Type of Paper: Protocol

Student Activity and Sport Study Ireland (SASSI): an online survey and environmental audit tool for assessing the role of multiple factors for university student physical activity.

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Abstract

Background: A growing number of individuals spend early adulthood (i.e. 18 – 24 years old) in a university setting, a setting associated with engagement in behaviours that diminish health such as high levels of physical inactivity. Increasing physical activity (PA) is a key element of health promotion strategies in many countries but a better understanding of students’ PA behaviours and how they are influenced by personal, behavioural and environmental factors is needed. A number of studies provide protocols to collect information regarding these factors separately; however, none have developed a validated systematic approach to gather information pertaining to all across a whole country.

Objective: The purpose of this paper is to present a protocol that allows for the examination of students’ PA and how it is influenced by personal, behavioural and environmental factors.

Methods: Student Activity and Sport Study Ireland (SASSI) is a university based cross-sectional study that was carried out across the island of Ireland in 2014. A novel and comprehensive online environmental audit tool gathered information pertaining to the environment provided by universities for PA. An online student survey collected information about the PA beliefs, attitudes, motivations and behaviours of students. The audit tool and student survey were developed through rigorous consultation processes involving international experts. An institutional champion volunteered at each university to recruit, administer and ensure the completion of both assessments.

Results: Data collection was undertaken between May and December 2014. Thirty-three universities (80% response rate) completed the environmental audit tool, while 8,122 students (49.1% male; 23.17 ± 6.75 years) completed the student survey (88.3% response rate). Studies are currently underway using the data collected using this protocol.

Conclusions: SASSI provides a novel and comprehensive protocol for systematically assessing the PA behaviours of students and the influence of personal, behavioural, and ‘actual’ environmental factors. The strengths of the SASSI study are presented and include high response rates and a unique dataset that can provide information to relevant stakeholders and policymakers, along with aiding the development of university environments and interventions that promote PA involvement. The weaknesses of the protocol are recognised with suggestions given to overcome them in future research. The current protocol is applicable for other countries and has great potential to create harmonisation of data, which would allow for direct comparisons across nations.

Keywords: physical activity, university environment, university students, social-cognitive theory
Introduction

Early adulthood is regarded as an exploratory phase which anchors health related behaviors that often persist into later life and determine long-term health outcomes [1]. A growing number of individuals spend their early adulthood (i.e. 18 – 24 years old) in a university setting. The global student population reached 178 million in 2010, with this expected to reach 263 million by 2025 [2], suggesting that increasing proportions of the global population will pass through this exploratory phase. Research indicates a high proportion of university students engage in behaviours that diminish their health such as high levels of physical inactivity (23% - 44%) [3], exceeding the daily-recommended alcohol limits and smoking tobacco [4]. With students exposed to a number of health-related behaviours, it seems prudent to focus on a behaviour known to benefit the physical, cognitive and social health of individuals, such as physical activity (PA) [5]. The recommendation to increase PA is a key element of health promotion strategies in many countries [3], where PA includes sport, structured exercise and active transport [6]. In the general population, PA is an important factor for the prevention of non-communicable diseases such as obesity, cardiovascular heart diseases and type-2 diabetes mellitus [7,8]. Although the PA behaviours of children and adults across the globe are well documented [9], university students’ PA behaviours, beliefs, and attitudes and how these are formed and reinforced during their university experience, particularly in representative or random samples requires further research [10].

Understanding the factors that influence PA behaviours is a key step for developing effective evidence-based programs [11]. Bandura’s Social Cognitive Theory offers the belief that a range of factors that can be categorised as personal, behavioural, and environmental influence human behaviour [12]. Research suggests that personal (e.g. age, sex, attitudes, knowledge of benefits), behavioural (e.g. past PA, smoking etc.), and environmental (e.g. peer support, recreational PA opportunities etc.) factors are associated with adults and students’ PA behaviours [10,13]. Personal and behavioural factors relating to PA are much better understood, with research neglecting the examination of the physical environment [10,14,15]. Research is needed to determine and better understand how the environment within which individuals spend time might act to enhance or
constrain PA [15]. Our understanding of the impact of the university setting on PA behaviour is limited [16], but the physical environment has been shown to influence students’ decision-making process regarding engagement in PA [17]. Nonetheless, evidence is lacking regarding the impact of institution size, the number of support staff, extent and nature of facilities, financial investment, opportunities for participation and institutional ethos and policy on students PA participation.

