Beyond the Host Nation: An Investigation of Trickle-Down Effects in the "Hometowns" of Canadian Athletes who Competed at the London 2012 Olympic Games

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Abstract

Research question: Can evidence of trickle-down-effects be observed among youth living in the hometowns of Canadian athletes that competed and/or won medals at the London 2012 Olympic Games?

Research methods: Leisure-time physical activity (LTPA) rates of male and female youth were extracted from the Canadian Community Health Survey (n > 1,000,000) for 110 health regions during the pre-Olympic (2009/2010), Olympic (2011/2012), and post-Olympic (2013/2014) year periods. The health regions were treated as panel units and, beyond Canadian athletes and medallists, the panel data analysis incorporated population size and previous Olympic hosting as control variables in the model.

Results and Findings: The panel analysis revealed that the number of Canadian athletes representing youths' hometowns at the London 2012 Olympic Games was negatively associated with LTPA rates when considering the full sample of youth, and male youth in particular. Interestingly however, winning medals (of any colour) was positively associated with hometown LTPA rates among the full sample of youth and male youth. Hometown population size was negatively associated with LTPA rates for the full sample of youth and female youth specifically. Winning a gold medal and hosting previous Olympic/Paralympic Games were not significantly associated with hometown LTPA rates when considering the full sample of youth or male and female youth separately.

Implications: Our study demonstrates a need for researchers and sport managers to consider the spatial reach and scope of trick-down-effects beyond that which can occur within a host nation. These effects have the potential to be a global phenomenon.

***Keywords*:** Physical activity, sport participation, Olympic Games, sport media consumption, inspiration.

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Large scale investments associated with hosting mega-sport events such as the Olympic or Paralympic Games are often justified by governments based on positive impacts the events will have for local communities. Those who support hosting elite sport events often cite numerous positive impacts as justification for the commitment of public investment including increased spending at local businesses, job creation, increased tourism, improved destination image, legacy facilities and programs, and enhanced community pride and socialization (Brown & Massey, 2001; Gursoy & Kendall, 2006; Potwarka & Snelgrove, 2017). Government officials and bid stakeholders have also made claims that staging elite sport events will result in a *trickle-down effect* (TDE). This effect refers to a mega-sport event's capacity to increase sport and physical activity participation among host nation residents (Craig & Bauman, 2014; Taks et al., 2014; Weed et al. 2012). For the purposes of the current study, we are particularly interested in examining leisure time physical activity (LTPA), which is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen et al., p. 126); and which takes place during non-work/school time and time free from other obligations.

To date, evidence to indicate that staging mega-sport events raised participation in host communities has been mixed, and marginal at best (Weed et al., 2015). Indeed, not all studies relying on membership data or nationally representative surveys have shown positive relationships between event hosting or success in elite sport on grassroots participation in host communities (e.g., Veal et al., 2012). For example, population-level data collected after the Manchester 2002 Commonwealth Games revealed no impact on participation in sport-related activities or sport club membership (MORI, 2004). Veal (2003) found that in the year

following the Sydney Olympics, although participation in seven Olympic sports increased, participation decreased in nine others. Hodgetts and Duncan's (2015) examination of participation impacts of the Australian Surf Life Saving championships revealed limited evidence of a TDE.

That said, some studies in this area of inquiry have revealed important insights into whether, and under what circumstances there might be evidence of TDEs. For instance, research has suggested that TDEs can occur in certain contexts, such as when the sport is relatively novel in a community (Potwarka et al., 2020); in neighbourhoods and regions that housed Olympic venues (Potwarka & Leatherdale, 2016); when sport organizations leverage the event effectively (Misener et al., 2015); and as it relates to our study, when athletes win medals or championships (e.g., Frick & Wicker, 2016; Handstad & Skille, 2010; Haut & Gaum, 2018; Weimer et al., 2015).

Moreover, research has suggested that TDEs might be more pronounced among youth populations. Aizawa et al. (2018), for example, found that the long-term impact of the 1964 Tokyo Olympic Games was more prominent among those who were youth at the time of the event compared to older adult cohorts. Carmichael et al. (2013) reported that students and those in part-time employment positions were more likely to participate in moderately intense activities following the London 2012 Olympic Games compared to people who were employed full-time. As people age, areas of education, work, and family may be given priority over leisure and sport-related activities (Aizawa et al., 2018).

To date, however, explorations of TDEs in the context of Olympic Games have only focused on the extent to which participation increases within host nations. Extant TDE research often draws conclusions based on national-level participation data collected solely within host nations, and these studies are rarely delineated at regional, community, or

neighbourhood level (e.g., in the hometowns of athletes that win medals). Moreover, data are rarely delineated among particular sub-populations (e.g. male and female youth).

In other words, investigations of TDEs have almost exclusively focused on the extent to which participation increased among national-level samples of adult populations within host nations (e.g., Aizawa et al., 2018; Frawley, & Cush, 2011; Kokolakakis et al., 2019; Mahtani et al., 2013; Potwarka & Leatherdale, 2016; Ramchandani & Coleman, 2012; Ramchandani et al., 2017; Veal et al., 2012; Weimer et al., 2015). We advance the position that this approach to the study of TDEs, while useful, may not capture the full reach and scope of the TDE phenomena. It is possible that thousands of citizens and spectators can be inspired to participate within host communities, as a result of spectatorship, medal performances/role models, or as part of post-event participation legacy initiatives. However, millions more people from outside the host nation and around the globe tune in via television, or online formats to watch athletes from their communities compete for Olympic and Paralympic medals. Despite the potential role hometown athletes might play in increasing participation, they have yet to be considered in investigations of TDEs, particularly in the context of the Olympic Games.

