

RESEARCH ARTICLE

Open Access

Participation in sport and physical activity: associations with socio-economic status and geographical remoteness

Rochelle M Eime^{1,2*}, Melanie J Charity^{1,2}, Jack T Harvey¹ and Warren R Payne²

Abstract

Background: Many factors influence participation in sport and Physical Activity (PA). It is well established that socio-economic status (SES) is a critical factor. There is also growing evidence that there are differences in participation patterns according to residential location. However, little is known more specifically about the relationship of PA participation and frequency of participation in particular contexts, to SES and residential location. This study investigated the relationship of participation, and frequency and context of participation, to SES and location.

Methods: Three aspects of participation were investigated from data collected in the Exercise, Recreation and Sport Survey (ERASS) 2010 of persons aged 15+ years: any participation (yes, no), regular participation (<12 times per year, ≥12 times per year) and level of organisation of participation setting (non-organised, organised non-club setting, club setting).

Results: The rates of both any and regular PA participation increased as SES increased and decreased as remoteness increased. However, participation in PA was SES- or remoteness-prohibitive for only a few types of PA. As remoteness increased and SES decreased, participation in many team sports actually increased. For both SES and remoteness, there were more significant associations with overall participation, than with regular participation or participation in more organised contexts.

Conclusions: This study demonstrates the complexity of the associations between SES and location across different contexts of participation. Nevertheless, it seems that once initial engagement in PA is established, SES and remoteness are not critical determinants of the depth of engagement.

Keywords: Sport, Physical activity, Socio-economic status, Rurality

Background

There is an abundance of knowledge of the wide range of influences on participation in physical activity (PA). In accordance with the Socio-Ecological model, these influences or determinants of participation can relate to intrapersonal, interpersonal, organisational, environmental, and policy factors [1,2].

One key influence on participation is Socio-Economic Status (SES). This determinant impacts upon many PA determinants across a number of the Socio-Ecological model's domains [3]. It is consistently reported in both quantitative and qualitative studies that people with

higher SES are more likely than those with lower SES to participate in PA, and more specifically in sport [4-7].

A qualitative study of adults in the Netherlands, USA and Republic of Korea found that some barriers to PA and sport participation were consistently reported across all three countries. Along with time pressure, cost was articulated consistently throughout as a barrier to PA participation [8]. In addition to individual and household SES, there is evidence that neighbourhood SES is also related to PA participation. There is evidence that higher SES neighbourhoods have significantly more PA facilities than lower SES neighbourhoods, thus providing more opportunities to be physically active [9]. Furthermore, low SES neighbourhoods were found to have significantly fewer free-for-use facilities than high SES neighbourhoods [9].

* Correspondence: rochelle.eime@vu.edu.au

¹Institute of Sport, Exercise and Active Living, Victoria University, Melbourne, Australia

²School of Health Sciences and Psychology, Federation University, Ballarat, Australia

There are also differences amongst participation levels and trends according to different geographical regions [10-12]. It is not uncommon for studies to report PA differences according to residence in metropolitan or regional/rural locations [11,12]. There are also reports of variations of PA levels within state capital cities [10] and between different regional communities [11].

Many studies that do report PA according to different geographical regions, use very broad definitions, for example northern and southern regions of a country [6]. While specific measures of location or remoteness exist, these have rarely been used in research in this area. ARIA+ is a geographical measure of remoteness for Australia [13]. A study that adopted this measure of remoteness investigated PA levels amongst adolescents [14]. Both males and females living in major cities reported significantly lower moderate and vigorous PA (MVPA) minutes than males and females living in any other type of region. Participation in sport, however did not differ across regional classifications [14].

In terms of health-enhancing PA, frequency of participation is a key component. It is also important to understand the context of participation. Some studies incorporate frequency as a measure, especially when categorising individuals as meeting or failing to meet the recommended or health-enhancing levels of PA [10]. One important aspect of the context of leisure-time PA has been termed 'mode' [15], the four modes being: team sport, individual sport, organised but non-competitive PA, and non-organised PA [15]. There are likely to be differences in participation trends across these modes, however little attention has been paid to specific modes beyond the study of adolescents by Eime and colleagues [15].

In summary, many factors influence participation in sport and PA. It is well established that SES is a critical factor. There is also growing evidence that there are differences in participation patterns according to residential location. However, little is known more specifically about the relationship of PA participation, and frequency of participation in particular contexts, to SES and residential location.

This study investigates the association of participation, and regularity and organisational context of participation, with SES and location.

Methods

Data collected in the Exercise, Recreation and Sport Survey (ERASS), 2010 was obtained. The usefulness of the ERASS survey from a public health perspective has been established [10,16]. Importantly, it is useful as a national surveillance of habitual PA behaviours and specifically identifies the types of activities undertaken [16]. It has also been used to determine adult participation trends in

Leisure Time Physical Activity (LTPA) according to city of residence [10].

Quarterly survey samples for ERASS were selected from all persons aged 15 years and over, living in occupied private dwellings using Computer-assisted Telephone Interviewing. In each quarter approximately 3,400 persons were sampled Australia-wide from all states and territories. Verbal informed consent was indicated by the respondents' willingness to participate in the telephone survey. De-identified data from the 2010 survey period were analysed in this investigation. Ethics approval was granted by the University Human Research Ethics Committee.

