INTRODUCTION.

Much has been written about the various factors which cause or are thought to cause "cross infection" of wounds in hospital. In most investigations an individual problem such as theatre ventilation or the sterilisation of blankets has been studied in detail. The introduction of one such measure, although a step in the right direction, is unlikely to produce dramatic or permanent results. When, however, all the preventive measures which are known or thought to minimise "cross infection" are introduced simultaneously in one hospital one might expect a reduction in the incidence of infection of clean surgical wounds.

The known factors which influence "cross infection" are many and the necessary preventive measures involve the expenditure of large sums of money. At the Victoria Infirmary (a 500 bed General Teaching Hospital) it has been possible in the last year to introduce all the major preventive measures to the whole hospital. This has been possible because of four main factors. Between 1961 and 1963 nine new operating theatres have been opened, replacing the archaic facilities previously provided. These are of modern design and have full positive pressure ventilation with refrigeration. The second factor was a calculated administrative decision to invest large amounts of money in structural changes, equipment etc. in hopes that there would be a financial return measurable in a reduction in hospital inflicted morbidity and a reduction in the length of the average patient's stay in hospital. The third factor was
the introduction of a complete Central Sterile Supply Service to the hospital. The last boiler was removed from the hospital in January, 1962. Every instrument, dressing and drape used is sterile. The last and very important factor has been complete and enthusiastic cooperation of medical and nursing staff in accepting strict ward and theatre disciplines and rigid standardisation of materials and techniques.

These measures have eliminated several sources of cross infection which have been known to be important causes of cross infection in hospital outbreaks of wound infection. The air supplied to the theatres passes through filters guaranteed to remove particles over one micron. Slit sample tests in all theatres over twelve months have shown that the normal bacterial level in unoccupied theatres is one or two bacteria per 1,000 litres of air. No pathogenic organism has ever been recovered from the "Rothwell" sterile water supply. No pathogenic organism has ever been recovered from 1026 tests of items in theatre sterile packs over a period of twelve months. No instrument has been found contaminated in several hundred tests. With the virtual elimination of these common possible sources of infection it becomes easier to estimate the significance and relative importance of other factors.

The aim of this thesis is:-

(a) To discuss the factors thought to cause cross infection of surgical wounds in hospital.
(b) To discuss methods of prevention or elimination of these factors.

(c) To consider the practical problems involved and the results obtained in introducing many preventive measures simultaneously into a general teaching hospital.

It is generally agreed that the most important single factor which today makes the hospital a potentially dangerous place is the increased virulence and invasiveness of certain strains of staphylococcus aureus. The organism can be introduced to the patient's wound directly or via his nose or skin in the ward or in the operating suite. This is gross oversimplification of the situation but it is proposed, in order to be concise, to review the many aspects of "cross infection" under the following headings.

1. The Staphylococcus Aureus.

2. The provision of sterile instruments, fabrics and dressings.

3. The control of infection in theatres.

4. The control of infection in wards.
THE STAPHYLOCOCCUS.

Staphylococcus Aureus has in the last twenty years become increasingly important as a cause of infection in surgical wounds. In the pre-antibiotic era the streptococcus was considered the more dangerous organism. At that period the staphylococci encountered in clinical infection did not appear to have the "invasive" qualities of some of the present day virulent strains.

In the early days of the antibiotic era it was felt that the staphylococcus had been conquered. Penicillin resistant strains did not emerge for several years after the introduction of penicillin. Reliance on antibiotics led to a lowering of standards of aseptic technique in operating theatres and wards.

Gradually penicillin resistant strains of staphylococci emerged and these strains were much more common in hospital. As new antibiotics became available strains of staphylococci resistant to the new antibiotics appeared. There are now more penicillin resistant than penicillin sensitive strains of staphylococcus aureus.

Phage Typing.

The general introduction of phage typing after 1955 was a most important step in the study of the staphylococcus and the control of staphylococcal infections. The division of
staphylococci into groups based on their sensitivity to antibiotics is not a substitute for phage typing\(^2\). The high degree of specificity of the individual strains makes the tracing of the spread of clinical infection a practical procedure.

Phage typing has shown that a limited number of strains of staphylococci produce most of the cases of staphylococcal cross infection in surgical wounds\(^3,4,5\). These strains are restricted to phage group III and phage type 80 and account for nearly all antibiotic resistant strains\(^6\). An even larger proportion of staphylococci showing resistance to several antibiotics belong to phage group III\(^7\).

There is no evidence to show that staphylococci in general are increasing in virulence. There is abundant evidence however, to show that the virulent strains of group III and type 80 are much more prevalent in hospital than in the community as a whole\(^8\). The level in the community is rising also, although at a much slower rate\(^9\).

**Mechanism of Production of Antibiotic Resistant Strains.**

It is certainly of academic interest and it may be of practical value to know how antibiotic resistant strains of staphylococci appear. Between 1942 and 1945 very few penicillin resistant strains of staphylococci were present in the hospital or the community. If they existed they represented an extremely small proportion of all strains of staphylococci. Now penicillin resistant strains predominate.
Three possible theories have been formulated. In one it is suggested that the resistant strain is a mutant of the sensitive strain\(^1\). The opposite theory is postulated by Fairbrother\(^1\). He suggests that staphylococcus aureus originally existed in a "wild state" as a penicillin resistant strain producing penicillinase. He suggests that the organism colonised the human nares and that this ability to produce penicillinase was gradually lost. He supports his argument by describing the discovery of penicillin resistant and penicillin sensitive staphylococci of the same phage pattern isolated from the same lesion. He suggests that they had a common origin. He was able to produce penicillin sensitive variants from penicillin resistant staphylococci grown at \(44^\circ\)C. He was unable to grow resistant variants from penicillin sensitive staphylococci. A third theory\(^1\) is that the penicillin resistant strain is produced by the efforts of a sensitive strain to adapt metabolically to counter the effect of the drug. Part of this metabolic response is the production of penicillinase.

