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Comparative Study of Swimming Strategies in Individual Medley Events at International Swimming Meets

Sahil Dalal
Inventure Academy

Abstract:- The goal of this paper was to investigate how individual medley events are swum differently from 2000-2011 era to 2012-2022 era. We focused at major international meets during these eras to analyze how 200m and 400m individual medley events have changed. The meets selected include major world events – Olympics, World championships; the premier continental events – European championships, Pan Pacific Games; as well as major country-specific events – US and Australian Olympic trials. A 2-way statistical analysis of variance across gender [men vs women] and positions [medalists vs finalists vs semifinalists]) was performed for individual strokes of the medley. The means were compared with the Bonferroni post hoc test. The correlation between the individual split time of a stroke and final time was per- formed by using Pearson's simple correlation coefficient. Us- ing this data, trends were compared between the two papers. The results show that men and women swim the short-axis strokes, breaststroke and butterfly, faster than the long-axis strokes. This study shows that overall breaststroke during 2012-2022 is more correlated than it was during 2000-2011 and is a particularly dominant determinator for 400m Men races. Finally, Men and Women use more positive pacing for 200m and more even pacing strategy for the 400m events. These findings can be used by coaches to fine tune their training strategies.

I. INTRODUCTION

In swimming, a pacing strategy dictates how effort is dis- tributed over the course of a race. A swimmer can swim the first 50% of the race faster than the second 50%, also known as a positive pacing strategy; or the second 50% faster than the first 50%, a negative pacing strategy. The pacing strategy chosen can vary among athletes, and among the event, de- pending on the energy systems to be used. The past studies in these subjects such as proposals of pacing strategies [4] lays out specifics of how to train and swim for each stroke. Other studies of young swimmers at a national level [5] and international swimmers [3] [6] articulate how age and experience influence how a race is swum. These strategies can dictate the outcome of a race [6] [9] and are especially important in medley events which are more complex than the other events, which are of a single stroke.

In medley events, swimmers swim each of butterfly, back- stroke, breaststroke and freestyle in that order for 25% of the race distance. Therefore, the amount of time spent in each stroke is important as deployment of optimal effort in each stroke ultimately decides the placing [10]. A question which is of interest, therefore, is whether these strategies change or evolve. It is of importance to know whether these strategies evolve and how they evolve to better inform coaches and swimmers in a quantitative manner on the changing nature of the sport [4] [5]. Previous study [10] analyzed behavior of swimmers from 2001-2011 across major inter- national competitions. It concluded that medalists for 200 and 400m medley events tend to use even pacing strategy. It also inferred that for men and women, backstroke tends to be the stroke that most often determines the outcome of the race.

The goal of this paper was to assess the pacing strategies of top swimmers from 2012-2022 at the exact same set of inter- national events. We wanted to investigate how individual medley is swum differently and answer important questions pertaining to which stroke is now most determinant for final performance. Much like the previous study, we analyzed their performance through analysis of gender (men vs women) and their positions (medalists vs finalists vs semifinalists) using statistical methods.

II. METHODS

- *Experimental Approach to the Problem*

This paper aims to supplement a paper conducted previ- ously by a group of researchers [10] and look at the change in pacing strategies from 2000-2011 to 2012-2022. Like that study, the goal of this study was to draw conclusions to help coaches tweak their training based on how pacing pacing strategies in 200 and 400m individual medley have evolved. We examined split times of each stroke across gender (Men vs Women) as well as placings (medalists, finalists and semifinalists). Using statistical analysis of variance meth- ods, we identified how pacing strategies have changed and which stroke(s) are the best determinant of outcome in recent 10 years. We hope this analysis will help coaches tinker their coaching methods to help swimmers race in the most optimal way possible.

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The independent variables were gender - men vs women and placings - medalists vs finalists vs semifinalists. The dependent variable was the split time for each stroke within the 200 and 400m medley expressed as a % of the total time. We recorded the dependent variable for each category of the independent variable. We then calculated the mean and standard deviation for each stroke within each category. Table 1 and Table 2 lists the mean and standard deviation (SD) respectively for 200m and 400m events. Mean and SD are computed for each stroke for each gender, for each position as well as each gender within each position.

The motivation for choosing gender as an independent variable was that previous studies [4] had found gender significantly influences the pacing strategy. Additionally, the choice of position was based on the hypothesis that the final position in the event would be influenced by the relative predominance (split time) of each stroke.

