ADVISORY COMMITTEE ON THE NATIONAL BLOOD TRANSFUSION SERVICE

WORKING PARTY ON PLASMA SUPPLIES

SUMMARY

1. Following discussions with Directors of Haemophilia Centres, it has been determined that 100 million international units (iu) of Factor VIII concentrates is a reasonable estimate for clinical requirements in England and Wales by the mid-1980s. By obtaining enough plasma to satisfy FVIII needs there should be adequate source material to provide sufficient quantities of albumin products.

2. Consideration of the various types of FVIII concentrates has led to the conclusion that intermediate FVIII concentrate is the product of choice for the treatment of the majority of patients suffering from haemophilia A together with a requirement for a small proportion of high purity concentrates and frozen/freeze-dried cryoprecipitates.

3. Consideration of the yield of FVIII per kg. source plasma has led the Working Party to estimate that 435,000 kg. plasma are required to meet the future requirements for FVIII. At current yields this would produce 95m iu of intermediate purity FVIII concentrate and 5m iu of cryoprecipitate. Within this quantity of plasma there should be sufficient flexibility to produce the small quantity of high purity material required and also to produce 200g of albumin (as PPF) per 1,000 population.

4. It will be possible to obtain 200,000 kg. plasma from whole blood donations at a rate of blood collection which is required to provide adequate numbers of units of red cells for clinical use. Alternatives for obtaining the remaining plasma are:

(a) Increase the collection of whole blood.

(b) Introduce plasmapheresis.

For ethical and economic reasons, increasing the rate of collection of whole blood donations holds disadvantages, whilst the introduction of plasmapheresis appears feasible providing that finance is available to provide the necessary facilities.

5. The Working Party considers that it will be possible to provide sufficient plasma for self-sufficiency for FVIII and albumin for England and Wales.

1. Raw material for the preparation of plasma products can be considered under two headings:

(a) Normal human plasma for coagulation factor concentrates, normal immunoglobulins and albumin products.

(b) Antibody-containing human plasma for specific immunoglobulins.

Since the supply of normal human plasma has the greatest impact upon the Regional Transfusion Centres (RTCs) and the Blood Products Laboratory (BPL) this aspect has been considered first. The supply of plasma for specific immunoglobulin production is not dealt with in this report.

2. Before the volume of plasma required for self-sufficiency in the various products can be defined it is necessary to determine the quantity of each product required for clinical use.

In essence, this is reduced to the need for two groups of products, viz., factor VIII concentrates (FVIII) and albumin preparations, since self-sufficiency has been achieved already for other coagulation factor preparations and normal immunoglobulin.

2.1 Requirement for FVIII

Current annual usage of FVIII is about 60m iu. At present the combined capacities of BPL and the Plasma Fractionation Laboratory, Oxford (PFL) is 15m iu FVIII per year. Following the interim expansion at BPL, to be completed during 1982, production of FVIII will be increased to a maximum of 30m iu per year. Also, approximately 10m iu FVIII per year is prepared at RTCs, in the form of frozen cryoprecipitates; it is likely that this will continue at this rate for the present, although there is the possibility that it will be reduced following the expansion at BPL. Thus by the end of 1982 a maximum of 40m iu FVIII per year will be available.

Representatives of the Haemophilia Directors estimate that by the mid-1980s the annual requirement for FVIII will reach 100m iu for the United Kingdom. Forecasting beyond that time could not be accurate but it was considered that by the 1990s the need for FVIII could reach 150m iu per year.

2.2 Requirement for albumin products

The present production of Plasma Protein Fraction (PPF), the principal albumin preparation in use, is in the order of 55 kg. per 1m of the population per year. Following the interim expansion at BPL, this will be increased to 80-90 kg. per m per year. There is incomplete information available with respect to the purchase of imported albumin products but what evidence there is indicates that significant purchases of PPF are made in all Regions; nor is there an accurate estimate of the clinical requirements. In certain European countries its usage reached 350-375 kg. per m per year, but it is considered unlikely that this quantity would be required in England and Wales.

