The cost-effectiveness of reducing donor exposures with single-donor versus pooled random-donor platelets

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of single-donor versus pooled random-donor platelets in transfusions.

Type of intervention
Treatment and primary prevention.

Economic study type
Cost-utility analysis.

Study population
The model population baseline was a 40 year old female undergoing hematopoietic progenitor cell transplantation and a 70 year old male and 70 year old female undergoing primary coronary artery bypass grafting.

Setting
Hospital. The study was carried out in Pittsburgh, Pennsylvania, USA.

Dates to which data relate
Effectiveness data were derived from records of all adult patients at the University of Pittsburgh Cancer Institute undergoing HPCT between July 1991 and December 1995 and from records of 942 consecutive adult patients undergoing CABG at Allegheny General Hospital in 1995. Additional effectiveness data were derived from studies published between 1991 and 1997. Cost data were derived from 1993-1996 sources. The price year was 1996.

Source of effectiveness data
Effectiveness data were derived from a literature review and expert opinion.

Modelling
A decision analytic model was used to determine the cost-utility of the two health technologies.

Outcomes assessed in the review
The review assessed the following outcomes: viral complications, platelet dose by diagnosis, donor exposure by indication, bacterial contamination risk, virus-transmission risk, excess annual mortality.

Study designs and other criteria for inclusion in the review
Not stated.
Results of the review
For patients undergoing HPCT, the number of actual blood component transfusions varied between 2 and 15 with SDPs and between 6 and 33 with RDPs. For patients undergoing CABG, the number of actual blood component transfusions was 1 for SDPs or RDPs. The average platelet doses were 7.8 units for breast cancer, 14.2 units for non-Hodgkin’s lymphoma, 37.7 units for chronic myelogenous leukemia, 48.2 units for acute myelogenous leukemia, and 1.5 units for CABG. The risk for bacterial reaction was 1 in 19,000 with SDP and 1 in 2,000 with RDP. The risk was 0.15 for sepsis and/or death risk from septic transfusion reaction. For HIV, the transmission risk was 1 in 493,000 and the disease estimate was 1 for HIV infection and 1 for AIDS. For HCV, the transmission risk was 1 in 103,000, and the disease estimate was 0.28 for persistent hepatitis, 0.13 for active hepatitis, 0.1 for cirrhosis, and 0.01 for fulminant hepatitis. For HTLV-I, the transmission risk was 1 in 641,000 and the disease estimate was 0.04 for HAM. For HBV, the transmission risk was 1 in 63,000 and the disease estimate was 0.04 for carrier state, 0.02 for persistent hepatitis, 0.01 for active hepatitis, and 0.01 for cirrhosis or cancer. Excess annual mortality was estimated at 3% per year after CABG in addition to the age- and gender-related mortality. These data formed the principal input parameters for the model.

Methods used to derive estimates of effectiveness
Estimates of effectiveness were also based on the authors’ assumptions.

Estimates of effectiveness and key assumptions
The only advantage of SDPs was fewer donor exposures and the lower attendant risk of virus and bacteria transmission. The clinical efficacy of both platelet components was assumed to be the same. Assuming that all platelet components were WBC reduced for the HPCT population, the risk of HLA alloimmunisation was considered to be equivalent for RDPs and SDPs.

Measure of benefits used in the economic analysis
Quality-adjusted life years (QALYs) were used as the measure of benefits. Utility calculations used declining exponential approximations of life expectancy, with quality of life adjustments and future years discounted at 5% per
annum. Formulae used age- and gender-specific life expectancies in 1989. Quality of life adjustments for the various malignant disease states were based on institutional and published consensus estimates when available.

**Direct costs**
Direct costs were discounted at an annual rate of 5%. Quantities and costs were not reported separately. Direct costs included the hospital acquisition cost for SDPs and RDPs, medical costs for treating sepsis, fever and chills, and discounted lifetime medical costs for treating 10 specified viral complications of transfusion-transmitted viruses. The quantity/cost boundary adopted was that of the health service. The estimation of quantities and costs was based on actual data. Costs assigned to a transfusion of SDPs were based on the 1996 hospital acquisition cost from the local blood centre. The 1996-1997 Medicare reimbursement for DRG 416 was used to estimate the treatment cost for an episode of transfusion-associated bacterial sepsis. The cost of a febrile reaction was based on the local transfusion service charge for a transfusion reaction work-up and culture of the platelet bag. The price year was 1996.

**Statistical analysis of costs**
Not reported.

**Indirect Costs**
Not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
Sensitivity analyses were performed on the patient's age, acquisition cost differential, number of units in the RDP equivalent to an SDP, transfusion-associated transmission risk for HIV, HCV, HBV, HTLV-I, and bacterial sepsis, and the cost of treating viral infection-related morbidity and transfusion-related sepsis.

**Estimated benefits used in the economic analysis**
Not reported.

**Cost results**
Costs were not reported separately. See the synthesis of costs and benefits below.

**Synthesis of costs and benefits**
Among HPCT patients, the incremental cost of using SDPs as opposed to RDPs ranged from $168,700 per QALY in patients treated for NHL to $519,822 per QALY for AML. For patients undergoing CABG, the average incremental cost for both males and females was $204,348 per QALY, which is comparable to the cost for NHL patients. These results were sensitive to changes in the acquisition cost differential, the number of units in an RDP equivalent to an SDP, the septic transfusion reaction risk from RDPs, and the septic transfusion reaction-associated mortality rate.

**Authors' conclusions**
In comparison with other accepted medical interventions, the use of SDPs as opposed to RDPs may not be a cost-effective method of reducing donor exposures in the adult patient populations studied. SDPs were more cost-effective in patients undergoing primary CABG than in leukemia patients undergoing HPCT. Regardless of diagnosis, decreasing the acquisition cost differential would have the greatest impact on improving the cost-effectiveness of SDPs, as opposed to RDPs, to decrease donor exposures.
The rationale for the choice of the comparator was clear. You, as a user of this database, should verify whether these health technologies are relevant to your setting.

Validity of estimate of measure of benefit
A relevant measure of benefits was used. As the authors employed decision analytic methods, quality of life adjustments were based on published consensus estimates rather than actual patients’ experiences. In addition, the effectiveness data have been derived from, what may have been, a non-systematic review of the literature. The internal validity of effectiveness estimates cannot be fully assessed given the limited information provided about the literature review and the quality assessment of the primary studies. The authors acknowledged that the available data used to determine the risk of bacterial sepsis for RDPs versus SDPs was limited. Improved yield with random-donor platelet concentrates has resulted in smaller numbers of units in an RDP being equivalent to an SDP. Thus, the assumptions made by the authors (7-units in an RDP equivalent to an SDP) may underestimate the cost per QALY. The authors did not consider the perceived societal risks associated with blood transfusions, the emotional impact of the exposure to blood, and the theoretical risk of a new transfusion-transmitted infection.

Validity of estimate of costs
Only direct costs were considered. Indirect costs were not included. Some cost estimates were based on charges and, hence, do not represent true opportunity costs. Additionally, some cost estimates were derived from local sources and are unlikely to be generalisable to other settings.

Other issues
Adequate comparisons with other relevant studies were made. The generalisability of the results to other settings or countries was not discussed. The authors do not appear to have presented their results selectively. The study examined adult patients undergoing either HPCT or CABG and this was reflected in the authors’ conclusions.

Implications of the study
Efforts at reducing the transfusion-associated risk of bacterial contamination and the acquisition cost of SDPs versus RDPs may substantially impact on the cost-effectiveness of using SDPs.

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