None of these theories are supported by conclusive proof and further study is required.

When a resistant strain has emerged it is not difficult to see why it increases. The resistant strain withstands the assault of antibiotics and the sensitive strains are eliminated. The resistant strain is more virulent and spreads from lesion to lesion more effectively. The air and dust in hospital contains sufficient penicillin to keep the anterior nares free from penicillin sensitive strains\(^1\).
A nose free of staphylococcus aureus is more readily colonised with a penicillin resistant strain than one containing a sensitive strain of staphylococcus\textsuperscript{13}.

This seems a logical and convincing explanation of the increased incidence of antibiotic resistant strains.

**Staphylococcal Carriers.**

Staphylococcus aureus will grow and multiply in the human anterior nares, and on the skin without necessarily causing clinical infection.

The anterior nares of the population can, as far as staphylococcal colonisation is concerned, be divided into three groups\textsuperscript{14}.

A Persistant carriers.

B Intermittent carriers.

C Persistently free of staphylococci.

New entrants to the hospital community have a relatively low carrier rate especially of resistant strains. The carrier rate begins to rise within one week of entering the clinical department and rises to reach a high average level after several months\textsuperscript{15}. Gould and McKillop\textsuperscript{16} examined 500 medical students weekly for twelve months. They found
that 39% were persistant or intermittent carriers. Forty-two per cent harboured staphylococci only occasionally. Of the persistant carriers the same phage type persisted in the same carrier over 90% of examinations. This latter finding was confirmed by Williams.17

Among persistant and intermittent carriers more than seven times as many penicillin resistant strains were isolated from those who had had previous penicillin therapy.

Reference has already been made to the fact that a nose harbouring a relatively avirulent penicillin sensitive staphylococcus is less liable to colonisation with a virulent strain of penicillin resistant staphylococcus than a nose containing no staphylococci.13

These findings support the view that antibiotics should be used with discretion and only where the organism is known to be sensitive. Antibiotic nasal cream should not be used indiscriminately. It has a limited use in the treatment of a nasal carrier of an antibiotic resistant phage type when the staphylococcus is known to be sensitive to the antibiotic in the cream.

In recent years there has been increasing evidence that direct droplet infection from the nose is of less importance than has been previously believed.18,19 It is thought that the usual method of spread from a carrier's nose is via clothing, hands, fomites etc. The droplets evaporate and
the staphylococcus is transmitted in a dry state – directly as by hand or indirectly on dust particles. Hare and Ridley\(^{20}\) showed that three-fifths of nasal carriers have sufficient organisms on their clothing to enable them to transmit organisms by direct contact or by means of objects touched.

It is impracticable and dangerous to try and indiscriminately reduce the incidence of carriers of staphylococcus aureus in hospital. Where several wounds have been shown to be infected with the same phage type a determined effort should be made to ensure that the same phage type is not carried by those who may have had contact with the infected patient in ward or theatre.

Much less is known about skin carriers of staphylococcus aureus. The skin folds and especially the perineal area are the commonest sites of skin carriage. Ridley\(^{21}\) found that 22% of adult males were perineal carriers of staphylococcus aureus. The organisms were dispersed into the air on exercise.

Routine checks for skin carriers cannot, for obvious reasons, be a practicable measure. Such tests would in any case be of limited value. A retrospective search for a carrier of a particular phage type following an epidemic of wound sepsis is unlikely to receive the cooperation of the surgical and nursing staff. One could only feel justified in asking for perineal swabs from members of staff who were found to be nasal carriers of a virulent phage type.
Factors Causing Clinical Infection.

Elek studied in human volunteers the minimum doses of staphylococcus aureus required to produce pus when introduced intradermally and into full thickness cuts in skin. He found that in healthy subjects the minimum dose in both cases was between two and eight million organisms. The presence of foreign material such as catgut very greatly reduced the minimum dose. Ischaemia and factors interfering with the normal defence mechanism have the same effect.

From this interesting experimental work one can draw some logical conclusions. Debilitated patients are likely to be more easily infected than healthy adults. Where possible they should not be mixed before or after operation with cases of sepsis. Surgical technique is of great importance. Rough handling of tissues at operation and production of haematomata predispose to wound infection. A review of cases of wound sepsis in the Victoria Infirmary showed that the presence of deep tension sutures and haematomata were associated with a high incidence of staphylococcal infection.

The size of the inoculum required to produce sepsis would indicate that to introduce infection in a clean wound in theatre requires a gross breach of aseptic technique.
The Incidence of Staphylococcal Wound Infection in Hospital.

There can be no doubt that over the past fifteen years the incidence of reported wound infection has been high and that those surgeons who have taken the trouble to carefully record their sepsis rate have probably had less wound infection than their colleagues who were prepared to turn a "blind eye".