If sufficient plasma is collected to provide 100m iu FVIII per year there will be sufficient raw material to provide 200 kg. PPF per m per year. This is consistent with the recommendations of the Council of Europe's Public Health Committee's Sub-Committee of Specialists in Blood Problems (Report, CESP/TS(77)).

2.3 Other products

At present England and Wales are virtually self-sufficient with regard to Factor IX complex, normal and specific immunoglobulins. It is not expected that demand for these products will show a dramatic increase, although the Working Party has yet to consider these aspects in detail.

3. Basis for estimating plasma supply

The Working Party agreed that estimates for plasma supply should be based upon that required to produce 100m iu FVIII per year. Whilst it was noted that this estimate was made for the UK it was considered that the difficulties in providing completely accurate estimates for requirements of the product were such that it was a realistic level of usage to be aimed for in England and Wales.

4. Type of FVIII preparation required

Since the yield of FVIII achieved in the preparation of the various types of concentrates has a significant bearing on the volume of starting plasma required, the Working Party has examined the various products available and has considered the advantages and disadvantages of each.

Frozen or freeze-dried cryoprecipitate derived from small pools of plasma has advantages for patients requiring infrequent treatment since exposure to a large number of donations of plasma is avoided thus lessening the risk of the transmission of hepatitis. In certain countries where this is the primary FVIII preparation there is no obligation to attain standards required by an independent agency. In the UK the same methods could not be used to manufacture a similar product.

Freeze-dried cryoprecipitates prepared from large pools of plasma increase the exposure of the patient but result in greater homogeneity of the product. However, intermediate FVIII concentrate, also prepared from large pools, has advantages over freeze-dried cryoprecipitate with respect to stability, the risk of adverse reactions and potency (which results in a lower volume per dose given to the patient).

After careful consideration of the facts, the Working Party concluded that the intermediate purity concentrate was the product of choice for the treatment of the majority of patients with haemophilia A and this was also the view given by the representatives of the Haemophilia Directors.

Thus, in the total of 100m iu FVIII

Intermediate purity concentrate	=	95m iu per year
Frozen/Freeze-dried cryoprecipitate	=	5m iu per year

5. Yields of FVIII

From a consideration of the available data the Working Party has concluded that the yields given below form a realistic basis for the calculation of the volume of plasma required to obtain the 100m iu FVIII

Intermediate purity concentrate	= 225 iu per kg.*
Frozen/Freeze-dried cryoprecipitate	= 350 iu per kg.

(*1kg. plasma is approximately equal to 1 litre)

6. Quantity of plasma required

From the yields given above the quantity of fresh frozen plasma required was calculated as 435,000 kg. The plasma must be separated from the red cells and frozen within 18 hours after collection.

OPTIONS FOR OBTAINING 435,000 KG. PLASMA ANNUALLY

7. Plasma separated from donations of whole blood

During 1980, 2.032m donations of whole blood were collected by RTCs. Enquiry of the Regional Transfusion Directors has established that an additional 125,000 donations are required to satisfy clinical needs. It is difficult to forecast the demand for red cells in the mid-1980s, but the Working Party considered that a total of 2.2m donations per year was a reasonable estimate.

It has also been ascertained that an average of 51% of the whole blood donations could have the plasma separated within 18 hours provided that adequate staff and facilities were available. This would result in approximately 200,000 kg. plasma being available for the preparation of FVIII (and for other products after the FVIII has been removed from the plasma).

It is possible to obtain the remaining 235,000 kg. plasma by increasing the blood collection and separating the plasma from the additional whole blood donations. In the majority of RTCs 180 g. of plasma are removed from the donation so that the red cells are still suspended in a certain volume of plasma, making them more acceptable for transfusion compared with highly concentrated red cell preparations which may cause problems with regard to flow rate. However, once the requirement for red cells was met, it would be possible to remove more of the plasma from the whole blood donation. It is possible to separate 250 g. plasma from some donations, but if one is to avoid red cell contamination of the plasma destined for fractionation an average yield of 230 g. per donation is more realistic.