- *Subjects*

25 International competitions were analyzed including 6 Eu- ropean Championships (2012, 2014, 2016, 2018, 2021 and 2022), 3 Australian Olympic Trials (2012, 2016 and 2021), 5 World Championships (2013, 2015, 2017, 2019 and 2022), 3 Olympic Games (2012, 2016 and 2021), 3 U.S. Olympic Team Trials (2012, 2016 and 2021), 3 Commonwealth Games (2014, 2018 and 2022) and 2 Pan Pacific Games (2014 and 2018). Results were analyzed in a 11 year period (2012- 2022). A total of 1573 records were analyzed (787 men and 786 women) of a total of 1600 records (25 international com- petitions x 16 swimmers x 2 genders x 2 events [200 and 400 IM]). Swimmers who were disqualified were not included in the count, and in some competitions less than 16 swimmers were there in the results.

- *Procedures*

The results were taken from different websites. Web- sites used include https://www.omegatiming.com/, http://www.glasgow2014.com/, https://gc2018.com/, https://www.birmingham2022.com/, https://www.len.eu/, https://www.swimrankings.net/, https://www.fina.org/. Data entry was done manually into a google sheets file. Checks were done to make sure data was entered correctly and accurately.

For each swimmer, we first noted the split times of each stroke as well as percentage of overall time for that stroke. The normality of the data was confirmed by the Kolmogorov-Smirnov test. We used the percentage time to calculate mean and standard deviation (SD) to character- ize the sample with respect to the gender [2 levels: men, women] and position [3 levels: 1st to 3rd or medalists, 4th to 8th or finalists and 9th to 16th or semifinalists]. The Bonferroni post hoc test was used to compare means.

We then performed a one-way analysis of variance (ANOVA) for each of the independent variables - gender and position. one-way ANOVA was calculated by computing regression sum of squares error sum of squares. We also calculated the number of degrees of freedom for the treatment group and the error group. Finally, we calculated mean square (MS) of treatment and error group to arrive at F- value which is the ratio of MS treatment over MS error. After performing one-way ANOVA for gender and position, we similarly performed two-way ANOVA to account for interaction between gender and position.

III. STATISTICAL ANALYSES

For the analysis, we used the percentages in each style, be- cause we wanted gender to not be a bias in the analysis. Men and women swim differently. Using the percentage time in analysis and having gender as an independent variable not only removes the gender bias but also allows microscopic examination of how differently men vs women swim these events.

For one-way ANOVA calculation for gender, we calculated regression sum of squares for each of Men and Women by squaring the subtraction of group mean from the overall mean and multiplying that by the sample size of the group, and adding them. We then calculated the error sum of squares by squaring the individual value within a group from the group mean, and adding them across the sample size. We also calculated degrees of freedom for the treatment group by subtracting 1 from the number of groups within the independent variable, and degrees of freedom for the error group by subtracting the number of groups from total population size. MS of treatment is then the regression sum of squares / degrees of freedom for the treatment group. MS of error is the error sum of squares / degrees of freedom for the error group. The F-value is the ratio of MS treatment over MS error.

Finally, Pearson's simple correlation coefficient was used to determine correlations between the split time and overall time. The values of this statistic were assigned linguistic labels following recommendations in the literature [2]: >0.1 small, >0.3 moderate, >0.5 large; >0.7 very large; and >0.9 nearly perfect. A p value of <0.05 was considered to correspond to statistical significance.

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Table 1 Mean (SD) (time and Percentage), 2-way ANOVA (Gender, Position, and Interactions) with Bonferroni Post Hoc Test in the 200m Individual Medley.*

