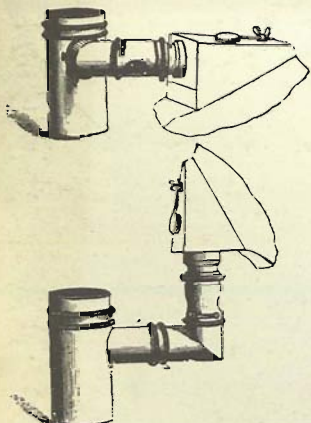


HOSPITAL PURCHASING

SURGICAL APPARATUS.



FIGS 1 AND 2.
SANSOM'S CHLOROFORM INHALER.



FIG. 12.—TRACHEOTOMY TUBE.



FIG. 10.
BOWMAN'S
DILATOR
FOR THE
CANALICULUS.



FIG. 4.
LIEBREICH'S OPHTHALMOSCOPE.



FIG. 11.—SNELLEN'S
EYE INSTRUMENT.

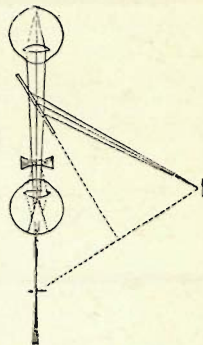


FIG. 3.—HELMHOLTZ'S
OPHTHALMOSCOPE.



FIG. 5.—MODE OF USING THE OPHTHALMOSCOPE.

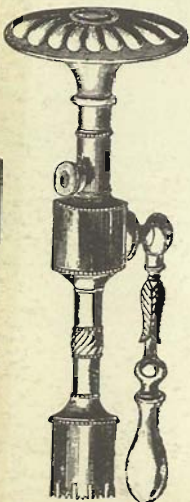


FIG. 13.—TREPHINE.



FIG. 7.
METAL
SPECULUM.

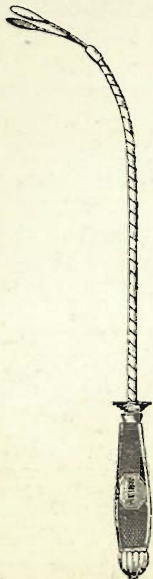


FIG. 9.
WEISS' CANULA
FORCEPS.

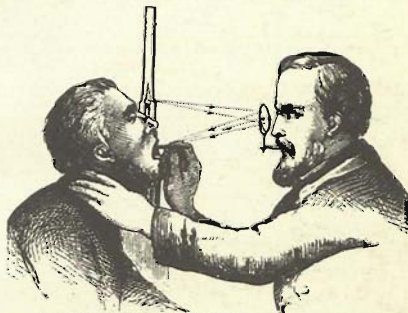


FIG. 6.—MODE OF USING THE LARYNGOSCOPE.

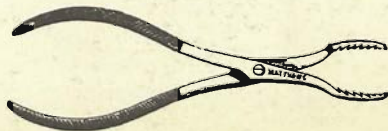
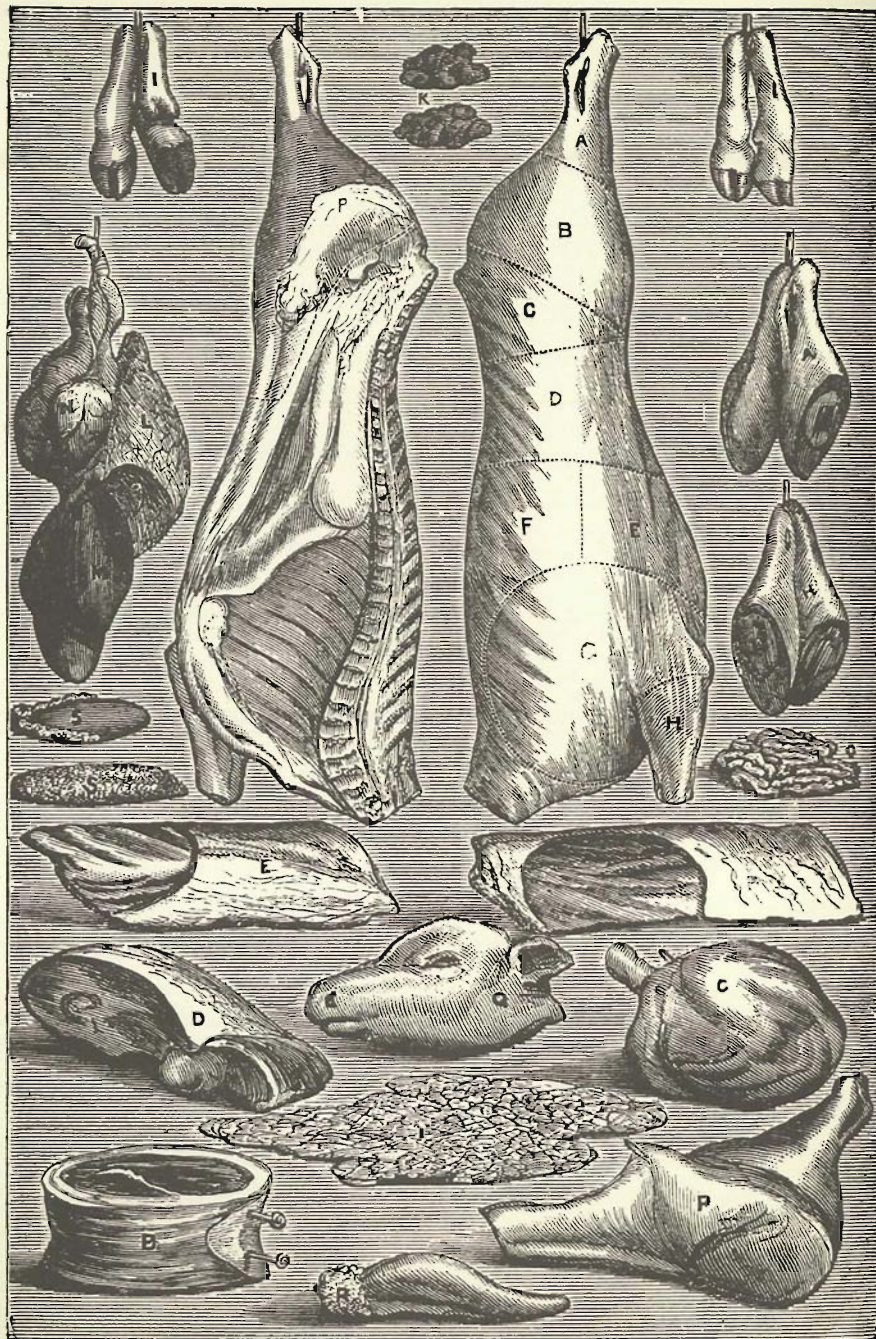


FIG. 8.—MATTHEWS' FORCEPS.

VEAL.



A, Hind Knuckle; B, Fillet; C, Loin (chump end); D, Do., best end; E, Breast; F, Neck; G, Shoulder; H, Fore Knuckle; I, Feet; K, Kidneys; L, Lights; M, Liver; N, Heart; O, Brains; P, Leg; Q, Head; R, Tongue; S, Sweetbread; T, Caul.

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HOSPITAL PURCHASING

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Office of Health Economics

The Office of Health Economics was founded in 1962 by the Association of the British Pharmaceutical Industry. Its terms of reference are:

- To undertake research on the economic aspects of medical care.
- To investigate other health and social problems.
- To collect data from other countries.
- To publish results, data and conclusions relevant to the above.

The Office of Health Economics welcomes financial support and discussions on research problems with any persons or bodies interested in its work.

Introduction

Out of £868 million spent on the revenue account of the hospital service in England and Wales in 1970, £242 million, or a little over one quarter, was spent on supplies of goods and equipment. Table 1 shows the breakdown of spending by the nine broad categories¹ which have been used for accounting under the National Health Service. These are the only comprehensive data available at the national level, though they are unable to reflect the diversity of medical and non medical goods purchased, from boiler fuel to pharmaceuticals and from food to surgical instruments. Nor do they give any impression of the range of needs which have to be satisfied from floor cleaning and bed making to the most sophisticated and expensive of clinical activities.

