



Research Article

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A cross-sectional study to examine constraints to sport participation among ethnically diverse female adolescents from Ontario, Canada

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Abstract

Sport participation during adolescence is associated with good physical and mental health as well as social connectedness and greater well-being. Importantly, adolescence is a key developmental period when lifelong habit and behavioral patterns are shaped and when the benefits of sport are particularly beneficial to physical and psychological development. However, in Canada and internationally, adolescent females are consistently less active than males during adolescent years, are typically underrepresented in sports, and tend to drop out at disproportionate rates compared with their male peers. This cross-sectional study (2017-2019) aimed to examine associations between sport participation and individual, environmental, and task constraints for 825 ethnically diverse adolescent girls aged 13-19 years. Guided by Newell's model on sport participation, analysis included a series of unadjusted and adjusted binary logistic regression models in order to examine individual, environmental, and task constraints as predictors of sport participation, as well as potential interactions between significant constraints and their association with sport participation. In the adjusted multivariate analyses, significant constraints to sport participation included weather (environmental), development and age (individual), and physical intensity (task), with no significant interactions. Overall, findings suggest that various constraints, particularly at the individual level (developmental) affect sport participation among diverse female adolescents. Future research should integrate mixed-methods to ensure a comprehensive examination of potential interactions of constraints. This can enhance understanding of complex and interacting factors, which can be integrated to lead to effective interventions, programs and policies that support adolescent female sport participation.

Keywords: Female sport participation, Physical activity.

INTRODUCTION

Participating in sport offers the benefits of physical activity, coupled with social interaction, skill building and teamwork [1]. Adolescence is a key period of development and habit formation, when the benefits of sport may be particularly beneficial to physical and psychological development. Sport participation during adolescence is linked with good physical and mental health as well as social connectedness and greater well-being [1, 2]. For example, sport has shown to be protective against obesity, low self-esteem and depression during this stage and into adulthood [3, 4, 5, 6]. The benefits of sport extend beyond adolescence, with sport participation in early life linked with lowered risk of depression symptoms and perceived stress in young adulthood [5]. Despite the known lifelong benefits, there is substantial evidence that demonstrates that sport participation significantly declines during adolescence, particularly among females.

In Canada, evidence supports that adolescent females are consistently less active than males during adolescent years [7]. Additionally, young females are typically underrepresented in sport, and tend to drop out at disproportionate rates compared with their male peers. Of concern, females are less likely to meet physical activity requirements and sport-dropout may further exclude them from the health and social benefits of participation. Previous work has highlighted that females may experience unique barriers to sport participation including greater impact of gender norms and body dissatisfaction [8].

Researchers have used diverse frameworks to guide examinations of predictors of health behaviors in young people [9]. Newell's model is a framework that has guided various research in sport and movement science, including motor development [10, 11] skill acquisitions and sport performance [12]. Newell's Model of Constraints suggests that three interacting types of constraints can restrict or facilitate activities. These constraint types are categorized as individual, environmental, and task constraints.

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Individual constraints relate to individual human qualities, including structural, function, and psychological qualities. Environmental constraints speak to the broader social constructs that affect a person, including family, friends and the physical environment. Finally, task constraints include required characteristics or features of the sport, such as speed, strength or agility. According to Newell's model, these three constraint types are considered points on a triangle, where any change to one of the three changes a specific outcome. Based on this constraints-led model, individuals develop skills or behaviors in response to relevant constraints [13].

Importantly, these constraints may be magnified among ethnic groups, who may experience a unique interaction of barriers with cultural norms. For example, cultural expectations or beliefs may deter females from sport participation and therefore exclude them from many of the benefits of participation [14, 15]. Despite known gender differences in sport participation, there has been limited improvement in engaging and retaining young females in sports [16, 17]. In countries with diverse ethnic populations such as Canada, complex constraints that interact to promote or hinder sport participation, particularly for females, are not completely understood. Identifying and understanding priority constraints is important to developing successful sport participation programs for females. While various constraints to adolescent female sport participation have been studied, less is known about the significance of these constraints and their interaction in relation to sport participation, particularly within an ethnically diverse sample of adolescent females.

