HOSPITAL DISPOSABLES.

Final Report on the Effects of using Disposable Goods on a Large Scale.

by

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DR. J.D. ALLAN GRAY, Consultant Pathologist to Central Middlesex and Acton Hospitals, has contributed an addendum on the effect of the disposables on the prevention and control of infection.

A. INTRODUCTION.

For an 18-month period between April, 1963 and October, 1964, the King's Fund, in conjunction with the hospital authorities concerned, financed the use of more than 100 different single-use products at Acton Hospital, having obtained preliminary experience of the problems to be explored during the course of previous 6-month pilot schemes in two wards each at the Royal Northern and Bedford General Hospitals. Acton is a small but busy general hospital of 85 beds and was regarded as particularly suitable for this experiment because the size limited the expense of research and facilitated close observation by existing staff, whilst the varied nature of the hospital's work made the Fund hopeful that other general hospitals at least would find the results useful in the development of their own policy on disposables.

The terms of reference were "to investigate the procedural and financial problems involved in the use of disposable equipment and materials and thus to help assess to what extent it is practicable and economic to use disposables in place of more conventional equipment and materials that are customarily cleaned, sterilised and used again". Procedural problems include the storage, distribution and disposal of disposables and these questions were discussed in some detail in the interim report ("Hospital" February 1964, and available from the Hospital Centre), together with a broad description of the various types of single-use product currently available from commercial sources. For these aspects therefore no more will be attempted here than to add any further relevant information that has come to light. The chief focus of attention in this final report will be the application of criteria in the establishment of priorities amongst disposables, their cost and compensating savings, as well as an indication of some possible future developments in this field.

A separate report was prepared by the Ministry of Health Central Organisation and Methods Unit in July 1964 entitled "Acton Hospital: Trial of Disposable Hospital Products", chiefly concerned with the measurement of the amount of time saved and the costs incurred in the experimental period.

That aspect of the trials which concerned disposable catering products has been the subject of a paper by Mr. G.J. Stormont, Catering Adviser to the King's Fund ("Hospital" November 1964 and available from the Hospital Centre).

Dr. J.D. Allan Gray, Consultant Pathologist at Central Middlesex and Acton Hospitals, has contributed a discussion concerning the effect of using disposables on the prevention and control of infection: this is appended to the present report.

B. EVALUATION OF DISPOSABLE PRODUCTS.

In a very real sense there can never be a final report in a field of hospital supplies which is developing so rapidly. The problem of basing judgements and measurements on a situation which is fluid rather than static is particularly acute in the case of individual product evaluations. The Assessment Committee (ward and departmental sisters, pathologist, medical/surgical registrar liaising with the Consultant staff, C.S.S.D. Supervisor, Ministry O. & M. officer, King's Fund representative, storekeeper, matron and hospital secretary, with help as required from group officers, Laundry Manager and Regional Board staff) felt the need to be specific rather than generalised in their comments, but appreciated that reports on individual products would have a far briefer validity, because of new developments, improvements, price fluctuations, change in circumstances, etc. than the broad principles and priorities which evolved from the review of such detail.

Nevertheless a number of representative individual disposable product assessments have been produced with answers to a series of questions of fact and opinion relating to suitability of design and packaging, acceptability to patients and staff, cost as compared with non-disposable techniques, details of delivery, storage, distribution and disposal, as well as a general indication of relative importance. An example was shown as part of the interim report and about 40 such assessments are, or will shortly be, available to enquirers from the Hospital Centre. They are all shown to the appropriate commercial suppliers for comment before a final version is produced and there has been remarkably little dispute as to their fairness, despite the criticisms we have freely made of particular items or features. We have not sought to give technical appraisals, nor to recommend any "best buys", but amongst matters which are often given all too little attention by commerce are strong but easily-opened packaging, convenient hygienic local storage and easy dispensing (preferably wall mounted), indication of sterilisation method and date, clear directions for use and means of safe but effective disposal. Particular products which have merited criticism have been, for example:

Syringes with unclear barrels, poor colour contrast between the graduations and the tip of the plunger, in packages which require cutting to open.

Needles without an easily understood indication of size or which simply are not consistently sharp enough.

Blankets which shred when tucked under the mattress.

Plates too shallow for stews.

Hand towels which are too rough and too small.

Bedpan drapes which cannot easily be separated from one another, resulting in a consumption at least 50% greater than necessary.

Ash trays which are too shallow and too flimsy for knocking out a pipe.

Dusters which cost 3¼d each and save only a very little rinsing time.

Sachets of mustard, consisting of one-third mustard and two-thirds air.

It may be of some interest that the Assessment Committee found it essential not to review any item until it had been in general use for at least a month. Initial opinions were very often extreme and diverse, but there was an understanding that the hospital staff would persevere with any items for at least a month, at the end of which time almost always a common body of soundly-based opinion had formed on which reliable decisions could be made.

C. CONSUMPTION AND COST INFORMATION.

Perhaps the greatest common interest in the trials at Acton is from those who wish to know which products are most useful, on what grounds and at what cost. Consequently an attempt is made in table 1 to give a list of disposable items which the hospital staff most wish to continue using after the completion of the trials, with an indication of the annual consumption and cost, the source of savings which might be set against that cost and a suggested classification in order of priority. This is an effort to offer guide lines from the experience of one hospital and the application of this information to other circumstances for other purposes must obviously be cautious. The following points should therefore be borne in mind when considering this material:-

1. Acton is an 85-bed acute general hospital, into which these disposables were introduced as fully as possible and of which the following may be considered to be the vital statistics for purposes of comparison with other units:

   4 wards, a major and a minor theatre: 32 medical, 25 surgical, 8 orthopaedic, 6 gynaecological, 6 T. & A, 3 E.N.T, 3 dermatological and 3 paediatric beds; 18,000 annual attendances in the casualty department, 19,000 in the out-patient department, 13,000 in x-ray and 24,000 in the physiotherapy department; 1,200 operations per year.

   Although the hospital was regarded as specially useful for this project because of its small size but varied work, in this connection it should particularly be noted that there is no independent laboratory and no maternity unit, so that the many disposables specially relevant to such work were not evaluated at Acton.

2. Most if not all the disposables cited in table 1 will be well known to people working in the health field and many have already become well-established in hospitals - often in spite of their cost rather than because of it - but have generally been introduced sporadically rather than as a deliberate act of management policy in full awareness of their organisational implications. This was the case at Acton Hospital itself, where 18 different disposables were already in general or limited use before the start of the trials at an annual cost of nearly £1,400: this

made precise before-and-after financial and time-saving comparisons difficult in some cases. The extent of their consumption and cost are however indicated in table 2, since for comparative purposes (if for instance any effort is being considered to estimate the additional cost and savings which might result from introducing disposables on a wider scale than at present) other hospitals would need to know how their own current "investment" in existing disposables compares with Acton's situation before the trials began. There can be few hospitals which do not support a number of single-use products which they have found beneficial and if for instance expensive items like syringes, needles, gloves, incontinent pads and hand-towels are already in use at a hospital, the extra cost of introducing the remaining significant disposables must be comparatively low, though equally the remaining advantages to be reaped from disposables will be small, if full advantage has already been gained from those that have been adopted.

3. The costs quoted in table 1 are those incurred by independent and small scale buying. In general it may be suggested that a scaling down of these prices by approximately 8% would give a fair indication of the cost when large scale buying and contracting can be introduced. Indeed there seems scope to follow and extend the example of certain Regional Boards and the London teaching hospitals in establishing inter-authority buying arrangements for disposables as for C.S.S.D. supplies. The scale of activity is also important when the effect on group functions such as buying, central storage, transport, laundry and accounting is considered. There was virtually no impact on these functions from Acton's 85 beds in a group of 1,300 beds, but these activities would almost certainly be affected if the whole group adopted disposables to the same extent. In general terms the biggest advantages from disposables can only be obtained by a big and conscious investment in them - piece-meal consideration tends to blur their cumulative impact and can lead to disorganisation and even financial chaos if their implications are not realised and provided for in advance.

