

1 Association between physical activity motives and type of physical activity in 2 children

3 Abstract

4 **Objectives:** Motives for participating in a specific type of physical activity (PA)
5 may differ across PA type in youth. We studied the relationship between PA
6 motives and type of PA engaged in by youth. **Design:** Cross-sectional analysis
7 using data from the Monitoring Activities of Teenagers to Comprehend their
8 Habits (MATCH) study. **Method:** 802 students age 10-11 years from 17
9 primary schools in New-Brunswick, Canada completed a questionnaire that
10 collected data on type of PA participated in (individual, group-based, organized,
11 non-organized), PA motives (enjoyment, social affiliation, competence,
12 fitness/health, appearance) and attainment of PA guidelines (60 minutes of
13 moderate-to-vigorous PA per day). The associations between PA motives and
14 PA type and between PA motives and attainment of PA recommendations were
15 assessed in multilevel logistic regression models. **Results:** Endorsing enjoyment
16 motives was associated with participation in organized PA (Odds Ratio, 95%
17 Confidence Interval: 1.54, 1.24-1.91). Competence motives were associated with
18 participation in group-based PA (1.27, 1.11-1.46) and achievement of PA
19 recommendations (1.95, 1.37-2.78). **Conclusion:** Targeting enjoyment and
20 competence motives may be associated with increased participation in organized
21 and group-based PA as well as with an increased likelihood of meeting PA
22 guidelines in youth.

23 **Key words:** physical activity; youth; motives; Self-Determination Theory

24

25 **Introduction**

26 Lack of physical activity (PA) is the fourth most important risk factor for mortality across
27 the globe (World Health Organization (WHO), 2013). Despite the many health benefits of PA
28 (Bailey, Boddy, Savory, Denton, & Kerr, 2012; Bloemers et al., 2011; Janssen & Leblanc, 2010;
29 Tremblay et al., 2011), only 5% of Canadian youth age 5 to 17 years attain the recommended 60
30 minutes of moderate-to-vigorous PA (MVPA) per day (Canadian Society for Exercise
31 Physiology (CSEP), 2011; Statistics Canada, 2012). There is a critical need for effective PA
32 programs that increase and sustain PA participation in youth as the positive effects of many PA
33 interventions targeting youth tend to be short-term (Dobbins, Husson, Decorby, & Rl, 2013;
34 Dudley, Okely, Pearson, & Cotton, 2011; Metcalf, Henley, & Wilkin, 2013; van Sluijs, McMinn,
35 & Griffin, 2007)

36 One reason for their lack of success may be that existing interventions focus on general
37 PA despite evidence that PA type may be important. For example, Aarnio et al. reported that
38 participation in organized sports may help youth maintain PA behavior (Aarnio, Winter,
39 Peltonen, Kujala, & Kaprio, 2002), and Belanger et al. (2009) showed that up to 90% of youth
40 maintained individual sports throughout adolescence, whereas only 41% of girls and 69% of boys
41 maintained participation in group-based PA. Further, some types of PA are only popular at
42 specific ages. Jump rope and PA in playgrounds are engaged in almost exclusively by children
43 (Mathieu Bélanger et al., 2012; Grieser & Vu, 2006; Pate, Sallis, & Ward, 2010), whereas fitness,
44 individual and occupational PA are engaged in during adolescence and adulthood (Mathieu
45 Bélanger et al., 2009; Mathieu Bélanger, Townsend, & Foster, 2011; Kjønnsen, Torsheim, &
46 Wold, 2008; Lunn, 2010).

