Perceptions of Five-Year Competitive Categories: Model of How Relative Age Influences Competitiveness in Masters Sport

Nikola Medic [1]✉**, Bradley W. Young** [2] **and J. Robert Grove** [3]
[1] School of Exercise and Health Sciences, Edith Cowan University, Perth, WA, Australia
[2] School of Human Kinetics, University of Ottawa, Ottawa, Ontario, Canada
[3] School of Sport Science, Exercise and Health, University of Western Australia, Perth, WA, Australia

Abstract
The purpose of this study was to examine the contrasting perceptions of masters swimmers related to the first and fifth constituent years of a 5-year age category. Swimmers aged between 35 and 93 years (154 male, 184 female) were surveyed at the 2008 FINA World Masters Championships. Exploratory factor analysis indicated the existence of the following five factors considered important for preparation, attendance, and success at masters competitions: awareness of advantages, expectancy, motivation, training, and physiological capacity. One sample t-tests showed that masters swimmers are conscious of advantages that 5-year age categories afford to relatively-younger cohorts (i.e., those who are in the first year of any age category). They also perceive that, in the first compared to the fifth year of an age category, they have greater physiological capacity, engage in more training, have higher expectations to perform well, and are more motivated (all ps < .001). Findings point to perceived psycho-social and physical factors that potentially explain why relatively younger masters athletes are more likely to perform better and to participate in masters competitions than relatively older masters athletes.

Key words: Sport participation, motivation, aging, competition.

Introduction

A relative age effect refers to the overall difference in age between individuals within each age group that may result in significant differences in performance and participation (Helsen et al., 2005). Contexts in which robust findings related to relative age effect have been found include youth sports (Cobley et al., 2009; Musch and Grondin, 2001) and academia (Allen and Barnsley, 1993). Similar to youth sport contexts, age categories also exist within masters-level sports. Recently, a relative age effect, or what has also been referred to as "constituent year effects" (Wattie et al., 2008, p. 1406), was also found within the context of masters-level sport (i.e., organized sports for athletes 35 years and older), specifically in swimming and track and field (Medic et al., 2009a; 2009b).

In relative age studies with youth, investigators identify advantaged and disadvantaged cohorts within a standard one-year age-category. Analogous to this approach and consistent with the definition of "relative age effect", in the masters sport context relatively younger and older cohorts are identified within a standard age category bracket that is typically five years rather than 1 year in duration. Thus, based on the 5-year age categories (e.g., 35-39, 40-44, etc.) in which masters athletes compete, Medic et al. (2007) and Medic et al. (2009a) found that the probability of participating in the U.S. national championships was significantly higher for masters swimmers and track and field athletes who were in their first or second year, and was lower if they were in the fourth or fifth year of any 5-year age category. The participation related relative age effect was stronger for males than females and got stronger with age (Medic et al., 2009a). It was also found in these studies that the probability of setting a U.S. national record was significantly higher if masters swimmers and track and field athletes were in the first year of any 5-year age category, and was lower if they were in either the third, fourth, or fifth year of an age category. Similarly, Medic et al. (2009b) found that the odds of participating in the international-level World Masters Games are higher if swimmers are in the first year and if track and field athletes are in the first or second year of any 5-year age category. Conversely, the probability of participating is lower if track and field athletes are in the fourth or fifth year of any 5-year age category. Finally, Medic et al. (2009b) also found that the probability of participating in masters international-level weightlifting and rowing seems to be equally distributed among individuals across all five constituent years of an age category, suggesting that a relative age effect may not exist in masters sports where competitors are arranged by both age and weight rather than chronological age only. Overall, findings from relative age effect studies in masters sports at national and international-level suggest that the benevolent intent of the 5-year age category system in the context of masters competitive sports, especially swimming and track and field, is not being realized. Initially, the 5-year cohorts were designed to "level the playing field" such that individuals would feel motivated to continue participation across the lifespan without suffering disadvantages due to age-related decline. However, whether the 5-year brackets serve to perpetuate involvement across the lifespan is questionable considering cross-sectional evidence of irregular patterns of participation and performance achievement across constituent years favoring relatively younger cohorts of masters athletes.