		Time(s)		**Percentage (%)**				
200-Individual medley	**Style**	**Men**	**Women**	**Men**	**Women**			
1st-3rd (n = 150)	Butterfly	25.26 (0.43)	28.04 (0.51)	21.57 (0.33)	21.64 (0.33)			
	Backstroke	29.50 (0.80)	33.04 (1.12)	25.19 (0.55)	25.50 (0.72)			
	Breaststroke	33.94 (0.74)	37.48 (0.98)	28.98 (0.51)	28.93 (0.71)			
	Freestyle	28.41 (0.92)	31.00 (0.61)	24.26 (0.63)	23.93 (0.42)			
4th-8th (n = 249)	Butterfly	25.63 (0.51)	28.55 (0.62)	21.48 (0.29)	21.53 (0.40)			
	Backstroke	30.16 (0.93)	33.76 (0.86)	25.28 (0.62)	25.45 (0.49)			
	Breaststroke	34.53 (0.83)	38.66 (1.11)	28.94 (0.57)	29.15 (0.60)			
	Freestyle	28.99 (0.73)	31.65 (0.75)	24.30 (0.55)	23.86 (0.41)			
9th-16th (n = 382)	Butterfly	26.06 (0.75)	29.03 (0.77)	21.39 (0.41)	21.44 (0.43)			
	Backstroke	31.16 (1.08)	34.69 (1.24)	25.57 (0.55)	25.62 (0.56)			
	Breaststroke	35.28 (1.34)	39.44 (1.80)	28.95 (0.60)	29.12 (0.74)			
	Freestyle	29.35 (0.99)	32.25 (1.35)	24.09 (0.58)	23.81 (0.62)			
		Gender (%)		**Position (%)**				
		Men	**Women**	**1st-3rd (a)**	**4th-8th (b)**	**9th-16th (c)**		
Whole sample	Butterfly	21.45 (0.37)	21.51 (0.41)	21.60 (0.33)	21.51 (0.35)	21.42 (0.42)		
by gender	Backstroke	25.40 (0.60)	25.55 (0.58)	25.35 (0.66)	25.37 (0.57)	25.60 (0.56)		
and position	Breaststroke	28.95 (0.57)	29.09 (0.69)	28.96 (0.62)	29.04 (0.59)	29.04 (0.68)		
independently	Freestyle	24.19 (0.58)	23.85 (0.52)	24.09 (0.55)	24.08 (0.53)	23.95 (0.61)		
		Gender			**Position**			**Gender × position**
		F(1, 780)	**Diff.**	***p***	**F(2,780)**	**Diff.**	***p***	**F(2,780)**	***p***
Main effects and	Butterfly	4.037	n.s.	**0.045**	15.472	a < b, c	<**0.001**	0.054	0.94
interactions	Backstroke	11.230	Men < Women	<**0.001**	17.775	a < c	<**0.001**	88.82	< **0.0001**
	Breaststroke	9.487	Men < Women	**0.002**	1.180	n.s.	0.308	25.42	< **0.0001**
	Freestyle	72.100	Men > Women	<**0.001**	6.508	a > c	**0.002**	206.93	< **0.0001**

*n.s. = not significant; Diff. = differences; ANOVA = analysis of variance. Bold numbers p <0.05.

Table 2 Mean (SD) (Time and Percentage), 2-Way ANOVA (Gender, Position, and Interactions) with Bonferroni Post Hoc Test in the 400m Individual Medley.*

		Time(s)		Percentage (%)		
400-Individual medley	**Style**	**Men**	**Women**	**Men**	**Women**	
1st-3rd (n = 156)	Butterfly	56.77 (0.97)	62.30 (1.06)	22.65 (0.28)	22.76 (0.33)	
	Backstroke	64.18 (1.19)	70.17 (1.53)	25.60 (0.41)	25.55 (0.41)	
	Breaststroke	70.98 (1.74)	78.82 (1.77)	28.31 (0.52)	28.71 (0.56)	
	Freestyle	58.77 (1.23)	63.09 (1.35)	23.44 (0.47)	22.97 (0.39)	
4th-8th (n = 260)	Butterfly	57.83 (1.18)	63.60 (1.11)	22.55 (0.33)	22.62 (0.33)	
	Backstroke	65.82 (1.72)	72.14 (1.72)	25.66 (0.50)	25.65 (0.37)	
	Breaststroke	73.19 (1.87)	80.89 (2.34)	28.54 (0.53)	28.76 (0.52)	
	Freestyle	59.62 (1.59)	64.59 (1.65)	23.25 (0.45)	22.97 (0.38)	
9th-16th (n = 376)	Butterfly	58.51 (2.91)	64.62 (1.68)	22.42 (0.88)	22.48 (0.37)	
	Backstroke	66.98 (2.71)	73.45 (2.73)	25.66 (0.66)	25.54 (0.53)	
	Breaststroke	74.48 (3.38)	82.76 (3.09)	28.54 (0.73)	28.78 (0.64)	
	Freestyle	61.02 (2.00)	66.73 (2.41)	23.39 (0.46)	23.20 (0.47)	
		Gender (%)		**Position (%)**		
		Men	Women	1st-3rd (a)	4th-8th (b)	9th-16th (c)
Whole sample by gender	Butterfly	22.51 (0.65)	22.58 (0.37)	22.71 (0.31)	22.58 (0.33)	22.45 (0.68)
and position	Backstroke	25.65 (0.57)	25.58 (0.46)	25.58 (0.41)	25.66 (0.44)	25.60 (0.60)
independently	Breaststroke	28.49 (0.64)	28.76 (0.59)	28.51 (0.58)	28.65 (0.54)	28.66 (0.70)
	Freestyle	23.35 (0.46)	23.08 (0.44)	23.21 (0.49)	23.11 (0.44)	23.29 (0.47)

