

LETTER

Blood stewardship: conservation and supply of blood components during the severe acute respiratory syndrome coronavirus 2 pandemic

The novel severe acute respiratory syndrome coronavirus disease 2 (COVID-19) pandemic strain has spread to all 50 states, and there are now almost two million cases with more than 112,000 deaths as of 11 June 2020.¹⁻² During national disasters of this magnitude, transfusion services are concerned with the sustainability of the blood supply. In hard-hit areas, such as New York City, the disruption that COVID-19 has had on daily life may ultimately impact donations of this lifesaving resource for which there is no replacement.³

Although the AABB Interorganizational Task Force on Domestic Disasters and Acts of Terrorism is available to assist and coordinate the response of blood banks during times of crisis, it is important for each facility to develop an internal plan with conservative transfusion guidelines for times when the supply is unavailable or critically short.⁴ Internal and external disaster plans are not only good practice but also a regulatory requirement.⁵ Knowing that New York City may soon be confronted with a large gap between supply and demand of blood products, the Executive Transfusion Committee representing eight of the New York–Presbyterian (NYP) hospitals and patient blood management was convened to address the possibility of blood inventory depletion.

To facilitate the identification of a shortage and quickly implement a mitigation strategy, we developed a rubric that describes four levels of inventory status and its associated predetermined response (Table 1). The rubric of four hazard echelons of transfusion medicine response (green, yellow, orange, red) is based on the current supply and anticipated replenishment representing a spectrum of normal operating capacity to severe shortage creating a common language used by all sites to quickly describe the current status of supply to the central command center and generate an automatic response. The prescribed responses in each echelon are meant to be cumulative in nature (eg, actions in red include actions in other levels such as the cancellations of transplant surgeries). The first echelon (green) is preventative in nature, underscoring the need to prepare for anticipated shortages down the road, with the hope that this can

decrease the impact of reduced incoming shipments later in the crisis. Later echelons limiting nonurgent procedures require collaboration with hospital executive leadership as state-by-state requirements for triage of patients will vary and are not up to the transfusion service alone.

During nonemergency operations, transfusion guidelines are based on expert consensus of a multidisciplinary committee and reviews of the evidence-based literature, as no national standard of transfusion thresholds exist in the United States. NYP hospitals have extensive standardized transfusion thresholds for a variety of clinical scenarios and patient ages, which are expected to be adhered to and audited across all campuses. In general, cutoffs for nonbleeding adults are as follows: hemoglobin less than 7 g/dL (8 for cardiac patients), international normalized ratio greater than 1.6 for plasma, platelets less than 10,000/uL for platelet products (<100,000 for extracorporeal membrane oxygenation), and fibrinogen less than 60 mg/dL for cryoprecipitate. Actively bleeding patients require neither prior laboratory values nor specific cutoffs to release blood components at NYP hospitals.

In developing the rubric, we recognized that we could not define supply by a specific number of units of products stocked, as each hospital operates with a different supply at baseline. For example, a smaller hospital may normally stock 60 to 70 units of red cells, whereas the network's trauma center keeps approximately 10 to 20 times more. Therefore, a reporting system based on the percentage of normal supply was adopted. Because appropriate staffing has a direct impact on the blood bank's ability to safely operate, we incorporated staffing shortages into the rubric as well. In addition, frozen products are not included in the rubric, as the short-term supply of components with a multiyear shelf life is not anticipated to be affected during pandemic operations.

As part of the response strategy, each hospital was assigned a similarly sized "sister" hospital to assist with immediate resupply in an emergency. The pairings were made based on geographic location, hospital size, and acuity levels treated. In an acute bleeding scenario when

TABLE 1 Transfusion medicine echelons of care

Situation	Response
Green	
Standard supply and utilization (preventative measures only)	Prospective audit and transfusion medicine physician approval required for: <ol style="list-style-type: none"> Orders exceeding transfusion guidelines Second dose of blood product within 24 h Hospital leadership to limit elective (nonurgent) procedures
Yellow	
Incoming shipment decreased 50%	Conservative management: <ol style="list-style-type: none"> Semielective procedures with high likelihood of transfusion require review/approval by hospital leadership (eg, transplant) Split platelet products into smaller doses Encourage nontransfusion approaches (ie, antifibrinolytics)
Orange	
Incoming shipment decreased 75%	Aggressive mitigation: <ol style="list-style-type: none"> Cancel bone marrow and liver transplants Platelets for active bleeding only Lower hemoglobin transfusion thresholds in nonbleeding patients
Red	
<10% inventory remains or Unable to maintain minimal staffing	Crisis plan: <ol style="list-style-type: none"> All products for active bleeding only All products emergency release only (no pretransfusion testing) Lower hemoglobin transfusion threshold for ECMO Prospective audit of all massive hemorrhage activations (First round of blood products released, followed by a multidisciplinary goals of care discussion with treatment team)



