We can do that! Collaborative assessment of school environments to promote healthy adolescent nutrition and physical activity behaviors

Susan L. Williams1* and W. Kerry Mummery2
1School of Medical and Applied Sciences, CQ University, North Rockhampton, QLD 4702, Australia and 2Faculty of Physical Education and Recreation, University of Alberta, W1-34 van Vliet Centre, Edmonton, AB T6G 2H9, Canada
*Correspondence to: S. L. Williams. E-mail: s.p.williams@cqu.edu.au
Received on June 5, 2014; accepted on January 13, 2015

Abstract
Evidence for effectiveness of school-based studies for prevention of adolescent obesity is equivocal. Tailoring interventions to specific settings is considered necessary for effectiveness and sustainability. The PRECEDE framework provides a formative research approach for comprehensive understanding of school environments and identification of key issues/areas to focus resources and energies. No reported studies have tested applicability of the PRECEDE framework in schools in relation to obesity. Adolescents (n = 362), parents (n = 349) and teachers (n = 146) from six secondary schools participated in two quantitative studies and two qualitative studies. Data collected from these studies permitted confirmation of adolescent overweight/obesity a health issue for schools; the need for secondary schools to focus health promotion efforts on healthy nutrition, with inclusion of parents/homes and appreciation for gender differences in developing interventions. Community buy-in and commitment to school-based obesity prevention programs may be dependent on initially addressing what may be perceived as minor issues, and developing policies to guide practices within schools in relation to supply and access to healthy foods, use of sporting equipment and participation in physical activities. The PRECEDE framework allows systematic assessment of school environments and provided opportunity to identify realistic and relevant interventions for promoting healthy adolescent physical activity and nutrition behaviors.

Introduction
Preventing obesity requires appreciation and understanding of obesity related behaviors (physical activity and nutrition), how they are adopted and sustained, and the factors which may promote or hinder their development and change [1]. Adolescence is considered a critical period of increased risk for obesity [2]. Like other health-risk behaviors (cigarette smoking, alcohol intake, drug use and sexual behavior) adolescents develop physical activity and nutrition behaviors in response to aspects of their physical and social environments, personal characteristics and genetics, and stability over time in any one of these factors may reinforce behaviors and reduce overall health risk [3, 4]. To develop relevant and effective health interventions, understanding of the relationships between adolescent health and health behaviors is required. Additionally, there is requirement for greater understanding of the environments in which adolescents spend much of their time (for example school and home) and how best to integrate interventions into the systems and processes which occur within these environments [5, 6].

Schools are considered to be in unique positions to play pivotal roles in promoting health and...
preventing obesity [7]. This belief is based on recognition that schools afford opportunities to reach a majority, are able to integrate health promotion activities within school plans, policy and practice, and advantage can be made of the reciprocal relationships between education and health and the social setting they provide for children and adolescents [5, 8–10]. Despite this recognition, relatively few secondary school-based studies of adolescent obesity have been conducted [11], evidence of their effectiveness is equivocal, and many studies are limited by design, implementation and methodological issues. Previous research suggests that the effectiveness and sustainability of programs may be dependent on developing tailored interventions for specific settings and communities [12], stakeholder involvement in program development [13], development of gender-specific interventions [13, 14] and reporting of formative research and process evaluation [15].

Formative research is an ecological approach considered integral to the development of health behavior change interventions [16]. The use of both quantitative and qualitative methods to assess the perceptions and behaviors of population groups within the context of their specific environments can enhance feasibility, effectiveness and likelihood of sustainability of subsequent interventions [17, 18]. This participatory approach to intervention design and development is recommended for obesity prevention programs [19] and has been used successfully in identifying workplace-based interventions for the prevention of obesity [17, 18, 20] and interventions for promoting adolescent physical activity and obesity prevention [15, 16, 21–23].

The Precede-Proceed Model for health promotion planning uses an ecological, educational and participatory approach to develop community health promotion programs that can be applied to a range of settings to engage community members in health promotion efforts that focus on health issues relevant to the community-specific needs and institutional resources [24]. The Precede-Proceed model is considered an intensive but comprehensive and logical health promotion planning process [25] which has been used extensively in the past 30 years across a range of settings.

