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The Constituent Year Effect in European Track and Field Masters Athletes: Evidence of Participation and Performance Advantages

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Abstract

Inequalities in relative age distribution have previously been demonstrated to influence participation and performance achievements in Masters athletes. The purpose of the present study was to examine the participation- and performance-related constituent year effect among Masters athletes ($n = 2474$) from the European Masters Track and Field Championships across sub disciplines and age. The results indicated that a participation-related constituent year effect was observed. The likelihood of participating was significantly higher for athletes in their first year of any 5-year age category ($\chi^2 = 149.8, p < 0.001$) and decreased significantly when they were in the fourth or fifth year. The results also indicated a performance-related constituent year effect. Masters athletes in their first year won significantly more medals than expected based upon observed participation rate ($\chi^2 = 23.39, p < 0.001$). We compare our results with the existing literature and discuss potential mechanisms for this constituent year effect.

Keywords: relative age effect, masters athletes, performance, sport participation, motivation, aging

Introduction

Many sports are organized into annual age groups based on specific cut-off dates to provide equal opportunities and to “age-match” young athletes (Helsen, Van Winckel, & Williams, 2005). This type of organizational structure is widely used in schools and youth clubs to avoid age differences between children in the same class or groups/cohorts (Musch & Grondin, 2001). Within these age groups, there are invariably cognitive, physical, and emotional differences (Musch & Grondin, 2001; Helsen et al., 2005). This observation of subtle chronological age discrepancies in performance and participation between the youngest and the oldest within an annual age group is known as the relative age effect (Barnsley, Thompson, & Barnsley, 1985; Barnsley & Thompson, 1988; Copley, Baker, Wattie, & McKenna, 2009).

A number of previous researchers have identified an asymmetrical distribution of birth dates and a significant over-representation of athletes born in the first quarter of the selection year. In younger athletes, this finding has been demonstrated in numerous team (e.g., ice-hockey and soccer) and individual sports (e.g., swimming, track and field) for each age group and level of competition (Baker, Janning, Wong, Copley, & Schorer, 2014; Copley et al., 2009; Grondin, Deschaies, & Nault, 1984). It is important to note that the relative age effect is not universal Copley (2009), since no evidence exists in sports such as dance (Van Rossum, 2006), golf (Côté, MacDonald, Baker, & Abernethy, 2006), figure skating (Baker et al, 2014) and taekwondo (Albuquerque et al, 2012), however in gymnastics the advantage is reversed to those born later rather than earlier in the selection year (Baker et al, 2014).

Age categories exist within veteran or Masters-level sports and are used to organize and award prizes in competitions (Medic, Starkes, & Young, 2007). However, in Masters sports age registration categories in most cases span over 5 years rather than 1 year as is the case with most youth sports (Medic et al., 2007). These broader age categories can thus be used to identify Masters athletes who are relatively younger and relatively older. The first study on the

relative age disparities among a population of Masters athletes was conducted by Medic et al. (2007). They examined a population of athletes from USA masters track-and-field and swimming. It was shown that the probability of an athlete setting a record in the first year was much higher than expected and that it was significantly lower for athletes in the third, fourth or fifth year, of any five-year age category. Likewise, there were more athletes participating in the National championships when they were in the first and second year of an age group. Wattie et al. (2008) recommended that relative age disparities in Masters sport be referred to as the ‘constituent year effect’ so that it can be distinguished from the relative age processes among youth.

Medic, Young, Starkes, Weir, and Grove (2009a) examined the impact of gender, age, and type of sport on the relative age effect. These researchers provided evidence of a participation-related constituent year effect in both male and female Masters athletes, however, the effect was stronger for males. This participation-related constituent year effect existed during the 4th decade and onwards, but not for the 3rd decade of life.

Similarly, Medic, Young, Starkes, Weir, and Grove (2009b) examined the constituent year effect in different Masters sports. They found the existence of a constituent year effect in swimming and track and field, but not in weightlifting and rowing. This was likely because weightlifting and rowing are categorized by both age and weight class and/or due to the reduced popularity and cultural importance of these sports. In 2011, Medic, Young, and Medic examined participation-related constituent year effects in Masters swimming using a retrospective longitudinal study design and found that the odds of a masters swimmer participating in the first year of any 5-year age category was more than two times greater than the odds of that athlete participating during the fifth year.