To date, a number of studies provide protocols to collect both individual [18–20] and environmental information [21,22], however, none have developed a validated systematic approach to gather information pertaining to the individual (i.e. personal and behavioural) and environment across a whole country. Student Activity and Sport Study Ireland (SASSI), the first of its kind, addresses the important topic of the interaction between these factors and participation in PA on the island of Ireland. This study had a number of aims including the creation of a comprehensive audit tool for examining the environment, provision and support offered by universities for student PA participation. Second, to develop a survey to collect information regarding the level, type and nature of PA participation by students including the associated determinants, health-related behaviours and outcomes. Finally, it was hoped that the protocol would be generalizable and could be used in other nations and by other stakeholders to quantify and evaluate the factors that are important for student PA engagement. Such evaluations will aid the success of health promotion efforts for this population.
Methods

SASSI is a university based environmental audit tool (EAT) and student survey (SS), which was carried out in 2014. All universities (N=41) on the island of Ireland were invited to partake in SASSI, with the following university size classification agreed: i) Large = ≥ 11,000 students; ii) Medium = 117,000 to 10,999 students; and iii) Small = ≤ 3,999 students. University size was based on the distribution of the 2013/14 fulltime undergraduate and postgraduate enrolment figures across all universities [23,24]. The active partners in the study included the research team, the Student Sport Ireland (SSI) Research Management Group and the Institutional Champions (IC) (Figure 1). SSI are the governing body of university sport in Ireland. Due to the all-island approach, ethical clearance from relevant ethical committees in the Republic of Ireland (Waterford Institute of Technology School of Health Science Research Ethics Committee) and Northern Ireland (Ulster University Research Governance) was obtained and extended through recognition by all universities involved. Detailed information sheets about the study were provided prior to the start of the EAT and SS. Signed informed institutional consent was received for the EAT and informed consent was assumed for those who chose to proceed with the SS.

Institutional Champions

Given the extent of the study, the geographical spread of the universities, the research team relied heavily upon the voluntary contribution of institutional champions (IC; n = 52). In the majority of cases, the IC was the designated contact person for SSI in each of the universities. The ICs were an integral part of the study; their key roles were to promote the research within their university, lead the completion of the EAT through engagement with other institutional stakeholders, and recruit for, and administer the SS according to pre-determined quotas. In order to maintain consistency across all universities and ensure the collection of valid data, each IC completed a half-day training program that was used to empower the IC to assist with sufficient data collection. Not only did this process ensure standardisation in the implementation across each university, it also created an opportunity to build grass roots commitment and ownership in the study. A research manager was employed as part
of the research team and responsible for overall quality control and ensuring that the IC were supported in their roles.

Environmental Audit Tool (EAT)

The purpose of the EAT was to provide an analysis of the environment and provision made by universities to support student participation in PA. The EAT consisted of eight sections with 39 questions addressing the following constructs potentially relevant to university support for PA participation: (i) organisational structures; (ii) personnel; (iii) facilities; (iv) funding/investment; (v) opportunities for participation; (vi) high performance athletic support and (vii) institutional ethos, prioritisation and quality of provision. An initial section gathered information on the respondents (e.g. title, contact details, section responsible for completing etc.).

EAT Administration and Completion Procedure
To aid with the distribution and data collection, the EAT was translated into an online instrument using SurveyMonkey. The research manager then uploaded the university specific audit tools, generating an online link for each. This link was sent to the IC of each participating universities via email who then facilitated its completion within the timeframe required. The ICs were requested to identify the appropriate personnel in their universities to complete or inform each section. The EAT was comprehensive and required time and resources to complete. To ensure the completion of the phase, a ‘save as you go’ function was applied to the EAT, allowing the participants to save answers and return later. This function also allowed the respondents to edit answers before submitting to the research manager.

