

## The Logistical and Practical Benefits of Combined Components

Tucker H<sup>1</sup>, Green L<sup>2,3</sup>, English W<sup>3</sup>, Morrison A<sup>3</sup>, Trampleasure O<sup>3</sup>, Weaver A<sup>3,4</sup>

<sup>1</sup>Centre for Trauma Sciences, Queen Mary University of London; <sup>2</sup>NHS Blood and Transplant; <sup>3</sup>Barts Health NHS Trust; <sup>4</sup>London's Air Ambulance harriet.tucker2@nhs.net

### Aim

To establish the logistical and practical benefits of pre-hospital combined blood component transfusion

### Background

An early, balanced 1:1 haemostatic resuscitation with red blood cells (RBC) and fresh-frozen-plasma (FFP) reduces mortality in traumatic haemorrhage<sup>1,2</sup>. This is standard of care in hospital<sup>3</sup>.

Achieving an early balanced resuscitation using different blood components pre-hospital is a logistical and clinical challenge, with space, weight and resource constraints<sup>4</sup>.

A product containing all components in one bag (i.e. leuco-depleted red cell and plasma [RCP] or whole blood [WB]) could overcome these challenges.



### Results

Transfusion of a combined component (2 RCP units) had a shorter flow-time and touch-time compared to other arms.

A combined component required fewer steps, pieces of equipment and checks to reach complete transfusion.

After one-way ANOVA, the differences between group A and groups B and C were found to be statistically different (p = .00193 (significant at p < 0.5).

Blood Components	Flow Time Median (IQR)	Touch Time Median (IQR)	No. of steps	No. of pieces of equipment	No. of Checks	No. of people
<b>Arm-A [2 RCP]</b>	6min 31sec (5min 07, 7min14)	2 min 31sec (2min07, 3min11)	28	4	8	2
<b>Arm-B [2 RBC + 2 TP]</b>	12min 20sec (10min47, 13min53)	5min 21sec (4min43, 6min07)	40	10	16	2
<b>Arm-C [2 RBC + 2 Lyoplas]</b>	16min 29sec (13min11, 17min 02)	13min 03sec (11min48, 14min53)	46	12	16	3

Figure 2. Simulation Study Results



### Methods

This study aimed to establish the logistical and practical benefits of pre-hospital RCP use (2 units) versus other commonly used pre-hospital transfusion strategies (2 RBC + 2 FFP units and 2 RBC + 2 Lyophilised plasma 'Lyoplas' units) by conducting a three-arm cross-over simulation study.

Outcomes were: median flow time (overall scene time), median touch time (time crews are directly involved in blood transfusion), and the number of steps, checks, people, and equipment needed from decision to transfuse (DTT) to complete transfusion.