To summarize, relative age effects routinely occur in children and youth sports such that relatively older children within any age category have a distinct performance advantage.

To date, in Masters sports a constituent year effect has been demonstrated such that relatively younger athletes in each age category have an advantage for performance (Medic et al., 2007; Medic et al., 2009a). Moreover, Masters athletes are more likely to participate during the early years of any age category. However, there remains a paucity of research on large cohorts of Masters athletes and our knowledge of the extent to which the constituent year effect impacts participation and performance in middle- and older-aged athletes is currently unknown. Such knowledge is crucial if we are to encourage extended participation in sport to promote successful and healthy aging through sport (Geard, Rebar, Reaburn, & Dionigi, 2018; McKendry, Breen, Shad, & Greig, 2018; McPhee et al., 2016).

In this paper we extend knowledge by examining the extent to which the constituent year effect exists in a population of European Masters Track and Field athletes. A much larger population of athletes is used than previously reported. We examined the participation rate and performance achievements of Masters athletes who participated at the 8th European Veterans Indoor Athletics Championships in 2011 of all competitors. Based on documented disparities in physical demands (Hunter & Stevens, 2013; Kundert, Di Gangi, Nikolaidis, & Knechtle, 2018) and the age of peak performance (Allen & Hopkins, 2015; Nikolaidis, Di Gangi, & Knechtle, 2018) within various a track and field sub-disciplines, we explored if the constituent year effect among Masters athletes is moderated by the track sub-discipline, as well by age (Medic et al., 2009a). It was hypothesized that constituent year effects will exist in European masters athletes and that participation-related constituent year effects will become progressively stronger across decades of life. Given the exploratory nature of the investigation across track sub-disciplines, no other hypotheses were proposed.

Methods

Data collection

The data were collected from archived records on the official internet site for the 8th European Veterans Indoor Athletics Championships (2011), held in Gent, Belgium (<http://www.evaci2011.be/nl>). We acquired the participation entry list with the birthdays and nationalities of all athletes from the organizing committee. A total of 2474 male Masters athletes were considered. The sample comprised participants from 29 different countries across Europe. Data on athletes were first separated manually. For example, the group M35 contained athletes who were born between 20/3/1971 and 15/3/1976. This procedure meant we manually combined the athletes for each 5-year age category. To calculate the total participation rate, we eliminated participants whose name appeared more than once; because many athletes competed in several disciplines. Athletes who participated in more than one sub-discipline were taken into account for the separate disciplines.

Procedure

Given that Masters athletes compete in 5-year age categories and that this starts at 35 years of age for athletics (e.g., 35-39, 40-44, 45-49 years, etc.), we divided the categories in 5-year blocks such that Masters athletes who were in their first year of any 5-year age category were designated to 'Year 1'. Similarly, Masters athletes who were in the second, third, fourth or fifth year of an age category were included in 'Year 2, 3, 4, and 5', respectively. All protocols were approved by an institutional ethics review board for testing of human subjects.

Data analysis

First, the data for Track and Field were analysed in total, then for the disciplines of Track, Jumps, Throws, and Pentathlon separately. The data of all 5-year age categories were collapsed for year 1, 2, 3, 4, and 5. Participation rate was calculated using frequency counts

and percentages. In line with previous research (Medic et al., 2007; Medic et al., 2009), we assumed that the distribution for the expected counts was equal across each of the 5-year periods (i.e., 20%).

We also recorded the performances of the Masters athletes. Totals were compared for all the award winners for each year and compared with the number of expected award winners for that specific year within the 5-year age category. We then calculated the results for the first, second, and third place as well as for Track and Field as a whole, as well as for Track, Jumps, Throws, and Pentathlon separately. To guard against type I errors, we calculated the numbers of participants who finished first, second, and third for each year and correlated this with the frequency of participants. Chi-square goodness-of-fit tests were used to calculate the difference between the observed and the expected counts. The effect size was calculated as the ratio between the differences in observed and expected frequency and the standard deviation. This procedure follows the methods used in previous studies (Medic et al., 2009a).