Therefore, to obtain 235,000 kg. plasma by separating 230 g. per donation it would be necessary to collect 1.0m donations.

When considering this option the following must be borne in mind:

- Blood collection in England and Wales would have to increase substantially.

- If plasma is separated from whole blood donations and the red cells are discarded, the total cost of collection and processing has to be applied to the plasma harvested. At an average of 230 g. plasma per donation there are 4.35 donations per kg. The cost of obtaining 1 kg. plasma in this way is £87.70 (see below).

- In order to increase blood collection to this rate a large capital investment would be required. Many RTCs would require additional space and some would require new premises. All RTCs would require additional mobile teams.

- Obtaining plasma by this means would, inevitably, lead to a major and unethical waste of red cells.

8. The introduction of plasmapheresis

Several countries use plasmapheresis, ie the separation of plasma from red cells of the donor with return of the red cells to the donor, as a source of plasma for the fractionation of plasma for coagulation factors.

Plasmapheresis can be conducted in two ways:

(a) Manual procedures. These have been well-tried for the collection of antibody-specific plasma. However, in order to collect 500 g. plasma the time required is 1-1½ hours. This has been put forward as a disadvantage in the recruitment of panels of such donors, although it is employed successfully in Belgium.

(b) Machine procedures. Several machines have been devised which are efficient in separating plasma from red cells. Some employ a continuous procedure and require two needles to be inserted into the veins of the donor. Other machines are discontinuous and can be used with a single venepuncture. Such machines would be those of choice for the purpose of obtaining plasma for fractionation and 500 g. plasma can be obtained in 35-45 minutes. A code of practice for the use of the latter machines has recently been compiled.

Using plasmapheresis to obtain plasma for fractionation would require the establishment of Plasmapheresis Centres in the regions and the recruitment of plasmapheresis donor panels.

8.1 Establishment of Plasmapheresis Centres

The Working Party found it difficult to predict whether Centres should be based upon machine or manual procedures or whether they should be established in conurbations or in smaller towns. A machine plasmapheresis centre has been established in a city in the Yorkshire region and experience gained in operating this Centre will be valuable. However, it was considered that Centres in smaller towns, using manual plasmapheresis should be retained as an option since they function successfully in Belgium. It was agreed that there was urgent need for a pilot study to evaluate this method of obtaining plasma.

From the experience gained in the Yorkshire region it seems that one could expect to obtain slightly over 1,000 kg. plasma per couch per year in a machine plasmapheresis centre. If one assumes 8 couches in a centre then at 8,500 kg. plasma per year approximately 28 centres would be required in England and Wales. A similar size centre conducting the slower manual plasmapheresis could expect to collect 4,500 kg. plasma per year (see Appendix 3), so that approximately 45 centres would be required.

Combination of donor plasmapheresis centres and units carrying out therapeutic plasmapheresis was considered to be undesirable.

8.2 Donor Panels for Plasmapheresis

WHO recommendations limit the volume of plasma collected annually from a donor to 15 kg. It is considered that this volume should not be exceeded.

From the pilot study in the Yorkshire region, the initial conclusions suggest that a maximum of 5 donations per year (2.5 kg. plasma) may be preferable from the viewpoint of retaining donors on the panel. It was concluded that the

maximum of 30 donations per year (15 kg. plasma) would be unlikely to be achieved and the realistic maximum would be 20 donations (10 kg. plasma). The estimated number of donors required on the panels to obtain between 2.5 kg. and 10 kg. plasma is shown in Appendix 1.

9. Cost of plasma collection

The cost of plasma collection has been explored in detail.

9.1 Obtaining plasma from whole blood donations

A protocol for detailing the cost of blood collection and processing is given in Appendix 2 (proposals for extending the costing to laboratory tests and distribution are also given). To determine the various costs, those which apply to the RTC Manchester have been calculated by the Chairman of the Working Party. These costs may or may not be typical for England and Wales overall. However, the method of costing could be applied to other RTCs to give equivalent values.