Various motivational, expectancy, and physiological factors have been hypothesized as potential explanations of a relative age effect in masters-level sports, however no empirical data had been collected to date in rela-

tion to any of these. For example, it has been proposed (Medic et al., 2007; 2009a) that relatively younger masters athletes may be more likely to set records and participate in competitions because they may have higher cardio-respiratory capacity and strength (Baker and Tang, 2010, Berthelot et al., 2011; Desgorces et al., 2008; Donato et al., 2003), higher expectations to win (Wilson, 2005), and/or higher motivation (Weir et al., 2002) in comparison to relatively older peers in the same 5-year age category. To test these hypotheses and to build upon early studies that have established trends using archived participation and performance data, Medic (2009) recommended that future studies should examine whether "masters athletes believe that they have specific advantages or disadvantages during the five constituent years of a 5-year age category" (p. 118). This could provide insight into whether middle- and older-aged athletes are cognizant of a relative age effect and underlying explanations interacting with one's age to produce such effects. As a result of this potential awareness (which is likely a factor that is different in masters rather than youth sports), they may have the opportunity to make decisions to participate based on their perceptions of a relative age advantage.

There is some evidence that masters swimmers do elect to avoid participating in competition depending on whether they are early or late in a competitive bracket. By employing a retrospective longitudinal study design, participation rates of masters swimmers were examined on a within-individual basis at USA Masters Short Course National Championships as a function of an individual's constituent year within any 5-year age category over a period of six years (Medic et al., 2011). It was found that the odds of a masters swimmer participating in the championship during the first constituent year of any 5-year age category was more than two times greater than the odds of that athlete participating during the fifth constituent year. It was also found that about 8 out of 10 swimmers who participated in the national championship event failed to return to the national championship at any point in the next six years suggesting high drop-out rates amongst "average" masters athletes (Medic et al., 2011, p. 34). In comparison, for more serious masters swimmers (i.e., those who attended at least three championships over the period of six years), 70 % of them were more likely to return when they found themselves in a relatively-advantaged competitive position (i.e., first year of an age category) and about 50 % continued to return when they were in a relatively-disadvantaged position (i.e., last year of an age category). Although these participation disruptions may be a threat to the continuously active lifestyle of athletes, it is important to understand the perceived explanations and possible perceived inequities associated with such decisions.

The current study, therefore, was the first to date to ask masters athletes to report their perceptions of competitive advantages from being relatively youngest versus relatively oldest. More specifically, the main purpose of this study was to examine masters swimmers' perceptions of differences related to possible participation and performance advantages between the first and final constitu-

ent years of a 5-year age category. Masters swimmers were chosen because participatory and performance differences reflecting relative age within 5-year cohorts have been found consistently in this sport. Given the exploratory nature of the study, no hypotheses were proposed.

Methods

Upon receiving approval from the institutional ethics review board, survey data were collected during the 2008 FINA World Masters Championships. Three hundred and thirty eight masters swimmers (154 male; 184 female) returned completed surveys (53% response rate). The mean age of the sample was 55.3 years ($SD = 11.8$; range = 35–93 years). The sample was comprised mostly of elite level masters swimmers; 51% reported that to that point in time their highest level of completion where they competed at was the international level, 25% at the national level, and 24% at the provincial level. Distribution of swimmers in each of the age categories were: 35-39 years (n = 27), 40-44 (n = 49), 45-49 (n = 40), 50-54 (n = 43), 55-59 (n = 54), 60-64 (n = 55), 65-69 (n = 31), 70-74 (n = 17), 75-79 (n = 16), 80-84 (n = 2), 85-89 (n = 2), and 90-94 (n = 3). Frequencies of participants' responses across constituent years of all 5-year age categories were: Year 1 of any age category (n = 70), Year 2 (n = 76), Year 3 (n = 70), Year 4 (n = 59), and Year 5 (n = 63).