Respondents were first asked whether they participated in any PA during the 12 months prior to the survey. Those who had done so were asked to nominate up to 10 types of PA from a classification of 95 types (e.g. basketball, tennis, aerobics, walking), including both sports (defined as a physical activity that by its nature has a sport governing body and by its nature and organisation, is competitive and is generally accepted as being a sport)[17] and other forms of recreational PA. Hence, for each of the 95 ERASS PA types, each respondent was classified as a participant or a non-participant. For participants in each PA type, two further aspects of participation were investigated: frequency of participation in the 12 months prior to the survey and level of organisation of participation setting (non-organised, organised non-club setting, club setting). After consultation with sport governing bodies, regular participation was defined as at least 12 times in the 12 months prior to the survey, i.e. at least monthly on average. With regard to level of organisation, a person can engage in a particular type of PA in more than one setting. In accordance with the hierarchical precedence of participation settings articulated by Eime et al. [18] all persons who participated in a club setting were classified as club participants, regardless of whether they also participated in other settings. Of those remaining, persons who participated in an organised non-club setting were classified as organised non-club participants, regardless of whether they also participated in non-organised settings. Those remaining participated in only non-organised settings, and were classified as such.

Thus, the following PA indicators (outcome variables) were defined for each respondent: participation in any type of PA (yes/no), participation in each of 95 types of PA (yes/no), regular participation in up to 10 types of PA (yes: ≥ 12 times per year, no: < 12 times per year), and level of organisation of participation in up to 10 types of PA (non-organised, organised non-club setting, club setting).

Socio-economic status was represented by the Australian Bureau of Statistics (ABS) Socio-economic Indices for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) [19]. The SEIFA IRSAD value assigned to each respondent was the 2011 SEIFA

value assigned by ABS to the residential postcode of the respondent [19]. For ease of interpretation, analysis was based on ERASS quintiles of SEIFA IRSAD. SEIFA IRSAD scores are centred on 1000, with a range in the 2010 ERASS sample from 619.55 to 1164.41. The four quintile cutoffs for the 2010 ERASS sample were 938.80, 979.77, 1019.46 and 1065.35.

Access to services and remoteness was represented by five standard categories based on the Access and Remoteness Index for Australia (ARIA+) [13]. These categories are: Major cities, Inner regional, Outer regional, Remote and Very remote. The ARIA+ category assigned to each respondent was the 2011 ARIA+ category assigned to the residential postcode of the respondent. Because the sample sizes in the two most remote of the five ARIA+ categories were small (see Table 1), the ARIA+ measure was collapsed into three categories: major cities, inner regional, and other (i.e. outer regional, remote, very remote).

All analyses used ERASS data weighted at the state, region (metropolitan, rest of state), age group and gender levels. Analyses were conducted using SPSS Version 21. Analyses were conducted of the relationship of each of the three outcome variables with the two predictors (SEIFA quintile and ARIA category).

Table 1 - Respondent Characteristics

| | All respondents | | PA participants | |
|--|-----------------|-------|-----------------|-------|
| | n | % | n | % |
| SEIFA IRSAD quintile/range (of residential postal area) | 21,593 | | 17,435 | |
| 1 (619.55-938.8) | 4,332 | 20.1 | 3,267 | 18.7 |
| 2 (938.81-979.77) | 4,306 | 19.9 | 3,330 | 19.1 |
| 3 (979.79-1019.46) | 4,334 | 20.1 | 3,473 | 19.9 |
| 4 (1019.48-1065.35) | 4,326 | 20.0 | 3,623 | 20.8 |
| 5 (1065.51-1164.41) | 4,295 | 19.9 | 3,742 | 21.5 |
| ARIA+ category/range (of residential postal area) | 21,603 | | 17,445 | |
| Major cities of Australia (0–0.20) | 11,257 | 52.1 | 9,320 | 53.4 |
| Inner regional Australia (>0.20 - 2.40) | 5,103 | 23.6 | 4,019 | 23.0 |
| Outer regional Australia (>2.40 - 5.92) | 4,290 | 19.9 | 3,352 | 19.2 |
| Remote Australia (>5.92 - 10.53) | 690 | 3.2 | 541 | 3.1 |
| Very remote Australia (>10.53) | 263 | 1.2 | 213 | 1.2 |
| Gender | 21,603 | | 17,445 | |
| Male | 9,452 | 43.8 | 7,719 | 44.2 |
| Female | 12,151 | 56.2 | 9,726 | 55.8 |
| Age | Mean | Range | Mean | Range |
| | 49.9 | 15-98 | 48.6 | 15-96 |

For the two dichotomous outcome variables (participation, regular participation), binary logistic regression was used to investigate the relationship with each of the two predictors. The results were expressed in terms of rates: the participation rate, estimated by the proportion of the sample who reported participating, and the rate of regular participation, estimated by the proportion of participants who were regular participants. Any significant relationship was further investigated to determine the nature of that relationship. The method of polynomial contrasts was used to break down the (frequently curvilinear) relationship between the log odds of the outcome and the predictor into a linear component and any second-, third- or fourth-order components, each of which was independently assessed for statistical significance. For reporting purposes, the relationships identified were classified as positive linear, negative linear or non-linear. Positive and negative linear relationships were defined by the sign of the log-odds value. A non-linear relationship was generally a second-, third- or fourth- order relationship, possibly superimposed on a linear trend. However, in a few cases an overall statistically significant relationship was shown but this could not be characterised into a polynomial pattern.

For the ordinal outcome variable (level of organisation), crosstabulation analysis was conducted, and Goodman and Kruskal's gamma, designed to measure the concordance of two ordinal variables known to have tied observations, was used to identify any statistically significant association between each predictor and the level of organisation. For reporting purposes, a positive relationship was defined as a positive value of Goodman and Kruskal's gamma between predictor and outcome variable, while a negative relationship was defined as a negative value of Goodman and Kruskal's gamma.

