

# LTOWB HOSPITAL EXPERIENCE

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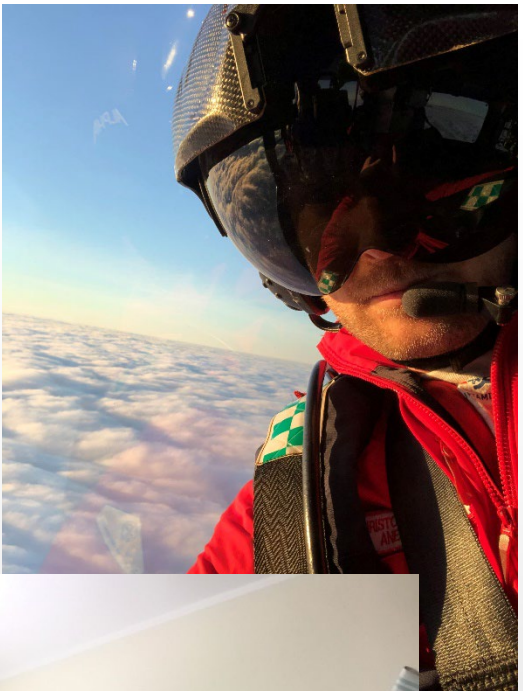
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# Disclaimer

- *The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Norwegian armed forces medical services or Helse-Bergen*



# Haukeland University Hospital

- Level 1 trauma center
  - Population 1.1 million
- National Burn Unit
- Local hospital
  - Population 285.000
- ~ 800 beds





# Timeline LTOWB Haukeland University Hospital



**Red cells in Air  
Ambulance,  
July 2014**

**Whole blood in Air  
Ambulance,  
Dec 2015**



**Whole blood in  
Haukeland University  
Hospital,  
Dec 2017**

**Whole blood in  
Voss Hospital  
April 2019**

**Freeze dried plasma in  
Air Ambulance  
2013**

# Rationale – “Hemostatic resuscitation”

- 1) Enhance the body's ability to form clots at sites of active bleeding
- 2) Minimize adverse effects (edema and dilution of clotting factors) resulting from iatrogenic resuscitation injury
- 3) Restore adequate intravascular volume and organ perfusion prior to definitive surgical control of hemorrhage
- 4) Optimize oxygen carrying capacity

# Rationale – Prehospital implementation

- Non-compressible bleeding
- Balanced transfusion:
  - Only realistic option LTOWB
- Logistical challenge
  - Vascular access
  - Confined workspace
  - Hard to communicate
  - «Not enough hands»
  - Single bag is easier than 3
- «Get the initiative
- Stay on top of things»





# Rationale – While awaiting hemorrhage control:

- Logistics - massive transfusion protocol:
  - Vascular access
  - Activation of MTP – Blood bank logistics
  - Crew resource management
  - Workload/mental capacity
  - Balanced transfusion
    - «It always ends up 1:1:1 but during???
  - Intrahospital transfer
  - Diagnostics
- Easier with one bag instead of three





# Rationale – Inhospital LTOWB

While waiting for hemorrhage control:

No time to waste

«Stay on top of things – do not lag behind!»

«Minimize the shock dose»