This model includes two components (PRECEDE and PROCEED) and each component includes multiple phases of evaluation. The PRECEDE (predisposing, reinforcing and enabling constructs in educational/ecological diagnosis and evaluation) component includes three main formative evaluation phases (social assessment; epidemiological assessment and educational and ecological assessment) which through community engagement, generate specific measureable objectives and baselines, and a fourth phase which allows for development of a specific program plan for subsequent implementation. The PROCEED (policy, regulatory and organizational constructs in educational and environmental development) component includes multiple phases of summative evaluation which include monitoring, documenting and continuous quality improvement throughout the implementation processes.

This article presents summary results of the formative evaluation phases of the CHASE (creating healthy adolescents and secondary school environments) project. The CHASE project was a multi-phased, multi-component formative research project which used the PRECEDE component of the PRECEDE-PROCEED model [24] to systematically assess school environments for identification of factors influencing adolescent physical activity and nutrition behaviors. Using a socioecological approach and based on the holistic approach to health promotion which underpins the Precede-Proceed model, this project utilized a collaborative approach and the Health Promoting Schools (HPS) framework [26] to align and classify school evaluation outcomes into recognized domains of school activity (curriculum; physical environment; school ethos/social environment; policy and practice; school health services; and school-home-community interaction) which had been applied previously in Australian schools [27, 28].

Aligned with the first three phases of the PRECEDE component of the Precede-Proceed model, and based on available evidence at the time of assessment development, the CHASE project
aimed to: (i) engage school communities [29] and substantiate adolescent overweight/obesity as a health issue in local school communities [24] (Phase I, Social assessment and participatory planning); (ii) examine parent weight status [30], adolescent and parent physical activity [31, 32] and nutrition behaviors [33–35], and parent support of adolescent health behaviors [36–40] (Phase II, Epidemiological assessment) and (iii) identify adolescent, teacher and parent perceptions of adolescent health, physical activity and nutrition and their school environments [41, 42] and school resources and practices in relation to adolescent physical activity and nutrition behaviors (Phase III, Educational and ecological assessment).

Specifically this figure depicts the first three Precede assessment phases and their components, and potential interactions and reciprocal effects of adolescents and their school environments. The initial phase involved engagement of the school community in confirming adolescent overweight/obesity as a relevant health problem. The second phase included assessment of factors which may have contributed to, or interacted with adolescent overweight and obesity and related behaviors. The third phase included assessment of the positive and negative predisposing, reinforcing and enabling factors associated with adolescent overweight and obesity. Completion of all three phases permitted identification of the range of factors within school environments which were predisposing, enabling and reinforcing adolescent physical activity and

Fig. 1. Application of the PRECEDE component of the PRECEDE-PROCEED model to create healthy school environments (Adapted from Green and Kreuter, 2005).
nutrition behaviors, and leverage points for interventions to influence both adolescents and their specific school environments. This information was subsequently used for further intervention matching and mapping, however, reporting of specific interventions, and their alignment is beyond the scope of this manuscript.

**Methods and procedures**

**Study setting and participants**

*Schools*

This project was conducted in a regional city (population ~69,000) in Queensland, Australia. All secondary schools (n = 11; ~5,300 adolescents enrolled) in the city were invited to participate, and nine schools initially agreed to participate. The non-participating schools (n = 2) included one Government school with a student enrolment of 1,100, and one independent school with a student enrolment of 650. These schools declined participation during recruitment phase, citing limited human and time resources for commitment to a long term extra-curricular activity. Only six schools [Catholic (n = 2), Government (n = 2), independent (n = 2)] completed all phases of the study. The three non-completing schools included one independent school with a student enrolment of 22, and two Catholic schools with student enrolments of 35 and 9, respectively. Any data collected from these non-completing schools was not included in final analysis or reporting of results.

*School community members*

Based on the theoretical and evidentiary need for participation and collaboration [7, 43, 44], key stakeholders with capacity to act as ‘champions’ for the project were initially enlisted to provide guidance on school-related process for their respective schools. To promote program reach and teacher involvement, all teachers (n = 323) from each of the participating schools (n = 6) were invited to participate in the study and information sessions were provided via staff and project meetings. A total of 146 teachers (response rate 45%) completed the teacher survey (66% female).

