Research Article

The Ecological Model of Sprinting Determinants of Jamaican Athletes

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Abstract

Introduction: Studies have found that athletes from certain regions enjoy unparalleled success on track and field events and usually dominate the sprint events at the Olympics and World Championship Games. Historically, Jamaican men athletes dating back to 1952 have held world records in the 100m and 200m sprints and the 4x100m, 4x200m and 4x400m relays. In spite of the prowess of Jamaican athletes in the sprinting events at the Olympics or World Championship Games, a study has never been conducted on using the ecological model to examine these athletes.

Objectives: The aim of the study is to show how an established ecological track and field model can impact the performance of athletes. The ecological model was used to identify environmental determinants and influences that interacted to affect participation of athletes from Jamaica at the Olympics and/or World Championships Games (elite games).

Materials and Methods: The original number of athletes who initially participated was 120 but was collapsed to 63 because of incomplete information from some of the athletes. All the athletes had represented Jamaica at international games including the Olympic and World Championships Games (elite games), the Commonwealth Games, the Pan American Games, Junior World Championships, World Youth Championships and the CARIFTA Games. The athletes were divided into three groups based on athletic disciplines: sprint (s: 100-400m, n=40), jump and throw (j/t: jump and throw, n=13), and middle distance (md: 800-3000 m, n=10). Although Jamaica is not usually successful internationally in middle distance events (800-3000m), these athletes were included in the study to investigate the possibility of disproportionate number of athletes originating from a particular geographical area being the result of an abundant prominence of athletics in that area. The groups were further sub-divided into those who represented Jamaica at the Olympic Games and the World Championships (elite games) and those who represented Jamaica at other international games such as Pan-American, Commonwealth, World Junior Championships, World Youth Olympics, World University Games and the CARIFTA Games (sub-elite games). Each participant was given a questionnaire. The questionnaire used was written in English and modeled off studies done on world class athletes from Kenya and Ethiopia. Questions were simple and were explained to those who could not easily understand. The questions were designed to obtain the following information. Determinants were: domicile characteristics of the sexual partners of the athlete's parents, locality of athlete's grandparents, intra island migration pattern of athlete, school which the athlete attended and county in Jamaica where an athlete lived. Important influences were: place of birth, age and athletic discipline. In the track and field ecology model, county or place of birth in Jamaica influenced whether an athlete was selected to participate in elite games. Place or county where an athlete resides determined whether an athlete was likely to medal in the elite games. The data were entered, stored and retrieved using the Statistical Packages for the Social Sciences, Version 22 for Windows. The level of significance that is used to determine statistical significance is less than 5% (0.05) at the 2-tailed level of significance. Cross tabulations were used to indicate statistical associations and binary regression was used to check for influence of independent variables on a dependent variable.

Findings: Of the sampled respondents (n=63), 49.2% were males, 96.8% spoke English and 95.2% were born in Jamaica, 39.7% were born in Middlesex, 71.4% and 12.7% of those who represented the country lived in Surrey and overseas respectively, 39.7% participated in the short sprints (100m and/or 200m), and 23.8 % participated in the 400m.

Those participating in the sprints (100-400m) accounted for 63.5% of participants. Of the sampled population only 26.9 % went to the elite games (Olympics and or World Championships) with the remainder (73.1%) participating in the other games. Athletes who were born in Middlesex with reference to Cornwall were 0.95 time less (OR=0.05, 95% CI: 0.002-1.14) likely to participate in the elite games. This means that athletes who were born in Cornwall in reference to those born in Middlesex were more likely to participate in the Olympics or World Championships, with no difference emerging between those born in Cornwall and Surrey.

Conclusion: The ecological model of track and field for Jamaicans showed that residency in urban areas increases the chance of gaining a medal in the Olympics or World Championships and those athletes usually move to the urbanized county to increase the chance of selection to these elite games.