Survey items used in this study were developed based on previous literature on relative age effects in masters sport (Climstein et al., 2010; Medic et al., 2009b) and elements of multiple dominant psycho-social theories (e.g., self-determination theory, sport commitment model). To improve content validity, items were initially screened by a panel of 3 experts in the field and pilot tested with 28 masters swimmers. Items assessed masters swimmers' perceptions of differences related to a possible participation and performance advantage between the first and final (fifth) constituent years of a 5-year age category described in a hypothetical scenario. This approach (i.e., the perceived difference between the first and fifth constituent year) was adopted because this is when the largest difference in participation and performance has been found to exist (Medic et al., 2009a; 2011). Prior to responding, participants read the following preface: 'Consider the 50-54 year old age category for masters competition. If an athlete is 50 years old, he/she would be in the first year of that competitive age category. If an athlete is 54 years old, he/she would be in the final year of that competitive age category. This was an example. Now please consider the 5-year age category that you are in presently and the differences between the first and final year in your age category.' In particular, participants were asked 22 questions related to perceived advantages associated with the first and fifth constituent years (e.g., If I were in the first year of a 5-year age category, my enjoyment at competitions compared to if I were in the final year would be ...). Each response was randomly ordered and coded on a 5-point Likert scale as: 'much lower' (-2); 'a little lower' (-1); 'same' (0); and 'a little higher' (1); 'much higher' (2).

An exploratory factor analyses (EFA) was first

conducted using items to determine the initial composition and structure, followed by computation of internal consistency reliability estimates (Coefficient α) and Pearson *r* correlations between factors. As per Gerbing and Hamilton's (1996) recommendations, this analytical approach was used to examine the structure of the items on the instrument and to determine how various items aligned with respective subscales representing explanations for relative age effects. Next, one-sample *t*-tests were used to examine whether the obtained values on each of the five subscales differed significantly from the hypothesized or expected value (i.e., the value of '0', which indicated no difference in perceptions pertaining to the first and final constituent years of a 5-year age category). Tests were performed with SPSS 17.0 and significance was established at $p < 0.01$ in order to control for error rate inflation (Bonferroni adjustment). The effect size (*ES*) was calculated as the ratio between the difference in observed and expected value and the pooled standard deviation (Sheskin, 2000). Analyses were first performed for a total sample of masters swimmers, irrespective of age or constituent year with any 5-year age category. Then, to complement the analysis with the total sample, a veridical cross-validation analysis was conducted separately for only those masters swimmers who

were in their first or fifth year of any 5-year age category when they completed the survey. This subgroup was chosen because the first and fifth constituent years in the hypothetical question corresponded to their constituent years of actual participation within their age category.

Results

The latent factor structure and composition of the item pool was examined in a Principal-Axes Factor Analyses (PAF) with an oblique rotation using Thurstone's simple structure criteria, factor interpretability, and factor definition as the criteria for item retention. Following joint consideration of the Kaiser-Guttman (eigenvalues > 1) and scree plot stopping rules (Cattell and Schuerger, 1978), a 5-factor solution emerged: expectancy, motivation, training, awareness of advantages, and physiological capacity. These analyses resulted in the retention of 18 items that accounted for 69.04% of the item variance. An examination of the transformed pattern matrix presented in Table 1 indicates adequate simple structure (i.e., all items loaded > |.50| on determined factors and < |.30| on non-determined factors). The internal consistency reliability estimates for each factor/subscale (Table 1) were excellent ranging from 0.74 to 0.91. In addition, all items

Table 1. Exploratory Factor Analysis on the Advantages of a Relative Age Effect in Masters Sport

