Discovering Statistics Using IBM SPSS Statistics*. 5th edn. SAGE Publications, London, 2017.

Fleary SA, Joseph P, Pappagianopoulos JE. Adolescent health literacy and health behaviors: a systematic review. *J Adolesc* 2018;**62**:116–27. https://doi.org/10.1016/j.adolescence.2017.11.010

Gandrieau J, Schnitzler C, Derigny T *et al*. How knowledge about physical activity is impacted by school institution, grade level, and gender throughout high school years in france? *J. Teach Phys Educ* 2022;**41**:601–9. https://doi.org/10.1123/jtpe.2021-0092

Grady CL, Murtagh E, Ng K *et al*. Communicating physical activity messages with adolescents: what works? a scoping review and stakeholder consultation. *Int J Behav Nutr Phys Act* 2025;**22**:20. https://doi.org/10.1186/s12966-025-01717-8

Guthold R, Stevens GA, Riley LM *et al*. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. *Lancet Child Adolesc Health* 2020;**4**:23–35. https://doi.org/10.1016/S2352-4642(19)30323-2

Hayes G, Dowd KP, MacDonncha C *et al*. Tracking of physical activity and sedentary behavior from adolescence to young adulthood: a systematic literature review. *J Adolesc Health* 2019;**65**:446–54. https://doi.org/10.1016/j.jadohealth.2019.03.013

Jafari A, Tavakoly Sany SB, Peyman N. The status of health literacy in students aged 6 to 18 old years: a systematic review study. *Iran J Public Health* 2021;**50**:448–58. https://doi.org/10.18502/ijph.v50i3.5584

Johnstone A, Hughes AR, Janssen X *et al*. Pragmatic evaluation of the Go2Play active play intervention on physical activity and fundamental movement skills in children. *Prev Med Rep* 2017;**7**:58–63. https://doi.org/10.1016/j.pmedr.2017.05.002

Kenney-Benson GA, Pomerantz EM, Ryan AM *et al*. Sex differences in math performance: the role of children's approach to schoolwork. *Dev Psychol* 2006;**42**:11–26. https://doi.org/10.1037/0012-1649.42.1.11

Khajouei R and Salehi F. Health literacy among Iranian high school students. *Am J Health Behav* 2017;**41**:215–22. https://doi.org/10.5993/AJHB.41.2.13

Kleszczewska D, Porwit K, Boberova Z *et al*. Adolescent health literacy and neighbourhood features: HBSC findings from Czech Republic, Poland, and Slovakia. *Int J Environ Res Public Health* 2021;**18**:7388. https://doi.org/10.3390/ijerph18147388

Knox ECL, Musson H, Adams EJ. Knowledge of physical activity recommendations in adults employed in England: associations with individual and workplace-related predictors. *Int J Behav Nutr Phys Act* 2015;**12**:69. https://doi.org/10.1186/s12966-015-0231-3

MacPhail A, Tannehill D, Ataman R. The role of the critical friend in supporting and enhancing professional learning and development. *Prof Dev Educ* 2020;**50**:597–610. https://doi.org/10.1080/19415257.2021.1879235

McHale F, Ng K, Scanlon D *et al*. Implementation evaluation of an Irish secondary-level whole school programme: a qualitative inquiry. *Health Promot Int* 2022;**37**:daac131. https://doi.org/10.1093/heapro/daac131

Milton K, Cavill N, Chalkley A *et al*. Eight Investments that work for physical activity. *J Phys Act Health* 2021;**18**:625–30. https://doi.org/10.1123/jpah.2021-0112

Moreno SM, Perez-Gomez J, Rojo-Ramos J. Level of knowledge of adolescents about the recommendations of the world health organization on physical activity and health. *J Sports Phys Educ* 2023;**10**:41–7. https://doi.ord/10.9790/6737-1006014147

