The Annual Cost to Society of Blood Transfusions in the UK

Susan J Varney and Julian F Guest *Catalyst Health Economics Consultants, Northwood, Middlesex, UK.*

INTRODUCTION

- The UK's blood transfusion service is currently organised into four national services for the collection, testing, processing and issuing of blood products to hospitals.
- These blood transfusion services rely on the voluntary contribution of whole blood and apheresis donors. This involves costs in donor time, travel expenses and time away from work.
- Whole blood donors can donate up to three times a year, whereas apheresis donors can donate up to every two weeks. All four blood transfusion services have standard blood donor selection criteria [1], and providing those criteria are met, any healthy adult between the ages of 17 and 60 years can donate blood, and regular donors can donate until they reach 70 years of age.
- The aim of this study was to estimate the cost of blood donations and transfusions in the UK during 2000/01.

METHODOLOGY

Perspective

- The analysis considered the direct costs of blood transfusions incurred by:
  - The blood transfusion services.
  - Hospitals.
  - Blood donors.
- The analysis also considered the indirect costs incurred by society.

Blood Transfusion Services

- The costs incurred by the blood transfusion services in collecting, testing, processing and issuing of blood products were derived from published operating costs [2-8]. This was supplemented with information obtained from interviews with directors and finance managers of the four national blood transfusion services.

Hospital Resource Use

- Hospital resource use associated with blood transfusions was quantified using published information and interviews with NHS personnel (n=13). By applying unit costs to the resource utilisation estimates, the annual hospital cost associated with blood transfusions was estimated.
- Incidence and management of transfusion-related complications were obtained from interviews with haematologists and review of key publications [9,10].
- This analysis made a number of assumptions relating to the costs of hospital resource use. Therefore, sensitivity analyses were undertaken to determine the effect of changing these assumptions on the final results.

Blood Donors

- Advertisements were placed in selected national newspapers during July 2002 inviting blood donors to participate in a telephone survey.
- Results from the survey were used to estimate:
  - The annual direct costs of public and private transport and lost earnings incurred by all donors in the UK as a result of donating blood.
  - Lost productivity costs incurred by society arising from blood donors taking time off work in order to donate blood.
  - Blood donors' leisure time used to donate blood.

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RESULTS

The Blood Transfusion Services

Blood Donations

- During 2000/01, the four national blood transfusion services collected 2.8 million whole blood donations and 70,000 apheresis donations.
- These donations resulted in 2.71 million red blood cell units, 0.39 million fresh frozen plasma units, 0.25 million platelet doses, 0.09 million cryoprecipitate units and 0.08 million paediatric units being issued to hospitals.

Costs Incurred by the Blood Transfusion Services

- The annual cost incurred by the four blood transfusion services in collecting, testing, processing and issuing of red blood cells, fresh frozen plasma, platelets, cryoprecipitate and paediatric products was £284.1 million during 2000/01. (Figure 1).

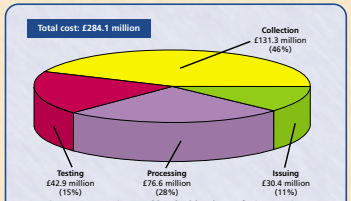

Figure 1: Costs incurred by the blood transfusion services in 2000/01, stratified by activity.

Direct Costs Of Blood Transfusions Incurred By Hospitals

- It was estimated that 1.7 million transfusions were performed during 2000/01, based on interviews with NHS personnel and the following assumptions:
  - On average, 2.7 units of red blood cells, 2.8 units of plasma and 1 therapeutic dose of platelets are used in an adult transfusion of the respective products.
  - 66% of fresh frozen plasma units are used in combination with red blood cell transfusions with the remainder (34%) being transfused in isolation.
  - 37% of platelet doses are used in combination with red blood cell transfusions with the remainder (63%) being transfused in isolation.
  - 91% of cryoprecipitate units are used in combination with red blood cell transfusions with the remainder (9%) being transfused in isolation.
  - 10% of paediatric platelets and 10% of paediatric fresh frozen plasma units are transfused in combination with red blood cells whilst 50% of each are transfused in combination with each other (the remaining 40% of each being transfused in isolation).
  - Less than 2% of each product is wasted.
- The annual direct hospital cost attributable to blood transfusions during 2000/01 was estimated to be £613.9 million (Figure 2) for 0.09 million day cases and 1.39 million bed days.

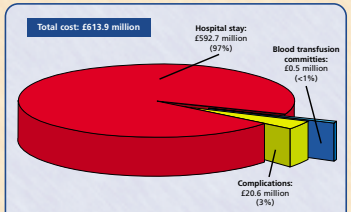

Figure 2: Distribution of the component costs attributable to blood transfusions in hospitals during 2000/01.

- Sensitivity analyses showed that increasing the number of units per transfusion by 25% increases the annual hospital cost of managing blood transfusions by 31%. Conversely, decreasing the number of units per transfusion by 25% decreases the annual hospital cost of managing transfusions by 19%.
- The annual hospital cost was not sensitive to changes in any of the other assumptions used to estimate the number of blood transfusions.
- Sensitivity analyses also demonstrated that the annual hospital cost of managing blood transfusions is very sensitive to the length of stay by patients who were in hospital for another reason and subsequently received a transfusion.

Total NHS Cost Associated With Blood Transfusions

- The total NHS cost (hospitals plus blood transfusion services) attributable to blood transfusions in 2000/01 was estimated to be £898.0 million (Figure 3).