A Public Health Laboratory Service Report 1960 showed that over twenty-one hospitals the incidence of post operative sepsis varied from 4.7% to 21.8% with an average of 9.7%. Staphylococcus aureus was the commonest organism.

A 1958 review of eight published series of cases of wound infection showed that the incidence of wound infection varied between 3.3% and 26.1%.

The incidence of infection was lower in surgical wounds where infection was not present or anticipated. Comparison between series is difficult because different surgeons grade degrees of infection differently. Some accept redness as indicating sepsis and others only count a wound as infected when pus is present.

Between 1st October and 31st December, 1960, three senior registrars and the Medical Superintendent recorded the incidence of wound infection in "clean operations" in the Victoria Infirmary. A clean case was defined as one not involving the small or large intestine and one in which
sepsis was not anticipated. Wounds were inspected when the dressing was removed - usually about the sixth post operative day. Wounds were recorded as:-

Clean
Stitch Abscess
Infected

Redness of the wound was ignored if it did not later produce pus.

Three hundred and forty-two such operations were performed with the following results.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>319</td>
</tr>
<tr>
<td>Stitch Abscess</td>
<td>7</td>
</tr>
<tr>
<td>Infected</td>
<td>16</td>
</tr>
</tbody>
</table>

Of these 2.1% had a stitch abscess and 4.6% had frank sepsis. The combined incidence of sepsis was 6.7%.

The diagnosis was in every case clinical and bacteriological swabs were taken in only a proportion of those with sepsis. No phage typing was performed. This neglect of bacteriology was not deliberate. Phage typing was not readily available. In one unit the consultant in charge was not cooperative and the survey was conducted as quietly as possible. The highest incidence of sepsis was recorded in this surgical unit.
THE SUPPLY OF STERILE INSTRUMENTS, DRESSINGS AND FABRICS TO WARDS AND THEATRES.

Introduction.

During the period 1955 - 1959 there became an increasing awareness of the inadequacy of our sterilising facilities in hospital. In 1956 Howie and Timbury\textsuperscript{25} drew attention to the inefficiency of the existing downward displacement autoclaves. The Nuffield Provincial Trust Report\textsuperscript{26} in 1958 was received with incredulity. Most autoclaves had been wrongly installed, were improperly operated and were incapable of satisfactory sterilisation.

Theatre dressings and fabrics were normally packed in metal drums. The drums were frequently packed too tightly and many were so designed that penetration of steam by downward displacement was impossible. Theatre dressings were prepared by overworked nurses in whatever accommodation was available in the theatre suite.

In most hospitals syringes were boiled in the ward or inadequately sterilised by steam in a downward displacement autoclave. In only a few progressive centres were syringes sterilised by dry heat in hot air ovens or by infra-red radiation\textsuperscript{27}.

Ward instruments were boiled in the ward. Because of shortage of instruments the length of time of boiling was
often quite inadequate. In many theatres surgical instruments were boiled. In only a few were instruments autoclaved.

Surgical gloves were either boiled or sterilised in a downward displacement autoclave at steam pressures varying from five to twenty-five lb. per square inch. Gloves were used until they disintegrated and were frequently inadequately patched.

In the late fifties clinicians and hospital administrators began to realise that these facilities were inadequate to combat the rising incidence of wound infection caused by the increasing numbers of antibiotic resistant staphylococci. The clinician was jolted out of his complacency by the more enlightened of his colleagues in laboratory medicine. Standards for sterilisation rose rapidly.

It was fortunate that in 1960 high vacuum high pressure autoclaves became fairly freely available in Britain. They made the sterilisation of dressings and fabrics a much more reliable and safe process. The arrival of this type of steriliser was the "Industrial Revolution" of sterilisation in the Health Service. At first, in a burst of administrative panic they were scattered throughout hospital regions like confetti in the misplaced belief that wound infection would end with their installation. Many were not uncrated for years. Many were wrongly installed. These early models
were just a little more crude and temperamental than those we now have. It became obvious that these expensive machines required experienced engineers to service them and that they were costly to operate. Hospitals had grossly overestimated their requirements of these sterilisers. Small hospitals found themselves with 60 cubic foot autoclaves which even looked like white elephants.

Hospitals and Regional Boards slowly accepted the fact that expensive sterilising facilities must be centralised. Experimental small scale Central Sterilising Units had been started at Musgrove Park Hospital, Northern Ireland in 1958 and at Addenbrooke's Hospital, Cambridge, in 1960. Both projects were supported by the Nuffield Provincial Hospital Trust.

In 1958 a Central Syringe Service Department which was equipped with an ultrasonic washer and an infra-red conveyor belt oven was started at the Victoria Infirmary. By April 1961, it had developed into a Central Sterile Supply Department (C.S.S.D.) supplying syringes and instruments to wards, and operation packs to theatres. All ward boilers were removed from the Hospital in January, 1961. Some items such as catheters, 2 cc. syringes and disposable ward dressings were bought pre-sterilised from the trade.

In April, 1961, the Western Regional Hospital Board agreed to allow rapid expansion of the C.S.S.D. to cover the hospitals in two Hospital Groups in South Glasgow. The growth and operation of this C.S.S.D. between April, 1961, and
March, 1962, is described in the brochure "South Glasgow C.S.S.D." - attached as Appendix "A". A 16 mm. colour sound film entitled "C.S.S.D." was produced in March, 1962. Four copies of this film have circulated continuously throughout Britain and are still in constant demand. A further twelve copies have been purchased and copies are now circulating as far away as Australia. The film describes the methods of production and methods of using C.S.S.D. products.

