Exercise Behavior of Ultramarathon Runners: Baseline Findings From the ULTRA Study

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Abstract

Hoffman, MD, and Krishnan, E. Exercise behavior of ultramarathon runners: baseline findings from the ULTRA Study. *J Strength Cond Res* 27(11): 2939–2945, 2013–Little is known about exercise habits of those who compete in foot races longer than the standard 42-km marathon distance. The purpose of this work was to describe the past-year and lifetime exercise patterns of a large cohort of ultramarathon runners. Information on exercise history was collected on 1,345 current and former ultramarathon runners as baseline data for participation in a longitudinal observational study. Median age at the first ultramarathon was 36 years, and the median number of years of regular running before the first ultramarathon was 7 (interquartile range, 3–15). Age at first ultramarathon did not change across the past several decades, but there was evidence of an inverse relationship ($r = -0.13$, $p < 0.0001$) between number of years of regular running before the first ultramarathon and calendar year. The active ultramarathon runners ($n = 1,212$) had a previous year median running distance of 3,347 km, which was minimally related to age ($r = -0.068$, $p = 0.018$), but mostly related to their longest ultramarathon competition of the year ($p < 0.0001$). Running injuries represented the most common reason for discontinuation of regular running, whereas work and family commitments were reported as the main reasons for not running an ultramarathon in the previous year among those who were regularly running and intending to run ultramarathons again. We conclude that runners tend to be well into adulthood and with several years of running experience before running their first ultramarathon, but 25% have only been regularly running for 3 years or less at the time of their first ultramarathon.

Key Words aging, health, injuries, running

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Introduction

An ultramarathon is defined as a foot race longer than the standard 42.2-km marathon distance. Typical distances for these races are 50 km, 50 miles (80 km), 100 km, and 100 miles (161 km), but there are also timed (e.g., 12 or 24 hours) and multiple-day continuous and stage races. In North America, the 50-km distance has been the most popular, accounting for more than half of the 63,530 ultramarathon finishes in 2012 (25). Most of these races are on trails, sometimes through remote environments, rather than on roads.

Participation in ultramarathons has seen exponential growth in recent years (10,25). For instance, there was a 22% increase in the number of ultramarathon finishes in North America between 2011 and 2012 (25). As participation in these events increases, it becomes increasingly more important to understand the characteristics of those participating in these events. To date, little has been published about this group besides limited information about their sociodemographics (8,17,24), body characteristics (4,9,15,18,21), exercise-related injuries (7), and nutritional (22,23) and medical needs (2,3,8,12–14,19,20) during events. Even less is known about the general health, and exercise behaviors of this population.

The Ultrarunners Longitudinal TRAcking (ULTRA) Study is a longitudinal study monitoring the health status of ultramarathon runners. The primary purpose of the study is to assess for potential health consequences related to the high levels of exercise that is characteristic of this group, but baseline enrollment information offers potential insight into current and past exercise patterns of these individuals. To provide greater knowledge into these areas, we present in this article the baseline findings related to lifetime and past-year exercise behaviors for this large cohort of ultramarathon runners. Specifically, it was our intention to examine patterns in age and running experience at the time of first ultramarathon, relationships of age with annual running distance and number of competitions, extent of participation in alternate exercise activities among this group, and reasons why these individuals stop regular running or running ultramarathons. Information from such analyses should be of practical importance to race directors and medical providers who care for these athletes during and outside of the events.

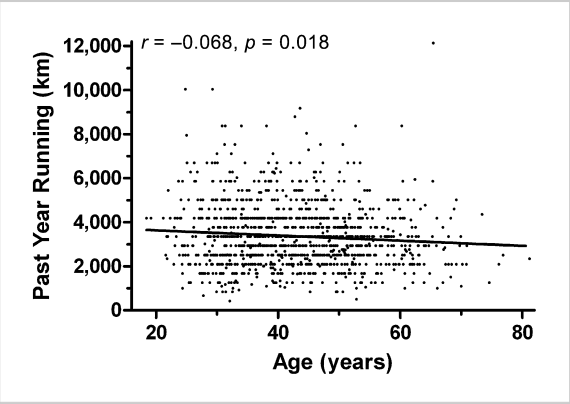

Figure 1. Running distance in previous year relative to age among 1,212 active ultramarathon runners.