From the calculations in Appendix 2 it can be seen that:

(i) the cost of collection of one unit of blood is £13.58
(ii) the cost of processing one unit of plasma is £ 6.58

Assuming 180 g. plasma from one donation, plasma from 5.7 donations will be required to produce 1 kg. plasma. The cost of producing plasma for fractionation from whole blood is, therefore, £37.51 per kg, PROVIDING THE RED CELLS ARE USED FOR TRANSFUSION.

It has been calculated that 200,000 kg. plasma could be obtained from whole blood donations (para 7 above); the processing cost will be, therefore, £7.5m.

If the whole of the plasma necessary for self-sufficiency were to be obtained from whole blood donations an additional 235,000 kg. would be required. Since the red cells would not be needed for clinical use, it has been calculated that 230 g. plasma could be obtained from each donation (para 7 above); thus 1 kg. plasma would be obtained from 4.35 donations. Since the red cells would be discarded, the cost of collection (£13.58) must be added to the processing cost (£6.58); thus the cost of preparing one unit of plasma would be £20.16 ie £87.70 per kg. The cost of preparing 235,000 kg. plasma in this way would be £20.6m.

9.2 Cost of obtaining plasma by plasmapheresis

Plasmapheresis can be conducted by machine or manual methods. Detailed examination of the costs of the two types of plasmapheresis centres is given in Appendix 3. The costs assume that the centre has to be built which may or may not be the case. For instance, some centres may be incorporated in existing RTC buildings, others may be situated in vacant space owned by the RHA or AHA and also, in some instances, it may be possible to rent accommodation.

However, from Appendix 3 it can be seen that:

(i) In machine operated centres, 1 kg. plasma would cost an average of £49.25. If such centres were used to collect 235,000 kg. of plasma the cost would be £11.6m.

(ii) Using manual plasmapheresis, the average cost of 1 kg. plasma is £41.60. The cost of obtaining 235,000 kg. would be £9.8m.

Since the cost of providing the accommodation for both types of centres is the same (Appendix 3), the cost of equipping the centres becomes an important factor.

To equip 28 machine centres would cost £5.55m. To equip 45 manual centres would cost £1.25m.

It should be noted that the cost of setting up the centres has been included in the calculation of the cost per litre of the plasma.

9.3 Summary of costs

(a) Processing cost of 200,000 kg. plasma from whole blood donations		£ 7.5m
Collection and processing costs of additional 235,000 kg. plasma from whole blood donations (discarding red cells)		£20.6m
	Total:	£28.1m
(b) Cost of producing 235,000 kg. plasma by machine-pheresis		£11.6m
plus cost of 200,000 kg. plasma from whole blood donations		£ 7.5m
	Total:	£19.1m
(c) Cost of producing 235,000 kg. plasma by manual pheresis		£ 9.8m
plus cost of 200,000 kg. plasma from whole blood donations		£ 7.5m
	Total:	£17.3m

Apart from the ethical considerations of discarding red cells from whole donations and the difficulties which would be encountered in recruiting sufficient donors, this option would be prohibitively expensive. From the data analysed, manual pheresis seems to be the most economical way to achieve the required plasma volume.

10. Progress towards self-sufficiency

It must be remembered that of the 150,000 kg. plasma at present supplied to BPL only some 70,000 kg. are in the form of fresh plasma from which Factor VIII can be manufactured. Thus the cost of processing 150,000 kg. plasma ie £5.6m is not realizing its full potential. It is hoped that by 1982 RHAs will have agreed to provide facilities in RTCs for the separation of 150,000 kg. fresh plasma.

In Appendix 4 three levels of annual plasma collection are shown, viz

(i) 200,000 kg. - obtainable from whole blood after a modest increase in blood collection.

(ii) 325,000 kg. - an estimate of the quantity of plasma required to produce Factor VIII and albumin in quantities which could be the anticipated usage within the next two or three years.