Recruitment of adolescents was reliant upon student assent and active parent consent for each student under 18 years of age. To recruit adolescents, stratified random sampling was used to calculate minimum sample sizes for each school and proportional allocation was used to determine random sampling sizes for each gender and school year. From the total randomized sample of adolescents (n = 1,954; from six schools, across years 9, 10, 11 and 12) a total of 442 adolescents returned forms (22.6% return rate) and 362 adolescents (18.4% response rate) and their parents (n = 349) consented to participate in the project. The consented adolescent sample comprised more females (62%) than males, with a mean age of 15.1 years (SD = 1.2). From this consented sample, 126 adolescents (66% female) participated in focus groups (n = 18) across the participating schools.

Parents were invited to participate in this study via take-home packages provided to adolescents who consented to participate in the project. Recruitment of parents was reliant on the return of signed informed consent forms. A total of 306 parents completed questionnaires [67% mothers; mean age 42.7 years (SD = 8.4)].

**Data collection**

This formative research project included two quantitative studies: (i) adolescent physical activity and body mass index (BMI) and the associations between adolescent behaviors, parent BMI and parent behaviors [30]; and (ii) adolescent nutrition behaviors, and the associations between adolescent behaviors, parent BMI and parent behaviors [31]; and two qualitative studies of (i) adolescent perceptions and insight for promoting adolescent physical activity and health nutrition behaviors and (ii) parent and teacher perceptions and insight for promoting adolescent physical activity and healthy nutrition behaviors. During supervised sessions in schools, students completed a 64-item questionnaire relating their personal and demographic characteristics, physical activity, sedentary and nutrition behaviors. Students height and
body weights were objectively measured for classification of age-and gender-specific BMI (kg/m²) using standardized cut-off points [45].

One parent/guardian of each consented student completed a 60-item questionnaire which included questions regarding their demographic characteristics (including self-reported height and body weight), personal physical activity and nutrition behaviors, support of their child’s physical activity and an 11-item questionnaire about their child’s secondary school environment. These questions aimed to identify: the parent’s degree of engagement in school-based activities related to physical activity and nutrition; the value parents placed on their involvement in such activities; and how supportive they perceived their school to be of adolescent physical activity and nutrition needs.

All teachers from all participating schools were initially emailed an electronic copy of the teacher questionnaire with an introductory letter and project information booklet. This however resulted in slow uptake and all teachers were subsequently provided with paper copies of the survey, and full instructions for their collection and return. Teacher consent to participate in the study was assumed upon voluntary return of a completed survey. Questions in the teacher surveys were based on the range of HPS indicators previously used in Australian schools [27, 28] and pilot tested by teachers (n = 12) from three of the participating schools. Specific details of data collection and measures used for each of the quantitative studies are published elsewhere [46, 47] and due to word limit restrictions, not included in this manuscript.

Human research ethical approval was gained from the Central Queensland University Human Research Ethics Committee and approval to conduct research in secondary schools was granted by Education Queensland, the Diocesan Catholic Education Office (Rockhampton) and the school Principals of each independent school. The collaborative nature of this research project necessitated two separate submissions for ethical approval by the Central Queensland University Human Research Ethics Committee. The initial submission outlined research aims, design and methodologies and anticipated time lines, and the final submission included copies of student and parent questionnaires, information booklets and consent forms which were developed in collaboration with school key stakeholders. Approval to conduct research in secondary schools was also granted by Education Queensland, the Diocesan Catholic Education Office (Rockhampton) and the school Principals of each independent school.

Results

Phase I—Social assessment and participatory planning

This initial phase of program planning aimed to engage the target community, and identify and verify the problems and priorities of these communities [24]. From the nine initially consented schools, 17 teaching staff and/or school Principals contributed to formal (n = 6) and informal steering committee meetings to obtain ‘insider knowledge’ and expert advice on the processes necessary to conduct school-based research.