47 Another possible reason for their mitigated success is that PA interventions rarely target
48 youth's reasons or motives for engaging in PA. Intrinsic and extrinsic motives may affect
49 participation across PA type, and youth involved in different activities may have different
50 motives. (Gillison, Standage, & Skevington, 2006; McLachlan & Hagger, 2011) The self-
51 determination theory (SDT) provides a theoretical framework for studying intrinsic and extrinsic
52 motives and their impact on motivation and well-being (Deci & Ryan, 1985, 2000; Teixeira,
53 Carraça, Markland, Silva, & Ryan, 2012). Motives that are intrinsic in nature (i.e., enjoyment,
54 competence, challenge, skill development) are inherently satisfying and gratifying (McLachlan &
55 Hagger, 2011; Sebire, Standage, & Vansteenkiste, 2009; Teixeira et al., 2012) and have been
56 associated with greater PA participation in youth (Gillison et al., 2006; Woods, Bolton, Graber,
57 & Crull, 2007). In contrast, extrinsic motives (i.e., appearance, social recognition, wealth) are
58 pursued for external outcomes or rewards (Frederick & Ryan, 1993; Ryan, Frederick, Lepes,
59 Rubio, & Sheldon, 1997; Teixeira et al., 2012) and may not relate to maintenance or
60 sustainability of PA behaviors. A recent systematic review on SDT and PA noted that more in-
61 depth understanding of the relationship between motives and PA needs to consider specific
62 characteristics of PA participation such as type and intensity (Teixeira et al., 2012). Beyond the
63 PA literature, studies pertaining to motives across school subjects suggest that there is variability
64 in types of motives associated with different academic domains (Bong, 2001), and motives have
65 also been reported to differ across various components of physical education curricula (Chen,
66 Martin, Ennis, & Sun, 2008). Similarly, different PA motives may relate to different PA practices
67 (Ryan et al., 1997; Sebire et al., 2009). For example, adults participating in individual sports had
68 higher levels of enjoyment and competence motives than fitness group participants (Frederick &
69 Ryan, 1993). Similarly, Tae Kwon Do participants had higher enjoyment and competence-related
70 motives, as well as lower body-related motives, than participants in aerobics (Ryan et al., 1997).

71 This same study also suggested that motives focused on enjoyment, competence and social
72 interactions were associated with greater exercise adherence than fitness and appearance motives
73 (Ryan et al., 1997). These two studies are among the few to date that examined motives in
74 association with specific types of PA. No previous study has explored this association in youth.

75 To address this research gap, this current study examined the associations among
76 enjoyment, competence, social, health/fitness and appearance PA motives (Frederick & Ryan,
77 1993; Ryan et al., 1997) and participation in organized, non-organized, group-based and
78 individual leisure time PA in grade 5 and 6 youth (10-11 years). These (non-mutually exclusive)
79 categories of leisure time PA were selected since there is variability in the prevalence of
80 participation across categories as well as in the likelihood of being sustained (Aarnio et al., 2002;
81 Erwin, 2008; Findlay, Garner, & Kohen, 2010; Kjønnsen et al., 2008; Lunn, 2010; Pate et al.,
82 2010; Taylor, Blair, Cummings, Wun, & Malina, 1999). A secondary objective was to study the
83 association between PA motives and attaining current PA recommendations of ≥ 60 minutes of
84 MVPA per day (Canadian Society for Exercise Physiology (CSEP), 2011). The objectives took
85 sex into account given previous studies have shown sex differences in types of activities engaged
86 in by youth (Bradley, McMurray, Harrell, & Deng, 2000; Lunn, 2010; Mulhall, Reis, & Begum,
87 2011; Rosenkranz, Welk, Hastmann, & Dzewaltowski, 2011) as well as in motives for taking part
88 in PA (Sirard, Pfeiffer, & Pate, 2006).

89 **Methods**

90 *Participants*

91 Data were available for 802 participants (55% girls; mean (sd) age = 10.7 (0.6) years)
92 enrolled in the Measuring Activities of Teenagers to Comprehend their Habits (MATCH) study
93 (Mathieu Bélanger et al., 2013). Language spoken was French among 66% of participants and

94 English among 34%. Based on a composite measure of the quality of housing, household
95 finances, employment, social stability, education and accessibility to services in the area in which
96 the school was located (Government of Canada, 2004), 12% of participants lived in high, 63%
97 lived in moderate, and 25% lived in low socioeconomic status neighborhoods.

98 *Procedures*

99 Schools were recruited across the province of New Brunswick, Canada and included a
100 mix of French and English speaking students from high, moderate, and low socioeconomic
101 neighbourhoods situated in rural and urban areas. Schools were recruited according to their
102 proximity to the research center in order to minimize travel costs, and schools with less than 30
103 students in grades 5 or 6 were excluded. Nineteen schools were initially recruited to participate in
104 MATCH, but two schools were excluded because of a low return of consent forms. All Grade 5
105 and 6 students (age 10-11 years) from the 17 schools were invited to participate in the study. A
106 total of 802 of 1545 eligible students (52%) consented to participate. The decision to recruit
107 grade 5 and 6 students was based on the expectation that youth generally achieve their highest
108 levels of PA during this period (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008), and
109 because it marks the transition from childhood to adolescence which is typically characterized by
110 a decrease in PA. The MATCH study received approval from the *Centre Hospitalier de*
111 *l'Université de Sherbrooke* ethics review board. All participants and a parent or guardian
112 provided signed informed consent prior to enrollment in the study.