Indeed, there has been a growing interest among researchers to examine impacts of mega-sport events in non-host regions (Chen & Misener, 2019). In particular, researchers have suggested that people from outside a host nation can be inspired to "participate" as they watch athletes win medals on television or online (Potwarka et al., 2017; Wicker & Frick, 2016). These participation increases can reflect the particular sport on display, non-Olympic sports, or physical activity more generally (Potwarka et al., 2016; Weed et al., 2012). Moreover, local, regional, and national media create "buzz" and excitement around particular athletes that are medal hopefuls. These narratives often reinforce athletes' connections to their hometowns, and often their experiences as a youth participating in sport in their

communities.Thus, the underlying research question of our investigation was: *Can evidence of trickle-down-effects be observed among youth living in the hometowns of Canadian athletes that competed and/or won medals at the London 2012 Olympic Games?*

Literature Review

Hometown Sport Media Consumption and Inspiration

The nature of youth's experience while consuming sport media or engaging with the "buzz" and excitement generated when local athletes compete or experience success on the world stage may play a critical role in understanding TDEs. What people think about and feel while watching the superior athletic performances and consuming media-related stories might influence decisions to try the sport on display or participate in physical activity (Lockwood & Kunda, 1999; Potwarka et al., 2017). Indeed, these participation decisions/behaviours can occur any time before, during, or after the conclusion of the event or an athletic performance.

To date, cognitive and affective mechanisms that might underpin TDEs have received limited attention in the scholarly literature. In particular, when describing TDEs, scholars often identify an affective state of "inspiration" as being the most salient mechanism involved in the process by which consuming sport-related media (e.g., watching local athletes perform on television broadcasts, reading news media and narratives about local athletes) might lead to increased participation (Boardley, 2013; Potwarka et al., 2017; Ramchandani & Coleman, 2012; Zhou et al., 2018).

The term "inspiration" is often used to explain a variety of social behaviors. Many people claim to have felt "inspired" by particular role models or events that they have witnessed (e.g., a star athlete, an outstanding musical performance). Moreover, individuals commonly cite exposure to a particularly "inspiring" event (e.g., witnessing an athlete win a medal) as triggering them to think or act in a manner previously held to be outside their realm of possibilities (Thrash & Elliot, 2003).

Thrash and Elliot (2003) argued that regardless of the social behavioral domain (e.g., leisure, sport, creative, spiritual) or stimuli (e.g., elite athletes/events), inspiration can be conceptualized and measured in terms of three core characteristics: transcendence, evocation, and approach motivation. According to the authors, *transcendence* refers to gaining awareness of better possibilities and is associated with notions of optimism, perceived competence, and self-esteem. *Evocation* refers to the idea that the experience of inspiration is drawn out of the individual by observation of an external event. In other words, people cannot feel directly responsible for becoming inspired; instead the experience must be induced by some external stimulus. Evocation is reflected in feelings of being overtaken, uncontrolled, or possessing a keen 'attraction from' or 'openness to' an object (Thrash & Elliot, 2003). Finally, Thrash and Elliot provided evidence that inspiration involves *approach motivation*. This characteristic suggests that an individual becomes compelled or energized to actualize their new idea or vision. This characteristic of inspiration is related to psychosocial variables such as intrinsic motivation and self-determination (Thrash & Elliot, 2003).

According to Lockwood and Kunda (1997), athletic role models provoke inspiration when they are perceived as being personally relevant to the individual. Thus, as it relates to evocation, hometown sport media consumption may serve to enhance youths' attraction to, and openness to the experience, which may increase the likelihood of evoking an inspired affective state (Dahl & Stengel, 1978; Hart, 1998; Thrash & Elliot, 2003). Moreover, consumer behaviour and media research have shown that perceived personal relevance with an external stimuli (e.g., consuming images and narratives of hometown elite athletes) can evoke increased attentional engagement and psychological involvement in the consumptive experience (Mittal, 1995; Zaichkowsky, 1985; 1994). Attentional engagement and psychological involvement can be salient predictors of behavioural responses to media content (Schreiner et al., 2019).

Hometown sport media consumption might also enhance opportunities for youth to experience approach motivation, which occurs when an individual becomes compelled or energized to actualize their new idea or vision (Thrash & Elliot, 2003). Psychosocial notions of place attachment (e.g., Scannell & Gifford, 2010) might play an important role in enhancing approach motivation. Sharing connections to a particular geographic region with elite athletes might strengthen the perceived personal relevance of watching elite athletes perform/win medals and consuming related media (Potwarka & Leatherdale, 2016). Youth, in particular, might identify with the narratives and experiences of elite athletes who grew up participating in the same community. In many cases, youth may perceive a special connection with elite athletes from their hometown because they share similar access to sport-related opportunities, coaches, and activity promoting infrastructure in the built environment. When youth perceive that all "right" elements are in place in their hometown to support relevant athletic development, they may experience increased self-efficacy and self-determination as it relates to participation (Deci & Ryan, 2012; Lockwood & Kunda, 1997; Thrash & Elliot, 2003).

Hometown media consumption might also enhance the likelihood of transcendent inspirational experiences, whereby youth gain awareness of better possibilities participating in sport or physical activities. Commentators and journalists often share stories about the "humble" beginnings of athletes participating in sport as youth in their hometowns. Consuming these images and narratives of hometown athletes participating in sport may influence what youth think about and how they feel while immersed in the viewing experience (Potwarka et al., 2017; 2020). In particular, consuming media in athletes' hometowns might increase the propensity for youth spectators to fantasize being an athlete competing in the sport on display (Madrigal, 2006). Indeed, vicarious sport media consumption has been shown to positively influence a state of inspiration (Potwarka et al.,

2017; Potwarka et al., 2020). As Lockwood and Kunda (1999) stated, "to be inspired by an outstanding other, one must be able to imagine an equally outstanding future self" (Lockwood & Kunda, 1999, p. 214).

