Addressing the risk of bacterial contamination in platelets: a hospital economic perspective

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BACKGROUND: Bacterially contaminated platelets (PLTs) remain a serious risk. The Food and Drug Administration has issued draft guidance recommending hospitals implement secondary testing or transfuse PLTs that have been treated with pathogen reduction technology (PRT). The cost implications of these approaches are not well understood.

STUDY DESIGN AND METHODS: We modeled incurred costs when hospitals acquire, process, and transfuse PLTs that are PRT treated with INTERCEPT (Cerus Corp.) or secondary tested with the PLT PGD Test (Verax Biomedical).

RESULTS: Hospitals will spend $221.27 (30.0%) more per PRT-treated apheresis PLT unit administered compared to a Zika-tested apheresis PLT unit that is irradiated and PGD tested in hospital. This difference is reflected in PRT PLT units having: 1) a higher hospital purchase price ($100.00 additional charge compared to an untreated PLT); 2) lower therapeutic effectiveness than untreated PLTs among hematologic-oncologic patients, which contributes to additional transfusions ($96.05); or 3) fewer PLT storage days, which contributes to higher outdating cost from expired PLTs ($67.87). Only a small portion of the incremental costs for PRT-treated PLTs are offset by costs that may be avoided, including primary bacterial culture, secondary bacterial testing ($26.65), hospital irradiation ($8.50), Zika testing ($4.47), and other costs ($3.03).

CONCLUSION: The significantly higher cost of PRT-treated PLTs over PGD-tested PLTs should interest stakeholders. For hospitals that outdate PLTs, savings associated with expiration extension to 7 days by adding PGD testing will likely be substantially greater than the cost of implementing PGD-testing. Our findings might usefully inform a hospital’s decision to select a particular blood safety approach.

ABBREVIATIONS: LR = leukoreduced; PRT(s) = pathogen reduction technology(-ies); TP/FP = true/false positive.

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test for bacteria. In the United States, INTERCEPT is the only FDA-approved PRT for PLTs, and the Verax PLT PGD Test is the only rapid bacterial detection test cleared as a safety measure, which allows extension of dating to 7 days. The draft also reiterates the existing pathway for the extension of apheresis PLT dating from 5 to 7 days with a technology cleared and approved as a “safety measure.” Currently, the only safety measure is the PLT PGD Test (PGD; Verax Biomedical).

We compare hospital direct and indirect costs of acquiring, processing, and transfusing apheresis PLTs that have undergone INTERCEPT Blood System (INTERCEPT; Cerus Corp.) treatment to untreated apheresis PLTs that have been tested with PGD. Results from this analysis may help hospitals to think through options that best suit their institutional needs in compliance with the draft guidance.

**MATERIALS AND METHODS**

A model was developed to compare hospital acquisition, processing, and transfusion costs for apheresis PLTs that undergo PRT treatment with INTERCEPT to those untreated PLTs tested for bacteria with PGD. Costs for the two paths were translated into a bifurcated cost model accounting for all cost-related activities, starting from point of hospital purchase and ending with PLT transfusion.

An apheresis PLT baseline unit (leukoreduced [LR], nonirradiated) cost was identified. From this, mutually exclusive processing and associated costs were estimated and added to enable hospitals to compare the total cost of providing PLTs for transfusion that meet the recommenda-

dinations of the FDA draft guidance for bacterial contamination risk mitigation.

To calculate cost per transfused PLT unit to a given hospital, we identified the cost-related activities that are: 1) built into the initial hospital acquisition price of a PLT unit, 2) incurred through in-hospital processing, and 3) associated with component transfusion. After these direct costs were computed, peer-reviewed literature was used to anticipate changes in hospital unit purchases that would be required to treat an equivalent patient population to equivalent outcomes with either PGD-tested or INTERCEPT-treated PLTs. Materially different unit purchases in INTERCEPT-treated and PGD-tested PLTs were expected due to: 1) different discard rates for PLT outdated under 5-day (INTERCEPT) and 7-day (PGD) storage, 2) PLT unit discards for true-/false-positive (TP/FP) test (PGD) results, and 3) the effect of PRT (INTERCEPT) on PLT degradation. Incremental unit purchases were allocated to a per PLT unit cost to facilitate an overall cost comparison of an INTERCEPT-treated PLT to an untreated PGD-tested PLT.