# Potential benefit?

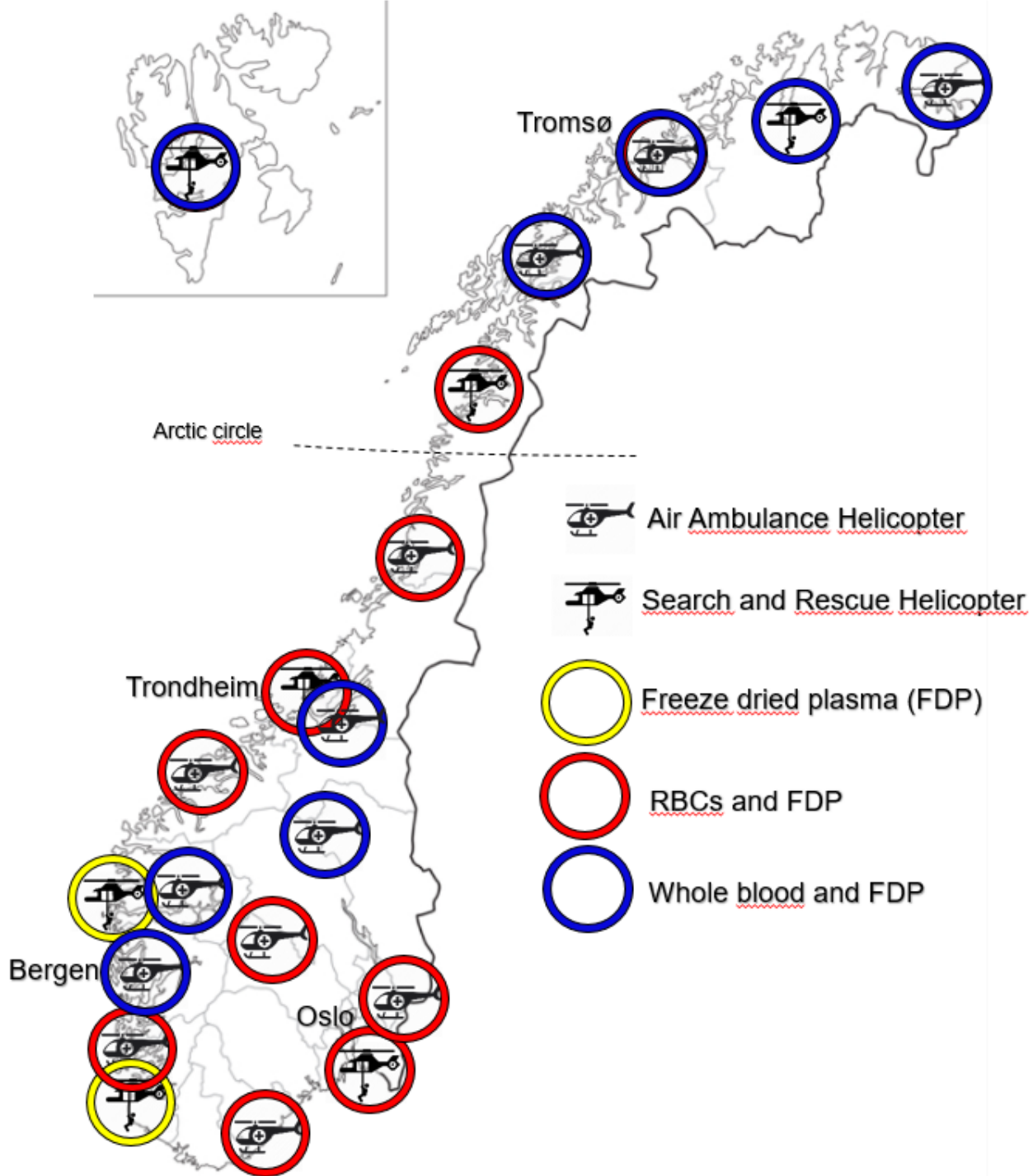
- Oxygen carrying capacity in LTOWB compared to components?
- Fibrinogen?
- Less impact of hypocalcemia due to large amounts of additives in component alternative?
- Less need for the use advanced of TEG/ROTEM in the early phase of care etc?

# Smaller hospitals?

- Platelet inventory?
- Personell on standby?







# Prehospital inventory

HEMS and SAR Bases

# Whole Blood in Helse Bergen

- CPD Leukoreduced whole blood
- Storage: 7-21 days
- Donors:
  - Group O
  - RhD positive and RhD negative
  - Both male and female donors
- Low titer definition: (gel-method):
  - IgM anti-A/B < 256
  - IgG anti-A/B < 512
- Massive transfusion package



# Massive transfusion package:

## Alt 1:

### WB - MTP

#### 4 units low titer group O

- O neg, K neg: female < 50 years
- O pos, K neg: male , female > 50 years

## Alt 2:

### Component - MTP

- 6 Erythrocyte concentrates (O)
- 6 SD-plasma (AB/A)
- 2 platelet concentrates (O)