(iii) 435,000 kg. - the quantity of plasma estimated to achieve self-sufficiency in Factor VIII and albumin by the mid 1980s.

The quantities of Factor VIII and albumin which could be obtained from each level of plasma supply are shown together with the cost of obtaining this plasma and the estimated commercial value of the products to be derived from it.

It is clear that there is considerable financial benefit at all levels of plasma production with respect to the two products, Factor VIII and albumin. It becomes of greater significance if one adds to the total value of these products the value of the many other products produced at BPL for use in the NHS.

Plasma required per year Kg.	Plasma per donation Kg.	No. donations at 10 kg. per year	Est. No. donors on panel*	No. donations at 5 kg. per year	Est. No. donors on panel	No. donations at 2.5 kg. per year	Est. No. donors on panel*
300,000	0.5	30,000	40,000	60,000	80,000	120,000	160,000
		i.e. 0.8 per 1000		i.e. 1.6 per 1000		i.e. 3.2 per 1000	

* Estimate based on recruitment of 30% more donors than actually donate per year to compensate for non-attendances.

Appendix 1

National Blood Transfusion Service

PROPOSALS FOR COSTING OF PRODUCTS

(1) The routine activities of an R.T.C. can be divided into:

1.1 Blood collection.

1.2 Processing:

1.2.1 Laboratory tests required on each unit of blood collected.

1.2.2 Preparation of blood products.

1.3 Distribution of blood and blood products to regional hospitals.

(2) For each activity there will be cost factors, thus:

2.1 Direct costs:

2.1.1 Staff salaries and wages.

2.1.2 Materials, equipment and accommodation outside R.T.C.

2.2 Indirect costs:

2.2.1 Salaries of senior supervisory staff not specifically performing duties in a particular activity.

2.2.2 Salaries of administrative and clerical staff not specifically designated to a particular activity.

2.2.3 Salaries of ancillary staff, e.g. maintenance, porters, cleaners, etc.

2.2.4 Maintenance of R.T.C. buildings, rates and rents.

2.2.5 Maintenance and replacement of equipment (revenue).

2.2.6 Capital depreciation and maintenance of buildings and equipment (calculated by D.H.S.S. formula as 8.3% of total revenue).

2.2.7 Energy costs.

2.2.8 Postage (except that clearly identified with donor call-up), printing, stationery and telephones.

2.2.9 Research and development.

2.2.10 Training.

All salary costs must include employers on-costs.

In the past, attempts have been made to determine indirect costs as a proportion of a cost factor between the various functions, e.g. the proportion of a consultant's time involved with blood collection, distribution or laboratory services. Other costs have been ignored, e.g. capital depreciation. This has led to different interpretations in the regions so that comparative costs have been inaccurate.

Direct and indirect costs calculated as suggested above will only have relevance if they are related to units of activity.

(3) UNITS OF ACTIVITY

3.1 DIRECT COSTS

3.1.1 Blood collection

The unit of activity is the number of usable units collected in a financial year (April 1 - March 31). This can be calculated as the number of donors bled minus the number of inadequately filled containers, full containers found to be unsuitable for transfusion, and donors issued with unit numbers but not bled. It is important that this number is used so that the cost of the unusable donations is spread over the remainder and does not appear as a cost factor which is lost.

3.1.2 Laboratory tests

Since, in general, most donations collected are grouped and tested for HBsAg, etc., the unit of activity should be the number of usable donations to spread the cost of wasted tests.

3.1.3 Blood products

It is not practical to separate most of the products with respect to cost since one cannot accurately define the time spent on preparation and some products, e.g. platelets, which may take more time to prepare than fresh plasma for fractionation, do not involve the documentation, storage arrangements, which will probably balance the time taken overall. Two products, viz. washed red cells and frozen red cells, could be separately costed.

3.1.4 Issues

The unit of activity is the number of units issued, including all products. It is not practical to include delivery of grouping reagents, bottles or other documents sent with the transport. It is also difficult to isolate the costs of transport of plasma to B.P.L. and B.G.R.L.

