Coaching Applications

Characteristics of a Polar Bear Swim Champion – The Challenges of San Francisco Bay Winter Swimming

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ABSTRACT
In this report we discuss the characteristics of a 56-year-old man who, as part of a record-matching Polar Bear Challenge swimming event, swam a remarkable 356 cumulative miles without a wetsuit in the San Francisco Bay over a 3-month period in winter (December 21, 2012 to March 21, 2013; water temperature range: 9.5 °C (49.1 °F) to 12.9 °C (55.2 °F)). The swimmer had a recreational swimming background and was not overweight or obese. At time points before, during, and after (November to August) the winter swim period, his body mass index (BMI) ranged from 22.7 to 23.2 kg/m² (normal BMI: 18.5 to 25.0 kg/m²). His % body fat (measured range: 17.6 to 20.7%) was consistently below the American 50th percentile for age (23.2%). 4 days after the winter swim period his resting pulse was 54 bpm. Serum total cholesterol was near normal (borderline high) and was not substantially different before (200 mg/dl) compared to after (212 mg/dl) swimming consistently in cold water for 3 months. During the winter swim period the swimmer contracted severe shingles, which added to an already challenging experience. Because he was relatively lean, he likely did not have substantial protection from core hypothermia. Rather, the swimmer’s ability to swim in cold water was related to a combination of experience, acclimatization, access to warm showers and saunas, mental fortitude, and most importantly, a swim strategy that limited time in the water per swim.

INTRODUCTION
Safety remains our foremost concern when considering the coaching applications relevant to the case we describe. Swimming in cold open water without a wetsuit is an inherently risky activity, and the unique aspects of the sport merit caution and careful preparation. The case we describe provides several valuable insights into swimming in cold open water, and below we stress aspects of cold-water swimming that may not be readily apparent to pool swimmers.
CASE REPORT

The swimmer we describe was simultaneously both ordinary and extraordinary. His body composition parameters were not remarkable – he was of average size, and his % body fat was below the 50th percentile for age. He had a predominately recreational swimming background and was not an elite athlete. He was employed full-time during the majority of the Polar Bear Challenge. He had no special diet, his weight and % fat varied only modestly during the event, and his cholesterol did not change substantially. As would be expected, our swimmer had a relatively low heart rate, suggesting general cardiovascular fitness related to exercise.

As we discussed in the companion article, our swimmer was almost certainly acclimatized. With repeated daily exposure to cold water, his response to cold shock was thus blunted – he did not have the intense hyperventilation and tachycardia that non-acclimatized swimmers would have had. Entry into cold water was thus much easier than it would have been for a non-acclimatized swimmer. But as we also discussed, this acclimatization, did not provide substantial protection from true core hypothermia. Because his body composition parameters were similar to national averages, our swimmer was still susceptible to core hypothermia, even though he was acclimatized. Despite his extensive swimming experience, he also remained at risk of muscle fatigue and cold incapacitation.

The swimmer was able to prevent hypothermia and cold incapacitation by judiciously limiting his time in the water. This, in our opinion, is the most important take-home lesson from this case.

In addition to limiting his time in the water, our swimmer also wisely swam only within the confines of a designated swim area. He had extensive knowledge of local water conditions and checked tide and currents prior to swimming. In fact, he planned each swim carefully and was often able to use tide and current patterns to his advantage. When conditions dictated, he was accompanied by a companion swimmer, or a pilot in a kayak.

Dedication and mental fortitude were needed for this event. Clearly, the swimmer had these characteristics. He swam in pre-dawn darkness, was employed full-time during the majority of the event, and continued to swim after contracting severe shingles (Figure 1).
Figure 1. Severe Shingles in a Polar Bear Swimmer (Photos taken 3.11.13, early in the illness).
Although he graciously credited support from family and friends, the extraordinary nature of his accomplishments remains. In summary, an individual with average biophysical parameters and a recreational swimming background was able to achieve an extraordinary result. By limiting time in the water and by planning each swim with careful attention to local conditions, he was able to safely accomplish his goal.

**DISCUSSION**

Appropriate caution is indicated for the pool swimmer who wishes to consider swimming in cold open water without a wetsuit. As we outlined in the companion article, several physiological changes occur when an individual enters cold water. Perhaps most notably, a new swimmer can expect to experience intense hyperventilation and tachycardia when entering cold water. These reflex responses to cold water typically improve over the course of roughly 5 minutes. Before setting out on a swim, new swimmers would be advised to wait (by standing or treading water in place) until the peak effects of hyperventilation and tachycardia have subsided. Gradually entering cold water (rather than immediately plunging in) and splashing cold water on the face prior to entry may also be of benefit.