Results

Table 1 summarises the gender, age, SEIFA IRSD and ARIA+ profiles of: 1) all ERASS 2010 survey respondents; and 2) those respondents who reported participating in recreational PA in the twelve months prior to the survey. Table 2 shows the nature of the relationship between each of the three PA participation indicators, with PA aggregated across all 95 types of PA, and the two predictors. For this aggregated analysis, a participant was classified as a regular or non-regular participant on the basis of the highest frequency they reported across all of their (up to 10) reported PA types. Similarly, the level of organisation was assigned to each participant on the basis of the highest level of organisation reported across all of their reported PA types. Table 2 shows that the rates of both PA participation in general and regular PA participation increased as SES (SEIFA IRSD quintile) increased and decreased as remoteness (ARIA+ category) increased. In the case of SEIFA IRSD, there was a linear trend with some

Table 2 - Relationships between three PA participation indicators and two predictors

| Indicator | Predictor | n | Relationship | | | p-value ² |
|---|----------------------|--------|--------------|------------|-------------------------|----------------------|
| | | | +ve linear | -ve linear | Non-linear ¹ | |
| Rate of any participation (All respondents) | SEIFA IRSAD quintile | 21,596 | * | | * | <0.001 |
| | ARIA+ category | 21,603 | | * | | <0.001 |
| Rate of regular participation (Participants only) | SEIFA IRSAD quintile | 17,733 | * | | * | <0.001 |
| | ARIA+ category | 17,739 | | * | | <0.001 |
| Level of organisation of participation setting ⁵ | SEIFA IRSAD quintile | 17,421 | | * | | p-value ⁴ |
| | ARIA+ category | 17,425 | * | | | <0.001 |

¹Includes any significant 2nd, 3rd or 4th order relationship.

²Logistic regression likelihood ratio test.

³Based on the sign of Goodman and Kruskal's gamma coefficient.

⁴p-value for Goodman and Kruskal's gamma coefficient.

⁵1 = unorganised, 2 = organised non-club, 3 = club

non-linearity superimposed. Conversely, the level of organisation of PA context increased as remoteness increased, and decreased as SES increased.

The subsequent tables summarise the nature of the relationship between the two predictors and each of the three PA participation indicators, separately for each of the 95 types of PA.

Table 3 shows the nature of the relationship between the rate of any participation in PA and SEIFA quintile. Forty two of the 95 types of PA were shown to have a statistically significant relationship between rate of participation and SEIFA IRSAD quintile. Twenty five had a positive linear relationship between rate of participation and SEIFA IRSAD quintile, with 16 of these also having a superimposed non-linear relationship. Ten had a negative linear relationship between rate of participation and SEIFA IRSAD quintile, of which seven also had a superimposed non-linear relationship. Five had a solely non-linear relationship between participation and SEIFA IRSAD quintile, with no significant linear trend. Additional file 1: Table S3A provides detailed examples illustrating different patterns of relationship. It should be borne in mind that the term "linear" applies to the relationship between the log odds of participation (not the odds of participation) and the SEIFA quintile.

Table 4 shows the nature of the relationship between rate of regular participation and SEIFA IRSAD quintile. Twenty one of the 95 types of PA were shown to have a significant relationship between rate of regular participation and SEIFA IRSAD quintile. Of these, one had a 'purely' positive linear relationship, three had a 'purely' negative linear relationship, and two had a negative but non-linear relationship. The remaining 13 had non-linear relationships with no linear component. Additional file 1: Table S4A provides detailed examples illustrating different patterns of relationship.

Table 5 shows the nature of the relationship between level of organisation of participation and SEIFA IRSAD

quintile. Because level of organisational participation is an ordinal variable (as opposed to a quantitative rate associated with a binary variable), the issue of linearity does not apply. Twenty of the 95 types of PA were shown to have a significant relationship (concordance) between level of organisation of PA and SEIFA IRSAD quintile. Six concordances were positive and 14 were negative.

Table 6 shows the nature of the relationship between rate of any participation in PA and ARIA+ category (numbered from 1–3, with 1 being the major cities). Thirty two of the 95 types of PA were shown to have a significant relationship between rate of participation and ARIA+ category. Fifteen had a positive linear relationship between rate of participation and ARIA+ category, with seven of these also having a superimposed non-linear relationship. Eleven had a negative linear relationship between rate of participation and ARIA+ category, of which four also had a superimposed non-linear relationship. Three had a purely non-linear relationship between participation and ARIA+ category, with no significant linear trend. Additional file 1: Table S6A provides detailed examples illustrating different patterns of relationship.

Table 7 shows the nature of the relationship between the rate of regular participation and ARIA+ category. Fifteen of the 95 types of PA were shown to have a significant relationship between rate of participation and ARIA+ category. Five had a positive linear relationship between rate of regular participation and ARIA+ category, with two of these also having a superimposed non-linear relationship. Three had a negative linear relationship between rate of participation and ARIA+ category, of which one also had a superimposed non-linear relationship. Five had a purely non-linear relationship between participation and ARIA+ category, with no significant linear trend. Additional file 1: Table S7A provides detailed examples illustrating different patterns of relationship.

Table 8 shows the nature of the relationship between level of organisation of participation and ARIA+ category.