Results

Participation

Table 1 presents the frequency counts for each year in the 5-year age categories for all participants of Track and field and for the participants of Track, Jumps, Throws, and Pentathlon separately. A participation-related constituent year effect was significant among male Masters athletes from Track and Field ($\chi^2 = 149.8$, $p < 0.001$), for Track only ($\chi^2 = 77.95$, $p < 0.001$), for Jumps ($\chi^2 = 28.12$, $p < 0.001$), for Throws ($\chi^2 = 18.59$, $p < 0.001$), and for Pentathlon ($\chi^2 = 18.75$, $p < 0.001$). The likelihood of participation was significantly higher for athletes in their first year of a 5-year age category. The participation rate was significantly lower for athletes in their fifth year. For all disciplines, the effect sizes were largest during the first year and the fifth year. Table 2 shows the participation rate for the separate age categories among Masters

athletes from Track and Field and from the different sub-disciplines separately. The results for Track and Field indicate a significant participation-related constituent year effect for all age categories except for M35 and M80.

Figure 1 shows the frequencies of participation rates per decade. In track and field as a whole, the results indicate the decline in participation rate from year 1 to year 5 between the fourth and eighth decade of life. The overall results for the discipline Jumps indicate a participation-related constituent year effect, but the results for most of the age categories separately were not significant. The same conclusion can be drawn for the disciplines of Throwing and Pentathlon.

Performance

We calculated the number of winners and their corresponding year of any age category (Table 3, 4, and 5). This was obtained for the first, second, and third places of the championship and was also calculated for the total number of award winners for each year within a 5-year age category while controlling for participation rates. The results for award winners (i.e., first place, second place, and third place) were significant ($\chi^2 = 66.96$, $p < 0.001$). Athletes from year 1 won significantly more medals than expected by chance ($\chi^2 = 23.39$, $p < 0.001$). Athletes from years 4 ($\chi^2 = 24.97$, $p < 0.001$) and 5 ($\chi^2 = 16.05$, $p < 0.001$) won fewer medals than was expected by chance based on participation rates. These results are represented in Figure 2. For Track, the same results were seen for the award winning athletes, but the results for the other sub-disciplines showed lower or non-significant levels.

Results for first place performances showed that significantly more Masters athletes who were in the first year won their competition. In addition, significantly fewer Masters athletes who were in their fourth or fifth year placed first ($\chi^2 = 34.45$, $p < 0.001$). Figure 3 shows the difference between the observed frequencies and the expected frequencies of medal

winning Masters athletes. The observed number of those who achieved first place finish was greater in year 1 and lower in year 5. The same observation was seen for the second ($\chi^2 = 13.98$, $p < 0.001$) and third place ($\chi^2 = 28.13$, $p < 0.001$). The effect sizes were largest for years 1 and 5.

The results for the sub-discipline Track showed more award winners in year 1 ($\chi^2 = 8.56$, $p < 0.01$) and 3 ($\chi^2 = 10.79$, $p < 0.01$) than expected based on participation rate, and fewer award winners in years 4 ($\chi^2 = 18.61$, $p < 0.001$) and 5 ($\chi^2 = 12.54$, $p < 0.001$). However, there were not significantly more athletes from year 1 who finished in first place. Within the discipline Jumps, the results indicated only a performance-related constituent year effect for first place ($\chi^2 = 16.17$, $p < 0.01$). Athletes in their first year tended to win more in long jump, high jump, triple jump, and pole vault than athletes in their fifth year. There were no significance differences for second and third place. The same result can be seen for the discipline Throws ($\chi^2 = 16.38$, $p < 0.01$). None of the results for Pentathlon were significant.

Discussion

In the present study, we sought to replicate and extend the findings of Medic and colleagues (Medic et al., 2007; Medic et al., 2009a; Medic et al., 2009b; Medic et al., 2011) using a much larger group of Masters athletes from Europe compared to the samples previously employed. Moreover, we examined the existence of the constituent year effect by considering the influence of Masters athletes' relative age on the participation rates and performances.