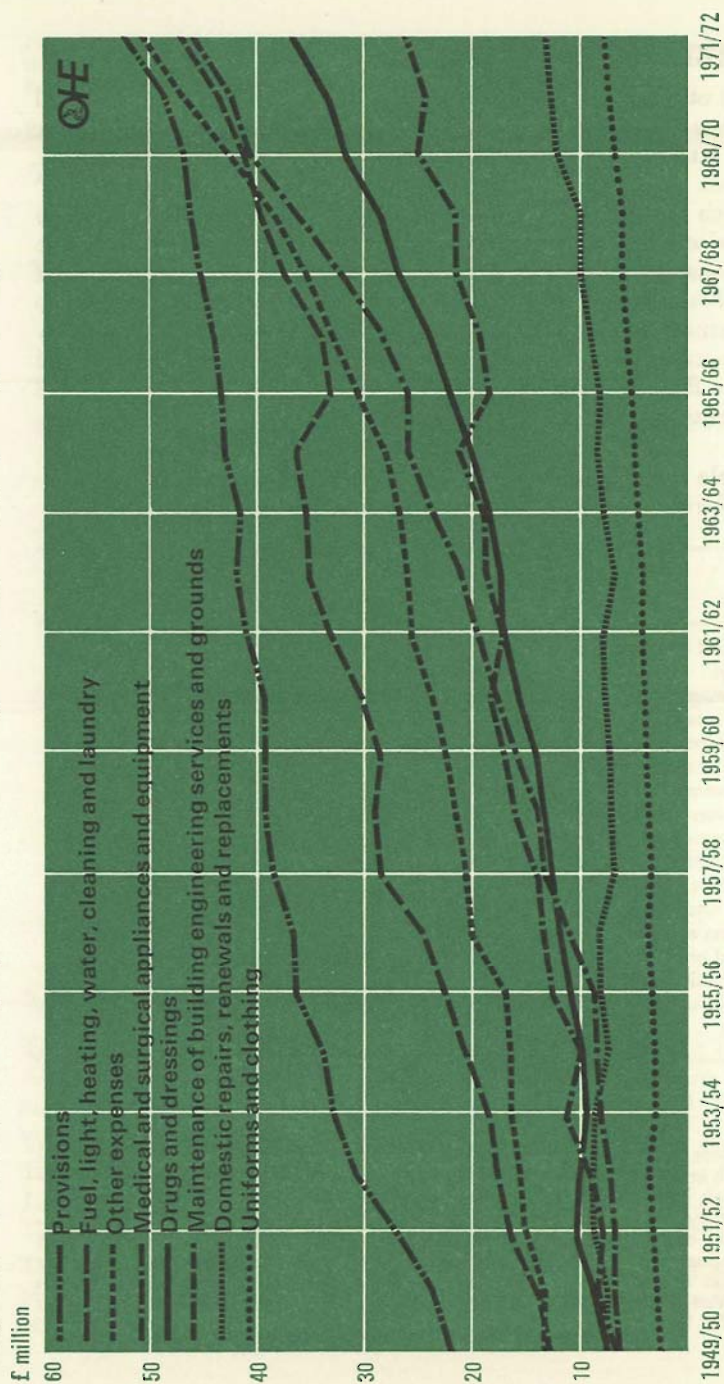
Table 1 *Current Expenditure of National Health Service Hospital Authorities England and Wales 1969-70*

| | £ million | % of total 'supplies' expenditure |
|--|------------|-----------------------------------|
| Medical and surgical appliances and equipment | 40 | 17 |
| Drugs | 26 | 11 |
| Dressings | 6 | 2 |
| (Sub total 'medical' supplies) | (72) | (30) |
| Provisions | 46 | 19 |
| General services (power, light, heating, water, cleaning, laundry) | 40 | 17 |
| Maintenance of buildings, plant and grounds | 25 | 10 |
| Domestic repairs, renewals and replacements | 11 | 5 |
| Staff uniforms and patients' clothing | 6 | 2 |
| Other maintenance expenditure | 42 | 17 |
| (Sub total) | (242) | (100) |
| Salaries and wages | 586 | |
| Blood transfusion, mass radiography etc and central administration | 40 | |
| Total | 868 | |

Source Digest of Health Statistics 1971.

1 Some of the expenditure in the broad supplies categories in Table 1 relates to items which are placed under the same heading as supplies as a matter of accounting convention, but which, it can be argued, are not subject to normal purchasing processes. These include travelling expenses, rents and patient allowances and also a large proportion of 'Maintenance of buildings, plant and grounds'. Excluding such items, but including expenditure on equipment on the capital account, it is estimated that English hospitals alone spent £187 million on 'goods and equipment subject to negotiation', that is 81 per cent of the total English expenditure on the categories detailed in Table 1.

Figure 1 Gross hospital running expenditure on various categories of supplies 1949-50 to 1971-72 England and Wales



Source Civil Estimates, Various years

Medical goods and equipment, sales of which are characteristically confined to the health services, make up only a minority of expenditure in hospitals, £72 million or 30 per cent of the total spent on supplies in 1969-70. The amount spent on high technology goods is an even smaller proportion of the total. Although estimates are unreliable it has been suggested (CSTI 1970) that domestic sales of medical instruments, largely to the hospital service, are in the order of £15 million per annum.

The major part of supplies expenditure is on 'common user' items such as food and cleaning materials, reflecting the dual role of hospitals as providers of medical care and 'hotel keepers'. For example food ('provisions') is the largest of the classifications shown in Table 1 and other major items include the maintenance of buildings and general services. As the Committee of Public Accounts (HMSO 1972) noted, the hospital service is the largest hotel and laundry organisation in Britain. In these areas hospitals are, by and large, only one group of purchasers among many in both the public and private sectors. Characteristically, they are also the product areas which by their nature are most susceptible to rationalisation in the interests of economy. Their uses are usually quite easily defined and the exercise of managerial authority is less likely to be controversial, among either professional users or manufacturers, than it may be, for example, with specialised medical equipment. Supplies organisations, at least at regional level and below, have accordingly reflected a concentration of administrative interest on these 'common user' product areas.

The 1946 National Health Service Act vested purchasing powers for all types of goods in the 376 Hospital Management Committees and 36 Boards of Governors. However, the functions of supply have changed significantly in twenty years and it has become increasingly apparent that the original administrative framework is unsuited to their execution. The major problems of mismatch between supply processes and their mode of organisation have inevitably become explicit with the critical analysis involved in attempts to define the optimal level for purchasing goods. It is to be expected that the level which makes best use of economies of scale will vary from product to product and this problem does not admit to easy solution itself, but it has as its corollary an even more intractable problem of actually getting decision taking onto that optimal level while the Hospital Management Committees and Boards of Governors still retain the powers vested in them under the NHS Act. Attempts to reorganise hospital purchasing since the 1950s have revolved around these two interrelated problems.

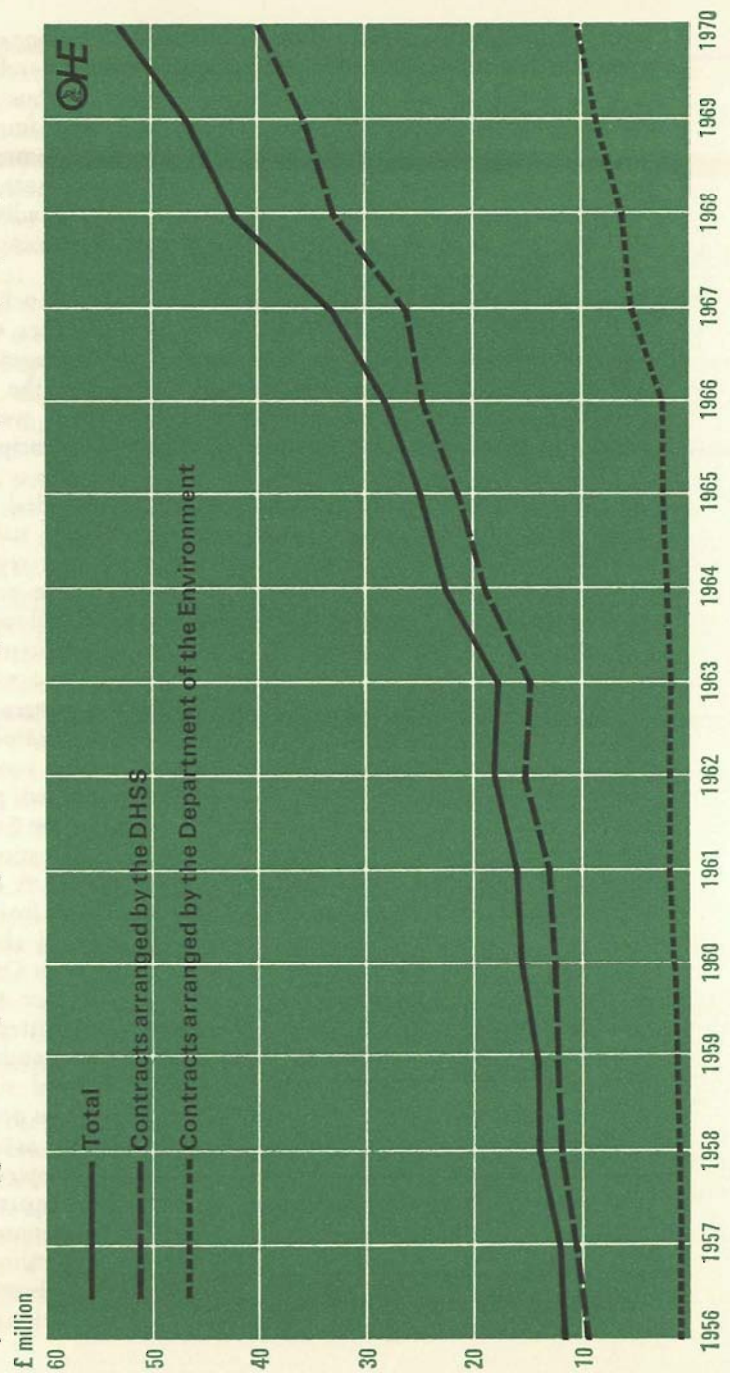
Developments in the organisation of hospital supply since the inception of the NHS