4. The three criteria regarded as significant - reduced infection risks and the saving of staff time, in the light of the net additional cost - clearly justify a fuller discussion but, if a sub-division of the "A" priority section were required in order to distinguish a small number of disposables of the very highest importance, this would single out the small-bore clinical items used in direct contact with the patient - syringes, needles, catheters and cannulae, etc. This is the type of product which in its traditional re-usable form is the most difficult and time-consuming to reprocess efficiently and which is potentially most dangerous if that reprocessing (cleaning, sterilising, re-sharpening etc) is not 100% effective. Nevertheless it is recognised that an efficient

TABLE 1.

CONSUMPTION AND COST OF RECOMMENDED DISPOSABLES.

(See report, section C).

CATEGORY 'A' ITEMS (defined as vitally important products from the clinical point of view in reducing infection and cross infection risks as well as in saving professional time by the elimination of cleaning, sterilising and other processes).

Item.	Annual Consumption approx.	Annual Cost approx	Avoided non-disposable replacement costs where identifiable approx	Chief Potential Savings.
Staff Uniforms.				
*Face Masks.	15,000	£ 80		Nursing/laundry time
*Theatre Caps.	5,000	£ 35		" " "
Patients' Clothing.				
*Baby Napkins.	3,500	£ 45		" " "
Med. & Surg. Equipment.				
*Catheters, all types.	900	£195	£ 15	Cleaning & Sterilising time.
*Colostomy Bags.	1,300	£ 50		(Cleaning up time & cost (of dressings used therein.
*Finger cots & stalls.	3,600	£ 12	£ 8	Cleaning & Sterilising time.
*Examination gloves.	4,000	£ 40		" " "
Surgeons' gloves.	4,800 prs	£420	£170	Glove processing time.
*Ryles tubes.	150	£ 40		Cleaning & Sterilising time.
*Sputum containers.	3,850	£ 33		" " "
*Needles.	26,000	£235	£180	Cleaning, sharpening & sterilising.
Syringes.	19,000	£465		Cleaning & Sterilising.
Spigots.	600	£ 7	£ 4	" "
*Oxygen masks.	360	£ 29		" "
I.V. Cannulae.	450	£145		" "
*Urine drainage bags & tubes.	1,600	£ 75		Cleaning & disinfecting time.
Spatulae.	3,000	£ 4		Cleaning time.
Ventimasks.	72	£ 27		(Partial alternative to (use of oxygen tents.
Rectal tubes.	120	£ 8		Cleaning & sterilising time.
Hardware & Crockery.				
*Bags, various.	31,000	£165		Bin cleaning etc.
Bedding & Linen.				
*Bedpan covers.	48,000	£ 94		Laundry time.
Urinal bottle covers.	14,400	£ 26		" "
*Dressing towels.	180 rolls	£ 60		" "
*Incontinent pads.	7,800	£265		Nursing & laundry time.
Medical wipes.	800 boxes.	£ 20		Laundry time & dressings.
Draw mackintosh sheets.	2,400	£ 45		Nursing time.
Gross full year cost of 'A' priority disposables.		£2620	£377	

CATEGORY 'B' ITEMS (defined as valuable products on grounds of convenience and time-saving, but without any over-riding clinical advantage over traditional re-processed alternatives provided that their re-processing is done efficiently).

Item.	Annual Consumption approx.	Annual Cost approx	Avoided non-disposable replacement costs where identifiable approx	Chief Potential Savings.
Staff Uniforms.				
Nurses caps.	3,600	£ 45	£ 15	Laundry time.
Nurses collars.	2,000	£ 20		" "
Nurses cuffs.	700 prs	£ 10		" "
Patients' Clothing.				
Adult feeding bibs.	750	£ 10		Nursing/laundry time.
Dressings.				
Pre-sterilised packs.	6,570	£105	£ 75	Nursing time.
Med. & Surg. Equipment.				
Dressing forceps.	12,000	£ 60		Cleaning & sterilising time.
Medicine measures.	30,000	£ 43		Cleaning time.
Scissors.	300	£ 17		Sharpening cost & prolongs life of precision scissors.
Furniture etc.				
Bath mats.	4,800	£ 65		Laundry time.
Hardware & Crockery.				
Drinking straws, flexible.	1,200	£ 2		Nursing time.
Denture containers.	720	£ 5		Cleaning time.
Waste sacks, various.	15,000	£220	£ 23	Cleaning & portering time.
Bedding & Linen.				
*Hand towels.	3,700boxes	£425	£ 75	Roll towelling cost & laundry.
Inspection sheets.	6,000	£ 20		Laundry time.
[illegible] cloths.	3,000	£ 10		Rinsing time.
Serviettes.	96,000	£ 70		Laundry time.
Tray cloths, childrens.	3,000	£ 15		" "
Gross full-year cost of 'B' priority disposables.		£1142	£188	

* N.B. Items marked with an asterisk were already in use before the trials, though not necessarily to the same extent or at the same cost - see table 2. Compare tables 1 and 2 to see the cost and consumption consequences of the restriction to special uses only placed on the use of catheters, examination gloves, needles, drainage bags, oxygen masks and hand towels until the start of the trials.

TABLE 2.

CONSUMPTION AND COST OF DISPOSABLES IN USE BEFORE TRIALS.

(see report, section C)

Item.	Estimated Annual Consumption.	Cost.
Face Masks.	20,000	£115
Theatre Caps.	5,000	£ 35
Baby Napkins.	3,600	£ 47
Catheters (indwelling).	300	£120
Colostomy Bags.	3,600	£130
Finger Cots and Stalls.	750	£ 2
Examination Gloves.	2,250	£ 27
Ryles' Tubes.	150	£ 17
Sputum Containers.	2,500	£ 19
Needles (theatre).	1,200	£ 9
Oxygen Masks.	200	£ 14
Urine Drainage Bags.	250	£ 12
Bags (various).	30,000	£225
Bedpan Cover squares Bedpan Cover bags	62,500	£118
Dressing Towel rolls.	100	£ 40
Incontinent Pads.	20,000	£375
Hand Towel boxes.	600	£ 75
	Total Annual Cost	£1380

C.S.S.D. is able to meet the same standards of safety and professional convenience which we have used to emphasize the importance of the clinical disposables and this question of comparative efficiency in reprocessing is also further discussed below.

5. Catagory 'C' items (defined as disposable products which may have some value in specialised circumstances but which cannot be recommended for general use in their present form or at present prices) have not been fully costed, but examples include blankets (estimated at £1,320 per annum) and disposable crockery and cutlery (the full range estimated at about £3,700 per annum after allowing a credit for the value of saved washing-up time and the cost of breakages). Other items given this classification are individually-wrapped provisions, dusters, ash trays, tablecloths, sheets, pillow cases and such items of disposable clothing - gowns, aprons, surgeons' suits, overalls etc. - as are currently available at very high cost. This is not of course to say that improved versions of the same products, or prices more conducive to disposability, would not be worth consideration in the future, for the market situation is constantly changing.

6. The list in table 1 represents the common view of all the professions represented on the Disposables Assessment Committee and there was clearly a very high degree of unanimity on the evaluation and priority of the products under consideration. Nevertheless, inevitably a few products did not produce a unanimous expression of opinion, whilst a few others were introduced rather late in the trials and could not be assessed in the same way. The following items have therefore deliberately been left unclassified: children's bibs, infusion fluids, enemas, antiseptic cloths, mop-heads, toilet seat covers, papier mache bedpans and urinal bottles, vomit bowls and plastic bedpan liners. Some of these items would seem to be potentially of very considerable importance and justify serious consideration in hospitals able to subject them to a careful appreciation of advantages and disadvantages.