Keywords: Determinants; Ecological model; Jamaican athletes; Medical sociology; Olympics; Track and field

Abbreviations

MM: Mother's Mother; MF: Mother's Father; FM: Father's Mother; FF: Father's Father

Introduction

Ecological models that take into consideration environmental synergies can be used to elucidate factors that impact physical performance [1]. An ecological model can provide a set of theoretical principles that aid in understanding the interconnectivity among a wide range of personal and environmental factors. From an ecological perspective, the potential for performance modification within groups such as athletes in a population can be considered within the contexts of friends, family and neighborhood [2]. Ecological models can be robust in physical activity because of the several physical activity multi-level prototypes that include individual, social and environmental variables. Because performance or activity is enhanced in specific settings, studies have established statistical relationship between physical activity and a wide range of environmental variables to include socio-physical settings [3]. A school based setting in particular consisting of individual and environment components can improve physical fitness [4], increase the likelihood of participation at the elite level and winning of a medal in competition. In the physical activity constructs in Jamaica, a talented student is identified is transferred to a school with a history of students who have represented the country at the regional and national levels. The transferred student is thus placed with a cohort of students performing at or above the transferee's level. Equipment for training and resources become readily available and the transferred student athlete is likely to be selected as a national representative [5]. The band for athletic selection is thus narrowed to basically contain a selected group.

In 2014, Jamaica has a population of 2,723,246 people (female, 1,375,203; male, 1.348,043) distributed in 3 counties namely Cornwall, Middlesex and Surrey, and fourteen parishes comprise the three counties [6]. The country is English speaking however persons in less urbanized areas of Jamaica speak patois, a mix of English and the languages of their ancestors from Africa. The country's population according to a United Nations report consists of people mainly of African descent [7] whose ancestors originated from West and West-Central Africa [8]. Genetic profile which includes African haplotypes

has been linked to increased participation in certain athletic events [8]. Environment determinants, however, enhance greatly the chance of success at the elite level as illustrated by the Ethiopian and Kenyan runners from particularly mountainous regions in those countries [9,10]. Intervention in athletic through environmental setting has being going on in Jamaican high schools for more than 100 years [5]. The issue of the physical performance of athletes is a bio-medical matter and the inclusion of social determinants (i.e., ecological model of sprinting determinants) make the matter medical sociology.

For centuries, Jamaican sporting administrators including coaches have been utilizing a track and field model to select likely prospective athletes at the junior level to become senior participants. Initially, the matter athletic performance was not viewed from a bio-medical perspective in Jamaica; but with the prowess of Usain Bolt, Veronica Campbell-Brown, Shelly-Ann Fraser-Pryce, and Asafa Powell among others, the matter of the physical performance of athletes (i.e., track and field model) is now widely studied from a bio-medical vantage point. Because of an understanding of this track and field model, certain schools in Jamaica have had an over representation of athletes who have gone on to win numerous elite games medals. The Jamaican ecological model for selection to national teams has shown that school based intervention through emersion in the athletic setting in a particular school in a particular region of Jamaica is an important factor in the grooming of an athlete to represent Jamaica at the regional level (sub-elite games). Other factors however are important if the athlete wishes to transcend to the elite level. Mentoring is very important but mentoring commonly takes place at traditional schools in areas known to produce Olympic and World Champions [5]. In Jamaica as soon as a young talent shows athletic potential an older retired athlete is likely to move the young athlete into his or her home and to the school the retired athletes previously attended. The athlete is thus mentored by someone who is experienced and has performed at the international level. The athlete becomes fully immersed in school based mentorship supported by the retired Olympians and other Olympians from that school who are friends of the retiree. Most of retired athletes even if their parents and grandparents originated in another county in Jamaica were likely to be living in the county of Surrey as this county has the capital of Jamaica and is very urbanized with piped water and modern amenities [11]. Thus most national representatives who have performed admirably at the international levels tend to live in a certain region of Jamaica or outside of Jamaica
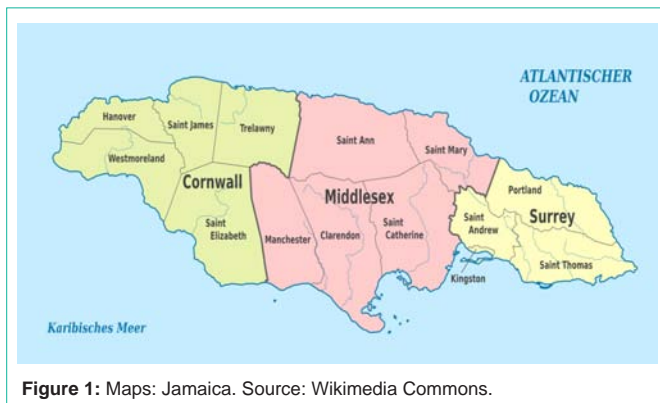
Figure 1: Maps: Jamaica. Source: Wikimedia Commons.