**EAT Development**

To guide the development of the EAT, SSI identified the following aspects that should be investigated: i) local context (e.g. location and enrolments); ii) policies and provision; iii) culture (e.g. perceived level of support for PA participation); iv) facilities; and v) needs and resources assessment (e.g. current needs and resources to further promote PA). In addition to the above guidance, additional insight into possible content was gained by examining existing literature and other published audits on environments provided by universities in England and Scotland [21,22]. Subsequent to the production of the final EAT, an extensive 6-month consultation process took place to further develop, refine and confirm it. This included consultation with i) members of the research team and the SSI research management group (n = 10); ii) key stakeholders in the PA provision in universities (n = 15, SSI designated contact person); and iii) international experts (n = 3, Sports Provision in Scottish Universities, Irish Higher Education Surveys, and Statistician). This process resulted in the development of a comprehensive EAT, designed to investigate the environment provided by universities to support and promote PA engagement. An overview of the sections included in the EAT is provided below, with the full version available in Supplementary Material 1.

**Organisational Structure of PA**

To understand the organisational structures of PA within universities, two questions were asked. First, the number of organisational structures (e.g. Department of Sport, Sport Clubs, Student Union etc.)
which provide direct support to PA participation, the individual (e.g. Director of Sport, Student Services etc.) within the institution that the organisational structure reports to, and a brief description of the role of the structure was asked about. Second, the nature and number of other partnerships within the institution that support sport and PA participation (e.g. Health Service, Disability Service, etc.) were assessed. Responses were open, allowing the respondents to answer from their universities perspective.

**Personnel**

The EAT included questions regarding: i) the number of full-time employees, part-time employees and volunteers supporting PA participation in 2009 and 2014 and ii) the relevant staff titles (e.g. “Director of Sport”). This question was answered for each named organisational structure within the university (i.e. from previous section). Information regarding training and recognition available to student volunteers was also gathered.

**Facilities Provision**

Questions regarding the extent and nature of both indoor and outdoor facilities available to each university at all locations were included in the EAT. Details about the type of facility, facility dimensions, specifications and number (e.g. number of courts, pitches), ownership (owned or hired) and accessibility for individuals with a disability was gathered. A list of named facilities were included (n = 19) and respondents had the option to include “other” facilities. The section included closed responses (i.e. yes/no and owned/hired) and open responses to allow more details about the facilities to be provided. Respondents were asked to complete this section for each location used by their university to provide PA opportunities.

**Funding/Investment for PA**

Investment in PA provision within universities was investigated by gaining insights into the: i) past (last 20 years) and planned (next 5 years) capital investment in facilities by institutional, private and public sources; ii) current investment in each of the previous five years; iii) provision of direct institutional grants for sport clubs; iv) annual fees/charge to students; and v) student charge to access facility or PA opportunity. Specific funding range (e.g. up to 25,000; 25,001-35,000 etc.) were
provided for capital and current investment questions. Open responses were facilitated in the remaining questions.

Student Sport and PA Participation Provision

Questions were asked regarding: i) number of sports clubs provided by the university; ii) the nature of sport clubs provided (i.e. type, provision for individuals with a disability); iii) number participants; iv) description of link between sport clubs and the university organisational structures; and v) participation rates in exercise and fitness opportunities. Additional detail was gathered regarding the competition levels engaged in, level of training hours, staffing, income and expenditure of clubs. A response was requested for a list of 54 named sports clubs (Supplementary Material 1), with an option for the respondent to include additional options. The majority of questions were closed in nature with drop down menus to facilitate selection of the most appropriate answers.