The first official committee to make a study of the hospital supply service was the Bradbeer Committee (HMSO 1954). Reporting on the internal administration of hospitals it recognised that the problem of organising hospital supplies centred on defining the optimum unit for purchasing and contracting, which would vary from product to product and area to area. In the absence of sufficient evidence it recommended much more detailed investigation and following this the Central Health Services Council appointed a committee on hospital supplies. In 1958 this committee, the Messer Committee, concluded that 'joint contracting among management committee and teaching hospital groups provides the only practical method of combining the advantages of large scale buying with the existing autonomy of hospital groups and of avoiding a much greater degree of central purchasing or contracting'. Consequently central contracting only expanded slowly during the late fifties and early sixties (*Fig. 2*) while joint contracting and the organisation of supplies in general grew haphazardly according to the individual initiative of a multiplicity of authorities.

The impetus to the next investigation of supplies organisation was given by the Committee of Public Accounts in 1963. Its comments on variations in prices and specifications of similar items purchased by hospitals led immediately to the setting up of national specification working groups in fifteen product areas, in an attempt to reduce these variations, and also to the establishment of a committee, chaired by J F Hunt of the Ministry of Health, but otherwise composed of officers of the hospital service, to 'review the present organisation for the purchase and distribution of goods and equipment' . . . 'and to make recommendations'. The Hunt Committee's report in 1966 came at a time of growing concern about inefficiency in spending public money and urged a number of radical changes in the interests of economy. This was also a time when modern ideas on management structures in public services were becoming increasingly popular and the trend was reflected in the committee's primary concern with creating a sound organisational system for the purchase and distribution of supplies.

The Hunt Committee found that despite ostensible reliance on joint contracting as the primary means of achieving economies of large scale purchasing only an estimated 23 per cent of 'goods and equipment subject to negotiation' were covered by this method of

Figure 2 *Medical and hospital supplies. Items supplied under central contracts (including items purchased by the Department of Health but supplied to other government departments and NHS agencies outside the hospital service). 1956-1970*



Source: DHSS Annual Reports, Various years.

purchasing by 1964-65, ranging from under 10 per cent in one region to over 75 per cent in another. Additionally, central purchasing amounted to 11 per cent of total supply expenditure. Thus about two thirds of total expenditure, according to the Hunt Committee statistics, was still undertaken by Hospital Management Committees or Boards of Governors acting independently. Furthermore, they often delegated the function to individual departments in individual hospitals, even in those cases where large scale purchasing was manifestly advantageous.

Faced with evidence like this, the Hunt Committee's conclusions and recommendations went counter to the earlier Messer Committee. It saw the imposition of authority on a fragmented purchasing situation as the only feasible solution to the most obvious problems and in essence its recommendations were an attempt to strengthen central authority and apply the principles of line management throughout the whole hospital supplies organisation. In addition to a strong central authority to deal with specifications, quality control, storage methods, the national vocabulary and central contracts, it recommended that regional hospital boards should for the first time play an active part in supplies organisation through the appointment of a regional supplies officer. In keeping with a pattern of line management it recommended that area supplies units (which were seen as a natural development from informal joint contracting committees pre-existing in some regions) should be set up and run by staff employed by, and thus directly responsible to, the regional hospital board.

Most of the individual recommendations have been at least partly implemented. A hospital supply branch was set up in the Supply Division of the Department of Health, with some of its senior and intermediate staff drawn from the hospital service itself. A direct line of management was established, potentially at least, from the central authority to the Regional Hospital Boards and also, as recommended, each region appointed a Regional Supplies Officer.

In the event, however, the re-organisation was neither as extensive nor as radical as that envisaged by the Hunt Committee. The importance originally attached to strengthening central authority was so great that the report recommended a hospital supply branch as an interim measure only, to be replaced as soon as possible by a separate hospital supply board, statutorily established as a corporate entity. But this last recommendation was not accepted and the hospital supply branch which was set up within the Department of Health may not have acquired the strength or autonomy in operation of a separate Board as envisaged by the Committee. In addition, a key recommendation about Area Supplies Officers was not, in the event, implemented. In keeping with the rationale of

the report, that a direct line of management should be extended down to area and hospital group levels, it was recommended that Area Supplies Officers should be officers of Regional Hospital Boards and thus directly answerable to them. This was felt to be a necessary condition for the co-ordination of the activities of purchasing officers and authorities, though not of course a sufficient condition in itself. However, the problems of superimposing a direct line of management on a multiplicity of autonomous Hospital Management Committees and Boards of Governors proved to be intractable in most cases, and even in those regions where a line management structure has been created by making Area Supplies Officers more or less responsible to the Regional Board, this has never wholly excluded the supply service from the co-existing authority of individual Hospital Management Committees.

The circular implementing the Hunt Committee recommendations (HM (67) 95) allowed each region discretion as to the precise system it would adopt, given that from four to eight areas (administered by area supplies officers) would be the key purchasing units in the regional purchasing plan. Regions did not, in the event, co-operate to present one single standard pattern of supplies organisation throughout the entire country and there was considerable opposition among Hospital Management Committees to the transfer of authority over supplies personnel to the regional boards. The resulting compromises led to the adoption of different systems in different regions. Most commonly, supplies staff from the area officers downwards were placed under the joint employment of the Hospital Management Committees making up any one area. This has meant divided responsibilities among supplies staff. A few regional boards, either in part or in whole, have followed the Hunt Committee's original recommendations and employed Area Supplies Officers themselves, and in this situation the Regional Supplies Officer can exercise a much greater degree of control over the whole supplies organisation in his area. However, in no case has the direct line of management yet extended down from the regional hospital board to cover all hospital supply or stores staff.

For the most part, therefore, the Hunt Committee's plan for a direct line of management from the centre downwards has not been realised. Although Regional Hospital Boards have mandatory powers, authority still tends to remain fragmented in most cases and the development of joint contracting and other co-operative aspects of supply remain dependent on the co-operation of individual and autonomous authorities. In some regions voluntary co-operation has been effective in meeting minimal criteria for an

efficient supplies service. But in other regions reliance on voluntary co-operation has meant continuing poor communications, high prices and continued small scale and inefficient purchasing.

The re-organisation of hospital supplies, four years after the implementation of the Hunt report, remains incomplete. Adaptation to local conditions and pressures has produced a variety of systems and, equally, a variety of proposals for organisational solutions, all of which, at least those of professional supplies officers, have a common theme of full implementation of principles of line management. However, because any organisational solution is likely to be very dependent on radical changes in the whole of the hospital service, of which supply is just a part, the scope for supplies organisations to find their own answers, without the sort of wholesale re-organisation that is due to take place in 1974, has always been severely limited.

Purchasing processes

Because of the nature of the hospital service, with its separate and autonomous authorities, a single description of the purchasing process and all its ramifications is not possible. The methods and scale of purchase vary very widely from product to product and from area to area. However, the major variants can at least be described and illustrated.

About 20 per cent of expenditure on goods subject to negotiation is currently covered by central government contracts, arranged mainly by the Departments of Health and the Environment. This proportion has been increasing since the mid 1960s; Fig. 2 and Table 2 illustrate the wide spectrum of goods covered. Central purchasing is not dominated by a small number of massive contracts for very expensive plant or equipment. Only in the hospital building programme do single projects exceed a value of £10 million, and these are outside the scope of this paper.

