What is this research about?
Canada’s Special Forces operate in extreme conditions and dangerous environments. When a soldier is injured, blood is required, but transporting blood under battlefield conditions presents challenges. Blood products must be transported through extreme environmental conditions where they can be sent to battlefield locations by parachute descent followed by long distance treks (usually in the backpack of patrol soldiers) over rugged terrain in extreme environmental temperatures. The stress of these transport conditions may impact the quality of the blood products and potentially limit their clinical effectiveness or even have a negative clinical impact. Canadian Blood Services and the Canadian Forces have worked together to evaluate the impact of mechanical agitation and environmental temperature extremes on the quality of red blood cells, one of the blood products distributed to the military by Canadian Blood Services. This collaborative study brought together the unique quality testing expertise that exists within Canadian Blood Services Research & Development group and the Canadian Forces ability to simulate Special Forces operations to resolve a real world problem.

What did the researchers do?
Canadian Blood Services research clinic in Vancouver collected whole blood from deferred volunteer blood donors. Whole blood was manufactured to obtain 20 packed red blood cell units (red blood cells separated from whole blood), a normal procedure for transfusion purposes. The units were pooled and split to create enough units to support the study. One sample from each pool was tested as a control to determine the quality prior to shipment to Toronto where the Special Forces operation was simulated. The simulated Special Forces operation placed red blood cell units in specialized blood transport boxes and replicated a high altitude low opening parachute descent and 12 h transport in a backpack at 48 °C with 9 % humidity using a hyperbaric chamber and participants running on a treadmill. This simulation was representative of an Afghan summer. Samples were taken throughout the simulation. These samples were tested immediately on site and then sent to Canadian Blood Services research laboratories for a more detailed evaluation of red blood cell quality. All data collected was analyzed to determine if the mechanical agitation and environmental temperature extremes had an impact on the quality of the red blood cells.

What did the researchers find?

 ucfirst(No significant differences were identified between control and test red blood cells at any time point during the simulation.)
No impact on the quality of the packed red blood cell units was identified in this study. The specially designed transport boxes were able to maintain an environment within which the quality of the red blood cells was maintained even when conditions were extreme.

**How can you use this research?**

Degradation of red blood cell quality may have pathological consequences upon transfusion, especially when massive transfusion is required, such as in trauma cases. Therefore, Canadian Forces Health Services program must be confident that red blood cell quality can be maintained even in extreme environmental conditions. The evidence collected during this study demonstrates that the specialized transport boxes are able to maintain the quality of red blood cells during a short Special Forces operation.

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**About the research team:** Dr. Jason Acker is a Senior Development Scientist with Canadian Blood Services. Dr Acker is also a Professor in the Department of Laboratory Medicine and Pathology at the University of Alberta. His research lab specializes in understanding the impact of storage of packed red blood cell units on red blood cell quality *in vitro* while attempting to understand the connection of *in vitro* quality to *in vivo* outcomes. Major Andrew Beckett MD is a Critical Care Fellow at Sunnybrook Hospital and a Trauma Surgeon at the Canadian Forces. His research interest is in making a positive impact on the way casualties are treated in the field. Dr. Cathy Boscarino is a Scientist with Defence Research & Development Canada, Toronto in the Individual Behaviour and Performance Section. Dr Boscarino's research interest is in medical science particularly gene expression and clinical markers/symptoms. The DRDC focuses its science and technology expertise in areas of critical importance to current and future Canadian Forces operations and public security.

**This ResearchUnit is derived from the following publications:**

2. This work was presented at the Military Health System Research Symposium on August 14, 2012 in Fort Lauderdale, Florida.

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**Keywords:** Packed Red Blood Cells, Quality, Special Forces Operations.

**Want to know more?** Contact Dr. Jason Acker at jason.acker@blood.ca.