**PLT acquisition**

The hospital baseline apheresis PLT acquisition cost was determined from the AABB 2013 survey of US hospitals and blood collection establishments. The FDA has directed that all donations collected in the United States and its territories should be tested with an investigational individual donor nucleic acid test for the Zika virus under an investigational new drug application, or when available, a licensed test, or their donations should be pathogen inactivated with an FDA-approved pathogen reduction device. Congressional communications to the commissioner of the FDA and to the acting administrator of the Centers for Medicare & Medicaid Services have respectively indicated the cost of this test is “less than $10.00” and “$7 to $10.” While it is not clear whether the cost of this test will be borne by hospitals, blood collection establishments, or the Federal government, we have incorporated this as an incremental cost to hospital untreated PLTs. We have used $8.50 as the test cost, accounting for a reported collection “split rate” of 1.9 PLT collections per donation to calculate a per-unit test cost of $4.47.

We presumed that INTERCEPT treatment eliminates blood collection establishment costs for irradiation, Zika testing, and early culture of PLTs. FDA has not indicated to date that other microbial testing may be eliminated by PRT. Additionally, these other tests, like early culture, are included in the purchase price of a PLT unit. The additional charge by blood collectors for PRT-treated PLTs (net of costs avoided) over untreated PLTs (nonirradiated) was estimated based on literature and experts’ knowledge of the US blood banking community. Both INTERCEPT-treated and PGD-tested PLTs were presumed to accrue equivalent transportation costs from blood collection establishments to hospitals.

**In-hospital processing**

Many nonirradiated PLTs purchased by hospitals are irradiated in hospital, thereby adding costs for technologist labor and irradiation equipment. Additionally, these PLTs would accrue in-hospital costs for PGD testing related activities, including: 1) test device, labor, and results management in routine use and 2) test device and labor for the infrequent use in quality control (QC), proficiency testing, repeat testing of positive results, and repeat testing of units not transfused within 24 hours. Not all PLTs require testing before transfusion. Draft FDA guidance on bacterial risk reduction in PLTs does not recommend performing secondary testing on PLTs transfused before Day 4. We averaged the findings of Jacobs and colleagues (45.0%) and Sorkin and Jacobson (17.2%) and used 31.1% for the percentage of PLTs transfused before Day 4 that do not require secondary testing.

We assumed that INTERCEPT treatment eliminates in-hospital processing for irradiation and secondary testing (through Day 5). Both INTERCEPT-treated and PGD-tested PLTs were presumed to accrue equivalent in-hospital handling and issuance costs.
PLT administration

Both INTERCEPT-treated and PGD-tested PLTs accrue a per unit cost for administration of the PLT unit to a patient. We applied a cost for the inpatient administration of a unit of plasma identified in one study to that of a unit of PLTs, since we were unable to find an equivalent PLT cost. This study also found that 16% of all PLTs transfused at the authors’ hospital were given to outpatients. We were unable to find outpatient specific administration cost data and therefore made no distinction between inpatient and outpatient PLT unit administration costs.

Number of PLT units transfused

We identified three areas of difference in the number of PLTs purchased and transfused between PRT-treated and PGD-tested PLTs. They were: 1) outdate waste due to PLT expiry differences, 2) discards for positive PGD-tested PLTs, and 3) incremental purchase and transfusion due to PLT degradation from INTERCEPT treatment. Each of these cost impacts was allocated to a per-PLT-unit cost to facilitate comparison.

A percentage of both INTERCEPT-treated and PGD-tested PLTs will never be transfused because they expire past their FDA-allowable shelf-life of 5 and 7 days, respectively. Rates of PLT wastage due to outdating after 5 and 7 days were identified in the published literature, which shows that the additional allowable transfusion days afforded to PGD-tested PLTs has the potential to markedly reduce outdate rates.