High Performance Programmes/Athletes

Questions regarding various aspects of provision for high performance programmes and athletes were included in the EAT. High performance/ Elite were defined as students currently competing at national and/or international standard at either senior or junior levels. The following aspects were examined: i) institutional partnership with national governing bodies of sport and national/international level sport clubs; ii) provision, nature, source and value of athletic scholarships and of “in-kind” athletic support (e.g. free access to facilities, sport science support etc.). A combination of open and closed questions was used and the option of adding “other” choices was included as appropriate.

Institutional Ethos and Prioritisation

The EAT concluded with questions regarding perceived institutional ethos and prioritisation for PA provision. First, respondents were asked about the perceived importance placed on participation in and the promotion of PA, and how this importance has changed over the last 3 years. This was followed by asking about the impact of specific factors (e.g. cost of provision, health of students etc.) on the institutional prioritisation of PA. Subsequently, the perceived quality of provision under a range of headings (e.g. indoor/outdoor facilities, PA opportunities, funding etc.) for PA was assessed.
Finally, the existence and availability of strategic priorities for PA in each university was asked. Likert scales were used to assess the above, with exception to the final area which allowed respondents to include a link to any strategic information regarding PA provision.

Data Management of the EAT

The responses from the SurveyMonkey online portal was directed to an SPSS database (Version 22). Each university was given a unique identification number (ID), which allowed the data to be matched across the EAT and SS. To produce a clean and complete dataset the following steps were followed: i) successful data transfer from SurveyMonkey to SPSS was confirmed; ii) missing data was identified and appropriately coded; iii) university size was added; and iv) to ensure that the datasets were anonymous any text which would enable identification of a specific university was edited.

The EAT was designed so that provision for each construct by universities could be usefully scored and analysed. From the EAT, the following key performance indicators (KPIs) were agreed to represent the environment and provision made by universities to support student participation in PA (Supplementary Material 2).

An institutional score for total provision (e.g. total number of staff) and for provision relative to 100 students was calculated for each KPI listed above. The development of the provision score facilitates analysis of total and relative provision for each KPI across small, medium and large institutions. In addition, it is also possible to categorise universities as making high, medium and low provision for each KPI. The different categories of provision were determined by calculating a university rank (1-33) for both the total provision score and the total score relative to 100 students. These two ranking values were then summed and ranked to get a composite rank for each university. Based on this composite rank, institutions were assigned equally to either a high, medium or low provision category for each KPI (i.e. ranks 1-11 = high; ranks 12-22 = medium and ranks 23-33 = low). Details regarding calculation of university total provision score for each KPI are provided in Supplementary Material 2.

Student Survey (SS)
The purpose of the SS was to provide information of the students’ behaviours, beliefs and attitudes regarding sport and PA. The SS consisted of eight sections with 98 questions addressing the following areas: (i) general PA; (ii) determinants of PA; (iii) volunteering in sport; (iv) coaching acquired; (v) sport and recreational PA participation; (vi) elite athlete satisfaction; (vii) related health behaviours. Additional questions gathered demographic information regarding the respondent (e.g. sex, age, household income etc.).

SS Administration and Completion Procedure

In order to achieve a nationally representative sample from each university, 3.9% of the student population in large universities (N=7), 5% of the population in medium sized universities (N=12) and 6.1% of the population in smaller universities (N=13) were sought. Students were also required from different fields and years of study within each university, depending on the student enrolments. Data collection implemented a stratified cluster design for subject selection, stratified by year group and across fields of study, which allowed for a representative sample based on university enrolments. A quota of students needed from each university was developed and given to the IC responsible. The IC then worked alongside the research manager to ensure that the sample was representative of their student body. The IC requested access to the required students and administered the SS during class time, which was completed using the SurveyMonkey software. Prior to the students being given their university specific survey link, the study was explained and it was advised that the SS could be completed on a laptop, tablet or smartphone. The use of a supervised online survey was to maximise response rates, minimise potential for data entry errors and facilitate the merging of data from a number of universities. Administering the survey during class time was based on previous research where response rates in excess of 90% have been achieved [3,25]. To ensure that the ICs collected the data as requested, the date stamp of responses were examined by the research manager. Where the majority of responses (>90%) occurred in batches and within normal university hours it was deemed likely that the protocol was adhered to. The ICs were encouraged to collect as many responses as possible. Where the response rate was greater than the quota needed, the research manager drew a random stratified sample to obtain a representative sample for the overall study. This
allowed each university to use their own full dataset for further local analysis while the quota for the
national survey was achieved.