Between April, 1962, and March, 1963, the C.S.S.D. has grown rapidly and many useful conclusions have emerged. On 1st March, 1963, the C.S.S.D. is supplying theatre packs to forty-four theatres and labour rooms. Ward instruments are being supplied to 4,100 beds. Ward dressing packs are being supplied to 8,700 beds. The range of items supplied and a detail of the C.S.S.D.'s costs, customers etc. is given in the attached Appendix "B". The Central Sterile Supply Department's present target which can be achieved without increased accommodation is -

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Number of Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ward instruments (C.S.S.D. 1 items)</td>
<td>5,000 beds</td>
</tr>
<tr>
<td>Theatre and labour rooms (C.S.S.D. 2 items)</td>
<td>200</td>
</tr>
<tr>
<td>Ward dressings (C.S.S.D. 3 items)</td>
<td>30,000 beds</td>
</tr>
</tbody>
</table>

One's views on the development of the C.S.S.D. changes rapidly with the appearance of new machines, packaging and, above all, with practical experience. The opinions expressed in 1962 Appendix "C" now require modification and it is proposed to discuss some of the conclusions reached in March, 1963.
Types and Size of C.S.S.D. Units.

C.S.S.Ds. producing disposable ward dressings (C.S.S.D.3) and theatre fabric packs (C.S.S.D. 2) can operate jointly or separately on a basis of 5,000 - 30,000 beds and 25 - 200 theatres or labour rooms. Below the minimum levels production is uneconomical and output per person is low. When twenty-five theatres were supplied from C.S.S.D. 2 one domestic prepared the fabrics and dressings for four theatres. At present while covering fifty-five theatres one assistant can prepare the requirement of eight theatres. It is anticipated that output in C.S.S.D. 2 will rise to a level where one domestic can meet the demand of ten theatres.

Ward instruments (C.S.S.D. 1) cannot be supplied to as large a pool of beds as disposable ward dressings as they must be returned for cleaning and re-sterilisation. We propose to limit C.S.S.D. 1 to 5,000 beds. One domestic can look after the instrument needs of 1,000 beds. A department supplying less than 2,000 beds is difficult to operate because of the cost of production and one supplying more than 5,000 beds is difficult because of distribution problems. It is now cheaper to buy all sizes of syringes presterilised and disposable than to process glass syringes in a syringe service. If they are not separately delivered in special containers breakages amount to as much as 6d. per usage.

It was suggested to the Western Regional Hospital Board that those hospitals supplied by us with C.S.S.D. 2 and C.S.S.D. 3 items should make local arrangements for the sterilisation of
instruments. Existing syringe services at Dumfries, Stirling, Ayr and Stobhill Hospitals are being discontinued and the staff and equipment are being used to sterilise ward instruments. Each unit will serve between 1,500 and 2,500 beds.

Size of High Pressure High Vacuum Autoclaves.

The size of sterilisers required for C.S.S.Ds. is still being overestimated.

One 10 cubic ft. steriliser can without using the standby autoclave cope with the fabrics, dressings and glove requirements of fifty theatres. In C.S.S.D. 3 it requires one girl working full time from 8 a.m. - 4 p.m. to keep each cubic foot of autoclave space in constant use. One 15 cubic ft. autoclave between 8 a.m. - 4 p.m. can sterilise between 10,000 and 20,000 ward packs depending on the type of pack. This is equivalent to the ward dressing requirement of 6,000 beds.

Check of Sterility.

No autoclave is used unless on its first run of the day it draws (as measured on a direct vacuum gauge) a pre-sterilising vacuum of 29.2" mercury and a post-sterilising vacuum of 28" mercury. This is the most useful test employed. Failure to sterilise is almost invariably linked with failure to draw or hold a vacuum. The failure can be caused by a
defective pump or a leaking gasket or valve. Fallon pointed out that a pump can overcome an air leak and pump down to a vacuum of 28.2” mercury but that when the pump stops this vacuum is not maintained.

Thermocouples and heat sensitive tape are inserted once daily in a test drum as recommended by Bowie. This is a very severe test in comparison to the loose packs we use and offers a large margin of safety.

Brownes tubes (yellow spot) and heat sensitive spores are inserted in every load. These have never given unexpected results. On two occasions when the tubes failed to change colour and the spores were not killed the vacuum had not reached 28” mercury.

To allow a large margin of safety all autoclaves are operated on the following cycle:

- Pre-vacuum 8½ minutes.
- Sterilising 6 minutes.
- Post-vacuum 7½ minutes.
- Release 2½ minutes.

Our Group Bacteriologist takes daily an average of three samples of our products at any level of distribution at any hospital in the Victoria Group. Other bacteriologists are encouraged to do likewise. A small proportion of individual packs are stamped "Do not Open. Return to Dr. Bruce, Bacteriology Department, Victoria Infirmary". These samples are checked for possible contamination. Of the first
defective pump or a leaking gasket or valve. Fallon pointed out that a pump can overcome an air leak and pump down to a vacuum of 28.2" mercury but that when the pump stops this vacuum is not maintained.

Thermocouples and heat sensitive tape are inserted once daily in a test drum as recommended by Bowie. This is a very severe test in comparison to the loose packs we use and offers a large margin of safety.

Brownes' tubes (yellow spot) and heat sensitive spores are inserted in every load. These have never given unexpected results. On two occasions when the tubes failed to change colour and the spores were not killed the vacuum had not reached 28" mercury.