The term 'central contracting' is misleading in that it implies a certain homogeneity whereas, in fact, the purchasing processes subsumed under the term can in themselves vary very widely indeed. On the one hand, some goods, such as vaccines and sera, are not only centrally purchased but distributed centrally as well. On the other hand, most goods purchased under central contracts are distributed on a call off basis whereby each locally placed order is met by the manufacturing firm itself or its closest wholesaler.²

2 In recent years there has been a trend away from the central storage of goods by the Department of Health or the Department of the Environment themselves.

Table 2

Medical and hospital supplies: goods and services supplied under central contracts England, Wales and Scotland

| | 1970 value £ million |
|---|-------------------------|
| 1 Contracts placed by the Department of Health and Social Security, including supply to Scottish and Welsh Hospitals and other Government Departments | |
| Pathological and blood transfusion equipment and surgical instruments | 3.3 |
| X-ray equipment | 4.9 |
| Mattresses | 0.1 |
| Powered invalid three-wheelers, sheds and invalid chairs | 2.7 |
| Repairs to invalid three-wheelers, sheds and invalid chairs | 1.8 |
| Artificial limbs | 3.6 |
| Appurtenances | 0.2 |
| Surgical appliances including boots and wigs | 6.4* |
| Vaccines, sera, etc., including poliomyelitis, BCG and smallpox vaccines | 0.3 |
| Rubella vaccine | 0.3 |
| Ear inserts and non-electrical hearing aids, etc. | (0.03) |
| Drugs and dressings | 3.4 |
| Wrapping paper and bags for sterile packs | 0.6 |
| Spectacles (hospitals only) | 0.1 |
| X-ray film and paper | 6.2 |
| Rubber gloves and sundries | 1.6 |
| Plastics disposable syringes and needles | 2.4 |
| Dental equipment | 0.4 |
| Intermittent dialysis equipment | 0.7 |
| Paint | 0.4 |
| Disposable bedpans, etc. | 0.5 |
| Bedsteads to King Edward's Fund specification | 0.2 |
| 2 Contracts placed by Department of the Environment | |
| Cleaning materials and hardware | 0.9* |
| Linoleum and floor coverings | 0.3* |
| Floor cleaning equipment | 0.3* |
| Carpets | 0.6* |
| Furniture | 1.4* |
| Heavy canteen equipment | 0.4* |
| Cutlery, glassware and crockery | 0.6* |
| Fire fighting equipment | 0.1* |
| Light kitchen equipment | 0.1* |
| Venetian blinds | (0.01)* |
| Grass cutting equipment | (0.02)* |
| Boiler fuel oil | 4.9* |
| Building stores and materials | 0.5* |
| 3 Contracts placed by HM Stationery Office | |
| Stationery and Office equipment | 1.1 |
| 4 Contracts placed by Ministry of Defence | |
| Commercial and passenger vehicles | 0.2 |
| Motors cars for the disabled | 0.6 |
| 5 Contracts placed by Department of Trade and Industry | |
| Electric lamps | 0.1 |
| 6 Contracts placed by the Post Office Corporation | |
| Hearing aids and components and repairs | 0.8 |

* These figures do not include Scotland

Source DHSS Annual Report 1971

The influence of the supply branch is brought to bear not by the physical purchase and distribution of goods but simply by stipulating prices and specifications which may be more or less strongly recommended to hospitals themselves, but which have never yet been made mandatory. In some cases specifications can be quite rigorous, while in others they do no more than reflect market availability and untrammelled choice among users. The purchase of furniture may be used as an illustrative example of a situation where central purchasing has led to a quite significant degree of effective control over the type of goods to be purchased. In this case it is partly because the approved models and manufacturers on the Department of the Environment list are exempt from purchase tax. Thus while the opportunity for choice is maintained the range of choice is in practice limited. In other product areas, however, particularly among medical goods and equipment, the individual users themselves maintain virtually complete control over the decision-making process and central contracts simply respond to unfettered professional preferences.

In the past, central contracts have often been arranged following reports from 'specification working groups', set up after 1963 with representatives of the Ministry, user groups and hospital supplies officers. These have recently been replaced by 'purchasing advisory groups' for broad commodity groups such as food, textiles and household goods. The new system was designed to obtain better and more rapid results through the adoption of a continuing advisory and research role, in which recommendations and changes do not have to await the publication of a report. They provide important links between the hospital supply branch and the hospital service itself.

The remaining 80 per cent of expenditure is made at various levels between Hospital Management Committees and Regional Hospital Boards and here there are similar, though even wider, variations in styles and methods of purchasing. The Hospital Management Committees form the basic units, but two or more may co-operate for the joint purchase of some products. In addition there are now area supplies organisations covering a number of Management Committee groups and since the re-organisation of hospital supplies in the late 1960s, these have taken responsibility for much joint contracting. However, it remains normal practice for the Management Committees to maintain their function as the actual purchasing authority, acting in concert with others in the area. This also applies to purchasing at the regional level. The supplies organisation at the Regional Hospital Board, though it exercises influence over policy, and in some cases may direct Hospital Management Committees, rarely takes responsibility for

the operation of purchasing itself. Regional, area and inter-group contracts, in common with central contracts, can all vary from those which are rigorously specified and applied to those which are in reality no more than loose purchasing guidelines. In some cases, regional decisions have been made mandatory for constituent Hospital Management Committees while in other regions there is relatively little interference with the autonomy of Management Committees or individuals within hospitals. One common factor, however, is that the purchase of 'common user' items is more susceptible to the imposition of control and rationalisation. Few attempts have been made to follow similar policies which might affect freedom of choice among medically qualified personnel and other professional users of supplies except when large items requiring considerable capital expenditure are involved.

Finally, probably about half of all goods continue to be purchased entirely at the level of the smallest administrative units, the Hospital Management Committees and Boards of Governors. This can range from bulk purchase of food for large hospitals to small scale purchases of pharmaceuticals delivered by pharmaceutical wholesalers as part of their daily rounds.

An optimal supplies policy

What are the criteria for determining what the optimum supply policy is? Over recent years the major issues have revolved around defining the best level for purchasing with a view to minimising costs while maintaining a satisfactory flow of goods and services. At the very simplest level this includes the parameters of cost and satisfaction of wants (however that may be defined) and thus seems to provide a reasonable, if not very helpful, summary of what any supply service should aim at. Clearly there are important constraints as well. One is that organisational changes designed to make best use of short term economies of scale may in the event prove counter-productive if they interfere with lines of communication and the flow of information between purchasers, supplies and users. Another is the extent to which short term cost reduction may in the long term undermine the competitive environment or affect the economic viability of suppliers as a whole, or even discourage the development of new goods and services.

Whatever these (often indeterminate) constraints are it might still be expected that, of all the separate parts of the National Health Service, the functions and objectives of supply could be most precisely defined. Certainly these are less open ended and ambiguous

than the functions of the National Health Service as a whole, but nevertheless, for a number of reasons, the stage has not been reached where optimal solutions to the level and means of purchasing can be derived with reasonable confidence from quantitative data. The hospital service is unlikely to provide definitive solutions until a number of conditions have been satisfied.

The availability of information

The first and most basic point is that even in the case of those parameters which are easily measurable, such as costs and quantity of purchases, and which would fit relatively easily into a quantitative model, the necessary information for rational policy making seldom exists. In practice, very little is measured as a matter of course in a way that would provide hospital management with useful empirical data for decision making, and this can mean that in practice opportunities to place purchasing on a rational basis can be missed. This can be illustrated by the Department of Health's own enquiries into the proportion of goods bought under 'joint contracts'. By 1969-70, according to returns from the regions, the proportion of goods bought under joint contracting arrangements (either at inter group, area or regional level) was estimated to have reached 27 per cent. However an examination of the reasons for variations in the information collected revealed that the bases of classification and the sources of information were so varied that the figures had very little meaning. The Department realised from this study the need for a more reliable basis for statistics of this kind.

Furthermore, purchasing records tend to be scattered throughout hospitals themselves and are very often inaccessible to policy making staff at area or regional level, with the net result that without special searches they may have little knowledge of the total amounts of some goods being purchased and consumed every year.