In order to better understand and guide essential next steps in addressing this gap, this study aimed to examine predictors and constraints to sport participation among ethnically diverse females in Ontario, Canada. More specifically, this exploratory project aims to evaluate individual, environmental and task predictors of sport participation among ethnically diverse adolescent girls. It is important to simultaneously investigate the impact of constraints at various levels to account for multi-level influences that interact to determine sport participation. As such, this study also aims to examine interactions of constraints that may influence sport participation. These exploratory analyses are important during adolescence, particularly among females, as they provide an opportunity to understand priority factors that affect sport participation, to guide interventions and policy that can encourage sport participation among adolescent females.

METHODS

Study design and participants

This cross-sectional study was conducted between 2017 and 2019 throughout Ontario. Data were obtained from female adolescent respondents to the survey 'Examining and Addressing Constraints to Sport Participation among Ethnically-Diverse Female Adolescents in Ontario'. Participants were recruited through school boards, private education programs, community organizations and social media advertising using a non-probability, voluntary sample method.

A mix of in-person and online recruitment strategies were used to recruit females throughout Ontario. In-person recruitment included contacting administrators at local school districts and youth organizations and, where necessary, attaining ethics approval from institute ethics boards. Online recruitment involved social media (Instagram and Facebook ads) targeted to females aged 13 to 19 in Ontario. Inclusion criteria to participate in the survey included females aged 13 to 19 as well as parental and participant consent. Ethics approval was obtained from the Ontario Tech University Research Ethics Board in January 2017.

Survey instrument

This survey was developed and tested as part of a pilot study that aimed to examine constraints to adolescent female sport participation specifically in the Durham region [18]. The survey was developed based on two theoretical frameworks- Newell's model [19] and the Developmental Assets Profile (DAP) framework [20] – as well as an extensive literature review to identify constraints to sport participation (Figure 1). Questions were created to either directly evaluate or triangulate a constraint. Most questions were in a Likert scale format to ensure richness of the dataset. Where Likert scale was not use, questions were categorical (i.e. ethnicity, number of responsibilities) or continuous (age). An expert panel was consulted to review the survey for construct and content validity. The survey was pilot tested (n=97) in the spring of 2017 in three high schools and one community organization in Durham Region, Ontario. The survey demonstrated good reliability, with an overall Cronbach's $\alpha=0.907$ [21]. A total of 67 questions (51 indexed, 16 independent), were included as constraints based on the Newell and DAP frameworks and availability for both pilot and main study participants.

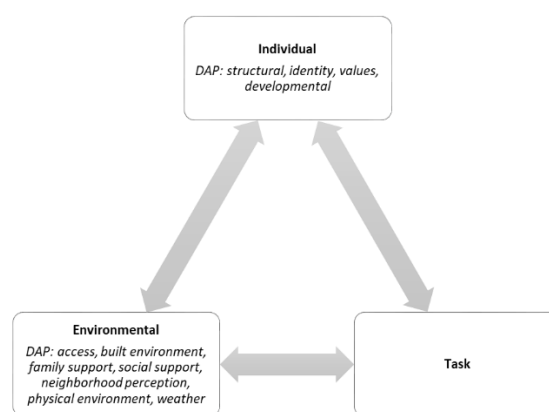


Figure 1: Newell's (1986a) model of constraints (bolded) with indices based on the DAP (Scales, 1999).

Survey Measures

The survey included demographic characteristics including age (in years), immigration status (year immigrated), parental education (tertiary education, completed high school, did not complete high school, prefer not to say), ethnicity (prefer not to say, white, non-white, multi-ethnic), body type (don't know/prefer not to say, underweight, average, overweight), and employment (yes/no).