There will be PGD-tested PLT unit discards for positive results (TP and FP). We applied a loss rate to PGD-tested PLTs derived from published manufacturer specificity and literature. The cost of PLT units testing positive and discarded were included. Notwithstanding the method used to apply a cost for discards due to positive results, it should be noted that as long as a hospital has an outdate rate that is greater than the combination of TP and FP rates, there will be little or no incremental cost for discarded units. The discarded unit would be replaced with a unit that would otherwise have been discarded as an outdated PLT.

Purchase and transfusion of additional PLTs to adjust for PLT degradation induced by INTERCEPT treatment has been observed in randomized studies of hematologic-oncology patients. We used PLT loss rate from the FDA filing of INTERCEPT Summary of Safety and Efficacy Data (SSED) and published studies to quantify PLT degradation and applied this to the hematology-oncology patient population. We used the SSED to quantify loss due to PLT degradation and only applied that loss rate to the subset of transfusion patients with hematologic-oncologic disease.

RESULTS

Hospital acquisition cost for apheresis PLTs

Our model builds from a nonirradiated apheresis LR PLT baseline cost assumption of $516.96, which was the mean amount paid per unit by US hospitals in 2013. McCullough and coworkers estimated the mean incremental cost for in-hospital irradiation of PLTs to be $8.50 per unit. We applied this amount to estimate cost for hospital-irradiated PLT units.

PLT irradiation cost (blood centers and in hospital)

The FDA draft guidance recommends apheresis PLTs be either secondary tested within 24 hours of transfusion after Day 3 or PRT treated after collection. Hospitals testing their PLTs with PGD will incur costs for purchasing the test device and the labor to perform it. The mean price paid for a PLT PGD Test is $26.50 (per test).

To calculate the labor cost associated with each PGD test performed, we assume that most PLT transfusions are performed in hospitals that will run PGD tests in batches of 6 or 12 PLT units. We conservatively estimate the labor time for an average batch of 9 PLT units by using the required time to run a batch of 24 units (60 min). We assumed that technologists, a profession with an average national hourly rate of $38.70 (including benefits) according to BLS, are primarily responsible for test performance, which amounts to a per-PLT-unit labor cost for sampling and test performance of $4.30 (i.e., $38.70/9). McCullough and colleagues also observed that management of routine testing results and the cost for QC and proficiency testing accrue separate costs of $0.33 and $2.08 per unit, respectively.

PGD instructions for use state that repeat testing in duplicate should be performed on units that test initially reactive. TP (0.0003) and FP (0.005) test result rates were identified in the manufacturer’s package insert and literature, and in such cases, we assumed two additional tests will be performed (when only one additional may be sufficient), which contributes an additional cost of $0.33 per PLT (i.e., $(0.0003 + 0.005) \times ((26.50 + 4.30 + 0.33) \times 2)$) to cover all repeat testing costs for PLTs that initially test reactive (TP and FP). PGD specificity is such that hospital PLT transfusions would need to exceed 2200 annually before the institution should expect to discard a single PLT unit (either TP or FP) per month.
A total of 16.5% of PGD-tested PLTs were retested when not transfused within 24 hours over the reported period of 2014 to 2015. Therefore, each PLT unit accrues an additional cost of $5.14 (i.e., $(26.50 + 4.30 + 0.33) \times 0.165$), which includes the cost of test device, labor for test performance, and management of results to cover the cost of retesting for PGD results that have expired.

As noted, we used 31.1% as the proportion of PLTs transfused before Day 4 of shelf life. This is supported by Department of Health and Human Services–reported data on the mean age of PLTs at transfusion reported by US hospitals. Therefore, we assumed that only 68.9% of PLTs would be PGD tested. All costs associated with in-hospital PGD testing of PLTs ($26.65) are summarized in Table 1 and are consistent with field experience.

### Additional charge for pathogen reduction treatment

Although we were unable to identify a firm amount charged by blood centers to hospitals for PRT treatment, a range of an incremental $100 to $160 has been offered in literature. We assumed the lowest end of this range and, further, that this amount covers all blood center costs unique to PRT treatment. We also assumed that the additional charge includes the impact of blood center cost savings for the elimination of irradiation, primary culture testing, and Zika testing and covers any mark-up required by the blood center. There were not sufficient data published to show PRT treatment cost breakdown; however, the type of services presumed to be included in a $100 PRT additional charge by blood centers to hospitals are outlined in Table 2 and warrant further investigation. PRT-treated PLTs would avoid in-hospital costs associated with irradiation and secondary testing (through Day 5).