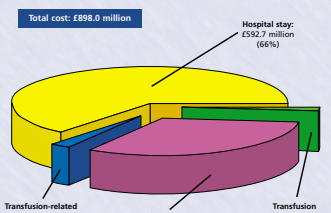

Figure 3: Total NHS cost of blood transfusions in 2000/01, stratified by transfusion services and hospitals.

- By accounting for the cost of NHS hospital resource use attributable to blood transfusions and those costs incurred by the blood transfusion services, the average NHS cost of transfusions was estimated (Figure 4).

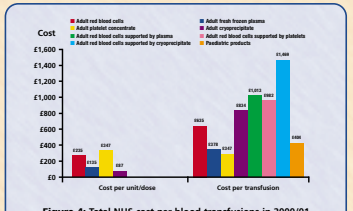

Figure 4: Total NHS cost per blood transfusions in 2000/01.

Direct Costs to Donors and Indirect Costs to Society

- 424 blood donors participated in the telephone survey. Of these, 98% (n=414) were whole blood donors and 2% (n=10) were apheresis donors, which is consistent with the proportions of whole blood donations and apheresis donations that took place in the UK in 2000/01. The sample was also geographically representative of the UK.
- 99% of whole blood donors were existing donors with a mean age of 49.5±11.0 years. 75% were employed and 64% of these employed respondents earned between £10,000 and £30,000. Similar findings were observed for the apheresis donors, although proportionally more earned a higher salary (60% earned between £20,000 and £40,000).
- The mean time spent at blood donor sessions was estimated to be 50.3 (48.0; 52.6) minutes for whole blood donors and 102.5 (78.8; 126.5) minutes for apheresis donors.
- Blood donors incurred an estimated £8.1 million in direct cost and used an estimated 3.1 million hours of leisure time in order to donate blood (Table 1). Additionally, the societal cost of lost productivity due to donors donating blood during work time amounted to £7.2 million.

	Total burden (95% Confidence intervals)
DIRECT COSTS	
Public transport	£301,945 (£158,629; £445,261)
Private transport	£4,602,891 (£3,782,865; £5,422,918)
Loss of earnings	£3,121,711 (£0; £6,893,001)
TOTAL	**£8,121,947 (£3,941,494; £12,761,180)**
INDIRECT COSTS	
Productivity losses	£7,196,597 (£5,481,613; £8,911,580)
Lost working time (hours)	424,407 (363,671; 485,144)
Used leisure time (hours)	3,109,135 (2,937,003; 3,281,268)

Table 1: Total annual direct and indirect costs incurred by blood donors and society in 2000/01.

DISCUSSION

Future Changes in Blood Transfusion

- The appropriate use of donor blood and effective alternatives has become a much-discussed public health issue in the UK due in part to the anticipated changes in the demand for blood, which is forecast to increase by 4.9% by 2008 [11].
- A number of measures may be introduced which could possibly reduce the donor pool. These include excluding blood donors who themselves have received transfusions [12] and introducing a screening test for Creutzfeldt-Jakob disease [13].
- Continual enhancement of safety criteria may lead to an insufficient supply of blood products to meet current levels of hospital demand [13]. Moreover, introducing further screening tests will increase the cost of blood transfusions yet further.

Reducing Blood Transfusions

- Autologous transfusion is one of several techniques used to reduce the need for allogeneic blood transfusions in elective surgery. It has been excluded from this analysis as the evidence suggests that it is not widely used in the UK.
- Erythropoietin can also reduce the need for transfusion in specific patient groups (cancer, renal and orthopaedic surgery). The incidence of using erythropoietin for the treatment of cancer patients with anaemia has been estimated to be only 5% in the UK compared to 42%, 33%, 66% and 41% in France, Germany, Italy and Spain, respectively [14].

Study Limitations

- This study excluded direct, indirect and intangible costs accruing to blood transfusion patients and their families. The costs of transporting blood between hospitals and any hospital legal costs are also excluded as there were little data available.
- It was assumed that the length of hospitalisation for those patients who had a blood transfusion after being admitted to hospital for another main procedure would be extended by one day. Whilst there is evidence to support this assumption this estimate is uncertain as many patients may be receiving other interventions that contribute to the length of hospitalisation, or the transfusion in some instances may allow patients to leave hospital earlier than without the transfusion. Hence, there is a need for a prospective study to assess the actual impact of blood transfusions on hospital stay for different patient groups.
- Those transfusion-related complications with an incidence of <1% were excluded from the analysis. However, it is recognised that many incidents may go unrecognised or unreported [10].
- The use of clinician interviews to estimate the number of units of product used per transfusion may be subject to recall bias and thus may vary from actual practice.
- The blood donors who participated in the survey were a self-selected group who responded to the advertisements and may not reflect all blood donors. Additionally, the respondents may reflect the readership of the target newspapers and not all blood donors (in terms of educational status and salary). 99% of the respondents were existing blood donors suggesting that they were committed. Thus, the survey may not be representative of less-committed blood donors.

CONCLUSION

In 2000/01, blood transfusions were estimated to cost the NHS £898 million. Blood donors incurred an annual direct cost of £8.1 million and 3.1 million hours of used leisure time. There was also an indirect societal cost of £7.2 million arising from lost productivity. More research is needed to assess how ongoing changes in safety criteria and population demographics will affect the future donor pool and thus the blood supply. Additionally, it is important to continue to evaluate the economic impact of changes to the blood transfusion system and the socioeconomic impact of alternatives to allogeneic blood transfusions.