in areas of the developed countries populated by retired Jamaicans who have been national representatives. The model of athletic setting extends outside of Jamaica to some areas in the developed countries because retired Jamaican Olympians who have attended school overseas are often recruiters for these schools of young emerging Jamaican talents [5] (Figure 1).

Theoretical framework

A constructed ecological model of physical attributes and environmental influences produces the theoretical framework that may elucidate the reasons for Jamaica's sustained performance for over seven decades at elite international athletic games such as the Olympics and World Championships [5]. The present study will employ the ecological model in order to examine which Jamaican athletes are likely to performance at a high level among the elite athletes. This research, therefore, highlights the environmental and contextual correlates that may have contributed to an ecological theoretical model that determined participation of Jamaican track and field athletes at the elite games. The aim of the study is to show how an established ecological track and field model can impact the performance of athletes. The ecological model was used to identify environmental determinants and influences that interacted to affect participation of athletes from Jamaica at the Olympics and/or World Championships Games (elite games). The research also indicates what factor has the most important influence on an athlete' medal prospect at Olympics and/or World Championships games.

Methods

The study was approved by the Ethics Committee of the University of the West Indies, Kingston, Jamaica in the spirit of the Helsinki Declaration. The experimental procedures were in accordance with the policy statement of the American College of Sports Medicine. The original number of athletes who initially participated was 120 but was collapsed to 63 because of incomplete information from some of the athletes. All the athletes had represented Jamaica at international games including the Olympic Games and World Championships (elite games), the Commonwealth Games, the Pan American Games, Junior World Championships, World Youth Championships and the CARIFTA Games. The athletes were divided into three groups based on athletic disciplines: sprint (s: 100 - 400m, n=40), jump and throw (j/t: jump and throw, n=13), and middle distance (md: 800-3000m, n=10). Although Jamaica is not usually successful internationally in middle distance events (800-3000m), these athletes were included in

the study to investigate the possibility of disproportionate number of athletes originating from a particular geographical area being the result of an abundant prominence of athletics in that area. The groups were further sub-divided into those who represented Jamaica at the Olympic Games and the World Championships (elite games) and those who represented Jamaica at other international games such as Pan-American, Commonwealth, World Junior Championships, World Youth Olympics, World University Games and the CARIFTA Games (sub-elite games). Each participant was given a questionnaire. The questionnaire used was written in English and modeled off studies done on world class athletes from Kenya and Ethiopia [9,10].

Questions were simple and were explained to those who could not easily understand. The questions were designed to obtain the following information.

Place of birth of athletes, parents and grandparents. This was classified according to the 14 parishes and three counties of Jamaica (STATIN, 2013). The main aim was to identify particular regions with a disproportionate high number of athletes in response to reports that the majority of Jamaica's most successful sprinters are from the county of Cornwall. Other aims were to determine whether athletes and their parents and grandparents moved from their county of birth to another county in Jamaica and whether athletes, parents and grandparents were born outside of Jamaica.

Place of residence prior to selection to national team

This was to determine the percentage of representation by county in Jamaica and to determine the percentage of national team members who reside outside of Jamaica as to determine whether there was disproportionate representation by any group.

Spoken language and that of parents and grandparents

This serves to provide information on ethnicity. Jamaicans who represent the country at international athletic events tend to be of West African descent [8]. A common language is often indicative of common origin, and a related language or a language of the same family indicates a common origin dating further back in time [12]. At present only two languages are used by most Jamaicans: English and Patois (Creole-English).

Mean of transport

(walk, run, and bus or car) and distance travelled to school (2 km, 2-5 km, 5-10 km, 10-15 km, and >15 km).

This was also used to find out whether students were attending schools that were near to their homes or schools traditionally associated with athletics which may be some distance from home.