### Other in-hospital costs for PLTs

We assumed all apheresis PLTs (PGD-tested and INTERCEPT-treated) accrue a $3.53 and $5.28 cost per unit for hospital blood bank handling and issuing PLTs to floor, respectively, based on activity-based cost estimates for fresh-frozen plasma.

### Incremental unit purchases for PLT efficacy degradation from PRT treatment

The PRT treatment process exposes PLTs to chemicals and ultraviolet light causing degradation of PLT efficacy. The affected patient population and the extent of incremental PLT transfusions required to compensate for this degradation remain uncertain. We assumed that PRT-treated PLT degradation impacts the subset of hospital apheresis transfusions to hematologic-oncologic patients, which, in the United States in 2011, was reported to account for 34.4% of all transfusions. A randomized controlled trial of PRT-treated compared to untreated PLTs administered to hematologic and cancer patients found 35.5% more transfusions were needed when using PRT-treated PLTs. After weighting to the affected patient population, the overall effective PLT loss due to PRT degradation is 12.2% (i.e., $34.4\% \times 35.5\%$).

The inpatient cost of administering a PLT unit is an estimated $160.78 per unit. This amount includes the cost of labor for administering and monitoring transfusions, as well as pre- and posttransfusion logistics. Although 16% of all PLTs are delivered to outpatients, we were unable to find outpatient specific costs and therefore applied the inpatient rate to the universe of PLT transfusions.

Since the effects of PRT-treated PLT degradation were observed at the treatment level, the $12.2\%$ rate was applied to the PRT-treated unit cost inclusive of...
the cost of acquisition, handling and administration to a patient, totaling $786.55. The total economic impact per PLT unit to cover the cost of the increased number of PLT units transfused driven by PRT treatment degradation is $96.05 ($786.55 × 12.2%).

PLT unit purchase reduction enabled by PGD testing expiry extension to 7 days

The mean hospital apheresis PLT unit discard rate with 5-day storage was 11% in 2013. Although efficiency studies of PLT outdating under the new 7-day rule were not available in time for this publication, a 2010 prospective pilot study investigating contamination rates for 7-day PLT storage observed an outdate rate of 1.55% (6039 of 388,903 units).17

As PRT-treated PLTs are currently regulated to 5-day storage, we applied the 2013 outdate rate of 0.11 to the per unit cost of a (nonadministered) PRT-treated PLT unit, $620.49, to determine a per-unit financial impact of outdating of $76.69. Thus, every PRT-treated PLT unit transfused by a given hospital accrues an additional cost of $76.69 to cover the cost of outdated discarded units. Applying this logic to PGD-tested, hospital-irradiated PLTs using a 7-day outdate rate of 0.0155 and the per-unit costs of (nonadministered) PLTs of $560.11 yields accrued per-unit cost to cover discards of $8.82.

PLT units discarded as a result of TP and FP PGD test results accrue separate costs. The sum of PGD TP and FP rates is applied to hospital-irradiated PLTs for an accrued cost of $2.98 ((0.0003 + 0.005) × $560.11). Additionally, for repeatedly reactive results, the PLT unit must be cultured. We allot $10.00 for this, which adds $0.05 to each PGD test ((0.0003 + 0.005) × $10.00). In total, there is an accrued per-unit cost of $3.03 to cover the units discarded because of TP/FP test results and culturing.

