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ADVISORY COMMITTEE ON N.B.T.S.

WORKING PARTY TO ADVISE ON PLASMA SUPPLIES

FOR SELF-SUFFICIENCY IN BLOOD PRODUCTS

SUPPLEMENT TO PRELIMINARY REPORT (AC(81)11)

(1) CONSIDERATION OF COST IN DETAIL OF PLASMA COLLECTION AND PROCESSING

1.1 Quantity of plasma required

In the paper AC(81)11 it was calculated that some 500,000 kg plasma would be required to satisfy requirements for Factor VIII concentrates. Following a further meeting with representatives of the Haemophilia Centre Directors it seems that the quantity of cryoprecipitate needed had been over-estimated and, although supplies of high purity Factor VIII concentrate would be necessary, the quantity was difficult to determine. It seems reasonable, therefore, to reduce the total annual plasma requirement to 435,000 kg from which can be processed 95 M i.u. intermediate concentrate and 5 M i.u. cryoprecipitate at current yields. Within this total supply of plasma there should be sufficient flexibility to produce the small quantity of high purity material required and also to provide 200g albumin (P.P.F.) per 1000 population.

The maximum figure of 435,000 kg plasma will be used in this report.

1.2 At the request of the Advisory Committee the cost of plasma collection has been explored in more detail.

1.2.1 Obtaining plasma from whole blood donations.

A protocol for detailing the cost of blood collection and processing is given in Appendix I (proposals for extending the costing to laboratory tests and distribution are also given). To determine the various costs, those which apply to the R.T.C. 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 R.T.C's to give equivalent values.

From the calculations in Appendix I 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 180g plasma from one donation, it will require plasma from 5.7 donations 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.

In AC(81)11 it was calculated that 200,000 kg plasma could be obtained from whole blood donations; the processing cost will be, therefore, £7.5 M.

If the whole of the plasma necessary for self-sufficienty were to be detained from whole blood donations an additional 235,000 kg would be required. Since the red cells would not be needed for clinical use, it was calculated that 230g plasma could be obtained from each donation (AC(81)11, section 7); thus 1 kg plasma would be detained 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 i.e. £87.70 per kg. The cost of preparing 235,000 kg plasma in this way would be £20.6M.

1.2.2 Cost of obtaining plasma by plasmapheresis

Plasmapheresis can be conducted by machine or manual methods as described in AC(81)11. Detailed examination of the costs of the two types of plasmapheresis centres is given in Appendix II. 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 R.T.C. buildings, others may be situated in vacant space owned by the R.H.A. or A.H.A. and also, in some instances, it may be possible to rent accomodation.

However, from Appendix II 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 exclusively, the cost of obtaining 235,000 kg (that required in excess of plasma from whole blood donations) is £11.6M.

(ii) Using manual plasmapheresis, the average cost of 1 kg plasma is £41.60. The cost of detaining 235,000kg is £9.8M

It will be noted in Appendix II that the throughput of donors in a machine pheresis centre is higher than that of the manual pheresis centre. For every donor bled in a manual unit there will be 1.6 donors bled in a machine unit.

If 17,000 donors are plasmapheresed per year in a machine unit, obtaining 0.5 kg plasma per procedure, the yield of plasma will be 8,500 kg.
To obtain 235,000 kg plasma it would require 28 centres in England and Wales.

The number of manual units to obtain the same quantity of plasma would be 45.

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

To equip 28 machine centres would cost £4.44M
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.

1.3 SUMMARY AND CONCLUSIONS

1.3.1	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
1.3.2	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
1.3.3.	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 v olume. It is significant in this regard that commercial manufacturers of blood products use manual plasmapheresis to obtain their raw material.

(2) PROGRESS TOWARDS SELF-SUFFICIENCY

At the present time England and Wales are virtually self-sufficient with regard to Factor IX complex, normal and specific immunoglobulins. It is not anticipated that the demand for these products will show a dramatic increase, although the Working Party has yet to consider these aspects in detail. Approximately 60 M i.u. Factor VIII concentrate are currently used annually of which 15 M i.u. are provided by B.P.L. and 8 M i.u. in the form of cryoprecipitate by the R.T.C's. It has not been possible to estimate accurately the quantity of albumin (as P.P.F.) which is used annually, but evidence suggests that significant purchases of this material are being made in all regions.