One practical consequence of this is that hospital authorities are often incapable of forecasting their own take up of many products within a reasonable margin of error. In part this may be due to uncertainties inherent in the pattern of hospital consumption but to a considerable extent it also reflects a lack of even the most basic information. Among suppliers themselves, one of the commonest criticisms of hospital purchasing methods is the imprecise nature of the contracts they are offered and the hospitals' inability to guarantee a specific level of take up. Large scale purchasing can lead, and has led, to reductions in unit prices. However, it can be argued that maximum discounts will in practice only be obtained where quantities are specified in contracts with suppliers and actual take up corresponds with specified quantities so that suppliers can plan their activities to obtain economies themselves.

To an extent, this inaccessibility of basic information to supplies organisations is only a temporary phenomenon. It is particularly acute when joint, area or regional contracts are being made for the first time, but in the years following, data from past contracts will make information more readily available to policy makers. A rapid expansion in the use of computers would also make a profound impression in this and other areas. As yet, however, much of the elementary infrastructure for rationalisation has not been created.

Information on the less elementary determinants of the total cost of supplies is no more readily available. In addition to quantities of goods and unit prices, they include transport and distribution costs which hospitals bear and the costs of storage, both the labour involved and the cost of stockholding. Possible trade offs between purchases and the use of manpower is also a vital component in any comprehensive overview of the total cost of supplies. In none of these cases does adequate information exist, either at national, regional or area level, which would allow policy making supplies authorities to forecast the net effect of a change in one of the parameters on total costs, and plan their supplies service accordingly.

There have been some studies which have used operational research techniques in an attempt to shed light on optimal supplies policies, taking into account the variables of prices, quantities, transport and distribution and storage costs. In a model based on these variables it may be proposed that large scale purchasing will be associated with economies of scale and these will be the larger if accompanied by a complementary reduction in delivery points and drops, so long as suppliers pass on the benefits from their own reduced delivery costs. Additionally, it may be worthwhile for the hospital service itself to arrange its own storage and distribution of goods to individual hospitals or departments. In this case the extent of total savings might be increased by larger discounts, by stockholding savings and any net manpower savings in handling goods, but decreased by the extra costs incurred by the hospital service itself in storing, transporting and distributing goods. The objective would be to find the most economic mix of these variables given that other things remain equal. Using theoretical data, the Oxford Regional Hospital Board Operational Research Unit has published one such study while the Operational Research Executive of the National Coal Board has been undertaking continuing work for the hospital service on this subject. However, the validity of these exercises depends largely on the quality of the data used and their results must be very suspect because neither the present hospital accounting system, nor any other *ad hoc* study, has been able to throw up the sort of information, such as the actual cost of trans-

porting an item from one hospital to another, which would form an empirical basis for such calculations.

More quantitative studies of the operational research type should be of great practical value in defining optimal supplies policies, but only if their objectives are limited to what the sensitivity and the comprehensiveness of the data will bear. The sort of data emanating from the hospital accounting system could be made more relevant to supplies management but it is unlikely that the routine collection of statistics will provide all that is required at any time without also producing a great deal of unnecessary information. In this as well as other areas of the health services, well designed and executed *ad hoc* studies, directed to answering specific questions, are a necessary supplement to routine statistics.

Computers

The development of better management information is likely to depend on the pace at which computerisation spreads through the health service as a whole and supplies organisations in particular. Every Regional Hospital Board now has access to a computer but they tend to use them primarily for administrative purposes rather than as a tool of management in the supplies or any other field. Computerisation will, in the case of supplies, be applied in harness with the National Catalogue which is being developed at present and promises on its completion to provide a unique code and description for each individual item purchased by hospitals.

In some regions, computerised equipment scheduling systems have been developed to meet the specialised need for equipping new hospitals coming into commission during the late sixties. However, most regions have been awaiting the development of the National Catalogue, which will extend its unique coding system to all types of goods. Twelve of the twenty-six divisions are expected to have been completed by the end of 1972 but it may be a further five years before the whole system comes 'on line' throughout the country. In the interim period the completed parts may be of some value, for example, as an aid to standardisation and variety reduction, if it appears that outmoded or superfluous products would otherwise be included in the catalogue. But its potential benefits will not be realised until the whole scheme is operational and an established part of the supplies 'infrastructure'.

The value of the National Catalogue (in harness with computerisation) lies in the uses made of it. Apart from the baseline information which, it has been argued, is at present lacking for even the simplest planning decisions, the most promising use lies in the control of stocks, ordering and distribution of commonly used goods. This demands rapid feedback of information on flows of

specific products. The National Catalogue will provide just this facility for monitoring specific products at each stage from ordering to the user department, in a consistent manner throughout the entire country. In addition, any such system will enforce the rationalisation and standardisation of ordering procedures, documentation and other paperwork. These can vary widely from authority to authority at present and are often both costly in labour and a barrier to rationalisation of other procedures, as well as being inconvenient to supplying firms.

However, here again the National Catalogue and computerisation must be considered as a more or less necessary condition for the rationalisation of supply processes, but not as an end in itself. As with any other monitoring system there is the danger of providing large amounts of irrelevant information. More seriously, there is the danger of receiving inaccurate and unusable information if the inputs are unsound. Data on stocks and flows of goods in specialised storage units are relatively easy to control but data on consumption and wastage of goods within the individual user departments of hospitals themselves are prone to many sorts of human errors and failures. Attempts to monitor and control the flow of goods throughout the whole hospital service are, for this reason, likely to prove too ambitious. There is the danger of over zealous coding and recording of products at every stage of their progress to the final user, and unproductive or even counter-productive processing and analysis of information.

Storage facilities

The value of the National Catalogue and a computerised stock control system largely depends, in its turn, on the existence of storage facilities capable of being organised along these lines. This is another of the preconditions which seem necessary before a rationalised supplies organisation can be brought into operation. However, this brings supply into direct competition with alternative users of capital. Stores have always been low on the list of priorities for capital expenditure. No region has yet been able to build a stores network on the basis of a rational appraisal of needs and in virtually all regions existing stores are considered to be totally inadequate either for possible future methods of organising supply services, or even for present methods. Some regions have plans for central stores (some well advanced) and the Hospital Supply Branch at the Department of Health is making a special study of storage facilities, but in view of limited resources and low priority it is unlikely that a network of stores will be in operation in many regions in the near or medium term future.

If, however, priorities change, then it is important that the kind

of storage facilities be carefully considered. The results of operational research cannot be accepted uncritically because of the paucity and poor quality of the data it may have to rely on. It is possible for one set of assumptions to lead to one conclusion and another equally acceptable set of assumptions to lead to another. Furthermore, theory can change rapidly, as it has in the past over the merits of large central stores as against smaller peripheral stores. Because of this, flexibility in a stores system must be a key objective, as it must be in the building of hospitals themselves which are also susceptible to technological change.

Other factors

The analysis has so far confined itself to the relatively unambiguous issues surrounding the cost of alternative supplies policies and the availability of resources for implementing them. A second set of criteria, however, is less easy to define. This can be termed the satisfaction of final user needs. A necessary part of any cost/benefit equation would be a definition, or at least a description, of the amount of value derived from goods and services, but the critical point here is that the simple satisfaction of users' demands is likely to be a very poor indicator of final benefit. The exercise of choice by individual users of goods can often lead to wide variations in purchases which may have little to do with the effectiveness of goods and this has been basic rationale behind efforts to achieve standardisation and variety reduction in a large number of product areas. These issues are discussed more fully later.

A third set of criteria can be described as the constraints under which a hospital supplies organisation must work, and these are equally difficult to measure or to value in order to define the optimal supplies policy, except on an *ad hoc* basis. These constraints include the need to maintain an adequate flow of information between users, purchasers and suppliers and the need to consider the economic viability of suppliers in any purchasing decision.

In summary, the problems of defining the optimal supplies service for any given region or any given product group are in principle the same problems that would be met in any public service. First of all, management information does not provide adequate data on costs and benefits of those facets of supply which can, potentially, be easily defined and measured. Second, consumer preferences as reflected in the market cannot be used as an infallible indicator of satisfaction. Third, apart from those cost and benefit components of supply which are difficult to define or difficult to measure, the organisation of supply must operate under constraints which are not possible to build into any general system of evaluation but which can only be taken into consideration on an *ad hoc* basis. What this means in practice is that although operational

research is likely to be more fruitful in the supplies field than in most others (providing resources for implementation are made available) the use of sophisticated operational research techniques brings with it the danger of uncritical acceptance of pseudo-scientific results. Probably the path towards an optimal supplies policy lies in progressively reducing the area of uncertainty through specific studies, instead of an impossible attempt to bring all the costs and benefits of all alternative policies into one comprehensive evaluative model.