In addition, potential correlates of participation or non-participation in sport were measured based on the frameworks described above. Where possible, variables belonging to the same constraint category were combined conceptually into 'indices' according to the DAP framework. For example, variables regarding availability of facilities, opportunity to play sport outside of school and safe public transport were indexed together as 'Access'. Variables that could not be conceptually indexed or were categorical were entered individually (i.e. age, overall health). Additional variables that were not included in the DAP framework but are considered conceptually relevant to sport participation in this age group (i.e. body shape, immigrant status) were included.

Environmental constraints

Environmental constraints refer to broader social factors or constructs that impact a person. Environmental constraints comprised of 7 indices and 4 independent constraints. Indices included access (i.e.,

opportunities in school, available facilities), built environment (i.e., safe spaces, indoor/outdoor options), family support, social support, neighborhood perception (i.e. proud of neighbourhood, feel safe), physical environment (i.e. air quality, weather allows/prevents) and weather (i.e. hot, cold, snow). Variables that were summed to compute indices were scored on Likert scales ranging from 1 to 5 (strongly agree/always). Additional constraints included immigrant status of participant, immigrant status of parent, hours employed and number of responsibilities, scored categorically. Please refer to Klicnic *et al.* (2021a) for more information on justifications of the inclusion of constraints.

Individual constraints

Individual constraints were related to psychological, functional or structural human qualities. Individual constraints included 3 indices and 4 independent constraints. Indices included identity (i.e. body satisfaction, have energy), values (i.e. belief that sport is important, have time) and developmental (i.e. enjoy sport, are confident). Age (years), overall health (scale of 1 through 5, highest), ethnicity (white, non-white, multi-ethnic) and body type (underweight, average, overweight) were also included.

Task constraints

Task constraints refer to the demands, goals or structure of an activity (i.e. strength, agility, co-ed). These were derived from the literature and in consultation with an expert panel during survey development. These constraints were based on evidence suggesting that task characteristics in sport, such as competition, may oppose female ideals and thus act as a constraint [22]. There were a total of eight constraints, including competitive, recreational, physically intense, strict rules, co-ed, contact between players, long duration and perseverance. Task constraints were examined by asking "please rate how likely you are to participate in a sport which is/has/requires:" Responses were collected on a scale of 0 (Not likely at all) through 2 (Very likely). Responses of 'not likely at all' were coded as a constraint. For perseverance, participants were asked 'When something slows down or prevents my participation in sport, I do my best to resolve the issue' and responses ranged from 0 (never) to 4 (always).

Outcome

The primary outcome in this study was regular sport participation (3 times per week or more). Responses were captured using a Likert Scale and dichotomised as yes (strongly agree, agree) and no (strongly disagree through to neutral).

Data analysis

All data were analysed using IBM SPSS statistical software (version 26, New York, United States). Selected demographic characteristics were used to summarise the characteristics of the sample. All environmental, individual and task constraints were summarized using descriptive statistics. The mean and standard deviation were reported for all continuous or indexed variables, and the number and frequency for all categorical variables. Between group differences among regular sport participants and non-participants were examined using t-tests of continuous variables and chi square for categorical variables.

We then conducted a series of unadjusted and adjusted binary logistic regression models to i) examine individual, environmental and task constraints as predictors of sport participation and ii) examine potential interactions between significance constraints and their association with sport participation. Three exploratory bivariate logistic regression models were undertaken to determine which constraint significantly predicted sport participation ($p < 0.05$). At the first stage, all potential constraint predictor variables were entered individually into three unadjusted binary logistic regression models, one for each

category (environmental, individual, task). In the second stage of analyses, all significant predictors from the unadjusted models were entered into an adjusted binary logistic model. This fully adjusted model examined potentially significant predictors while adjusting for the effect of other significant predictors. Finally, significant predictors from the fully adjusted binary logistic model were entered into a final model that examined potential interactions. The final model included the remaining significant constraints, and interaction terms for individual x environmental x task constraints. The Hosmer and Lemeshow test was used to assess goodness of fit for the adjusted binary logistic regression model and the final model with interactions. The proportion of variability explained by each model was estimated using Nagelkerke's R².