School attended prior to participation in international games

This served to provide information on the influence of the school on likely selection as national representative. National representatives tend to come from a particular group of schools which usually produce the athletes who win major titles at the annual Boys and Girls Championships (CHAMPS) [5]. These students usually form the pool that national and international track and field athletes are selected from.

Table 1: Socio-demographic characteristics of sampled respondents, n = 63.

Description	n	Percent
Gender		
Male	31	49.2
Female	32	50.8
Native Language		
English	61	96.8
Other	2	3.2
Nationality of Birth		
Jamaica	60	95.2
Outside of Jamaica	3	4.8
Athlete' County of Birth		
Cornwall	14	22.2
Middlesex	25	39.7
Surrey	24	38.1
Athlete County of Residence		
Cornwall	6	9.5
Middlesex	4	6.3
Surrey	45	71.4
Outside Jamaica	8	12.7
Mode of Transport to school		
Walk	24	38.1
Ride bicycle	4	6.3
Transport (bus, car)	35	55.5
Events Participated In		
100m &/or 200m	25	39.7
400m	15	23.8
800-3000m	8	12.7
100m hurdles	9	14.3
400m hurdles	6	9.5
Participated In		
Olympics/World Championships	17	26.9
Other Games	46	73.1

Characteristics of athletes from Jamaica who participated in elite and sub-elite games between 1948-2012.

Data Analysis

Contingency chi-squares using IBM SPSS Statistics 21 (IBM, USA) were performed using the Yates, correction factor in all occasions to identify frequency differences between groups given the low subject numbers in some fields (place of birth, languages, ethnicity, mean and distance travelled to school and school attended). Individual chi-squares were then performed to identify between which groups the differences lay. Cross tabulations were used to indicate statistical associations and binary regression was used to check for influence of independent variables on a dependent variable. Statistical significance was defined as $P \leq 0.05$. The 14 parishes of Jamaica were collapsed into the three counties of Jamaica to allow for statistical analysis using contingency chi-squares.

Table 2: A cross tabulation between athletes mother's parents.

Description	County of Birth of Grandfather (MF)		
County of Birth of Grandmother (MM)	**Cornwall**	**Middlesex**	**Surrey**
	n (%)	n (%)	n (%)
Cornwall	20 (76.9)	3 (9.3)	1 (20.0)
Middlexex	4 (15.4)	27 (84.3)	1 (20.0)
Surrey	2 (7.7)	2 (6.2)	3 (60.0)
Total	**26**	**32**	**5**

60% of the athletes' grandfathers and grandmothers were born in surrey compared to 84.3 % who were born in Middlesex and 76.9% in Cornwall.

Results

Table 1 presents the socio-demographic characteristics of the sampled respondents including the events they have participated in and whether they have participated in the elite or sub-elite games. Of the sampled respondents (n=63), 49.2% were males, 96.8% spoke English and 95.2% were born in Jamaica, 39.7% were born in Middlesex, 71.4% and 12.7% of those who represented the country lived in Surrey and overseas respectively, 39.7% participated in the short sprints (100m and/or 200m), and 23.8 % participated in the 400m. Those participating in the sprints (100-400m) accounted for 63.5% of participants. Of the sampled population only 26.9% went to the elite games (Olympics and/or World Championships) with the remainder (73.1%) participating in the other games such as Pan-American and Commonwealth (sub-elite).

Migration and relationships

Athletes mother's parents: Table 2 presents a cross tabulation of data on grandparents of the athletes who are parents of their mother's. The Table showed that 60% of the athletes' grandfathers and grandmothers were born in Surrey compared to 84.3 % who were born in Middlesex and 76.9% in Cornwall County. It can be deduce from such findings that migratory relationship occurred most among the grandparents who were born in Surrey. This means that many of the athletes' mothers' parents who were born in Surrey had sex relation with someone from another county compared to those who were born in the other counties. Another 76.9% of athletes mother's father who was born in Cornwall county had a sexual relationship

Table 3: A cross tabulation between athlete's father's parents.

