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FINANCIAL ANALYSIS OF TRANSFUSION THERAPY: A FOCUS ON LIQUID PLASMA AND FRESH FROZEN PLASMA

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ABSTRACT
Fresh Frozen Plasma (FFP) is widely used in transfusions, but its short shelf life once thawed, Thawed Plasma (TP), can lead to wastage. Never-frozen Liquid Plasma (LQP), which doesn't require thawing and has a longer shelf life, is a potential alternative. However, its use in transfusion protocols is debated. Our project examines the benefits and drawbacks of LQP versus FFP, with a focus on reducing wastage and improving cost-effectiveness. We aim to propose a policy for LQP use based on our findings at two Level I trauma centers.

INTRODUCTION
Fresh Frozen Plasma (FFP) is widely used in transfusions, but its short shelf life once thawed can lead to wastage. Liquid Plasma (LQP), which doesn't require thawing and has a longer shelf life, is a potential alternative. However, its use in transfusion protocols is debated. Our project examines the benefits and drawbacks of LQP versus FFP, with a focus on reducing wastage and improving cost-effectiveness. We aim to propose a policy for LQP use based on our findings.

METHOD
In this study, we conducted a detailed retrospective evaluation of FFP usage and wastage data for AB blood units from 01/01/2022- 12/31/2022, obtained from Detroit Receiving Hospital and Sinai Grace Hospital, specifically pertaining to trauma and trauma activation cases.

We calculated FFP usage cost as: FFP costs $40.80 per unit plus additional $20 fee for AB units, total cost of FFP is $60.80. We then hypothetically calculated LQP usage cost as: LQP costs $56.10 per unit plus additional $20 fee for AB units. Total cost of LQP is $76.10.

Finally, we conducted a cost-effectiveness analysis of hypothetical usage of LQP relative to FFP at two Level I trauma centers. Our methodology also involves a comprehensive review of existing literature, focusing on the utility and advantages of liquid plasma incorporation in transfusion protocols, and strategies to mitigate the wastage of Fresh Frozen Plasma (FFP). Based on our literature review and data analysis, we intend to devise a policy advocating for the ready availability of liquid plasma in our blood banks. This policy proposal aims to enhance the efficiency of blood product utilization while reducing wastage.

RESULTS
Our 2022 transfusion data analysis from Trauma centers at Detroit Receiving Hospital (DRH) and Sinai Grace Hospital (SGH) revealed notable Fresh Frozen Plasma (FFP) usage and wastage.

DRH transfused 908 FFP units, with a high wastage of 695 units, resulting in a financial loss of $28,356 for the year of 2022 as seen in table 1 and Figure 1. SGH transfused 663 units, wasting 329, costing the hospital $13,423 for the year of 2022 as seen in table 1. These findings highlight the need for more efficient FFP usage, possibly through liquid plasma implementation in transfusion protocols.

Table 1.

Hospital	Total FFP Units Transfused in one year	FFP Units Wasted in one year	FFP Cost per unit	Financial Loss due to FFP Wastage in one year
DRH	908	695	$60.80	$28,356
SGH	663	329	$60.80	$12,423

Total	1,571	1,024	$60.80	$40,779

*DRH= Detroit Receiving Hospital
*SGH= Sinai Grace Hospital

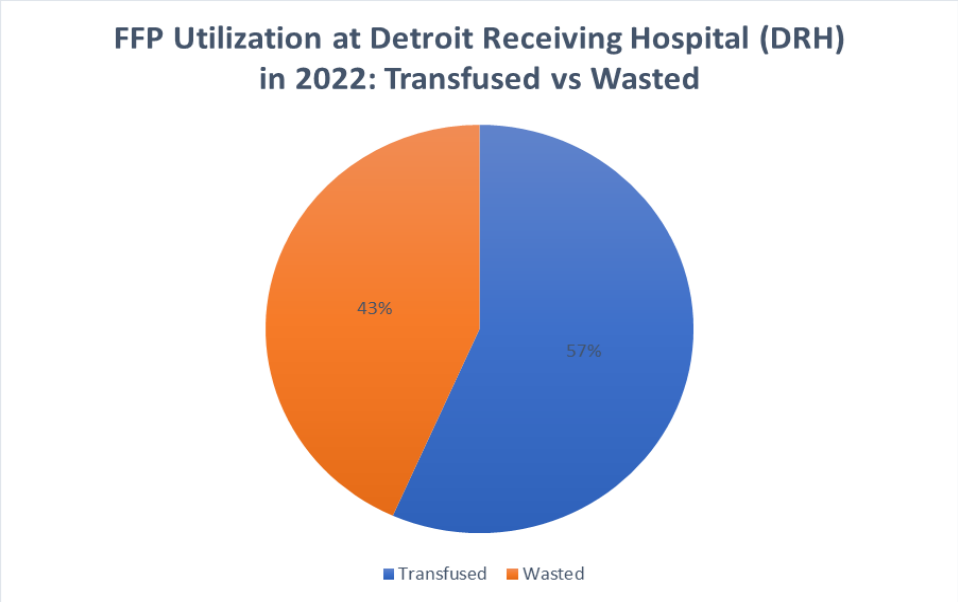

Figure 1: FFP utilization percentage of transfused vs wasted at Detroit Receiving Hospital (DRH) in 2022.