The results indicated that a participation-related constituent year effect exists. Specifically, relatively younger Masters athletes participated significantly more often than athletes in their fourth or fifth year of an age category. Furthermore, we reported that a significantly greater number of athletes from year 1 of an age category finished in first place, thus demonstrating the existence of a performance-related constituent year effect in a

population of European track and field athletes. On a positive note, every athlete potentially experiences, once in 5 years, the advantages of being in year 1 (Medic et al., 2011). This advantage is in contrast to the relative age effect in youth sports, which remains consistent across all youth categories. The performance-related constituent year effect among Masters athletes may be explained by declining physical capacities. While relatively younger Masters athletes generally have a higher cardiorespiratory capacity, there is an age-related decline in performance (Bradbury, 2009; Medic et al., 2007; Weir, Kerr, Hodges, McKay, & Starkes, 2002). Typically, the performance of Masters athletes declines approximately 1% to 3.4% per year after the age of 35 years, depending on sports discipline (Allen & Hopkins, 2015; Kundert et al., 2018; Nikolaidis, Zingg, & Knechtle, 2017). Generally, there is a slow decline from age 50 to 75 years and a steeper decline after the age of 75 years. Nevertheless, there is evidence that maintaining engagement in sports can reduce the rate of decline. Several researchers have reported little difference in the decline of sprint and endurance performance with increasing age (Young & Starkes, 2008; Wright & Perricelli, 2008).

The second explanation may be related to motivational and psychological factors (Medic, Young, & Grove, 2013). Athletes can choose not to compete. Male Masters athletes are very ego-oriented (Wilson, 2005) and compete to win. In Masters sports, athletes can periodise their participation at competitions and prepare for the first year of the next age category. In contrast, relatively older Masters athletes may perceive some barriers to winning and therefore choose not to participate. It appears that Masters athletes in year 1 of an age category may have higher intrinsic motivation (Hodge, Allen, & Smellie, 2008), higher perception of competence and higher expectations of winning (Medic et al, 2013; Wilson, 2005). In contrast, Masters athletes in their fourth or fifth year may be less motivated. This negative experience may lead to an interruption of training and competition (Young, Weir, Starkes, & Medic, 2008) and an increased tendency to drop-out (Medic, 2009; Medic et al.,

2011). Masters athletes are likely to make their own decisions to participate in competition (Medic et al., 2007; Medic et al., 2009a) and thus may not be affected significantly by the perceptions and actions of coaches (e.g., being selected or removed from the team) and organizers (e.g., meeting a qualifying time/performance). Relatively younger Masters athletes may also have a more positive athletic identity (Stevenson, 2002) and are more drawn to national or international championships. Other factors such as distance, travel and accommodation costs may also amplify these motivational factors (Medic et al., 2013). For example, an athlete in year 1 of an age category will be more motivated to travel farther and to spend more money (Hritz & Ramos, 2005) because their chances of winning are higher.

In contrast with previous research (Medic et al., 2009a), we calculated the participation and performance for Jumps, Throws, and Pentathlon separately to distinguish the disciplines by type of physical demands. The discipline Throws in athletics is a low dynamic and high static sport, such as weightlifting. Although Medic et al. (2009b) did not find a participation-related constituent year effect among Masters athletes from weightlifting, we did find a significant constituent year effect among Masters athletes from Throws ($\chi^2 = 18.59, p < 0.001$). Medic et al (2009b) concluded that the constituent year effect might not occur in weightlifting because of the sport's arrangement by age and weight class. These data suggest that the participation-related constituent year effect may also occur in high dynamic sports that are only arranged by age. Importantly, there was a performance-related constituent year effect observed in the present study, but this was only significant for first place ($\chi^2 = 16.38, p = 0.01$). Medic (2009b) provided one explanation as to why a constituent year effect was not found, namely, a lower number of participants (332 athletes). However, the frequency of participants in the discipline Throws in the present study was not much higher (372 athletes). Therefore, further research is needed to examine the existence of a participation- and performance-related

constituent year effect in high dynamic sports arranged by age only and by age and weight class.