Suppliers' criticisms

Given that there are so few objective quantitative data for assessing the efficiency and effectiveness of hospital supplies it is interesting to look at the criticisms of existing supplies organisations by manufacturers and suppliers. The only documented evidence on this comes from Hyman and Day (1969). In a pilot project attempting to identify the problem areas in the hospital supply process they questioned twenty-five manufacturers about their attitudes to hospitals as purchasers of their products. The firms concerned were mainly producers of 'common user' items and most criticisms were at the level of inefficient purchasing procedures and the high cost and inconvenience of dealing with hospital orders. They suggested that many of the barriers to efficiency were to be found in the internal organisation of hospitals. Firms complained about irrational internal ordering, storage and distribution which meant more paperwork for both parties. Order forms varied widely and were difficult and costly to interpret. Sometimes orders were duplicated from different departments in the same hospital. Often, delivery to a large number of points was demanded by hospitals and some suppliers, especially those with bulky products, claimed that price cuts would follow a reduction in numbers of deliveries, though others did not know the contribution of deliveries to their costs and thus could make no such promises. Another common complaint was that contracts were imprecise and that the purchasing authority could rarely be expected to give a reliable estimate of the quantity of a product which was eventually to be bought. Also, firms complained that the time between tender and acceptance was too long and the time given between acceptance of tender and first delivery too short. Finally, it was claimed that there were inadequate channels of communication between suppliers and contracting authorities at all levels.

None of these criticisms, except perhaps the last, is fundamental,

and all are susceptible to solution by rationalisation which is now taking place, if slowly, in the field of hospital supply. In most regions standardised order forms have already been, or are being, brought into use. Where they have not, computerisation will provide an impetus to change by making standardisation to a rational pattern essential, and this should provide benefits to both suppliers and purchasers in terms of reduced labour costs. Duplication of orders and excessive time taken to decide on contracts can also be resolved by more accurate and relevant management information which would be the corollary of computerisation. The problem of disparities between quantities of goods contracted for and quantities actually taken up can also be obviated if all products are unambiguously coded under the National Catalogue and flows are monitored by computer. An answer to the problems of excessive delivery points must await the construction of rational stores systems but even here the monitoring of supplies and stores activity can, as a by product, produce the empirical data necessary to aid decision making.

In general, suppliers' criticisms largely stem from a disparity between themselves and most hospital supply organisations in the use of up-to-date methods of management and control. One rapid solution to this disparity in individual cases could be an extension of the practice, common in the United States, of manufacturing firms working out a system of ordering, stock control and distribution as part of their overall sales service to hospitals. There are examples of this practice in Scotland in the supply of disposables, but partly because of fears of dependency and a loss of competitive environment this practice has not become widespread in Britain.

Human resources

Prescriptions for rationalising supply processes largely involve the removal of obvious barriers to effectiveness to satisfy what are thought to be the necessary conditions for progress, and the generally accepted need for strong lines of management has been the issue which has come in for most discussion. Strong efforts have been made in recent years to detach the supply services as far as possible from the remainder of hospital organisation, reflecting the view that a rational supplies management is unlikely to be possible when it is subordinate to, or intermeshed with, an irrational general management. The re-organisation of the Health Service in 1974 should at least remove this barrier to rationalisation by providing an administrative framework within which concepts of line

management can be applied without being frustrated by a multiplicity of small autonomous authorities. However, even if this condition for an effective supply service is satisfied, and even if others are satisfied as well, for example, by the development of storage facilities and more rapid computerisation, it may still be questioned whether the quality of available manpower is adequate to make a new structure work at both the decision-making and operational levels.

A recent report of the Committee of Public Accounts (HMSO 1972) drew attention to the sort of failings in financial control throughout the hospital service which are symptomatic of relatively intractable management problems, likely to require more than administrative re-organisation alone for their solution. Between January 1969 and April 1971, officers of the Comptroller and Auditor-General visited fifty-two hospitals and made formal audit queries among fifty. Many of the criticisms of financial control directly or indirectly involved supplies services, including failure to select the most economical gas and electricity tariffs, high costs of nurses' uniforms and food waste. Many of these questions had been raised previously with other or even the same hospital authorities.

Furthermore, even after a letter from the Department of Health and Social Security in January 1970 to all hospital authorities drawing attention to six areas where there was *prima facie* evidence of wasteful expenditure, it was found that twelve out of nineteen authorities visited by officers of the Comptroller and Auditor-General, six to fifteen months later, had failed to review one or more of the areas of criticism.

It may also be questioned whether there is sufficient technical expertise to aid decision making in supplies organisations, particularly where the definition of standards is concerned. Both the Hunt Committee and the later implementation circular recognised the importance of such technical expertise and this is increasingly becoming available. In particular it is becoming available at regional level where specialist officers such as regional pharmacists and engineers are employed. Part of the same process has been the increasing employment of specialist staff at various levels within the hospital service and this has encouraged the acceptance of national standards associated with common education and training of specialist staff throughout the country. However, despite the existence of more specialist expertise throughout the regions, supply organisations tend only to have access to this through informal or *ad hoc* arrangements, for example through the representation of specialist users on regional commodity working groups, and what is available tends to be fragmented and under-utilised. Although comparative figures for the hospital service do not exist, their employment of

experts is certainly very much less than other large scale and diversified purchasing organisations. Whereas purchasing in industry is normally a well recognised skill, it is only recently that this idea has been gaining general acceptance in the hospital service. The availability of personnel, either on a full-time or a part-time basis, has often reflected the comparatively low status of supply activities.

At the central level also, within the hospital supply branch, the relative scarcity of professional and technical expertise has in the past resulted in slow progress towards standardisation, variety reduction and central contracting. The long time-periods between the original institution of specification working groups in 1963 and their final reports were in part due to almost total reliance on part-time advice and guidance from officers working full-time within the hospital service itself. There are thus strong reasons for changes in the career structure in the hospital supply service to encourage better deployment of existing technical expertise in the various product areas. One such change could be much greater two way interchange for supplies officers and other specialist hospital officers between the central hospital supply branch and the regions. Another may be a greater degree of lateral mobility between supplies organisations and other parts of the hospital service where technical knowledge of purchasing is important, for example catering or engineering. In many purchasing organisations within industry, officers often have considerable experience as practitioners in their own particular field before entering purchasing and there is no reason why this practice should not be applied to the hospital service. There are also strong arguments for an extension of lateral mobility to encompass an interchange of purchasing personnel between the hospital service and other public bodies and industry. At present, career structures and terms of employment in the hospital service do not encourage such mobility.

Finally, as an illustration of what can be achieved even with relatively unsophisticated personnel and a mode of organisation which falls far short of the ideal, an example from outside the health service can be quoted. Many small grocery shops avail themselves of a service from large scale purchasing agencies which in essence amounts to injecting expertise within the constraints imposed by a multiplicity of small and autonomous outlets. The agencies purchase goods in bulk on behalf of the shops, thus exploiting economies of scale and establishing standards of quality control, while allowing each individual shopkeeper to remain autonomous. Methods of management, for instance in stock control, must be changed by shopkeepers in order to make use of the agency's service, but only in so far as the competence of the least capable shopkeepers will allow. It would not be possible to use highly

sophisticated methods if their use depended on the co-operation of persons and organisations with strictly limited expertise. If the analogy is applicable to the hospital service then it provides both a warning of the dangers of over sophisticated methods and a reminder of what can be achieved with relatively simple methods if the limitations of the situation are recognised.

Standardisation and innovation in hospital supplies

There is broad agreement as to the general direction in which hospital supplies organisations should move in so far as purchasing procedures, computerisation and organisation of storage and distribution are concerned. The major issue involved is how rapidly changes should take place and how much priority this should have over other parts of the health service. However, the trend towards standardisation and control over the range of products available, which has been a corollary of increasing central decision making, raises much more fundamental issues because it involves, effectively, the restriction of choice in an area where individual choice has traditionally been paramount.

Standardisation is a term which has a number of connotations, but essentially it has two facets. The first is a specification of standards to which the product must conform, bearing in mind its range of functions. Standardisation in this sense does not necessarily involve reducing the available range though this second facet, variety reduction, may often be a corollary of any attempt to match products rationally to their functions. Although variety reduction need not be the primary objective in itself, it may often be a necessary condition for achieving significant savings where the extent of variation is a barrier to economic use of resources.