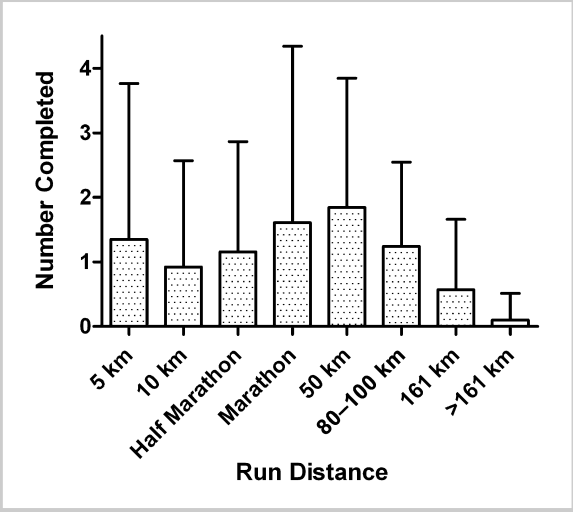

Figure 3. Mean number of races of various distances completed by 1,212 active ultramarathon runners in the previous year. Error bars represent 1 *SD*. Statistical differences were present for each pairwise comparison except between 5 km and half marathon, and between marathon and 80–100 km distances.

Methods

Experimental Approach to the Problem

As a precursor to the data to be obtained from longitudinal examination of a large group of ultramarathoners participating in the ULTRA Study, we used cross-sectional data from the baseline findings to investigate past-year and lifetime exercise behaviors, participation patterns related to age and running experience, and reasons for cessation of regular running or running ultramarathons.

Subjects and Procedures

The ULTRA Study enrollment began in November 2011 and was accomplished through direct electronic mailing to over 3,000 ultramarathon runners, postings on various ultramarathon-related web sites and blogs, advertisements in magazines related to ultramarathon running, and distribution of flyers at a number of the largest ultramarathons in the United States. To qualify for enrollment in the ULTRA Study, the individual must have completed at least 1 ultramarathon of 50-km distance or longer at some point in their life. The findings reported here are from the initial 12-month enrollment period. The study was approved by Institutional Review Boards of the Veterans Affairs Northern California Health Care System and Stanford University, and each

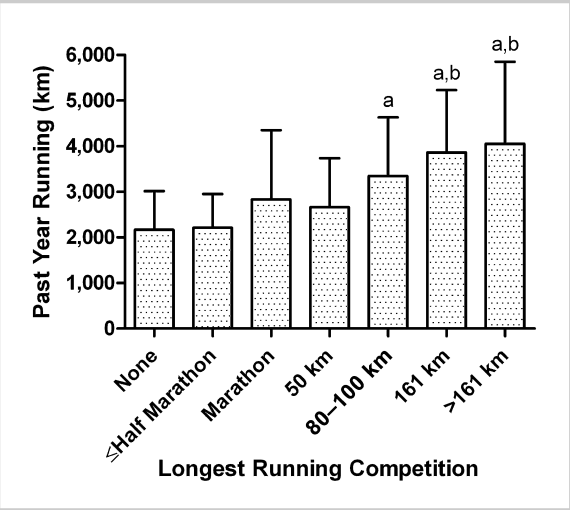

Figure 2. Running distance in previous year relative to the longest running competition completed during the year among 1,212 active ultramarathon runners. Error bars represent 1 *SD*. a, $p < 0.01$ compared with none, half marathon or shorter, and 50 km; b, $p < 0.05$ compared with marathon and 80–100 km.

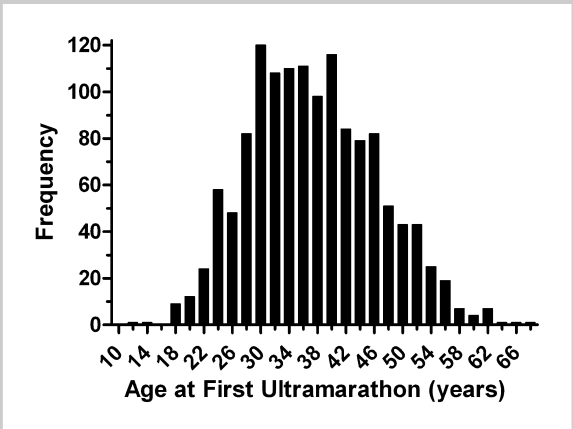

Figure 4. Frequency distribution of age at first ultramarathon among 1,345 current and former ultramarathon runners. Each bracket represents 2 years.

