

## **New insulation technology provides next-generation containers for “iceless” and lightweight transport of RBCs at 1 to 10°C in extreme temperatures for over 78 hours**

*Francisco J. Rentas, Victor W. Macdonald, Delorles M. Houchens, Peter J. Hmel, and Thomas J. Reid*

**BACKGROUND:** There is a universal need, in both civilian and military settings, for a lightweight container capable of maintaining RBCs at 1 to 10°C in remote areas, during extended transit times, and under austere environments. The use of ice in insulated containers or small commercial coolers for these purposes often results in loss of RBCs due to failure to maintain temperatures within the requisite range. A lightweight and thermally efficient container capable of carrying 4 to 6 units of RBCs at 1 to 10°C for over 72 hours under extreme conditions would help resolve current problems in RBC transportation.

**STUDY DESIGN AND METHODS:** Six different prototype containers incorporating phase-change materials (PCMs) in their designs were evaluated for their ability to maintain RBCs between 1 and 10°C while exposed to external temperatures of -24°C and 40°C. In separate experiments, a container was opened and a RBC unit removed.

**RESULTS:** One container weighing 10 pounds with four units of RBCs was capable of maintaining the temperature of the units between 1 and 10°C for over 78 hours, 96 hours, and 120 hours at 40°C, -24°C, and 23°C, respectively. Opening the container decreased these times by 2 to 3 hours.

**CONCLUSIONS:** An energy-efficient and lightweight container that maintains RBCs at 1 to 10°C under austere environments for over 78 hours is now available. This container, known as the Golden Hour container (GHC), will facilitate transport of RBCs. The GHC will have additional applications (transport and/or storage of vaccines, other biologics, organs, reagents, etc).