To allow a large margin of safety all autoclaves are operated on the following cycle:

- **Pre-vacuum**: 8½ minutes.
- **Sterilising**: 6 minutes.
- **Post-vacuum**: 7½ minutes.
- **Release**: 2½ minutes.

Our Group Bacteriologist takes daily an average of three samples of our products at any level of distribution at any hospital in the Victoria Group. Other bacteriologists are encouraged to do likewise. A small proportion of individual packs are stamped "Do not Open. Return to Dr. Bruce, Bacteriology Department, Victoria Infirmary". These samples are checked for possible contamination. Of the first
1,000 tests twenty-three were positive. The organisms isolated were anthracoids and staphylococcus albus. In nine tests the articles were wooden spatulae or spigots in heat sealed paper bags. We concluded that after sterilisation organisms were emerging from the depth of the wood. Since then all wooden articles are sterilised in bulk in a Koch steamer for two hours. They are then packaged and sterilised in the normal cycle. No positive cultures have been obtained in wooden articles in the last six months. The remaining positive tests were attributed by the Bacteriologist to contamination during testing. This rate was 1.4%. Alder and Alder considered that in testing paper wrapped dressings their accidental contamination rate was 3.86%.

Packaging.

Packaging is the keystone of C.S.S.D. organisation. The first and most fundamental decision to be made in planning a C.S.S.D. must be a decision to package on an "Individual Item" basis or on a "Comprehensive Pack" basis. The type of accommodation and workflows necessary for the two procedures are quite different. It is unfortunate that the Scottish Home and Health C.S.S.D. Planning Booklet omits this vital point. In the booklet (para. 17) it suggests that a C.S.S.D. should provide for 5,000 - 6,000 acute beds. Appendix A to this booklet shows a diagrammatic layout of a C.S.S.D. It is not made clear that 5,000 beds can only be served on an "Individual Item" packaging basis.
and that the layout suggested is more suited to a single hospital "Comprehensive Pack" system. In the "Comprehensive System" instruments and dressings are packed together to provide everything required for a clinical procedure. This means that there is very little latitude allowed in the method of performing the procedure. The capital cost of providing the ward instruments when this system of packaging is employed is about £20 per bed as compared with £3.10/- per bed on the "Individual Item" system. Production becomes more difficult as only a limited number of packs can be stored sterile. On the "Individual Item" basis the disposable ward dressings can be stockpiled for up to three months. This means that C.S.S.D. 3 can close down for holidays and that when sickness etc. reduces manpower in C.S.S.D. 1 or 2 labour can be switched from C.S.S.D. 3. All these factors tend to make the "Comprehensive Pack" system more suitable for an individual hospital. I think one is compelled to adopt the "Individual Item" system if the service is to be cheap and serve several thousand beds.

The advice given in the Interim Report prepared by the Joint Committee of the Central and Scottish Health Services Councils37 in 1962 is sound but conservative. It is given in much too general terms. If this committee does not quickly make intelligent forecasts its ultimate report will arrive too late to be of value.
Standardisation.

Mass production and standardisation of packs reduces costs. Between April, 1963 - April, 1964, we will buy two million swabs at a discount on normal trade prices of 25%. Standardisation is not difficult to achieve when the service is good. C.S.S.D. 2 supply has expanded at the rate of four or five theatres per month and no adverse comment is received from new users. At a meeting in Glasgow on November 28th, 1962, obstetricians and superintendent midwives accepted on behalf of eight maternity hospitals five standard fabric packs to cover:— (a) Normal delivery. (b) Forceps delivery. (c) Caesarian section. (d) Rupture of membranes. (e) Perineal stitching. New linen was prepared and two maternity hospitals were provided by January 16th, 1963.

The nurses and doctors in all theatres and labour rooms use a standard common gown. These facts are stated to show that Regional standardisation is probably easier than hospital standardisation.

Trends in C.S.S.D. Development.

Accurate costing of Health Service central sterile supply departments will indicate that only large departments serving several thousand beds will be economical.

Trade manufacturers who have been "sitting on the fence" for some time have now decided to produce sterilised dressing packs on a large scale. Large firms are installing gamma
irradiation sterilising units and pack prices are dropping rapidly. At present our C.S.S.D. ward pack prices are only slightly below the lowest of commercial manufacturers. We are negotiating with commercial suppliers for the supply of certain packs ready for boxing and sterilising. These facts would indicate that unless C.S.S.D. supply is efficiently organised and operated on a large scale the trade is likely to produce more cheaply.

There seems little possibility that ward instruments will become disposable. Unless all instruments become disposable washing and sterilising facilities will continue to be required. There is no economy in using disposable forceps if stitch scissors and artery forceps etc. have to circulate through a C.S.S.D. There is a real danger also in mixing disposable and non-disposable instruments. It is inevitable that the wrong instruments will be accidentally discarded. At present our method of providing ward instruments is the cheapest available.

As long as theatre packs contain linen, commercial suppliers will be unable to produce these supplies. They do not have laundry facilities and fabrics do not withstand repeated gamma irradiation. Commercial firms can enter this field only when satisfactory sterile paper gowns can be supplied properly wrapped for 8d. each. This at present seems unlikely. We are experimenting with a bonded fabric costing 4d. per square yard. It has a good dry and wet strength and possesses all the qualities of fabric. If
the price were one-third of the present level it could be used as disposable in place of linen.