SS Development

The SS was developed using versions of known valid tools and measures that have been used in
similar studies [19,20,26–28]. The research team consulted with the SSI research management group
(N=7) international experts (N=3; health professionals) and statisticians (N = 2) to develop and refine
the SS through a series of drafts (n =4) over a 5 month period. The final SS used open and closed
questions to gain the relevant responses with any sensitive questions related to personal or financial
circumstances placed at the end of the survey, as they can be a barrier to further survey completion.
Filtering was applied throughout the survey so that the relevant questions were asked based on
participants’ previous responses. An overview of the SS’s main sections can be found below, with
more information of how the SS was structured, along with the filtering information available in
Supplementary Material 3.

General Physical Activity

Students’ views of their PA levels was asked using five single item questions including: i) if they think
they take enough PA to keep healthy; ii) their PA levels compared to others; iii) their PA levels
compared to last year; iv) increasing PA over the next year; and v) how important PA opportunities
were when enrolling. Responses were recorded using a range of Likert scales and categories.
Knowledge of the PA guidelines was asked using a single question, with responses allowed in minutes
per week or day. General PA levels were measured using three valid and reliable measurement tools
for assessing attainment of the PA guidelines [30]; the International Physical Activity Questionnaire –
Short Form (IPAQ-SF) [31], an adapted version of the PACE [32] and a single item measure [33].
Domains of PA were measured, including PA as a form of transport, cycling, walking and muscle
strengthening exercises. PA as a form of transport was measured using two questions asking about the
form of transport used to get to university and the duration of time it takes [20]. Students who
travelled to university by a motorised form were asked to give three reasons for not actively travelling, with 12 options available. Walking for recreation was measured with a 3-item question asking about the frequency, duration and intensity [20]. The frequency and duration of cycling PA [26] and muscle strengthening PA were also assessed using 2-item questions [20].

Determinants of Physical Activity

The psychosocial determinants of PA participation were assessed using the Determinants of PA Questionnaire (DPAQ) [34]. Shortened from its original for practical purposes, one item for each of the eleven determinants was selected based on the items with the highest factor loading from a confirmatory factor analysis [34]. The shortened DPAQ presents eleven statements, worded positively and negatively, asking students to respond using a 7-point Likert scale ranging from strongly disagree to strongly agree. The determinant areas included knowledge, environmental resources, motivation, beliefs about capabilities, emotion, skills, social influences, beliefs about consequences, action planning, coping planning, and goal conflict related to PA.

Volunteering in Sport

A question asked students if they completed any sports voluntary work in the past 4 weeks, with responses dichotomised into volunteers and non-volunteers. Those who ‘volunteered’ were asked to indicate the duration (hours/week) and type (range of seven activities) of volunteering both inside and outside university.

Coaching

This section asked students if they had received any formal coaching or instruction to improve PA performance in the past 4 weeks, with responses dichotomised into yes or no. If ‘yes’ then information about where it was accessed was asked with six responses provided.

Sport and Recreational Physical Activity Participation

Student engagement in recreational PA inside their university was assessed by asking “Did you do any sport or recreational PA in the last 4 weeks?” with four options that acted as filters, categorising
Students as ‘non-participants’, participating only ‘within university’, ‘outside university’ or ‘both in and outside university’. Each category directed to a specific set of questions designed to find out more about their PA behavioural choices:-

“Within University” and “Both” categories were asked about the frequency, intensity, duration, standard and the type of PA they participate in with options given for each [28]. These students were asked to rate the top five reasons for participation within their university, with 17 responses provided [35], and their satisfaction with provision for PA by their university, using 10-point Likert scales. Students were then asked to indicate the uptake of any new PA since beginning university and the highest level that they have participated at, through closed questions [36].

