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Socioecological factors potentially associated with participation in physical activity and sport: A longitudinal study of adolescent girls

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ABSTRACT

Objectives: Many adolescents are not physically active enough to receive associated health benefits. Furthermore, participation in physical activity generally declines during adolescence, and to a greater degree for females. Longitudinal research is required to better understand the determinants of change in physical activity by adolescent females to inform physical activity-related policy and practice. This study explored patterns of change in socioecological factors hypothesised to be associated with physical activity and sport, across the adolescent period for females.

Methods: This longitudinal study employed three annual surveys of females from metropolitan and non-metropolitan areas recruited in Year 7 ($n = 328$) and Year 11 ($n = 112$). Self-report measures included questions regarding general barriers to participation, as well as factors relating to the socioecological domains.

Results: The barriers where significant changes within or differences between cohorts were observed were mostly intrapersonal (lack of energy, lack of time due to other leisure activities). Lack of time was more prevalent in the Year 11 cohort than in the Year 7 cohort. Perceived importance of life priorities mainly related to education and study and more so for the Year 11 cohort. Perceived competence declined for the Year 7 cohort. Support from family and peers trended downwards in both cohorts, whereas access to facilities increased both within and between cohorts.

Conclusions: Significant patterns of change in the determinants of physical activity participation were observed across the adolescent period. It is important to consider flexible structure and scheduling of physical activity and strategies to develop competency in childhood and early adolescence.

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1. Introduction

Females are commonly identified as being less active than males.¹ Furthermore, an Australian study reported that fewer than half of adolescent females are active enough to meet the physical activity (PA) guidelines.² The adolescent period is recognised as a difficult and stressful period of life transition. During this time life there are many biological, environmental, social and psychological transformations which influence changes in PA.^{3,4} As a result of the low levels of PA, particularly among adolescent girls, researchers have sought to understand determinants of participation in PA from both quantitative^{5,6} and qualitative^{4,7,8} perspectives.

A systematic review of prospective studies quantifying change in PA in children and adolescents found that the majority of quantitative studies have been conducted in North America among 10–13 year olds.⁵ For these children, PA tended to increase over time, and previous PA and self-efficacy were consistently positively associated with this change.⁵ For adolescents 14 years and older, smaller declines occurred in PA, with perceived behavioural control, social support and self-efficacy being negatively associated with declines in PA.⁵ However, the determinants examined were mostly limited to individual factors which were not investigated across the studies in a consistent manner and not all established correlates could be confirmed longitudinally.⁵ Historically, research has focused on individual-level factors and only recently have ecological models been adopted⁶ and evidence encompassing all domains of the ecological model identified in an holistic manner.⁵

The socioecological model was developed to demonstrate multiple levels of influences on health behaviours including

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intrapersonal, interpersonal, organisational, community and public policy levels.⁹ Socioecological models have been applied to qualitative studies to determine the multiple influences on participation in PA among adolescents.^{4,7,10} These studies found that environmental factors including proximity, cost, and access to facilities were important,^{4,7,10} especially for youth living in low-socioeconomic areas¹¹ or in regional communities.^{4,7} Further, intrapersonal factors (i.e. perceived skill and competence), interpersonal factors (i.e. support of friends and adults), and organisational factors (i.e. school and community sport club environment) were also considered important influences on PA participation.^{4,7,10}

There have been calls for longitudinal research into determinants of changes in PA in order to achieve a more definitive understanding of why people are active or inactive.⁶ Longitudinal studies that examine determinants of PA participation across the socioecological model are needed in order to better inform strategies to foster continued participation in PA throughout adolescence.⁴ Importantly, little is known about the changes in determinants of PA during adolescence despite adolescence being recognised as a difficult period of life transition.

This study explored patterns of change in socioecological factors hypothesised to be associated with physical activity and sport, across the adolescent period for females.

2. Methods

This study is part of a larger study for which the methodological procedure has been previously outlined.² Seventeen secondary schools in the metropolitan area of Melbourne, Victoria, Australia and 14 schools in surrounding rural and regional areas participated in the study. Ethical approval was gained from the University Human Research Ethics Committees, the Victorian Department of Education and the Victorian Catholic Education Office.