The CHASE project was initiated to address the adolescent health issue of overweight and obesity. This social analysis ‘after the fact’, was driven by concern for the increasing rates of adolescent overweight and obesity and national trends which indicate that 50% of all young Australians could be overweight by the year 2025 [48]. Australian studies of adolescents have found approximately one-quarter of adolescents overweight/obese [49, 50] and in this project, comparative rates of adolescent overweight/obesity (23% of all adolescents; 25% of males, 21% of females) were subsequently found.

Phase II—Epidemiological assessment

For the two quantitative studies included in this phase, logistic regression was used to analyze data from 295 matched student and parent questionnaires to examine associations between adolescent physical activity, nutrition and BMI and a range of adolescent and parent/home obesity-related factors. From these studies, in addition to the comparative rate of adolescent overweight/obesity, we found a high prevalence...
of parent overweight/obesity (62%; 70% males/58% females) and positive association between adolescent physical activity and parent BMI (odds ratio (OR) 3.21, \( P = 0.006 \)). A majority of adolescents were classified sufficiently active (62%) with statistically significant differences (\( P = 0.002 \)) found between sufficiently active adolescent males (74%) and females (56%), and in our sample of adult parents, 57% (51% males, 61% females) were classified sufficiently active. Only 55% of all adolescents met current recommendations to spend 2 h or less per day in non-educational sedentary behaviors such as watching TV, using computers and playing computer/video games, and 53% of females and 46% of males were classified with healthy nutrition behaviors. In the parent sample, 60% of mothers and 40% of fathers were classified with healthy nutrition behaviors.

Adolescent physical activity was negatively associated with parent BMI (OR 0.40, \( P = 0.002 \)) and positively associated with parent support of adolescent physical activity (OR 7.38, \( P < 0.001 \)). In females, sufficient physical activity was positively associated with healthier nutrition behaviors (OR 3.24, \( P = 0.03 \)). Significant positive associations were found between healthy nutrition behaviors and time spent in sedentary education with stronger associations found in males (OR 8.32, \( P = 0.004 \)) than females (OR 2.48, \( P = 0.02 \)). Also in males, healthy nutrition behaviors were negatively associated with time spent in small screen recreation (OR 0.13, \( P = 0.002 \)). No associations were found between adolescent healthy nutrition behaviors and parent nutrition behaviors, having a television in the bedroom, parent BMI or parent values of adolescent health behaviors. Full reports of findings for associations between (i) adolescent physical activity, BMI and adolescent and parent characteristics, and (ii) adolescent nutrition behaviors and adolescent and parent characteristics, have been published elsewhere [46, 47].

**Phase III—Educational and ecological assessment**

This phase included qualitative studies which explored adolescent, teacher and parent perceptions of school environments, to identify the positive and negative predisposing, enabling and reinforcing factors within their school environments that influence adolescent physical activity and nutrition behaviors. Although a wide range of social conditions present in school communities were identified by adolescents, parents and teachers overall, school environments were perceived as unsupportive of adolescent healthy nutrition behaviors but supportive of adolescent physical activity, and most schools lacked supportive school policies relating to healthy nutrition and physical activity.

**Predisposing factors**

Predisposing factors are antecedents to behavioral change that provide impetus for individuals to adopt a behavior [24]. Adolescents expressed a strong desire to engage in school-based activities. Many parents expressed interest in being involved in school activities, but only a minority of parents reported involvement in school-based activities such as curriculum (7%), school sports (10%) and the school canteen/tuckshop (8%). The majority (85%) of teachers believed they had personal capacity to provide advice and guidance to students regarding their health, nutrition and physical activity. The majority of adolescents, parents and teachers perceived healthy eating and physical activity as important health issues for adolescents.

**Enabling factors**

Enabling factors are antecedents to behavioral and environmental change and include any characteristic of an environment, resource or skill of an individual which supports action [24]. Overall for adolescent physical activity, after school sports teams and compulsory participation in school-based physical activities were identified as positive enabling factors; however, limited availability and accessibility to good quality and well maintained sports equipment and facilities, and limited supervision from teaching staff were commonly identified as negative enabling factors. For adolescent healthy nutrition behaviors, restriction of access to nearby takeaway food outlets and teacher encouragement to
consume healthy foods/drinks were identified most commonly as positive enabling factors, and affordability, availability and accessibility to a wide range of unhealthy foods within schools were universally identified as negative enabling factors.