“Outside University” category were asked about the frequency, intensity, duration, standard and the type of PA they participate in along with whom they participate. The top three reasons for not participating through the university was asked with an option to suggest what their university could do to encourage participation [28]. Questions regarding the reasons for PA participation, the uptake of new activities and the highest standard participated were then asked.

“Non-participants” category were asked for the three reasons for non-participation in any PA, the length of time since they last participated, if they could be encouraged to participate in PA (yes/no), and what would encourage them to participate (13 options) both inside and outside the university [26].

Elite Athlete Satisfaction

Students who indicated that the highest level participated as “elite” were asked if they received a scholarship or bursary from their university. If “yes”, questions about the sufficiency of scholarship, the type of activities participated in and their satisfaction with the provision for elite athletes by their university followed.

Related Health Behaviours

Questions were asked to assess the health related behaviour choices of students. Alcohol intake, smoking and drug use were all measured using single item frequency questionnaires [19]. Sedentary
behaviours were measured by students to estimate the number of minutes spent sitting on weekdays and weekends in a range of eight situations [37]. Dietary habits were measured using two adapted single item frequency measures, asking about convenience foods (e.g. fast food) and fresh foods (e.g. fruit and vegetables) [19]. Students’ perception of body image, general health in the past 12 months and happiness were assessed using single item measures with responses recorded using Likert scales [20,26]. Mental health was measured using the five-item Mental Health Index (MHI-5), a subscale from the Short Form Health Survey [38, 39].

**Data Management of the SS**

The sample collected was reviewed against the nationally representative figures once the data collection was complete. This enabled a weighting to be matched to the selection process based on the parameters of age and sex, depending on any gaps or underrepresentation in the initial data collection.

The decision to weight by gender and age was based on the knowledge from previous research that participation in sport and physical activity is significantly influenced by both factors. Weighting of the data was completed by statisticians (n =2) and allowed for the data to be an exact representative of the national statistics. When data collection was complete, each dataset was given an ID, which was the only identifier of respondent. An ID was also generated based on the university the responses came from, which reflected the ID of the universities in the EAT. This meant the environmental data and SS responses could be matched, allowing examination of the relationship between the university environment and students responses to the SS. Reliability of data would affect any future analysis, thus data cleaning and reliability checks were paramount to this phase. This involved checking data for consistency, completeness and accuracy through spot checks.
Figure 2. Data collection process for SASSI.

Results

Data collection using the EAT was undertaken between May and August 2014. Thirty-three of the universities (80% response rate) responded to the EAT. Overall, 70 people from the participating universities played a part in the completion of the EAT including the following staff or equivalent in each university: Director of Sport; Sports/ Clubs and Societies Officer; Health/ PA Promotion Officer.

In 14 institutions (42.4%), the IC only played a role in the completion of the EAT. Data collection using the SS was undertaken between October and December 2014. Students from thirty-two universities (78% university response rate) participated in this phase of the study. Of the 9,197 student administered the SS, 88.3% provided sufficient responses (N = 8,122; 49.1% male; 23.17 ± 6.75 years). Analysis were conducted on the datasets to examine the PA attitudes, beliefs and behaviours of students and to investigate the influence of relevant factors (i.e. individual, behavioural and environmental) for student PA engagement. The full findings generated from this protocol are available in the SASSI report [40], with additional studies planned in the near future.
Discussion

Potential of the protocol

The SASSI study is a novel, two-phase cross sectional study combining a purposefully designed EAT and a supervised online SS. Together, the measurement tools provide comprehensive data, which permits an investigation of how personal, behavioural and environmental factors relate to students’ PA. This enables us to have a holistic view of the factors related to behaviour as proposed by the Social Cognitive Theory. Additionally, the protocol allows the evaluation of the ‘actual’ environment provided by universities and their influence on students’ PA behaviours. This has the potential to eliminate the gap in the literature regarding the association of the physical environment with PA engagement in students [10,15,41]. The data collection tools developed can be used to evaluate existing university provision for PA and measure change in that provision; interrogate and inform the future research agenda and in addition provide a platform for the pooling and harmonisation of data collected.