All female students in Years 7 and 11 from participating schools were invited to participate. There were three longitudinal waves of data collection at 12-month intervals during Autumn of 2008–2010.² Details of the content of the following questions are shown in Tables 1 and 2, and in Supplementary table.

In this study, the Australian Sports Commission definition of sport was adopted: “a human activity involving physical exertion and skill as the primary focus of the activity, with elements of competition where rules and patterns of behaviour governing the activity exist formally through organisations, and is generally recognised as a sport”.¹² More broadly, the contexts of leisure-time physical activity (LTPA) have been classified in terms of modes, settings and types.² The four modes of LTPA are: team sport, individual sport, organised but non-competitive PA; and non-organised PA.

Regarding barriers, a list of potential intrapersonal, interpersonal and environmental/organisational barriers to PA participation was derived^{13,14} and participants were asked how likely these issues would arise over the next three months on a 5-point scale. For analysis, the responses were dichotomised to ‘yes’ (at least moderately likely) or ‘no’ (no more than slightly likely).

Regarding intrapersonal factors, perceived physical/sports competence was assessed using items from three scales/inventories.^{15–17} A 5-point scale was used to maintain consistency with other aspects of the questionnaire, and the terms ‘sport’ and ‘PA’ were used to align with the focus of this research. Self-efficacy was assessed in the second and third waves of questionnaires using items on a 5-point scale regarding confidence about participating in PA or sport when conditions were not ideal, adapted from Marcus and Forsyth.¹⁸

Priority of PA was examined through questions on leisure preference.¹⁹ Life priorities were measured using a scale that was

developed for this study which examined the importance of eight types of activity, including PA.

Interpersonal factors such as support from family and friends were measured using items which have demonstrated good reliability.²⁰ All family and friend items were scored on a 5-point scale. The support score for each domain – family and friends – was the mean score of the set of items, with high scores representing a high level of support from family or friends.

Environmental factors were examined with questions related to an adolescent’s ability to access each of 14 types of PA and sport facilities and were based on those used by Sallis et al.¹⁴ The 14 items were scored on a 4-point ordered scale indicating ease of access to the facility. The access score was the mean score of the 14 items, with high scores representing greater independent access/mobility. Neighbourhood socio-economic status (SES) was represented by the Socio-economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)²¹ score for the residential postcode of each participant.

Preliminary data screening (Eime et al.²) included ensuring that numerically coded responses to categorical items were within the specified range, and that dates of birth and self-reported heights and weights were within feasible limits. In a preliminary analysis, baseline characteristics of participants who returned survey forms in all three years of the study (‘completers’) and those who did not (‘non-completers’) were compared using *t*-tests and chi-square tests. Longitudinal analysis was based on the completers. All variables analysed were either quantitative (means of coded responses to a set of Likert scale items) or Yes/No dichotomies (see Tables 1 and 2). Linear mixed models and longitudinal logistic regression fitted by the method of generalised estimating equations were used to identify statistically significant differences between the two cohorts and statistically significant longitudinal trends – linear and non-linear – within each cohort. Differences between cohorts were assessed in 2-factor models incorporating cohort effects, time trends and cohort–time interactions. Time trends were assessed in simple effects analyses, i.e. separate analyses of trend for each cohort. All analyses were conducted using SPSS Version 19, with statistical significance set at $p < .05$.

3. Results

The 2008 recruitment/response rate (the proportion of invited students who provided consent returned the first survey form) was 19.6% with retention rates in 2009 and 2010 of 82.7% and 74.0%, respectively. Respondents who returned survey forms in all three waves of the study comprised: Year 7 ($n = 328$, 74.5%; aged 11–13, $M \pm SD = 12.2 \pm 0.5$ years at baseline) and Year 11 ($n = 112$, 25.5%; aged 16–18, 16.2 ± 0.6 years at baseline). Details of sampling design, recruitment and retention rates can be found in supplementary material.

For the Year 7 cohort those who completed all three surveys (‘completers’) had a lower mean self-reported weight at baseline ($M \pm SD = 46.6 \pm 9.3$ kg; $p = .009$) than those who did not (‘non-completers’: $M \pm SD = 49.4 \pm 10.9$ kg). There were no significant differences at baseline in mean age, SES (SEIFA IRSAD score of residential postcode), self-reported height or BMI. There were no significant differences at baseline between Year 11 completers and non-completers.