RESULTS

A total of 850 female adolescents aged 13 to 19 years who resided in Ontario, Canada completed the survey. A total of 20 participants did not meet inclusion criteria and were excluded from the study; five participants did not report their sport participation and were also excluded. A total of 825 participants were retained for analysis. A total of 53.2% of participants regularly participated in sport. The average age of participants was 16.8 (SD 1.2) years and participants were primarily white (63.7%), born in Canada (85.7%) and had a self-rated overall health score of 3.35 (SD 0.95) out of 5.

Demographic

There were key demographic differences between females who regularly participated in sport and those who did not. Although the age difference between participants and non-participants was significant ($p=0.05$), this age difference is not clinically significant (16.70 vs 16.94, Table 1). Compared to regular sport participants, a larger proportion of non-participants were immigrants ($p=0.032$), identified themselves as overweight ($p=0.000$), were unemployed ($p=0.000$), and had lower levels of parental education ($p=0.000$). Although not statistically significant, a larger proportion of non-participants identified as non-white (Black/African Canadian, Southeast Asian, East Asian, Middle Eastern, First Nations, South Asian, Latin American, Pacific Islander, $p=0.063$).

Between group comparison

Univariate analyses revealed differences between regular sports participants and non-participants. Regular sport participants reported significantly higher average scores (indicating lower perceived barriers) on all environmental, individual and task constraint indices compared to non-participants (Table 2). A greater proportion of participants were born in Canada compared with those who had immigrated ($p=0.032$) and were employed less than 10 hours a week, versus not employed or working over 10 hours ($p=0.001$). There were no significant differences between groups on parental immigrant status and number of responsibilities. Non-indexed individual constraints showed significant differences in self rated overall health between sport participants (M 3.65, SD 0.876) and non-participants (M 3.02, SD 0.911). In addition, a greater proportion of sport participants identified as an average weight (82.2% vs 69.4% among non-participants), and a greater proportion of sport non-participants identified as overweight (20.2% vs 7.7% in participants). The proportion of participants who reported task constraints was significantly greater in the non-participant group compared to participants in all task constraint categories (Table 2).

Regression models

Table 3, 4 and 5 show results of three constraint-type regression models (Environmental, Individual, Task). The regression model for environmental constraints explained 33.5% of the variability (R²N) and correctly identified 72.8% of cases. Among environmental constraints,

weather (OR: 1.093, 95% CI: 1.052, 1.135)), social support (OR: 1.216, 95%CI 1.141, 1.296) and family support (OR: 1.178, 95%CI: 1.107, 1.253) were all significantly associated with increased odds of sport participation.

The regression model for individual constraints successfully predicted 76.0% of cases and explaining 48.5% of the variability (R²N). Developmental (OR: 1.163, 95% CI: 1.117, 1.210), values (OR: 1.124, 95% CI: 1.027, 1.221), and identity (OR: 1.193, 95% CI: 1.034, 1.376) were all significantly positively associated with sport participation, and lower age was also significantly linked with increased odds of participation (OR: 0.791, 95%CI: 0.681, 0.919).

In the task constraint model, those who reported greater likelihood of participating in sports that required competition (OR: 1.821, 96% CI: 1.321, 2.509)) physically intense (OR: 1.953, 95% CI: 1.408, 1.708), games of long duration (OR: 2.031, 95% CI: 1.451, 2.843) and perseverance (OR: 3.490, 95%CI: 2.339, 5.207)) had greater odds of sport participation. Conversely, those who reported greater likelihood of participating in sports that were recreational (OR: 0.682, 95%CI: 0.503, 0.924) had a significantly decreased likelihood of sport participation. The regression model for task constraints predicted 73.8% of cases and explaining 38.7% of the variability (R²N).

