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Reply to Dr Muller

To the Editor:

We appreciate the comments of Dr Muller. He makes a number of important points. We did not measure oxygen consumption or electromyography in our subjects, and, therefore, we did not obtain objective data to document shivering heat production. We agree that objective measurement of shivering would have been optimal. We did record subjective onset of shivering (not reported in the manuscript), and all subjects experienced onset of vigorous shivering prior to, or during, extrication from snow burial. Mild shivering occurred in all subjects prior to extrications. We have measured oxygen consumption in the field in a previous study of cooling during snow burial,¹ and it is a technical challenge that in our experimental setup requires fixed inspired carbon dioxide and oxygen concentrations. In the study under discussion here, we chose to use the AvaLung breathing device that results in a rising carbon dioxide, and falling oxygen concentration during the course of the 1-hour snow burial. This is a better simulation of the changing inspired gas concentrations during avalanche burial.^{2,3}

In regard to the question pertaining to the title of our paper and measurement of shivering thermogenesis: the title of our paper refers to the method of rewarming used, spontaneous endogenous rewarming, which is rewarming by shivering. Since our subjects remained at rest during rewarming, the method of rewarming was predominately by shivering with adequate insulation provided from the hypothermia wrap. Given the specific limitations we discuss in the paper, we are able to make conclusions based on our data about the ability to rewarm mildly hypothermic avalanche burial victims using the method in our study.

We disagree with Dr Muller regarding the likely mechanism for afterdrop in our study. The rapid increase in cooling rate during the afterdrop period observed in our study is due to a predominant convective mechanism; core blood perfuses cold peripheral tissue, cools off, and returns to the core, causing a continued core cooling, or afterdrop. Anything that increases perfusion of cold tissue increases the afterdrop. In our subjects, the increased activity during extrication contributed to increased blood flow to the extremities and a convective afterdrop mechanism. The conductive mechanism for afterdrop, due to equilibration of the cooler periphery and warmer core, always occurs; but it is a slower process that cannot account for the rapid increase in cooling rate seen in our study. It is well established that the convective mechanism occurs much faster than the conductive mechanism^{4–7} and is the operative mechanism for afterdrop in settings of increased physical activity, as occurred during extrication of our subjects.

We disagree that further study is required before widespread guidelines for rewarming avalanche victims can be implemented. We do not claim that the method of rewarming we applied is the most optimal, and we agree that the lack of a control group makes it impossible for us to claim that our rewarming method is the best. Our objective was to demonstrate that successful rewarming can occur by simply placing an extricated avalanche burial victim in a hypothermia wrap in a manner that would occur in a field situation. We tested a commonly used insulation system and demonstrated that it can effectively rewarm subjects after extrication from snow burial. Further studies are required to determine the optimal system, and to characterize individual differences in rewarming rates under different circumstances.

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Sidecountry and Backcountry Rescues

To the Editor:

It is with great interest that I read Dr Van Tilburg's editorial regarding, "Sidecountry Rescue—Who Should Respond to Ski Resort Out-of-Bounds Rescues?"¹ I agree with his conclusions and implementation of recommendations; however, I cannot overstate the geographical generalities with which sidecountry and backcountry skiing actually pose problems.

The 4 major ski resorts in Arctic Scandinavia, Abisko, Björkliden, Riksgränsen, and Narvik owe, in many cases, their entire existence to sidecountry and backcountry access. Indeed, the actual groomed areas are passable, but in many cases marginal at best. Trail maps readily mark areas that are not patrolled but commonly known to be popular "rides." The Arctic location, combined with lack of foliage and very cold powdered snow, is impossible to resist. Because of the rough weather conditions and remoteness, at times these locations are completely isolated from the outside world. Transport by road, helicopter, or rail is impossible. It is the resort-employed ski patrollers who must act far outside of their basic training.

It is not uncommon for the local ski patrollers' knowledge of the local terrain to far outweigh that of the county and national rescue agencies.

Northern Europe is not yet inundated by lawsuits from the occasional disgruntled family member, so the question of liability coverage is less concerning here. It is widely accepted that the mere existence of these Arctic ski areas and their ease of access to the side- and backcountry make the ski areas liable both inside and outside the ski area boundaries.

My professional experience is limited to Riksgränsen, located on the border of Norway and Sweden. The hotel and all resort staff are located on the Swedish side of the international boundary, but some of the groomed runs and sidecountry access traverse the border. All ski patrollers are certified by the Swedish ski area governing

body, Svenska Liftanläggnings Organisation (SLAO). Their education is similar to that of their counterparts in North America. Medical training is on par with the North American "First Responder" training, and they are schooled in avalanche control, mountain extrication, mountain rescue, and mass casualty incident control.

The SLAO has begun certifying resort physicians in an attempt to better integrate medical practitioners into the daily operations of the mountain. This education is similar to Advanced Wilderness Life Support and Pre-Hospital Trauma Life Support but is mainly focused on potential medical, surgical, and trauma cases that can arise at a ski resort.

Typically, ski patrol and medical personnel are only staffed to patrol the in-boundary skiing. But as the resort offers heliskiing and is a staging ground for snowmobile and backcountry access, personnel may be called to respond outside the area. While official responsibilities include transporting the victim to the nearest vehicle access point, ski patrollers often receive "field promotions" to nurse the victim, and, in some cases, they are the only medical assistance to the resort physician for several hours. Ski patrollers may be requested to respond to an incident miles away from the ski area; they are picked up and transported by a local tourist operator helicopter.

While these ski patrollers campaign for more education and more compensation for such incident involvement, their employers are less enthusiastic. Training and time off-mountain are seen as economic obstacles causing a degree of disgruntlement: the patrollers feel that their knowledge and training are not being best utilized.

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Shark and Other Aquatic Predator Attacks on Kayakers

To the Editor:

The recent report on sea kayaking mishaps in New Zealand significantly adds to our knowledge about the epidemiology and medical aspects of untoward incidents occurring in this increasingly popular sport.¹ No shark attacks were included among the 50 incidents analyzed by Bailey,¹ although an attack on a kayaker along Northland's east coast in 2005² underscores that there is a