### Fully loaded hospital cost difference of PGD-testing versus PRT-treating

PRT-treated PLTs would cost $221.27 ($959.29 - $738.02) more per PLT unit than PLTs that would be Zika tested before being irradiated and secondary tested in-hospital. There are three contributors to this difference. First, the additional charge for PRT treatment ($100.00 per unit) is 252% of the combined cost for Zika testing ($4.47), in-hospital irradiating ($8.50), and secondary testing ($26.65). The second is that incremental PRT-treated PLTs will be required to treat an equivalent patient population due to PLT degradation. This increased transfusion requirement creates an allocation of $96.05 per PRT-treated PLT unit. Third, PRT-treated PLTs are limited to 5-day storage while PGD-tested (as a safety measure) can be stored up to 7 days. PRT-treated PLTs are allocated $67.87 ($76.69 - $8.82) more per unit for outdate cost. The PGD testing economic advantage owing to outdate reduction is marginally offset by costs for discards and culturing ($3.03) associated with TP/FP results. The complete hospital cost differences are summarized in Table 3.

| TABLE 3. Cost comparison for implementation of PGD testing or INTERCEPT treatment |
|-----------------------------------------------|-----------------------------------------------|
| **Hospital PLT cost**                        | **Primary cultured**                           |
| **Acquisition**                              | **Adding PGD testing**                         |
| **INTERCEPT treated**                        | **Intercept treated**                          |
| **Apheresis (LR) PLT cost**                  | **$516.96**                                    | **$516.96**                                    |
| **Zika testing by BC**                       | **$4.47**                                      | **$4.47**                                      |
| **Pathogen reduction by BC**                 |                                               | **$100.00**                                    |
| **Subtotal: cost of acquiring**              | **$521.43**                                    | **$616.96**                                    |
| **Processing**                               | **Secondary testing cost (test and labor)**    |
| **Irradiation cost (done at hospital*)**     | **$8.50**                                      | **$8.50**                                      |
| **Blood bank handling cost**                | **$3.53**                                      | **$3.53**                                      |
| **Subtotal: cost at issue**                 | **$533.46**                                    | **$620.49**                                    |
| **Administration**                           | **Blood bank issuance cost**                  |
| **Blood bank issuance cost**                | **$5.28**                                      | **$5.28**                                      |
| **Administration cost**                     | **$160.78**                                    | **$160.78**                                    |
| **Subtotal: cost as administered**          | **$699.52**                                    | **$786.55**                                    |
| **Unit purchase differential**              | **Loss from outdate**                          |
| **Loss from outdate**                        | 11.00%                                        | 1.55%                                          |
| **Averaged unit increase for outdates**      | **$65.93**                                     | **$76.69**                                     |
| **Loss from TP/FP discards**                | 0.53%                                         | **$3.03**                                      |
| **Averaged unit increase for TP/FP discards**|                                               | **$3.03**                                      |
| **Hospital usage for hematology-oncology patients** | 34.40%                                        |
| **Average unit increase PRT degradation**   |                                               | **$96.05**                                    |
| **Total: cost as administered (averaged)**  | **$765.45**                                    | **$792.29**                                    |
| **Change from current ($)**                 | (2) $27.42                                     | **$193.84**                                    |
| **Change from current (%)**                 | (3.6%)                                        | **25.3%**                                      |

* Remove $8.50 irradiation cost on Line 5 if hospital does not use irradiated PLTs, or remove $8.50 and increase the cost of acquiring by $40.32 to reflect cost of PLTs irradiated by blood center.

| **Unit purchase differential**              | **Loss from outdate**                          |
| **Loss from outdate**                       | 11.00%                                        | 1.55%                                          |
| **Averaged unit increase for outdates**      | **$65.93**                                     | **$76.69**                                     |
| **Loss from TP/FP discards**                | 0.53%                                         | **$3.03**                                      |
| **Averaged unit increase for TP/FP discards**|                                               | **$3.03**                                      |
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Limitations

We have not assigned costs for the increased adverse events associated with PRT treatment reported in the SPRINT trial\textsuperscript{31} and described in the FDA INTERCEPT SSED\textsuperscript{18} or for the reduction in split rates and absence of triple collections with PRT treatment. Our analysis has presumed that hospitals will use 100% PRT-treated or 100% PGD-tested PLTs. It may not be feasible, particularly initially, for a hospital to obtain an inventory of 100% PRT-treated PLTs. We have not accounted for a hospital using a dual inventory in our analysis. A complete list of limitations is in Table 4.