Description	County of Birth of Grandfather (FF)		
County of Birth of Grandmother (FM)	**Cornwall**	**Middlesex**	**Surrey**
	n (%)	n (%)	n (%)
Cornwall	28 (87.5)	0 (0.0)	0 (0.0)
Middlesex	2 (6.2)	24 (100.0)	2 (28.6)
Surrey	2 (6.3)	0 (0.0)	5 (71.4)
Total	**32**	**24**	**7**

Grandparents born in Middlesex in comparison to those born in Surrey (71.4 %) and Cornwall (87.5 %); χ^2 (df = 4) = 38.0, $P < 0.0001$) had no outside sexual relationship.

Table 4: Percent of locality of athletes' grandparents.

Characteristic	Athletes' Grandparents			
	MM	MF	FM	FF
County of birth	n (%)	n (%)	n (%)	n (%)
Cornwall	21 (33.3)	21 (33.3)	20 (31.7)	25 (39.7)
Middlesex	32 (50.8)	35 (55.5)	32 (50.8)	25 (39.7)
Surrey	10 (15.9)	7 (11.1)	11 (17.4)	13 (20.6)
Total	63	63	63	63

Distribution of athletes' grandparents by county of birth.

Table 5: Cross tabulation between athletes' county of birth and events participated in.

Description	County of Birth			Total
Event participated In	Cornwall	Middlesex	Surrey	
	n (%)	n (%)	n (%)	
Sprints (100m, 200M,400m)	9 (22.5)	16 (40.0)	15 (37.5)	40 (63.5)
Others (including 800m)	9 (39.1)	7 (30.5)	7 (30.4)	23 (36.5)
Total	18	23	22	63

No significant association was found between event athlete participated in and county of birth (χ^2 (df = 2) = 0.542, P = 0.763).

with a woman (mother's mother) who was born in Cornwall county (χ^2 (df=4)=29.4, $P < 0.0001$), with the relationship between these two variables being a moderately positive and strong one (contingency coefficient=0.658).

Athletes' father's parents: The parents of the fathers of athletes are presented in Table 3. Table 3 shows no outside sexual relationship between grandparents occurred among those born in Middlesex in comparison to those born in Surrey (71.4 %) and Cornwall (87.5 %); χ^2 (df=4)=38.0, $P < 0.0001$, with the relationship between the two variables being a positively strong one (contingency coefficient = 0.746).

Locality of athletes' grandparents: The majority of the sampled respondents' grandparents were born in Middlesex, with at most one fifth been born in county of Surrey (father's father, Table 4).

County of birth and event participation

A cross tabulation between event participated in at the elite and sub-elite games by the athlete and county of birth revealed no significant statistical association (χ^2 (df=2)=0.542, P=0.763), (Table 5). Information however can be had from an examination of the results. Of 40 respondents who indicated that they participated in the sprints (100- 400m), 37.5% were born in Surrey, 40.0 % in Middlesex and 22.5 % in Cornwall County. Approximately 36.5% of the respondents participated in events outside of the 100-400m.

County of residence and elite games participation

The majority (58.3%) of the athletes who have participated in the sub-elite games were born in Middlesex (Figure 2). The county
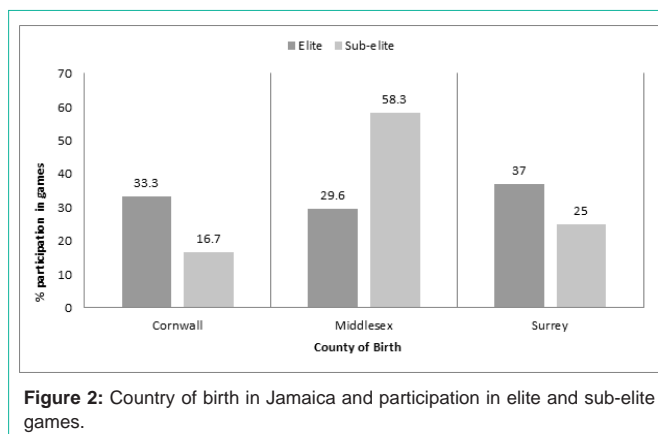

Figure 2: Country of birth in Jamaica and participation in elite and sub-elite games.

distribution of those who participated in the elite games was more equal than for those who participated in the sub-elite games. We can deduce from the aforementioned findings that there is a migration of young Jamaica athletes from a set of geographical areas to others, particularly from Middlesex to Cornwall and Surrey.