113 Data for the current analysis were collected in fall, winter and spring of the 2011-12
114 school year. Questionnaire administration was repeated at 4-month intervals to capture seasonal
115 variation in PA (M Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009). At each
116 survey cycle, students completed a self-report questionnaire during class hours under the

117 supervision of the MATCH research staff. Questionnaires were administered in the language of
118 instruction of the school (French or English). When questionnaire items were not already
119 available in French from other surveys, English items were translated into French and back-
120 translated using a standard language equivalence protocol (Brislin, 1970; Chapman & Carter,
121 1979). Pilot-testing among 12 French and English students in grades 5 and 6 indicated that
122 children had no problem understanding and answering the questions. Data from the three survey
123 cycles were collapsed to appropriately represent one year of PA participation and minimize
124 systematic variation attributable to seasonality.

125 *Measures*

126 *Level of PA*

127 Attainment of the PA guidelines (i.e., accumulate ≥ 60 minutes of MVPA daily; (Canadian
128 Society for Exercise Physiology (CSEP), 2011)) was measured in two items (“Over the course of
129 the past 7 days, how many days were you physically active for a total of at least 60 minutes per
130 day?” and “Over the course of a typical or usual week, how many days are you physically active
131 for a total of at least 60 minutes per day?”) (Prochaska, Sallis, & Long, 2001). This two-item
132 questionnaire has test-retest reliability of $r=0.70$ and the scores correlate with accelerometer data
133 at $r=0.40$, which represents as good or better criterion validity compared to other PA
134 questionnaires (Prochaska et al., 2001). Participants were categorized as consistently meeting PA
135 recommendations (yes, no) if the average score of the two questions was 7 (rounded values of \geq
136 6.5) days per week in each of the three survey cycles.

137

138 *Type of Physical Activity*

139 Participants reported all leisure time PA in the past four months using a list of 36 PAs
140 typically engaged in by youth. This questionnaire is similar to other PA checklists validated
141 among youth (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997; Janz, Lutuchy, Wenthe,
142 & Levy, 2008; Sallis et al., 1993), and was designed to include PAs commonly engaged in by
143 youth in Atlantic Canada (Craig, Cameron, Russell, & Beaulieu, 2001). Using response options
144 including never, once per month or less, 2-3 times per month, once per week, 2-3 times per week,
145 4-5 times per week and almost every day, students reported how often (“Think about the
146 activities that you have done outside of your gym class in the past 4 months. How often did you
147 take part in the following activities?”) and with whom (alone, organized group or team, siblings,
148 friends, parents) they most often engaged in each activity. We considered the item “with whom
149 they most often engaged in each activity” to be an indicator of the context in which the activity
150 was practiced (Pate et al., 2010). PA during physical education classes was excluded because
151 youth do not have control over the content of these classes. Based on previous research (Aarnio et
152 al., 2002; Erwin, 2008; Findlay et al., 2010; Kjønnsen et al., 2008; Lunn, 2010; Pate et al.,
153 2010; Taylor et al., 1999), activities were categorized as organized or non-organized, and also as
154 group-based or individual. The four researchers responsible for these categorizations also took
155 the nature of the activity and with whom participants engaged in the activity into consideration.
156 They then worked to consensus on the following categorizations: Seven of the 36 PAs were
157 categorized as non-organized (trampoline, jump rope, games, home exercises, weight lifting,
158 indoor and outdoor chores). The other 29 activities were categorized as non-organized if the
159 participant reported to usually engage in the activity alone, with friends, with siblings or with a
160 parent. Conversely, activities were categorized as organized if the participant reported that he/she

161 usually engaged in the activity with an organized group or team. Similarly, 24 of the 36 PAs were
162 categorized as individual activities (i.e., generally practiced individually or if competition results
163 are based on the performance of one individual: ice skating, in-line skating, skateboarding,
164 bicycling, walking for exercise, track and field, jogging or running, golfing, swimming,
165 gymnastics, aerobics or yoga or exercise classes, home exercises, weight training, badminton,
166 tennis, kayaking or canoeing, trampoline, jump rope, downhill skiing or snowboarding, boxing or
167 wrestling, karate or judo or tai chi or taekwondo, cross-country skiing, indoor and outdoor
168 chores). The remaining 12 PAs were categorized as individual activities if they were reported to
169 be usually engaged in alone; or group-based if they were practiced most often with siblings,
170 parents, an organized group or team or with friends (Appendix 1 provides a detailed description
171 of the four types of PA). The average frequency of participation in each of the four types of PA
172 was computed using data collected in the three cycles. The four variables representing type of PA
173 therefore take into account seasonal variations in the practice of the 36 PAs over one year (e.g.
174 softball in the summer, football in the fall, skiing in the winter). Students were described as
175 having participated in organized, non-organized, group-based and individual PA (yes, no) if any
176 activity pertaining to each category was reported at least once per week in each cycle.