		Gender			**Position**			**Gender × position**	
		F(1, 792)	**Diff.**	***p***	**F(2,792)**	**Diff.**	***p***	**F(2,792)**	***p***
Main effects and	Butterfly	1.889	n.s.	**0.047**	7.686	a > b, c	< **0.001**	0.17	0.84
interactions	Backstroke	1.525	n.s	0.052	0.599	a < b	0.227	0.91	0.4
	Breaststroke	4.252	Men < Women	< **0.001**	0.449	a < b,c	**0.019**	0.69	0.5

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	Freestyle	29.978	Men > Women	< **0.001**	5.697	b < a, c	< **0.001**	5.82	**0.003**

*n.s. = not significant; Diff. = differences; ANOVA = analysis of variance. Bold numbers p < 0.05.

Table 3 Pearson's linear simple correlation (r) for variables (split time) significantly correlated with overall time (p , 0.01).

		200m Individual Medley		400m Individual Medley	
		Men	**Women**	**Men**	**Women**
1st-3rd	Butterfly	0.538	0.567	0.638	0.635
	Backstroke	0.598	0.618	0.612	0.760
	Breaststroke	0.591	0.355	0.730	0.701
	Freestyle	0.600	0.491	0.631	0.747
4th-8th	Butterfly	0.834	0.770	0.709	0.678
	Backstroke	0.769	0.807	0.690	0.792
	Breaststroke	0.741	0.879	0.696	0.815
	Freestyle	0.718	0.831	0.709	0.780
9th-16th	Butterfly	0.895	0.911	0.680	0.812
	Backstroke	0.933	0.925	0.783	0.827
	Breaststroke	0.924	0.932	0.836	0.799
	Freestyle	0.853	0.881	0.816	0.831

IV. RESULTS

Table 1 shows the analysis for the 200m Individual Medley event. The fastest style (smallest % of overall time) was still the butterfly for the men and the women. Men swam back- stroke ($p < 0.001$) and breaststroke ($p = 0.002$) faster than the women, while men swam freestyle ($p < 0.001$) slower than women.

Compared to previous study [10], men and women swam butterfly faster and freestyle slower. Also, men swam back- stroke (25.40 vs 25.49 earlier) faster while women backstroke slower (25.55 vs 25.51 earlier). This resulted in men and women swimming first 100 faster - Men 46.85% vs 47.02% earlier while women 47.06% vs 47.15% earlier.

In terms of position, the medalists still swam butter- fly ($p < 0.001$) and freestyle ($p = 0.002$) slower and swam backstroke ($p < 0.001$) faster than the semifinalists. All swimmers spent less time in breaststroke compared to the previous study [10]. However, there was hardly any difference between the faster swimmers and slower swimmers ($p = 0.307$). This shows breaststroke has gotten faster for everyone.

In general, both men and women are swimming butterfly and breaststroke faster, and swimming freestyle slower. Overall, it reveals that Men and Women employ more positive pacing strategies than earlier.

Table 2 shows the results for the 400 Individual Medley event. The men swam freestyle ($p < 0.001$) slower than women; however, they swam breaststroke faster ($p < 0.001$) than women.

With regard to the position, the medalists swam butterfly ($p < 0.001$) slower so as to swim breaststroke ($p = 0.019$) considerably faster than the semifinalists. Backstroke was no longer as significant of a statistic in determining the final placing ($p = 0.227$). Medalists men spend less time 48.25% on the first half than the medalist women 48.32%. This percentage decreased from medalist to finalists (Men 48.21% and Women 48.27%) and semifinalists (Men 48.08% and Women 48.02%).

