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Richard Larouche [a]; Louis Laurencelle [a]; Simon Grondin [b];François Trudeau [a]
[a] Département des Sciences de l'Activité Physique, Université du Québec à Trois-Rivières, Trois-Rivières, Québec [b] Ecole de Psychologie, Université Laval, Québec, Canada

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Influence of birth quarter on the rate of physical activities and sports participation

RICHARD LAROUCHE[1], LOUIS LAURENCELLE[1], SIMON GRONDIN[2], & FRANÇOIS TRUDEAU[1]

[1]*Département des Sciences de l'Activité Physique, Université du Québec à Trois-Rivières, Trois-Rivières, Québec and* [2]*Ecole de Psychologie, Université Laval, Québec, Canada*

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Abstract
The purpose of this study was to assess the potential influence of birth quarter on the frequency of physical activity and participation in specific activities during adulthood. We used data from one national and one provincial survey, the 2005 Canadian Community Health Survey and the 1998 Quebec Social and Health Survey (*Enquête sociale et de santé du Québec*) respectively. We analysed the distribution of participants at each level of practice of a given leisure activity and work-related physical activity. In the Canadian Community Health Survey, a relative age effect was found for participation in soccer in the 25- to 60-year-old population. However, for volleyball, a significant relative age effect was also observed but with over-representation of the last quarters of the year for the whole population and for men aged 12–60 years. In the Quebec Social and Health Survey, significant differences in the frequency of distribution without a relative age effect were revealed for participation in women's ice hockey, work-related physical activity level, and stage of change for physical activity. Overall, the data indicate that the systematic relative age effect reported in other studies for some competitive sports, such as ice hockey and soccer, is not as prevalent in leisure physical activities during adulthood. This may reflect lower competitive selection and attrition in population physical activity compared with competitive sports in younger athletes.

Keywords: *Birth quarter, relative age effect, sports, physical activity*

Introduction

The impact of birth quarter has generated a large amount of research, originally focusing on its potential effect on academic performance (Shearer, 1967) and later in the context of sports. The relative age effect, a new concept that has emerged from this research, is defined as the consequence of age differences between individuals within the same cohort, either in school or in sports teams (Grondin, Deshaies, & Nault, 1984; Musch & Grondin, 2001). Sports federations establish cut-off dates for age categories, which may disadvantage children born just before this date who will have to compete with relatively older children. Being born in the last quarter before the cut-off date (e.g. October 1 to December 31, when the cut-off date is January 1) has been found to decrease the probability of performing at the highest level in many sports, including ice hockey (Barnsley, Thompson, & Barnsley, 1985; Côté, MacDonald, Baker, & Abernethy, 2006; Grondin & Trudeau, 1991; Musch & Grondin, 2001; Sherar, Baxter-Jones, Faulkner, & Russell, 2007), baseball (Côté et al., 2006), basketball (Delorme & Raspaud, 2009), and European football (Dudink, 1994; Helsen, van Winckel, & Williams, 2005; Julien, Turpin, & Carling, 2008). The relative age effect raises many concerns, since it may be a cause of attrition of sport talents following missed development opportunities or team selection due to a lower age in the same group. Given the huge amount of money spent on athletic development, it is even more worrying that talents are lost for procedural reasons. It may even be considered as entry discrimination based on age rather than thoughtful selection based on talent or performance (Delorme & Raspaud, 2009).

Most research projects on the relative age effect in sports have focused specifically on competitive sports. Therefore, it is unclear whether this effect exists in recreational sports and leisure activities. Recent data from Cobley and colleagues (Cobley, Abraham, & Baker, 2008) are even more disturbing,

Correspondence: F. Trudeau, Département des Sciences de l'Activité Physique, Université du Québec à Trois-Rivières, Trois-Rivières, Québec G9A 5H7, Canada. E-mail: francois.trudeau@uqtr.ca

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since they suggest that the relative age effect may also impinge on physical education classes. Indeed, school groups are divided by cut-off dates. It is possible to find differences in physical education scores, with higher scores for the first birth quarter of the cohort. Therefore, it is possible to observe a relative age effect even in an education environment supposed to favour training over competition. Given the high prevalence of sedentary behaviour in youth, it is important to determine whether the relative age effect is also present in the population for physical activity in general. The purpose of this exploratory and descriptive study was, therefore, to determine if birth quarter has an influence on the frequency of physical activity and participation in specific activities in adulthood as well as on work-related physical activity.