Track and Jumps are moderate dynamic and static sports. The current data suggest a strong participation-related constituent year effect among participants of Track ($\chi^2 = 77.95$, $p < 0.0001$) and a moderate effect among participants of Jumps ($\chi^2 = 28.12$, $p < 0.001$). The chi-square results for the separate age categories were less significant. The results for the age-category M35 were not significant, both in Track and Field and in the various disciplines. This suggests that during the third decade of life being relatively younger in comparison to peers may not be advantageous. An alternative possibility is that lack of constituent year effect during the third decade of life may be an indicator of the ages when adults begin to return to competition after having taken time off, following dis-engagement from youth or young adult participation. The results for age categories in different disciplines were also not significant, potentially be due to a lower sporting population size of athletes in Jumping disciplines, making the competitive 'pool' smaller and less competitive. Another possibility is that the competitive pool talent varies for each event type, which may influence the constituent year effect.

The current results indicated a performance-related constituent year effect in Masters athletes from Track and Field for the first, second, and third place. Results for Jumps and Throws were only significant for first place and not significant for second and third place. The results for Pentathlon were not significant, probably because these athletes don't focus on one particular event as perhaps it may be that these athletes don't see themselves capable of winning in individual events and thus focus on all round competition.

There were several limitations with the current study that need to be acknowledged. The number of participants was small for the separate age categories; for example, for the separated Masters Track and Field sub-disciplines and beyond seventh decade of life. Future research needs to consider attrition rates as a control variable in order to isolate the effect

resulting from constituent years. Another limitation was that performances were calculated using the ranking of athletes at the championship and not by using a potentially more objective setting of European records.

Age grading is just one of the options available to resolve the problem of constituent year effect in Masters athletes. Age grading is a way of providing a handicap to athletes of different abilities, as is done in golf. World Masters Athletics (WMA) has provided age-graded tables. The age corrected time is derived from the absolute performance time by using mathematical formulae to process age factors and age standards multiplied by time or distance for each gender. These tables can be applied to 5-year age groups or for individuals from the age of 8 to 100 years. These tables can only be used to score multi-event competitions. Athletes can compare their results with other athletes from different age-categories. Furthermore, we may compare two gold medal winners in the 200m sprint event. The winner in the category M40 ran the 200m in 22.31 seconds. He was at that time 42 years of age. His age-graded time would be 20.1 seconds. In his prime he would have run a time of 20.1 seconds. His age-graded performance would be 96.1 %. The winner in the category M75 was a 76 year old man who ran the 200m in 31.11 seconds. His age-graded time would be 21.11 seconds. His age graded performance would be 91.5%. This means that the 42 year old man delivered a better result than the 76 year old athlete.

These tables have been updated several times. However, they remain controversial. Some athletes, particularly in very young or old categories can perform at better than world record levels when actual performances are corrected by age-grading tables. Generally, age-grading appears to work best on middle age categories for Masters athletes, than on the very young or very old age groups. Another solution that can potentially reduce the constituent year effect in Masters athletes would be the introduction of more condensed age categories (e.g. 3 years). Also, a more defined weight category might also help to reduce the constituent year

effect, as seen in weightlifting. Finally, a combination of these methods may also be useful to reduce the constituent year effect in Masters sport.

In summary, the present findings are important as they provide further evidence of the existence of the participation- and performance-related constituent year effect in more diverse contexts (i.e., Europe) within the masters sport of track and field. It is important that future research confirms present findings in a larger data set, as well as examines potential solutions for the constituent year effect and to prevent disadvantages and drop-out in Masters athletes. The awareness of the constituent year effect in Masters sport is not well understood even though preliminary evidence suggests that some Masters athletes are aware of it (Medic et al., 2013). It is particularly important that constituent year effect is understood not only by middle- and older-aged athletes, but also by sport planners, coaches, researchers and sport psychologists as it can potentially affect athlete's motivation and the likelihood of them maintaining lifelong training, competition routines, and performance. Given that 5-year age categories in Masters sport were created to promote continued participation and involvement rather than disrupt it, alternative strategies to continue to lead athletes forward as they age may need to be explored. Meanwhile, to maximize chances of success, individuals working with masters athletes could work on developing strategies that involve entering competitions when they are in the early years of a 5-year age category and structuring their training schedules accordingly, and placing an emphasis on performance (e.g., time) rather than outcome (e.g., placing).

Disclosure statement

No potential conflict of interest was reported by the authors.

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Figure 1: Participation rate per decade within the 5-year age category (M35 and M90 not included).

