

An Update on the Age of National-level American Swimmers

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Abstract

*The age of national-level American female swimmers increased from 1972 to 1996. Whether or not this trend has continued and whether or not a similar trend exists for male swimmers is unclear. **PURPOSE:** To analyze participant age for national-level female and male American swimmers from 1969 to 2016. **METHODS:** We calculated the mean age of all participants (ALL ENTRANTS) and athletes qualifying for championship heats (FINALISTS) at U.S. Long Course Swimming National Championships from 1969 to 2016. Three-way ANOVA was used to determine if ALL ENTRANTS, FINALISTS, and the difference between them (DIFFERENCE) differed by sex and varied within and across Olympiads. **RESULTS:** Significant sex by Olympiad interactions ($P < 0.05$) showed greater increases in age for women than for men. ALL ENTRANTS increased from 15.77 (95% CI, 14.74 to 16.80) to 19.28 years (95% CI, 19.13 to 19.43) for women and from 18.28 (95% CI, 17.40 to 19.16) to 20.28 years (95% CI, 20.08 to 20.48) for men. FINALISTS increased from 16.63 (95% CI, 16.25 to 17.01) to 20.63 years (95% CI, 19.22 to 22.04) for women and 18.80 (95% CI, 17.95 to 19.65) to 22.15 years (95% CI, 21.13 to 23.17) for men. DIFFERENCE increased from 0.67 years (95% CI, -0.03 to 0.43) to 1.36 years (95% CI, 0.90 to 1.82). **CONCLUSION:** The national-level American swim population has gotten older since 1969 to the extent that this group is now, from the perspective of age, distinct from the identically defined group from nearly five decades ago.*

Introduction

Stager, Emery, Tanner, Edwards, and Wigglesworth (4) demonstrated that the age of female participants at the United States Long Course Swimming National Championships increased approximately two and a half years from 1972 to 1996. During this time, national-level female swimmers changed from a group consisting primarily of middle adolescents to a group comprised predominantly of late adolescents and young adults. One probable explanation for this finding is that socio-environmental factors – such as incentives, motivations, and opportunities for women to continue to participate – changed during this time, and contributed to an older national-level swim population. Whether or not the age of national-level female swimmers has continued to increase in the years since 1996 is currently unclear.

If our argument is correct – i.e., that socio-environmental factors are influencing ‘age’ – then it may be that, unless factors influencing age are unique for women, an age change is also apparent over this same time for male swimmers. Opportunities to participate in high school and college swimming have increased for both sexes since the late 1960’s (2, 3), but because participation numbers have increased less

for men than women (2, 3), it might be that the age of national-level American swimmers has also increased less for men than for women. Whether or not this is true remains to be determined because the age of national-level American male swimmers since the late 1960's has not been reported.

In their analysis of age, Stager et al. (4) also showed that, at the time, the top-performing female swimmers at the national championship competitions were significantly older than the national-level female swim population as a whole. The cause(s) and implication(s) of this observation remain speculative. And it's unknown whether or not this is even still the case for women, and whether or not a similar age difference is present for men. What is known, though, is that the opportunities and incentives – financial and otherwise – to continue training and competing in college and beyond have steadily increased since the late 1960's for all swimmers, but more so for the top few swimmers in each event (6). As a result, it would seem logical that the age difference between the top-performing American swimmers and the national-level swim population as a whole has increased as well.

The primary purpose of this study is to evaluate the age of swimmers at the United States Long Course Swimming National Championship events to determine whether or not the age of this participant population has increased over the last several decades. We hypothesize that participant age increased for both sexes since the late 1960's, with the change being greater for women than men. We also expect to find that the most successful swimmers within this cohort, the subpopulation of finalists at the U.S. National Championships, will be older than the less successful participants at this event, with the age difference between these performance groups increasing over time. If this turns out to be so, then there may be important strategic implications for USA Swimming, the national governing body of swimming in the United States.