Adjusted regression model

When all significant predictors from each of the three constraint categories were entered into a separate model together, the model explained over half of the variance (R²N = 53.0%). The model was a moderate fit ($\chi^2= 15.441$, $p=0.051$), and it correctly predicted 78.2% of cases. In this model, weather, developmental and the physically intense task constraint predictors remained significant in their association with increased odds of sport participation (Table 6). Younger age remained significantly associated with greater odds of sport participation.

Interaction analysis

In the final regression model, remaining significant constraints were included to the model, along with interaction terms between all Individual x Environmental x Task constraints (Table 7). The model explained 48.9% of the variance in sport participation, and was a good fit ($\chi^2= 6.379$, $p=0.605$). The model correctly identified cases 78.0% of the time. The results indicated no significant interactions between any predictors.

Table 1: Demographics of female adolescent participants by sport participation

	Participant n=439	Non-participant n=386	Total n=825	p
n (%)				
Age (mean, SD)	16.70 (1.26) (1.26)	16.94 (1.20)	16.81 (1.24)	0.05
Immigrant				0.001
No	392 (89.7)	312 (81.3)	704 (85.7)	
Yes	45 (10.3)	72 (18.8)	117 (14.3)	
Highest Parental Education				0.375
Don't know/prefer not to say	20 (4.6)	23 (6.0)	43 (5.2)	
Elementary school/did not complete high school	2 (0.5)	2 (0.5)	4 (0.5)	
Completed high school	388 (88.4)	337 (87.3)	725 (87.9)	
Tertiary education	29 (6.6)	24 (6.2)	53 (6.4)	
Ethnicity				0.098
Prefer not to say	3 (0.7)	2 (0.5)	5 (0.6)	
White	302 (68.9)	224 (58.0)	526 (63.8)	
Non-White	93 (21.2)	136 (35.2)	229 (27.8)	
Multi-ethnic	40 (9.1)	24 (6.2)	64 (7.8)	
Body type				0.000
Don't know/prefer not to say	19 (4.3)	16 (4.1)	35 (4.2)	
Underweight	25 (5.7)	24 (6.2)	49 (5.9)	
Average	361 (82.2)	268 (69.4)	629 (76.2)	
Overweight	34 (7.7)	78 (20.2)	112 (13.6)	
Employed				0.003
No	223 (50.8)	236 (61.1)	459 (55.6)	
Yes	216 (49.2)	150 (38.9)	366 (44.4)	

*missing: Ethnicity n=1, Immigrant n=4, age n = 7

difference between groups estimated using independent sample t-tests and one-way ANOVA