177 *PA motives*

178 Participants' PA motives were assessed using the Motives for Physical Activity Measure-
179 Revised (MPAM-R) questionnaire (Frederick & Ryan, 1993; Ryan et al., 1997). This measure
180 comprises 30 items, assessing: enjoyment ("Because it is stimulating; fun"), competence ("To
181 develop or maintain existing skills or to challenge oneself"), social affiliation ("To make new
182 friends or to be with existing friends"), health/fitness ("To improve or maintain health and
183 fitness") and appearance ("To improve one's appearance; to be more physically attractive")

184 motives. Responses are recorded on 7-point Likert-type scales ranging from 1 to 7, with 1
185 representing “not a PA related motive” and 7 representing “an important PA related motive”
186 (Frederick & Ryan, 1993; Ryan et al., 1997). Consistent with what is found in the literature
187 (Buckworth, Lee, Regan, Schneider, & DiClemente, 2007; Davey, Fitzpatrick, Garland, &
188 Kilgour, 2009; Frederick & Ryan, 1993; McLachlan & Hagger, 2011; Ryan et al., 1997; Sebire et
189 al., 2009; Sebire, Standage, & Vansteenkiste, 2011; Teixeira et al., 2012), enjoyment,
190 competence, and social affiliation motives were considered intrinsic, and the health/fitness and
191 appearance motives were considered extrinsic. Although our pilot test of the MPAM-R among 12
192 Grade 5-6 students indicated that children had no problem understanding and answering this
193 questionnaire, we used data from a random sample of 100 participants in cycle 1 to run a series of
194 exploratory (EFA) and confirmatory factor analyses (CFA) to verify the factor structure of the
195 tool among children (FACTOR and CALIS procedures in SAS, version 9.2; SAS Institute Inc.,
196 Cary, NC, USA.). Following the EFA, we reduced the number of items to include in the analyses
197 from 30 to 23 (Appendix 2). The 23-item based CFA yielded a Goodness of Fit index (GFI) of
198 0.91, an Adjusted-GFI of 0.90, a Normed Fit Index (NFI) of 0.92, a non-NFI of 0.94 (values \geq
199 0.9 indicate good fit for all the goodness-of-fit statistics), and a Root Mean Square Error of
200 Approximation of 0.06 (under 0.08 indicates reasonable fit for RMSEA) (Norman & Streiner,
201 2008). There was evidence of internal consistency for our version of the subscale scores given
202 Cronbach’s alpha coefficients for the enjoyment, competence, social affiliation, health/fitness and
203 appearance subscales in the first survey cycle of the current study were 0.85, 0.84, 0.79, 0.80, and
204 0.90, respectively. Similar Cronbach’s alpha coefficients were obtained for survey cycles 2 and 3.
205 For this analysis, MPAM-R scores were averaged over the three cycles to represent PA motives
206 in the past year.

207 *Demographic questions*

208 Data on age, sex and language were collected in the questionnaire. Socioeconomic status
209 was determined at the school level based on publicly available geospatial data (Government of
210 Canada, 2004).

211 ***Data Analysis***

212 Multi-level logistic regression was used to estimate the relationship between each PA
213 motive and participation in each of the four PA types. The multi-level framework accounted for
214 nesting of students within schools. Model 1 tested each motive individually. Model 2 included all
215 motives to reflect covariance among motives and to identify which motives most strongly
216 associated with PA type. Model 3 was the same as Model 2 with adjustment for sex, age,
217 language, and socioeconomic status. We used the same approach to investigate the relationship
218 between motives and attainment of PA recommendations. In the tables, we only present Models 1
219 and 3 since there were no meaningful differences between estimates obtained in Models 2 and 3.
220 All analyses were computed using R statistical computing software (Institute for Statistics and
221 Mathematics, 2012).

222 **Results**

223 Sixty-eight participants including 27 girls and 41 boys (9% of all participants), attained
224 the PA recommendation. Non-organized PA had the highest percentage of participation. Among
225 PA motives, enjoyment had the highest mean score followed by health/fitness, competence,
226 social affiliation and appearance (see Table 1). Soccer (n=109), ice hockey (n=98), and dance
227 (n=71) were the most commonly reported activities in the organized PA category; biking
228 (n=522), playing games such as tag and hide & seek (n=441), and walking for exercise (n=436)
229 were the most common activities in the non-organized category; ball-playing (n=362), dance

230 (n=300), and basketball (n=221) were the most common activities in the group-based category;
231 biking (n=592), walking for exercise (n=565), and playing games such as tag and hide & seek
232 (n=555) were the most common activities in the individual category. Consistent with previous
233 studies using the MPAM or MPAM-R (Frederick & Ryan, 1993; Ryan et al., 1997), the five PA
234 motives were correlated with one another (Table 2). Correlations among motives and the various
235 PA types as well as attainment of PA recommendations were generally weak.