There is no consensus in the TDE literature regarding what people will be inspired by while watching athletes from their hometown complete on television/online or consuming related media coverage. However, the more athletes that come from a particular hometown, the more likely one of them may trigger youth in that area to become inspired by their personality (e.g., Mutter & Pawlowski, 2014; Wicker & Frick, 2016) or success (e.g., Handstad & Skille, 2010; Haut & Gaum, 2018; Weimer et al.,2015). That said, it is possible that actually winning a medal (i.e., gold, silver, or bronze) might also be important for inspiring participation among hometown youth. Winning gold medals, in particular, may be a key underpinning of TDEs in hometown communities. Thus, as it relates to our research question, we propose the following hypothesis (H):

H1: The number of Canadian athletes representing youths' hometowns at the London 2012 Olympic Games will be positively associated with youth LTPA rates in the hometown.

H2: Winning a medal of any kind (i.e., bronze, silver, or gold) at the London 2012 Olympic Games will be positively associated with youth LTPA rates in the hometown.

H3: Winning a gold medal at the London 2012 Olympic Games will be positively associated with youth LTPA rates in the hometown.

Gender Differences and Inspiration

Research has suggested the extent to which youth are inspired by elite athletes might be related to gender (Frick & Wicker, 2016; Wicker & Frick, 2016). Male and female youth may react differently to elite athlete role models and sporting success. Hargreaves (2000), for example, noted the gendered nature of heroism. Gendered heroism reflects the idea that sporting heroes are socially constructed, and often reflect values associated with

stereotypically "masculine" traits of being "strong" "aggressive" and "brave" (Hargreaves). This dominant gender ideology privileges male athlete accomplishments, whereby male athletes can more easily be transformed and constructed into sporting heroes compared to female athletes (Hargreaves; Wicker & Frick, 2016). Although female athletes continue to resist and challenge this dominant gender ideology, their athletic successes are often downplayed or trivialized in comparison to their male counterparts (Coakley, 2017; Wicker & Frick, 2016). This trivialization of women's sporting accomplishments may be a key barrier to their being perceived as an elite sporting role models, and limit the inspirational effects of their performances. According to Frick and Wicker (2016), future studies should examine reasons why, compared to male identified athletes, female athletic successes may have less of a measurable inspirational effect on amateur sport participation.

Moreover, Frick and Wicker (2016) suggested that future research should whether (fe)males are more inspired by sporting success of (fe)males and vice versa. Insights into this question may be gleaned by examining social comparison research, which suggests that exposure to exemplary others can evoke positive motivational states under certain conditions (Festinger, 1954; Haidt, 2003; Lockwood & Kunda, 1997; Suls, Martin, & Wheeler, 2002). For instance, favourable "upward" comparisons to superior athletes may be more easily experienced when the athlete and youth share the same gender identity. Thus, we investigate gender differences in relation to our hypotheses.

Hometown Characteristics: Population Size and Previous Event Hosting

Unique characteristics of athletes' hometowns may play an important role in understanding the potential for TDEs beyond the host nation. In particular, the size of hometown population might be associated with changes in participation rates among youth. Studies have shown that the size of the population as well as population density and the percentage of urban population can partly explain differences in sports participation levels

between countries (Van Tuyckom, 2011) and between regions within the same country (Kokolakakis et al. 2014, 2017). Kokolakakis et al. (2017), for example, found that informal sport participation among adults was less likely to take place in urban areas of England.

Similarly, there is evidence to suggest that more densely populated urban areas might be less likely to experience TDEs. For example, Potwarka and Leatherdale (2016) did not find any changes in participation rates among youth living in metropolitan Vancouver from pre-to-post 2010 Olympic Winter Games. The authors explained this finding by suggesting that large urban centres often play host to many major sport events and are home to many elite athletes, which may "desensitize" residents and limit inspirational effects. The authors stated that TDE might be masked within prominent large urban centers that continually host elite sport events.

Moreover, there is evidence to suggest that previous Olympic and Paralympic Games hosting might also be associated with evidence of TDEs. Previous hosting often results in the development of sport and activity promoting infrastructure. Indeed, proximity and access to activity promoting infrastructure in the built environment, including parks, playgrounds and sport fields are well-documented correlates of PA and sport participation (Van Hecke et al., 2018).

As well, previous event hosting may serve to increase awareness of sport opportunities and elite athletes in a community. This increased awareness of sport and athletes may result from event leveraging initiatives designed to promote and educate youth about sport and physical activity in conjunction with the event (Chalip et al., 2017; Misener et al., 2015). Increased knowledge of sport and athletes generated by previous hosting may increase sport media consumption knowledge of youth for future events. To this end, Teare et al. (2020) found that previous knowledge of the sport and athletes, as well as spectator experiences that evoked intense feelings of being inspired while immersed in 2015 Pan Am

Games track cycling competitions were salient mechanisms involved in decisions to try a new sport on display. Population size and whether or not regions hosted Olympic/Paralympic events previously will be considered as control variables when testing our hypotheses.

Method

We advance the position that evidence of TDEs may be localized within certain non-host communities (i.e., in the hometowns of Canadian athletes that competed in and/or won medals at the London 2012 Olympic Games) and among particular segments of a population (e.g., male and female youth). Research has suggested that Statistics Canada provides the most valid and reliable source of data for this type of investigation (Montoya et al., 2013).

Statistics Canada is a federal government organization that produces statistics to help Canadians better understand their country - its population, resources, economy, society and culture (Statistics Canada, 2016a). In addition to conducting a census every five years, Statistics Canada oversees more than 350 active surveys on virtually all aspects of Canadian life (Statistics Canada, 2016a). The current study uses data from the Canadian Community Health Survey (CCHS), which measures LTPA rates among the Canadian population. The CCHS is a repeat cross-sectional nationally representative survey, with a central objective of gathering health-related data at the sub-provincial levels of geography (health region or combined health regions). The CCHS gathers data from 110 unique health regions across the country. Respondents are posed questions about the nature, frequency and duration of their participation in leisure-time physical activities. Data extracted from the CCHS represent two-year time period estimates. According to Frick and Wicker (2016), this type of secondary data should be preferred over primary sources to allow for more objective analyses of TDEs.