If I were in the first year of a 5-year age category…	EXP	MOT	TRN	AWR	PHY
Expectancy (EXP)					
My expectation to set an international record in competitions compared to if I were in the final year would be...	**.80**	.17	.06	.17	.18
My expectation to set a personal record in competitions compared to if I were in the final year would be...	**.79**	.12	.22	.17	.18
My expectation about how I would place in competitions compared to if I were in the final year would be...	**.84**	.20	.11	.28	.01
My overall advantage over my opponents compared to if I were in the final year would be...	**.76**	.27	.07	.27	.06
Motivation (MOT)					
My enjoyment at competitions compared to if I were in the final year would be...	.15	**.78**	.03	.09	.25
My obligation to enter competitions compared to if I were in the final year would be...	.19	**.68**	.26	-.11	.02
My desire to enter competitions compared to if I were in the final year would be...	.29	**.66**	.19	.28	.00
My expectation to enter competitions compared to if I were in the final year would be...	.29	**.65**	.25	.03	.02
The support and encouragement that I would receive from others for my sport involvement compared to if I were in the final year would be...	-.04	**.56**	.08	.05	.28
My excitement about competitions compared to if I were in the final year would be...	.28	**.53**	.29	.28	.19
Training (TRN)					
The duration of my training sessions compared to if I were in the final year would be...	.10	.19	**.89**	.08	.21
The intensity of my training sessions compared to if I were in the final year would be...	.16	.19	**.84**	.17	.16
The frequency of my training sessions compared to if I were in the final year would be...	.15	.25	**.80**	.15	.23
Awareness of Advantage (AWR)					
The number of times that I would set an international record in competition compared to if I were in the final year would be...	.24	.09	.04	**.75**	.15
The number of times that I would set a personal record in competition compared to if I were in the final year would be...	.28	.04	.07	**.73**	.22
My placing in competitions compared to if I were in the final year would be...	.27	.03	.21	**.67**	-.07
Physiological Capacity (PHY)					
My physical fitness compared to if I were in the final year would be...	.11	.19	.34	.02	**.78**
My physical capability compared to if I were in the final year would be...	.29	.06	.25	.16	**.72**
Cronbach's alpha	.90	.84	.91	.74	.77
Eigen Value	8.66	2.21	1.44	1.19	1.10
% Variance	41.22	10.50	6.88	5.67	4.79
Motivation (MOT)	.58	-			
Training (TRN)	.38	.56	-		
Awareness of Advantage (AWR)	.56	.39	.36	-	
Physiological Capacity (PHY)	.41	.47	.50	.30	-

Table 2. Perceptions of an advantage between first and final constituent year of a 5-year age category.

	Total sample			Combined first and fifth year of 5yr age category		
	M (±SD)	t	ES	M (±SD)	t	ES
Expectancy	.33 (.90)	6.55	.52	.35 (.95)	4.74	.52
Motivation	.22 (.46)	8.74	.67	.23 (.55)	5.52	.59
Training	.15 (.46)	5.88	.46	.14 (.54)	3.58	.37
Awareness of Advantage	.32 (.88)	6.25	.51	.34 (.97)	4.47	.50
Physiological Capacity	.21 (.68)	5.65	.44	.24 (.76)	4.16	.45

All ps < 0.001; 'Combined first and fifth year of 5yr age category' is the veridical cross-validation sub-sample.

demonstrated satisfactory inter-item dependence ($C^2 = 3772.01$, p < 0.001) and an acceptable KMO sampling adequacy statistic (KMO = 0.89). Finally, correlations between factors were significantly (all ps < 0.001) positive and were low to moderate in strength (Table 1).

Results of one sample *t*-tests (Table 2) for the total sample and the veridical sub-sample both showed that masters athletes are conscious of advantages that 5-year age categories afford to relatively younger cohorts and that when they are in the first year of an age category, they perceive that they would have higher expectations to perform well, would be more motivated to enter competitions, would be more likely to engage in more training and higher intensity training, they perceive that they would perform better at competitions, and they would have higher physiological capacity, compared to when they are in their fifth year of an age category (all ps < 0.001).
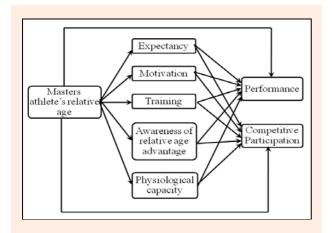

Figure 1. Model of how relative age influences performance and competitiveness in masters-level sport.