Children:

Both options available



# Inventory

## Haukeland Hospital:

8 units

4 O RhD pos (lav titer, K neg)

4 O RhD neg (lav titer, K neg)

## OBGYN dept:

2 units O RhD neg (lav titer, K neg)

## Voss Hospital:

2 units O RhD neg (lav titer, K neg)

## HEMS:

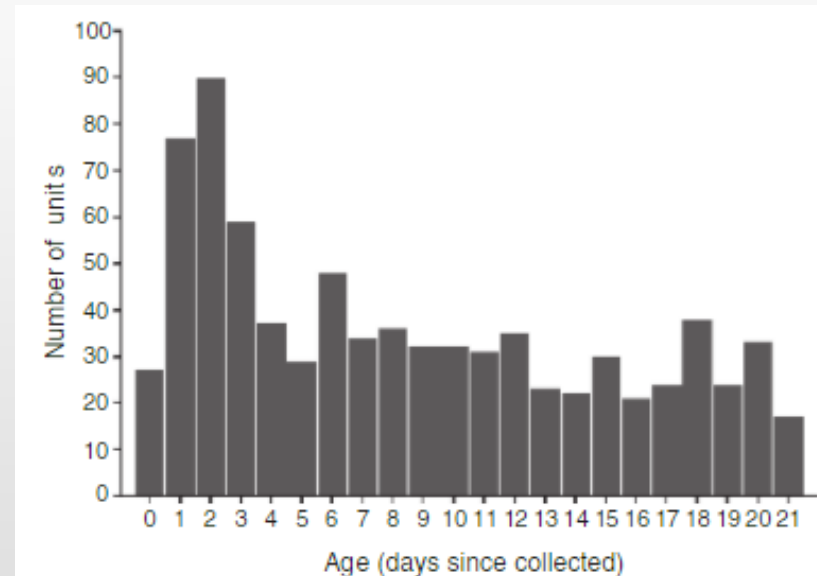
2 units O RhD neg (lav titer, K neg)