Table 2: Bivariate analyses of constraints by sport participation

	Participants (n=439)	Non-participants (n=386)	Total	p
<i>Environmental indices</i>		Mean (SD)		
Weather	16.42 (4.41)	14.11 (4.79)	15.34 (4.73)	0.000
Physical Environment	11.42 (2.54)	10.75 (2.95)	11.11 (2.75)	0.001
Family Support	12.75 (2.76)	10.25 (3.31)	11.58 (3.28)	0.000
Neighborhood Perception	8.41 (1.70)	7.76 (2.16)	8.10 (1.95)	0.000
Access	19.52 (4.18)	16.40 (5.04)	18.06 (4.86)	0.000
Built Environment	19.93 (3.57)	17.71 (4.97)	18.89 (4.42)	0.000
Social Support	13.55 (2.74)	11.02 (2.97)	12.37 (3.11)	0.000
<i>Environmental constraints (non-indexed)</i>				
Immigrant Status				0.001
No	392 (89.7)	312 (81.3)	704 (85.7)	
Yes	45 (10.3)	72 (18.8)	117 (14.3)	
Parental Immigrant status				0.772
No	360 (82.6)	320 (83.3)	680 (82.9)	
Yes	76 (17.4)	64 (16.7)	140 (17.1)	
Employment				0.096
Not employed	219 (49.9)	230 (59.6)	449 (54.4)	
Less than 10hrs/wk	129 (29.4)	78 (20.2)	207 (25.1)	
More than 10 hrs/wk	87 (19.8)	72 (18.7)	159 (19.3)	
Number of responsibilities				0.213
0	59 (13.4)	54 (14.0)	113 (13.7)	
1	195 (44.4)	190 (49.2)	285 (46.7)	
2	143 (32.6)	110 (28.5)	253 (30.7)	
3	42 (9.6)	32 (8.3)	74 (9.0)	
<i>Individual indices</i>				
Developmental	51.31 (5.39)	41.77 (8.19)	46.85 (8.33)	0.000
Identity	9.42 (1.43)	7.41 (2.04)	8.47 (2.01)	0.000
Values	21.97 (1.96)	19.25 (3.23)	20.70 (2.96)	0.000
<i>Individual constraints (non-indexed)</i>				
Age	16.70 (1.26)	16.94 (1.20)	16.81 (1.24)	0.05
Overall Health	3.65 (0.876)	3.02 (0.911)	3.35 (0.946)	0.000
Ethnicity (n, %)				0.098
Prefer not to say	3 (0.7)	2 (0.5)	5 (0.6)	
White	302 (68.9)	224 (58.0)	526 (63.8)	
Non-White	93 (21.2)	136 (35.2)	229 (27.8)	
Multi-ethnic	40 (9.1)	24 (6.2)	64 (7.8)	
Body type				0.000
Don't know/prefer not to say	19 (4.3)	16 (4.1)	35 (4.2)	
Underweight	25 (5.7)	24 (6.2)	49 (5.9)	
Average	361 (82.2)	268 (69.4)	629 (76.2)	
Overweight	34 (7.7)	78 (20.2)	112 (13.6)	
<i>Task constraints (n,%)^a</i>				
Competitive	28 (6.4)	107 (28.0)	135 (16.5)	
Recreational	40 (9.3)	24 (6.4)	64 (7.9)	
Physically Intense	32 (7.3)	117 (31.0)	149 (18.1)	
Strict Rules	65 (14.9)	131 (34.4)	196 (24.0)	
Co-Ed	53 (12.3)	84 (22.6)	137 (17.1)	
Contact between players	65 (14.9)	103 (27.9)	168 (20.8)	
Games of Long Duration	28 (6.4)	112 (29.9)	140 (17.3)	
Perseverance	3 (0.7)	44 (11.7)	47 (11.5)	

^a Values represent participants who responded 'not likely at all' to the likelihood that they would participate in a sport that requires each task

Task: Please rate how likely you are to participate in a sport which is/has/requires:

Table 3: Regression model of environmental predictors of sport participation

Constraints	OR (CI95%)	p
Weather	1.093 (1.052, 1.135)	0.000
Physical Environment	0.972 (0.910, 1.038)	0.393
Social Support	1.216 (1.141, 1.296)	0.000
Family Support	1.178 (1.107, 1.253)	0.000
Neighborhood Perception	0.955 (0.860, 1.060)	0.389
Access	1.053 (1.000, 1.110)	0.051
Built Environment	1.026 (0.965, 1.091)	0.410
Immigrant Status (ref: non-immigrant)	1.372 (0.845, 2.228)	0.200
Parental Immigrant status (ref: Non-immigrant)	0.838 (0.539, 1.301)	0.431
Employment (ref not employed)		0.610
Less than 10 hours	0.794 (0.173, 3.648)	0.766
More than 10 hours	1.021 (0.217, 4.803)	0.979
Number of responsibilities (ref: 0)		0.163
1	1.107 (0.545, 2.252)	0.778
2	0.678 (0.374, 1.230)	0.201
3	0.907 (0.489, 1.683)	0.757