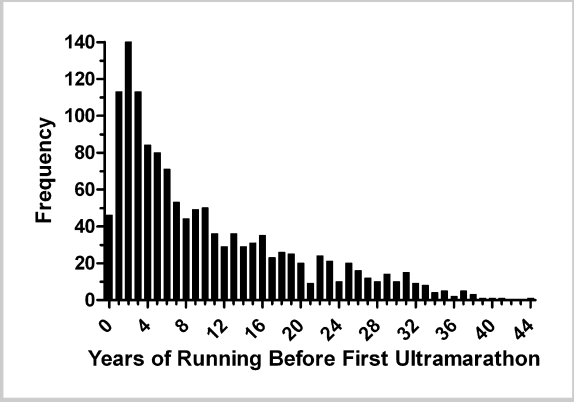

Figure 5. Frequency distribution of number of years of regular running (defined as running at least 3 $d \cdot wk^{-1}$) at the time the individual ran their first ultramarathon among 1,345 current and former ultramarathon runners. There were 11 individuals who indicated they had not started running at least 3 $d \cdot wk^{-1}$ before their first ultramarathon, and those data are not included the figure.

subject provided informed consent through electronic means.

All participants completed a secure web-based questionnaire. The survey included demographic questions, and questions related to medical and exercise history. Responses that were incomplete, obviously invalid, and represented duplications were removed from the dataset. Each variable was also examined for major outliers, and subjects were contacted to verify the accuracy of such data.

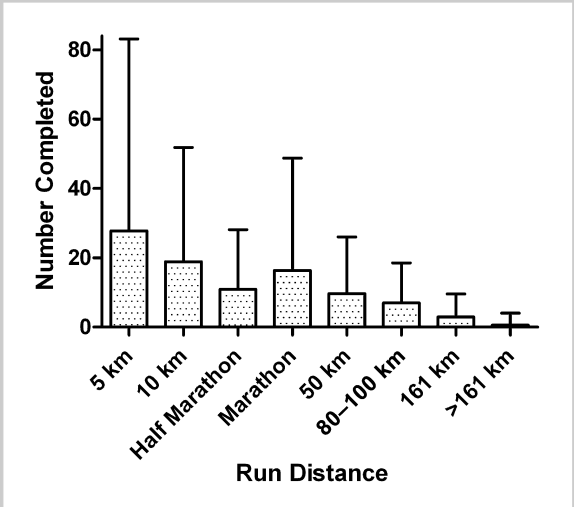

Figure 6. Mean lifetime number of races of various distances completed by 1,345 current and former ultramarathon runners. Brackets represent 1 *SD*. Statistical differences were present for each pairwise comparison except between 5 and 10 km, 10 km and marathon, and half marathon and marathon distances.

Estimated percentage of exercise time at light, moderate, and high intensities was assessed. For purposes of this study, light intensity was defined as "Does not induce sweating unless it's a hot, humid day. There is no noticeable change in breathing patterns." Moderate intensity was defined as "Will break a sweat after performing the activity for about 10 minutes. Breathing becomes deeper and more frequent. You can carry on a conversation but not sing." High intensity was defined as "Will break a sweat after 3–5 minutes. Breathing is deep and rapid. You can only talk in short phrases."

Because some of the study participants were no longer running regularly or had not completed an ultramarathon in recent years, a subset of active ultramarathon runners was used for some analyses. One was considered to be an active ultramarathon runner if they had completed an ultramarathon within the 12 months before completing the survey, or had completed an ultramarathon in 2010 or 2011 and indicated that they were regularly running and intended to run ultramarathons again.

Statistical Analyses

Descriptive analyses were performed and are presented. Variables undergoing statistical analyses did not pass normality testing with the D'Agostino and Pearson omnibus normality test, so, 2 group comparisons were made using the Mann-Whitney test, multiple group comparisons were made with the Kruskal-Wallis test followed by the Dunn's multiple comparison test, and correlations were made using Spearman correlation analyses. Statistical significance was set at $p \leq 0.05$.

Results

Study Populations

After incomplete, invalid, and duplicate responses were removed, there were 1,345 respondents with completed surveys. This full study group was 68.3% men and had a mean (median) age of 43.4 (42.8) years (interquartile range [IQR], 35–51 years). Most of the study group was from the United States (87.7%), but small percentages were from Europe (6.2%), Canada (4.0%), Australia and New Zealand (1.0%), or elsewhere (1.1%). Most of them (93.3%) reported their ethnic origin as white, not of Hispanic origin. They reported having been regular runners a mean (median) of 16.2 (14) years (IQR, 6–25 years) and running ultramarathons a mean (median) of 6.0 (3) years (IQR, 1–8 years).