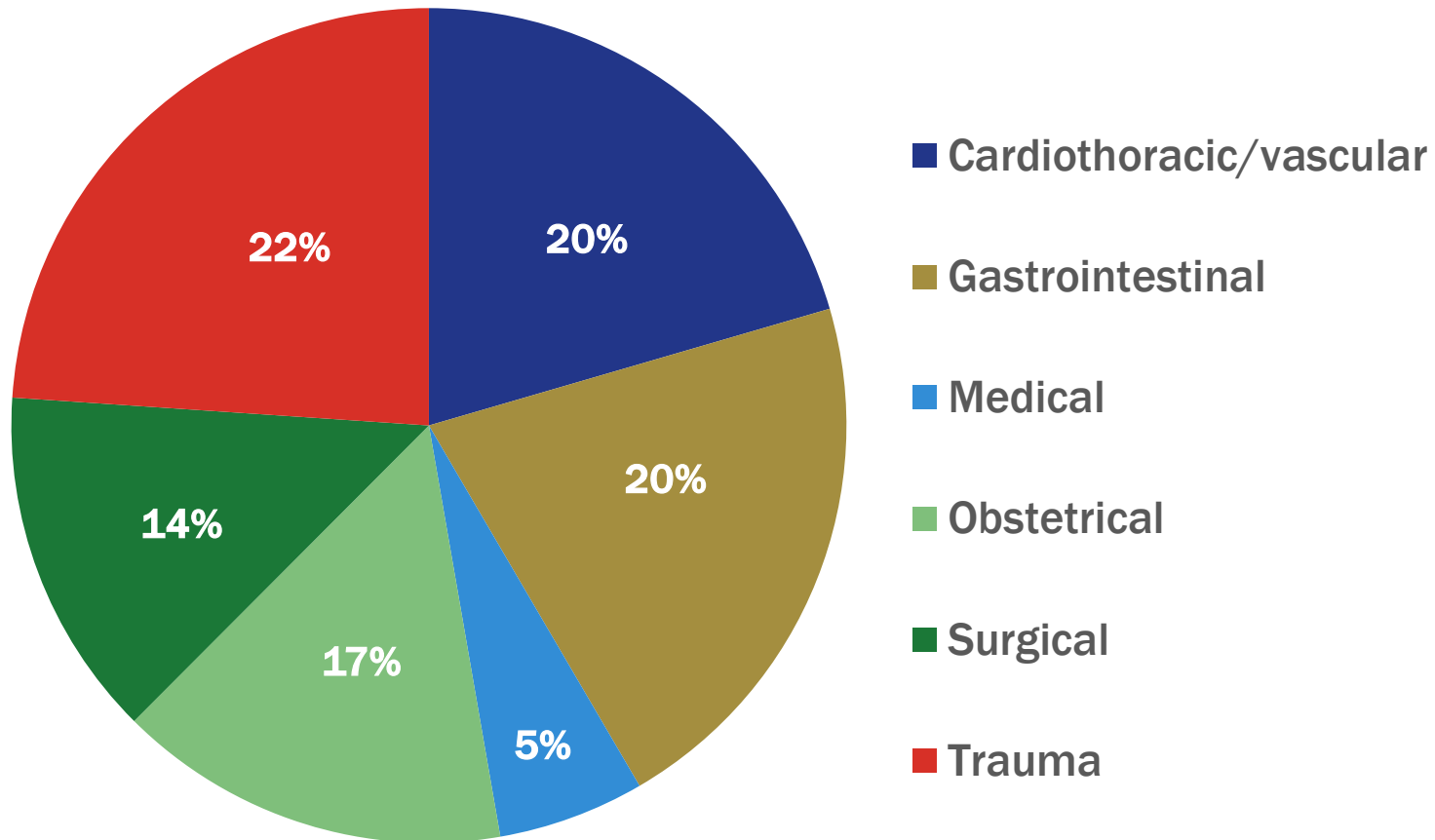
## LTOWB Transfusions (Des 2017 – oct 22)

- 603 patients
  - Avg age: 55 years (IQR 52-58, min-max 1-92)
  - ~64% male  
~36% female
- Total 2078 units
- Avg. 3.7 units (IQR 3.2-4.2, min-max 1-35) pr episode
  - No upper limit in the amount of units pr episode.
- Storage duration 0-21 days (fig. 1)



**FIGURE 1** Age distribution of low titer group O whole blood units at the time of transfusion. Units with an age of 0 days were issued on the same days as collection. Some of these were issued as warm, fresh, and irradiated units, and some with ongoing (but not completed) TTD screening, due to emergency need for transfusion

# Indications



# Survey:

	<b>Blood Bank Laboratory Staff (n=21)</b>	<b>Physicians (n=40)</b>	<b>Nurses (n=25)</b>
Which blood product would you choose for a massively bleeding patient?			
Balanced transfusion with components	0	0	0
Whole blood	21 (100%)	36 (90%)	24 (96%)
Both options are equal	0	4 (10%)	0
Which of the following were deciding factors for your choice in the previous question			
Easier handling	10 (48%)	28 (70%)	14 (56%)
Faster handling	20 (95%)	33 (83%)	20 (80%)
Less labor intensive	12 (57%)	24 (60%)	17 (68%)
Better physiological option	12 (57%)	36 (90%)	15 (60%)
Economic benefit	1 (5%)	0	0

Ref. Hagen KG et al. A Whole Blood based resuscitation strategy in civilian medical services; experience from a Norwegian hospital in the period 2017 – 2020. *Transfusion*. 2021. DOI: 10.1111/trf.16490. In press

# Conclusion

- LTOWB has its greatest potential in the early phases of care.  
(Before surgical/medical/interventional hemostasis)
- Logistics of the early, aggressive resuscitation of hemorrhagic shock.
- Minimize the shock dose burden
- At least one - two extra pair of hands in resuscitation team
- Clinical evidence of potential superiority is secondary (irrelevant?)  
in the early stages of care.