A challenge of studying TDEs is that there is no established temporal framework in which to investigate for evidence (Potwarka & McCarville, 2010). Therefore, we captured a time period from the years leading up to, and including the event, to several years after the

event (the London 2012 Olympics were held from July 27th to August 12th 2012). Moreover, the Olympic Games might inspire participation in Olympic-related sport activities, non-Olympic sports, or physical activity more generally (Potwarka et al., 2016; Potwarka & McCarville, 2010). Thus, we employ measures of "LTPA" because they can capture a wide range of possible behaviour changes that might be inspired by Olympic medal success (e.g., participation in a sport activity, working out at a gym, walking, running, cycling, etc).

Data Collection Procedures: Hometown Regions and Control Samples

Canada has a number of provinces that are spatially sub-divided into 110 health regions. Overall 275 athletes represented Canada at London 2012, of whom 270 resided in one of 60 Canadian health regions with the remaining five athletes residing outside Canada. There were 50 health regions that were not home to any athletes representing Canada at London 2012. Among the sub-sample of 270 athletes who resided in Canada, 56 athletes from across 33 health regions won a medal of any colour at London 2012. Two athletes from two separate health regions won a gold medal.

Canadian athletes won a total 18 medals at London 2012. These medals were won in the following sports: athletics (1), canoeing (3), cycling (1), diving (2), gymnastics (1), judo (1), rowing (2), soccer (1), swimming (3), weightlifting (1) and wrestling (2). Nine of the 18 medals were won in events contested by men and nine in women's events. The perceived discrepancy between the number of medallists (56) and the number of medals won (18) can be explained by medal success achieved in team sports (e.g. soccer), where a single medal is associated with multiple medallists.

A full list of the "hometown" health regions of Canadian athletes who competed in and/or or medalled at London 2012 is presented in Table 1. Three of the health regions shown in Table 1 -Vancouver Health Service Delivery Area; North Shore/Coast Garibaldi Health Service Delivery Area; and, South Vancouver Island Health Service Delivery Area - were a

host location for the 2010 Winter Olympic Games staged in the Canadian province of British Columbia.

[Insert Table 1 About Here]

LTPA rates of females and males, aged 12-19, were extracted from the CCHS 2009-2010 (pre-Olympic period; n = 1,007,499); 2011-2012 (Olympic period; n = 1,041,552); and 2013-2014 (post-Olympic period; n = 1,037,017). These data were extracted for each of the 60 "hometown" health regions of Canadian athletes, including the 33 health regions that were home to medallists. To better understand our results, LTPA rates were also extracted for the 77 health regions that were not home to an Olympic medallist from the 2012 Games, including 50 health regions that were not home to an Olympic athlete from Canada. These health regions served as a control sample for which to compare and interpret our findings.

CCHS respondents were classified as "active," "moderately active," or "inactive" based on an index of average daily physical activity over the past 3 months. For each leisure-time physical activity engaged in by the respondent, an average daily energy expenditure was calculated by multiplying the number of times the activity was performed, by the average duration of the activity, by the energy cost (kilocalories per kilogram of body weight per hour) of the activity (Statistics Canada, 2016b). The index was then summed to form an average daily expenditure for all activities. Respondents were classified based on the following criteria: 3.0 kcal/kg/day or more was defined as being physically "active;" 1.5 to 2.9 kcal/kg/day was defined as being "moderately active;" and less than 1.5 kcal/kg/day was defined as being "inactive" (Statistics Canada, 2016b). The "inactive" threshold represents the equivalent (in terms of activity duration and intensity) of walking less than 30 minutes per day; the "moderately active" threshold represents the equivalent of walking 30-59 minutes per day; and the "active" threshold represents the equivalent of walking more than 60 minutes per day (Canadian Institute for Health Information, 2011).

In accordance with Statistics Canada reporting and analysis procedures, the top two participation categories (i.e., active and moderately active) were amalgamated to form one category of "moderately active/active" individuals. Only variations in this amalgamated category were available for testing in our study. Specifically, participation data represented two-year period estimates of the proportion of females and males aged 12 to 19 that were classified as being "moderately active/active" for the years 2009-2010 (pre-Olympic period), 2011-2012 (Olympic period), and 2013-2014 (post-Olympic period).

Data Analysis

Two types of analyses were conducted on the data. First, we conducted a comparative analysis to test the extent to which there had been any recorded increases in youths' LTPA rates in the health regions with and without Olympic athletes and medallists between the pre-Olympic, Olympic and post-Olympic time periods. This analysis was conducted using SPSS version 24. Statistical inference was based on whether the likelihood of increases occurring in health regions that were home to athletes/ medallists was significantly different from health regions without any athletes/medallists

Second, the participation statistics for the 110 health regions available across the three time-series points were organised as a panel dataset, resulting in an overall sample size of 330 observations (i.e., 110 x 3). This data was examined in Stata for all youth (Model 1) as well as for male (Model 2) and female (Model 3) youth cohorts separately. All of the variables included in this analysis are outlined in Table 2. For the purposes of this investigation, we include population size and whether or not regions hosted Olympic/Paralympic events previously as control variables in subsequent analysis.

Because the scale version of the variable 'Medallist' was found to be highly correlated with the variable 'Athletes' ($r = 0.71$), the former was converted into a dummy measure. The dummy equivalent of the variable 'Gold' was identical to its continuous form. All of the

independent variables that were incorporated in the panel analysis had acceptable levels of correlation between them ($r < 0.7$) (see Tabachnick & Fidell, 2007).