In general, both men and women are employing a more even pacing strategy than the 200m race. Both Men and Women regardless of placing are swimming breaststroke faster than they swam earlier.

Table 3 has the correlations of partial times for different strokes with the total time for the 200m and 400m IM.

For men medalists, for the 200 IM, the freestyle was the most correlated stroke; whereas for the finalists it was the butterfly, and for the semi finalists it was the backstroke. Having said that, for the medalists, the correlations were very close (0.6 for Freestyle, 0.598 for backstroke and breast- stroke was 0.591). For the 400m event for the medalists and semifinalists, it was breaststroke. For the finalists it was the butterfly and freestyle (both 0.709) although breaststroke was fairly close (0.696).

For women, in the 200m event, the most strongly correlated stroke was backstroke for the medalists and breaststroke for finalists and semifinalists. In the 400m event, the most strongly correlated stroke was backstroke for the medalists, breaststroke for finalists and freestyle for semifinalists.

Almost all the correlations may be considered as "large" ($r > 0.5$) or "very large" ($r > 0.7$), and even "nearly perfect" ($r > 0.9$) (14). The breaststroke and freestyle correlation was remarkably weak in the 200m event medalists for women ($r= 0.355$, $r = 0.491$)

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V. DISCUSSION

This study aimed to compare how pacing strategies have changed in the past 11 years as compared to the results from the 2000-2011 competitions. The main observations were:

(1) Butterfly and Breaststroke have gotten faster for both men and women over the last 11 years, (2) Both men and women are deploying strategy to swim Backstroke slower than they swam earlier, (3) While men seem to employ more positive pacing and women employed less positive pacing, which is similar to the 2000-2011 competitions, men and women are employing more positive pacing for 200 IM than they used to, (4) Breaststroke seems to be more correlated with final performance than backstroke.

Some trends have remained the same, butterfly is still the fastest style with the lowest percentage, regardless of placing or gender [6]. Another trend which has remained constant is positive pacing [7] [8], however, the pacing has become more positive for men for both events, they are spending 46.85% of the time in the 200 IM for the front half, as compared to 47.02% from the previous paper [10]. For women as well, 200 IM pacing has become more positive, they are spending 47.06% of the time in the front half, as compared to 47.15% from the previous paper. The difference in the 400 IM for men and women both is less staggering. Furthermore, women still tend to use a less positive pacing strategy, therefore, leading them to be significantly faster than the men in the last lap regardless of their final position, in both 200m (0.34%, $p < 0.001$) and 400m (0.27%, $p < 0.001$). This indicates that women still are able to swim their race with a more even split, perhaps because of better lactic acid management in these events.

First of all, in the 200 IM event, men and women both seem to spend less time in the short axis strokes than they used to in 2000-2011. Men spend 0.08% less time in butterfly, and women spend 0.13% time in butterfly. This trend is even more evident in medalists: medalists in the male category spent 0.14% less time in butterfly, and women spent 0.15% less in butterfly. Similarly, for the breaststroke, men as a whole group spend 0.09% less than they used to in 2000-2011, and women as a whole group spend 0.20% less than they used to in 2000-2011. Interestingly, for the men medalists, the percentage of time spent in breaststroke is the same, however, women medalists now spend 0.24% less in this section of the race.

In the 400 IM event, a similar trend is seen with both men and women spending less time in the short axis stroke sections: men spend 0.08% less in the butterfly section, women spend 0.07% less in the butterfly section. Again, this trend is more evident in medalists: male medalists spend 0.14% less and female medalists spend 0.05% less. Similarly for the breaststroke, men spend 0.10% less time in breaststroke, and women spend 0.17% time in breaststroke. Medalists spend less time in the breaststroke (men: 0.14% less, women: 0.15% less).

This means over the past ten years, pacing strategies have evolved to push more in the butterfly section of the race in both events. In the backstroke section, in the 400 IM event, more time is being spent. In both events, espe- cially for medalists, breaststroke time spent is reducing and freestyle time proportion is increasing. This could be due to improvement in technique in the shorter axis strokes, which led to faster strokes, or a different strategy to push harder in these strokes.