The estimates derived for the use of Factor VIII and albumin were based upon information of the expected needs of these materials in the mid-80s. It is evident that the estimates exceed the quantities of these materials purchased at the present time. Therefore, the investments in plasma products by R.H.A's to achieve self-sufficiency will be in excess of that provided at present, including that spent on commercial products.

It must be remembered that of the 150,000 kg plasma at present supplied to B.P.L. 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 i.e. £5.6M is not realizing its full potential. It is hoped that by 1982 R.H.A's will have agreed to provide facilities in R.T.C's for the separation of 150,000 kg fresh plasma.

In Table 1, 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.

In the table, the quantities of Factor VIII and albumin which will 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.

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 B.P.L.

The ADVISORY COMMITTEE is asked to approve the supplementary report to AC(81)11 and to seek Ministers' agreement with respect to consultation with R.H.A's with a view to determining the supply levels of plasma for the redeveloped B.P.L. The Advisory Committee is also asked to consider the future role of the Working Party with respect to discussions with R.T.D's on the supply of plasma and a consideration in detail of the plasma requirements for the preparation of specific immunoglobulins.

TABLE I

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

Kg FRESH PLASMA	QUANTITY OF PRODUCTS PRODUCED			COST OF PLASMA			COMMERCIAL VALUE OF PRODUCTS			
	ALBUMIN (PPF)	FACTOR VIII CONCENTRATES						Factor VIII		
	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
200,000	92	40	7.5	7.5			7.9	4.8	0.6	13.3
325,000	150	68	7.5		13.7	12.7	12.8	8.2	0.6	21.6
435,000	200	95	5		19.1	17.3	17.1	10.8	0.45	28.35

NOTE 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 £2M

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

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	11,886	
	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 £	Total £
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	365,661
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	595,454
		GRAND TOTAL:	£961,115

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	60,436
MATERIALS:	Plastic packs	120,806	120,806
		TOTAL:	£181,242

APPENDIX II

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 levels

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

COST OF PLASMAPHERESIS CENTRES

(a) Automated 8-bed Centre

Cost item		Expenditure £, 1980/81 price levels	
INITIAL CAPITAL EXPENDITURE			
Building (160 sq. metres)	71,800		
Furniture and equipment	158,600		
Total capital expenditure		230,400	
Equivalent Annual Cost.			29,100
REVENUE EXPENDITURE			
Staff:			
Supervision (medical + admin)	10,000		
Medical Officer	13,500		
SRN	5,600		
5 Donor Attendants	20,000		
Clerical Officer	3,750		
Domestic	3,400		
Total staff costs			56,250
Direct costs 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		
Total indirect costs			5,700

No. of procedures p.a. = 16,000-18,000

Hence direct procedure cost p.a. = 308,000-346,500

Total cost p.a. including capital = £399,000-437,600

If each procedure produces 0.5 kg plasma, then

Total cost per kg plasma = £48.60-£49.90

The figure of £49.25 quoted in the text is the mid-point of this range.

(b) Manual 8-bed Centre

Cost item		Expenditure £, 1980/81 levels	
INITIAL CAPITAL EXPENDITURE			
Building (160 sq. metres)	71,800		
Furniture and equipment	27,600		
Total capital expenditure		99,400	
Equivalent Annual Cost			7,300
REVENUE EXPENDITURE			
Staff:			
Supervision (medical + admin)	10,000		
Medical Officer	13,500		
SRN	5,600		
5 Donor Attendants	20,000		
Lab. Assistant	3,900		
Clerical Officer	3,750		
Domestic	3,400		
Total staff costs			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 costs per procedure		13.80	
Indirect costs			
Heat, light, telephone, rates	3,000		
Building maintenance	600		
Refreshments	600		
Advertising and postage	1,500		
Total indirect costs		5,700	

No. of procedures p.a. = 9,000-12,500

Hence direct procedure cost p.a. = 124,200-172,500

Total cost p.a. including capital = £197,400-245,700

If each procedure produces 0.5 kg plasma, then

Total cost per kg plasma = £39.30-43.90

The figure of £41.60 per kg quoted in the text is the mid-point of this range.