[Insert Table 2 About Here]

The health regions' LTPA rates for each gender group, expressed in terms of proportions (i.e., in the range 0 to 1) were treated as the dependent variable in the panel analysis. As no observation took the limit values of 0 and 1, a beta regression, clustering by the variable 'health region' was deemed appropriate to model the panel dataset. A detailed discussion of the arguments in favour of the choice of a beta model can be found in Paolino (2001) and Kieschnick and McCullough (2003). In the case of proportions, one feature of the beta distribution is that it takes into account that the mean and the variance may be closely connected; a proportion variable with a mean close to either 0 or 1 generally has a smaller variance compared with a mean of 0.5. Thus, in a quantitative model, any covariate that has a large effect upon the mean is also likely to imply a heterogeneous variance (Paolino, 2001). In this respect, the beta distribution models heteroskedasticity in such a way that the variance is largest when the average proportion is near 0.5, while the mean assumes different values in different health regions depending on the values of the explanatory variables. Due to the fact that the beta model has a nonlinear form, the resulting regression coefficients do not measure the effect of the explanatory variables on the outcome probabilities directly. They can only be interpreted as log-odds (Smithson & Verkuilen, 2006) or, alternatively (as in this research), the so-called marginal effects can be used. A marginal effect is the predicted change in the dependent variable for a unit change in the explanatory variable, assuming that the effect does not change over the interval.

Results

Comparative Analysis by Olympic Athletes and Medallists

Table 3 presents the results of the comparative analysis of LPTA rates for health regions with and without Olympic athletes over the three time periods under review.

[Insert Table 3 About Here]

The hometown health regions of Olympic athletes were more likely, at face value, to demonstrate increases in LTPA rates among all youth compared with regions that were not home to any Olympic athletes. However, these observed differences in overall youth LTPA rates between health regions with and without Olympic athletes were not sufficiently large to be statistically significant ($p > 0.05$). The only statistically significant result found was for female youth. Specifically, hometown health regions were significantly more likely to demonstrate increases in LTPA rates for this particular demographic between the pre-Olympic and Olympic time period ($p < 0.05$).

When the data were analysed by Olympic medallists, no statistically significant results were returned ($p > 0.05$) among youth overall, and among the male and female youth cohorts separately, as evidenced by the statistics presented in Table 4.

[Insert Table 4 About Here]

Panel Analysis

The results of the beta regression conducted on the panel dataset are summarised in Table 5. Model 1 relates to all youth (LTPA_All), Model 2 relates to male youth only (LTPA_Male) and Model 3 relates to female youth only (LTPA_Female).

[Insert Table 5 About Here]

Model 1 shows that LTPA rates for all youth clustered for the 110 health regions were positively associated with the variables 'Medallist' ($p < 0.05$) but negatively associated with 'Athletes' ($p < 0.05$), as well as the control variable 'Population' ($p < 0.01$). The variable 'Gold' ($p > 0.10$) and the control variable 'Host' ($p > 0.05$) were not significant predictors of youth LTPA rates overall. The largest marginal effect in Model 1 was associated with

'Medallist'. The smallest marginal effects in Model 1 were related to the variables with significant negative associations with LTPA rates i.e., 'Population' followed by 'Athletes'.

Separate analysis of the LTPA rates of male (Model 2) and female (Model 3) samples provided mixed results. Consistent with the results of Model 1 for all youth, LTPA rates for male youth examined in Model 2 were positively associated with 'Medallists' ($p < 0.05$) and negatively associated with 'Athletes' ($p < 0.01$), with the former having the largest marginal effect. However, 'Population' and 'Host' (along with 'Gold') were not statistically significant control variables in this model. Model 3 illustrates that there were significant negative associations between LTPA rales of female youth and the control variable 'Population' ($p < 0.01$). None of the other variables in Model 3 had statistically significant coefficients.

Discussion

The underlying question guiding our investigation was: can evidence of trickle-down-effects be observed among youth living in the hometowns of Canadian athletes that competed and/or won medals at the London 2012 Olympic Games? The separate comparative analyses incorporating health regions with and without athletes/medallists produced largely insignificant findings. However, based on the results of the panel analysis, we advance the position that researchers and sport managers should re-think the full reach and scope of TDEs. In particular, our findings suggest that youth residing in the same hometowns as athletes that win medals might be more susceptible to the TDE compared to samples of youth from more generalized populations. Moreover, the results suggest that TDEs may be more prominent among youth living in less densely populated areas. We interpret and explain our findings in relation to each hypothesis below.

H1 (i.e., the number of Canadian athletes representing youths' hometowns at the London 2012 Olympic Games will be positively associated with youth LTPA rates) was not supported. Contrary to expectations, we observed significant negative associations between

the number of athletes representing hometowns and LTPA rates among all youth (i.e., full sample) and male youth. One possible explanation for this counter-intuitive finding might emerge from a scan of the literature related to media and advertising clutter. The more athletes that represent a particular community, the more media-related narratives and images dedicated to each athlete. Consistent with research on media and advertising clutter (e.g., Elliot & Speck, 1998; Ha & McCann, 2008), this coverage may create a context where it becomes difficult for athletes to stand out and make personally relevant connections with youth in their hometown community. Winning a medal, however, might be the key factor that allows athletes in these communities to stand out and have an inspirational effect.

H2 (i.e., winning a medal of any kind at the London 2012 Olympic Games will be positively associated with youth LTPA rates) was partially supported. As expected, we observed significant positive associations between winning medals and hometown LTPA participation rates among the full sample of youth and male youth in particular. The nature of youth's experience while watching local athletes compete and/or experience success on the world stage may play a critical role in understanding these observed relationships. For instance, witnessing athletes win medals might increase the perceived personal relevance of medallists, which has been shown to be necessary condition to be inspired by an outstanding other (Lockwood & Kunda, 1999). These athletes may become personally relevant to youth because of shared connections that exist within hometown areas (e.g., programs, supporting infrastructure, coaching, etc.).

