

# THE INCREASING COST OF BLOOD TRANSFUSIONS IN THE UK

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

## INTRODUCTION

- The collection, testing, processing and issuing of blood products to hospitals in the UK is undertaken by four national blood transfusion services.
- The UK's blood transfusion services rely on the voluntary contribution of whole blood and apheresis donors who have to meet specific selection criteria.
- Blood is processed into red blood cells, platelets, plasma and cryoprecipitate. Since 1998, all of the components from each donation are leucodepleted as a precaution against the transmission of variant Creutzfeldt-Jakob disease (CJD).
- We previously estimated that in 1994/95 [1], the cost to the UK's blood transfusion services of providing blood products for transfusion that were collected from 2.75 million whole blood donations and 144,000 apheresis donations was £165.5 million. The cost of hospital resource use attributable to performing transfusions and the associated transfusion-related complications amounted to £52.6 million.
- To the best of our knowledge, there have been no further studies published on the annual health service cost of blood transfusions in the UK. Accordingly, we have re-performed this study to estimate the annual cost of blood transfusions five years on, for the financial year 2000/01.

## METHODOLOGY

### Perspective

- This study estimated the annual cost of blood transfusions incurred by the National Health Service (NHS) in the UK during 2000/01. The analysis considered the direct costs of blood transfusions incurred by the blood transfusion services and hospitals.

### The 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.

### Cost of 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 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.

## REFERENCES

- Guest, J.F., Munro, V. & Cookson, R.F. (1998) The annual cost of blood transfusions in the United Kingdom. *Clinical Laboratory Haematology*, 20, 111-118.
- Northern Ireland Blood Transfusion Service, Belfast. Annual Report 2000-2001.
- National Blood Service, Watford. Annual Report 2000-2001.
- Welsh Blood Service, Cardiff. Annual Report 2000-2001.
- Scottish National Blood Transfusion Service, Edinburgh. Annual Report 1999-2000.
- National Blood Authority, Watford. Annual Accounts of the National Blood Authority 2000-2001.
- Northern Ireland Blood Transfusion Service (Special Agency), Belfast. Statement of Accounts Year Ended 31st March 2001.
- Velindre NHS Trust, Cardiff. Annual Accounts 2000-01.
- Handbook of Transfusion Medicine. Editor: McVilland D.B.L., Third Edition 2001. The Stationery Office, London.
- Serious Hazards of Transfusion Committee. SHOT Annual Report 2000-2001. Manchester: SHOT, 2002.
- National Audit Office (2000) *The National Blood Service*. Report by the Comptroller and Auditor General HC 6 Session 2000-2001. National Audit Office, London.
- NHS Executive (2003) Hospital Episode Statistics. London: Department of Health. <http://www.doh.gov.uk/hes>.
- Information and Statistics Division (2001). Scottish Morbidity Register (SMR01) Scottish Executive, Edinburgh.
- Health Solutions Wales (2002) Patient Episode Database for Wales (PEDW) Cardiff: Velindre NHS.
- Health and Personal Social Services (2002). Hospital Statistics, Regional Information Branch, Belfast.
- NHS Executive. *Better Blood Transfusion*. London: Department of Health, 1998 (Health Service Circular (HSC) 1998/224).
- Department of Health (2001) NHS Reference Costs. Department of Health, London.
- Wells, A.V., Moutter, P.L., Chapman, C.E., Stansby, D. & Wallis, J.P. (2002) Where does blood go? Prospective observational study of red cell transfusion in north England. *British Medical Journal*, 325, 803.
- Regan, F. & Taylor C. (2002) Recent developments: Blood Transfusion Medicine. *British Medical Journal* 325: 143-147.
- Regan, F., Widdowson, C. & Oliver, A. (2001) The impact of improved safety on maintaining a sufficient blood supply. *Transfusion Clinique et Biologique*, 8(3), 235-9.
- Cavill, I. (2002) Reducing blood transfusion. Focus should be on improving patients' ability to make own blood. *British Medical Journal*, 325 (7265), 655.

## ACKNOWLEDGEMENTS

The authors thank the following personnel from the blood transfusion services for their help in providing the relevant data to enable us to perform the analysis. Mr B Savery, Director of Finance, NBS, Mr S Morgan, Finance Department, NBS, Mr M Bowden, NBS Finance Information Manager, Mr D Evans, Acting Director, WBS, Ms S Chrimas, Departmental Administrator, National Finance and Procurement Directorate, SNBTS, Mr G Bell, Finance Manager, NBS. The authors also thank the following for their help in providing information about hospital resource use associated with blood transfusions. Dr D Bareford, Birmingham City Hospital, Dr M Chapple, Dewsbury Hospital, Dr G Jackson, Royal Victoria Infirmary, Newcastle, Dr S Kaczmarek, Hillingdon Hospital, Middlesex, Dr M Martlew, Royal Liverpool University Hospital, Dr T Morris, Belfast City Hospital, Dr A Paggiola, Kings College Hospital, London, Dr S Rule, Derriford Hospital, Plymouth, Dr A Smith, Southampton General Hospital, Dr R Souter, Western Infirmary (Garnavel Hospital), Glasgow, Dr C Taylor, Royal Free Hospital, London, Dr K Wilson, Welsh Blood Service & University of Wales Hospital, Cardiff, Mr J Wiley, Blood Bank Manager, Belfast City Hospital.