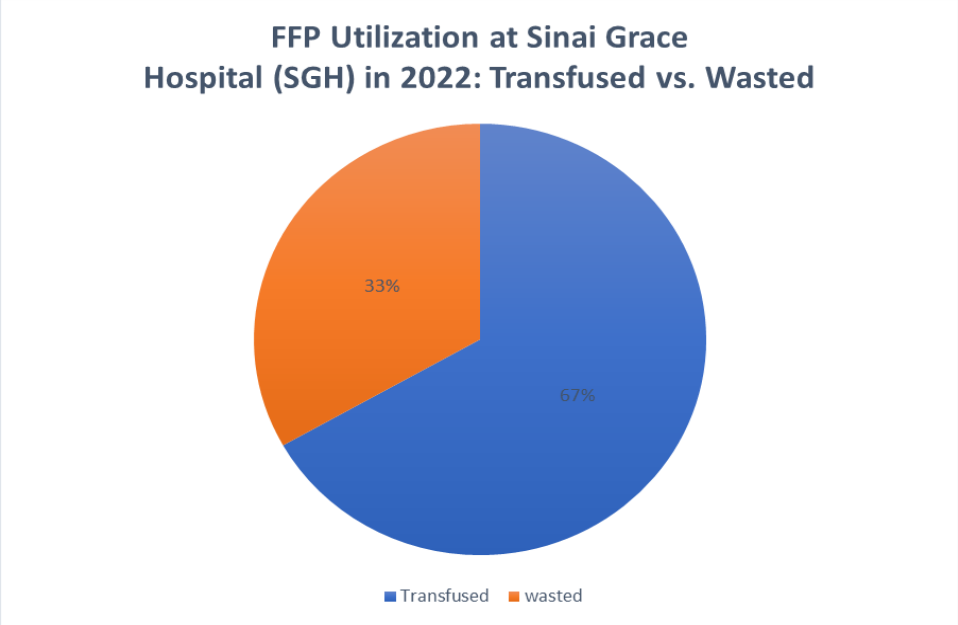

Figure 2.

Our analysis found that we ordered a total number of FFP units 2022 of 2,595, of which, 1,024 units (39%) were wasted and only 1,571 units (61%) were used. The total cost of FFP units = 2595 x $40.8 = $105,876. If we had used LQP instead of FFP and avoided the waste, the total cost of LQP units would have been $88,133. The use of LQP instead of FFP in 2022 would have led to a savings of $17,745.

DISCUSSION

In the United States, fresh-frozen plasma (FFP) must be frozen within 6–8 hours of collection and stored at temperatures below -18°C [FDA, Cardigan]. FFP is the preferred plasma product but requires thawing before use. After thawing, FFP can be refrigerated at 1°C to 6°C for up to five days [AABB standards]. This limited shelf life can lead to waste and a 30-40% loss of coagulation factors, notably Factor VIII, after storage.

Liquid plasma (LQP), derived from whole blood donations, is an approved alternative by the FDA and AABB. It can be stored refrigerated at 1-6°C for up to 26 days without the need for thawing. Although cost-effective and immediately available, the limited data on

its hemostatic profile and clinical effectiveness in initial trauma resuscitation has restricted its widespread adoption. However, recent studies, including those by Chehad et al., show comparable clinical outcomes to FFP in trauma resuscitation regarding mortality, hospital stay length, and complications. The median time to the first LQP transfusion is also significantly shorter than FFP [Chehad].

While thawed FFP's storage period is limited to 5 days in the U.S., European guidelines suggest that plasma can be stored for longer periods—up to 42 days at 1°C to 6°C [Matijevic]. For LQP, data confirms that it retains over 88% of its initial factor and inhibitor activities up to its 26-day expiration, except for Factor V, Factor VIII, and free Protein S. The decrease in Factor VIII may not be clinically significant in trauma patients since Factor VIII is an acute phase protein released after injury [Matijevic].

A study by Smith aligns with our objective, comparing LQP and FFP usage at Oregon Science University Level I Trauma Center. It found that LQP use could have resulted in savings of $39,376 (or $107 per unit) over two years [Smith].

Considering our study's findings on cost-effectiveness, and literature supported favorable hemostatic profile, and clinical effectiveness, LQP should be incorporated into the resuscitation protocol in Trauma Centers. Despite LQP's higher per-unit cost, the reduced waste compared to FFP can lead to overall cost savings for hospitals, positioning LQP as a more economically viable option when considering waste reduction.

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