Table 3 - Relationship between rate of participation in particular types of physical activity and quintiles of SEIFA IRSAD

| Physical activity ¹ | n | Relationship with SEIFA IRSAD quintile | | | p-value ³ |
|------------------------------------|--------|--|-----------------|--------------------------|----------------------|
| | | Positive linear | Negative linear | Non- linear ² | |
| Aerobics/fitness | 21,597 | * | | * | <0.001 |
| Australian rules football | 21,598 | | | * | <0.001 |
| Badminton | 21,597 | * | | | 0.019 |
| Basketball | 21,599 | * | | | 0.015 |
| Boxing | 21,598 | * | | * | <0.001 |
| Bush walking | 21,597 | * | | * | <0.001 |
| Canoeing/kayaking | 21,598 | * | | * | 0.002 |
| Cricket (indoor) | 21,597 | | | * | 0.001 |
| Cricket (outdoor) | 21,598 | | * | * | <0.001 |
| Cycling | 21,597 | * | | * | <0.001 |
| Fishing | 21,597 | | * | * | <0.001 |
| Football (indoor) | 21,598 | * | | * | <0.001 |
| Football (outdoor) | 21,597 | * | | * | <0.001 |
| Golf | 21,597 | * | | * | <0.001 |
| Gridiron | 21,598 | | | * | <0.001 |
| Horse riding/equestrian/polo cross | 21,598 | | * | | 0.013 |
| Ice/snow sports | 21,599 | * | | | <0.001 |
| Lawn bowls | 21,598 | | * | | <0.001 |
| Motor sports | 21,597 | | * | * | <0.001 |
| Netball | 21,597 | | | * | 0.018 |
| Orienteering | 21,597 | * | | | 0.015 |
| Rock climbing | 21,598 | * | | | <0.001 |
| Roller sports | 21,599 | * | | | <0.001 |
| Rowing | 21,597 | * | | | <0.001 |
| Rugby league | 21,598 | | * | * | <0.001 |
| Rugby union | 21,597 | * | | * | <0.001 |
| Running | 21,598 | * | | * | <0.001 |
| Sailing | 21,597 | * | | * | <0.001 |
| Shooting sports | 21,596 | | * | * | <0.001 |
| Surf sports | 21,598 | * | | * | <0.001 |
| Swimming | 21,597 | * | | | <0.001 |
| Table tennis | 21,597 | | * | | 0.030 |
| Tennis | 21,599 | * | | * | <0.001 |
| Tenpin bowling | 21,597 | | * | * | 0.005 |
| Touch football | 21,597 | | * | * | <0.001 |
| Triathlons | 21,598 | * | | * | 0.001 |
| Volleyball | 21,597 | | | * | <0.001 |
| Walking | 21,598 | * | | | <0.001 |
| Water polo | 21,598 | | | | <0.001 |
| Water-skiing/power boating | 21,597 | | | | 0.037 |
| Weight training | 21,598 | * | | * | 0.013 |
| Yoga | 21,598 | * | | * | <0.001 |

¹For the remaining 53 types of physical activity, there was no significant relationship between SEIFA IRSAD quintile and the rate of regular participation.

²Includes any significant 2nd, 3rd or 4th order relationship.

³Logistic regression likelihood ratio test.

Table 4 - Relationship between rate of regular¹ participation in particular types of physical activity and quintiles of SEIFA IRSAD

| Physical activity ² | n | Relationship with SEIFA IRSAD quintile | | | p-value ⁴ |
|--------------------------------|-------|--|-----------------|-------------------------|----------------------|
| | | Positive linear | Negative linear | Non-linear ³ | |
| Aquarobics | 229 | | | * | 0.017 |
| Athletics/track and field | 144 | * | | | <0.001 |
| Australian rules football | 712 | | * | | 0.018 |
| Basketball | 746 | * | | * | 0.002 |
| Boxing | 254 | | | * | 0.047 |
| Bush walking | 1,038 | | * | | 0.024 |
| Cricket (outdoor) | 694 | | | * | 0.038 |
| Football (indoor) | 412 | | | * | <0.001 |
| Football (outdoor) | 1,036 | | | * | <0.001 |
| Lawn bowls | 441 | | * | * | 0.046 |
| Martial arts | 450 | | | * | 0.032 |
| Rugby league | 292 | | | * | 0.001 |
| Scuba diving | 118 | | | * | 0.020 |
| Shooting sports | 164 | | * | * | <0.001 |
| Swimming | 2,797 | | | | 0.035 |
| Table tennis | 119 | | | * | 0.010 |
| Tenpin bowling | 130 | | | * | 0.011 |
| Touch football | 597 | | | * | <0.001 |
| Walking | 7,716 | | | * | 0.001 |
| Water-skiing/power boating | 142 | | * | | 0.017 |
| Weight training | 632 | | | * | 0.006 |

¹Twelve times or more v fewer than 12 times in past 12 months.

²For the remaining 74 types of physical activity, either there was no significant relationship between SEIFA IRSAD quintile and the rate of regular participation, or the sample size was too small for valid statistical analysis.

³Includes any significant 2nd, 3rd or 4th order relationship.

⁴Logistic regression likelihood ratio test.

Seventeen of the 95 types of PA were shown to have a significant relationship (concordance) between level of organisation of PA and ARIA+ category quintile. Fourteen concordances were positive and three were negative.

Discussion

This study provides detailed information about the associations between participation in particular sports and physical activities and measures of SES and location. It demonstrates the complexity of these associations across different contexts of participation.

SES

Many studies have shown a broad association between higher SES and higher levels of PA and sport [5,6,20,21] and the present study confirms this positive overall association, both for any recreational PA participation in a 12-month period and for regular participation in some form of PA over that period. However, more specifically this study demonstrates that only 42 (44%) of the 95 specific

types of PA showed a significant association between participation and neighbourhood SES. Furthermore, in even fewer cases ($n = 25$; 26%) was the association positive, with high/low participation being associated with high/low SES.

SES can be defined in terms of individual, household and neighbourhood characteristics. The socioeconomic inequalities in sport participation have been explained by a combination of individual, household and neighbourhood factors [20]. Lower PA levels have been associated with lower neighbourhood and household SES (education, income) [5]. Participation in club sport by adolescent females has been significantly positively associated with neighbourhood and household measures of SES, particularly in metropolitan compared to regional/rural areas [7].