The economic arguments for standardisation are usually quite clear. Economies of scale can often be exploited if only a limited range of products is purchased for all the essential functions now being performed by a multiplicity of different ones. More significant, in terms of the magnitude of potential savings, standardisation can lead to radical changes in the usage of goods. Thus the development of standardised components, and even entire modules, which can be used in all new hospital buildings, has led to large savings through both changes in building methods and improvements in the speed at which design and building is done. As another example, the rationale behind the national nursing dress, developed after work by one of the specification working groups set up in 1963,

was that so long as nurses' uniforms continued to vary from hospital to hospital, whenever a nurse changed her hospital she had also to return her old uniforms and acquire a new set from her new hospital. If nurses kept the same dresses when moving, then the savings from reduced stocks and wastage would be much greater even than the savings attributable to bulk purchase of a single range. As a further example, standardisation may lead to economies through changes in patterns of work. Thus the introduction of packs of bandages to a standard specification in parts of Scotland may facilitate standard methods of operation and training which in turn lead to potential economies in the use of manpower. Similarly, the development of standard systems of pre-cooking food and reheating at ward level could lead to very considerable changes, and economies, in the way manpower is used.

Against this, it may be argued that in specific cases standardisation acts to the detriment of the final user, either by failing to provide adequately for the whole spectrum of needs, including minority needs, or perhaps by failing to take account of the full implications of standardisation to the personnel who must use the standardised product. Thus, in the case of nurses' dresses where a standard range was developed after a number of years' work, opposition within the nursing profession has meant that the central authority has not yet decided to make its purchase mandatory for all hospital authorities. This is a good illustration of the strength of the tradition of individual choice within the National Health Service and also an illustration of the inefficacy of processes of standardisation at present. Although the nursing profession was well represented at the development stage, and although the dresses have been given a full scale trial in one large hospital, it has not been possible to secure general approval for the finished range and the supply service has been unable to implement fully its own policy. It would be both short-sighted and misconceived to reject professional opposition out of hand as being irrational but on the other hand a line must be drawn somewhere when uncritical acceptance of individual preferences involves the loss of opportunities to realise significant economies. It is worth noting that the existing variety of uniforms in fact gives no more freedom of choice to the individual nurse and the question worth asking is whether, after they had been in use some time, nurses at present in favour of the maintenance of the *status quo* would not be equally enthusiastic in defending the national nurses' dresses.

Much depends on the degree of latitude which professional users expect to have in choosing products for their own use and in cases where, for one reason or another, choice has been obligatorily reduced it may often be found that no detriment is in fact perceived

by users. Thus there has been a demand from hospital pharmacies for pharmaceutical manufacturers to supply them basic ingredients so that they can be made up at the hospital level. But manufacturers have not been willing to supply in this form. Instead they have supplied branded formulations and it is interesting that in this case, where individual choice and autonomy have been effectively curtailed, there is no reason to suppose that the benefits to the final users of drugs have been in any way reduced. Furthermore, the supply of branded formulations also ensures that the active ingredient of the product will always be available at the same concentration. Among non branded formulations there is likely to be much greater variation in biological availability and thus less accurate control over therapy.

These illustrative examples raise the issues of where and to what extent standardisation is beneficial, or even feasible, and what the criteria for evaluation ought to be. Clearly, the critical questions are how standardisation is undertaken and who is responsible for evaluating the results of standardisation before it is imposed. Just as the preferences of individual users may or may not be valid, national specifications for their part are not necessarily correct simply because made at the national level. Thus the strengthening of central authority in this respect, although it may be considered a necessary condition for rapid implementation of change, cannot be judged advantageous or disadvantageous in itself.

It seems to be a necessary part of the process of standardisation not only that a degree of authority, or at least persuasion, should be applied to the users, but also that final users should be brought into the decision making process, or at least that their needs should be fully understood. This is especially relevant in those cases where users' preferences and methods of working are in themselves important determinants of the effectiveness of products. Thus, in the context of nursing equipment, Norton (1970) has shown that the commercial success or failure of innovations which involve any changes in nursing habits and routine seems to be largely dependent on the innovators' understanding of the essential needs of users of goods and the implications of changes in their patterns of behaviour.

However, there are a variety of ways in which users' needs can be established. At the simplest level, user groups can be asked to state their preferences and this in essence is what much of the consultation by the original specification working groups set up in 1963 amounted to. But this method may prove inappropriate because of irrational preferences and because attitudes to products can be largely dependent on patterns of works. For example, a new or standardised type of bedpan may require a particular method of cleaning or a re-organisation of ward routine and there are likely to be as many

different assessments by user groups as there are patterns of work, each of which will be equally meaningless as far as the definition of a generally applicable standard is concerned. An analogous situation may be the construction of a hospital around the declared wishes of many individual doctors without any attempt to find any common denominators. It is unlikely that any economies of scale or savings in usage would follow from this model for establishing users' 'needs'.

On the other hand, attempts at standardisation may use something akin to an experimental method by analysing needs in relation to functions, defining the criteria upon which the standard is to be based, and establishing through evaluative trials to what specifications a standard product ought to adhere. This will involve the rejection of many opinions and the choice of the 'best' specification rather than the most popular specification. One example where this model has led to an acceptable solution is hospital beds made to the King's Fund specification. The development of this specification involved both recording subjective opinion and using objective measurement and analysis.

However, an example of where the 'experimental' and 'objective' method has failed to provide a wholly acceptable solution may be the Medresco hearing aid. Soon after the beginning of the National Health Service the Ministry of Health accepted a specification for hearing aids developed by a committee of the Medical Research Council. The 'Medresco' hearing aids are technically effective but are aesthetically unpleasing body worn models. Despite advances in miniaturisation the standard model has only been significantly changed once since its introduction (when it became possible to dispense with valves). A 'behind the ear' aid recently introduced was for children only and on an experimental basis. A single standard model may have been appropriate to the 1950s but viewed in the context of the 1970s, the present range of Medresco aids represents an extreme example of a failure to take account of at least one important criterion, in this case consumers' preferences (which may be as significant as technical effectiveness in determining take up of hearing aids). The decision to purchase only Medresco aids at low prices on contract from the Post Office also profoundly undermined the viability of the hearing aid industry.

The processes of standardisation in hospital supplies have attracted little research work. A series of case studies on attempts at standardisation could lead to a number of insights into the reasons for relative success or failure in particular instances, but without evidence from research of this sort it is only possible to discuss principles in very general terms and give illustrations on an anecdotal basis. Clearly, the approach of the hospital service to the problems of standardisation and variety reduction should be flexible since the

imposition of solutions from above is no more or less likely to be satisfactory than allowing them to flow up from below. Probably more important than the organisational framework within which standardisation takes place is the calibre of what may be described as marketing intelligence or research. This can be carried out either by the supply service or by manufacturing firms themselves. In the case of medical and nursing equipment industrial firms have often demonstrated a lack of appreciation of the need for this research. They have, for example, often developed a product on the basis of testing in one particular hospital or one particular department, only to find that the product which was ideal in one situation was unacceptable in another. With notable exceptions (as in the field of auto-analysers) industry has often shown a lack of understanding of the need to educate and change behaviour in order to obtain high levels of sales, together with the economies of scale and cash flow for further research which are associated with a high concentration of sales among a small number of products. For their part, supply services, though they might appreciate the need, have shown an equal unwillingness to take action to educate users and change behaviour on the basis of hard evidence from marketing research and evaluative trials.

Changes in this direction would depend on a considerable improvement in access to specialist expertise. The specification working groups in the past suffered from their reliance solely on part-time advice, often representing conflicting user interests, and from a lack of permanent staff to assist in the performance of research and the evaluation of results. Organisationally, a promising line of approach may be an extension of the terms of reference of existing supplies organisations to make them into a focal point for discussion and guidance to general management on all the economic implications of supplies and services. Standardisation, patterns of work, labour deployment and trade offs between goods, services and labour are all integrally related to each other and it is important that the extension of intensive research that has been proposed should take place within a sufficiently wide context.

Many of the issues involved in standardisation are similar to those involved in the development of new products, either by industry or the Department of Health. Increasingly, the Department of Health is taking the initiative in financing the development of high technology products such as atom powered cardiac pacemakers and neutron therapy, with the co-operation of research establishments and private industry working on a contract basis. However, there remain a number of areas where industry itself is engaged in developing new products for use in the hospital service. In those areas where costs of development are high and where the hospital service

provides the major home outlet for sales, purchasing policies are particularly likely to affect profoundly the viability of producing industries. Here again, the hearing aid industry can provide an illustrative example of the dangers inherent in the exercise of monopsonistic purchasing power. With the decision to exclude all aids except the Medresco from the National Health Service, sales revenue from hearing aids has continued to rely on a small private sector which has proved inadequate to support a significant British owned hearing aid industry.