Across both cohorts, at baseline completers were significantly more likely than non-completers to report participating in PE classes at school (63.9% vs 45.8%, $p < .001$), competitive team sports outside school (64.5% vs 53.7%, $p = .003$), or competitive individual sports at school (68.6% vs 55.1%, $p < .001$). There were no significant differences with regard to participation in competitive team sports

Table 1
Longitudinal changes within cohorts and differences between cohorts for perceived barriers to regular participation in PA (including sport).

Barrier	Dichotomy	Variable	Cohort, calendar year and school year level												Statistically significant difference between cohorts	
			Year 7 (n = 328)						Year 11 (n = 112)						p-Value	Sign ^b
			2008	2009	2010	Statistically significant trend			2008	2009	2010	Statistically significant trend				
Year 7	Year 8	Year 9	p-Value	Type	Sign ^a	Year 11	Year 12	Year 13	p-Value	Type	Sign ^a	p-Value	Sign ^b			
<i>Intrapersonal barriers</i>																
Self-consciousness about my looks when I exercise	Yes/No	% Yes	25	23	28				28	16	19					
Feeling tired or lacking energy	Yes/No	% Yes	33	37	42	.029	Linear	+	37	48	52	.011	Linear	+	.047	+
Lack of time due to other leisure activities (e.g. other interests, socialising)	Yes/No	% Yes	36	45	55	<.001	Linear	+	55	55	57				.006	+
Lacking time due to work or study	Yes/No	% Yes	50	52	62	.001	Linear	+	80	87	75	.042	Quadratic	+–	<.001	+
Not having enough skills in physical activities	Yes/No	% Yes	24	25	25				27	26	20					
Not being fit or strong enough	Yes/No	% Yes	23	26	29				37	32	28					
Difficulties in organising equipment or facilities	Yes/No	% Yes	25	21	22				30	17	18	.020	Linear	–		
Fear of injury	Yes/No	% Yes	21	19	17				17	12	12					
Inability to get myself going	Yes/No	% Yes	24	27	28				39	40	43				<.001	+
Having injury, disability or illnesses	Yes/No	% Yes	22	21	20				21	16	22					
Difficulties with language (e.g. do not understand English well enough)	Yes/No	% Yes	4	4	6				1	1	1				.037	–
<i>Interpersonal barriers</i>																
Difficulty finding someone to participate with	Yes/No	% Yes	21	20	27				20	19	28					
Difficulties in organising friends or other people to participate	Yes/No	% Yes	27	27	26				29	27	27					
<i>Organisational/environmental barriers</i>																
Conflict with cultural expectations or beliefs	Yes/No	% Yes	12	8	6	.015	Linear	–	2	3	2				.003	–
Lack of opportunity or resources (e.g. lack of programmes or facilities)	Yes/No	% Yes	21	17	16				14	15	12					
Rules about boys and girls playing together	Yes/No	% Yes	15	16	15				10	6	5				.001	–
Cost of participation (e.g. buying equipment, hiring facilities)	Yes/No	% Yes	28	27	28				25	21	33					
Conflict with religious rules, beliefs or expectations	Yes/No	% Yes	8	6	7				1	1	1				.005	–
Unpleasant weather (e.g. hot, cold, rainy)	Yes/No	% Yes	31	33	36				33	37	45					
Conflict with rules about clothes that should be worn	Yes/No	% Yes	17	13	13				7	4	2				<.001	–

^a Signs indicate direction of linear trend and pattern of quadratic curvature superimposed on linear trend.

^b Signs indicate the direction of difference of Year 11 relative to Year 7.

Table 2
Longitudinal changes within cohorts and differences between cohorts in the intrapersonal, interpersonal and organisational/environmental factors influencing participation in PA (including sport) and in PA levels.

