

Costs of Outpatient Red Blood Cell Transfusions

With the goals of improving oxygen delivery,¹ reducing anemia, and enhancing quality of life, over 12 million red blood cell (RBC) units are transfused annually in the United States.² At a hospital acquisition cost per RBC unit of \$122 (1999 dollars),² US acquisition costs exceed \$1.5 billion annually. Adding testing and transfusion, the total health system cost for two units (based on prior studies³⁻⁸ and adjusted by the medical care consumer price index⁹) is \$2-\$8 billion annually.

Naturally, efforts have been applied to reduce transfusion costs.^{10,11} This study focused on hospitals and their costs, seeking description of the steps comprising RBC administration, administration duration, administration costs, and total costs.

METHODS

Study objectives were addressed through interviews, a record review to describe transfusion duration and reaction incidence, and a time-motion study for all administration-related objectives. The time-motion method overcomes

limitations of prior studies using interviews³⁻⁷ or hospital charges and cost-to-charge ratios.^{10,12}

We considered RBC acquisition/preparation, testing, and administration costs. Acquisition/preparation and testing estimates were based on nine interviews in three hospitals during late 2005. Four oncologists or hematologists/oncologists and five managers responsible for transfusion services provided cost estimates from financial records/reports and internal studies.

Records were reviewed in late 2005 at the 339-bed Inova Alexandria Hospital in Alexandria, Va. We sought a systematic sample of 100 outpatient RBC transfusion visits. Beginning with RBC transfusion visits on May 1, 2005, and continuing with those on consecutive prior dates, we identified outpatients who were ≥ 18 years old receiving RBCs. We excluded patients receiving other therapies during their RBC transfusion visit.

The time-motion study was conducted at the same hospital during summer 2005, to seek a systematic sample of 20 outpatient RBC transfusion visits. Begin-

ning July 27, 2005, we included each outpatient transfusion visit made by persons aged ≥ 18 years. A trained observer accompanied the nurse or others performing transfusion tasks from the time the patient first presented until the last medical record entry following transfusion. Because only one observer was used, we excluded visits that started while a prior visit was under observation.

Using a stopwatch, the observer measured tasks spent on patient registration, clinical assessment, medical record entry, supply management, verification of proper blood matching, collection of RBCs from the blood bank, and other activities. Each task was also described as occurring pre-transfusion, during transfusion, between transfusion units, or post-transfusion.

Based on median wage rates¹³⁻¹⁵ and including non-wage compensation of 29.6% of total compensation,¹⁶ we used hourly labor costs of \$37.70, \$18.42, and \$15.34 for registered nurses, medical secretaries, and medical technicians, respectively. Costs are reported in 2005 dollars.

RESULTS

In the record review, 100 transfusion visits by 36 subjects were assessed. All prior outpatient RBC transfusion visits were also assessed for subjects with visits that satisfied entry criteria. Patients had a mean (SD) age of 66.7 (15.7) years; 58% were male, 61% were insured through Medicare, and 58% had anemia caused primarily by chemotherapy. Two units were transfused at 81% of visits, and 1 unit was transfused at 19% of visits. Mean (SD) transfusion duration was 103 (18.6) and 102 (18.3) minutes for the first and second units, respectively, and for 2-unit visits, mean (SD) duration between units was 18 (10) minutes. Mean (SD) total time for a 2-unit transfusion was 223 (54) minutes, or 3.7 hours.

In the time-motion study, 20 transfusion visits by 16 subjects were observed. These patients had a mean (SD) age of 63.1 (16.8) years; 50% were male, 44% were insured through Medicare, and 81% had anemia caused primarily by

Table 1

Time-Motion Study (n = 20): Average Labor Times per Visit in Minutes (SD)