236 In Model 1, all PA motives were positively associated with participation in at least one of
237 the four PA types ($p < 0.05$) (Table 3). However, when all PA motives were included in the same
238 model (Model 2), only enjoyment and competence (i.e., two intrinsic motives) were statistically
239 significantly associated with participation in at least one PA type. Further adjustment for
240 potentially confounding variables did not change the estimated parameters meaningfully (hence,
241 Model 3, but not Model 2 data are presented in Table 3). In adjusted models, enjoyment was
242 positively associated with organized PA. Specifically, the odds of organized PA were 54% higher
243 with each additional unit increase in the enjoyment motive score. Participation in group-based PA
244 was positively associated with competence motives. Each additional unit increase in the
245 competence motive score was associated with a 27% higher odds of participating in group-based
246 PA.

247
248 There were no statistically significant associations between PA motives and participation
249 in non-organized or individual types of PA in the fully adjusted models. A unit increase in the
250 competence motive score was associated with a two-fold increase in the odds of meeting PA
251 recommendations.

252 **Discussion**

253 In this study, differences in motives distinguished participants from non-participants in
254 four types of PA. This finding adds to previous research on the variability of motives and its
255 implications for the sustainability of PA practices and intervention design (Bong, 2001; Chen et
256 al., 2008). Consistent with adult findings (Buckworth et al., 2007; Davey et al., 2009; Deci &
257 Ryan, 2000; Frederick & Ryan, 1993; Ryan et al., 1997), intrinsic motives of competence and
258 enjoyment were associated with participation in organized and group-based PA among youth.
259 There were no significant associations between extrinsic motives and the four types of PA in
260 adjusted models.

261 Competence motives in the current study were positively related to group-based activities and
262 meeting PA guidelines, supporting earlier findings that belonging to a team helped task-oriented
263 physically active adults improve their physical performance (Davey et al., 2009). In addition, the
264 finding implies that challenge and skill development are important among active individuals
265 because competence motives better predicted adult participation in fitness and exercise than
266 enjoyment and body-related motives (Frederick & Ryan, 1993). Interventions that develop
267 competence-related PA motives may therefore increase group-based and organized PA
268 participation.

269 Similar to Frederick and Ryan (1993), higher enjoyment motives were associated with
270 participating in organized PA, which typically requires commitment and consistency in
271 participation (Aarnio et al., 2002). It is therefore possible that regular PA participation is
272 associated with endorsing high levels of enjoyment (i.e. intrinsic motive) for that activity
273 (Buckworth et al., 2007). Given it was not possible to establish the temporality of PA practices
274 among our participants, it is conceivable that our participants were maintaining rather than
275 initiating organized PA practices at the time of data collection. This would be consistent with

276 previous research showing that enjoyment motives are generally higher among consistently active
277 individuals (Buckworth et al., 2007) and are associated with long-term PA maintenance, longer
278 workouts (Ryan et al., 1997) and high exercise performance (Davey et al., 2009). The SDT
279 literature consistently reports a positive association between intrinsic motives and PA (Deci &
280 Ryan, 2000; García Calvo, Cervelló, Jiménez, Iglesias, & Moreno Murcia, 2010; Ryan et al.,
281 1997; Thøgersen-Ntoumani & Ntoumanis, 2006). Thus, the intrinsic motive of enjoyment could
282 be fundamental in PA interventions, especially for those targeting organized PA participation.
283 Studies investigating what may promote enjoyment among those who do not like organized PA
284 are needed to guide such interventions. Recent data support an association between positive
285 affect during exercise and increased MVPA participation in youth (Schneider, Dunn, & Cooper,
286 2009; Stych & Parfitt, 2011). In one study among low-active adolescents, the most pleasurable
287 experiences were recorded for the self-selected and low-intensity PA conditions. Participants
288 reported displeasure during high intensity PA, consistently describing uncomfortable physical
289 sensations of hurt, aches, and pains in the muscles as well as sweating, feeling hot, and breathing
290 more heavily (Stych & Parfitt, 2011). Interventions promoting low intensity organized PA may
291 be useful in fostering feelings of enjoyment in low-active youth.