D. PRIORITY CRITERIA.

It is important to explain the reasoning behind the three criteria which have produced the classification commented on above, since it is suggested that any hospital considering the further development of disposables should ensure that its position is well-established with the items classified 'A' before investing too fully in those with a lower classification. Certainly this creation of an order of priority is extremely important because disposables, although generally representing higher standards, cost more (at least initially) by comparison with traditional techniques and scarce resources for which there are many competing claims must be used carefully: this implies the establishment of soundly based priorities.

Moreover the word "disposable" still tends to evoke rather extreme reactions and there is as much danger in an undiscriminating "disposables stampede", based on a rash presumption that anything new is good, as in the opposite over-restrictive attitude which sees the problems thrown up by disposables - cost, re-training, storage, disposal, etc. - as too difficult to be overcome. And this establishment of priorities must be evolved by close collaboration between all the varied professional interests legitimately concerned - medical and bacteriological, nursing and C.S.S.D., engineering, buying and storing, financial and administrative. Although the circumstances of each hospital and the opinions of each group of such professional staff will inevitably vary, these criteria have stood up to scrutiny from a number of sources and it is hoped that they, and the classification which they have produced, will have some general validity at least by offering a broad standard for comparative purposes.

1. Reduction of infection risks.

Dr. Allan Gray's addendum to this report, on the bacteriological aspects of the trial of disposables, deals with this matter and points out amongst other things the difficulty of establishing any causal connection between the use of disposables and the absence of significant cross-infection during the course of the trials. It would be impertinent for a layman to comment on the purely clinical considerations involved, but since the patient's safety is everyone's concern one may safely make the following comments from a purely administrative point of view:

a) There is in any case an indirect contribution from disposables to the patient's safety through the saving of time and the greater convenience to the professional user by their immediate readiness for use at the time of need, with a minimum of preparation, laying-up etc. This has chiefly been appreciated by the medical and nursing staff of Acton through the elimination of rush, risk and the short-cuts which inevitably result from having to do too much in too short a time.

b) The cost of an outbreak of cross-infection, as estimated from ward closures experienced before the trials began, is very high: not just in human suffering, isolation, transfer and other disorganisation of the hospital's life, but also in the financial sense of wasted resources (estimated at £2,500 when one 30-bed ward had to be closed for a period of 4 weeks) as well as the more obvious cost of bacteriological investigations, medication and disinfection measures.

c) Although the nurse is released from some of her routine non-nursing cleansing and sterilising tasks in the clean and dirty utility rooms and is thus able to concentrate more attention both on bedside nursing and on the measures needed to help avoid cross-infection, there is obviously no substitute for impeccable procedural technique and the

highest standards of personal and professional precaution. It would be a disservice if disposables were thought to permit any relaxation of standards. Indeed there is a very considerable task of re-training in new techniques if disposables are to be used properly.

d) Though no certain evidence can be adduced to prove a link between the use of disposables and the reduction of cross-infection, there is undoubtedly strong medical support for particular clinical items, in the belief that they represent a higher standard of bacteriological safety than products and processing techniques still in common use. This medical commendation has been given specially to such items as disposable napkins and drawsheets, bags, bin-liners and bathmats, bedpan and urinal bottles, catheters and spigots, colostomy/ileostomy bags, face-masks and examination gloves, intravenous cannulae, syringes and needles, oxygen masks, stomach and other internal tubing, sputum containers and hand towels. This largely turns on the known inadequacies of traditional sterilising techniques such as those on which the spotlight fell some years ago in the frightening Nuffield Report "Present Sterilising Practice in Six Hospitals". The general unsuitability of the boiling water steriliser and the manually opened and closed metal drum as sterilising equipment is now very widely recognised, but there is still a very long way to go before these items disappear altogether from British hospitals. If an efficiently organised C.S.S.D. has already displaced the inherited practices of the "boiler and drum era", all well and good. There would presumably be no bacteriological bonus to be gained simply by changing to commercially pre-sterilised disposables and the place of disposables would depend principally on the processing time saved, their convenience and efficiency in use and on sheer economics. This is no doubt why in North America, where a long-established background of effective Central Sterile Supply is far more common, there is no such striking contrast from the bacteriological point of view on transfer to a disposables regime and no substantiated claims are made that such and such a disposable "reduces cross-infection". As Dr. Carl Walter said at Chicago in July of last year "certainly there is nothing magic about the word disposable which renders out of date the essential concentration on efficient technique in processing and use". Nevertheless in this country, where sterilising in so many hospitals remains frankly primitive by modern standards, the commercially pre-sterilised disposable is one welcome addition to professional armoury in the constant fight against the risks of transmitted infection.

2. Saving of Personnel time.

Disposables eliminate processing. Consequently wherever processing in all its forms - cleaning, packing and sterilising, glove testing and powdering, needle sharpening, laundering, washing-up, dustbin cleaning, making up small articles from condemned bedlinen and so on - was formerly practiced in the continued re-use of non-disposable products, the time taken to perform those tasks is saved when such processing is replaced or reduced by the introduction of disposables. This saved time is almost all on the credit side and/the crucial question in this field is whether the savings of time can or should be converted into savings of money to go towards the cost of the disposables. To this we must give close attention, but the one significant item on the debit side is an increase of storekeeping and distribution which, in circumstances of deliberate independence from group arrangements for the purposes of the trial, totalled at Acton Hospital about 10 hours a week (say £150 per annum). Since the end of the trials greater reliance has naturally been placed on group central storage and existing transport communications, with no measurable extra strain on the latter, so that the additional net burden on storekeeping by increasing disposables at Acton from the 18 already stocked before the expansion to the 50 or 60 now in regular use represents about 3 hours a week. There is admittedly an initial period when unfamiliarity with a large number of new products can easily give the impression of a much greater increase in storekeeping and distribution and there are obviously circumstances where even a slight increase in the workload could not reasonably be absorbed without substantial extra cost.

Readers are referred to the Ministry O. & M. report already quoted for fuller details of personnel time saved and the following is merely an outline of the main features.

a) Ancillary Staff time.

The introduction of a paper waste sack system has greatly reduced the use of dustbins and pedal bins. About 5 hours portering time a week has been saved by the elimination of dustbin cleansing etc. whilst a similar amount of sewing room time has been saved by the introduction of disposable items which have replaced the practice of converting condemned linen into caps, face cloths, dressing towels, bedpan covers and so on. In both cases normal staff turnover gave the opportunity of reaping the financial advantage (about £120 per annum) of this saving of time and, although this is a comparatively small contribution towards the cost of the disposables affected, it is important that any such benefits should be used constructively rather pass unnoticed and unrealised. The introduction of a full range of disposable crockery and cutlery (plates, cups, beakers, bowls, knives, forks and