Methods

The ages of all female and male participants at the United States Long Course Swimming National Championship were obtained from official meet records for the years 1969 through 2016. Participant age records for meets prior to 1969 were not preserved and in some cases the meet results are no longer available. In addition, after 1969 there was difficulty obtaining complete records for certain years. For two years, 1985 and 1987, complete data were unobtainable thus placing some uncertainty on participant ages during these two meets. Also, we were unable to locate any age records for the women's competition in 1969 and the men's competition in 1981. As a result, the total number of athletes at the competitions from 1969 to 2016 is approximated as being 19,070 women and 17,637 men.

The age of each participant is that at the last birthday, recorded – in years – as of the first day of the meet. Although participation in these meets is open to individuals from other countries, only the ages of the American swimmers were considered for this analysis. Despite the fact that swimmers are eligible to swim in all events for which they have met the qualifying standard, and many do compete in more than one event, each athlete's age was incorporated only once per

competition for the calculation of the mean age of all swimmers (ALL ENTRANTS). In addition, the mean age was determined of athletes who finished in the finals in at least one event (FINALISTS). Again, each athlete's age was incorporated only once in the calculation of FINALISTS, even if she or he placed in the finals in more than one event.

ALL ENTRANTS and FINALISTS were determined for the women and men, separately. Each competition was grouped into one of twelve Olympiads (1972, 1976, 1980, 1984, 1988, 1992, 1996, 2000, 2004, 2008, 2012, and 2016) and categorized according to its placement within an Olympiad. We considered each Olympiad to consist of a four-year period ending in an Olympic year. Thus, the first year in an Olympiad was the year following an Olympic year, and the fourth year in the Olympiad was the year with an Olympic Games. For instance, the 1972 Olympiad consisted of the years 1969-1972, with 1969 being the first year in the Olympiad, 1970 the second, 1971 the third, and 1972 the fourth. By grouping the data in this manner, we were able to determine whether or not ALL ENTRANTS and FINALISTS (i) differed between women and men, (ii) differed between Olympiads, (iii) differed between years within an Olympiad, and (iv) whether or not any of these variables interacted with each other. We analyzed the data using a Three-Way (Olympiad by sex by year-within-Olympiad) Analysis of Variance (ANOVA). And, to assess the relationship between the age of those qualifying for a championship final in at least one event and the age of all entrants at these competitions, an additional Three-Way ANOVA was conducted on the difference between FINALISTS and ALL ENTRANTS (DIFFERENCE). In the event of a significant main effect for any of the ANOVA's, we planned to perform all pairwise comparisons using Tukey's Honestly Significant Difference (HSD) Test. For all analyses, statistical significance was set at an alpha level of 0.05.

Results

Olympiad, sex, and year-within-Olympiad had significant effects on ALL ENTRANTS ($P < 0.05$). ALL ENTRANTS increased with Olympiad, with the youngest mean age during the 1972 Olympiad (17.20 years; 95% CI, 15.89 to 18.51 years) and the oldest mean age during the 2016 Olympiad (19.78 years; 95% CI, 19.32 to 20.24 years). In addition, ALL ENTRANTS was greater for men (19.80 years; 95% CI, 19.57 to 20.03 years) than for women (17.90 years; 95% CI, 17.57 to 18.23 years). However, there was a significant two-way Olympiad by sex interaction ($P < 0.05$), which indicated that the difference between women and men changed with Olympiad (see Figure 1). And finally, year-within-Olympiad significantly affected ALL ENTRANTS, with an older age during the fourth year in the Olympiad (19.36 years, 95% CI, 18.76 to 19.96 years) than the first (18.62 years, 95% CI, 18.05 to 19.19 years), second (18.59 years, 95% CI, 18.01 to 19.17 years), and third (18.82 years, 95% CI, 18.27 to 19.37 years) years within the Olympiad, and an older age in the third year than the first and second years.