Moreover, the cognitive and affective nature of the sport consumption experience might also help explain these results. For example, hometown youth may be more likely to fantasize participating in the action and envision a future self participating in the sport on display compared to youth from other geographic areas. Fantasizing and envisioning a future self participating in an activity has been shown to increase feelings of inspiration, which in

turn, can influence behavioural responses to the media-related stimuli (Lockwood & Kunda, 1999; Potwarka et al., 2017; 2020; Thrash & Elliot, 2003).

H3 (i.e., winning a gold medal at the London 2012 Olympic Games will be positively associated with youth LTPA rates) was not supported. However, we must be extremely cautious when interpreting and explaining this particular finding because of the 110 health regions under investigation, only two regions (i.e., Région du Nord-du-Québec and York Regional Health Unit) had gold medals associated with them. Counter to our expectations, it is entirely possible that some female youth in particular may experience a discouragement effect in response to gold medals, on the basis that the coefficient for this variable in Model 3 was negative and close to being statistically significant ($p = 0.06$) even with just two individual gold medallists (both female athletes) in our sample. This effect can occur when youth perceive the performances (and the requisite skills and abilities) necessary to win the gold medal as being unmatchable (Hindson et al., 1994). In these instances, youth can become apathetic toward sport-related behaviour and decide not to participate (Potwarka et al., 2016). It is important to note that compared to males, youth females may be more susceptible to experience a discouragement effect because they often face more structural barriers and constraints to physical activity and sport-related participation (Laar et al., 2019).

Male and female athletes representing Canada won an equal share of the nation's medals at London 2012 (i.e. 9 of the 18 medals achieved by Canada were won in events contested by men and 9 were won in women's events). However, there were more than twice as many female medal-winning athletes (39) than male medal-winning athletes (17) from Canada. While our study does not examine explicitly whether the performances of male and female athletes representing Canada at London 2012 were separately associated with changes in the LTPA rates of male and female youth, our findings do illustrate that male and female youth responded differently to medal winning athletes. It is not immediately clear whether

male youth were inspired by the medal success of male and female athletes in equal measure. However, consistent with Frick and Wicker (2016), we contend that medal success and specifically the medal success of female athletes might be perceived as being less inspirational by female youth in particular. This point lends support to the notion of gendered heroism (Hargreaves, 2000) and the tendency to trivialize the sporting achievements of female athletes (Coakley, 2017; Wicker & Frick, 2016). It is not possible to make similar inferences for our hypotheses relating to gold medals and athletes, because the former was not significantly associated with youth LTPA rates for both genders, and for the latter there was a significant negative association with LTPA rates for male youth and no significant association with LTPA rates for female youth.

As it relates to our control variables, we observed significant negative relationships between hometown population size and LTPA rates among the full sample of youth and youth females in particular. These findings indicate that the influence of athletic success on LTPA might be more pronounced within less densely populated hometowns. This finding is consistent with previous research (e.g., Kokolakakis et al., 2017), which has suggested that certain types of sport participation are less likely to take place in urban areas. Moreover, Potwarka and Leatherdale (2016) suggested that hosting the Olympic and Paralympic Games may be less likely to result in a trickle-down effect in larger urban centres because they often play host to multitude of major sport events and are home to many elite athletes, which may "desensitize" residents and limit inspirational effects. Thus, large urban centres may limit the ability for youth to make connections with elite athletes, and be inspired by their success compared to smaller, less densely populated hometown areas (Potwarka & Leatherdale, 2016). In less populated areas, medallists may be more likely to dominate local news and media cycles for longer periods of time.

The control variable of previous event hosting (i.e., hosting an event for the Vancouver 2010 Olympic Winter Games) was not significantly associated with hometown LTPA rates among youth. This finding is somewhat surprising given that regions that host previous Olympic and Paralympic Games often benefit from the development of new sport and recreation infrastructure (e.g., facilities, sports fields, parks, and stadia). If they are effectively planned and promoted for public use after the Games, these developments have the potential to be positive environmental correlates of post-event participation (Hiller, 2006; Van Hecke et al., 2018).

Management and Policy Implications

Our results have three important management and policy implications. First, efforts must be made to support athlete development pathways. To this end, our findings underscore the importance of identifying, investing resources and supporting medal hopefuls at the local level. Training and development efforts that help athletes earn positions on the podium, particularly in team sport contexts might prove beneficial to realizing a trickle-down effect. If a nation is successful in team sport events like football, then more of its athletes are in receipt of medals compared to the number of medal winning athletes in an individual sport context.

Second, media narratives that emphasize shared connections with medallists' hometowns may be particularly important in commentary and coverage of events. Media stories that profile how athletes became involved in sports in their community might increase the perceived personal relevance of the athletes in the minds of youth. As noted, perceived personal relevance has been identified as a key antecedent of being inspired by an outstanding other (Lockwood & Kunda, 1999).

Third, our findings suggest a need to address Frick and Wicker's (2016) notion of gendered heroism. In the current study, there were more than twice as many female medal-winning athletes than male medal-winning athletes. However, this trend seemed to have a

disproportional (and rather limited) inspirational effect among the samples of female youth under investigation. Consistent with previous research (Pergoraro et al., 2019), we advocate for more equitable media representation and promotion of elite female athletes and their elite sporting successes. Indeed, previous research has found that the portrayal of women athletes is often quite gendered. As noted by Mean and Kassing (2008), "gender remains the primary categorization of women athletes, re-producing female athletes as women who play sport rather than as athletes first and foremost" (p.127). Thus, women athletes are often referred to as mothers by the media, and images and narratives often focus on their femininity instead of their athletic abilities and achievements (Mean & Kassing, 2008).