The authors also thank Johnson & Johnson for their financial support of this study.

## RESULTS

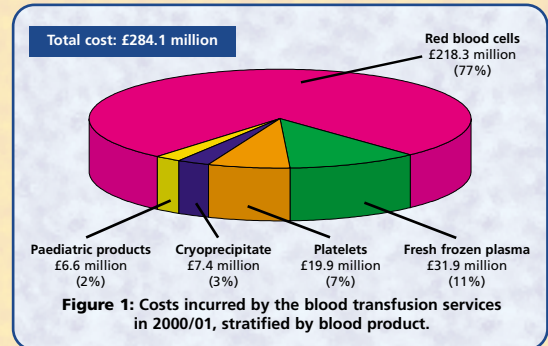
### The Blood Transfusion Services

#### Blood Donations

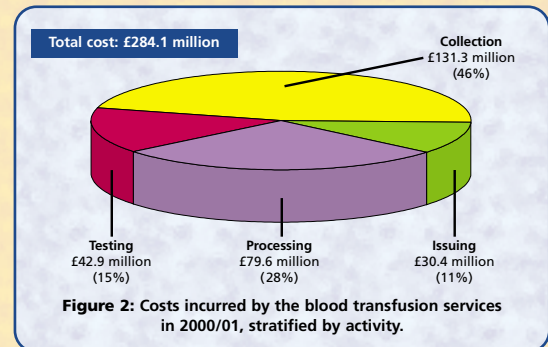
- During 2000/01, the four national blood transfusion services collected 2.8 million whole blood donations and 70,000 apheresis donations.
- Ninety three per cent of collected red blood cell units were issued to hospitals [11], with the remainder being lost either during the blood donating session due to processing and/or quality control checks or because of expiration of the blood's shelf life while the products were in stock.

#### Costs Incurred by the Blood Transfusion Services

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



- Figure 2 illustrates the annual cost incurred by the four blood transfusion services stratified by activity.

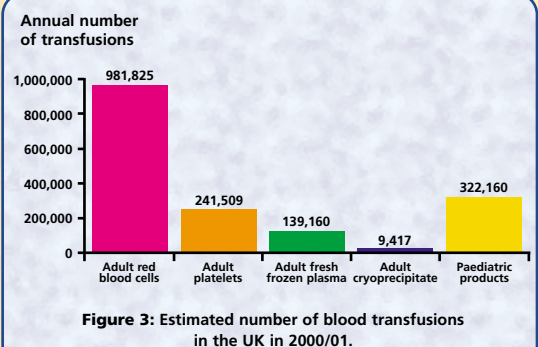


### Direct Costs Of Blood Transfusions Incurred By Hospitals

#### Transfusion of Blood Products

- The number of units of blood products issued to hospitals for transfusion in 2000/01 was obtained from the four blood transfusion services.
- Based on interviews with NHS personnel, the following assumptions were made to estimate the annual number of transfusions performed during 2000/01 (Figure 3):
  - 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 product.
  - 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.



- Using Hospital Episode Statistics [12-15], it was estimated that the cost of hospital stay attributable to blood transfusions was £592.7 million in 2000/01.

#### Hospital Transfusion Committees

- There were 413 hospitals transfusing blood products in the UK during 2000/01 [16], and each had a blood transfusion committee to oversee all aspects of blood transfusion [15].
- The blood transfusion committees at the 413 blood transfusing hospitals were estimated to cost £0.5 million in staff time.

#### Blood Transfusion-Related Complications

- Blood transfusion-related complications were estimated to cost £20.6 million in 2000/01.
- Hospital ward stay accounted for 93% of the cost (£19.1 million), drugs for 7% (£1.4 million) and ICU stay and diagnostic and laboratory tests for <1% each.

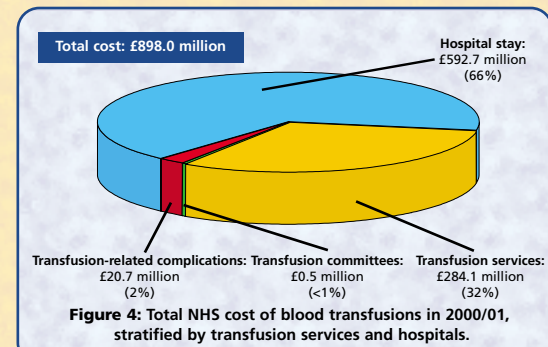
- Additionally, 98% of the cost was due to fluid overload due to its high incidence of 6%.