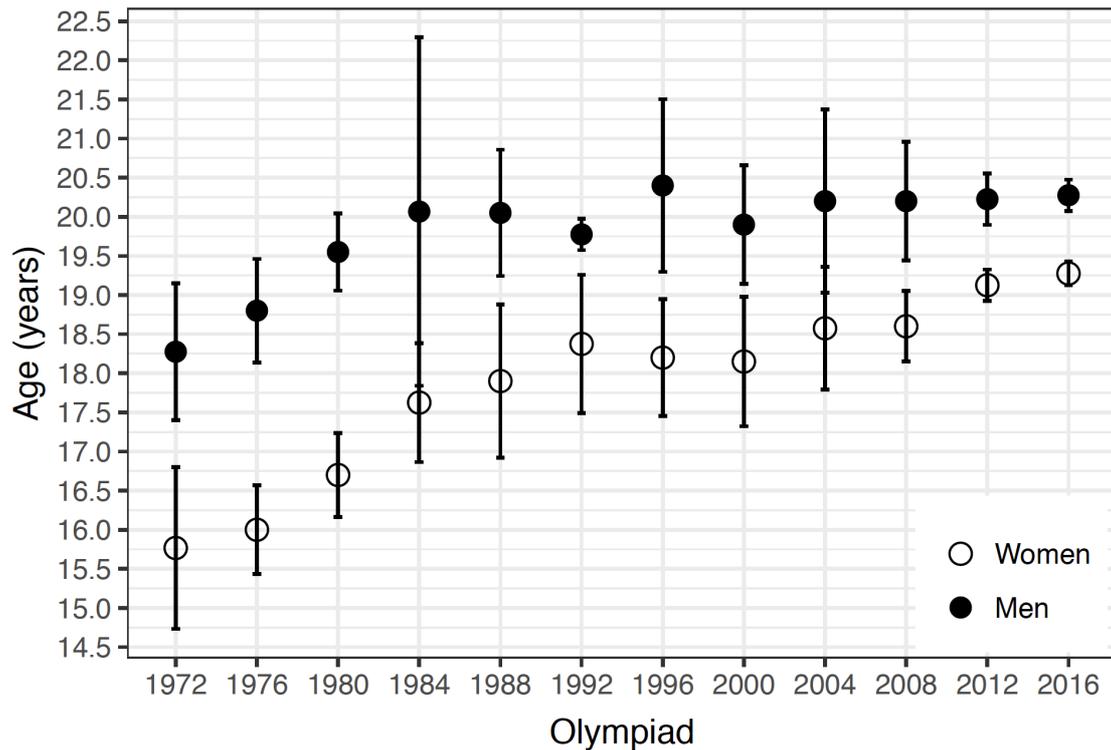


Figure 1. The mean age of competitors at the United States Long Course Swimming National Championships (ALL ENTRANTS) from 1969 to 2016 as a function of Olympiad and sex. There were significant main effects for Olympiad and sex as well as a significant Olympiad by sex interaction. Error bars represent the 95% confidence interval.

Olympiad, sex, and year-within-Olympiad had significant effects on FINALISTS ($P < 0.05$). FINALISTS increased with Olympiad, with the youngest mean age during the 1972 Olympiad (17.87 years; 95% CI, 16.74 to 19.00 years) and the oldest mean age during the 2012 Olympiad (21.61 years; 95% CI, 20.73 to 22.49 years). In addition, FINALISTS was greater for men (20.82 years; 95% CI, 20.47 to 21.17 years) than for women (18.72 years; 95% CI, 18.27 to 19.17 years). However, there was a significant two-way Olympiad by sex interaction ($P < 0.05$), which indicated that the difference between men and women changed with Olympiad (see Figure 2). Lastly, year-within-Olympiad significantly affected FINALISTS, with an older age during the fourth year in the Olympiad (20.45 years, 95% CI, 19.66 to 21.24 years) than the first (19.31 years, 95% CI, 18.59 to 20.03 years), second (19.50 years, 95% CI, 18.78 to 20.22 years), and third (19.78 years, 95% CI, 19.11 to 20.45 years) years within the Olympiad, and an older age in the third year than the first and second years.