Reinforcing factors
Reinforcing factors follow behavior and reward or punish behavior, and thereby provide incentive for continuation of the behavior [24]. Adolescents had high levels of conceptualization of health and a majority of teachers perceived themselves capable of supporting adolescents to develop and maintain healthy physical activity and nutrition behaviors. Teacher role modeling was commonly identified by adolescents and teachers as positive reinforcing factors for both participation in sports and physical activities and healthy nutrition behaviors. A strong emphasis on ‘winning’ over participation was a commonly identified negative reinforcing factor for adolescent participation in physical activity.

The triangulation of adolescent surveys, adolescent focus groups and parent and teacher surveys facilitated discovery of the inter-connectedness of adolescent behaviors and their school environments. The range of school environment factors found to influence adolescent nutrition and physical activity behaviors are included in Tables I and II.

Discussion
This study used a formative research approach to identify key areas for application of school-based efforts and resources for the promotion of adolescent physical activity and nutrition behaviors. From the outset, community engagement was considered an integral component of this projects success. The early engagement of school community members provided an avenue for reciprocal learning, clarification of appropriate research processes and confirmation of adolescent overweight and obesity as a perceived health priority in the local school communities. Despite early recognition for stakeholder ‘buy-in’ and community-based research action, several research issues (requirement for parental consent, privacy laws which limit access to student names and addresses) and issues inherent in schools (timetabling, focus on learning/education not health promotion), limited opportunity to collaborate extensively throughout all phases of the project. The social assessment and participatory planning phase extended over 12 months and was valuable for providing an avenue for reciprocal learning between researchers and schools, and opportunity to clarify appropriate research processes and confirmation of adolescent overweight/obesity as an actual health problem/issue for address, in local school communities. Overall, parent and adolescent participation in the project was low despite use of recommended recruitment strategies [51]. In addition to the teacher interactions, more face-to-face interactions with students during early phases of the study may have facilitated greater acceptance and participation in the assessment and intervention phases. This would require additional time and resource commitment by both research staff and teaching staff (to support coordination). For future school-based studies this would require consideration in the early stages of research design to ensure appropriate commitment of both time and financial support.

The epidemiological assessment aimed to qualify the importance of adolescent overweight/obesity as a health problem in the local community, provide evidence for setting health promotion priorities within schools, and identify the relative importance of environmental factors which influence the health problem [24]. There is strong evidence for a genetic component to obesity with parent BMI found to be a significant predictor of adolescent overweight and obesity [30, 52]. In support of previous research, our epidemiological assessment found a high prevalence of parent overweight/obesity and positive association with adolescent overweight/obesity, and a negative association between parent overweight/obesity and adolescent physical activity (which were supportive of previous studies). This finding highlighted the relevance of adolescent overweight/obesity as a health issue in local schools and as intended, promoted engagement of community members and acceptance of health promotion efforts within the project [24].
The target behaviors of physical activity, sedentary behaviors and nutrition behaviors were included in this study to permit specificity in developing behavioral objectives in future health promotion efforts. Our findings for adolescent physical activity behaviors were comparative to other recent Australian studies [49, 53]. Our assessment of behaviors provided evidence that the majority of adolescents was sufficiently active; however, approximately half of all adolescents exhibited unhealthy nutrition behaviors and engaged in excessive amounts of non-educational sedentary behaviors. Our findings, provided evidence for schools to focus health promotion efforts on healthy nutrition, and ensure inclusion of the home environment in addressing adolescent physical activity and sedentary behaviors. The findings of gender differences in some obesity-related behaviors highlighted a need for schools to consider different target groups and designs when developing intervention programs for the promotion of healthy adolescent behaviors and the prevention of adolescent overweight/obesity.