		Cohort, calendar year and school year level													Statistically significant difference between cohorts		
Factor	Measure or dichotomy	Variable	Year 7 (n = 327)						Year 11 (n = 113)						p-Value	Sign ^b	
			2008	2009	2010	Statistically significant trend			2008	2009	2010	Statistically significant trend					
			Year 7	Year 8	Year 9	p-Value	Type	Sign ^a	Year 11	Year 12	Year 13	p-Value	Type	Sign ^a			
<i>Intrapersonal factors</i>																	
Perceived competence	Scale (1–5)	Mean	3.9	3.87	3.75	<.001	Linear	–	3.83	3.97	3.81						
Self-efficacy ^c	Scale (1–5)	Mean		2.85	2.87					2.72	2.72						
<i>Importance of activities:</i>																	
Schoolwork/education/study	Yes/No	% Yes	86	89	89				95	99	95	.045	Quadratic	+–	<.001		
Friends	Yes/No	% Yes	90	99	94	<.001	Quadratic	+–	95	98	96						
Boyfriend/girlfriend	Yes/No	% Yes	28	42	43	<.001	Linear/quadratic	++	35	49	55	<.001	Linear		.030	+	
						.025											
Part-time job	Yes/No	% Yes	40	48	55	<.001	Linear	+	53	46	75	<.001	<.001	Linear/quadratic	+	.008	+
Career	Yes/No	% Yes	61	67	71	.002	Linear	+	81	84	86				<.001	+	
Community service (volunteering)	Yes/No	% Yes	29	29	24				26	29	38	.019	Linear	+			
Home and family	Yes/No	% Yes	92	97	91	.001	Quadratic	+–	91	97	94						
Physical activities and sport	Yes/No	% Yes	79	84	76	.003	Quadratic	+–	79	77	75						
<i>Interpersonal factors</i>																	
Family support	Scale (1–5)	Mean	3.97	3.92	3.67	<.001	.001	Linear/quadratic	–+–	3.87	3.87	3.71	.0198	Linear	–		
Friend support	Scale (1–5)	Mean	3.65	3.67	3.51	.004	.003	Linear/quadratic	–+–	3.58	3.42	3.45				.008	–
<i>Organisational/environmental factors</i>																	
Access to facilities	Scale (1–4)	Mean	3.08	3.24	3.31	<.001	Linear	Quadratic	++	3.33	3.43	3.50	<.001	Linear	+	<.001	+

^a Signs indicate direction of linear trend and pattern of quadratic curvature superimposed on linear trend.

^b Signs indicate the direction of difference of Year 11 relative to Year 7.

^c The self-efficacy question was not asked in 2008.

in school, competitive individual sports outside school, organised but non-competitive PA or non-organised PA.

Tables 1 and 2 summarise the longitudinal changes within cohorts and differences between cohorts for perceived socioecological barriers to regular PA participation (Table 1) and socioecological factors influencing PA participation (Table 2).

The percentage of girls reporting barriers across the three socioecological domains ranged from as few as 1% for difficulties with language to 87% for lack of time due to work or study among Year 11 respondents. Around half of the barriers listed were reported consistently by about 20% of respondents in both cohorts.

The barriers for which there were significant changes within cohorts or differences between cohorts were mostly intrapersonal, including lack of energy and lack of time due to other leisure activities. At baseline, lack of time due to work or study was reported by 50% of the younger cohort and 80% of the older cohort. Lack of energy and lack of time both trended upward in the younger cohort. Lack of energy also trended upward in the older cohort. The percentages reporting lack of time were higher in the older cohort than the younger cohort, though they tended to plateau (lack of time due to other leisure interests) or fall after leaving school (lack of time due to study). Barriers relating to the interpersonal domain showed no significant trends in either cohort and no significant differences between cohorts. Within the organisational/environmental domain, items such as cultural and religious beliefs and expectations and rules about clothing were all reported by relatively small minorities (generally less than 10%) of respondents.

Among the potential socioecological determinants of PA participation, significant changes or differences were observed across all three domains – especially for the Year 7 cohort. In terms of intrapersonal factors, perceived competence was high overall, however it diminished over time in the Year 7 cohort, although the Year 11 cohort reported consistently high levels. This anomaly may be due to a greater self-selection bias (i.e. more competent girls being more likely to complete the survey) in the smaller Year 11 cohort compared to the Year 7 cohort. Self-efficacy did not significantly change within or differ between cohorts. Adolescent girls reported that they were moderately confident about participating in PA or sport when conditions were not ideal.