292 In this study, appearance motive-related scores were lower than scores for the other motives.
293 This may relate to the young age (10-11 years) of participants who may not yet place the same
294 value on appearance as adults. While appearance is a strong motive for initiating PA (Davey et
295 al., 2009; Frederick & Ryan, 1993), appearance-related motives are not typically associated with
296 greater participation in or adherence to PA among adults (Buckworth et al., 2007; Frederick &
297 Ryan, 1993; Ryan et al., 1997). In fact, appearance motives were found negatively associated
298 with PA participation and mental health (Gillison et al., 2006; Ingledew & Markland, 2008;

299 Maltby & Day, 2001; Ryan et al., 1997; Strelan, Mehaffey, & Tiggemann, 2003). Intrinsic PA
300 motives that are related to the inherent value of being physically active may therefore be more
301 important in terms of PA participation than extrinsic PA motives.

302 Similar to our results, enjoyment and improving fitness and health were the two most
303 important reasons for participating in PA among adults (Sit, Kerr, & Wong, 2008). In our study,
304 models with these motives considered individually suggested that they are positively associated
305 with most PA types. However, fitness and health motives were not statistically significant at the
306 multivariate level because participants and non-participants in the four types of PA did not vary
307 considerably in fitness or health-related motives. This is consistent with the finding that
308 youthfrequent and occasional PA participants identify health motives as a reason for taking part
309 in PA (Mathieu Bélanger et al., 2011). The high prevalence of fitness and health motives may
310 therefore relate to youth being conditioned to simply repeat the prevailing message that being
311 physically fit is important. Alternatively, different motives may each explain a similar component
312 of the variance in PA participation, such that enjoyment and competence motives may have
313 suppressed the estimated influence of other motives in the multivariate models (Nathans, Oswald,
314 & Nimon, 2012). In this study, however, there were no meaningful multivariate associations
315 among the motives and the individual and non-organized PA types, although univariate
316 associations were observed. The associations may become more evident as youths age. This may
317 underscore the complex nature of coexisting motives for engaging in a specific PA, whereby all
318 motives have the possibility of being present at different intensities.

319 Limitations of this study include that although we studied five motives, it is possible that
320 other motives including social recognition, competition and stress management may underpin PA
321 participation in youth (Buckworth et al., 2007; Ingledew & Markland, 2008; Sebire et al., 2009).

322 Also, because examining motives associated with each specific PA would have required over a
323 thousand additional questions, it was not feasible to measure activity-specific motives.
324 Nevertheless, we were able to capture motives associated with participants' general PA practices.
325 Further, although our categorisation of motives as intrinsic or extrinsic is supported by previous
326 work (Buckworth et al., 2007; Davey et al., 2009; Frederick & Ryan, 1993; McLachlan &
327 Hagger, 2011; Ryan et al., 1997; Sebire et al., 2009, 2011; Teixeira et al., 2012), it is possible
328 that misclassification occurred. Misclassification may also have occurred in categorizing PA
329 types. There is no "gold standard" for the categorization of activities as organized, non-
330 organized, group-based or individual; however, our method was more rigorous than previous
331 attempts because it considered PA context (with whom participation usually took place). In
332 addition, although activities such as trampoline and jump rope can take place in an organized
333 setting in some regions, the categorization of some activities as non-organized in this study was
334 based on knowledge that they are not available in an organized setting in or around the
335 communities from which we sampled participants. Finally, the cross-sectional nature of our
336 analyses inhibits us from establishing directionality of our associations between motives and
337 types of PA. It is therefore possible that motives are not the reasons behind PA practices, but
338 rather that PA practices can lead to the development of different motives for continued
339 participation. It is also possible that the motives expressed are simply a reflection of participants'
340 feelings about the activities.

341 **Conclusions and recommendations for future research and practice**

342 This study is the first to report that PA motives are associated with PA types in youth.
343 Intrinsic motives of enjoyment and competence were associated with organized and group-based
344 PA, as well as with meeting PA guidelines. Despite some limitations, these findings, along with

345 previous research and theoretical tenets, support the idea that targeting intrinsic PA motives in
346 interventions for youth may increase participation in organized and group-based PA, as well as
347 increase the likelihood of meeting PA guidelines.

348 Given the importance attributed by children to enjoyment motives, it seems reasonable that
349 PA practitioners, schools and communities hoping to increase participation in organized PA aim
350 at making activities interesting, fun, and stimulating, notwithstanding the fact that we are unsure
351 of the direction of association between motives and physical activity participation. Similarly, to
352 increase participation in group-based PA, interventions may need to incorporate consideration of
353 competence motives by reinforcing skill development and enhanced performance and offering
354 realistic and attainable challenges through PA opportunities.