In the 200m event, the medalists swam butterfly slower than the finalists and semi finalists did ($p < 0.001$). Their freestyle sections times were also slower than that of the semifinalists ($p = 0.002$), because of the effort invested in the backstroke, in which they are also faster ($p < 0.001$). Male medalists are faster in the first hundred than final- ists or semifinalists (medalists 46.76% vs finalists 46.76% vs semifinalists 46.96%). On the other hand, female medalists are slower in the first hundred than finalists or semifinalists (medalist 47.14%, vs finalist 46.98%, 9-16 vs semifinalists 47.06%). Women however are faster in the first hundred than they were in the previous study. The takeaway is that while Men and Women employ more positive pacing than earlier, women medalists in particular tend to favor even pacing a bit more.

In the 400m event also, as one descends down the placing, the time spent in butterfly is lesser, while the time spent in breaststroke is more. The time spent in freestyle is less in the finalists as compared to the medal winners. In the butterfly there is a difference of 0.26% ($p < 0.001$), in the breaststroke (0.15%, $p = 0.019$) and in the freestyle (0.18%, $p < 0.001$). Male medalists are slower in the first half than finalists or semi finalists (medalist 48.25% vs finalist 48.21% vs semifinalists 48.08%) and female medalists are also slower in the first half than finalists or semifinalists (medalist 48.31% vs finalist 48.27% vs semifinalists 48.04%). These trends are generally similar to that of the previous study [10].

Overall, both Men and Women employ a positive pacing strategy in 200m and even pacing strategy in 400m. The 200m pacing strategy has gotten more positive especially for Men than earlier. Women are also employing more positive pacing than earlier, however medalists tend to favor slightly more even pacing. For the 400m, both Men and Women employ even pacing strategy as evidenced by significant improvement in breaststroke times.

In terms of interaction (gender x position), 200m medley events in particular, there was strong evidence for backstroke ($F_{2, 781} = 88.82$, $p < 0.0001$), breaststroke ($F_{2, 781} = 25.42$, $p < 0.0001$) and freestyle ($F_{2, 781} = 206.93$, $p < 0.00001$). This is further confirmed by the analysis that men have deployed more positive pacing strategy than the previous study [10] while women, especially medalists continue to favor slightly more even pacing strategy. It indicates the need to develop different training strategies for men and women for the shorter medley races.

For the 400m medley event, there was interaction (gender x position) for freestyle ($F_{2, 792} = 5.82$, $p = 0.003$). It wasn't as strong as the 200m event though.

Another trend which has remained the same is that back- stroke is the most correlated stroke in the 200m events for Women medalists (r values are often higher than other strokes). For the Men medalists though it was freestyle (0.6) and backstroke (0.598) that were key determinants of the final outcome. This shows that best swimmers tend to set the race up in the backstroke and maintain the momentum for the rest of the race.

For the 400m event, in general, breaststroke in men and backstroke in women were the most strongly correlated strokes. Freestyle was also highly correlated to final performance for women. This is different for Men where backstroke was highly correlated stroke. For women, the freestyle section and backstroke section seem important for perfor- mance in the 400m event [1] [8]. This means, an even pacing strategy is important in the event. Building speed through the race is important so that one is fast enough in the back- stroke. Breaststroke seems to be a race-defining stroke for the men in the 400m event.

VI. PRACTICAL APPLICATIONS

The results suggest that for 200m, coaches should focus on a strong positive pacing strategy for men; while for women, the strategy should be less positive. For the 400m event, the pacing should be more even, with a more relaxed butterfly, to make sure that lactic acid concentrations do not spike at the start of the race.

The results suggest that coaches must focus on backstroke and breaststroke for men and women for both events, because these two strokes were common for both genders for both events. Breaststroke in particular has become a lot more critical to win both the 400m and 200m events. Additionally, coaches should focus on freestyle for the women for the 400m event.

As a directional goal, coaches could also focus on obtain- ing a similar percentage distribution of times as is in this paper: in the 200m event, men should have 21.6-25.2-29.0- 24.3% split, while women should have 21.6-25.5-28.9-23.9% split in their race. In the 400m event, men should have a 22.7-25.6-28.3-23.4% split, while women should have a 22.8- 25.6-28.7-23.0% split. If these percentage of race times are obtained, the race strategy of the swimmer will be optimal. Training closer to competition could be focused on hitting these percentages based on goal times. However, swimmers who are better at one stroke would naturally be faster in that section of the race in which case, the percentages will vary.

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