The Cost Of A Unit Of Red Blood Cells In Canada: A Reanalysis Of Existing Estimates Incorporating The Absolute Risk Of Bacterial Infections Following Transfusions

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**Background:**
There have been several economic analyses, which have attempted to estimate the cost of a unit of allogeneic red blood cells (RBCs). These estimates included costs for collection, production, distribution, delivery and infectious complications such as hepatitis and HIV. To our knowledge, these studies did not incorporate the incremental cost of treating transfusion induced post-operative infections. There is a growing body of literature to support the hypothesis that RBC transfusions increase the risk of post-operative infections and that this response is dose-related. In this study, the economic impact of transfusion induced bacterial infections was incorporated into the cost of a unit of RBCs by application of the incidence method (Hamilton, 1994).

**Methods:**
The cost of a post-operative bacterial infection was estimated at $Can261 (Dranitsaris, 2000). From a randomized trial in patients undergoing cardiac surgery, the absolute increase in the risk of infections was approximately 4.6% after a median of 4 units of white cell reduced RBCs (Van de Watering, 1998). Hence, these estimates allowed the application of the incidence method to assess the cost impact of the additional infections in transfused patients undergoing cardiac surgery.

**Results:**
The incremental cost of bacterial infections with four units of allogeneic RBCs would be $Can1.031 ($Can261 x 4). For a single unit, the incremental cost of bacterial infections would be $Can25 (Can25.0/4). Adding this to the current estimate suggests that the true cost of a unit of RBCs is in Canada is approximately $536 in 1999 dollars ($Can1.031 x 4). Hence, these estimates allowed the application of the incidence method to assess the cost impact of the additional infections in transfused patients undergoing cardiac surgery.

**Conclusions:**
The cost of a unit of red blood cells in Canada is higher than previously thought. As result, the clinical and economic utility of new blood sparing technology such as hemoglobin (Hgb) based oxygen carriers, recombinant Hgb, and universal blood should be a welcome addition to transfusion medicine.

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**Current Estimates for the Cost of a Unit of Blood**

<table>
<thead>
<tr>
<th>Estimated Cost/Unit</th>
<th>Fiscal Year</th>
<th>Country</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Can1.031</td>
<td>1999</td>
<td>Ca</td>
<td>Tretak et al. (1996)</td>
</tr>
<tr>
<td>$Can25</td>
<td>1999</td>
<td>Ca</td>
<td>Dranitsaris (2000)</td>
</tr>
<tr>
<td>$Can156</td>
<td>1995</td>
<td>UK</td>
<td>Guest et al. (1998)</td>
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**Table 1.** Selected studies estimating the cost of an RBC transfusion.

**Methods:**
In this study, the economic impact of transfusion induced post-operative infections was incorporated into the cost of a unit of blood by application of the incidence method (Hamilton, 1994). This was illustrated in patients undergoing cardiac surgery.

**Primary Objective:**
The objective of this study is to accurately estimate the cost of a unit of allogeneic red blood cells (RBCs).

**Results:**
The incremental cost of bacterial infections with four units of allogeneic RBCs would be $Can1.031 ($Can261 x 4). For a single RBC unit, the incremental cost of bacterial infections would be $Can25 (Can25.0/4). Adding this to the current estimate suggests that the true cost of a unit of RBCs is substantially higher than previously estimated.

**Conclusions:**
1. The incidence method is a simple approach to incorporate the economic impact of side effects associated with a particular medical intervention (RBC transfusions).
2. It appears that the economic impact of post-operative infections on the cost of a unit of RBCs ($Can525) is substantially higher than that for HIV and hepatitis infection.
3. This example demonstrates that the cost of a unit of RBCs in Canada ($Can786) is considerably higher than previously estimated.
4. Economic studies evaluating the cost of blood-sparing technology such as epoetin alfa and hemoglobin based oxygen carriers will need to incorporate the economic impact of transfusion induced post-operative infections into the overall analysis.
5. At a minimum, it is recommended that such an economic impact should be evaluated via sensitivity analysis.
6. Failure to incorporate costs associated with postoperative infections in comparative analyses will underestimate the economic value of new blood sparing technology.

**Analysis Limitations:**
1. The cost of a unit of RBCs estimated using this method can only be generalized to patients undergoing cardiac surgery.
2. For different types of surgeries, the absolute increase in the risk of post-operative infections must be identified and incorporated into the direct cost of a unit of RBCs.
3. Data to support such calculations may not be available for certain surgical indications.

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**Introduction:**
1. One of the challenges faced by blood agencies and health economists is to accurately estimate the cost of a unit of allogeneic red blood cells (RBCs).
2. The primary components in estimating the cost of a unit of RBCs have consisted of:
   - Collection
   - Production
   - Distribution
   - Delivery
3. The cost of infectious disease transmission such as HIV and hepatitis has also been included in these estimates.

**Limitations of Current Estimates**
1. The low risk of disease (e.g. HIV, hepatitis) transmission (i.e. 1 in 100,000 to 300,000 units) has had a negligible impact on the overall cost of a unit of RBCs.
2. Previous studies did not incorporate the incremental cost of treating transfusion induced post-operative infections in surgical patients.
3. There is a growing body of literature to support the hypothesis that RBC transfusions increase the risk of post-operative infections and that this risk is dose-related.