*employment 'prefer not to say' not shown

Table 4: Regression model of individual predictors of sport participation

Constraints	OR (CI95%)	p
Developmental	1.163 (1.117, 1.210)	0.000
Identity	1.193 (1.034, 1.376)	0.016
Values	1.124 (1.027, 1.221)	0.011
Age	0.791 (0.681, 0.919)	0.002
Overall Health	1.175 (0.951, 1.452)	0.135
Ethnicity (ref: white)		
Non-white	1.063 (0.149, 7.559)	0.952
Multi-ethnic	0.673 (0.093, 4.853)	0.695
Body type (ref: Average)		0.657
Underweight	0.605 (0.249, 1.467)	0.266
Overweight	0.651 (0.204, 2.082)	0.469

*Ethnicity pref not to say not displayed

Table 5: Regression model of task predictors of sport participation

Constraints	OR (CI95%)	p
Competitive	1.821 (1.321, 2.509)	0.000
Recreational	0.682 (0.503, 0.924)	0.014
Physically Intense	1.953 (1.408, 1.708)	0.000
Strict Rules	0.857 (0.629, 1.169)	0.331
Co-Ed	1.135 (0.863, 1.493)	0.364
Contact between players	0.872 (0.652, 1.167)	0.358
Games of Long Duration	2.031 (1.451, 2.843)	0.000
Perseverance	3.490 (2.339, 5.207)	0.000

Table 6: Regression model of combined individual, environmental and task predictors of sport participation

Constraints	OR (CI95%)	p
Weather	1.063 (1.015, 1.114)	0.010
Family Support	1.066 (0.991, 1.148)	0.086
Social Support	1.084 (0.999, 1.176)	0.052
Developmental	1.126 (1.075, 1.180)	0.000
Identity	1.142 (0.971, 1.342)	0.109
Values	1.088 (0.981, 1.207)	0.109
Age	0.741 (0.625, 0.878)	0.001
Competitive	1.234 (0.875, 1.738)	0.230
Physically intense	1.438 (1.019, 2.029)	0.039
Long Duration	1.302 (0.927, 1.830)	0.128
Perseverance	1.465 (0.925, 2.321)	0.104

Table 7: Regression analysis of interaction terms between significant individual x environmental and individual x task constraints

Constraints	OR (CI95%)	p
Weather	1.044 (0.962, 1.133)	0.300
Developmental	1.191 (1.059, 1.340)	0.000
Age	0.788 (0.640, 0.989)	0.025
Physically intense	1.184 (0.469, 2.989)	0.721
<i>Interactions</i>		
Developmental*Weather*Physically intense	1.184 (0.469, 2.989)	0.345
Age*Environmental*Physically intense	0.998 (0.990, 1.006)	0.637

DISCUSSION

This cross-sectional survey of 13 to 19-year-old females in Ontario aimed to evaluate individual, environmental and task constraints to sport participation and to identify combinations of constraints that are associated with sport participation. The current study extends previous research by examining three categories of constraints guided by two theoretical frameworks, and their association with female sport participation among an ethnically diverse sample. Constraints identified in this study that were most predictive of sport participation were individual factors that captured female's previous sport experiences, beliefs about their own abilities, belonging in sport, and attitudes towards sport. Physical intensity of sport, weather, and age were also associated with sport participation. Although the current study did not identify any constraint interactions, this work provides a framework for future studies to examine the complexities of sport participation in young women.