Figure 2: Difference between the observed and expected frequency of award winners within the 5-year age category.

Figure 3: Observed and expected frequency for first, second and third places within the t-year age category.

Table 1: Participation rate distributions across constituent years among Masters athletes in Track and Field.

	Frequency	χ^2	Df	ES	p
Track and Field					
Year 1	662	56.36	1	1.23	0.001
Year 2	572	11.98	1	0.57	0.001
Year 3	521	1.37	1	-	NS
Year 4	398	18.90	1	-0.71	0.001
Year 5	321	61.19	1	-1.28	0.001
Total	2474	149.8	4	-	0.001
Track					
Year 1	334	31.48	1	1.27	0.001
Year 2	277	3.91	1	0.45	0.05
Year 3	264	1.32	1	-	NS
Year 4	197	9.76	1	-0.71	0.01
Year 5	158	31.48	1	-1.27	0.001
Total	1230	77.95	4	-	0.001
Jumps					
Year 1	122	15.07	1	1.46	0.001
Year 2	95	0.94	1	-	NS
Year 3	85	0.01	1	-	NS
Year 4	70	2.98	1	-0.65	0.1
Year 5	58	9.12	1	-1.14	0.01
Total	430	28.12	4	-	0.001
Throws					
Year 1	92	4.16	1	0.95	0.05
Year 2	95	5.70	1	1.11	0.05
Year 3	71	0.16	1	-	NS
Year 4	61	2.41	1	-	NS
Year 5	53	6.16	1	-1.15	0.05
Total	372	18.59	4	-	0.001
Pentathlon					
Year 1	60	11.04	1	1.54	0.001
Year 2	37	0.12	1	-	NS
Year 3	39	0.001	1	-	NS
Year 4	38	0.04	1	-	NS
Year 5	22	7.55	1	-1.27	0.01
Total	196	18.75	4	-	0.001

Note. χ^2 = Chi square; Df = Degrees of freedom; ES = Effect Size; p = p-value; NS = Non-significant.

Table 2: Participation rate distributions across constituent years for the separate age categories among Masters athletes in Track and Field.

Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total	χ^2	p
Track and Field								
M35	59	63	60	55	57	294	0.63	NS
M40	94	92	87	70	58	401	12.14	0.05
M45	103	96	90	78	57	424	15.37	0.01
M50	102	91	72	49	45	359	35.07	0.001
M55	81	61	60	32	29	263	36.37	0.001
M60	79	53	59	42	32	265	24.03	0.001
M65	52	42	43	29	21	187	16.19	0.01
M70	51	44	23	29	17	164	24.90	0.001
M75	22	21	12	8	4	67	18.76	0.001
M80	14	6	8	4	1	33	14.43	0.01
M85	4	2	4	2	0	12	4.67	NS
M90 +	1	1	3	0	0	5	6.00	NS
Track								
M35	28	35	27	30	30	150	1.27	NS
M40	52	47	41	34	27	201	9.92	0.05
M45	50	52	39	38	26	205	10.74	0.05
M50	49	36	43	20	18	166	22.86	0.001
M55	39	29	30	18	17	133	12.67	0.05
M60	43	22	33	21	16	135	17.55	0.01
M65	25	18	16	12	9	80	9.37	0.1
M70	21	22	14	16	13	86	3.89	NS
M75	15	12	9	5	2	43	12.70	0.05
M80	9	3	6	2	0	20	12.50	0.05
M85	3	1	4	1	0	9	6.01	NS
M90	0	0	2	0	0	2	8.00	NS
Jumps								
M35	13	9	7	10	10	49	1.92	NS
M40	14	11	9	10	10	54	1.37	NS
M45	22	15	14	11	11	73	6.15	NS
M50	20	14	10	6	5	55	13.81	0.01
M55	13	10	14	7	6	50	5.00	NS
M60	12	7	10	8	3	40	5.75	NS
M65	7	8	11	9	7	42	1.32	NS
M70	9	12	2	6	5	34	8.65	0.1
M75	3	8	4	1	0	16	4.00	NS
M80	7	1	0	2	1	11	6.00	NS
M85	2	0	2	0	0	4	2.00	NS
M90 +	0	0	2	0	0	2	8.00	0.1
Throws								
M35	3	5	9	4	8	29	4.26	NS
M40	12	17	8	12	6	55	6.54	NS
M45	11	11	11	9	11	53	0.30	NS
M50	9	17	11	7	9	53	5.58	NS
M55	15	10	7	5	5	42	8.48	0.1
M60	17	11	9	10	9	56	3.99	NS
M65	4	6	12	5	1	28	11.64	0.05
M70	13	9	0	4	2	28	20.21	0.01
M75	3	5	1	3	1	13	4.30	NS
M80	3	3	1	0	1	8	4.52	NS
M85	2	1	0	2	0	5	3.00	NS
M90	0	0	2	0	0	2	1.60	NS
Pentathlon								
M35	9	6	9	6	4	34	2.75	NS
M40	7	3	2	7	8	27	5.40	NS
M45	10	4	7	5	2	28	6.64	NS
M50	10	8	11	5	2	36	7.62	NS

Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total	χ^2	p
M55	6	6	3	5	4	24	1.42	NS
M60	5	5	1	5	0	16	7.74	NS
M65	5	2	3	1	0	11	6.72	NS
M70	5	3	1	3	2	14	2.24	NS
M75	0	0	2	1	0	3	5.34	NS
M80	3	0	0	0	0	3	12.00	0.05

Note. χ^2 = Chi square; p = p-value; NS = Non-significant.

Table 3: Frequency of award winners across constituent years among Masters athletes in Track and Field.

	Observed	Expected	χ^2	ES	p
Track and Field					
<u>Total</u>					
Year 1	217	156.5	23.39	0.82	0.001
Year 2	143	134.9	0.49	-	NS
Year 3	137	123.2	1.55	-	NS
Year 4	46	94.6	24.97	-0.66	0.001
Year 5	41	75.9	16.05	-0.47	0.001
			66.96		0.001
<u>First place</u>					
Year 1	78	55.2	9.42	0.77	0.01
Year 2	59	47.6	2.73	0.39	0.1
Year 3	45	43.5	0.05	-	NS
Year 4	16	33.4	9.06	-0.59	0.01
Year 5	8	26.8	13.19	-0.64	0.001
			34.45		0.001
<u>Second place</u>					
Year 1	65	52	3.25	0.63	0.1
Year 2	45	44.8	0	-	NS
Year 3	47	40.9	0.9	-	NS
Year 4	14	31.4	9.64	-1.54	0.01
Year 5	23	25.2	0.19	-	NS
			13.98		0.001
<u>Third place</u>					
Year 1	74	49.3	12.38	0.97	0.001
Year 2	39	42.5	0.29	-	NS
Year 3	45	38.8	0.99	-	NS
Year 4	16	29.8	6.39	-0.54	0.05
Year 5	10	23.9	8.08	-0.54	0.01
			28.13		0.001

Note. χ^2 = Chi square; ES = Effect Size; p = p-value; NS = Non-significant.

Table 4: Frequency of award winners across constituent years among Masters athletes in Track and Jumps.