Methods

National and provincial data

The data used for analysis in this study were provided by the Institut de la statistique du Québec (2006). They originally came from the 2005 Canadian Community Health Survey by Statistics Canada and the 1998 Quebec Social and Health Survey (*Enquête sociale et de santé du Québec*) by the Institut de la statistique du Québec. Major, periodic epidemiological surveys, performed respectively by the Canadian federal and Quebec provincial governments, surveyed the health status of Canadians and Quebecers. Both of them included a section that targeted physical activity patterns, and the participants (132,221 in the Canadian Community Health Survey and 20,773 in the Quebec Social and Health Survey) were asked their date of birth. Participants in the Canadian Community Health Survey were aged 12–60 years and those in the Quebec Social and Health Survey 15–60 years. While the data bank from the Canadian Community Health Survey examined only the practice of physical activity in general and different activities (e.g. golf, volleyball), the Quebec Social and Health Survey also included questions on attitudes, an evaluation of the stage of change according to the trans-theoretical model (Prochaska & DiClemente, 1983), and the frequency of physical activities in general. These questions could help elucidate the potential of the relative age effect on psychosocial variables known to influence the rate of physical activity and sports participation. This research was approved by the Université du Québec à Trois-Rivières institutional ethics review committee.

Statistical analyses

Since date of birth information is protected, we could not obtain the raw data. Instead, the Institut de la statistique du Québec provided 200 Microsoft Excel® worksheets with cross-tabulations for each sports/physical activity by sex (males, females, and males plus females combined) as well as results from various questions on physical activity and its determinants. These files included the proportion of participants born in each quarter who provided a specific answer for their weekly frequency of physical activity and their practice of sports and leisure activities included in the questionnaires and for work-related physical activity requirements. Physical activities were dichotomized according to frequency of participation, while work-related physical activity was divided into four categories: mostly seated, often standing/walking, lifting/carrying loads, and lifting heavy/physically demanding loads. The chi-square statistic was used to determine whether our samples had a birth date distribution different from that of the population as a whole. It is noteworthy that, because we were unable to access detailed population data to perform appropriate goodness-of-fit chi-square analysis, we conducted a test of independence for each contingency table. If a frequency distribution difference was present, the test of independence would reveal it. Only activities for which we observed significant differences (at the $P < 0.05$ level) according to birth quarter are discussed below. The first quarter started in January and finished in March, the second quarter was from April to June, the third quarter from July to September, and the fourth quarter from October to December.

Results

In the Canadian Community Health Survey, significant distribution differences were observed for two activities. First, as shown in Tables I and II,

Table I. Practice of volleyball by men plus women, 12–60 years old (2005 Canadian Community Health Survey).

	First quarter	Second quarter	Third quarter	Fourth quarter
Yes	25.2% (438)	23.5% (407)	27.2% (472)	24.1% (418)
No	24.5% (4497)	26.6% (4880)	25.7% (4712)	23.1% (4229)
Total	24.6% (4935)	26.4% (5287)	25.9% (5184)	23.2% (4647)

Note: All results are presented as percentages of participants born in each quarter who provided a specific answer, with frequencies in parentheses.
$\chi^2 = 8.44$, d.f. $= 3$, $P = 0.04$.

frequency distributions were unequal for volleyball in the population as a whole (men + women) and among men only ($\chi^2 = 8.44$, d.f. = 3, $P = 0.039$ and $\chi^2 = 10.68$, d.f. = 3, $P = 0.014$): persons born in the second quarter were under-represented among volleyball players, with a slight over-representation for the third quarter. Similarly, the practice of soccer varied across birth quarters according to a relative age effect, but only for the 25- to 60-year population ($\chi^2 = 11.36$, d.f. = 3, $P = 0.011$; Table III), in the guise of under-representation in the fourth quarter.