355 Future behavioral research on PA among youth should investigate these findings from a
356 longitudinal perspective to establish temporality. Examining the initiation, maintenance and drop-
357 out from PA and their association with motives could be useful in determining how to intervene
358 at critical stages of behavior change. Future studies should examine the underlying process
359 regulating these motives to gain a deeper understanding of PA motivation.

360

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- 529
- 530

531 **Appendix 1 - Classification of the 36 physical activities as non-organized, organized, group-**
 532 **based and individual**

533

PHYSICAL ACTIVITY	NON- ORGANIZED	ORGANIZED	GROUP-BASED	INDIVIDUAL
Home exercises (push-ups, sit-ups)	√			√
Weight training	√			√
Trampoline	√			√
Skipping rope	√			√
Indoor chores (vacuuming, cleaning)	√			√
Outdoor chores (mowing, gardening)	√			√
Games (chase, tag, hide and seek)	√		C	D
Baseball or softball	A	B	C	D
Basketball	A	B	C	D
Football	A	B	C	D
Soccer	A	B	C	D
Volleyball	A	B	C	D
Dance	A	B	C	D
Handball or mini handball	A	B	C	D
Ball-playing (dodge ball, kickball, catch)	A	B	C	D
Street hockey, floor hockey	A	B	C	D
Ice hockey	A	B	C	D
Ringette	A	B	C	D
Ice skating (not for hockey or ringette)	A	B		√
In-line skating	A	B		√
Skateboarding	A	B		√
Bicycling	A	B		√
Walking for exercise	A	B		√
Track and field	A	B		√
Jogging or running	A	B		√
Golf	A	B		√
Swimming	A	B		√
Gymnastics	A	B		√
Aerobics, yoga, exercise class	A	B		√
Badminton	A	B		√
Tennis	A	B		√
Kayak, canoe	A	B		√
Downhill skiing or snowboarding	A	B		√
Boxing, wrestling	A	B		√
Karate, Judo, Tai-chi ou Tae Kwon Do	A	B		√
Cross-country skiing	A	B		√

534 √ = automatically classified in this category

535 A = classified in this category if most often practiced alone, with siblings, with parents, with friends

536 B = classified in this category if most often practiced with an organized group or team

537 C = classified in this category if most often practiced with siblings, with parents, with friends or with an organized group or team

538 D = classified in this category if most often practiced alone

539

540 **Appendix 2 – List of *Motives for Physical Activity Measure-Revised (MPAM-R)* items**
 541 **included in the creation of the scores for each PA motive**
 542

PA MOTIVE	QUESTIONNAIRE ITEMS
Enjoyment	2*, 7*, 11*, 18*, 22*, 26, 29
Competence	3*, 4*, 8, 9*, 12, 14*, 25
Social Affiliation	6*, 15*, 21*, 28, 30*
Health/Fitness	1*, 13*, 16, 19*, 23*
Appearance	5*, 10*, 17*, 20*, 24*, 27*

543 * Item included

544

545 Table 1 – Selected characteristics of study participants (n=802)

546

	Cycle 1	Cycle 2	Cycle 3	Year 1
	Mean ± sd or n (%)	Mean ± sd or n (%)	Mean ± sd or n (%)	Mean ± sd or n (%)
Age (years)				10.7 ± 0.6
Sex, Boys				359 (45)
Socioeconomic status				
Low				198 (25)
Moderate				507 (63)
High				12
Language, French				527 (66)
Met PA recommendation	20	20	22	68 (9)
Participated ≥ once/wk in ...				
Organized PA				393 (49)
Non-organized PA				642 (80)
Group-based PA				489 (61)
Individual PA				634 (79)
PA motives				
Enjoyment	6.0 ± 1.2	5.9 ± 1.3	5.9 ± 1.3	5.9 ± 1.1
Health/Fitness	5.8 ± 1.3	5.6 ± 1.4	5.6 ± 1.4	5.6 ± 1.2
Competence	4.9 ± 1.7	4.9 ± 1.7	4.9 ± 1.8	4.9 ± 1.5
Social affiliation	4.9 ± 1.6	4.7 ± 1.7	4.6 ± 1.7	4.7 ± 1.4
Appearance	4.0 ± 1.9	3.9 ± 1.9	3.7 ± 1.9	3.9 ± 1.7

547 SD= Standard deviation

548

549 Table 2 – Point-biserial correlation^a and Pearson product moment correlation^b coefficients
 550 between study variables (n = 802)