Murtagh E, Power D, Foster C *et al*. *Update of the National Physical Activity Guidelines for Ireland—Final Research Report*. University of Limerick Research Repository, 2024; https://doi.org/10.34961/researchrepository-ul.24762942.v1

Ng KW, McHale F, Cotter K *et al*. Feasibility study of the secondary level active school flag programme: study protocol. *J. Funct Morphol Kinesiol* 2019;**4**:16. https://doi.org/10.3390/jfmk4010016

Nutbeam D. Health promotion glossary. *Health Promot Int* 1998;**13**:349–64. https://doi.org/10.1093/heapro/13.4.349

O'Cathain A, Murphy E, Nicholl J. The quality of mixed methods studies in health services research. *J Health Serv Res Policy* 2008;**13**:92–8. https://doi.org/10.1258/jhsrp.2007.007074

OECD. (2019). *PISA 2018 Results (Volume II)*. https://doi.org/10.1787/b5fd1b8f-en

Olmos-Vega FM, Stalmeijer RE, Varpio L *et al*. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Med Teach* 2023;**45**:241–51. https://doi.org/10.1080/0142159X.2022.2057287

Paakkari L, George S. Ethical underpinnings for the development of health literacy in schools: ethical premises ('why'), orientations ('what') and tone ('how'). *BMC Public Health* 2018;**18**:326. https://doi.org/10.1186/s12889-018-5224-0

Paakkari L, Torppa M, Mazur J *et al*. A comparative study on adolescents' health literacy in Europe: findings from the HBSC study. *Int J Environ Res Public Health* 2020;**17**:3543. https://doi.org/10.3390/ijerph17103543

Paakkari LT, Torppa MP, Paakkari OP *et al*. Does health literacy explain the link between structural stratifiers and adolescent health? *Eur J Public Health* 2019;**29**:919–24. https://doi.org/10.1093/eurpub/ckz011

Paakkari O, Torppa M, Kannas L *et al*. Subjective health literacy: development of a brief instrument for school-aged children. *Scand J Public Health* 2016;**44**:751–7. https://doi.org/10.1177/1403494816669639

Paakkari O, Torppa M, Villberg J *et al*. Subjective health literacy among school-aged children. *Health Educ* 2017;**118**:182–95.

Pluye P, Garcia Bengoechea E, Granikov V *et al*. A world of possibilities in mixed methods: review of the combinations of strategies used to integrate qualitative and quantitative phases, results and data. *Int J Mult Res Approaches* 2018;**10**:1–16.

Roth M, Stamatakis E. Linking young people's knowledge of public health guidelines to physical activity levels in England. *Pediatr Exerc Sci* 2010;**22**:467–76. https://doi.org/10.1123/pes.22.3.467

Rutter H, Cavill N, Bauman A *et al*. Systems approaches to global and national physical activity plans. *Bull World Health Organ* 2019;**97**:162–5. https://doi.org/10.2471/BLT.18.220533

Taylor N, Lawton R, Conner M. Development and initial validation of the determinants of physical activity questionnaire. *Int J Behav Nutr Phys Act* 2013;**10**:74. https://doi.org/10.1186/1479-5868-10-74

Torsheim T, Cavallo F, Levin KA *et al*.; FAS Development Study Group. Psychometric validation of the revised family affluence scale: a latent variable approach. *Child Indic Res* 2016;**9**:771–84. https://doi.org/10.1007/s12187-015-9339-x

Weis M, Heikamp T, Trommsdorff G. Gender differences in school achievement: the role of self-regulation [Original Research]. *Front Psychol* 2013;**4**:442. https://doi.org/10.3389/fpsyg.2013.00442

Williamson C, Kelly P, Tomasone JR *et al*. A modified Delphi study to enhance and gain international consensus on the Physical Activity Messaging Framework (PAMF) and Checklist (PAMC). *Child Indic Res* 2021;**18**:108. https://doi.org/10.1186/s12966-021-01182-z.