TABLE 4. Study limitations of economic analysis

| Limitation                        | Description                                                                                                                                 |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Cost of PRT treatment            | Current published mark-ups for PRT-treated vs. untreated PLTs were unavailable. The low end of a 2008 hospital charge estimate range of $100-$160 was used.\textsuperscript{30} The use of $100 additional charge for PRT treatment is believed to be a conservative estimate. |
| PRT impact on split rates        | Increased cost of reductions in split rate from PRT guard bands for PLT yields is not estimated. Increased cost of reduced split rates caused by the absence of a PRT triple unit set is not estimated. |
| Cost avoidance from PRT          | Estimated Zika testing costs are not included for PRT-treated PLTs, but are in PGD-tested PLTs. Discussion has occurred regarding the opportunity for Federal funding to cover Zika testing. $100 PRT additional charge from blood establishment is assumed to include savings from irradiation and culture elimination. No other cost avoidance is assigned to PRT for microorganism testing (no elimination yet approved by FDA) or transmission. |
| PLT age and type restrictions    | No cost was assigned for limitation of PRT processing restrictions (e.g. Fresenius Amicus PLTs only in Fresenius Intersol PAS, Terumo Trima PLTs only in plasma). No benefit was assigned to PGD testing for being cleared on all PLT types in use in the United States. No large-scale contemporary (since 2011) data on the proportion of PLTs transfused before Day 4. |
| PRT AE                           | No cost was assigned for the increased AE\textsuperscript{s} associated with PRT reported in SPRINT trial\textsuperscript{31} and described in the FDA INTERCEPT SSED.\textsuperscript{18} The PRT (INTERCEPT) Phase IV study on pulmonary AE\textsuperscript{s} (specifically ARDS) remains in progress. The current analysis considers immediate costs only. |
| PLT efficacy degradation         | Cost of PRT processing degradation was limited to subset of hematology and oncology patients. No studies were identified that evaluated increased PRT PLT utilization in other patient populations. No cost was assigned for efficacy reduction of PLTs that may be used on Day 6 or 7 by utilizing a safety measure cleared test. |
| 7-Day PLT operations             | No cost was assigned for increased RBC transfusions with PRT treatment.\textsuperscript{24} No benefit was estimated for reductions in weekend or holiday collections that would be enabled by PLT expiry extension. |
| Performance failures            | False-negative PGD tests were not included in the analysis. Actual rate is not known. Failures of PRT to sufficiently inactivate microbial contaminants were not included in the analysis. Actual rate is not known. |

AE\textsuperscript{s} = adverse events.

DISCUSSION

Few studies have shown the impact of these different technologies on hospital costs. We compared the mean hospital cost per transfusion for an INTERCEPT PRT-treated PLT unit to a Zika-tested PLT unit that is irradiated and PGD tested in hospital (Table 3). Regardless of whether PLTs are nonirradiated or irradiated (at the blood center or at the hospital), PLTs that are PGD tested are substantially more economical for hospitals to use than PRT-treated PLTs. We found that hospitals would accrue an additional cost of $221.27 per PRT-treated PLT transfusion compared to the aforementioned PGD-tested unit. If a hospital receives PLTs irradiated at the collection establishment, it can add the additional cost when calculating the differential; if the component is not irradiated, it can subtract the cost attributable to irradiation (in our calculation $8.50). The final cost difference incorporates all costs avoided by PRT treatment.

