Swimming Relay Exchange Times: 2008 Olympics

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Abstract

Competitive swimming relay teams with shorter exchange times have been shown to place ahead of teams with equal or shorter swim times. Training relay exchanges to a standardize-time which is shorter than the expected mean has been proposed in order to minimize the possibility of the team being out-placed by teams with average exchange times. This study investigated whether standardized relay exchange time training is consistent with competitive swimming relay performance results.

Swimming relay competition results from the 2008 Beijing Olympics were analyzed using the mean (± standard deviation) of team relay exchange times. Teams with shorter exchange times (0.529 ± 0.204 seconds) out-placed teams with longer exchange times (0.912 ± 0.206 seconds). The mean team exchange time for teams other than the above was 0.703 (± 0.219) seconds. All three means were significantly ($p \leq .05$) different from one another.

Swimming relay performance data from the 2008 Olympics supports training to a standardized relay exchange time. Attainment of this goal may increase the probability that finish places would be based on swimming performance. The training of a team's relay exchange times should be considered in line with a team's tolerance for risk taking which may change over a competitive season.

Introduction

In *Swimming Fastest*, Ernest Maglischo (2) suggests that relay exchange times could affect a team's finish placing and this has been confirmed using the results from USA NCAA Championships. Here, over a two year period, 205 relay teams (15% of those competing) with shorter relay exchange times out-placed teams with longer exchange times (3). Because of the potential to impact on the finish placings, exchange times while being non-swimming technical aspects of a race do warrant time and effort in skill development. Relay swimmers could train to absolutely minimize their exchange times, but such a strategy would increase the risk of an exchange time disqualification. David Marsh, when an Auburn coach in 2007, suggested a 0.15 second (sec) target training time for individual relay exchanges for his NCAA Division I teams (4).

Coach Marsh's plan reflects an optimal exchange time training strategy: train to a standardized time that is equal to or less than the expected average of other teams in the competition. Thoughtfully conceived swim training emphasizes the

minimizing of a team's swim time but haphazard attempts at minimizing relay exchange times risks the disqualification of the team. Training to a standardized relay exchange time could minimize the possibility of a team being out-placed by a team with average exchange times while still maintaining a margin to avoid disqualification. Is using standardized relay exchange time training (as a protection against being out-placed by a team with shorter relay exchange times) consistent with competitive swimming relay performance results?

To investigate this, the author used data from the relay swimming competition at the 2008 Beijing Olympics and analyzed three key pieces of information: mean relay exchange time of teams that were out-placing other teams by virtue of shorter exchange times, mean exchange time of teams that were out-placed by those teams, and mean team exchange time for all other teams (not out-placing and not out-placed) that were not disqualified. The hypothesis that was developed stated that only teams which out-placed other teams would have significantly shorter relay exchange times.

Methods

Swimming relay performance data from the 2008 Beijing Olympics (5) competitions were available at the official results website: (http://results.beijing2008.cn/WRM/ENG/Schedule/SW.shtml) and, in February and March of 2009, were downloaded from it to spreadsheets for analysis with PASW/SPSS (Version 17; Chicago IL) and SAS (Version 9.2; Crary NC) software. Relay exchange times from both the women's and men's, preliminaries and finals, of the 400m and 800m freestyle and 400m medley relays were included. An algorithm written for an earlier investigation was modified and applied to calculate total exchange time from each team's competition results (sum of three individual exchange times), differences in the total exchange time and finish time for each team compared to the next placed teams, as well as to identify which teams had shorter exchange times by a margin equal to or greater than the difference in finish times (that is, did the shorter exchange time improve the finish place of the team). Data were analyzed to describe and compare relay team exchange times.

Results

Athletes (169 women and 187 men) representing 26 National Olympic Committees competed in swimming relay teams; there were 16 teams in each of the men's 400m and 800m freestyle and 400m medley event preliminary relays and the same number of teams for women except one less in the 400m freestyle relay. Eight teams competed in each of the finals competitions with the exception there was one less in the men's 800m freestyle relay final.