These reflexes also become less intense with acclimatization – the result of repeated exposure to cold water. By swimming regularly in cold water, hyperventilation and tachycardia become less pronounced. Acclimatization leads to greater comfort and a limited but important improvement in swim performance, particularly in the first minutes after entry into cold water. However, as we have repeatedly stressed, acclimatization likely has little effect on core temperature, and thus does little to prevent true core hypothermia.

Swimmers with high levels of fitness may also be able to generate heat to counter partially the heat loss from cold water. However, this heat production has limits, particularly in colder water temperatures.

We do not mean to belittle the benefits of acclimatization or physical training. Swimmers feel better and are likely to swim with greater efficiency if they are acclimatized, and a high level of physical fitness is obviously needed to swim safely in open water. But core temperature can continue to decline even in acclimatized and trained individuals. Even though a swimmer may feel fine, his or her core temperature could continue to decrease to a point that could critically impact swim performance and safety. Cold incapacitation from muscle fatigue (prior to the onset of hypothermia) is also a risk of prolonged immersion, even in experienced swimmers.

Swimmers should be aware of these important points and limit their time in the water appropriately. In water temperatures such as those we described, a new swimmer would do well to initially limit his or her time to 5-10 minutes. As swimmers become more accustomed to swimming in cold water they may gradually
increase time in the water over several swims. However, each swimmer should proceed with caution, especially on colder days. Leaner swimmers are more susceptible to core hypothermia and should be especially cautious.

The swimmers in our case limited his average time in the water to between 10 and 30 minutes per swim, depending on the water temperature and conditions. Wisely, he employed shorter swims on days in which the water temperature was particularly cold. Following the example of our swimmer, new swimmers should familiarize themselves with local conditions and adapt their swims accordingly. Swimming with a partner or pilot (in a kayak or boat) is always advisable.

The swimmer in our case utilized warm showers and a sauna for rewarming after swims. A review of the first aid treatment of hypothermia is beyond the scope of this work. However, basic treatment includes removing the affected individual from cold stress (getting out of cold water, wind, etc.), drying the individual, and providing a warm environment. Appropriate first aid and CPR training for coaches and support personnel, including familiarization with automated external defibrillators, is warranted. Additionally, most rewarming protocols do not recommend complete immersion in warm water (e.g., warm bath, hot tub), which could cause rapid vasodilatation and precipitate shock. In severe cases of hypothermia, stabilization and transport to a medical facility may be needed, and coaches and support personnel should be familiar with access to local emergency medical services.

The swimmer in our report consumed a regular diet without special modifications. Nutrition remains controversial in all sports, and discussions of special diets or intentional weight gain to counter hypothermia are also beyond the scope of this work.

The swimmer we describe was unsuccessful in a subsequent English Channel solo attempt. In hindsight, we wonder if a rigorous training regimen in a pool during that winter would be have been more advantageous toward the accomplishment of that goal. As we noted in the companion article, the average water temperatures of the San Francisco Bay during the Polar Bear Challenge were substantially colder than the temperatures typically encountered in the English Channel when most solo crossings are attempted. Training in a pool, with an emphasis on long-distance swimming, may have yielded improved strength and stamina resulting in a higher likelihood of success for a solo English Channel crossing.

As we outlined in the companion article, numerous (and sometimes dramatic) health benefits have been attributed to swimming in cold water. We remain skeptical about many of these proposed benefits and prefer to focus on the inherent advantages of fitness and exercise associated with swimming. We also respect our swimmer’s insights into the beauty of cold-water swimming and continue to be inspired by his persistence, dedication, and fortitude.
CONCLUSION

Safety remains our foremost concern when considering the coaching applications relevant to the case we describe. Several physiological changes occur when an individual enters cold water, and appropriate caution is indicated for the pool swimmer who wishes to consider swimming in cold open water without a wetsuit. Core temperature can continue to decline even in acclimatized and trained individuals, and cold incapacitation from muscle fatigue (prior to the onset of hypothermia) can occur even in experienced swimmers. Swimmers should be aware of these important points and limit their time in cold water. The swimmer we describe, an individual with average biophysical parameters and a recreational swimming background, was able to achieve an extraordinary result by limiting time in the water and planning each swim with careful attention to local conditions and safety.