Limitations and Future Research

Some of the results from our study are supportive of a TDE linked to the medal success of Canadian athletes at London 2012 (i.e., medals of any kind) and particular hometown characteristics (i.e., population size). However, the significant relationships that emerged from our analyses cannot be confirmed as being causal in nature. Our study utilises cross-sectional LPTA data relating to youth populations at different points in time. To overcome this limitation, longitudinal research involving the same people is required to draw stronger inferences about changes in LPTA and its attribution to Olympic medal success.

Capturing evidence of TDEs is extremely complex. As with any non-experimental (field research) methodological design, it is extremely challenging to isolate the unique influence of Olympic-related stimuli and measure its direct impact on subsequent changes in participation. In the current study, we were not able to account for a myriad of other factors that may have influenced participation in particular hometowns. For instance, the London 2012 Olympic and Paralympic Games were not the only major sport events televised and covered by media during the time periods covered in the current study. It is possible that media consumption of other major events and non-Olympic hometown athletes might also

explain some of our findings. Little is known, for example, if consuming Olympic and Paralympic-related media is more likely to inspire participation compared to other mega and non-mega events that connect audiences to hometown athletes.

Thus, further investigations with youth living in the hometowns identified in the current study are needed to develop a better understanding of the significant relationships we reported, and the mechanisms that might be at play. In other words, further primary research is required to address the question: what is it about hometown connections and Olympic/Paralympic media consumption in particular that might inspire participation? For example, future research might explore relationships between how athletes are framed, positioned, and discussed in local and national media coverage and their subsequent influences on inspiration and post-consumption participatory behaviour. Future research might also consider examining what makes watching athletic performances and competitions particularly inspiring? What specific images and narratives embedded within media coverage and commentary tend to evoke feelings of inspiration and post-consumption desires to participate? In the same way, it might also be useful for future research to establish conditions by which consumptive experiences trigger a discouragement effect for some individuals.

Finally, our dataset used does not enable us to make inferences about changes in LTPA at a sport-specific level. Subject to the availability of sport-specific data, it would be worthwhile to test whether changes in LPTA are observed in those sports in which hometown athletes won medals. Moreover, the data we employed to test our hypotheses did not allow us to make inferences about the extent to which changes in rates of LTPA reflected decisions to participate in new sport opportunities, or simply increase the frequency and/or duration of activities youth already participate in. Future research might benefit from delineating the

influence of elite athletes' success on different participatory outcomes of TDEs in hometown regions.

Conclusion

The current study is intended to stimulate a debate among researchers about the potential reach and scope of TDEs. Our findings lend some support to the notion that participation impacts associated with major sporting events are not necessarily limited to the host nation and can be global in their reach. Results suggest that evidence of TDEs can be observed among youth living in the hometowns of Canadian athletes that won medals at the London 2012 Olympic Games. Although the total number of athletes representing a hometown at the Games was significantly negatively associated with youth LTPA rates (for the full sample of youth and male youth cohorts), winning medals (of any colour) was positively associated with hometown LTPA rates among the full sample of youth and male youth. Moreover, positive changes in youth LTPA seemed to be more pronounced among male youth and in less populated hometowns. Future research should continue to examine the complexity of these relationships by making efforts to isolate the unique elements of hometown Olympic and Paralympic media consumptive experiences that contribute to feelings of inspiration and decisions to participate.

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Table 1: Number of Canadian athletes and medallists at London 2012 by health region

Health Region	Athletes	Medallists (Gold Medallists)
Prince Edward Island	1	0 (0)
South Shore/South West Nova	1	0 (0)
Colchester East Hants/Cumberland	1	0 (0)
Pictou County/Guysborough Antigonish Strait	1	0 (0)
Capital District Health Authority	7	1 (0)
Région du Bas-Saint-Laurent	1	0 (0)
Région de la Capitale-Nationale	8	1 (0)
Région de la Mauricie et du Centre-du-Québec	3	1 (0)
Région de l'Estrie	1	0 (0)
Région de Montréal	25	3 (0)
Région de l'Outaouais	3	0 (0)
Région du Nord-du-Québec	1	1 (1)
Région de la Chaudière-Appalaches	2	0 (0)
Région de Laval	7	2 (0)
Région de Lanaudière	1	0 (0)
Région de la Montérégie	8	1 (0)
Durham Regional Health Unit	9	1 (0)
Grey Bruce Health Unit	1	0 (0)
Haliburton, Kawartha, Pine Ridge District Health Unit	2	2 (0)
Halton Regional Health Unit	7	3 (0)
City of Hamilton Health Unit	3	1 (0)
Hastings and Prince Edward Counties Health Unit	1	1 (0)
Kingston, Frontenac and Lennox and Addington Health Unit	3	2 (0)
Lambton Health Unit	1	1 (0)
Leeds, Grenville and Lanark District Health Unit	2	1 (0)
Middlesex-London Health Unit	7	1 (0)
Niagara Regional Area Health Unit	4	2 (0)
Northwestern Health Unit	1	0 (0)
City of Ottawa Health Unit	3	0 (0)
Peel Regional Health Unit	9	4 (0)
Perth District Health Unit	3	0 (0)
Peterborough County-City Health Unit	1	0 (0)
Renfrew County and District Health Unit	1	0 (0)
Waterloo Health Unit	4	0 (0)
Wellington-Dufferin-Guelph Health Unit	2	0 (0)
Windsor-Essex County Health Unit	1	0 (0)
York Regional Health Unit	13	1 (1)
City of Toronto Health Unit	24	2 (0)
Winnipeg Regional Health Authority	5	2 (0)
Northern Regional Health Authority	1	1 (0)
Regina Qu'Appelle Regional Health Authority	4	2 (0)
Saskatoon Regional Health Authority	4	1 (0)
South Zone	3	0 (0)