3.2 INDIRECT COSTS

3.2.1 Blood collection

Since the indirect costs are spread over the whole activity of the R.T.C., they should be related to the unit of overall activity. This will comprise the number of all blood products prepared at the R.T.C., each of which is regarded as being of equal weight and is given a single unit value.

Thus, number of units of:

Unusable units
Whole blood
Plasma reduced blood
Leucocyte-poor blood
Platelet-rich plasma
Platelet concentrates
Snap-frozen plasma for clinical use
Fresh-frozen plasma for fractionation
Time-expired and cryo-supernatant plasma
Specific antibody plasma
Cryoprecipitate
Buffy coats
Donations for specific immunoglobulins
Donations for typing reagents.

When the total indirect cost has been established it should be divided by the number of units of overall activity, and this cost will be apportioned to the cost of red cells collected or the other products produced by the R.T.C.

It will be noted that indirect costs are not apportioned to laboratory or distribution costs. For the laboratory, there are specific indirect costs (see below), and for distribution the indirect costs are probably low.

3.2.2. Laboratory tests

The laboratory tests will have to bear indirect costs of running the laboratory, e.g. certain staff costs and the cost of materials. It is impossible to separate the purchase of laboratory equipment for each function and therefore it is reasonable to spread this throughout the entire laboratory functions. Thus the unit of activity will comprise the sum of the following:

No. of donations collected
No. of antenatal specimens received.
No. of specimens for special investigations,
e.g. transfusion reactions, incompatible crossmatches.
No. of specimens for HLA tests.
Etc., etc.

The proposals given above, it is hoped, will provide a more rational approach to costing in the N.B.T.S. It still represents a compromise and several aspects where costs will not exactly represent the true cost can be identified. Some have been pointed out above, others are: the cost of blood grouping does not include the costs of the blood grouping reagents, the general indirect costs have been applied only to blood collection and not to the laboratory tests. However, if one adds together the costs for blood collection, testing and distribution, the total cost of a unit of blood from donor to hospital laboratory will be a fairly accurate one.

In order to test the proposals, they have been applied to the Manchester Regional Centre of the North Western Blood Transfusion Service.

H. H. GUNSON.

SUMMARY OF COSTS OF BLOOD COLLECTION, PROCESSING, TESTING AND ISSUING AT R.T.C. MANCHESTER 1980/81 *

1. BLOOD COLLECTION

No. of donors bled 124,153

No. of usable units 113,637

Units of overall activity:			%
	unusable units	10,516	
	units whole blood	66,022	58.2
	plasma reduced blood	47,615	
	platelet concentrates	10,529	
	cryoprecipitate	16,940	
	S.F.P. (clinical use)	2,786	
	Plasma for fractionation:		40.9
	F.F.P.	18,950	
	T.E./C.S.	37,850	
	Specific antibodies	260	
	units for typing reagents	1,856	0.9
		213,324	

(TABLE I) DIRECT COSTS OF BLOOD COLLECTION £985,571

Cost per unit: £8.67

(TABLE II) INDIRECT COSTS £961,115

Apportioned to blood collection 58.2% £557,447

Cost per unit: £4.91

£13.58

2. PROCESSING OF BLOOD AND PLASMA COMPONENTS

(TABLE III) DIRECT COSTS OF PROCESSING £181,242
No. units processed: 87,315 Cost per unit: £2.08

(TABLE II) INDIRECT COSTS £961,115

Apportioned to processing 40.9% £393,096
Cost per unit: £4.50

£6.58

* These data have not been considered in detail by the Regional Treasurer of North Western RHA.

TABLE I

COST OF COLLECTION OF UNIT OF WHOLE BLOOD

MANCHESTER R.T.C.