With regard to life priorities, the perceived importance of education and study was consistently high for both cohorts, although Year 11 was significantly higher than Year 7; the importance of education peaked in the final year of school (Year 12). There were consistent and significant increases over time in the perceived importance of boyfriends/girlfriends, part-time jobs and careers and again the importance of these activities were significantly higher for the Year 11 cohort. The importance of home and family, friends and physical activities and sport remained consistently high throughout for both cohorts.

Support from family and peers (interpersonal factors) both significantly trended downwards from Year 7 to Year 9. Family support also dropped in Year 13 (i.e. after leaving school). Conversely, access to facilities (environmental factors) increased steadily with increasing age, both within and between cohorts.

4. Discussion

This study examined longitudinal patterns of change in intrapersonal, interpersonal and environmental determinants hypothesised to be associated with participation in PA and sport, across the adolescent period for two cohorts of girls. Understanding these determinants and how they change across transitional periods is important to contribute to evidence-based planning of public health interventions; particularly for girls who are less active than boys. Key findings to emerge from this study were

associated with each of the domains of the socioecological model and included: intrapersonal barriers such as lack of time, lack of energy and perceived competence; interpersonal factors associated with family and friend/peer support; and environmental/organisational factors including access, opportunity and resources. One intrapersonal factor which did not change within or between cohorts was self-efficacy. Others have also found self-efficacy for PA to be stable across secondary school years.²²

In this study there was a consistent trend that barriers associated with the intrapersonal domain increased as females matured – both within and between cohorts – including ‘feeling tired’ or ‘lacking energy’, ‘an inability to get going’, and increasing time issues associated with other leisure activities, work or study. Clearly, as adolescents mature there are numerous work, study, and leisure activities that increase in priority along with time allocation to these activities, leaving less time for PA opportunities. It has been reported that as adolescents age their participation in PA moves away from organised, competitive activities to individual-based physical activities, particularly due to increased demands of part-time employment and increasing desire to succeed educationally.² In this study, the importance of school, work, study, relationships, and careers also significantly increased with age. The importance of PA and sport, however, did not change and remained high, with 75% of respondents agreeing that it was an important activity. As Berger et al.²³ state, there is a need to position PA and sport in the context of the lived experiences of adolescents of today – meaning that we need to encourage adolescents to find ways to fit PA and sport into their time-challenged lives. Taking a socioecological perspective, rather than an individual focus, we therefore need to encourage the development in communities of physical activity options that have lower time demands as a requirement for participation and greater flexibility in scheduling of participation. For example, while organised sport is a popular activity among children, many sports programmes demand extensive and inflexible time commitments, and may not be providing an environment conducive to promoting lifelong involvement in sport.^{4,24}

Competence in sport and PA is a key determinant of participation for adolescent girls.^{7,25,26} Further, perceived sport competence in childhood and adolescence has been reported to be significantly associated with maintaining participation through the transition from adolescence to adulthood.²⁵ In this study, perceived competence declined for the Year 7 cohort over time, although not for the older cohort. This may be a consequence of self-selection bias in the older cohort, or it may be related to maturation in the younger cohort. Others have reported similar findings, whereby maturation status (i.e. progression towards the adult state) was inversely related to perceptions of sport competence.²⁶ Interventions that focus on developing perceived sport competence throughout adolescence, therefore, may be important for promoting lifelong PA participation.²⁵

It is well established that support from family and peers is important for adolescent PA and sport participation.^{27,28} Parental support has been shown to be a strong mediator for sport club participation among girls from low socio-economic areas.²⁹ Similarly, peer encouragement is important for participation in PA after school, especially for girls after the transition from primary to secondary school.²⁸ In this study, reported family support – via encouragement, praise, watching/supervision, or direct involvement in PA – decreased over time; particularly for the Year 7 cohort. Strategies to promote and maintain family support for PA for adolescent girls are required, especially since girls appear to receive less encouragement to be active from their parents than do boys.³⁰

Peer support was significantly higher among the younger cohort compared to the older cohort. Peer teasing can diminish peer support for, and enjoyment of, PA, and is a particular issue in the school environment⁷; and is also present in community environments

such as organised sport.³¹ Considering the decline in peer support reported in this study and evidence of peer teasing in schools and sports clubs, there is a need to promote more positive and inclusive environments for PA and sport participation to promote lifelong PA participation. Stafford et al.³¹ suggest that children should be involved fully in the decisions about their sporting lives, and participate in an environment where they feel empowered to have a voice for the context of participation, where it is safe, fun and carefree.