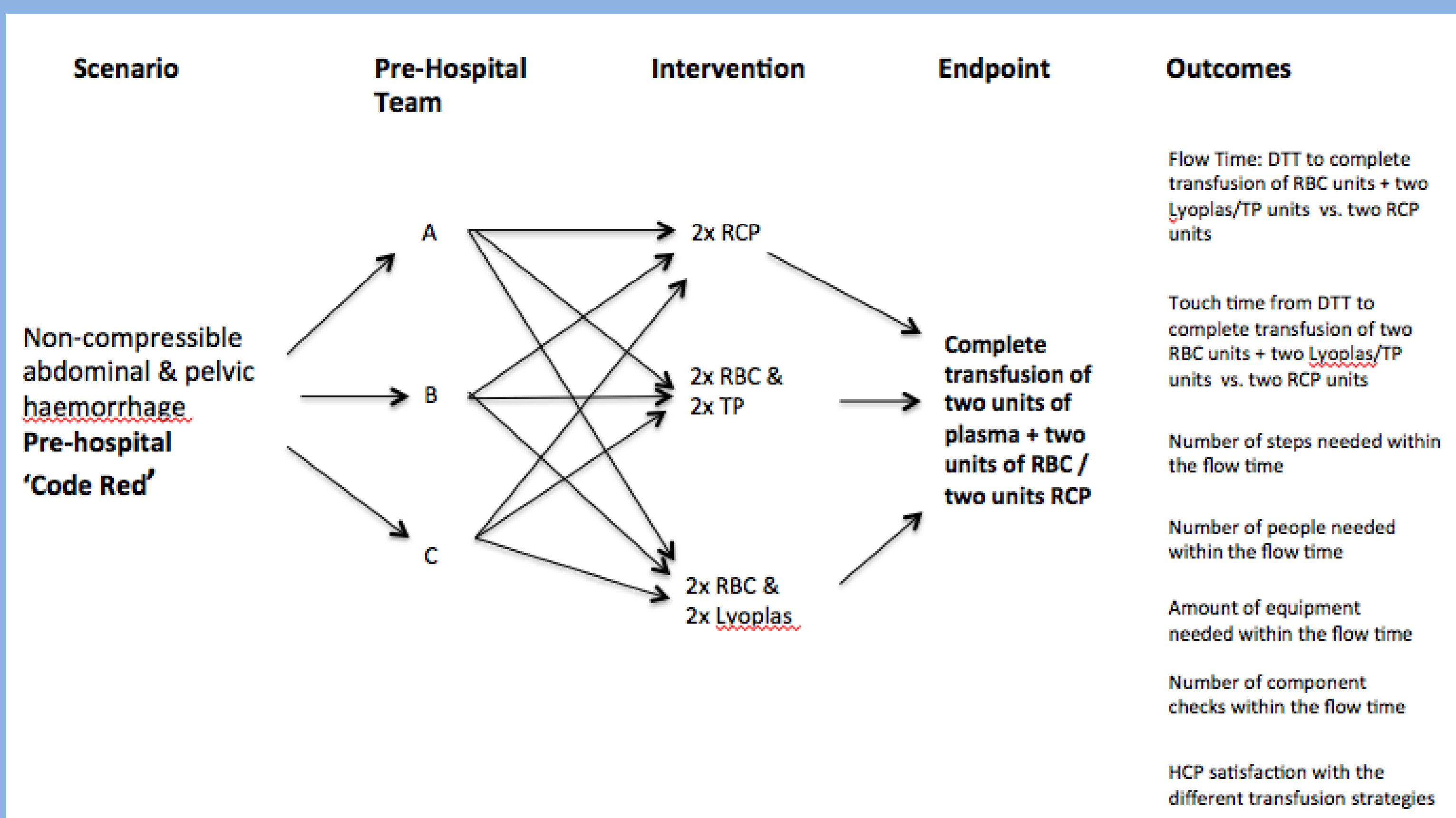


Fig.1 Simulation Study Schematic

### Discussion

This is the first study to demonstrate the significant reduction in pre-hospital flow-time and touch-time gained by transfusing a combined blood component.

Combined component use led to the shortest touch-time and flow time, and required fewer steps, people and equipment. This has important clinical implications.

The decreased times, especially touch time, liberates crews to complete other time-critical interventions, reduces their cognitive burden, reduces interruption of critical processes and the potential for human error due to interruptions.

The pre-hospital team is able to perform pre-hospital blood transfusions more efficiently with fewer resources, in a resource-limited environment.

### Conclusions

**The pre-hospital availability of a combined component (such as whole blood or combined red cells and plasma) leads to a significant reduction in pre-hospital flow-time and touch-time, with important clinical implications.**

**Pre-hospital combined component transfusion facilitates more effective use of resources, has a decreased team cognitive burden, and may lead to a more rapid hospital transfer for traumatically injured bleeding patients.**

References:  
 1. Holcomb JB, Tilley BC, Baraniuk S, et al. Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: The PROPPR randomized clinical trial. JAMA - Journal of the American Medical Association. 2015; 313(5): 471-482  
 2. Rehn M, Weaver A, Brohi K, et al. Effect of Prehospital Red Blood Cell Transfusion on Mortality and Time of Death in Civilian Trauma Patients. Shock. 2019;51(3):284-288.  
 3. Major trauma: assessment and initial management Major trauma: assessment and management of major trauma NICE Guideline 39 Methods, evidence and recommendations February 2016  
 4. Hawes R et al. Delivering balanced Red Blood Cell (RBC) Plasma transfusion in a UK air ambulance setting: Thawed fresh frozen plasma (FFP) versus freeze dried plasma Scand J Trauma Resusc Emerg Med. 2020; 28:13