1980/81

I DIRECT COSTS

	ITEM	Expenditure £	Total £
SALARIES & WAGES:	Clinical Assistants, blood collection	67,517	
	Nursing - Nurses	17,480	
	Donor Attendants	286,584	
	R.D.O.'s Department	204,064	
	Catering Assistants	4,523	
	Drivers	51,348	
	Ancillary	8,920	640,436
MATERIALS & EQUIPMENT:	*Blood packs	181,564	
	Drugs, dressings, chemicals	29,078	
	Bedding and linen	8,939	
	Uniforms	13,050	
	Transport costs	8,753	
	Provisions for donors	9,396	
	Hardware and crockery	3,303	
	Medical and surgical equipment	17,855	
	Postage - call-up	17,000	288,93
OTHER COSTS:	Travelling and subsistence	22,180	
	Publicity	17,669	
	Transport of donors	1,473	
	Hire of halls	11,885	
	Laundry	3,008	56,19
		GRAND TOTAL:	£985,57

* Cost of a single pack - balance of cost of blood packs are a direct cost on blood products.

TABLE II

COST OF COLLECTION OF UNIT OF WHOLE BLOOD

MANCHESTER R.T.C.

1980/81

II INDIRECT COSTS

	ITEM	Expenditure £	Tota £
SALARIES & WAGES:	Consultants	54,338	
	Medical Assistants & Senior Registrars	29,337	
	Scientists, Top Grade & Principal S.O.	30,750	
	Administration	50,886	
	Laboratory Secretariat	57,380	
	Transport - managerial, clerical	20,684	
	Cleaning staff, cleaning contracts	44,076	
	Ancillary, porters, storekeepers, etc.	24,760	
	Maintenance: transport	26,855	
	others	26,595	365,66
OTHER COSTS:	Postage	4,622	
	Printing and stationery	52,043	
	Telephones	20,693	
	Rent	17,048	
	Rates	45,062	
	Building maintenance	38,936	
	Energy: oil	39,145	
	electricity	27,147	
	gas	4,789	
	water and sewerage	10,907	
	Administrative costs	18,471	
	Training	1,557	
	Travelling and subsistence	3,476	
	Research and development	45,989	
	Revenue development	42,300	
	Capital depreciation	223,269	595,45
		GRAND TOTAL:	£961,11

TABLE III

COST OF BLOOD PRODUCTS

MANCHESTER R.T.C.

1980/81

	ITEM	Expenditure £	Total £
SALARIES & WAGES:	Chief M.L.S.O.	9,106	
	M.L.S.O./J.M.L.S.O.	30,444	
	Laboratory Aides	11,966	
	Ancillary	8,920	60,43
MATERIALS:	Plastic packs	120,806	120,80
		TOTAL:	£181,24

National Blood Transfusion Service

COST OF AUTOMATED PLASMAPHERESIS CENTRE

ITEM			Expenditure £	Total £
INITIAL CAPITAL EXPENDITURE:				
Building (160 m^2)			71,800	
Furniture and equipment			158,600	
Total capital expenditure				230,400
Equivalent Annual Cost				29,100
REVENUE EXPENDITURE:				
Staff:				
Supervision (medical and admin.)			10,000	
Medical Officer			13,500	
S.R.N.			5,600	
5 Donor Attendants			20,000	
Clerical Officer			3,750	
Domestic			3,400	56,250
Direct Cost per Procedure				
Pheresis set	16.82			
Sodium citrate	1.00			
Dressings and drugs	1.00			
Equipment servicing	0.43			
Total direct costs per procedure		19.25		
Indirect costs				
Heat, light, telephone, rates			3,000	
Building maintenance			600	
Refreshments			600	
Advertising and postage			1,500	5,700

Number of procedures per annum = 16000 - 18000
Hence, direct cost per procedure per annum = £308,000 - 346,500