In the Quebec Social and Health Survey, differences in distribution were observed for women's ice hockey ($\chi^2 = 13.63$, d.f. = 6, $P = 0.04$; Table IV), resulting mostly from an over-representation of female ice hockey players born in the fourth quarter among players versus the reference population. Moreover, as shown in Table V, the level of work-related physical activity differed significantly from the first to the fourth quarter for individuals aged under than 25 ($\chi^2 = 17.42$, d.f. = 9, $P = 0.04$). Frequency distribution was also discordant for stage of change according to the trans-theoretical model, but only for women ($\chi^2 = 24.64$, d.f. = 12, $P = 0.02$; Table VI).

Discussion and conclusion

The purpose of this study was to assess the potential influence of birth quarter on the frequency of physical activity and participation in specific activities practised by individuals aged 12–60 years. In both the Canadian Community Health Survey and Quebec Social and Health Survey data, differences in distribution across birth quarters emerged for four specific sports, work-related physical activity level, and the stage of change for physical activity compared with the normal distribution of births throughout the year (Tables I–V). However, a relative age effect favouring the first birth quarters was observed only for male and female soccer players aged 25–60 years, with a higher proportion of players in the first two quarters of the year than in the reference group (Table III). In the literature, a relative age effect was also noted for soccer players aged 16–39 years (Vaeyens, Philippaerts, & Malina 2005) and 17-year-old male and female players (Vincent & Glamser, 2006).

Apart from soccer, no relative age effect indicated that being born during the first two quarters of the year could have a positive effect on the rate of engagement by non-elite participants in sports and physical activities. In volleyball, we measured a relative age effect where the last two quarters were over-represented (54.4%). Moreover, in other instances, the differences were isolated in a single quarter, and none of them appeared simultaneously in both surveys for the same sport or type of physical activity. The lack of a more widespread relative age effect in adult physical activity could be explained in

Table II. Practice of volleyball by men, 12–60 years old (2005 Canadian Community Health Survey).

	First quarter	Second quarter	Third quarter	Fourth quarter
Yes	23.1% (207)	22.5% (201)	28.5% (255)	25.9% (232)
No	24.5% (2114)	26.5% (2286)	26.4% (2285)	22.6% (1955)
Total	24.3% (2321)	26.1% (2487)	26.6% (2540)	22.9% (2187)

$\chi^2 = 10.68$, d.f. = 3, $P = 0.01$.

Table III. Practice of soccer by men plus women, 12–60 years old (2005 Canadian Community Health Survey).

	First quarter	Second quarter	Third quarter	Fourth quarter
Yes	28.0% (155)	28.4% (157)	26.0% (144)	17.5% (97)
No	24.6% (3589)	26.3% (3847)	25.7% (3751)	23.4% (3419)
Total	24.7% (3744)	26.4% (4004)	25.7% (3895)	23.2% (3516)

$\chi^2 = 11.36$, d.f. = 3, $P = 0.01$.

Table IV. Practice of ice hockey by women, 15–60 years old (1998 Quebec Social and Health Survey).

Frequency	First quarter	Second quarter	Third quarter	Fourth quarter
1–4 times	23.1% (83)	23.7% (85)	22.3% (80)	30.9% (111)
5 times or more	19.1% (31)	32.7% (53)	24.1% (39)	24.1% (39)
None	24.1% (1915)	26.4% (2098)	25.6% (2039)	24.0% (1908)
Total	23.9% (2029)	26.4% (2236)	25.4% (2158)	24.3% (2058)

$\chi^2 = 13.63$, d.f. = 6, $P = 0.04$.

Table V. Level of work-related physical activity by men plus women, 15–24 years old (1998 Quebec Social and Health Survey).

Level	First quarter	Second quarter	Third quarter	Fourth quarter
Mostly seated	25.5% (221)	25.3% (219)	23.5% (203)	25.7% (222)
Often standing	22.2% (288)	28.2% (367)	25.5% (332)	24.1% (313)
Climbing stairs/lifting loads	21.9% (189)	25.9% (224)	30.2% (261)	22.0% (190)
Lifting heavy loads	22.7% (87)	24.7% (95)	25.8% (99)	26.8% (103)
Total	23.0% (785)	26.5% (905)	26.2% (895)	24.3% (828)

$\chi^2 = 17.42$, d.f. $= 9$, $P = 0.04$.