Interestingly, considering all the preliminaries and finals of the freestyle relays, fourth, second and first legs were swum fastest by 34%, 32%, and 26% of the teams,

respectively and third leg by only 8%. In medley relays, the order of legs from fastest to slowest was always freestyle, butterfly, backstroke, and breaststroke. The overall mean (± standard deviation) team relay exchange time for the 139 teams that were not disqualified was 0.708 ± 0.236 sec. For further data analysis, it was important to determine whether teams in finals had characteristically different exchange times than teams not in the finals. Analysis of variance (ANOVA) was conducted on team relay exchange times in preliminary competition to compare, within gender and event, the team exchange time results of those teams advancing to finals with those of teams not advancing to finals. There was a significant difference in the mean relay exchange times for gender ($F_{1,81}$ = 6.19, p=.014), but not for event ($F_{2,81}$ = 0.73, p=.485). Most importantly there was no significant difference between the first eight and the last eight finishers ($F_{1,81}$ = 3.21, p=.076). There were also no significant ($p \leq .05$) interactions.

Table 1 presents the mean relay team exchange times by gender and event for preliminaries versus finals – for all teams that were not disqualified. An ANOVA of all team exchange times showed a significant main effect in gender ($F_{1,127}$ = 4.31, p=.039) and in preliminaries versus finals ($F_{1,127}$ = 4.91, p=.028). There were no significant differences for event ($F_{2,127}$ = 2.46, p=.089), and there were no significant ($p \leq .05$) interactions. The overall men's teams mean (± standard deviation) exchange time (0.660 ± 0.251 sec) was shorter than the overall women's (0.757 ± 0.210 sec) and the mean team exchange time for finals (0.648 ± 0.246 sec) was shorter than the mean team exchange time (0.738 ± 0.204 sec) for preliminaries.

Table 1. Mean (± standard deviation, number of teams) relay team exchange times (seconds) by gender, preliminary versus finals, and event for non-disqualified teams. ANOVA indicated significant ($p < .05$) main effects of gender and preliminary versus finals. There were no significant interactions.

	400m Freestyle	800m Freestyle	400m Medley
Women			
Preliminaries	0.824 ± 0195, 15	0.788 ± 0208, 16	0.785 ± 0.233, 15
Finals	0.650 ± 0.094, 8	0.604 ± 0.147, 7	.761 ± 0272, 8
Men			
Preliminaries	0.645 ± 0.300, 15	0.623 ± 0.221, 16	0.766 ± 0.271, 16
Finals	0.533 ± 0.241, 8	0.617 ± 0.187, 7	0.715 ± 0.199, 8

Eighteen teams (12.6% of the 142 competing) with shorter relay exchange times out-placed other teams that had longer exchange times: in preliminary heats, two each 1st, 2nd, 3rd, and 4th places, four 5th places, one 6th place, and two 7th places; and in finals, one each 5th, 6th, and 7th place. The mean (± standard deviation) team exchange times for teams out-placing other teams was 0.529 ± 0.204 sec, for teams

that were out-placed, 0.912 ± 0.206 sec, and for other teams that were not disqualified, 0.703 ± 0.219 sec; those group means and distributions are depicted in Figure 1. An ANOVA of team exchange times (for those three groups of teams, gender, event, and preliminaries versus finals) showed a significant main effect of out-placing, out-placed, and other teams ($F_{2,110}$ = 9.08, p=.0002) but not gender (F $F_{1,110}$ = 2.21, p=.139), not event ($F_{2,110}$ = 0.87, p=.422), not preliminaries versus finals ($F_{1,110}$ = 0.95, p=.389), and no significant ($p \leq .05$) interactions. Tukey post-hoc tests of team exchange times for the out-placing, out-placed, and other teams showed all three means significantly ($p \leq .05$) different from one another.