Degradation

PGD testing is performed on a sample from a segment that would otherwise not be transfused and has no adverse effect on PLT quality or quantity. Although PRT effectively eliminates the transmission of a broad array of microbial contaminants, this process results in substantial PLT loss, dilution, and degradation.\textsuperscript{18-24} The FDA SSED for INTERCEPT describes radiolabeling studies demonstrating a 15% to 22% decrease in PLT recovery and a 20% to 25% decrease in PLT survival of INTERCEPT-treated PLTs compared to untreated PLTs.\textsuperscript{18} The clinical impact of diminished PLT recovery and survival is significant in hematology and oncology populations.\textsuperscript{20,23,24} In these populations, studies have found that patients transfused with PRT-treated PLTs require more units compared to patients who received untreated PLTs.\textsuperscript{18-24,25} The potential clinical impact in other patient populations has not been studied.
The economic impact of acquiring and transfusing incremental PLT units to compensate for PRT degradation is significant, as a sizable proportion (34.4%) of all apheresis PLTs transfused in the United States are administered to hematologic-oncologic patients. Randomized controlled trials in these patients have detected increased days of Grade 2 bleeding and an increased incidence of Grade 2 bleeding in patients receiving PRT PLTs compared to patients receiving untreated PLTs. Radiolabeling studies summarized by Ramsey found the immediate post-transfusion recoveries of PRT-treated PLTs stored for 5 days was 74% to 84% that of untreated PLTs, and posttransfusion life spans of PRT-treated PLTs stored for 5 days was 4 to 5 days, compared to 6 to 7 days for untreated PLTs.

There are no data to indicate whether increased PLT transfusions would be required owing to decreased efficacy of non-PRT PLTs stored for 7 days compared to those stored for 5 days or fewer. Because only approximately 11% of PLTs would be stored more than 5 days, the cost impact, if any, will be minimal.

Some states the decreased corrected count increments with transfusion of PRT PLTs is not a particular concern owing to the findings of the PLADO study in which lower PLT doses were not associated with inferior outcomes. If this is accepted, then the corollary for untreated PLTs is that dosing is excessive and could be reduced to accrue economic benefit.

**Effect of 7-day storage**

PLTs expiring past their FDA allowable shelf life are discarded. In 2015, the FDA approved increasing the shelf life of PGD-tested apheresis PLTs in plasma from 5 to 7 days. INTERCEPT PLTs remain regulated to 5-day storage.

Two additional storage days has a marked effect on rates of discarded PLTs. The US DHHS National Blood Collection and Utilization Survey from 2011 found 12.8% of all processed PLTs expire after 5-day storage. A comparable rate of 11.0% was reported by the AABB in 2013. A US study published in 2010 observed a 7-day outdate rate of 1.55% among bacterially tested apheresis PLTs. The reported outdate rate at the University of North Carolina Medical Center dropped from a 5-day-stored PLT outdate rate of 2.9% to 1.3% with a 7-day outdate. The University of Vermont Medical Center had a historical mean PLT outdate rate of 24% with a 5-day outdate that decreased to 12% in the first 3 months after implementing a 7-day outdate (S.K. Harm, personal experience). Dunbar and coworkers reported a 5-day outdate rate of 8.7% that decreased to 1.7% over the first 4 months after implementation of a 7-day outdate (N. Dunbar, personal communication, December 2, 2016).

In our model, lowering hospitals’ PLT outdate rates by extending shelf life dramatically improved the economic benefit of PGD-tested over PRT-treated PLTs. Increasing the PLT shelf-life to 7 days could also significantly reduce collection costs (weekends and holidays) and is worth further investigation.

In conclusion, PRT treatment creates a significant increase in hospital costs through both a higher unit purchase price and the need to purchase more PLTs owing to decreased PLT recovery and survival posttransfusion. PRT-treated PLTs add costs with no opportunity to extend dating. We calculate the mean incremental cost difference is $221.27 per unit more for a PRT-treated PLT unit compared to a Zika-tested PLT unit irradiated and PGT tested in hospital. If an institution chooses to use PLTs only through Day 5, the incremental cost difference is $160.86 (calculations not shown, available on request). We provide a model in which hospitals can enter their own costs and calculate the cost difference they will experience. If a hospital’s PLT acquisition cost times the PLT outdate rate is greater than the cost of PGD testing (Table 1), then implementing PGD testing is cost saving. This analysis can help inform a hospital’s decision regarding which FDA-guided option better serves their requirements.

**CONFLICT OF INTEREST**

MEB serves as an adviser to bioMerieux and to Verax; PDM is an employee of Verax Biomedical; and JWL, DC, AEG, and AD are employed by Dobson DaVanzo & Associates, LLC. Dobson DaVanzo & Associates, LLC, was retained by Verax Biomedical to lead this research effort. The other authors have disclosed no conflicts of interest.

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