Discussion

The goal of the present study was to expand the existing literature by analyzing the degree to which athletes participating in masters sport in which a relative age effect had been found (i.e., swimming) perceive to have competitive advantages from being relatively youngest versus relatively oldest. Preliminary evidence from this study indicated the existence of five factors considered to have an influence on preparations for, attendance at, and perceived success at masters-level competitions; these were labeled: awareness of advantages, expectancy, motivation, training, and physiological capacity. These five themes are unique because they provide researchers with a proposed model (see Figure 1) for more intensive and coher-

ent analyses of how masters athletes' relative age potentially influences their performance and competitiveness in masters-level sport. The results of the EFA provide a preliminary support for the multidimensional factor structure. Also, the retained items showed evidence of structural validity and internal consistency score reliability in this sample of masters swimmers.

The present findings are novel because they are the first to show empirical evidence that masters swimmers seem to be conscious of the advantage that 5-year age categories afford to relatively younger cohorts of athletes. This result offers initial evidence of convergent validity with the findings from previous studies which have suggested heightened probabilities for participation and superior performance amongst relatively younger masters (Medic et al., 2009a; 2009b). Also, these results support the notion that "masters athletes appear to be 'hedging their bets' for competitive success by preserving and increasing their likelihood for winning by consciously choosing in what years to compete" (Medic et al., 2009a, p. 1543).

Results of this investigation are important because they provide initial evidence suggesting that masters swimmers believe that both physical (i.e., physiological capacity, training) and psychological (i.e., expectancy, motivation) factors may influence differences in participation and performance advantages during the first and final years of age group membership. These results imply that the expectations for good performance and motivation to participate in competitions among masters swimmers may be related to perceptions of competitive opportunity (advantage or disadvantage) which arise from beliefs about age-related physiological decline (e.g., cardio-respiratory capacities, muscular power, cellular changes) within any 5-year competitive age category (Baker and Tang, 2010, Berthelot et al., 2011; Maharam et al., 1999). Even though research has shown that the rates of decline in performance within any given 5-year age category are more moderate for highly trained sport samples than non-trained individuals (Spirduso et al., 2005; Young and Starkes, 2005), the perceived advantage is likely a consequence of an actual physiological difference between early and late cohorts of athletes. This suggests that, from a psychological perspective, masters swimmers seem to perceive competitive opportunities that are accordant with the actual physiological differences. In order to further examine expectancy- and motivation-related factors of relative age effects in masters sport, future research could assess (using standardized questionnaires) whether specific motivational regulations (e.g., intrinsic or extrinsic regulations) predominate during certain constituent years within a 5-year age category.

The use of a sub-sample comprised of individuals who were actually in the first and fifth constituent years cross-validated the results obtained from the broader sample in the present investigation. Still, one of the potential limitations of this study was that the results were based on a new questionnaire as well as a hypothetical premise (i.e., "if I were in the first year of my 5-year age category in comparison to if I were in the fifth year). Although the hypothetical scenario used in this investigation was realistic and consonant with approaches utilized in various research studies within the field of sport psychology (Vallerand et al., 1988), an underlying assumption of this approach is that intentions directly transform into behavior (Grasmick and Bursik, 1990). However, given that the discrepancy between attitude and behavior has been well documented (Ajzen and Fishbein, 1977) and that individuals do not necessarily do what they say they will do (McGuire, 1985), future studies are needed in order to replicate the current results by assessing actual first versus fifth year participants and their perceptions of a competitive advantage using non-hypothetical scenarios (i.e., standardized questionnaires or measures). Studies could also consider how these differential perceptions may be moderated by factors which prior research (Medic et al., 2009a; 2009b) has shown to influence relative age effects in masters sport (i.e., gender, life stage, and sport type).