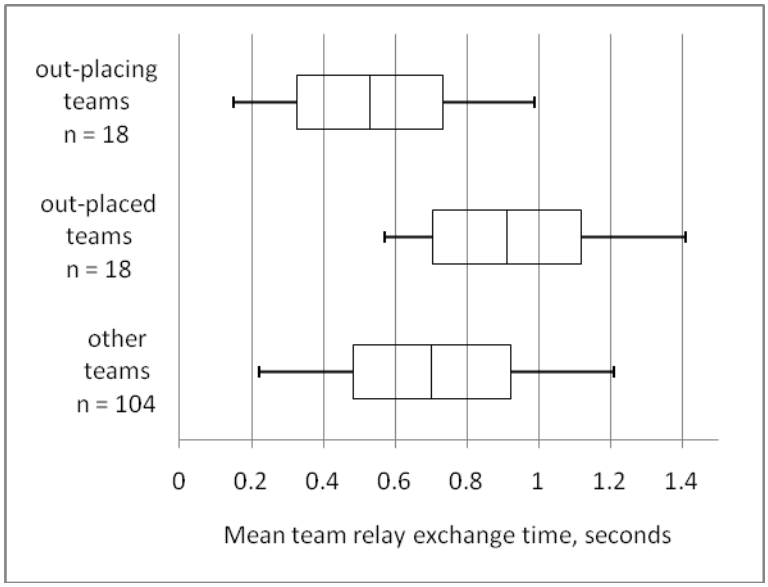

Figure 1. Team relay exchange time means and distributions for teams out-placing, for teams out-placed by faster exchange times, and for the other competing teams. Vertical lines in the boxes are means, boxes represent ±1 standard deviation from the mean, and whiskers indicate the ranges of the distributions. The three mean team exchange times were significantly different from one another ($p < .05$).

Of 142 competing relay teams, 4 (2.8%) were disqualified for early relay exchanges: three of those disqualifying exchanges were timed at –0.04 sec and one at –0.10 sec. Four teams with negative timed relay exchanges (two at –0.02 sec and two at –0.03 sec) were, apparently, not disqualified for those exchanges. The FINA 2005-2009 Swimming Rules (1) do not specify a timing system error tolerance margin for early relay exchanges.

Discussion

Previous investigation of swimming relay exchange times, from USA NCAA Divisions I and II (3) reported 15% of 205 teams out-placing other teams by means of shorter relay exchange times; this study of Olympic swimming found 12%. The mean team exchange time at the 2008 Olympics (for teams not disqualified) was 0.708 sec; at

the 2007 and 2008 Divisions I and II championships, 0.746 sec. NCAA teams out-placing other teams had a mean exchange time of 0.572 sec and such teams at the Beijing Olympics had a mean exchange time of 0.529 sec. Though relay exchange times might compare as expected (faster at higher levels of competition), the percentage of teams advantaging shorter exchange times were similar.

The findings of this study are limited by its use of a single convenience sample of competing swimming relay teams' results (2008 Olympics) and its assumption that the results of competition reflect pre-competition training and racing strategies. Future work may investigate whether relay exchange times that affected the finish placings were markedly enhanced by one or more inordinately short individual exchange time.

Swimming relay results from the 2008 Beijing Olympics do support a standardized relay exchange time training strategy. Teams out-placing other teams by shorter relay exchange times are doing so with shorter than average relay exchange times and out-placing teams with longer than average relay exchange times (Figure 1). An effort to train for a standardized team relay exchange time, such as the mean out-placing team exchange time, may predispose a team for placing purely on the basis of their swimming performance rather than on their relay exchange times. The chosen target training exchange time goal might be a result of an individual team's assessment of its willingness to take a risk of disqualification for anticipated gain. This however may be adjusted over a training season. Interestingly, the average out-placing team relay exchange time (0.529 sec), at the 2008 Olympics, was a little longer than three times Coach Marsh's (4) suggested individual training exchange time (0.15 sec).

References

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