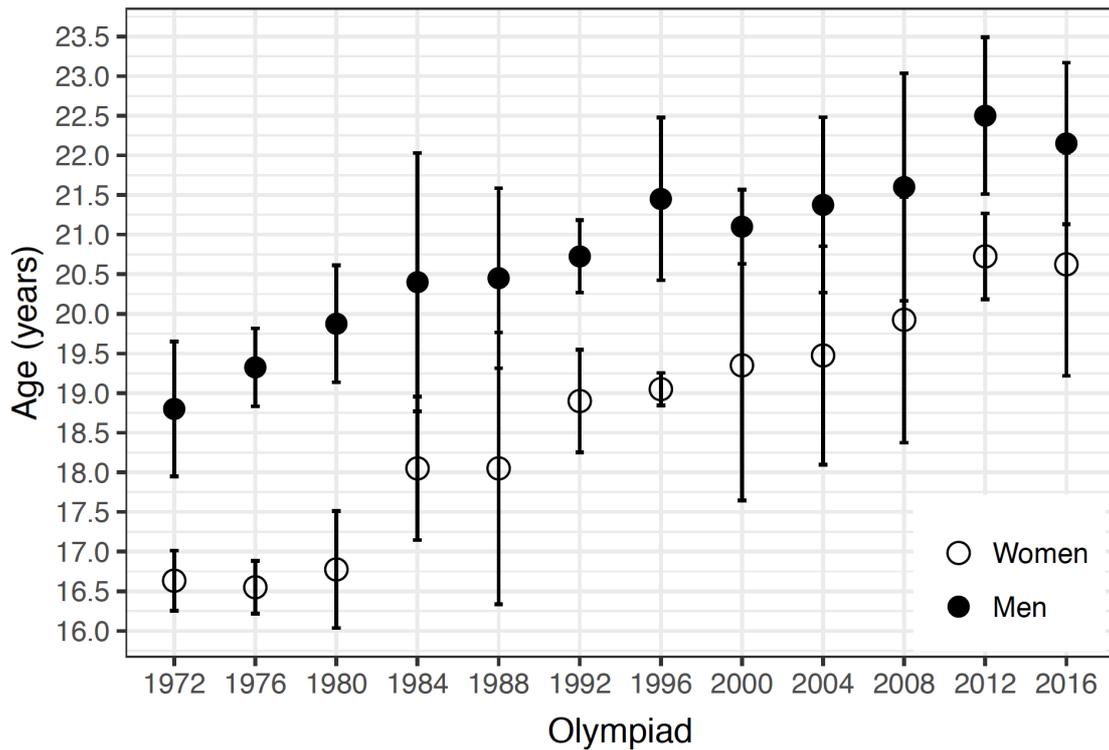


Figure 2. The mean age of the top eight finishers in each event at the United States Long Course Swimming National Championships (FINALISTS) from 1969 to 2016 as a function of Olympiad and sex. There were significant main effects for Olympiad and sex as well as a significant Olympiad by sex interaction. Error bars represent the 95% confidence interval.

FINALISTS was significantly greater than ALL ENTRANTS for women for all Olympiads except the 1980 and 1988 Olympiads, and for men for all Olympiads except the 1976, 1980, and 1984 Olympiads ($P < 0.05$). Further, Olympiad, sex, and year-within-Olympiad had significant effects on DIFFERENCE ($P < 0.05$). DIFFERENCE decreased from the 1972 Olympiad (0.67 years; 95% CI, 0.43 to 0.91 years) to the 1980 Olympiad (0.20 years; 95% CI, -0.03 to 0.43 years) and then steadily increased to a peak value during the 2012 Olympiad (1.94 years; 95% CI, 1.53 to 2.35 years) (see Figure 3). In addition, DIFFERENCE was greater for men (1.00 years; 95% CI, 0.81 to 1.19 years) than for women (0.80 years; 95% CI, 0.63 to 0.97 years). Year-within-Olympiad also significantly affected DIFFERENCE, with a greater DIFFERENCE for the third (0.96 years, 95% CI, 0.74 to 1.18 years) and fourth (1.05 years, 95% CI, 0.70 to 1.40 years) years in the Olympiad than for the first (0.70 years, 95% CI, 0.48 to 0.92 years).