spoons of different sizes) on all 4 wards for a 3-week trial saved washing-up time to an extent which was determined as 6½ hours per day for the hospital. The value of this (about £800 per annum) cannot in itself justify the particularly high cost of single-use catering items (at present estimated at about £4,500 per annum) and many problems of design, packaging and cost must be solved before their use on a permanent basis would be considered at Acton for general as opposed to special purposes. Nevertheless the reduction of noise was greatly appreciated and the centralisation of washing-up and food service would almost certainly enhance the possibility of achieving substantial labour savings by comparison with the difficulties of disentangling washing-up time saved from the other duties of ward domestic staff when this activity is decentralised. Apart from the special considerations relating to infectious diseases and paediatric nursing, it seems possible that the first major inroad of disposable crockery and cutlery will be at evenings and weekends where enhanced labour rates of pay apply. A link with the cost of introducing the next reduction of domestic staff hours will also be apparent. Mr. Stormont's valuable report on this aspect of the trials, already cited, is especially useful in the analysis it gives of the acceptability of disposable ware to patients. Laundry time is saved when disposables replace the need for this particular form of processing. By applying the then average cost of 3.61d per article laundered at the Central Middlesex Hospital group laundry, a very rough estimate of £500 per annum notionally saved by no longer sending from Acton items such as disposable uniform collars, caps, cuffs, theatre caps, blankets, hand towels, serviettes and tablecloths, bibs and baby napkins (totalling about 700 articles per week from this 85-bed hospital) was deduced. However, this theoretical saving has not been brought to account, partly because not all the items mentioned have been acceptable on other grounds, but chiefly because of the extreme difficulties experienced and anticipated in making the savings real. For one thing the scale of activity is too small in relation to the total number of articles dealt with by the group laundry (about 60,000 weekly) for any saving to Acton to be more than a book-keeping adjustment since all the Laundry Manager's continuing costs have remained the same, being virtually unaffected by such a slight variation. Secondly the average cost per article laundered includes an element of handling charges and is a common denominator embracing a very wide spectrum of different items, the "real" cost of laundering which may be anything from a penny to a shilling. Since the majority of the disposables most likely to reduce the volume of laundry would eliminate small flat work towards the lower end of this scale it is

quite wrong to assume that, if the price of a disposable item is less than about 3½d, net laundry and replacement costs are necessarily going to be saved. Finally it is clear that there is an optimum throughput of this class of laundry work to which machinery, fuel consumption and labour use is carefully geared, so that it is quite possible that the only result of introducing laundry-saving disposables in unfavourable circumstances will be to leave the laundry facility working inefficiently without any real savings. Certainly it is worth examining, each on its merits, the economics of introducing paper and non-woven fabric disposables which might significantly reduce the cost of laundering and the most promising in this field appear to include bedpan covers, bathmats, dressing and hand towels, table linen and uniform caps, collars and cuffs. These however must stand or fall on clinical grounds - chiefly the avoidance of cross-infection risks - and few seem likely to justify themselves purely on economic grounds, although the question of standards complicates the issue, for true comparison with the single-use product would be a freshly laundered hand towel or serviette for instance on each occasion of use. It is probable that staff time saved amongst laundry operatives will be greater in the sorting and packing functions than in the processing itself, except where a high finishing standard is called for, hand ironing of decent quality being at such a premium in present labour circumstances, whilst the cost of overtime and other enhanced payments must also be considered favourable to disposables where the laundry is in any case understaffed. All this is of necessity generalised and is merely an attempt to outline some of the considerations involved in this highly complex field. What is certain is that a very careful act of management on a substantial scale is needed to produce savings from any reduction in the laundry activity, although of course where a commercial laundry is used by the hospital the immediate savings by sending fewer articles for laundering are more easily realised. In the long term however the whole planning of the laundry operation depends on a careful estimate of the predictably greater use of disposables in the future - this could include disposable clothing and bedding - and this development will surely have repercussions on the design, equipment and staffing of this facility.

b) Nursing staff time.

Most professional and technical staff are not personally involved in processing, so that the actual time which say doctors, radiographers or physiotherapists save by the use of disposables is minimal even though the convenience of their immediate readiness for use is a valuable factor. But nurses, rightly or wrongly, are involved in a wide variety of processing tasks and it is in the range of work of this profession that saved time has been found most significant.

The circumstances of each hospital are obviously different and there is significance in the fact that Acton Hospital employs no ward orderlies and has no central sterile supply department of its own, since the benefit of disposables to the nursing staff has been greater than would have been the case if central services and supporting staff had already been more fully developed. However, there are in the vast majority of hospitals innumerable cleansing, sterilising and other processing tasks still performed by nurses and there can be few hospitals whose nurses are not actually or potentially relieved of work of one sort or another by the adoption of disposable syringes, needles, catheters of all kinds and spigots, intravenous cannulae, feeding and stomach tubes, oxygen masks, dressing forceps, medicine measures, enemas, colostomy bags, bedpans, urinal bottles, napkins, feeding bibs, paper tissues, bathmats, urine drainage bags, incontinent pads, drawsheets, denture and sputum containers, surgeons and examination gloves, finger cots and stalls.

Amongst the most significant items of nursing time saved as measured in the particular circumstances of this hospital have been 5 hours a week for the theatre by the use of disposable surgeons gloves (because it formerly took about 3¼ minutes per pair to wash, powder and inspect the re-usable version) and 17 hours a week for the whole hospital from disposable syringes (because an average of 1½ minutes was previously needed to rinse a non-disposable syringe, dry, lubricate, re-assemble and pack for sterilising). About ½minute is saved per use by disposable bedpans and urinal bottles, 1½ minutes is saved on average every time a disposable catheter or tube is thrown away rather than being cleaned and prepared for re-sterilising, whilst other disposable items eliminating or reducing the time formerly spent by the ward and departmental nurses on some form of processing help cumulatively to produce a total nursing time saved by the use of disposables of the order of 45 hours per week.

It is difficult if not impossible to consider the clinical pre-sterilised disposables which are so significant in the saving of nursing time as outlined above separately from the whole system of providing the wards and departments with sterile supplies. Some time before the start of the trials it was decided to eliminate the use of ward boiling water "sterilisers" and drums in favour of a system of centrally autoclaved and individually wrapped paper packs containing all the instruments, towels and swabs needed for all dressing and surgical procedures. The reasons for this will be clear enough from the discussion above on the subject of reduced infection risks, but there was no immediate prospect of a C.S.S.D. service, either independently

or from a group department, so the responsibility for making the packs was accepted by the wards, whilst advantage was taken of existing transport links to Central Middlesex Hospital to use some of the spare capacity in the modern high-speed high-vacuum autoclaves sited there. This system - as an interim measure pending the creation of a full C.S.S.D. service - has proved to be quicker, cheaper and safer than that which depended on local sterilising. It has been described elsewhere ("C.S.S. without the D ", Hospital, November 1963 and Ministry O. & M. report "Acton Hospital: A comparison of ward sterilising and central sterilising") and is relevant here partly because about 35 further nursing hours a week are saved by this change of procedure and partly because it could not have been completed without the introduction of pre-sterilised disposable syringes and needles, since no satisfactory re-sterilising alternative was available for syringes and needles - the former re-processing system would have had to remain but for the adoption of disposables. This overall change in arrangements for the provision of sterile supplies, separate from but very closely related to the introduction of disposables, resulted in a fuel and maintenance saving by the elimination of local boiling water sterilisers, as indicated in section E on financial savings, but is particularly important in the present context in so far as savings of nursing time consequent upon the substantial use of disposables in combination with the revised sterilising system total some 80 hours a week - almost equal to two full-time nurses - of which 45 may be related directly, and 35 indirectly, to the use of disposable hospital products.

Other hospitals in other circumstances adopting disposables on a similarly large scale may gain greater or lesser benefits therefrom, but 80 hours of nursing time a week strikes us as substantial and highly significant in present staffing and financial circumstances. It is a most important task of nursing administration at the present time, first of all to be conscious that saved personnel time of this order is being made by the adoption of time-saving products and systems, but then to take the further step of using it, re-deploying it and benefiting from it in one way or another according to local opportunities and needs. In some hospitals it could be the salvation of a hard-pressed nursing service already under-staffed and unable to meet its basic obligations. In others re-deployment of nursing time may become feasible to cope with tasks which have been neglected, to raise the standard of ward management and practical nurse training or to correct inadequacies in nursing technique which have grown up in periods of high pressure, whilst there are continual suggestions that too little time is being spent at present by the nurse

with her patient in ordinary but professional human contact. In some hospitals, where staffing levels and nursing standards are regarded as adequate, it may be possible to consider converting savings of nursing time into savings of nursing money as a means of helping to meet the cost of the disposables which achieve it.