Table 6 presents a binary logistic regression of selected socio-demographic variables and their likely influence on athletes' participation in the elite games (Olympics and or World Championships). Three variables were examined for their influence on the dependent variable. These are place of birth in Jamaica (i.e. county), age of respondent and an athlete being a sprinter or not. Of the three variables, only one emerged as a factor of dependent variable - place of birth. While no statistical correlated existed between being born in Surrey with reference to Cornwall and an athlete participation in the elite games, one emerged for Middlesex. In fact, athletes who were born in Middlesex with reference to Cornwall were 0.95 time less (OR=0.05, 95% CI: 0.002-1.14) likely to participate in the elite games. This means that athletes who were born in Cornwall in reference to those born in Middlesex were more likely to participate in the Olympics or World Championships, with no difference emerging between those born in Cornwall and Surrey.

Residence and medal tally at the elite games

The majority of athletes who earned medals at the elite games resided in Surrey or outside of Jamaica (Figure 3). Athletes who resided in Cornwall and Middlesex were 6-10 times less likely to gain a medal at these games. Athletes residing outside of Jamaica were > 2 times more likely to gain a medal than those living in Cornwall or Middlesex. It has emerged from the data that athletes who lived in Middlesex were less likely than those who lived in Cornwall, Surrey and overseas to gain medals at the elite games.

Discussion

The data showed that more than 27% of Jamaica's national representatives are selected to represent Jamaica at the elite games. The majority are usually selected to represent Jamaica at other games such as the Pan-American, Commonwealth, World Junior Championships, World Youth Olympics, World University Games and the CARIFTA Games. The majority of the athletes who participated in games other than the elite games were born in Middlesex (58.3 %). There is usually a general migration of young athletes from some geographical areas to others, particularly from Middlesex to Cornwall or Surrey.

Table 6: Binary logistic regression of selected socio-demographic variables on those who participated in Olympics.

	B	Std. Error	Wald	*P*	OR	95% C.I.	
						Lower	Upper
Gender (1=Male)	-1.22	1.15	1.132	0.287	0.29	0.03	2.80
Surrey	-2.05	1.59	1.659	0.198	0.15	0.01	2.91
Middlesex	-2.99	1.60	3.521	0.061	0.05	0.002	1.14
Cornwall (reference group)					1.00		
Age	0.12	0.05	5.496	0.019	1.12	1.02	1.24
Sprinters (1=100-400m)	2.57	1.35	3.643	0.056	13.09	0.93	183.5
Constant	-1.96	1.87	1.104	0.293	0.14		

-2LL = 24.24
Nagelkerke R^2 = 0.588
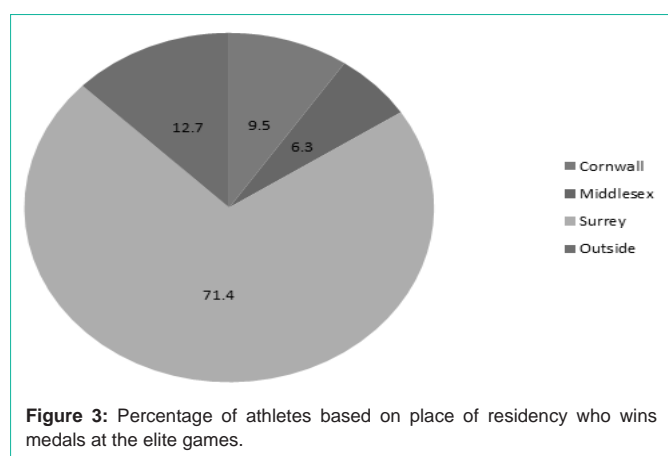Model χ^2 (df = 5) = 18.56, *P* = 0.002.

Figure 3: Percentage of athletes based on place of residency who wins medals at the elite games.