In the present study, for each of 95 different types of sport or PA, a neighbourhood SES measure was associated with rate of participation, rate of regular participation and level of organisation of the context of participation. Significant associations were observed between SES and a minority of activities - for any participation (42 activities), regular

Table 5 Relationship between level of organisation¹ of particular types of physical activity and quintiles of SEIFA IRSAD

| Physical activity ² | n | Relationship with SEIFA IRSAD quintile | | p-value ³ |
|--------------------------------|-------|--|----------|----------------------|
| | | Positive | Negative | |
| Air sports | 17 | | * | <0.001 |
| Athletics/track and field | 142 | * | | <0.001 |
| Australian rules football | 686 | | * | <0.001 |
| Basketball | 746 | | * | 0.008 |
| Billiards/snooker/pool | 16 | | * | <0.001 |
| Canoeing/kayaking | 267 | * | | 0.021 |
| Cricket (indoor) | 147 | | * | 0.007 |
| Cycling | 2,491 | * | | 0.002 |
| Football (outdoor) | 1,009 | | * | <0.001 |
| Golf | 1,408 | | * | <0.001 |
| Hockey (indoor) | 32 | * | | 0.001 |
| Hockey (outdoor) | 187 | | * | 0.005 |
| Netball | 781 | | * | 0.018 |
| Rowing | 80 | * | | 0.003 |
| Rugby union | 158 | | * | 0.024 |
| Shooting sports | 160 | | * | 0.008 |
| Squash/racquetball | 293 | | * | 0.045 |
| Table tennis | 112 | * | | 0.011 |
| Tennis | 1,263 | | * | <0.001 |
| Tenpin bowling | 121 | | * | 0.047 |

¹Level of organisation: 1 All unorganised; 2 At least some organised by a club or other organisation; 3 At least some in a sports club or leisure centre setting requiring payment.

²For the remaining 75 types of physical activity, either there was no significant relationship between SEIFA IRSAD quintile and the rate of regular participation, or the sample size was too small for valid statistical analysis.

³p-value for Goodman and Kruskal's gamma coefficient.

participation (21 activities) and participation in organised contexts (20 activities).

There were relatively few ($n = 25$) activities for which the rate of any participation increased as SES increased. For only two activities (Athletics/Track and Field, and Basketball) did the rate of regular participation increase as SES increased. For six activities, the proportion participating in more organised contexts increased as SES increased. For all three aspects of participation, the positive associations between participation and SES generally occurred for 'niche' sports and activities (such as canoeing/kayaking, rock climbing, rowing) rather than the more popular 'mainstream' sports (such as cricket, netball).

There were similar minorities of sports exhibiting negative relationships between the three aspects of participation (any, regular, level of organisation) and SES. Of the activities showing a negative relationship between any participation and SES, the majority were team sports. Negative relationships between participation in more organised contexts and SES were also more likely to exist for team sports, such as Australian rules football, basketball, football, hockey, netball and tennis.

From the numbers of sports listed in Tables 3,4,5, it would seem that SES is a significant correlate of participation in only a minority of sports, and is more likely to be associated with participation in general rather than for regular participation or participation in more organised contexts. Further, more complex non-linear relationships predominate over clear positive and negative trends. This contrasts somewhat with the positive overall association observed in this study, and in other studies that have reported significantly higher rates of PA in general, and organised sport participation in particular, for higher SES compared to lower SES [6,21]. Clearly, the general positive relationship between SES and participation does not apply uniformly to all types of sport and PA..

Further examination suggests that types of PA which: are undertaken indoors; are likely to require expensive infrastructure or equipment; or require access to water or snow, were more likely to exhibit positive relationships between participation and SES. Indoor activities such as yoga often require a fee for each participation session, in contrast to many club sports which have a yearly membership rather than an individual pay-and-play system. The cost of

Table 6 Relationship between rate of participation in particular types of physical activity and ARIA+ remoteness category

| Physical activity ¹ | n | Relationship with ARIA+ category | | | p-value ³ |
|------------------------------------|--------|----------------------------------|-----------------|--------------------------|----------------------|
| | | Positive linear | Negative linear | Non- linear ² | |
| Aerobics/fitness | 21,603 | | * | * | <0.001 |
| Athletics/track and field | 21,604 | | | | 0.038 |
| Australian rules football | 21,603 | * | | * | <0.001 |
| Badminton | 21,603 | | * | | 0.003 |
| Basketball | 21,604 | | | | 0.022 |
| Cricket (outdoor) | 21,603 | * | | * | <0.001 |
| Cycling | 21,602 | | * | * | <0.001 |
| Fishing | 21,603 | * | | | <0.001 |
| Football (indoor) | 21,603 | | * | | <0.001 |
| Golf | 21,604 | | | * | <0.001 |
| Gridiron | 21,604 | | | | 0.026 |
| Hockey (indoor) | 21,603 | * | | | 0.005 |
| Hockey (outdoor) | 21,602 | * | | * | <0.001 |
| Horse riding/equestrian/polo cross | 21,602 | * | | * | <0.001 |
| Ice/snow sports | 21,604 | | * | | 0.004 |
| Lawn bowls | 21,603 | * | | * | <0.001 |
| Martial arts | 21,603 | | | * | 0.020 |
| Motor sports | 21,602 | * | | * | <0.001 |
| Netball | 21,604 | * | | | <0.001 |
| Rugby league | 21,603 | * | | | <0.001 |
| Running | 21,602 | | * | * | <0.001 |
| Sailing | 21,604 | | | * | 0.018 |
| Scuba diving | 21,603 | * | | * | 0.001 |
| Shooting sports | 21,603 | * | | | <0.001 |
| Squash/racquetball | 21,603 | * | | | 0.001 |
| Surf sports | 21,604 | | * | | 0.001 |
| Swimming | 21,604 | | * | * | <0.001 |
| Tenpin bowling | 21,603 | | * | | 0.001 |
| Touch football | 21,603 | * | | | <0.001 |
| Water-skiing/power boating | 21,603 | * | | | <0.001 |
| Weight training | 21,604 | | * | | <0.001 |
| Yoga | 21,603 | | * | * | <0.001 |

¹For the remaining 63 types of physical activity, there was no significant relationship between ARIA+ category and the rate of regular participation.