Calgary Zone	7	2 (0)
Edmonton Zone	5	0 (0)
Okanagan Health Service Delivery Area	4	0 (0)
Thompson/Cariboo Health Service Delivery Area	3	0 (0)
Fraser East Health Service Delivery Area	4	2 (0)
Fraser North Health Service Delivery Area	7	3 (0)
Fraser South Health Service Delivery Area	2	0 (0)
Richmond Health Service Delivery Area	3	0 (0)
Vancouver Health Service Delivery Area	12	4 (0)
North Shore/Coast Garibaldi Health Service Delivery Area	6	1 (0)
South Vancouver Island Health Service Delivery Area	15	3 (0)
Central Vancouver Island Health Service Delivery Area	4	1 (0)
North Vancouver Island Health Service Delivery Area	4	0 (0)
Northwest Health Service Delivery Area	1	1 (0)
Northeast Health Service Delivery Area	1	1 (0)
Yukon	1	0 (0)
Northwest Territories	1	0 (0)

Table 2: Overview of dependent and independent variables for panel regression

Variable	Description	Type	Measure
LTPA_All	LTPA rates of all youth (aged 12-19 years) per health region	Dependent	Proportion
LTPA_Male	LTPA rates of male youth (aged 12-19 years) per health region	Dependent	Proportion
LTPA_Female	LTPA rates of female youth (aged 12-19 years) per health region	Dependent	Proportion
Athletes	Number of athletes represented at London 2012 per health region	Independent	Continuous
Medallist	Whether athletes from the health region won a medal of any colour at London 2012	Independent	Dummy (0=no, 1=yes)
Gold	Whether athletes from the health region won a gold medal at London 2012	Independent	Dummy (0=no, 1=yes)
Host	Whether the health region was a host location for the 2010 Winter Olympics	Control	Dummy (0=no, 1=yes)
Population	Total population per health region	Control	Continuous

Table 3: Percentage of health regions with increases in youth LTPA rates between different time points split by athlete representation at London 2012

Time period	Not represented (n=50)	Represented (n=60)	Difference	Z	P
LTPA_All					
Pre – Olympic	46.00%	55.00%	-9.00%	-0.940	0.347
Olympic – Post	42.00%	50.00%	-8.00%	-0.838	0.401
Pre – Post	44.00%	51.67%	-7.67%	-0.801	0.424
LTPA_Male					
Pre – Olympic	47.92%	51.67%	-3.75%	-0.387	0.697
Olympic – Post	48.84%	52.54%	-3.71%	-0.370	0.711
Pre – Post	53.49%	50.85%	2.64%	0.264	0.795
LTPA_Female					
Pre – Olympic	38.30%	57.63%	-19.33%	-1.978	0.048
Olympic – Post	57.14%	42.37%	14.77%	1.464	0.144
Pre – Post	48.84%	59.32%	-10.48%	-1.051	0.294

Table 4: Percentage of health regions with increases in youth LTPA rates between different time points split by athlete medal success at London 2012

Time period	No medal (n=77)	Medalled (n=33)	Difference	Z	p
LTPA_All					
Pre – Olympic	49.35%	54.55%	-5.19%	-0.499	0.617
Olympic – Post	49.35%	39.39%	9.96%	0.960	0.337
Pre – Post	50.65%	42.42%	8.23%	0.791	0.430
LTPA_Male					
Pre – Olympic	50.67%	48.48%	2.18%	0.209	0.834
Olympic – Post	53.62%	45.45%	8.17%	0.772	0.441
Pre – Post	56.52%	42.42%	14.10%	1.333	0.184
LTPA_Female					
Pre – Olympic	46.58%	54.55%	-7.97%	-0.760	0.447
Olympic – Post	52.94%	39.39%	13.55%	1.278	0.201
Pre – Post	55.07%	54.55%	0.53%	0.050	0.960

Table 5: Panel regression results (110 health regions x 3 time points)

Variable	Model 1 (Dependent variable: LTPA_All)			Model 2 (Dependent variable: LTPA_Male)			Model 3 (Dependent variable: LTPA_Female)		
	Coef. (S.E.)	**M.E.**	**p**	**Coef. (S.E.)**	**M.E.**	**p**	**Coef. (S.E.)**	**M.E.**	**p**
Athletes	-0.0177 (0.0079)	-0.0035	0.024*	-0.0302 (0.0100)	-0.0052	0.003**	-0.0074 (0.0105)	-0.0016	0.479
Medallist	0.2088 (0.0827)	0.0394	0.012*	0.2685 (0.1062)	0.0436	0.011*	0.1488 (0.1193)	0.0314	0.212
Gold	-0.0957 (0.0990)	-0.0192	0.334	0.0349 (0.1148)	0.0059	0.761	-0.2154 (0.1170)	-0.0483	0.065
Population	-1.09e-07 (2.89e-08)	-2.14e-08	0.000***	-5.94e-08 (3.99e-08)	-1.03e-08	0.137	-1.44e-07 (4.09e-08)	-3.11e-08	0.000***
Host	0.1919 (0.1153)	0.0360	0.096	0.1028 (0.1145)	0.0173	0.369	0.3541 (0.2904)	0.0715	0.223
Constant	1.0340 (0.0268)	—	0.000***	1.2724 (0.0359)	—	0.000***	0.8109 (0.0311)	—	0.000***
Phi	42.1523 (3.6014)			24.3514 (2.5164)			25.0926 (2.2874)		
Wald chi-square [df]	43.73 [5]		0.000***	27.54 [5]		0.000***	29.91 [5]		0.000***
Log pseudolikelihood	425.15			354.68			312.84		

Standard Errors (S.E.) adjusted for 110 clusters in health region; M.E. = Marginal effects.
** p < 0.05; ** p < 0.01; *** p < 0.001.