Total cost per annum, including capital = £399,000 - 437,600

If each procedure produces 0.5 kg plasma, then

Total cost per kg plasma = £48.60 - £49.90

rounding to nearest 10p

COST OF MANUAL PLASMAPHERESIS CENTRE

1980/81 price leve

ITEM		Expenditure £	Total £
INITIAL CAPITAL EXPENDITURE:			
Building (160 m^2)		71,800	
Furniture and equipment		27,600	
Total capital expenditure			99,400
Equivalent Annual Cost			7,300
REVENUE EXPENDITURE:			
Staff:			
Supervision (medical and admin.)		10,000	
Medical Officer		13,500	
S.R.N.		5,600	
5 Donor Attendants		20,000	
Lab. Assistant		3,900	
Clerical Officer		3,750	
Domestic		3,400	60,150
Direct costs per procedure			
Pheresis set	8.92		
Saline	0.77		
Drip set	3.04		
Dressings and drugs	1.00		
Equipment servicing	0.07		
Total direct cost per procedure	13.80		
Indirect costs			
Heat, light, telephones, rates		3,000	
Building maintenance		600	
Refreshments		600	
Advertising and postage		1,500	5,700

Number of procedures per annum = 9000 - 12500
Hence, direct cost per procedure per annum = £124,200 - 172,500

Total cost per annum, including capital = £197,400 - 245,700

If each procedure produces 0.5 kg plasma. then

Total cost per kg plasma = £37.30 - £43.90

rounding to nearest 10p

ANNUAL COST OF PRODUCING PLASMA FOR FACTOR VIII AND ALBUMIN AND THE EQUIVALENT COMMERCIAL VALUE

	QUANTITY OF PRODUCTS PRODUCED			COST OF PLASMA			COMMERCIAL VALUE OF PRODUCTS			
	ALBUMIN (PPF)	FACTOR VIII CONCENTRATES						Factor VIII		
ESH ASMA	g/1000 population	Int. Concentrate M i.u.	Cryo. (frozen/ freeze-dried M i.u.	whole blood £M	whole blood + machine pheresis £M	whole blood + manual pheresis £M	Albumin (PPF) £M	Int. Concentrate £M	Cryo £M	TOTAL £M
0,000	92	40	7.5	7.5			7.9	4.8	0.6	13.3
5,000	150	68	7.5		13.7	12.7	12.8	8.2	0.6	21.6
5,000	200	95	5		19.1	17.3	17.1	10.8	0.45	28.35

OTE To each total for the commercial value of the albumin and Factor VIII must be added the value of other products which can be produced from the plasma. i.e. Factor IX concentrates, fibrinogen, thrombin, salt-poor albumin, normal and certain specific immunoglobulins. Estimates of the commercial value of these products are difficult to obtain since some are not sold in the U.K. However, to purchase those required clinically would incur an annual cost of at least £4.5m

Appendix 4

MEMORANDUM

POTENTIAL IMPROVEMENTS IN YIELD OF FACTOR VIII

There are currently a few straws to clutch at, in the hope that the requirement for FF plasma may be reduced by improved yields of factor VIII. concentrate.

(1) Since the introduction of pro-rata return of factor VIII, several RTCs have substituted CPD for ACD anticoagulant and adopted other changes leading to improved quality of FF plasma. In addition, figures for the first six months of 1981 show that BPL has improved its performance over 1980 in reducing some of the avoidable losses. These combined improvements have raised net yield from 195 to 213 iu/kg plasma. This is the kind of saving expected to lead eventually to the target of 225 iu/kg, predicted without major technological advances.

(2) PFC, Edinburgh, report that the thoughtful engineering of large-scale cryoprecipitate recovery increased their gross yield of factor VIII from 206 to 320 iu/kg in 1980 (although the latter is not necessarily the yield being achieved routinely at the moment; for other reasons). BPL and PFL have similar equipment under construction at the moment, and expect to commission it before July 1982.

(3) Several groups are now claiming gross yield of about 600 iu/kg for a concentrate of intermediate purity made aseptically in blood bags from plasma collected in heparin anticoagulant. PFL are urgently checking a number of reservations about these claims, but it seems likely that substantial improvements in yield can be made, even by adding heparin to conventional citrated plasma before freezing. The logistics of obtaining heparin plasma from RTCs and the effect on comprehensive fractionation will take much longer to establish. This exciting development is far from sufficiently established to justify a serious review of BPL's required capacity for FF plasma.

J.K. SMITH

10.12.81.