We are discussing with an engineering firm the level of production at which a gamma irradiation sterilising plant would become practicable. The price at present quoted is £105,000 capital plant plus 1/82d. per cubic foot sterilising charge. This cost is based on an output of 2,000 cubic feet, a level which we are rapidly approaching. Increased production only slightly reduces operating charges. It would appear therefore that this method is unlikely to be introduced as steam sterilising costs are less than 9d. per cubic foot.

Sterilisation of Theatre Instruments.

The high capital cost of theatre instruments precludes their sterilisation outside the hospital in which they are used. South Glasgow C.S.S.D. 2 can economically circulate theatre fabric packs to theatres as far apart as OBAN and DUMFRIES - 200 miles.

There are two alternative methods of sterilising the common theatre instruments. They may be sterilised in the individual theatre unit or the instruments for many theatres may be sterilised outside but adjacent to the theatre suite using the Pre-set Trolley Top Tray System.
When planning the Victoria Infirmary theatre and sterilising arrangements in 1960 there was no alternative to sterilisation in the individual theatre. Ultrasonic washers were provided in each theatre unit. These have proved most successful. The model chosen has crystal transducers and works at forty kilocycles. A more recent ultrasonic washer works on a magneto-restrictive system at twenty kilocycles. Although undoubtedly efficient it produces high range sound waves which are intensely irritating. In the opinion of one consultant otolaryngologist it is potentially harmful to the human ear.

The clean unwrapped instruments and bowls are sterilised in the preparation room in a high pressure downward displacement autoclave. The autoclaves were manufactured to a specification similar to the sterilisers then used at the Royal Infirmary, Edinburgh, and described by Bowie. They vary from Bowie’s specification in two respects. The size was increased to internal diameter $1\frac{1}{4}\" \times 26\"$. This allowed size $12\"$ basins and a tray of instruments to be sterilised at each cycle. The autoclaves were jacketed. This has speeded the sterilisation cycle and dries the instruments rapidly. Eight of the autoclaves have been in constant use since October, 1961, and have been very effective. Steam leakage on opening the autoclave door is negligible and heat loss is small. This system is recommended where a hospital has fewer than five theatres or where theatres are widely scattered through a hospital. This system combines
well with theatre fabric packs such as those issued by South Glasgow C.S.S.D. 2. These autoclaves are sufficiently reliable to make a stand-by autoclave unjustifiable.

The alternative Pre-set Trolley Top Tray system as described by Bowie\textsuperscript{38} is ideal where large numbers of theatres are grouped vertically or horizontally. The complete requirement of instruments, utensils and fabrics for an operation are packed in a special tray which fits the theatre trolley top. The tray is covered with inner and outer trolley top covers wrapped specially to facilitate the covering of the trolley top in theatre. The packed trays are sterilised in high pressure high vacuum autoclaves. Gowns and gloves are packed and autoclaved separately.

Certain theatre instruments require special consideration. Fine eye instruments are damaged by the autoclave. The fine cataract knives at present used include carborundum to allow sharpening of a high standard. When autoclaved once at 32 lb. per square inch pressure the surface is visibly pitted and the cutting edge is ruined. The most readily available alternative method of sterilising is a hot air oven. The infra-red conveyor belt oven raises the temperature too rapidly to too high a temperature and damages fine edges. In America ethylene oxide has been used for ophthalmic instruments. Linn\textsuperscript{39} describes a "steribulb" containing ethylene oxide mixed with hydrogenated carbons. Sterilisation takes two hours and sets of instruments for
each operation are sterilised individually. The apparatus is portable but the method is costly and time consuming. Kelsey has had considerable experience of ethylene oxide sterilisation. He does not in general favour its use because of its cost, its dangers and because the only check on sterility is bacteriological and therefore delayed. Beta-propiolactone has been used in America for sterilising instruments. It is a better bactericidal agent than formaldehyde or ethylene oxide. It is most effective at a relative humidity of 75% or higher. It is, however, dangerous to handle.

At a symposium in London sponsored by the Pharmaceutical Society of Great Britain in 1961 the properties and uses of ethylene oxide were discussed. It was indicated that the use of ethylene oxide is likely to be restricted.

Cystoscopes and similar surgical instruments containing optical lenses are difficult to sterilise. New cystoscopes will withstand autoclaving and this is recommended. Hot air ovens will damage the cement settings of lenses. Where older cystoscopes are used "pasteurisation" is recommended. The instrument is heated at a controlled temperature of 75°C for ten minutes in water as recommended by Francis. This method does not kill spores but spores are not considered capable of producing infection in the urinary tract.

Green in 1961 pointed out that a rise in temperature greatly enhanced the bactericidal action of antiseptics and
in some cases conferred considerable sporicidal power. Since 1961 we have used \(0.02\%\) aqueous solution of chlorhexidine at 75\(^{\circ}\)C.

Provision of Sterile Water.

The old fashioned hot and cold water sterilisers, still common in many theatres, are dangerous. Behr\(^{47}\) described their defects. The hot air vent filters are frequently missing or dirty. The safety valve seating becomes worn and allows "dirty" water to be drawn into the tank as it cools. The cooling coil may leak. The inlet valve may leak. The outlet valve can become contaminated. The glass gauge may contain non-circulating, stagnant infected water. This type of steriliser should not be used.

