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VALIDITY OF BOSTON MARATHON QUALIFYING TIMES

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ABSTRACT

Purpose: Assess the validity of Boston Marathon qualifying (BMQ) standards for men and women.

Methods: Percent differences between BMQ and current world records (WR) by sex and age group were computed. WR was chosen as the criterion comparison because it is not confounded by intensity, body composition, lifestyle, or environmental factors. A consistent difference across age groups would indicate an appropriate slope of the age vs. BMQ curve. Inconsistent differences were corrected by adjusting BMQ standards to achieve a uniform percent difference from WR.

Results: BMQ standards for men were consistently ~50% slower than WR (mean = 51.5±1.4%, range = 49.6 to 54.4%), thus demonstrating acceptable validity. However, BMQ for women indicated convergence with WR as age increased (mean = 45.8±13.7%, range = 17.5 to 58.9%). The women's BMQ standards were revised to yield a consistent 50% deviation from WR across age groups (50.9±0.8%, range = 49.2 to 52.2%). Applied to all 16,773 women of the 2012 Chicago Marathon, the suggested BMQ standards would lead to a 4.90% success rate, compared to 8.39% using the current standard. This compared to a 9.6% success rate for all 20,681 men of the same race.

Conclusions: The current women's BMQ standards appear too lenient for women 18-54 yr and too strict for women 55-80 yr but yield equitable gender representation in percentage of qualifiers. The current men's and suggested women's BMQ standards appear valid but would lead to approximately 40% fewer women achieving BMQ standards.

Key Words: aging, physical performance, older adults

Introduction

The Boston Marathon qualifying (BMQ) standards[1] limit the number of participants in this popular race. However, no official written record exists to describe how and why these BMQ standards were developed (e.g., gender parity, fairness, capped participation). Furthermore, peer-reviewed research examining their validity appears unavailable.

There are several methods by which such validity might be assessed. The *best-fit* method compares best-fit curves of age vs. finish time to BMQ standards. However, since this method does not take into account intensity, training, and body composition, the result may mask the true relationship between performance and age alone[2]. The *VO$_{2peak}$* method is based on the independent contribution of age to the decline in maximal oxygen uptake (VO$_{2peak}$) from which prediction equations link VO$_{2peak}$ with marathon performance. However, the linear nature of this method conflicts with empirical evidence of an age vs. run time slope that is exponential beyond approximately 70 yr[3]. The *world record* (WR) method is based on BMQ standards being a fixed percentage slower than world record times for men and women in each age group[4]. The advantage of this model is that world bests are at the age-associated limits of human capability. As such, they are less confounded by intensity, body composition, and fitness level. A disadvantage may be that this method is subject to the stability of world records within each age group although a review of current marathon world records for the BMQ age groups[5] indicates the mean "age" of each record is 10.4 and 8.4 yr for men and women, respectively.

The purpose of the present study was to use the WR method to evaluate the validity of the current BMQ standards for men and women across all age groups.

Subjects

Subjects were the current male and female marathon WR holders (Table 1) for each of

the 11 BMQ age groups as officially recorded by the Association of Road Racing Statisticians[5].

Given that these data were archived and in the public domain, informed consent and institutional

review board approval were not necessary.

Methods/Statistical Analysis

Percent differences (PD) from WR were calculated for each gender by age group BMQ

standard along with the standard deviation (SD) of PD. Slopes of the best-fit curves of age vs.

PD were compared to a slope of 0 ($\alpha = 0.05$). For non-zero slopes and/or PD SD/mean ratio >

5%, revised standards were determined to the nearest 300 sec finish time increment (customary

for BMQ standards) that achieved a slope not different from zero and an SD/mean ratio < 5%.

To examine impact, the revised standards were then applied to official race data of the 2012

Chicago Marathon with 20,681 men and 16,773 women finishers. Race conditions were

favorable on this generally flat course.

Results

The PDs of current BMQ standards vs. WR men's data indicated a consistent deviation

both in best-fit slope (r = 0.0, p = 0.998) and SD (51.5% $\pm$ 1.4%), thus meeting the established

validity criteria. As a result, the same 50% deviation from WR became the goal standard for

women. Women's data, however, showed a polynomial slope (r = 0.97, p = 0.000) with a

significant trend for decreasing PD ranging from 58.8% (18-34 yr) to 17.4% (80+ yr).

A 3rd order polynomial was fitted to the women's age vs. WR curve and the 50%

decrement was calculated for each age group and rounded to the nearest 300 sec. The resulting

women's BMQ suggested standards (Table 1 and Fig. 1) achieved the thresholds of consistency

of deviation (r = 0.00, p = 0.985) and (50.9% $\pm$ 0.9%).

Applied to the 2012 Chicago Marathon finishers, the current BMQ standards would have

yielded 9.6% and 8.4% of the men and women, respectively, to have qualified. However, using

the suggested women's BMQ standards only 4.90% of the women (41.6% fewer) would have

qualified largely due to only 3.5% of all women runners being 55^+ yr.

Discussion

Based on the present analysis using the WR method to establish BMQ the men's current

standards were acceptably valid. However, the women's current BMQ standards were too

lenient by 10 min. for the 18 – 54 yr age groups and too strict by 10 min. for the 55 – 69 age

groups and 35 – 95 min. for the 70^+ age groups. Nonetheless, use of the current standards led to

generally the same percentage of qualifiers across gender. The suggested women's standards

met the aforementioned metrics for validity but led to nearly half as many qualifiers.