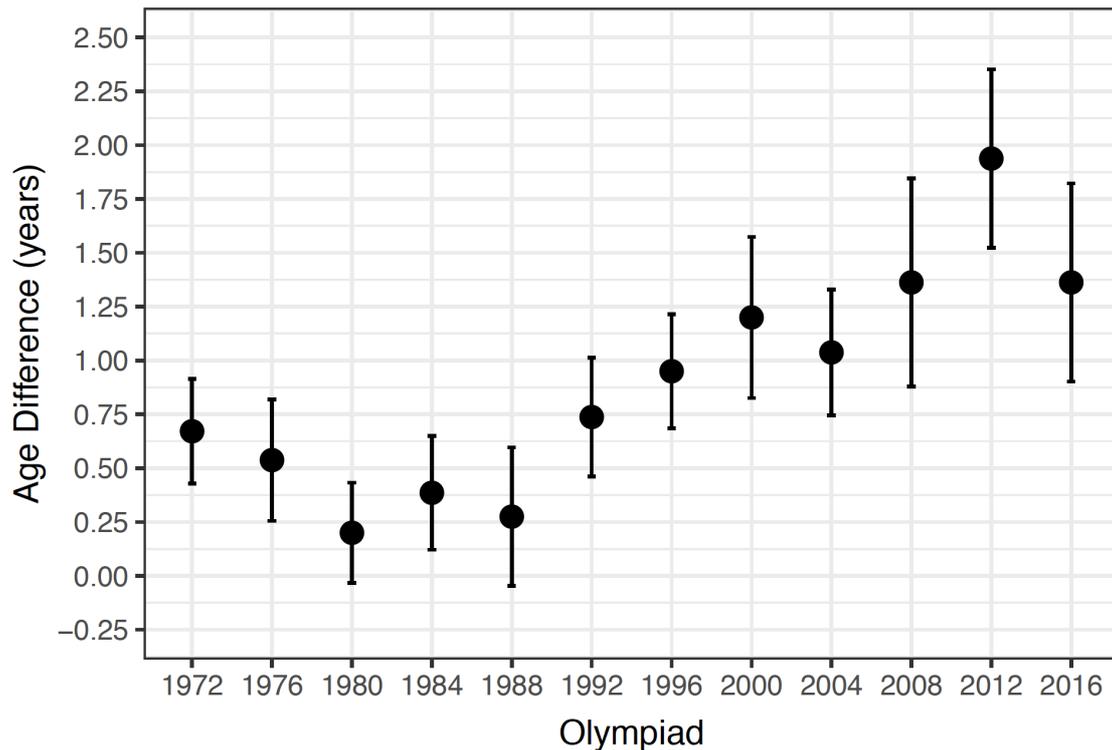


Figure 3. The mean difference between the age of the top eight finishers and the age of all competitors at the United States Long Course Swimming National Championships (DIFFERENCE) from 1969 to 2016 as a function of Olympiad. Olympiad has a significant effect on DIFFERENCE. Error bars represent the 95% confidence interval.

Discussion

Our purpose was to analyze the ages of American swimmers competing at the U.S. Long Course National Championships from 1969 to 2016. Our main finding is that this population of national-level athletes has gotten older since 1969 to the extent that this group is now, from the perspective of age, distinct from the identically defined group from nearly 50 years ago. Simplistically stated, during the first year analyzed here, because of their age, the cohort distribution favored inclusion of peri-adolescent and high school athletes (Mean age: 15.3 years for girls and 17.8 years for boys). In contrast, for the most recent year analyzed, the cohort of national-level American swimmers was comprised predominantly of collegiate athletes (Mean age: 19.2 years for women and 20.4 years for men).

Secondary to the confirmation of the increase in participant age across time is the observation that there is a difference in participant age between the sexes at these championship events. Over the last five decades, national-level female swimmers are consistently younger than their male counterparts. If we ‘pool’ across Olympiads and the years-within-Olympiads, we find the age difference between the sexes for ALL ENTRANTS to be about two years (17.90 vs. 19.80 years for women and men, respectively). The age difference between the sexes corresponds closely to the maturational age offset between girls and boys. We can’t say for sure if this similarity is happenstance or mechanistic. What we can say for sure, though, is that the age difference between the sexes has changed since the late 1960’s. While ALL ENTRANTS is still greater for men than women, the age difference decreased to its lowest point – about one year – during the most recent

Olympiad. Our explanation for this finding is that the decrease in age difference between the sexes reflects the disparate increase in opportunities and incentives for women and men to participate in swimming during this time (2, 3).