The problem of creating sufficient cash flow to support the development of new products is particularly relevant to the medical equipment industry. Their performance in sales and export terms has lagged behind other developed countries (CSII 1970). As Norton (1970) suggested in relation to nursing equipment, this could be due to inability to appreciate the needs of users and a failure to recognise that extensive market penetration, upon which economic viability depends, is likely to require a considerable educational effort to change patterns of work and behaviour. On the other hand, the industry itself has pointed to the damaging effect of Health Service purchasing policies which demand the production of prototypes and long and expensive evaluative trials before purchasing decisions are finally taken. At least one major electronics firm has reached the conclusion that expected profits do not at present justify entry into the medical equipment field.

The problem is not unique to the medical equipment industry. There are many examples in the application of new products or new knowledge in the health services where the desirability of controlled trials must be balanced against loss of benefit from delay. In some cases early decisions may prove to be wrong and in some cases they may prove to be right. With medical equipment, and with nursing equipment as well, there may be strong reasons for taking early decisions and introducing a product onto the general market before necessarily long and expensive trials have demonstrated beyond doubt that it is superior to alternatives. Wolff (1971) commenting on this dilemma, used the term 'constructive waste' to describe the premature acceptance of 'wrong' products which is a corollary of early acceptance of 'right' products if all new products become available before exhaustive trials are completed.

The rationale is that rapid introduction of new technology would, if nothing else, expose user groups to advanced techniques at an early date, and also that it would provide manufacturing firms with a cash flow with which to fund prior and continuing development work. It would also provide home firms with a more stable base to develop products which are saleable in other countries apart from Britain.

Conclusions

In 1974 there is an opportunity for a radical re-organisation of hospital supply and its relationship to the hospital service as a whole. The key word in the National Health Service re-organisation is 'management', especially at the tops of administrative hierarchies, and it is certainly true that there are many areas where an improved management structure and a better organisational framework will remove a number of barriers to an effective supply service, and indeed, to effective management overall.

However, the potential for improvement through organisational change alone must nevertheless be very limited. The recent report of the Committee of Public Accounts (HMSO 1972) indicated a situation of insufficient financial control, towards the base of the administrative pyramid, which is unlikely to be resolved without more substantive changes including more capable and well motivated personnel at the 'grass roots' level with better access to useful information.

From the management side, as far as both standardisation and variety reduction, and day to day purchasing are concerned, more technical and management expertise is probably a first priority throughout the supply service. In so far as the users of supplies are concerned, a basic change in the motivations of professional user groups, making them less protective of their customary rights to exercise their own preferences in purchasing decisions, is likely to be of more value than structuring formal lines of authority in anticipation of orders from above.

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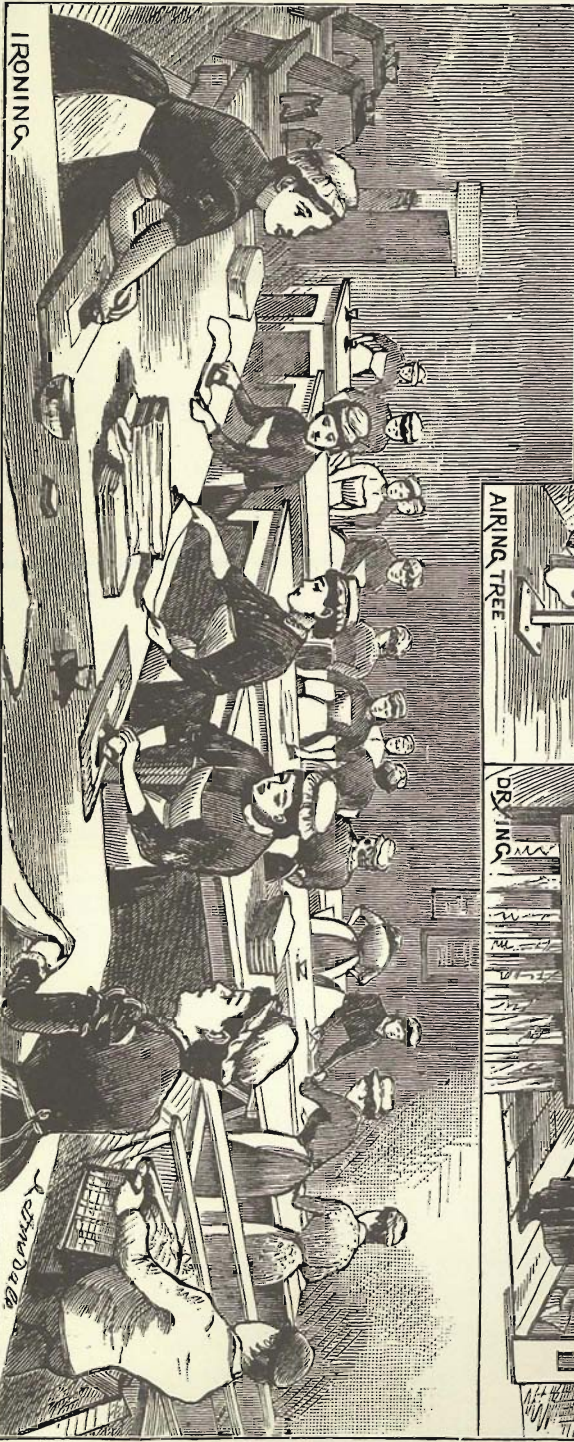
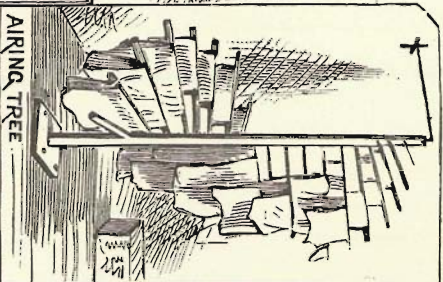
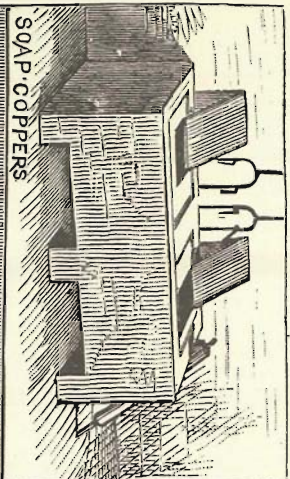
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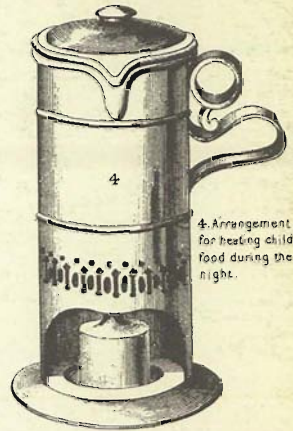


2 Breast Exhauster in use.

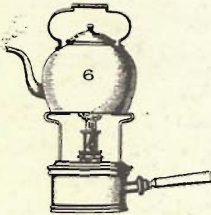
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1. Breast Exhauster.



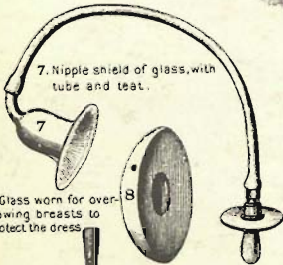
4. Arrangement for heating child's food during the night.



6. Ordinary kettle over spirit lamp used as a bronchitis kettle.



5. Arrangement of bed and kettle in cases of bronchitis and false croup &c.



7. Nipple shield of glass, with tube and teat.

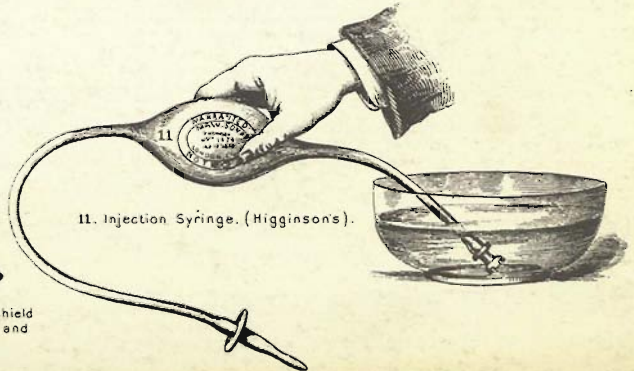
8. Glass worn for overflowing breasts to protect the dress.



10. Simple india-rubber bag and tube for injection.



9. India-rubber nipple shield in cases of hacks &c. and when nursing.



11. Injection Syringe. (Higginsons).