Recent evidence suggests that older women have not yet reached the physiological limits

of performance in the marathon. This may be due, in part, to low participation rates and yet-to-

be elucidated physiological changes not related to detraining but specific to aging women[6,7].

These findings could have implications for future adjustment of the women's BMQ standards.

Conclusion/Practical Application

The current BMQ standards are arguably valid for men, unfair for women older than 54

yr, too lenient for women younger than 55 yr, but yield gender parity in percentage of qualifiers.

The suggested women's BMQ standards, though fairer to all age groups, would lead to

approximately half as many women qualifying as men.

References

1. Boston Athletic Association. Boston Marathon. http://www.baa.org/races/boston-marathon.aspx. 2012. Accessed December 26, 2012.

2. Crecelius AR, Vanderburgh PM, Laubach LL. Contributions of body fat and effort in the 5K run: age and body weight handicap. *J Str Cond Res*. 2008;22:1475-1480.

3. Reaburn P, Dascombe B. Endurance performance in masters athletes. *Eur Rev Aging Phys Act*. 2008;5:31-42.

4. Grubb H. WMA Age-grading calculator. http://www.howardgrubb.co.uk/athletics/wmalookup06.html. Published 2006. Updated September 4, 2011. Accessed December 26, 2012.

5. Association of Road Racing Statisticians. World single-age records – Marathon. http://www.arrs.net/SA_Mara.htm. Updated December 18, 2012. Accessed December 26, 2012.

6. Hunter SK, Stevens AA. Sex differences in marathon running with advanced age: Physiology or participation? *Med Sci Sports Exerc*. 2013;45:148-156.

7. Lepers R, Cattagni T. Do older athletes reach limits in their performance during marathon running? *Age*. 2012;34:773-781.
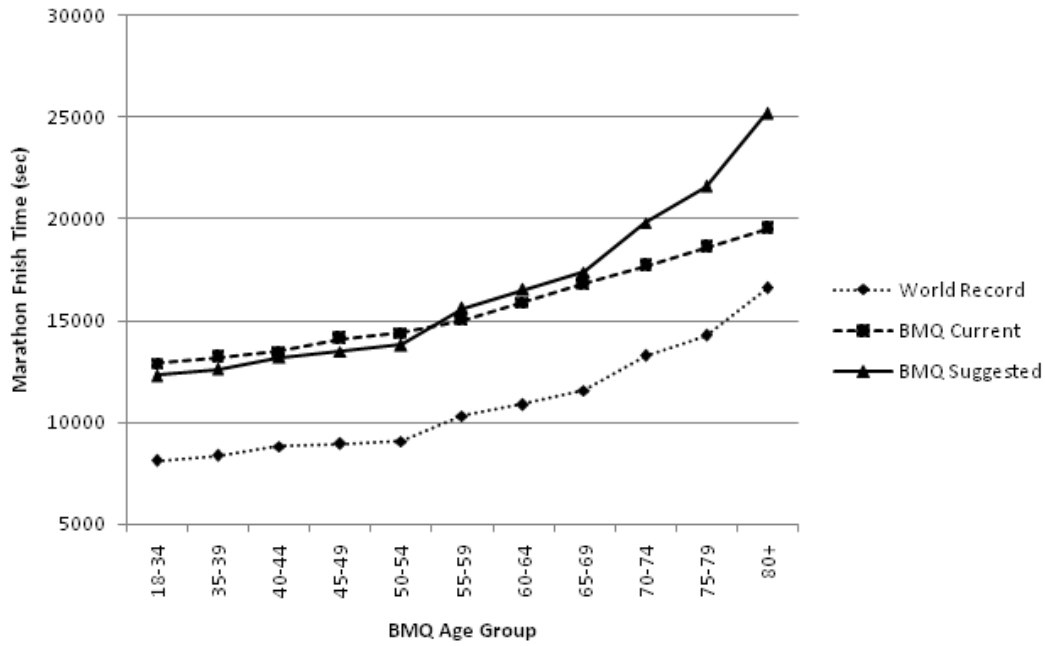
Figure 1. Women's current and revised BMQ Standards[1] compared to World Records[5].

Table 1. World Records[5], current[1], and suggested Boston Marathon Qualifying standards for men (M) and women (W). *Men's current and suggested standards are the same.

Age Groups	18-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+
World Records (hr:min:sec)[5]											
Men	2:03:38	2:03:58	2:08:46	2:14:16	2:19:29	2:25:56	2:36:30	2:41:57	2:54:48	3:04:53	3:15:54
Women	2:15:25	2:19:18	2:26:51	2:29:00	2:31:05	2:52:14	3:01:30	3:12:57	3:41:12	3:57:30	4:36:52
Boston Marathon Qualifying Standards[1]											
M current & suggested*	3:05	3:10	3:15	3:25	3:30	3:40	3:55	4:10	4:25	4:40	4:55
W current	3:35	3:40	3:45	3:55	4:00	4:10	4:25	4:40	4:55	5:10	5:25
W suggested	**3:25**	**3:30**	**3:40**	**3:50**	**3:55**	**4:20**	**4:35**	**4:50**	**5:30**	**6:00**	**7:00**