Activity	PRE-TRANSFUSION	DURING UNIT	BETWEEN UNITS	POST-TRANSFUSION	TOTAL
Registration	4.7 (7.1)	0.0 (0.0)	0.3 (1.2)	0.0 (0.0)	5.0 (4.1)
Clinical assessment	21.6 (8.8)	3.0 (1.1)	3.7 (4.5)	4.6 (2.9)	32.9 (9.0)
Medical record	0.1 (0.3)	0.0 (n/a)	0.0 (n/a)	7.4 (2.4)	7.5 (3.3)
Medication	0.0 (0.0)	0.0 (n/a)	0.0 (n/a)	0.1 (0.4)	0.1 (0.1)
Manage supplies	2.2 (1.9)	0.0 (n/a)	0.0 (n/a)	2.0 (1.1)	4.2 (2.8)
Check blood	2.2 (0.7)	0.0 (n/a)	2.0 (0.2)	0.0 (n/a)	4.2 (2.4)
Obtain blood	6.2 (2.2)	0.0 (n/a)	6.2 (2.7)	0.0 (n/a)	12.4 (3.7)
Other	0.0 (0.0)	0.4 (0.8)	0.4 (0.9)	0.3 (0.8)	1.1 (0.7)
Total	37.0 (13.6)	3.4 (1.8)	12.6 (4.1)	14.4 (3.2)	67.4 (18.9)
Occupation					
Registered nurse	36.2 (13.2)	3.4 (1.5)	11.8 (7.2)	14.4 (3.2)	65.8 (18.9)
Secretary	0.8 (2.2)	0.0 (n/a)	0.0 (0.0)	0.0 (n/a)	0.8 (2.2)
Medical technician	0.0 (n/a)	0.0 (n/a)	0.8 (2.0)	0.0 (n/a)	0.8 (1.8)
Total	37.0 (13.6)	3.4 (1.5)	12.6 (7.0)	14.4 (3.2)	67.4 (18.9)

chemotherapy. Two units were transfused at 80% of visits, and 1 unit was transferred at the remaining 20% of visits. Mean (SD) transfusion duration was 98.5 (12.7) and 92.5 (21.2) minutes for the first and second units, respectively.

Transfusion visits required a mean of 67 minutes of labor, 49% required for clinical assessment, and 55% during the pre-transfusion phase (Table 1). Only 3.4 minutes of labor occurred during transfusion, despite protocol-driven clinical assessments at each unit's transfusion initiation, completion, and every 15 minutes during transfusion. Registered nurses performed 98% of the labor, including obtaining RBCs from the blood bank. Total administration costs for one- and two-unit transfusions were \$166 and \$307, respectively. The total costs per transfusion are described in Table 2.

The incidence of reaction was 7.5%. Four record-review subjects had a documented reaction, records suggested reaction in five others, and no reactions were experienced by time-motion study subjects. All reactions were experienced during the first unit's transfusion or between units. One reaction was serious, with cyanosis and a drop in oxygen saturation to a level of 88%.

DISCUSSION

To our knowledge, this is the first study describing outpatient RBC transfusions and associated costs that empirically measured labor requirements. Our study has several limitations. First, other hospitals may experience different costs. For example, hospitals may have different protocols requiring more/less clinical assessments, may use non-nurse personnel to obtain RBCs from the blood bank, may not require two nurses to check blood type, etc. Second, our sample sizes were limited. However, despite these and other limitations, including the record-review selection method, we believe administration labor and labor costs were reasonably measured in this study. Moreover, further discussion of limitations would inappropriately focus results, since 80% of reported total costs were for acquisition/preparation and testing. External validity of these costs is limited to a basis of nine interviews

Table 2

Total Cost per Transfusion, in Dollars

	TESTING	RBCs AND PREPARATION	ADMINISTRATION	TOTAL
One unit				
Materials	5	97	28	130
Labor	61	81	35	177
Overhead	56	116	103	275
Total cost	122	294	166	582
Two units				
Materials	10	194	56	260
Labor	122	162	45	329
Overhead	112	232	206	550
Total cost	244	588	307	1,139

Abbreviation: RBC = red blood cell

among three hospitals, the hospital's RBC acquisition costs, the tests they perform, and overhead cost allocation formulas. Accordingly, further study of non-administration costs is suggested.

Comparisons with previous studies are difficult because of differences in patient populations, settings, cost category definitions, and overhead rates. Nevertheless, our data are comparable with another study of outpatient RBC transfusions among 517 cancer patients that estimated total costs for a 2-unit adult RBC transfusion at \$938, or \$1,251 in 2005 dollars.^{6,9} This cost was distributed comparably to our costs: 19% for materials, 35% for labor, and 46% for overhead. Finally, we note that our perspective was that of an institutional provider of RBC transfusions, and costs borne by other entities, such as the patient's lost productivity and transportation costs, were not considered.

These data highlight the high cost of RBC transfusion and may be useful in cost-effectiveness comparisons of allogeneic versus autologous transfusions, inpatient versus outpatient settings, and pharmacologic agents that reduce transfusion requirements.

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