Migratory pattern and relationships indicate that an athlete' parent and grandparents from the maternal side tend to have migratory relationships with partners from Cornwall and Middlesex. The indications are therefore that parent and grandparents of athletes on the maternal side tend not to be localized to a particular county in Jamaica. The migratory pattern and relationships on the paternal side tend to be much different. The grandparents of the athletes on the paternal from Middlesex tended to have intra-county relationships. The data showed no outside sexual relationship between grandparents occurred among those born in Middlesex in comparison to those born in Surrey (71.4 %) and Cornwall (87.5%).

Similar numbers of males (49.2%) and females (50.8%) are usually selected to represent Jamaica at the regional and international games and the highest representation (39.7%) in any event at these games then to be in the short sprints (100-200m). The majority of those who participated in the sprints were born in Surrey and Middlesex. Place of birth determined whether an athlete participate in the elite or sub-elite games. Athletes who were born in Middlesex with reference to Cornwall were 0.95 less likely to participate in the elite games (OR=0.05, 95% CI: 0.002-1.14). This means that athletes who were born in Cornwall in reference to those born in Middlesex were more likely to participate in the Olympics or World Championships, with no difference emerging between those born in Cornwall and Surrey. Environment has been proposed in other studies to greatly affect athletic development and performance. Research has highlighted the influence of environmental factors (early junior career) on the development of elite English cricketers [13]. The honing of talent is critical in the adolescent years [14]. The non-migratory or intra-sexual relationship patterns of the paternal grandparents of athletes from Middlesex may have resulted in some sort of natural selection for athletic talent [15] with their descendants less likely to be selected to the elite games.

Where an athlete resided at the time of selection determined whether the athlete was likely to medal at the elite games. An athlete who resided in Surrey and outside of Jamaica was more likely to medal at the elite games. An athlete who resides in Cornwall and Middlesex were 6-10 times less likely to medal at these games compared to those residing in Surrey. The athletes who reside abroad were more likely to medal in the elite games compared to those who resided in Middlesex and Cornwall. The reasons may be that training facilities in Surrey and the developed countries like USA and Canada tend to give a performance advantage to an athlete as there are more advanced equipment and coaching in urbanized areas and developed countries. Most of the athletes who lived outside of Jamaica and represented Jamaica at the international level were from the USA. This must be regarded in the context that all the athletes selected to the national track and field team are physiologically pre-disposed with an abundance of fast twitch muscles and the Actinin 3 gene associated with power sprinting [16,17]. Athletes however in urbanized regions get the chance to compete in competitive events such as the NCAA trails and are invited to Diamond Leagues meetings [18]. An athlete living in an urban area is exposed to mentoring by Olympians and are exposed better training facilities which give performance advantages. The athlete is therefore able to perform more efficiently at the Jamaican national trails, often placing in the top three for the respective event. The top three qualifiers for a particular event are usually classified as elite athletes and are usually selected as representatives to the Olympics and World Championships. There is also a correlation between the placement in an event at the national trails and medal prospect. The higher up an athlete is placed in an event at the trails, the more likely that the athlete will medal at the elite games.

The ecological model presented looked at determinants and influences of selection to the elite games. Although most of the athletes were born in Middlesex, fewer athletes from Middlesex get selected to represent Jamaica at the elite games. Where an athlete resided prior to selection seemed to greatly influence medal prospect at the elite games.

Conclusion

The athletes representing Jamaica in track and field are said to possess the genetic pre-disposition to be world class athletes [8]. Nevertheless certain environmental factors and social determinants enhance selection to elite games and medal prospect among Jamaican athletes. The ecological model of track and field for Jamaicans showed that residency in urban areas increases the chance of gaining a medal in the Olympics and/or World Championships games and those athletes usually move to the urbanized zones (i.e., Surrey County) to increase the chance of selection to these elite games. Furthermore, marginally more of the Jamaican elite athletes were born in the County of Middlesex and their genealogy showed less intimate partner migration relationships than those with grandparents of the other counties. Hence, we are proposed future studies on the social biology of genealogy of the Jamaican elite athletes; psychology of Jamaican athletes; genetics of Jamaican athletes of the County of Middlesex; disparities in intra-family fertilization among Jamaican elite athletes; and clinical inquiries on religious ideology and its likely influence on physiological functioning.

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