Of the full study group, there were 1,272 (94.6%) who reported they were regular runners and 73 (5.4%) who reported that they had stopped running regularly. The latter group had a mean (median) age of 46.0 (44.3) years (IQR, 38–55 years) and running and ultramarathon running histories that averaged 19.0 years (IQR, 8–27 years) and 8.5 years (IQR, 3–13 years), respectively.

There were 1,212 (90.1%) who were considered to be active ultramarathon runners, of which 94.7% had completed an ultramarathon in the previous 12 months. This

Table 1. Percentage of running distance on various surfaces during the previous 12 months among active ultramarathon runners ($n = 1,212$) and for lifetime among current and former ultramarathon runners ($n = 1,345$).

Running surface	Mean (median) in previous year	Mean (median) in lifetime
Concrete or asphalt	42.5 (40)	54.7 (58)*
Trail	49.5 (50)	34.9 (30)*
Track	2.4 (0)	4.5 (2)*
Treadmill	4.6 (0)	4.8 (2)*
Other	1.0 (0)	1.1 (0)

*$p < 0.0001$ for between group comparison.

Table 2. Percentage of exercise time at different intensities during the previous 12 months among active ultramarathon runners ($n = 1,212$) and for lifetime among current and former ultramarathon runners ($n = 1,345$).

Exercise intensity	Mean (median) in previous year	Mean (median) in lifetime
Light	14.6 (10)	19.6 (10)*
Moderate	61.9 (70)	58.2 (60)*
High	23.6 (20)	22.1 (20)

*$p < 0.0001$ for between group comparison.

subgroup had a mean (median) age of 42.8 (42.3) years (IQR, 34–50 years) and running and ultramarathon running histories that averaged 15.6 years (IQR, 6–24 years) and 5.7 years (IQR, 1–8 years), respectively.

Previous Year Exercise Pattern Among Active Ultramarathon Runners

Among the 1,212 active ultramarathon runners, the median running distance in the 12 months before the survey completion was 3,347 km (range, 418–12,135 km). There was a negligible association ($r = -0.068$, $p = 0.018$) between annual running distance and age such that the running distance decreased with age (Figure 1). Annual running distance did not differ ($p = 0.6$) between men and women, but was related ($p < 0.0001$) to the longest running competition during the year (Figure 2).

The mean number of running competitions of various distances is shown in Figure 3.

Table 3. The percentage of individuals reporting that they had participated in various activities and percentage of aerobic exercise time at the different activities during the previous 12 months among active ultramarathon runners ($n = 1,212$) and for lifetime among current and former ultramarathon runners ($n = 1,345$).

	Previous 12 months		Lifetime	
Aerobic exercise activity	Performed activity (%)	Mean (median) time at activity (%)	Performed activity (%)	Mean (median) time at activity (%)
Running	100.0	82.6 (90)	100.0	71.7 (80)*
Bicycling	63.0	8.8 (5)	85.8	14.0 (10)*
Backpacking or fastpacking	39.0	3.2 (0)	54.2	5.4 (1)*
Swimming	14.6	1.7 (0)	18.7	2.2 (0)
Cross-country or roller skiing	8.7	0.5 (0)	20.2	1.0 (0)*
Snowshoeing	11.6	0.4 (0)	17.1	0.5 (0)†
Flat water kayaking or canoeing	7.1	0.2 (0)	15.5	0.6 (0)‡
Other	19.0	2.6 (0)	26.0	4.7 (0)†

*$p < 0.0001$ for between group comparisons.
†$p \leq 0.05$.
‡$p < 0.001$.

Table 4. Reasons provided for no longer regularly running or not completing an ultramarathon in the previous year. Values are provided as a percentage within each group. Because more than 1 explanation could be provided, the percentages within each group do not total 100.

Group	Running injuries	Other medical issues	Work commitment	Family commitments	Focus on other sport(s)	Lack of interest
Not regularly running in past year, $n = 73$	47	22	29	26	6	0
Regularly running, no ultramarathon finish in past year, no intent to run ultramarathons again, $n = 8$	63	0	13	13	13	13
Regularly running, no ultramarathon finish in past year, with intent to run ultramarathons again, $n = 116$	29	16	36	34	16	10

The 50-km distance was the most popular. The median number of races completed in the previous year was 3 (maximum 44) marathon and shorter races, and 3 (maximum 40) ultramarathons. There were small but statistically significant correlations between the number of races completed and age for marathon and shorter races ($r = -0.060$, $p = 0.037$), as well as for ultramarathons ($r = 0.082$, $p = 0.004$).