Another limitation of this study relates to its cross-sectional nature. Given that in the present study the participants were recruited during a competition, this was likely to have produced a sampling bias since masters athletes who are in the later years of any 5-year age category at the time of the assessment would not have had an equal chance of being assessed because they are less likely to participate in competitions in the first place. However, this sampling phenomenon could also be taken as evidence that the findings obtained here are particularly robust because strong effects emerged in spite of the fact that relatively older individuals were perhaps more "self-selected" (since they attended the competition at the age at which they were less likely to participate in competitions, and thus had a chance to participate in the this study). To overcome this limitation and to better understand potential factors that determine relative age discrepancies over time, future studies could sample masters athletes outside of organized competitions (to provide an equal chance of participating in the study, specifically those who are less likely to or do not attend competitions during their final year of an age category) or could employ a longitudinal design in which masters athletes can be followed and reassessed during each of the five constituent years of a 5-year age category. Alternatively, a more economical way of utilizing a longitudinal assessment would involve following participants on a within-subject basis until they move into the next subsequent age-category, especially from fifth to first year (i.e., from being relatively oldest to being relatively youngest), and determining how decisions to participate vary depending on constituent year and concurrent measures relating to perceived physiological capacity, training, psycho-social, and expectancy-based factors. Finally, as the study population was made up of swimmers competing in world championships, care needs to be taken in generalizing the results to other populations.

Conclusion

In conclusion, the present study provided preliminary evidence for five perceived factors that potentially explain why relatively younger masters athletes are more likely to perform better and to participate in masters competitions than relatively older masters athletes. Furthermore, the results highlight the possibility that differential perceptions associated with the 5-year age brackets might compromise masters athletes' continuity of sport competitiveness and underlying training. Continuity of competitiveness is important and needs to be fostered since organized sport for middle to older-aged individuals can serve as a vehicle for active and healthy living (Menec, 2003). If one considers that an athlete's anticipation of participating in a competitive event stimulates a regular pattern of physical activity in preparatory activities (Young, 2011), then the fact that masters swimmers in the present study anticipated lower frequency, duration, and intensity of training sessions during a relatively older year is concerning. Research has already determined that masters swimmers decide to avoid competition when they are relatively older and disadvantaged in an age category (Medic et al., 2011); it will be important for future research to examine if discontinuities in competitive participation also subsequently compromise the continuity of their regular patterns of training/sporting activity. To date, it remains unclear whether relatively older masters athletes (a) simply reduce their training while remaining continuously involved, (b) neglect higher-level competitions (which require travel and greater expenses) and instead attend more local-level competitions, or (c) do not alter their training patterns at all. If results do indicate that perceived disadvantages accordant with the 5-year competitive age registration brackets actually reduce underlying training and competitiveness significantly, or more severely interrupt continuous involvement by athletes, then the utility of the 5-year brackets and alternative strategies for organizing competitive participation may need to be reconsidered.

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Key points

- There are at least five psycho-social and physical factors (i.e., awareness of advantages, expectancy, motivation, training, and physiological capacity) that may explain why relatively younger masters athletes are more likely to perform better and to participate more in masters competitions than relatively older masters athletes.
- Masters athletes are conscious of the advantage that 5-year age categories afford to relatively younger cohorts of athletes.
- Differential perceptions associated with the 5-year age categories might compromise masters athletes' continuity of sport competitiveness and underlying training.

AUTHORS BIOGRAPHY

Nikola MEDIC
Employment
Senior Lecturer, School of Exercise and Health Sciences, Edith Cowan University
Degree
PhD
Research interests
Relative age effect, sport commitment, sport motivation
E-mail: n.medic@ecu.edu.au

Bradley W. YOUNG
Employment
Associate Professor, School of Human Kinetics, University of Ottawa
Degree
PhD
Research interests
Psycho-social aspects of sport and aging, masters athletes, expert sport performance
E-mail: byoung@uottawa.ca

J. Robert GROVE
Employment
Winthrop Professor, School of Sport Science, Exercise and Health, University of Western Australia
Degree
PhD
Research interests
Participation motives, habit development, overtraining
E-mail: Bob.Grove@uwa.edu.au

✉ **Dr. Nikola Medic**
School of Exercise and Health Sciences, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA, Australia