#### Sensitivity Analyses

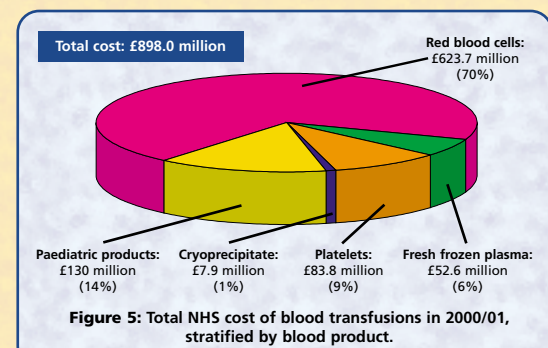
- The total direct hospital cost attributable to 1.5 million transfusion episodes during 2000/01 was estimated to be £613.9 million.
- Sensitivity analysis showed that increasing the number of units per transfusion by 25% increases the annual hospital cost of managing blood transfusions by 31%. Conversely, 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 the use of any other healthcare resource when these were decreased or increased by 25% (since the total cost decreases/increases were only 5% or less).

### Total NHS Cost Associated With Blood Transfusions

- The total NHS cost attributable to blood transfusions in 2000/01 was estimated to be £898.0 million (Figure 4).



- The distribution of the total NHS cost according to transfusion type is shown in Figure 5.



- 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 6).

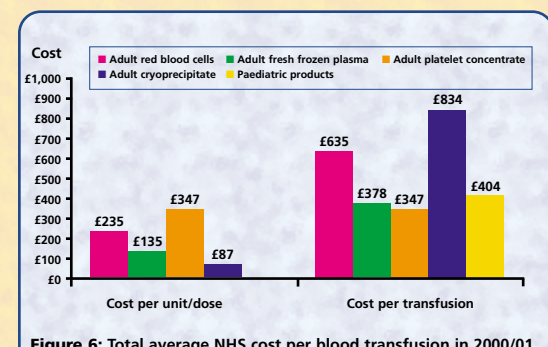


Figure 6: Total average NHS cost per blood transfusion in 2000/01.

- The average cost of adult red blood cell transfusions supported by a plasma transfusion was estimated to be £1,013 and £982 for transfusions supported by a platelet transfusion.

## DISCUSSION

### Comparison with 1994/95

- Comparisons with the 1994/95 estimates from our previous study. Comparisons revealed that at 2000/01 prices:
  - Expenditure by the blood transfusion services increased by 49% due in part to the introduction of leucodepletion.
  - Hospital costs increased by 905% from £61.1 million to £613.9 million, which may be due to:
    - NHS information systems being considerably improved in the last five years.
    - More complete data are now available on NHS hospital episodes [12-15], transfusion-related complications [10] and NHS reference costs [17].
    - There have probably also been some real cost increases as more blood products are now issued to hospitals and blood transfusion committees are a recently introduced hospital cost.
  - In 2000/01 there was a 2% increase in whole blood donations and a 52% decrease in apheresis donations compared to 1994/95. The reason for the reduction in apheresis donations over the last five years is not known.

### Study Limitations

- The study excluded direct, indirect and intangible costs accruing to blood transfusion patients and their families. Also excluded are the costs of autologous transfusions. The costs of transporting blood between hospitals and any hospital legal costs are also excluded as there were little data available.

- In the absence of any published evidence, it was conservatively assumed that the length of hospitalisation would be extended by one day for those patients who had a blood transfusion after being admitted for another main procedure.

- Those transfusion-related complications with an incidence of <1% were excluded from the analysis. However, it is a recognised limitation that many incidents may go unrecognised or unreported [10].

### 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 age profile of the UK population and the demand for blood, which is forecast to increase by 4.9% by 2008 [18].
- A number of measures may be introduced which could possibly reduce the donor pool. These include excluding blood donors who themselves received transfusions [19], and introducing a screening test for CJD, once available, which may lead to as much as a 50% reduction in the number of donors [19].
- Continual enhancement of safety criteria may lead to an insufficient supply of blood products to meet current levels of hospital demand [20]. Notably, the blood transfusion services are currently working towards the introduction of a screening test for human T cell leukaemia. 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. 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. 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 [21].

## CONCLUSIONS

In 2000/01, blood transfusions were estimated to cost the NHS £898 million, representing a 256% increase since 1994/95. Hospital stay accounts for 66% of this cost. With a potential fall in the donor pool, an aging population and the introduction of further screening tests, it will be 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.