²Second order (quadratic) relationship.

³Logistic regression likelihood ratio test.

equipment is often a determinant of participation [6,22]. It is a common finding that people of higher SES have better access to PA and sports facilities, can afford to live in a PA-friendly environment and have fewer barriers [23].

Studies investigating broad levels of PA have reported that access to low-cost recreation facilities can significantly, positively influence PA levels [24]. Recent research in Spain found that the odds for prevalence of physical activity were lower in neighbourhoods of lower

income [25]. The availability of sports facilities explained much of the excess prevalence in older years, but not for younger people [25]. Other studies have reported fewer facilities within lower SES compared to higher SES neighbourhoods, indicating that the physical environment hinders the ability in the lower SES categories to access PA opportunities [9]. Furthermore, the access to low-cost recreation facilities is not consistent and quite variable between countries. In a comparison of 11 countries, availability of low-cost recreation

Table 7 Relationship between rate of regular¹ participation in particular types of physical activity and ARIA+ remoteness category

| Physical activity ² | n | Relationship with ARIA+ category | | | p-value ⁴ |
|--------------------------------|-------|----------------------------------|-----------------|--------------------------|----------------------|
| | | Positive linear | Negative linear | Non- linear ³ | |
| Aerobics/Fitness | 5,070 | | * | | 0.001 |
| Australian Rules Football | 712 | | | * | 0.013 |
| Basketball | 747 | | | * | <0.001 |
| Bush Walking | 1,040 | * | | | <0.001 |
| Cycling | 2,562 | | | | 0.012 |
| Fishing | 481 | * | | | 0.014 |
| Hockey (indoor) | 33 | | | * | 0.004 |
| Ice/Snow Sports | 273 | | | | 0.023 |
| Motor Sports | 290 | | | * | <0.001 |
| Orienteering | 156 | | | * | 0.001 |
| Shooting Sports | 165 | * | | * | 0.003 |
| Squash/Racquetball | 296 | * | | * | 0.004 |
| Swimming | 2,799 | * | | | 0.001 |
| Table Tennis | 120 | | * | | 0.046 |
| Touch Football | 597 | | * | * | <0.001 |

¹Twelve times or more v fewer than 12 times in past 12 months.

²For the remaining 80 types of physical activity, either there was no significant relationship between ARIA+ category and the rate of regular participation, or the sample size was too small for valid statistical analysis.

³Second order (quadratic) relationship.

⁴Logistic regression likelihood ratio test.

facilities was least likely to be reported in Brazil and Columbia and most likely in Canada and New Zealand [24].

Notwithstanding the above, for some activities that can have very low participation costs (such as running and cycling) participation was positively associated with SES, although not in a clearly linear fashion. Whilst cycling can be an expensive activity in terms of equipment, running does not incur expenses above and beyond shoes. We know that people with higher SES are likely to have higher education, and it is reported that people with higher education have amongst other things, more social support and greater capacity to seek, understand and act on health messages that promote PA [23]. It may be that activities such as cycling and running provide easy options that do not require skills, facilities nor other people to participate with. It may also be that people from higher SES neighbourhoods have a more aesthetic environment which is more conducive to running and/or cycling, or they may feel safer. Conversely, poor health, cost, unfamiliarity of PA facilities and programs, limited social support and living in an unsafe neighbourhood are barriers to men from low SES being physically active [26].

From an equity perspective, it is a positive finding that rates of participation in many physical activities are not positively associated with levels of SES. For some activities, participation decreased as SES increased. These were predominantly organised team sports such as Australian rules

football, basketball, cricket, hockey, netball and tennis. We can conclude that many traditional Australian team sports are either not associated with SES in a prohibitive manner, or in some cases are more likely to be participated in by people from lower SES areas.

ARIA

We found that the rates of both PA participation in general and regular PA participation decreased as remoteness (ARIA+ category) increased, and the level of organisation of PA context increased as remoteness increased. However, for specific activities, significant associations between participation levels and remoteness occurred in only a minority of the 95 cases.

Significant associations were observed between remoteness and participation in general for 32 activities. However, for only 11 activities did the rate of participation decrease with increasing remoteness. For 15 activities, the rate of participation was higher in more remote areas; furthermore, these included some of the most popular mainstream sports – Australian rules football, cricket, netball, hockey and lawn bowls, as well as typical rural PA pursuits such as fishing [27]. The activities for which participation rates declined with increasing remoteness included a number requiring indoor facilities – aerobics/fitness, indoor football, tenpin bowling, weight training and yoga, consistent with the notion that infrastructure differences between

Table 8 Relationship between level of organisation¹ of physical particular types of activity and ARIA+ remoteness category

| Physical activity ² | n | Relationship with ARIA+ category | | p-value ³ |
|--------------------------------|-------|----------------------------------|----------|----------------------|
| | | Positive | Negative | |
| Air Sports | 16 | * | | 0.001 |
| Australian Rules Football | 687 | * | | <0.001 |
| Badminton | 155 | * | | 0.014 |
| Baseball | 39 | | * | 0.003 |
| Basketball | 746 | * | | <0.001 |
| Bush Walking | 991 | | * | 0.010 |
| Cricket (outdoor) | 676 | * | | 0.001 |
| Football (outdoor) | 1,010 | * | | <0.001 |
| Golf | 1,412 | * | | <0.001 |
| Hockey (outdoor) | 189 | * | | 0.005 |
| Netball | 781 | * | | <0.001 |
| Rugby Union | 160 | * | | 0.020 |
| Running | 2,175 | * | | <0.001 |
| Squash/Racquetball | 295 | * | | 0.005 |
| Tennis | 1,264 | * | | <0.001 |
| Touch Football | 569 | * | | 0.001 |
| Yoga | 662 | | * | <0.001 |

¹Level of organisation: All unorganised; At least some organised by a club or other organisation; At least some in a sports club or leisure centre setting requiring payment.