The proportion of running distance on various surfaces during the previous 12 months is shown in Table 1. The estimated percentage of exercise time at different intensities is shown in Table 2. There were 46.2% who reported that they had performed regular resistance training for at least a continuous 3-month period during the previous year.

Most of the active ultramarathon runners reported spending some time at aerobic exercise activities other than running. The percentage spending time at various activities and the overall percentage of aerobic exercise time at the different activities are shown in Table 3.

Lifetime Exercise Pattern Among Current and Former Ultramarathon Runners

Considering the sample of 1,345 current and former ultramarathon runners, the distribution of age at the time that each individual ran their first ultramarathon is shown in Figure 4. Mean (median) age was 36.9 (36) years (IQR, 30–43 years). The age of first ultramarathon was not related ($p = 0.12$) to the calendar year of the first ultramarathon.

The distribution of number of years of regular running before the first ultramarathon is shown in Figure 5. The median value was 7 years (IQR, 3–15 years). There was a weak but statistically significant correlation ($r = -0.13$, $p < 0.0001$) between the number of years of regular running before the first ultramarathon and the calendar year of the first ultramarathon.

The mean lifetime number of running competitions of various distances is shown in Figure 6. Considering all race distances, the 5-km distance was the most popular. Among the ultramarathon events, the 50-km distance was the most popular. The median lifetime number of races completed was 44 (maximum 1,255) marathon and shorter races, and 9 (maximum 352) ultramarathons.

There were 930 (69.1%) individuals reporting that they had participated in competitive sports while in high school. The most common sports were track and field (48.0%), cross-country running (38.7%), soccer (22.4%), basketball (21.5%), and football (18.3%). There were 429 (31.9%) of the individuals reporting that they had participated in competitive sports while in college. The most common sports were cross-country running (33.3%), track and field (26.8%), and soccer (14.2%).

The percentage of running distance spent on various surfaces over the course of the lifetime is shown in Table 1 alongside the values for the previous 12 months among the active ultramarathon runners. Compared with the previous year values for the active ultramarathon runners, the lifetime percentages were higher ($p < 0.0001$) for concrete and asphalt, track, and treadmill surfaces, and lower ($p < 0.0001$) for trail surfaces. The estimated percentage of exercise time at different intensities over the lifetime is shown in Table 2. Compared with the previous year intensities reported among the active ultramarathon runners, the full group reported a greater percentage ($p < 0.0001$) of time at light intensities and a lower percentage ($p < 0.0001$) of time at moderate intensities. There were 71.0% who reported that they had performed regular resistance training for at least a continuous 3-month period during their lifetime.

Most of the study participants reported spending some time at aerobic exercise activities other than running. The percentage spending time at various activities and the overall proportion of aerobic exercise time at the different activities is shown in Table 3. Compared with the time at various activities in the previous year among the active ultramarathoners, the lifetime values were lower ($p < 0.0001$) for running and higher ($p \leq 0.05$) for all other activities except swimming.

There were 73 individuals who indicated that they were no longer running regularly, and 124 who had not completed an ultramarathon in the previous year. Of the latter group, most ($n = 116$) indicated that they intended to run an ultramarathon again in the future. The reasons that were provided for no longer regularly running or not completing an ultramarathon in the previous year are shown in Table 4. Overall, key explanations included running injuries, and work and family commitments. Of the 73 individuals who reported that they had stopped running regularly, 82% indicated they were still performing some type of regular aerobic exercise, which was mostly accounted for in terms of percentage of exercise time with running (48%), bicycling (16%), fastpacking or backpacking (12%), and walking (8%).

Discussion

Previous observations from various ultramarathon competitions have shown that middle-aged men account for the majority of participants (4–11,25). But, we are unaware of any previous assessment of the age at which individuals start running ultramarathons. This work found median age to be 36 years at the first ultramarathon, and that the median number of years of running before the first ultramarathon was 7. Therefore, most individuals begin ultramarathon running well into adulthood and after several years of experience at running shorter distances. However, 25% of this group had run their first ultramarathon within 3 years of starting regular running, so a sizable minority had limited running experience at the time they took on the challenge of their first ultramarathon. We found no evidence that the age at which the first ultramarathon was run has changed over the past several decades, although there has been a weak trend toward a decrease in the number of years of regular running before the first ultramarathon. Since lack of running experience could influence medical and race day issues of these athletes, these findings are important for race directors and medical providers who care for these athletes during and outside of the events.

