-80℃ Frozen red blood cells, plasma and platelets, efficient logistics, available, compatible, safe and effective in the treatment of trauma patients with or without massive blood loss in military theatre.

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Background
During the period Aug2006-Feb2012, the Netherlands Military Blood Bank (MBB) supported 4 Military Treatment Facilities (MTF's) in Afghanistan with -80℃ frozen blood products (red blood cell (RBC), -80℃ (DEC), -80℃ plasma (DFP),-80℃ p latelet (DTC)) and occasionally with 4℃ stored RBC in SagM (EC). At 3 locations the MBB functioned as backup blood supply, at one location, Tarin Kowt (TK) the MBB was responsible for the total blood support of a NLD Medical Treatment Facility (MTF). To evaluate the -80℃ Net herlands military blood supply system, the use and effects of EC,DEC,DTC and DFP transfusion in TK during this period was further analyzed.

Methods
Leukodepleted fully tested products were frozen at -80℃ according to Valeri methods (O RhDpos/neg DEC in 40%glycerol, AB RhDpos/neg DFP, no additions, O RhDpos/neg DTC in 5%DMSO). Usage, hemovigilance and hospital discharge charts were reviewed and the survival of (military) trauma patients in TK was further analyzed. Of 347 patients, 280 trauma patients were transfused with ≥1RBC in TK, of which 46 patients required massive transfusion (MT; more than 10 units RBC/24 hours). High ratio DTC transfusion is defined as ≥1:8 DTC:RBC, high ratio DFP as ≥1:1.4 DFP:RBC.

Results
During this period 7125 MBB blood products (879EC; 2175DEC,3001DFP,1070DTC) have been transfused in 1011 patients without transfusion reactions observed. During the 1544 mission days of TK, 60 4℃ transports (1743EC) and 70 -80℃ transports (2439DEC, 1717DFP, 471DTC) provided the products of which respectively 41%, 51%, 68%, 79% was transfused (347 pat). Product loss was due to transport failures (2.9%EC,0.4%DEC), (freezer/aggregate failures (9.0% DEC, 2.4%DFP, 4.2%DTC), production failures (0.5%EC, 5.6%DEC, 9.5%DFP,4.7%DTC), leakage (0.5%DEC,0.7%DFP), delivered and not transfused (0.3%EC, 1.3%DEC, 3.0%DFP, 3.4%DTC,) and expiration (52.0%EC, 28.8%DEC, 7.0%DFP, 0.8%DTC). During and at the end of the mission, 3.3%EC, 3.0% DEC, 9.8% DFP and 8.3%DTC were shipped to neighboring MTF. In TK 280 trauma patients were transfused with 668EC, 1187DEC, 1047DFP and 332DTC. ±50% of these products was used in MT. Similar to patients treated with liquid stored apheresis platelets, RBC and fresh frozen plasma, (JG Perkins et al. 2007, 2009) survival was higher in high ratio DFP (N=23, 78% vs N=23, 57%) and higher in high ratio DTC (N=34, 74% vs N=12, 50%) treated MT patients. Survival was similar in non-MT patients (high ratio DFP N=69, 87% vs N=165, 90% ; high ratio DTC N=64, 86% vs N=170, 90%).

Conclusions
-80℃ Frozen blood products can be efficiently prod uced, transported and stored in the support of blood banks in (military) environments with unpredictable logistics and patient frequency. Products are readily available, compatible, safe and effective as shown by the improved survival of (military) MT trauma patients when treated with DTC and DFP in addition to RBC (DEC and/or EC).

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