²For the remaining 78 types of physical activity, either there was no significant relationship between ARIA+ category and the rate of regular participation, or the sample size was too small for valid statistical analysis.

³p-value for Goodman and Kruskal's gamma coefficient.

metropolitan and rural settings can have an effect on participation [10].

For only a small proportion of activities (n = 15) was remoteness associated with the rate of regular participation, and the direction and shape of these relationships was mixed. There was however a much more consistent pattern with regard to level of organisation, with more organised participation in more remote areas, again including some of the most popular mainstream sports – Australian rules football, basketball, cricket, football, netball, hockey and tennis. This suggests that for these activities, sporting clubs and organisations tend to play a more important role in rural than metropolitan communities.

The limited research discussing differences across geographical locations suggests that in rural communities there is likely to be an emphasis on traditional team sports and more limited choices than those available in metropolitan areas [12]. Nevertheless, a study of younger people (9–16 years) found that overall, time participating in organised sport did not differ for those living in major cities compared to regional and remote residents [14]. However, recent research with adults has reported that PA levels are lower in regional communities than state averages [11]. This study also found that there were different PA patterns in different regional communities. The proportion of

people reporting no activity was higher in some regions than others, which the authors suggested may be due to infrastructure for activity, as well as workplace policies and programs [11]. Another factor suggested by the respondents in this study is that their rural work and lifestyles required a considerable amount of PA already [11].

In summary, it is encouraging that participation in many traditional Australian team sports was not found to be positively associated with SES nor negatively associated with remoteness. Team sports are social in nature, and we know that people are inherently motivated to participate in sport for social opportunities [8,11]. Team sport participation, in addition to producing physical health benefits can enhance psychological and social health [28]. A study across three different countries found that sport delivery systems that create social opportunities may be a key to increased adult sport participation [8]. The social context of sport has also been identified as a mechanism for assisting men of low SES to overcome isolation [26]. These authors advocated the use of sport as a vehicle to achieve social inclusion.

Strengths and Limitations

A strength of this study is that it is based on a very large national dataset. This is a double edged sword however, in

that the resulting high statistical power may result in statistical significance in cases where the strength of the association is insufficient to be of great practical importance. Also, because of the large number of significance tests conducted, it is acknowledged that some of the relationships identified as significant will be spurious and due to Type 1 errors, i.e. chance patterns of participation within the ERASS survey sample. However, the rate of results significant at the 0.05 level in each table far exceeds the chance rate of one in 20, indicating that most of the significant results reported are valid and meaningful.

Another methodological limitation is that, because the ERASS survey did not include questions about individual or household SES, the measure of SES used was based on postal area. Further, ERASS data are limited to persons aged 15 years or more. The patterns of relationship between participation, SES and remoteness may be very different for children younger than 15 years.

Conclusions

In conclusion, it is encouraging that few types of PA were cost- or remoteness-prohibitive in terms of participation. As remoteness increased and SES decreased, participation in many team sports actually increased. For both SES and remoteness, there were more significant associations with overall participation, than with regular participation or participation in more organised contexts. This suggests that once initial engagement in PA is established, SES and remoteness are not critical determinants of the depth of engagement. Furthermore, it would seem inappropriate to generalise regarding SES and location. The level of contextual differentiation means that policies to promote PA participation based on generalisations may be poorly targeted. It is important that programs and policies designed to increase participation in PA take into account the strong contextual factors.

Additional file

Additional file 1: Table S1. List of 95 designated ERASS physical activity types. **Table S3A.** Examples of different patterns of relationship between rate of participation in particular types of physical activity and quintiles of SEIFA IRSAD. **Table S4A.** Examples of different patterns of relationship between rate of regular participation in particular types of physical activity and quintiles of SEIFA IRSAD. **Table S6A.** Examples of different patterns of relationship between rate of participation in particular types of physical activity and ARIA+ remoteness category. **Table S7A.** Examples of different patterns of relationship between regular participation in particular types of physical activity and ARIA+ remoteness category.

Abbreviations

ABS: Australian Bureau of Statistics; ARIA: Accessibility/Remoteness Index of Australia; ERASS: Exercise Recreation and Sport Survey; IRSAD: Index of Relative Socio-economic Advantage and Disadvantage; PA: Physical Activity; SEIFA: Socio-economic Indexes for Areas; SES: socio-economic status.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

RE contributed to the study design, interpretation of results, manuscript conceptualisation and preparation. MC and JH contributed to the study design, data management, statistical analysis and interpretation, manuscript conceptualisation and preparation. WP contributed to the study design, interpretation of results, manuscript conceptualisation and preparation. All authors have read and approved the final manuscript.

Acknowledgements

We thank the Australian Sports Commission for providing access to the ERASS data. Rochelle Eime is supported by a VicHealth Research Practice Fellowship- Physical Activity.