Nursing staff time saved is particularly difficult to utilize because it is widely disseminated amongst a large number of people and is built up from minutes and seconds saved in various places throughout twenty-four hours, so that it is not easy to gather this together without upsetting established routines and traditional staffing patterns. Nevertheless it is wise and currently opportune to consider this question of saved nurses'time (whether by disposables, by central sterile supply or by other means) in close conjunction with the reducing length of the working week. Lost hours of work, unless they were not fully occupied in the first place,which is unlikely, must be made up and money is set aside by the Ministry to enable this to be achieved. But it may be better and more economical in some circumstances to spend at least part of this extra money on an investment in products and systems which save nurses'time rather than seek to recruit additional staff who may be unobtainable anyway. This is not to detract in any way from the importance of human resources and clearly there is a basic level of staffing which must be maintained at all times and cannot be undermined. Nevertheless, that hospital is fortunate which can simply acquire extra pairs of hands to make good the hours lost by the shorter nursing week, so that other means of achieving economy and better utilization of nurses time merit serious consideration, means which do not displace existing nurses but go some way to avoiding the need to recruit more. Disposables are one such means.

Another major task which disposables present to nursing administration is that of ensuring that the training and re-training of nurses embrace the proper use of disposable hospital products. For that reason the nurse tutor plays a vital role in the team-work involved in introducing disposables on a large scale: Careful technique is just as necessary in the use of disposables as in the procedures which are displaced or changed by their use. The nursing administration will also have to consider carefully to what extent it is necessary to teach both the new and old procedures, not merely because of examination requirements but because many nurses will find themselves working in places in this country and abroad where disposable techniques are not practiced. In this matter a sound training in basic principles and the utilization of nursing imagination and initiative is the best safeguard.

3. Value for money.

This third and final criterion for the evaluation of disposables must be briefly explained. It did not seem wise to use the prime cost itself of single-use items as a starting point, partly because this would ignore the monetary value of savings in replacement costs, fuel/maintenance and staff time, but chiefly because in thinking of the establishment of priorities that would work themselves out over the coming months and years it would be a disservice to accept the straight-jacket of the "fixed budget mentality". Though limitations of finance are an ever present conditioning reality, it appeared justifiable to show the best of the disposables to be a legitimate clinical development, as significant in its way as any advance in drug therapy or medical equipment for instance - fields in which progress is rarely cheap but cannot ultimately be curbed. Worthwhile disposables surely deserve similar financial resources, in spite of their cost if it is high, and this cost, together with the savings that go towards it, is indicated in summary form in the "balance sheet" shown in table 3. It would clearly be mistaken to expect such a development to be contained within a fixed and stable budget and its claims must be considered in balance with all the other developments which need extra money for their implementation.

Nevertheless it was necessary throughout the trials to maintain a financial sense of proportion - value for money - for some disposables, though valuable in themselves, seemed at the prices then ruling to exceed the cost of former products and techniques by so much/that their overall "worth" in normal circumstances was in doubt. It was for this reason that disposable blankets, sheets and pillow cases, crockery, cutlery and individually wrapped provisions had only short term trials which did not last the whole 18 months of the overall experiment, whilst as another example it was generally agreed that a disposable duster, though widely liked by nursing and domestic staff, did not represent good value for money at 3½d each. By contrast, such high cost items as disposable syringes and incontinent pads have merited their priority because they have many substantial advantages (some of which can be realised in financial terms). This criterion has therefore been used, cautiously but intentionally, in the classification of single-use products evaluated in the course of the trials.

E. COMPENSATING SAVINGS AND FINANCIAL SUMMARY.

All that has been stated so far may be regarded from the financial point of view that, given the desirability of a large scale use of disposables on professional grounds, their cost is such that a strict order of priority must be established and the maximum financial benefit must be secured in the realisation of compensating savings.

TABLE 3.

SUMMARY OF COSTS AND SAVINGS.

(see report, section E).

Expenditure.	£ p.a.	Avoided Expenditure.	£ p.a.
Gross cost of 'A' priority disposables	2620.	Avoided replacement costs (on 'A' priority items £377, on 'B' priority items £188)	565
Gross cost of 'B' priority disposables	1142.		
Gross cost of recommended disposables (from Table 1)	3762.	Net fuel/maintenance savings by elimination of boiling water sterilisers.	430
Less Gross cost of disposables already in use (from Table 2)	1380.	Salary and wages savings (ancillary £120, nursing £750).	870
Gross extra cost of recommended disposables	2382	Net additional cost of recommended disposables.	567
Cost to H.I.C. of extra storekeeping time	50		
	2432		2432

It is possible to set down some kind of rudimentary "balance sheet" from the experience gained at Acton and this is shown in table 3. This should be read in conjunction with the following notes:

1. To other hospitals in other circumstances the figures quoted could of course serve only as a guide to the headings under which expenditure may be incurred and savings realised.

2. Particular items not brought to account include, on the debit side, the operating costs of two small ward incinerators (because they were introduced experimentally to evaluate local means of disposal as opposed to the existing central arrangements which would have been adequate to consume the increased volume of waste: the particular gas and electric models were of 1¼ cubic foot capacity and cost £72 and £40 per annum respectively in annual fuel cost). On the credit side the chief item excluded is the notional saving of £500 per annum in laundry costs (because, since no real saving in the group laundry's expenditure was achieved by such a very small reduction in use, the overall effect is merely a cross accounting adjustment). Similarly the scale of activity was too small by comparison with the work of the group as a whole to take any account of increased storage running costs (apart from the storekeeper's wages), whilst there was no noticeable impact on ordering, accounting and transport costs. Finally the potential saving in the provision of hot water or steam supplied to the ward by the adoption of the disposable bedpan system (about £70 per ward per annum) has not been included because on the basis of present evidence it is not intended to extend its use beyond the one ward which experimented with a papier mache disposal machine, although new hospitals might well secure greater financial advantage.

3. King Edward's Hospital Fund for London financed the initial outlay costs of this independent investigation as well as the running expenditure for the period of trial and amongst non-recurring items which other hospitals may or may not have to take into account are the cost of erecting and servicing additional central storage, purchase of additional means of distribution and local storage, purchase and installation of additional means of disposal. It is not easy to give an estimate of the collective financial implication of these factors since the experimental expenditure for the trials was atypical, but for Acton Hospital the additional storage, distribution and disposal facilities would probably not have exceeded £1,000 in cost if it had not been decided to establish main storage independent of group facilities.

4. Comparison of costs before and after the introduction of disposables is not a comparison of like with like. Non-disposable syringes were used and used again which were ill-fitting, needles were not freshly sharpened for each use, hand towels were used a number of times between launderings and so on whereas an efficiently produced disposable represents a freshly manufactured item in "mint" condition every time. Thus the use of disposables often signifies a higher standard than obtained previously.

It will be seen from table 3 that savings have been made at Acton of three distinct types:

1. Avoided replacement costs.

This is the most obvious saving and is made by the reduced need to purchase re-usable products. Examples vary from the comparatively high replacement rate and the cost of surgeons' rubber gloves, through the breakage rate of glass syringes and replacement of needles when beyond sharpening to the renewal of perished red rubber and condemned linen and the minimal replacement costs of stainless steel. Only those items have been included where replacement costs would be easily distinguished and the total saving is certainly greater than the £565 per annum quoted because no attempt has been made to take account of the longer life items which are renewed only at most infrequent intervals. New hospitals or new departments can avoid certain initial outlay costs on glass, stainless steel, rubber, linen etc. if it has previously been decided to use disposables on a large scale. This is of course at the expense of the continuing cost of the disposables themselves, but an additional saving may be achieved in the capital and revenue costs of processing facilities.