Strengths

The protocol developed by SASSI has a number of strengths, which encourage the possibility of its use in other nations wishing to investigate PA in this population. Identification of similar survey instruments and the consultation process throughout the development phases were strengths that allowed for the creation of two assessment tools that could be used in over 30 universities across two separate nations. The consultation process in both phases also allowed for face validity to be acquired for the EAT and SS. Both the EAT and SS are comprehensive in assessing their intended areas but are designed to be used together, which provide a unique dataset. This unique dataset has the potential to increase our understanding of the ‘actual’ environment provided by universities and the effects it has on students’ PA, while also assessing personal and behavioural factors. Other major strengths of the SASSI protocol concern the training, buy-in, and input from the ICs throughout both phases and the success of administering the EAT and SS through an online platform. These strengths were key factors for the high response rates in the EAT (80% of universities invited complete the EAT) and SS (88.3%...
of the 9,197 students administered the SS sufficiently complete it). For phase 2, the use of a supervised survey delivered during class time replicated the response rates of similar study protocols [3,25].

Limitations

Although the SASSI protocol possesses a number of strengths, the weaknesses also need to be recognised here and addressed for future research. The EAT and SS required a great deal of information and were time consuming. This magnifies the importance of the buy in from the ICs and the features offered through online administration (e.g. stop-save; ease of administration), which aided completion. Additional limitations concerning the questions used in the EAT and SS need to be addressed. Despite both tools being comprehensive, a number of questions and options offered may have resulted in responses that do not provide all the information needed. For example in the EAT, capital and current investment were assessed using closed questions with the lowest option being ‘up to €25,000’. This meant that universities that invested €25,000 were grouped with others who invested zero, with no way for the research team to tell the difference. Additionally in the SS, certain health related behaviour questions (e.g. alcohol, smoking etc.) assessed frequency but not the intensity of the behaviour (e.g. units of alcohol, number of cigarettes etc.). The primary focus of SASSI was PA, which meant less importance was put on other questions, but this is still a limitation of the current protocol. Suggestions for future research may be to provide additional options in the closed questions or offer open responses instead. Furthermore, a number of measures used in the SS were shortened and adapted for practical reasons and to reduce the burden on students, with evidence suggesting that lengthy measurement tools lead to greater amounts of missing data on individual questions, decreased variability in answers to grid-based questions and shorter responses to open-ended questions [42]. Although the face validity of these adapted measures were acquired through the consultation phase, there is a need to test the reliability of them. A further weakness of the SASSI protocol was the cross-sectional design that meant the correlates of PA could be measured, but not the true determinants.
Conclusions

Nevertheless, the authors believe that the SASSI protocol, with its whole country approach, is unique and can be used as a model for other nations hoping to investigate the PA behaviour and relating factors of university students. The use of one standardized comprehensive protocol to study such a topic would lead to the harmonisation of data allowing for the comparison of findings across countries. The information collected using the SASSI protocol may have a number of potential uses such as providing information to relevant stakeholders and policymakers, providing strategic guidance for future policy and planning of university settings and university health interventions in order to enhance the health, wellbeing and sustainability of students. The authors also hope that the tools developed in SASSI can be used in future longitudinal research hoping to investigate the personal, behavioural and environmental determinants of PA in university students.

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Authors’ Contribution

JJM developed a plan for this protocol and acted as an institutional champion for the student survey. CM, MHM, NM, CBW developed the overall protocol for SASSI and acted as co-authors for this paper. NB acted as the research manager for SASSI.

Conflicts of Interest

The authors declare that they have no competing interests, either financial or non-financial.

Abbreviations

PA = physical activity; IC = institutional champion; EAT = environmental audit tool: KPI = key performance indicator; SS: student survey; IPAQ-SF = international physical activity questionnaire - short form; DPAQ = determinants of physical activity questionnaire
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http://www.webcitation.org/6yna5ktkj