Received: 14 January 2015 Accepted: 22 April 2015

Published online: 29 April 2015

References

- McLeroy K, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q.* 1988;15(4):351–77.
- Sallis J, Owen N. *Physical Activity and Behavioral Medicine.* Thousand Oaks, California: Sage; 1999. p. 111–2.
- Eime R, Casey M, Harvey J, Sawyer NS, CM, Payne W: Socioecological factors potentially associated with participation in physical activity and sport: A longitudinal study of adolescent girls. *Journal of Science and Medicine in Sport* 2014, In Press.
- Steenhuis I, Nooy S, Moes M, Schuit A. Financial barriers and pricing strategies related to participation in sports activities: The perceptions of people of low income. *J Phys Act Health.* 2009;6:716–21.
- Pan S, Cameron C, DesMeules M, Morrison H, Craig C, Jiang X. Individual, social, environmental, and physical environmental correlates with physical activity among Canadians: a cross-sectional study. *BMC Public Health.* 2009;9(1):21.
- Federico B, Falese L, Marandola D, Capelli G. Socioeconomic differences in sport and physical activity among Italian adults. *J Sports Sci.* 2012;31(4):451–8.
- Eime R, Harvey J, Craike M, Symons C, Payne W. Family support and ease of access link socio-economic status and sports club membership in adolescent girls: A mediation study. *Int J Behav Nutr Phys Act.* 2013;10(50):1.
- Lim SY, Warner S, Dixon M, Berg B, Kim C, Newhouse-Bailey M. Sport Participation Across National Contexts: A Multilevel Investigation of Individual and Systemic Influences on Adult Sport Participation. *Eur Sport Manag Q.* 2011;11(3):197–224.
- Estabrooks P, Lee R, Gyurcsik N. Resources for physical activity participation: Does availability and accessibility differ by neighborhood socioeconomic status? *Ann Behav Med.* 2003;25(2):100–4.
- Bauman A, Curac N, King L, Venugopal K, Merom D. Active, healthy cities- how does population physical activity vary between Australian cities? *Health Promot J Austr.* 2012;23(3):201–7.
- Brown WJ, Burton NW, Sahlqvist S, Heesch KC, McCarthy KB, Ng N, et al. Physical activity in three regional communities in Queensland. *Aust J Rural Health.* 2013;21(2):112–20.
- Craike M, Symons C, Eime R, Payne W, Harvey J. A comparative study of factors influencing participation in sport and physical activity for metropolitan and rural female adolescents. *Ann Leisure Res.* 2011;14(4):355–68.
- Department of Health and Aged Care, Systems NKCFaOGL. Measuring remoteness: Accessibility/Remoteness Index of Australia (ARIA), in Occasional Papers: New Series Number 14. Adelaide: Department of Health and Aged Care; 2001. Accessed from: <http://www.health.gov.au/internet/main/publishing.nsf/Content/health-historicpubs-hfsocc-ocpanew14a.htm> 27th April 2015.
- Dollman J, Maher C, Olds TS, Ridley K. Physical activity and screen time behaviour in metropolitan, regional and rural adolescents: a -sectional study of Australians aged 9–16 years. *J Sci Med Sport.* 2012;15(1):32–7.
- Eime R, Harvey J, Sawyer N, Craike M, Symons C, Polman R, et al. Understanding the contexts of adolescent female participation in sport and physical activity. *Res Q Exerc Sport.* 2013;84(2):157–66.
- Merom D, Bauman A, Ford I. The public health usefulness of the exercise recreation and sport survey (ERASS) surveillance system. *J Sci Med Sport.* 2004;7:32–7.
- Australian Sports Commission: What is defined as a sport. n.d [cited 2014 9th October]; Available from: http://www.ausport.gov.au/supporting/nso/asc_recognition.
- Eime R, Harvey J, Brown W, Payne W. Does sports club participation contribute to health-related quality of life? *Med Sci Sports Exerc.* 2010;42(5):1022–8.

19. Australian Bureau of Statistics. Census of population and housing: Socio-Economic Indexes for Areas (SEIFA) - Technical paper, 2006 (No.2039.0.55.001). Canberra, Australia: Australian Bureau of Statistics; 2008. Accessed from: <http://www.abs.gov.au/ausstats/abs@nsf/mf/2039.0.55.001/>. 27th April 2015.
20. Kamphuis C, Van Lenthe F, Giskes K, Huisman M, Brug J, Mackenback J. Socioeconomic status, environmental and individual factors, and sports participation. *Med Sci Sports Exerc.* 2008;40(1):71–81.
21. Walters S, Barr-Anderson D, Wall M, Neumark-Sztainer D. Does Participation in Organized Sports Predict Future Physical Activity for Adolescents from Diverse Economic Backgrounds? *J Adolesc Health.* 2009;44(3):268–74.
22. Dollman J, Lewis NR. The impact of socioeconomic position on sport participation among South Australian youth. *J Sci Med Sport.* 2010;13(3):318–22.
23. Cerin E, Leslie E. How socio-economic status contributes to participation in leisure-time physical activity. *Soc Sci Med.* 2008;66(12):2596–609.
24. Sallis JF, Bowles HR, Bauman A, Ainsworth BE, Bull FC, Craig CL, et al. Neighborhood Environments and Physical Activity Among Adults in 11 Countries. *Am J Prev Med.* 2009;36(6):484–90.
25. Pascual C, Regidor E, Álvarez-del Arco D, Alejos B, Santos JM, Calle ME, Martínez D: Sports facilities in Madrid explain the relationship between neighbourhood economic context and physical inactivity in older people, but not in younger adults: a case study. *Journal of Epidemiology and Community Health* 2013.
26. Casey M, Eime R, Ball K, Payne W. Characteristics of physically active and inactive men from low socioeconomic communities and housing estates: a qualitative study using the socioecological model. *Ann Leisure Res.* 2011;14(1):1–21.
27. Lee J, Macdonald D, Wright J. Young men's physical activity choices: The impact of capital, masculinities, and location. *J SportSoc Issues.* 2009;33:59–76.
28. Eime R, Young J, Harvey J, Charity M, Payne W. A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *Int J Behav Nutr Phys Act.* 2013;10(98):1.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