2. Fuel and maintenance economies.

This saving of about £430 per annum is the net result of removing the boiling water sterilisers from the wards and departments of the hospital, made possible in part by the adoption of centrally autoclaved paper packs and in part by the purchase of commercially sterilised disposable syringes and needles in circumstances which have already been explained. These "sterilisers" were in use for an average total of 5½ hours per ward per day and gas consumption based on this usage was £400 per annum. To this is added the saving on maintenance, repairs and additional decorating amounting to £160 per annum and against this gross saving of £560 per annum must be set the cost of packaging materials for the autoclaved packs, about £130 per annum. This net saving of £430 would certainly not have been possible without disposables, and other hospitals still using boiling water sterilisers might well find themselves in a similar position, but the actual extent of the saving is closely linked with the

circumstances of this one hospital and certainly no substantial economy under this heading would be likely where the central provision of all sterile materials has already been achieved.

3. Staff salary savings.

It has already been suggested that conversion of staff time saved into staff money saved is the most difficult, though the most pertinent, problem in the economics of disposability. The ancillary staff time savings in portering and sewing-room functions were small and were realised in the course of normal staff turnover, but for the reasons outlined above (under section D.2) it would have been extremely difficult to do the same with the considerable amount of nursing time saved were it not for the advent of the shorter nursing week. Other hospitals might well not be in a position to even think along these lines, but it was decided as a matter of policy at Acton to make the equivalent value of the nursing time saved (about £1,300 per annum) a first charge against the money set aside by the Ministry to implement the reduction of hours from 44 to 42 per week. This could otherwise be stated as the deliberate avoidance of trying to recruit three additional nurses to make good the lost hours in favour of recruiting one extra nurse and making an investment in products and techniques which save nursing time to the necessary extent. However only £750 has been brought to account in the financial summary because 45 hours is the weekly time saving resulting directly from disposables, but it is perhaps worth pointing out that the value of the remaining nursing staff time saved (35 hours per week from the centrally autoclaved pack system) more than covers the net additional cost of the recommended disposables. In other words the total provision of sterile and other consumable materials to the wards and departments has been significantly improved without any addition to the hospital's running costs. Previous comments about the economy of a larger unit of purchase are also relevant in this connection.

However if we can isolate the potential effect of disposables alone on the hospital's budget, it would be reasonable to conclude from the foregoing that, whilst the higher standards achieved inevitably result in an increased cost compared with former techniques, the compensating savings, if they can be achieved, go far towards covering this expenditure.

F. IMPACT ON HOSPITAL ORGANISATION.

The interim report published a year ago offered a fairly detailed coverage of this subject under the headings of storage, distribution and disposal. There is little more to add on these aspects of the hospital's organisation and the following should therefore be regarded only as an additional brief commentary in the light of the often expressed fears that problems in this field will inhibit the development of single-use products.

1. Storage at hospital level.

Now that fewer than 60 disposable products are in general use the storage space required for these at Acton Hospital is approximately 200 sq. feet in a hut 9 ft. high. The minimum shelving depth advocated is 18 inches and there was great advantage in the fact that the shelving was adjustable vertically between each pair of uprights. Naturally the widespread use of sizable disposables would extend the storage requirement, but we have concluded that regular and frequent programmed deliveries of the bulkiest items - bedding, clothing, hand towels, bedpans, urinal bottles and incontinent pads - can mitigate the storage problem considerably. On the other hand this is an example of the considerable dependence which the hospital has on its sources of supply by a large scale use of disposables and these programmed deliveries must be completely reliable. The pre-sterilised clinical items which are at the heart of the disposables development are significant in that they make comparatively little demand on space.

2. Storage at ward level.

The same bulky items mentioned above tended to represent the chief problem at ward level, but much depended on the frequency of distribution. In the event only bedpans, urinal bottles, crockery and cutlery needed distribution more frequently than once a week in relation to ward storage limitations. We remain pleased with the stacking wire baskets for storage and distribution, mounted on a simple base frame with castors, and we strongly advocate the development of wall-mounted dispensing units for disposables. Adequate protection combined with a saving of scarce horizontal space put disposables offered in this presentation ata premium. On the other hand there were other single-use items - notably the crockery and cutlery - where re-handling after breaking down from bulk for ward distribution was unhygienic and time consuming simply because of thoughtless and inadequate packaging.

3. Disposal of used disposables.

With the exception of special products such as papier mache bedpans we remain of the opinion that the disposal technique of choice at the present time is incineration and that responsibility for the safe, speedy and effective disposal of soiled dressings and used disposables cannot be passed to the local authority without the most stringent safeguards. At Acton Hospital no difficulties were experienced with the incineration of the additional waste on the hospital boilers, but to use a heat-producing device for the destruction of waste is bad practice. There has been a problem of disposing of soiled dressings, pathological waste and other matter long before disposables made their additional impact

and every sizable hospital needs its own purpose-built destructor. Nevertheless we have been delighted with the performance of the small ward incinerators - one electric, one gas-fired, both about 1¼ cubic foot - which have efficiently reduced waste of all kinds (including rigid and soft plastics, disposable needles and aluminium foil, provided that the proportion of these difficult materials represents no more than about one-third of the total load, a proportion which is very rarely exceeded in normal ward practice). Until quite recently small incinerators have been strictly limited in their capabilities, but it is gratifying to note the progress in this field for it seems logical that soiled and potentially infected waste should be destroyed as soon as possible after it has been produced. This implies incineration at ward or floor level and it may well be worth considering suitable provision along these lines in the planning of future units. There has been ample capacity in relation to the needs of these 20-bed wards and we have generally preferred the model which allows access of waste to the incinerator at any time, without waiting forthe end of a cycle.

Finally in this connection it may be worth emphasizing that it is equally essential to have a safe and effective means of conveying waste to the disposal point as it is to have a safe and effective means of disposal. The various destinations and the types of waste are perhaps best distinguised by the colour coding of the paper or polythene waste sacks, but special precautions are likely to be necessary for the potentially dangerous used disposable needles and cannulae. Here again the problem has been exacerbated, but not created, by the advent of disposables.

4. Special departments.

It is very likely that certain specialized activities will produce a distinctive attitude to disposables that is legitimately different to that of the average general hospital. For instance the special factors involved in infectious diseases nursing, midwifery and intensive care units may well emphasize the criterion of reduced infection risks in evolving a policy on single-use products. The convenience of immediate readiness for use and the time saved by the elimination of processing and preparing may have a special premium in accident centres and local authority ambulance and public health work. In psychiatric and geriatric units the emphasis may be not so much on saving time in itself as on the patients' long-term comfort and the reduction of dirty and unpleasant tasks. These special attitudes are not well represented by the views of one small general hospital and deserve special consideration elsewhere. The only tentative guidance that can be offered from Acton's experience is the apparent differential between the demands of medical and surgical care,

America there is very great concern and discussion about this subject at the present time and, whilst no complete or cheap answer is envisaged as yet, in this country we hardly seem to have reached the stage of stating our requirements. Of course quality control is a diffused problem and certain freedoms for both supplier and customer must be safeguarded, but ultimately our common responsibility is to the patient and with our more unified hospital structure we should be able to deal efficiently with this whole matter of quality control and standards. Perhaps it would be a useful start to have from the Ministry, for the benefit of supplier and customer alike, a basic statement of what points need to be checked.

Where prices have increased in this period - notably for bedpans and urinals, hand towels and paper waste sacks - it may be significant that there was little that could be done about the situation because of the associated "capital" investment which had been made. In the case of the bedpans there is currently no alternative supplier and a return to previous techniques would involve wasting the money spent on the disposal unit and associated plumbing as well as the price of new equipment. In the case of hand towels and paper sacks there are alternative suppliers but the outlay on dispensing units and sack holders would be in jeopardy.