The active ultramarathon runners in this study had an annual median running distance of 3,347 km. This is relatively high compared with other reports of recreational (16,26,27) or competitive (1) distance runners where the annual running distance averaged less than 2,500–3,000 km. Interestingly, the annual running distance was minimally lower among older participants and was not different between men and women. Annual running distance was mostly related to the longest running competition of the year when considering races of ultramarathon distances. In general, those who completed no running races during the previous year ran as much distance as those with their longest running competition being 50 km.

Race participation and age were minimally related such that older ultramarathon runners completed fewer marathon and shorter distance races than younger ultramarathon runners. Whereas, there was a small, statistically significant, trend for older ultramarathon runners to complete more ultramarathons than younger ultramarathon runners. The presumption is that older ultramarathon runners are more likely to be at a phase in their lives where they have adequate financial resources and more time, because of reduced family and work commitments, allowing for greater participation in leisure activities.

This work demonstrates that active ultramarathon runners spend most of their exercise time running. It is not surprising that they are also more focused on running if they are actively participating in ultramarathons. Nonetheless, it is common for ultramarathon runners to also participate in a variety of other activities, with bicycling being the most common. However, less than half seem to perform resistance training on a consistent basis. Also of note was the finding that the transition to ultramarathon running appears to be associated with relatively more running distance being performed on trails, and less on concrete and asphalt, or on tracks. This is not surprising because most ultramarathon races are on trails (25).

More than two-thirds of ultramarathon runners participated in competitive sports in high school, but less than a third did so in college. The most common sports in which they participated were cross-country running and track and field. Nevertheless, the median age when the group started regularly running was 26 years. This indicates that regular running generally started well after the college years.

Running injuries represented the most common reason for discontinuation of regular running or ultramarathon running. We have previously reported that ongoing injury was the main reason for not starting an ultramarathon among 161-km ultramarathon entries (7). The present findings support the impact of running injuries in this group. Among those intending to run an ultramarathon again, work and family commitments were reported as the main reasons for not running an ultramarathon in the past year. It is not surprising that work and family commitments present obstacles to running ultramarathons, but it is reassuring that this group demonstrated that regular running could be continued despite these other commitments.

This investigation is limited by self-selection recruitment techniques and data collection by self-report. However, we are comfortable that self-selection bias does not seem to be a serious issue because many characteristics of this sample, some of which will be reported elsewhere, were comparable to previous reports of ultramarathoners (7,8,25). Additionally, the data were examined for outliers, and though it is possible that some incorrect entries could not be identified and corrected, the general conclusions of the study seem robust and well supported.

In summary, this work demonstrates that ultramarathon runners are generally well into adulthood and with several years of running experience before running their first ultramarathon, but 25% have only been regularly running for 3 years or less at the time of their first ultramarathon. There is also some evidence that the number of years of regular running before the first ultramarathon is decreasing. Annual running distance of ultramarathon runners is high and diminishes little with age, and is mostly dependent on the

longest ultramarathon competition the individual will run during the year. Running injuries represented the most common reason for discontinuation of regular running, whereas work and family commitments are the main reasons for temporarily discontinuing ultramarathon running.

Practical Applications

This work reveals that 25% of ultramarathon runners may have 3 or less years of regular running experience at the time of their first ultramarathon and that there is a trend toward a decrease in the number of years of regular running before the first ultramarathon. These findings are important for race directors and medical providers who care for these athletes during and outside of the events to recognize because a lack of running experience could influence the needs of these athletes.

The present work also demonstrates that active ultramarathon runners tend to have a high annual running distance that is diminished little with aging. In fact, it is the older ultramarathoners who tend to complete the most ultramarathons. Recognition that such behavior is characteristic of older ultramarathoners is important for those providing their medical care.

Finally, among the former ultramarathon runners, running injuries represented the most common reason for discontinuation of regular running or for deciding to not run ultramarathons in the future. These findings demonstrate the adverse impact of running injuries on the sustainability of ultramarathon running. Improved strategies for prevention and treatment of running injuries could play an important role in allowing these athletes to continue participating in this activity.

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