Both schools and homes provide a wide range of social and environmental factors which influence adolescent health; however, adolescent development and maintenance of physical activity and

| Table I. School environment factors influencing adolescent nutrition behaviors |
|---------------------------------|---------------------------------|---------------------------------|
| **Predisposing**                | **Enabling**                    | **Reinforcing**                 |
| Positive                        | Positive                        | Positive                        |
| Adolescent time spent in sedentary education | Chilled water fountains available throughout school | Adolescents have high level of conceptualization of health |
| Adolescents, parents and teachers perceive healthy eating important to adolescent health | Some healthy foods offered at school canteen | Teachers have perceived personal capacity to support adolescent healthy food choices |
| Adolescents, parents and teachers believe their school environment does not support healthy food behaviors | Some restriction of unhealthy food intake during school | Teachers encourage healthy nutrition behaviors |
| Adolescents would like to be involved in menu development | | School nurses provide advice about health and nutrition |
| Adolescents and teachers would like more healthy foods to be available | | One-on-one classes offered to at-risk students |
| Parents recognize value of involving adolescents in food choices | | |
| Negative                         | Negative                        | Negative                        |
| Male adolescents—time spent engaged in small screen recreation | A lot of unhealthy food available | Low parent participation in nutrition related activities and curriculum |
| Parent overweight/obesity | Limited range of healthy foods available | Adolescents perceive teachers poor role models for healthy nutrition behaviors |
| Parents do not perceive their involvement in school canteen as important | Long waiting times in queue for canteens | |
| Teachers believe healthy food supply will reduce financial gains in canteens | Unhealthy food cheaper than healthy food | |
| Teachers perceive a lack of upstream support from food suppliers and manufacturers | Unhealthy more visible than unhealthy foods | |
|                              | Healthy foods often of poor quality | |
|                              | No written policy specific to: supply and provision of healthy foods in school; parent involvement in curriculum and nutrition related issues; advertising of healthy/unhealthy foods within school | |
nutrition behaviors are considered dependent on positive role modeling and the support of parents in promoting such behaviors within the home [14, 40, 54]. Our assessment of environmental factors was concerned with assessing home environment factors (parent support of adolescent health, physical activity and nutrition behaviors) associated with adolescent physical activity and nutrition behaviors to identify the relative importance of these factors and provide schools with environmental objectives in future health promotion efforts. The only significant relationships found in this study were

| Table II. School environment factors influencing adolescent physical activity behaviors |
|----------------------------------------|---------------------------------|---------------------------------|
| **Predisposing**                      | **Enabling**                    | **Reinforcing**                 |
| **Positive**                          |                                 |                                 |
| Adolescent females-healthy nutrition behaviors | School PE compulsory for junior years | Sporting achievements awarded |
| Adolescents would like to be involved in deciding what sports/activities are offered | School sporting events advertised and promoted | After school sporting teams encouraged |
| Parents would like to receive information regarding health and related topics/curriculum | Compulsory participation in minor events at school sports carnivals | Adolescents and teachers recognize value of teachers as role models for sport |
| Parent support of adolescent physical activity | Range of after school sports teams offered |                                 |
| Adolescents, parents and teachers believe schools provide a variety of sports and physical activities | | |
| Adolescents, parents and teachers believe a range of sports equipment is provided | | |
| Adolescents and teachers consider physical activity and inactivity important health issues | | |
| Adolescents and teachers perceive school to have a strong sporting ethos | | |
| **Negative**                          |                                 |                                 |
| Adolescents perceive teachers to be uninterested in students' sports activities | Sports equipment not maintained | Focus on competitive sports |
| Parent overweight/obesity             | Supervision required for use of sporting facilities | No reward/incentive for participation |
| | Sports uniform policy restricts participation | Limited parent involvement in curriculum development |
| | Few organized lunchtime activities offered | | |
| | School policy restricts areas of play | | |
| | School policy for participation/non-participation in PE favors those who do not want to be physically active | | |
| | No showers, change facilities | | |
| | No broad level of skill training provided for less active students | | |
| | Physical activity not cross-curriculum | | |
between adolescent physical activity and parent support of adolescent physical activities. Our findings provided evidence to schools that parent role modeling was not a strong predictor of adolescent physical activity or nutrition behaviors; however, effort should be made in school health promotion to develop objectives which encourage parents to support their child’s participation in physical activities.