These are merely illustrations of the increasing dependence of hospitals on their commercial suppliers, by comparison with the period when self-sufficiency based on independent hospital processing was more common, and the point could be made equally from the aspect of continuity of supplies. Storage at hospital level in general does not permit long-term stock holding, so that regular deliveries are absolutely essential: in such circumstances inability to supply or broken delivery promises are a dangerous insult. The initial responsibility to ensure that the hospital is safely, rather than precariously, in the hands of its suppliers is that of commerce, particularly in relation to its stock holding and agency arrangements, which need radical re-thinking for the disposables era, but hospitals can help them meet this obligation by arranging long-term contracts with regular programmed deliveries against one order. This also reduces paperwork to everyone's advantage and where this buying method has been used at Acton (for the bulkiest items) we have been pleased with the results since adjustments up or down, though easily made, have rarely been needed. There have however been occasions when regular deliveries were not as regular as intended.

If prices can at least be kept steady, if not reduced as the market and unit of production expand, then the disposables development seems very likely to make further inroads on purely economic grounds because the cost of the alternative - hospital processing of re-usable products - is clearly rising with the increase in cost of the dearest element, the wages of the hospital staff who do the processing. Since industry specializes in making

and processing things and has the advantage of size one can expect the products of industrial activity to be cheaper (and possibly better) than those of hospital activity over a widening range where there are alternative equivalents.

However there is more in the relationship than purchase at a price. The best commercial representatives are technical experts in their own right who have a vital contribution to make to the hospital's life, even though there are still some hospital officers who seem to regard the representative as a kind of inferior being. On the other hand the distinctive marketing technique for disposables is not always recognised by commerce, for the organised field trial with a proper report at the end is far more valuable to all concerned than the traditional leaving of a few samples with whoever can be persuaded to spare the representative a few minutes'time. Opinions resulting from such old-fashioned salesmanship are highly individual and unreliable in the case of single-use products and hospitals must encourage the more thorough and systematic approach. Herein lies the value of product evaluations, for these help to indicate defects in existing products which can be remedied, but we have the additional responsibility of stating requirements for new disposables. It is not intended to offer a list of such needs here and everyone will have his own ideas on this matter, but amongst products which would seem to be highly desirable at reasonable price are: pre-sterilised disposable feed teats; composite single-use packs for procedures such as skin preparation, removal of sutures and catheterisation; bedside products to assist in dealing with the problems of isolation nursing; and disposable gowns, which in a small number of simple modifications from the standard would be expected to serve the needs of the surgical team, midwifery staff in hospital and the home, as well as being invaluable in barrier nursing, bedpan and dressing "rounds" and in ending the unpleasant practice of sharing out-patient and x-ray dressing and examination gowns.

I. THE PATIENT'S VIEWPOINT.

Public familiarity with certain "domestic" disposables which were tested in a hospital context is increasing and there was a high degree of acceptance of disposable crockery and cutlery as well of such disposable bedlinen as was available during the course of the trial. This was tolerance rather than enthusiasm and was far more marked with short-term than with long-term patients. Indeed there is a school of thought which strongly recommends that the patient should be exposed to as little as possible that is strange and unfamiliar when he is in the critical stage of illness, especially when isolated. However the criterion must surely be whether the standard of patient care is improved or not by the use of such disposables and more good "bedside" single-use or single-patient items - water carafes and cups, soap dishes, ashtrays etc. - would be welcomed on ground of time-saving and

general hygiene as well as the specific reduction of infection risk in the case of barrier-nursed patients.

"Before and after" comparisons are not feasible in the case of patient reactions to clinical disposables, but systematic conversation with a large number of patients has made it certain that there is a genuine appreciation of the fact of single-use in the case of syringes, catheters, colostomy bags, oxygen masks and so on, whilst comparison between the sharpness of the average re-usable needle with that of the best disposable versions leaves no doubt as to which is more appreciated by the patient. This is probably more significant than the results of any questionnaire, especially when combined with the realisation that the patient's best interests are served by using products which raise the standards of safety and release nursing staff from routine processing tasks to give greater attention to good technique and more bedside care. Products and techniques which offer such advantages are surely worth careful and thorough investigation.

J. GENERAL CONCLUSIONS AND SUMMARY.

As was stated at the outset, we have been conscious throughout the trials of hospital disposables that most of the items themselves are already well-known and that appreciation of their advantages and disadvantages is already widespread. Thus we have felt it right to concentrate less attention on the constantly changing products themselves than on their significance to the hospital's total organisation and therapeutic effort. Where it has been feasible to offer measurement, price and detail generally we have done so, not in the sense of trying to create "orthodox theory" - legitimate differences of opinion, variations between hospitals and the continually evolving supplies pattern would make this valueless as well as presumptuous - but because so little has been published to date on this subject that there is a clear need for something definite to be said that can be used as a yardstick or guide by others to compare or shortcut their own work. Disagreement with our findings above, in the interim report and in the general conclusions below is inevitable and healthy, but is of greatest value only if it too is published so that we can all benefit from facts and opinions expressed in such a way as to help form sound judgements and policy decisions in a field where they are at present most necessary yet most notable by their absence.

1. There is an increasing professional demand for and commercial supply of hospital products in single-use form, but they are not always being considered systematically by the hospital world with realisation of their overall impact.

2. This impact extends to storage, distribution, disposal, reliability of supply, cost and savings as well as to the clinical factors of safety in the treatment of our patients and the saving of personnel time. The problems do not appear to be insurmountable, provided that they are foreseen: they should however be affecting the present designing of future hospitals, although these implications are currently hardly more than being guessed at.

3. A reduced risk of infection by the use of disposables may be assumed but cannot be proved. Nevertheless the medical profession in general is welcoming the disposables development on grounds of convenience and safety.

4. The saving of staff time is considerable and is particularly significant in releasing professional, scarce and costly time for more purposeful activity than the making and processing for re-use of products in which the hospital attempts to be independent. This saving of time extends beyond professional to ancillary staff and there is a present or potential impact on the scope of hospital processing departments such as laundry, sewing room and C.S.S.D.

5. Application of the twin criteria of safety and time-saving against the background of cost emphasizes the significance of "clinical" rather than "domestic" disposables and this is reflected in the order of priority offered, with information on consumption and cost, in the body of this report.

6. Savings in avoided replacement costs, fuel economies and staff time can go a long way towards meeting the cost of disposables, particularly if the savings of staff time can be converted into savings of staff salaries and wages. This is difficult, but is essential to the economics of disposability and requires a conscious and informed act of management. Moreover there seems room for standardisation and a larger unit of purchasing which might stabilize or reduce the cost of disposables. Indeed as the labour cost involved in hospital processing continually and inevitably rises, it seems likely that more and more commercially produced disposables for a growing market should make a widening inroad into hospital supplies. On the other hand some net increase in cost by the use of disposables seems likely and represents the development of a higher standard which must be seen in context with other claims on the hospital's budget. This necessitates the creation of a careful order of priority by management in consultation with the wide range of professional interests legitimately concerned.

7. Disposables eliminate processing and in general the principle is accepted that industry rather than the hospital should undertake the making and processing of most hospital products. Nevertheless greater attention

must be given by industry to satisfying the hospital world's reasonable requirements on design, packaging, supply lines, ease of disposal and above all quality control.

8. The hospital world has a parallel responsibility to systematize its means of informing commerce of its agreed requirements, standardised wherever possible.