ECMO, extracorporeal membrane oxygenation.

the blood supplier verifies that no additional blood products are immediately available for delivery, the affected hospital contacts its assigned “sister” hospital and arranges for emergency transport of available products using security staff and vehicles. This mechanism would be used only in an extreme emergency situation when there is no time to wait on the blood supplier. During a staffing shortage, less impacted hospitals may also absorb some of the testing needs via sample sharing. Where this is not possible due to differences in medical record systems, the affected hospital will resort to emergency-issue-only operations where presumed compatible (“universally” compatible) products are issued without pretransfusion testing.

Currently, the social distancing efforts in New York City have had the interesting benefit of fewer injuries and accidents and, therefore, fewer massive hemorrhage events in hospitals. In addition, with the added continuation of an emergency-operations-only model limiting routine procedures, NYP has thus far remained in the green operational level for both products and staffing. We hope we will not have to implement more aggressive strategies but are confident that we are prepared for whatever may come our way.

CONFLICT OF INTEREST

R.A.D. is a consultant for Instrumentation Laboratory. The other authors declare no conflicts of interests.

Sarah Vossoughi MD, RN¹ 
 Katherine Fischkoff MD²
 Robert A. DeSimone MD³ 
 Joseph Schwartz MD, MPH¹



¹Department of Pathology and Cell Biology, Columbia University Irving Medical Center, New York, New York

²Department of Surgery and Critical Care, Columbia University Irving Medical Center, New York, New York

³Department of Pathology and Laboratory Medicine, Weill Cornell Medicine, New York, New York

DOI 10.1111/trf.15995

ORCID

Sarah Vossoughi  <https://orcid.org/0000-0001-8161-4888>
 Robert A. DeSimone  <https://orcid.org/0000-0002-3484-790X>

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In response: adoption of the platelet PGD test

We read with interest the recent publication by Rios et al.¹ in which the authors describe the operational challenges associated with the original version of the Platelet PGD Test (Verax Biomedical Inc., Marlborough MA). Specifically, they address false-positive results and initially reactive results and their impact on blood center costs and platelet (PLT) availability. We feel compelled to point out that all data in this report were derived from a discontinued version of the test which was replaced in 2019 by an updated test² that was specifically designed to reduce initially reactive and false-positive results. The updated version of the test reduced the occurrence of initial reactive results in leukoreduced apheresis PLTs by 85.9% and improved observed specificity from 99.4% to 99.9% compared to the original test. The authors reference correctly a personal communication that an even newer generation of the test (Platelet PGD_{prime}) has now been introduced that is designed to reduce false-positive results even further. In validation studies of 3800 PLT doses, the Platelet PGD_{prime} Test was found to have a 0.13% initial reactive rate compared to 0.61% for the original PGD Test and a final observed specificity of 100% with a one-sided 95% lower confidence limit of 99.9%.³

Regarding the authors' speculation on the use of the PGD Test, in our experience many PGD users confirm their positive results directly rather than only reporting initially reactive results to the blood center. Over 1.55 million PGD Tests have been shipped to U.S. users that account for over 23% of PLT transfusions in the U.S. annually. Many users perform the Test on apheresis

PLTs to extend dating. Hospitals doing so report average outdate reductions of 74%.⁴ Therefore, sites that extend expiration to 7 days avoid outdating over 100,000 PLTs annually.

CONFLICT OF INTEREST

The authors have disclosed no conflicts of interest.

Paul D. Mintz MD 

Verax Biomedical, Inc., Marlborough, MA
DOI 10.1111/trf.15976

ORCID

Paul D. Mintz  <https://orcid.org/0000-0001-7058-4724>

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To the Editor

We acknowledge that the data in our report is derived from hospital reports of single-unit platelets and apheresis platelets that were screened for evidence of potential bacterial contamination with a version of the

Pan General Detection (PGD) test (Verax Biomedical, Marlborough, MA) that is different from the version of the PGD test that became available in 2019 and that the 2019 version of this test might have an improved performance as compared to the prior version of the test.