551

	1 ^a	2 ^a	3 ^a	4 ^a	5 ^a	6 ^b	7 ^b	8 ^b	9 ^b	10 ^b	11 ^b	12 ^a	13 ^a
1. Met PA recommendation	1												
Participated in:													
2. Organized PA	0.08	1											
3. Non-organized PA	0.09	0.04	1										
4. Group-based PA	0.10	0.51*	0.18*	1									
5. Individual PA	0.04	0.09	0.50*	0.11	1								
PA Motives													
6. Enjoyment	0.14*	0.23*	0.08	0.23*	0.07	1							
7. Competence	0.18*	0.18*	0.10	0.24*	0.10	0.75*	1						
8. Social	0.12	0.03	0.04	0.10	0.04	0.54*	0.60*	1					
9. Health/ Fitness	0.09	0.11	0.08	0.16*	0.06	0.57*	0.70*	0.53*	1				
10. Appearance	0.00	-0.04	0.08	0.04	0.05	0.18*	0.40*	0.49*	0.57*	1			
Covariates													
11. Age	0.01	-0.01	0.04	-0.01	0.04	-0.05	-0.01	0.01	-0.02	0.00	1		
12. Sex	0.09	0.02	0.05	0.07	-0.05	-0.02	0.10	0.11	0.00	0.15*	0.00	1	
13. Language	0.04	-0.07	0.07	0.00	0.04	-0.12	0.02	-0.03	-0.11	-0.05	0.10	0.08	1

552 *p<0.0001

553

554 Table 3 – Odds ratio (OR) and 95% confidence intervals (CI) for meeting PA recommendations
 555 and for participation in four types of physical activity according to PA motives
 556
 557

Outcome	Motive	Model 1 OR (95% CI)	Model 3 OR (95% CI)
Met PA recommendations	Enjoyment	2.05 (1.44 – 2.92)*	1.17 (0.70 – 1.95)
	Competence	1.79 (1.41 – 2.26)*	1.95 (1.37 – 2.78)*
	Social	1.36 (1.12 – 1.66)*	1.07 (0.83 – 1.38)
	Fitness/Health	1.35 (1.05 – 1.74)*	0.85 (0.57 – 1.26)
	Appearance	1.00 (0.87 – 1.15)	0.84 (0.67 – 1.04)
Participation according to PA type			
Organized	Enjoyment	1.63 (1.40 – 1.91)*	1.54 (1.24 – 1.91)*
	Competence	1.26 (1.14 – 1.39)*	1.11 (0.96 – 1.27)
	Social	1.09 (0.99 – 1.21)	0.90 (0.78 – 1.03)
	Fitness/Health	1.25 (1.11 – 1.40)*	1.08 (0.89 – 1.32)
	Appearance	0.96 (0.89 – 1.04)	0.92 (0.82 – 1.04)
Non-organized	Enjoyment	1.17 (1.00 – 1.37)	1.08 (0.87 – 1.34)
	Competence	1.20 (1.06 – 1.35)*	1.17 (0.98 – 1.40)
	Social	1.05 (0.93 – 1.18)	0.89 (0.75 – 1.04)
	Fitness/Health	1.17 (1.02 – 1.35)*	1.03 (0.83 – 1.28)
	Appearance	1.12 (1.01 – 1.23)*	1.11 (0.96 – 1.27)
Group-based	Enjoyment	1.54 (1.34 – 1.76)*	1.21 (0.99 – 1.47)
	Competence	1.39 (1.26 – 1.53)*	1.27 (1.11 – 1.46)*
	Social	1.20 (1.09 – 1.32)*	0.95 (0.83 – 1.09)
	Fitness/Health	1.36 (1.21 – 1.53)*	1.13 (0.93 – 1.37)
	Appearance	1.05 (0.97 – 1.14)	0.95 (0.85 – 1.07)
Individual	Enjoyment	1.20 (1.02 – 1.40)*	1.13 (0.91 – 1.40)
	Competence	1.17 (1.04 – 1.32)*	1.13 (0.96 – 1.32)
	Social	1.06 (0.94 – 1.19)	0.92 (0.79 – 1.08)
	Fitness/Health	1.12 (0.98 – 1.29)	1.00 (0.81 – 1.24)
	Appearance	1.07 (0.97 – 1.18)	1.06 (0.93 – 1.22)

558 * p< 0.05

559 Model 1 = Multi-level logistic regression with each motive tested in separate models.

560 Model 2 = Multi-level logistic regressions with all motives tested in the same model, but not adjusted for other covariates.

561 Estimates are not presented since they are not different from Model 3 estimates.

562 Model 3 = Multi-level logistic regression with all motives tested in the same model adjusting for sex, age, language and
 563 socioeconomic status.