Participation records from the National Federation of State High School Associations (NFHS) illustrate that the number of high school athletic participants in *all sports* has increased nearly 100% from 1971-1972 to 2014-2015 (an increase from 3.9 to 7.8 million participants; participation records for individual sports during this time are not available). Importantly, the majority of the increase – approximately 75% – was for women, whose participation increased from 294,015 to 3.3 million athletes during the analyzed time period (3). The National Collegiate Athletic Association (NCAA) participation records indicate that the number of female and male *swimmers* increased from 1981-1982 to 2015-2016 (6,218 to 12,356 for women and 7746 to 9,455 for men; NCAA participation records not available prior to 1981) (2). Thus, a similar pattern is evident in NCAA swim participation as with NFHS athletic participation: the number of athletes has increased for both sexes, but the increase has been much greater for women than for men. While there are likely many factors that have contributed to this trend, Title IX, which was invoked in 1972, can be assumed to have played at least some role in the differing increases in participation between women and men (1).

While the primary purpose of this study was to determine whether or not the age of national-level swimmers has changed over time (which it has), and whether or not the age change was different between the sexes (which it was), the secondary purpose was to examine the relationship between age and performance within this population. During the studied time span, the records in all events for both sexes have improved (7). Added to this, our third major finding is that the best swimmers at the Long Course Swimming National Championships, the finalists, are consistently older than the athletes who fail to qualify for the top heat of an event, and this age difference has been steadily increasing since 1980. While Title IX and the subsequent expansion in high school and collegiate sports can explain why more athletes are training and competing into early adulthood, it does not necessarily account for the disproportionate increase in age among FINALISTS as compared to ALL ENTRANTS (see Figure 3). It is likely that this is more a function of increased incentives – financial or otherwise – available only to the best American swimmers.

Historically, the Olympic Games has been a major incentive for continued or renewed participation in the sport. The fact that ALL ENTRANTS and FINALISTS were significantly older during Olympic years than during the other years within the Olympiad suggests that the Olympics is a powerful motivator, one that can persuade athletes to continue competing for a year or two beyond when they otherwise would, or even entice swimmers to come out of retirement. Recently, an important incentive has become available to the very best swimmers in the United States, and has likely contributed to the greater increase in FINALISTS as compared to ALL ENTRANTS. USA Swimming has adopted an athlete assistance program in which collegiate and post-collegiate athletes are eligible for financial support if they meet certain performance criteria. For instance, swimmers who (i) are not competing for

their high school or college program, (ii) qualify for the national team – i.e., are one of the top six performers in an event in the United States – and (iii) have a top-8 Fédération Internationale de Natation (FINA) World Ranking in their event can receive up to \$3000 per month to continue training and competing (6). And swimmers on the national team with a FINA world ranking between 9th and 16th can get up to \$2000 per month. Thus, this program helps to keep the top-performing American swimmers in the sport by providing them with a source of income. Lower-performing swimmers don't have a financial support system like this, which might make them more likely to drop out of the sport at an earlier age. This has likely contributed to the disproportionate increase in the mean age of the very best swimmers in the country – i.e., the FINALISTS – as compared to the mean age of the less accomplished national-level swimmers in recent years.

Summary & Conclusions

Our purpose here was to analyze the age of swimmers at the United States Long Course National Championships from 1969-2016. We found that the age of national-level American swimmers increased for both sexes during this time, but to a greater extent for women (from 15.8 to 19.3 years) than for men (from 18.3 to 20.3 years). In addition, we found that the very best swimmers at these competitions – i.e., those qualifying for the finals – were consistently older than their less successful peers, with the difference in age steadily increasing from a low of 0.2 years during the 1980 Olympiad to a high of nearly two years during the 2012 Olympiad.

Our explanation for these findings is that socio-environmental factors – such as incentives, motivations, and opportunities to participate in swimming – changed during the past five decades, leading more swimmers to extend their competitive careers into college and beyond. USA Swimming could potentially utilize this information in an effort to accomplish two of its core objectives: (i) to “build the base” and (ii) “achieving sustained competitive success” (8). USA Swimming could build their base by working to expand opportunities to participate in the sport for children, adolescents, and young adults throughout the country. And to ensure continued international competitive success, USA Swimming could expand its athlete support system and develop new incentive programs to keep its most accomplished and most promising athletes training and competing.

Acknowledgments

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