In the Victoria Infirmary the "Rothwell System" of supply of sterile water has given excellent results. I think this system is good when it is properly installed with the modifications detailed below and when it is carefully and regularly tested and maintained.

Steam at 90 lb. per square inch is led from the hospital boiler in a separate steam pipe. It is condensed to water inside a steel chamber. There is no possibility of leakage of cooling water. The sterile water is pumped to roof level by a gunmetal Ogden pump. All pipes are welded copper lined with tin. The water is stored in hot and cold water tanks. Each tank was at our request fitted
with both steaming Vokes ceramic filters and, as a precaution against steam failure, with "aerox" filters. It is possible to introduce fluorescein into the cooling water to test any possible leakage in the copper cooling coil. Hot and cold water circulates by gravity back to the base tank. At each of the theatres there is one draw-off point. The hot and cold water is mixed to the required temperature in a Leonard-Rada mixing valve. Before withdrawing water a steam tap allows steam at 10 lbs. per square inch pressure to flush out the tap. Water is drawn directly into the surgeon's basin or into a stainless steel jug sterilised in the adjacent autoclave. This system was commissioned in October, 1961, and water from three different taps is tested weekly. No organism has been cultured. The whole system can be filled with steam at 12 lbs. per square inch pressure.

Most new theatre suites will be served with "Packaged" sterile water. Water in pint or litre bottles is sterilised in "slow release" downward displacement autoclaves. The mouths of the bottles have a special lip to prevent contamination in opening and pouring. An aluminium bottle has been developed in Newcastle and is shortly to be made commercially available. It will allow a faster sterilising cycle. Where bottles of sterile water are delivered to a theatre warming cabinets must be provided.

There is no general agreement as to where "packaged" water should be sterilised. It can come from three possible
sources. If the C.S.S.D. is a hospital C.S.S.D., it would be convenient to sterilise it here. Where there is a regional infusion fluid service or a regional blood transfusion service the facilities could be utilised to provide sterile water. Where a hospital is installing a "Trolley Top" system for instruments the accommodation and autoclaves could also be used to provide sterile water.

The surgeon requires sterile instruments and other items to perform safe surgery. He must have a well maintained theatre, ventilated and clean personnel and efficient operating dressings, patient and sterile dressings on standby. The area should be healthy, clean and not limited to sterility. It is proposed to discuss these factors in more detail.

Suiting the Theatre areas.

It is economical in building cost, provision of engineering services and staffing to build theatres in units of two or more. The sitting of the theatre suite is of importance. It must be near the central wards but not too intimately associated with them. The M.H.O. should recommend that the theatre suites should be an appendage of the main building with no more than essential communication to it through an air locked corridor. It is recommended that it should be situated on a lower floor and that the plant room should be in the basement. Except in an entirely new
CROSS INFECTION IN THEATRE.

Introduction of sepsis to clean surgical wounds most commonly occurs in the operating theatre. \(^{48, 49, 50}\) The open wound is exposed to aerial contamination and direct infection from instruments, gloves, catgut etc. Sources of infection must obviously come into the theatre to allow contamination. Possible sources are air, the staff, the patients, dressings, fabrics, equipment and trolleys.

The surgeon requires certain minimum conditions before he can perform safe surgery. He must have a well designed theatre, ventilated with clean filtered air. The instruments, dressings, fabrics and water used must be sterile. The staff must be healthy, clean, well trained and disciplined. It is proposed to discuss these factors in some detail.

Siting the Theatre Suite.

It is economical in building cost, provision of engineering services and staffing to build theatres in suites of two or more. The siting of the theatre suite is of importance. It must be near the surgical wards but not too intimately associated with them. The M.R.C. Report 1962\(^{51}\) recommends that the theatre suite should be an appendage of the main building with no more than essential communication to it through an air locked corridor. It is recommended that it should be situated on a lower floor and that the plant room should be in the basement. Except in an entirely new
hospital this advice can seldom be followed. Seven of the new theatres in the Victoria Infirmary are situated in a vertical block—four on the third floor, two on the first floor and one on the ground floor. The detailed layout is shown in the Brochure

The individual theatres are close to the wards which they serve. The theatre windows receive minimal sunlight in the early morning and late afternoon. The plant room is on the ground floor. There is no vibration and because of lengthy ducts there is no noise in the theatres. The four theatre suite on the top floor is completely cut off from lower floors except for a fire escape. It has only one entrance corridor and the flow of air in it is towards the main hospital building. The roof was specially insulated and solar heat gain has not been a problem. The twin E.N.T. theatre has only one entrance and is in a cul-de-sac. The fire escape door leading into the biochemistry department has a rubber airtight seal and the theatre has a measurable positive pressure. The ground floor theatre (gynaecology) is completely separated from the bacteriology department. There is no opening window in the suite.

C.S.S.D. 2, providing theatre linen and packs, is situated on the second floor and is connected by electrical lift to the four theatre suite sterile store. The C.S.S.D. can if required be adapted to provide the theatres on the "Trolley Top" system.
Theatre Design.

The design of operating theatres has only in recent years been scientifically studied. Between 1954 and 1963 I have been the chief planner of, and responsible for the equipping of, fourteen theatres. The first twin suite took four years to complete and incorporated many undesirable features. Traffic circulation was poor, the main corridor was too narrow and instrument boilers were installed. The boilers filled the preparation room with steam and the air conditioning plant was inefficient. The theatres became too hot.

From 1956 onwards information on the design of theatres became increasingly available.