Table VI. Stage of change according to the trans-theoretical model in women, 15–60 years old (1998 Quebec Social and Health Survey).

Stage	First quarter	Second quarter	Third quarter	Fourth quarter
Precontemplation	26.7% (224)	26.0% (218)	21.8% (183)	25.6% (215)
Contemplation	25.0% (316)	26.5% (335)	25.9% (328)	22.5% (285)
Preparation/irregular physical activity	22.1% (799)	26.0% (939)	27.2% (982)	24.7% (893)
Action	24.2% (173)	27.2% (195)	25.0% (179)	23.6% (169)
Maintenance	25.6% (602)	25.9% (609)	24.0% (565)	24.5% (575)
Total	25.0% (2114)	25.8% (2296)	25.3% (2237)	24.0% (2137)

$\chi^2 = 24.64$, d.f. $= 12$, $P = 0.02$.

part by a shift of practice towards less selective environments among individuals who are disadvantaged in a competitive sport known to present a relative age effect. In fact, individuals who do not play in a highly competitive league could easily continue their sport at another practice level. They may still like their sport but simply opt for a less selective level of practice due to other life constraints, such as studies, work, health status or fear of injuries (Allender, Hutchinson, & Foster, 2008). A setting geared towards participation might be preferred by this population for psychological reasons, such as high levels of intrinsic motivation or to simply pursue an activity where their relative perceived competence is stronger.

Other differences were found in the Quebec Social and Health Survey for the stage of change and for the practice of 20- to 30-min sessions of physical activities, but they were limited to specific segments of the population. Surprisingly, the first two birth quarters were slightly over-represented in the precontemplation stage of change (52.7%). This observation runs contrary to the hypothesis that, for children and adolescents, being older and taller than people of the same age may result in higher motivation to pursue physical activities, particularly those in which success is associated with greater height.

To our knowledge, this is the first study to assess the effect of birth quarter on the frequency of physical activity and of participation by the general population in specific activities. Therefore, it is impossible to compare our results with similar work by other researchers. We identified few significant differences in the practice of specific activities and in work-related physical activity level according to birth quarters. A relative age effect was observed only for soccer in the Canadian population of men and women aged 25–60 years. Such a relative age effect was also found in European football for participants of all age groups (Delorme & Raspaud, 2009). This may reflect the fast development of soccer in Canada and the relative lack of soccer leagues devoted to recreation versus competition. On the other hand, the inverse relative age effect noted for Canadian male volleyball players aged 12–60 years of age is puzzling and generates some speculation. We found that 54.4% of volleyball players came from the last two quarters. Is this the result of a transfer to volleyball from other sports presenting a relative age effect for the first birth quarters? Further research is warranted.

A complex interaction between physical and other factors (cognitive, emotional, and motivational) whose respective contributions remain unknown could better explain physical activity participation (Musch & Grondin, 2001). This study emphasizes in particular that the relative age effect may not be as important in general physical activity as it is in competitive sports. Also, a relative age effect was not found in many sports popular among adults (Côté et al., 2006). Furthermore, as pointed out by Musch and Grondin (2001), the competitive advantages provided by the relative age effect at a younger age in selected sports may later disappear in adulthood and not be as relevant for the level of participation in leisure and even competitive physical activities usually practised during this life period. As pointed out by Cobley and colleagues (Cobley, Baker, Wattie, & McKenna, 2009), the context of practice

is a main determinant of the presence of a relative age effect.

A positive finding of our study is that date of birth did not influence physical activity level in adults. This suggests that the relative age effect may foster over-representation of the first quarters in some competitive sports, but not participation in habitual physical activity. In fact, we do not know what physical activity people from the last birth quarters will be doing after they are excluded from their sport if a relative age effect is present. Further research is warranted to document the trajectory of sport participants from childhood to adulthood in sports characterized by a relative age effect. This would require a longitudinal design to confirm our results from cross-sectional data to better understand if, despite attrition from some sports due to a relative age effect, participants continue to engage in some form of physical activity later in life.

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