**Predisposing factors**

Identifying predisposing factors helped schools recognize the collective energies available to them in developing and implementing school-based interventions and how enlisting these energies may assist them (schools) in creating positive change and action within their social and physical environments. Most previous school-based physical activity and nutrition interventions have focused on curriculum-based changes [11, 55]. Although health and physical education are key learning areas in schools across Australia, currently there is no mandatory requirement for their implementation. A full assessment of curriculum content and degree of implementation by schools was beyond the scope of this study, and based on the outcomes of our teacher and parent surveys (which suggested that curriculum content and delivery are perceived as adequate and supportive of adolescent physical activity and nutrition behaviors), and our overall study aim to identify a health promotion plans relevant to school community members, further investigation of school curriculum was not warranted. Our results suggested that schools should look more broadly, and consider changes in the schools’ physical and social environments to support healthy adolescent behaviors.

Coupled with findings from the epidemiological assessment, our studies suggested a need to examine a range of factors within school canteens to promote healthy nutrition behaviors within schools. In addition, the majority of our schools needed to review the quality and quantity of school equipment and facilities, and procedures associated with use of sports equipment and facilities, to promote adolescent physical activity and guide change in the schools’ physical environment. Our findings that many schools lacked supportive school policies relating to healthy nutrition and participation in physical activity highlighted a need for an integrated approach including policy review and/or development to promote and maintain behavior change across the school environment. This could be addressed through curriculum which is designed to empower all students with the knowledge, skills and opportunities to be involved in creating positive changes and action in relation to healthy food and physical activity, within their physical and social environments.

Our findings for adolescents’ high levels of conceptualization of health and teachers confidence in providing support for adolescents to develop and maintain healthy physical activity and nutrition behaviors, suggested a high level of school community competence and readiness for dealing with adolescent overweight and obesity. These findings also validated the positive role and contribution teachers and adolescents could have in developing school-based interventions. Teacher role modeling was found to promote adolescent participation in sports and physical activity and unhealthy nutrition behaviors highlighting a need for schools to ensure that health promotion efforts were directed at all school community members to support maintenance of healthy adolescent behaviors. To build this strength across the school, schools should consider health promotion programs for staff related to physical activity and weight management and consider whole of school opportunities for physical activity. A strong emphasis on competition and ‘winning’ over participation was found to hinder adolescent participation in school-based physical activities stressing the importance of impartiality, a need for interventions which promote adolescent participation in a broad range of non-competitive and competitive activities, and reassessment of policy and procedures in relation to school sports awards and school-based competitions.

Similar to previous formative research approaches [15] during our study we experienced conflict between the need for immediate information and the time required to complete research phases. The research funding term for this study was two
years and as much of this time was utilized in conducting phases of the PRECEDE framework, little time (funded) remained for intervention development and implementation. This limitation requires recognition for future formative research projects. Although onerous, the PRECEDE-PROCEED model did facilitate collaborative and comprehensive assessment of the school environments. Use of both quantitative and qualitative methods highlighted to school communities the inter-connectedness of adolescent behaviors and their environments. The early engagement of community members strengthened health promotion action within the schools as well as the research-school partnerships. Use of the PRECEDE component permitted systematic assessment of the school environments, and development of realistic and relevant interventions for promoting healthy nutrition and physical activity behaviors of adolescents. Overall, the results of our formative evaluation suggest that early and ongoing engagement and communication with all school community members (teachers, parents and students) can facilitate comprehensive assessment of school environments and identification of health promotion strategies relevant to the specific needs (both perceived and actual) of secondary schools. Additionally, this project highlighted to us as researchers, that the effectiveness and sustainability of large-scale interventions may be initially dependent upon making relatively minor and inexpensive changes within school environments to create broader support for a range of factors across all domains of the school environment.

Acknowledgements

S.L.W. is the corresponding author for this manuscript and was responsible for study design, data collection, data analysis, data interpretation, literature search, generation of tables and figures and writing of the manuscript. K.W.M contributed to study design, data analysis, data interpretation and review of the manuscript.

Funding

This work was supported by a Telstra Foundation Australia, which supported conduct of the CHASE project.

Conflict of interest statement

None declared.

References

50. Uter J, Faeamani G, Malakellis M et al. Lifestyle and Obesity in South Pacific Youth: Baseline Results from the