9. Disposables deserve separate study because of their special nature but must also be related to their context to avoid distortion. In the fight against cross infection they may be related to the advantages of improved ventilation, ward design, treatment and isolation facilities, C.S.S. arrangements, drossing and operative techniques, drug therapy and personal standards of precaution. In the saving of professional time they must be evaluated in the light of central sterile supply again, other central services such as central wash-up and food service, speedier treatment techniques and the further development of supporting less-highly skilled assistant staff. Nevertheless the use of time-saving disposables is obviously very relevant to the effective and economical introduction of the shorter nursing week, and may be of particular benefit where recruitment is difficult.

10. The needs of the other branches of the health service - the local health authorities and the general practitioner service - must also be related to the purchase and availability of disposables in hospitals and the economical buying and efficient distribution and disposal of these products in the interests of the total health effort must be considered urgently at the highest level.

11. The next logical stage of investigation would be into the particular considerations involved in the use of disposables in special departments - infectious diseases, maternity, intensive care units, geriatric and psychiatric nursing - whilst the organisation and financial effects of a larger scale of activity than was possible at Acton should also be the subject of study.

12. Disposables are of great potential value but they produce certain problems and their implications are far reaching. In the longest possible view which we are capable of taking with our limited foresight at present, they may, in their undermining of "local" processing, be seen at some time in the future to be a fundamental consideration in a good deal of "hospital automation", understood as the rationalisation of all kinds of supply services and communications to the point of use, with the attendant implications on hospital design and function. Whilst this is necessarily part of a vast concept of which hospital research has as yet barely scratched the surface, it is hoped that the workdone at Acton may serve as an outline of the disposables development and suggest some of the possible ways of managing it in the interests of effective and economical medical care.

THE EFFECT OF THE DISPOSABLE GOODS ON THE PREVENTION AND CONTROL OF INFECTION.

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The trial began officially on 1.4.63, but before that date eighteen disposable articles were already in use. These were baby napkins, paper bags, bedpan covers, theatre caps, indwelling catheters, colostomy bags, dressing towels, face masks, finger cots, examination gloves, incontinent pads, injection needles, oxygen masks, Ryles tubes, shrouds, sputum containers, hand towels and urine drainage bags. After 1.4.63, the stocks of the non-disposable items were allowed to run down and a complete range of the disposable items was gradually introduced. The trial was fully implemented by 1st July, 1963. All the disposable items continued to be supplied until the 30th June, 1964. Thereafter the supplies of them left over were allowed to run down and by the end of September the hospital was using non-disposable equipment except for the same 18 items which were in use prior to the trial and certain additional disposable items which have been continued pending consideration of their usefulness and cost.

THE RESULTS.

Records are kept of every organism found which is likely to produce cross-infection. Their numbers for each month from January, 1963 to October, 1964 are given in the table. The specimens which yielded these organisms were the usual ones for a general hospital and, therefore, included those from casualty such as boils, carbuncles, pus, septic fingers and swabs from the throat, ear, eye and other parts of the body, and two breast abscesses (following confinements, one at Central Middlesex Hospital and one at Chiswick Maternity Hospital). Most of these infections had, as far as can be ascertained, been contracted outside the hospital. The specimens also included material from stitch-abscesses, varicose veins, bed-sores, ulcers of the foot, leg and neck and sputa. Few deductions can be made from the total numbers of the different organisms found.

Staphylococcal infections. All strains of Staphylococcus pyogenes found are phage-typed so that their origin and spread may be traced. The finding of staphylococci of the same phage-type on two or more occasions within a short period in the same ward is presumptive evidence of cross-infection. Staphylococci of phage-types 80, 81 and 80/81 are notorious for producing epidemics and the number of times on which each of these types was isolated is given in the table. In March, 1963, i.e. immediately before the official start of the trial, staphylococci of phage type 80 were obtained on sixteen occasions. They were widely disseminated in ward A and were spreading to wards C, D and B as well. As the nidus of the infection was in ward A, admissions to that ward were stopped on 17.3.63. The ward was empty for cleaning and disinfection between 17 and 23.3.63, when admissions were restarted. The number of patients took about a week to build up to normal. The infected patients in the other wards were transferred to Neasden Hospital. Although staphylococci of phage-type 80 have been isolated on several occasions since there is no evidence since May 1963 that any of these infections were cross infections. Staphylococci of that phage-type were not found at all during March, April and May 1964.

This outbreak of staphylococcal infection was unique in the history of the hospital and its occurrence just prior to the start of the trial demonstrates how such an outbreak, unrelated to the trial, might tempt one to make unwarranted assumptions on the influence of the disposables on the incidence of infection.

Other staphylococci obtained showed phage-patterns either identical to or at least closely similar to each other but these were from either out-patients or patients in Casualty or in-patients in different wards, so that there was no evidence of cross infection. A few operation

wounds yielded staphylococci but none of these were serious infections: they were not related to each other and did not give rise to further infections within the hospital.

DISCUSSION.

It is difficult to assess the effect of the introduction of sterile disposable goods on the incidence of infection because so many factors are involved.

Major principles have been determined and accepted as essential for preventing cross-infection but many of them have, of necessity, to be transgressed daily because of the inadequacy of the hospitals and their equipment. (1) The facilities for the segregation of infected personnel are frequently inadequate. Patients therefore specially liable to spread infection and others specially susceptible to infection may be accommodated in the same ward. (2) The ward staff may carry pathogenic organisms either unknown to themselves or because they fail to report sick when they should, and they are in a key position to disseminate these organisms to susceptible patients despite the efforts of the Control of Infection Officer. (3) The patients' inanimate environment may act as a reservoir of pathogens. Good domestic cleaning methods, however, can keep down the number of organisms on the floors, walls, ceilings and furniture of the wards; brooms can be replaced with vacuum cleaners fitted with filters on their exhausts; plastic covers can prevent mattresses and pillows being contaminated; sheets and suitable blankets can be laundered frequently and all equipment can be made of materials which can be disinfected. (4) Theatre and ward techniques should be those which are the least liable to convey pathogens. In the past many infections in different hospitals have undoubtedly been caused by the use of contaminated instruments and dressings. Syringes and needles

have conveyed infectious hepatitis; dressing wool has contained the spores of tetanus and catheters and drainage equipment have conveyed organisms to the urinary tract. It is in this field that disposables can and do eliminate many means of infection and the medical and nursing staff are entitled to be able to trust the sterility of the instruments and dressings they use. The benefits conferred by sterile instruments and dressings, however, may be largely counteracted if the theatres, wards and domestic equipment are themselves inadequate in structure and if operation wounds are dressed in the ward instead of in a "sterile wound" dressing-room supplied like the theatre with bacteria-free air under positive pressure.

The provision of sterile disposables has a beneficial effect on the morale of a hospital. They ease the work of both the medical and nursing staff and allow them to concentrate on the measures essential for the control of infection instead of being harassed by having to accomplish too much work in too short a time and having to attempt to sterilise articles by methods which they know to be ineffective.

SUMMARY.

There is no doubt that the use of disposable items of sterile equipment eliminates many of the chances of infection. Their introduction is therefore desirable but their use alone will neither prevent nor control infections due to other causes such as failure to segregate carriers and infected patients and staff and failure to provide adequate theatres, wards and equipment.

TABLE.

		Number of isolations of infectious organisms.	Isolations of Staph. pyog of phage types 80, 81 & 80/81.		
1963	Jan.	54	3		2
	Feb.	49	1		
	Mar.	71	16	1	2
	April.	48	5		
	May.	35	4		
	June.	46	2	1	
Period in which the Trial was fully implemented	July.	48	1		1
	Aug.	36	2	2	
	Sept.	30			
	Oct.	34	1	2	
	Nov.	24	1		
	Dec.	30		1	
1964	Jan.	32	1	1	
	Feb.	40	2		
	Mar.	23			
	April.	25			
	May.	15			
	June	24	1		
	July	34	1		
	Aug.	51	1	1	1
	Sept.	37	1		
	Oct.	17	3	1	