The access to facilities score significantly increased within each cohort over time and between cohorts, indicating that access to PA opportunities increased steadily throughout adolescence. Other evidence suggests that a greater number of available PA facilities is associated with increased PA levels.³² More specifically, access to facilities along with family support have been found to be strong mediators specifically between the association between socio-economic status (SES) and club sport participation.²⁹ Studies have also reported that for adolescents, the number of nearby facilities and number of nearby parks correlates positively with their PA.³³ This is supported by Scott et al.³⁴ who states that both the individual facility perceptions and the total number of facilities perceived was associated with increased PA for adolescent females. Our study showed that as girls aged fewer perceived that there was a lack of opportunity or resources for PA. This was in contrast to a cross-sectional study in the United States that reported that as young people aged (from Grade 7 to University freshman) they were more likely to identify a lack of community opportunities (e.g. lack of specific sports team to join/participate in) and resources (lack of facilities/variety of facilities) for PA.³⁵ This difference may be due to the dominance of the club sport system in Australia compared to the United States.

A major strength of this study was its prospective holistic design, which allowed changes in the determinants of participation to be assessed longitudinally across the socioecological domains over a three-year period in two cohorts of adolescents. While the information about determinants was based on subjective self-report, in most instances this was unavoidable, and generally, we used established measures of these constructs. As has been pointed out elsewhere.³⁶ It is acknowledged that while the study investigated access to a wide range of PA and sport facilities, it did not examine other aspects of the environment such as aesthetics, road and personal safety, walkability and quality of facilities. Studies of this population are difficult to conduct due to the ethical requirements of Australian education authorities to obtain specific 'opt-in' parental consent, which is exacerbated by the necessity to communicate with parents only indirectly in writing via the school and the students themselves. Consequently, participant recruitment rates were low – meaning that there is a possibility that students and/or parents with more interest in PA were more likely to have volunteered and/or given consent to participate in the study 2, which may underestimate the barriers to participation. Comparison of the baseline characteristics of those who completed all three surveys and those who did not indicates a degree of self-selection bias towards girls with a greater competitive sport focus. A further limitation which has implications for interpretation of the results is that, because the sample size in the Year 11 cohort was much smaller than that in the Year 7 cohort, larger effect sizes (bigger differences or stronger trends) were required in order to establish statistical significance in the smaller sample.

5. Conclusion

This study has identified significant and interrelated patterns of change in intrapersonal, interpersonal and environmental determinants of participation in PA by girls across the adolescent period.

In summary, intrapersonal barriers such as lack of time and lack of energy increased over a 3-year period for both cohorts, which were influenced by the increasing importance of education, work and career. Therefore, flexibility in the structure and scheduling of PA opportunities is likely to be an important consideration in order to retain older adolescents in PA and sport. Perceived competence also significantly decreased from Year 7 to 9, highlighting the need to continue to develop competency into the secondary school years. In terms of interpersonal factors, support from both family and friend/peers decreased, although only significantly so between Year 7 and 9. Strategies are required to promote family support for girls' PA along with strategies for fostering peer support and encouraging supportive and inclusive environments. Finally, reported access to a range of PA facilities was quite high and increased significantly over time within both cohorts.

6. Practical implications

- Position PA and sport in the context of the lived experiences of adolescents of today using individual and organisational strategies to encourage and support adolescents to find ways to fit PA and sport into their time-challenged lives.
- Interventions that focus on developing perceived sport competence throughout adolescence may be important for promoting lifelong PA participation.
- Promote and maintain family support for adolescent girls to be active.
- Create and promote positive and inclusive environments for PA and sport.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jsams.2014.09.012.

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