	Observed	Expected	χ^2	ES	p
Track					
Total Track					
Year 1	96	71.3	8.56	0.65	0.01
Year 2	58	58.93	0.02		NS
Year 3	81	56.34	10.79	0.65	0.01
Year 4	14	41.94	18.61	-0.74	0.001
Year 5	13	33.5	12.54	-0.54	0.001
			50.52		0.001
First place Track					
Year 1	33	25.3	2.34	-	NS
Year 2	26	20.9	1.24	-	NS
Year 3	26	20	1.8	-	NS
Year 4	5	14.9	6.58	-0.73	0.05
Year 5	3	11.9	6.66	-0.65	0.01
			18.62		0.001
Second place Track					
Year 1	33	24.2	3.2	0.65	0.1
Year 2	18	20.03	0.21	-	NS
Year 3	29	19.14	5.08	0.73	0.05
Year 4	2	14.24	10.52	-0.91	0.001
Year 5	7	11.4	1.7	-	NS
			20.71		0.001
Third place Track					
Year 1	30	21.8	3.08	0.7	0.1
Year 2	14	18	0.89	-	NS
Year 3	26	17.2	4.5	0.75	0.05
Year 4	7	12.8	2.63	-	NS
Year 5	3	10.2	5.08	-0.61	0.05
			16.18		0.01
Jumps					
Total Jumps					
Year 1	55	44.4	2.53	-	NS
Year 2	30	28.1	0.13	-	NS
Year 3	24	25.1	0.05	-	NS
Year 4	7	20.7	9.07	-0.36	0.01
Year 5	11	17.1	2.18	-	NS
			13.96		0.01
First place Jumps					
Year 1	24	12.8	9.8	1.25	0.01
Year 2	10	9.9	0	-	NS
Year 3	6	8.9	0.94	-	NS
Year 4	2	7.3	3.85	-0.59	0.05
Year 5	3	6.1	1.58	-	NS
			16.17		0.01
Second place Jumps					
Year 1	11	11.6	0.03	-	NS
Year 2	11	9.1	0.4	-	NS
Year 3	10	8.1	0.4	-	NS
Year 4	3	6.7	2.04	-	NS
Year 5	6	5.5	0.05	-	NS
			2.92		NS
Third place Jumps					
Year 1	20	11.6	6.08	1.14	0.05
Year 2	9	9.1	0.001	-	NS
Year 3	8	8.1	0.001	-	NS
Year 4	2	6.7	3.3	-0.64	0.1

	Observed	Expected	χ^2	ES	p
Year 5	2	5.5	2.23	-	NS
			11.61		0.05

Note. χ^2 = Chi square; ES = Effect Size; p = p-value; NS = Non-significant.

Table 5: Frequency of award winners across constituent years among Masters athletes in Throws and Pentathlon.

	Observed	Expected	χ^2	ES	p
Throws					
Total Throws					
Year 1	60	40.2	9.75	0.96	0.01
Year 2	49	41.6	1.32	-	NS
Year 3	17	31.1	6.39	-0.68	0.05
Year 4	23	26.7	0.51	-	NS
Year 5	14	23.1	3.58	-0.44	0.1
			21.55		0.001
First place Throws					
Year 1	23	14.3	5.3	0.92	0.05
Year 2	20	14.8	1.82	-	NS
Year 3	4	11.1	4.54	-0.75	0.05
Year 4	9	9.5	0.03	-	NS
Year 5	2	8.2	4.69	-0.66	0.05
			16.38		0.01
Second place Throws					
Year 1	18	13.1	1.83	-	NS
Year 2	14	13.5	0.02	-	NS
Year 3	5	10.1	2.58	-	NS
Year 4	8	8.7	0.06	-	NS
Year 5	8	7.5	0.03	-	NS
			4.52		NS
Third place Throws					
Year 1	19	12.8	3	-	0.1
Year 2	15	13.3	0.22	-	NS
Year 3	8	9.9	0.36	-	NS
Year 4	6	8.5	0.74	-	NS
Year 5	4	7.4	1.56	-	NS
	5		5.88		NS
Pentathlon					
Total Pentathlon					
Year 1	12	9.3	0.78	-	NS
Year 2	5	5.7	0.09	-	NS
Year 3	7	6	0.17	-	NS
Year 4	3	5.7	1.28	-	NS
Year 5	3	3.3	0.03	-	NS
			2.35		NS
First place Pentathlon					
Year 1	4	3.1	0.26	-	NS
Year 2	2	1.9	0.01	-	NS
Year 3	3	2	0.5	-	NS
Year 4	1	1.9	0.13	-	NS
Year 5	0	1.1	1.1	-	NS
			1.99		NS
Second place Pentathlon					
Year 1	3	3.1	0	-	NS
Year 2	2	1.9	0.01	-	NS
Year 3	2	2	0	-	NS
Year 4	1	1.9	0.42	-	NS
Year 5	2	1.1	0.74	-	NS
			1.17		NS
Third place Pentathlon					
Year 1	5	3.1	1.2	-	NS
Year 2	1	1.9	0.42	-	NS
Year 3	2	2	0	-	NS
Year 4	1	1.9	0.42	-	NS

	Observed	Expected	χ^2	ES	p
Year 5	1	1.1	0.01	-	NS
			2.05		NS

Note. χ^2 = Chi square; ES = Effect Size; p = p-value; NS = Non-significant.