The results of this survey highlight the role of developmental experiences and beliefs in predicting sport participation in girls. These findings from this study are consistent with previous research regarding sport participation among girls [2, 16, 23, 24]. Results of the current study demonstrated how constraints such as individual beliefs and experiences regarding sport played a role in participation among girls. Similarly, previous literature has suggested that individual factors such as perceived competence, perceived skill, and self-esteem affect sport participation among girls [22, 23]. Previous research has highlighted the role of internal factors like confidence, self-belief or fear of embarrassment in girls sport participation [24]. In particular,, evidence suggests that during adolescence, participating in sports may be considered unpopular for girls and to not align with a feminine image [22, 25]. This finding speaks to the impact of gendered messaging and societal expectations around female behavior, and supports previous work suggesting that girls are often socialized to believe that sport is not for them [26]. This may be a result of societal expectations that often do not encourage girls to participate in sport [25]. As a result, many girls may have different beliefs and experiences regarding sport that often limit their participation.

Environmental constraints such as social support and weather were also found to affect sport participation among participants. In particular, family support was significantly associated in sport participation where actions such as encouragement from family members, transportation provided from family, and teaching the skills required for the given sport all affected participation [23]. Thus, given that the family has such a large impact, lack of support may limit sport participation. Lastly, although task constraints played less of a role among this sample, certain factors that were linked to other constraints affected participation in sport. For example, physical intensity may be related to perceived competence, in which a participant may feel that the sport is too intense because they don't have the necessary skills to participate. This was shown among adolescents who immigrated where they were uncomfortable with certain sports since they were unfamiliar with the sport and skills required [27]. Additionally, previous research from an Australian cohort of children and adolescents aged 7 to 15 years has demonstrated that, among females, perceived sports competency is associated with being persistently active in the transition from adolescence to adulthood [28].

The current study adds to existing literature that explores potential interactions of constraints among a sample of ethnically diverse adolescent females. This study, however, is not without limitations. Firstly, the sample size is relatively small and may be underpowered to detect significant number of changes in multiple constraints. As this study is cross-sectional, neither causality nor the direction of associations can be assumed. Additionally, although the constraints explored in this study are guided by previous literature and by Newell's framework, the method of this approach may not be in-depth enough

to capture the complex interactions that occur in influencing a female's participation. It is possible that key constraints have not been adequately considered. For example, constraints included in this study may not adequately capture the social norms or expectations experienced by adolescent females. In addition, mental disorders such as depression and anxiety commonly emerge during adolescence and are disproportionately experienced by females, which may also affect participation [29, 30, 31]. Finally, other studies have suggested that due to the complexity of understanding how various, multi-level factors interact in female adolescents, that qualitative measures such as interviews or focus groups should be used to investigate sport participation [22]. For example, a previous study examined female perspectives regarding sport participation using focus group interviews and an Interpretive Phenomenology approach. The study comprised of a group an early adolescent (n=15, aged 12 to14) and mid-late (n=20, aged 15 to 18) with a range of physical activity levels [22]. This study was able to detect 'sub-themes' within broader vignettes, which may better capture the multi-level relationships between barriers to sport participation. For example, a theme of 'good nor not good enough' had sub-themes of pressure, ease of participation, and taking cues from others. In addition, this study also identified that all major themes a) friends or don't know anyone; b) good or not good enough; c) fun or not fun; d) good feeling or gross; d) peer support or peer pressure) were all tied to social context. Further, this research highlighted that these themes were not dichotomous, suggesting they may not adequately be captured in survey respondents. Given the impact of sport participation on future health outcomes, this is an important consideration for future research.

CONCLUSION

Overall, the findings of the current study suggest that various constraints, particularly at the individual level, affect sport participation among diverse female adolescents. However, this study did not identify any significant interactions of constraints that were associated with sport participation in this sample. This work adds to previous evidence that highlights the importance of female's experiences and beliefs about sport to encourage participation. Considering the social context that affects these beliefs is an important consideration for future programs and policies. Finally, although the current study did not identify any significant interactions, future research may integrate both quantitative and qualitative methods to ensure a comprehensive and detailed examination of potential interactions of constraints. This may enhance current understanding of complex and interacting constraints, in order to inform effective interventions, programs and policies to support adolescent female sport participation.

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