The basic requirements in the design of an operating suite are:

(1) On entering the suite one should pass through zones that increasingly approach sterility until the operating room is reached.

(2) Circulation flows should not cross.

(3) Within the suite one should be able to move from one clean area to another without risk of contamination.

The M.R.C. report 1962 considers that provision should be made for the removal of dirty materials from the suite.
without them passing through a clean area. I would modify this requirement as follows:—

Dirty materials should not be removed through clean areas while an operating session is in progress. Dirty materials should be enclosed in impervious bags and removed only at the end of the theatre list. This has proved a practicable procedure. Disposal chutes are dangerous. Hurst and others\textsuperscript{53} pointed out that chutes harbour staphylococci of the hospitals' endemic strain and that dangerous organisms can be blown out of them.

\textit{Layout.}

The Hospital Building Bulletin No. 1, Operating Theatre Suites 1957\textsuperscript{54} is now out of date. The areas recommended for individual rooms and the list of rooms required for varying sizes of suites are still acceptable. Other recommendations of the bulletin are not acceptable. The combination of shared "washup" and sterilising areas and the inadequate ventilation standards recommended is dangerous. The design and layout for the sterilising room was based on the packing of \textit{drums} in the nurses' preparation room (para. 192). The use of drums and the preparation of packs and gloves in the theatre suite is not now considered advisable.

The use of "boiler sterilisers" para. 136 and para. 139 as an alternative to or standby for an autoclave cannot be recommended. Boilers are not sterilisers and the two processes should not be confused. The autoclave size recommended 18" x 30" (para. 138) is unnecessarily large.
<table>
<thead>
<tr>
<th>Zone</th>
<th>Working air-pressure (in. of water)</th>
<th>Ventilation Input Outlet</th>
<th>Smell +ve</th>
<th>Smell -ve</th>
<th>Smell -ve or extract fan; 500 c.f.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrance lobby</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Recovery-room(s)</td>
<td>+0.02</td>
<td>+0.04</td>
<td></td>
<td></td>
<td>+0.02 or 0.04, whichever is greater</td>
</tr>
<tr>
<td>Operating-room</td>
<td>+0.04</td>
<td>+0.04</td>
<td></td>
<td></td>
<td>+0.04 or 0.06, whichever is greater</td>
</tr>
<tr>
<td>Sterile work-room</td>
<td>-</td>
<td>-</td>
<td>+0.02</td>
<td>+0.04</td>
<td>+0.04 or 0.06, whichever is greater</td>
</tr>
<tr>
<td>Sterile sterilising-room</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td>+0.02 or 0.04, whichever is greater</td>
</tr>
<tr>
<td>Sterile operating-room</td>
<td>+0.02</td>
<td>+0.04</td>
<td>+0.02</td>
<td>+0.04</td>
<td>+0.04 or 0.06, whichever is greater</td>
</tr>
</tbody>
</table>

Note: Balanced flaps and possibly local extract fans are required in some areas.
Autoclaves, if sited in the theatre, must be of minimum size 14" x 26" to prevent undue heat loss.

In para. 144 the provision of small hot and cold water sterilisers is considered as an alternative to the provision of sterile water in bottles. These small units are now condemned.

The bulletin is now due for major revision.

Tindal\textsuperscript{55} in 1962 recommended a theatre suite constructed of steel capable of withstanding steam at 5 lb. per square inch pressure. Such a theatre suite which would have an air lock would be very expensive to build and operate. The idea could not be supported on the grounds of improved asepsis. Repeated bacteriological tests of theatre walls and furniture have rarely produced pathogens on culture. Steam sterilisation of a theatre suite would be very costly. It is unlikely that this idea will be tried.

The M.R.C. report 1962\textsuperscript{44} divides the theatre suite into zones, as shown on page 35A.

The four theatre and twin theatre suites at the Victoria Infirmary were commenced in January, 1960, and completed in October, 1961. A plan of the layout of the four theatre suite is given as appendix "E". This plan shows the suite divided into zones A, B, C and D as defined
on page 35A. The plan broadly follows the 1957 Building Bulletin No. 1. The overall area available was 8,100 square feet compared with a recommended area for a four theatre suite of 8,700 square feet. The available site area was rectangular. The four theatres are identical or mirror images. They are completely separated physically and do not share any facilities. This was deliberately planned because in January, 1960, the idea of being able to completely control air flows was viewed with some doubt. The plan shows the separate circulations for patient, staff and instruments.

The walls of showers, lavatories, changing rooms, cleaner's room and kitchen are tiled. The operating and ancillary rooms are plastered and finished in eggshell paint. This provides a more easily cleaned surface. Hoses are provided in each theatre to thoroughly wash all surfaces. The recovery room is used by all patients requiring the supervision of an anaesthetist. All emergency cases sent to theatre after 9 p.m. are retained in the recovery room until 9 a.m.

Ventilation of Theatre Suites.

In a Lancet Editorial in 195656 it was recommended that a theatre suite ventilation system should be capable of:-

(a) Removing contaminated air.
(b) Removing anaesthetic gases.
(c) Preventing contaminated air from entering the theatre.
(d) Making the staff in theatre comfortable.
One expects more than this of a modern theatre ventilation system and in briefing an engineer on one's requirements an exact specification should be given.

Recirculation.

A decision must be taken to circulate air once or to recirculate it repeatedly. The latter system is much more economical as it is costly to heat and humidify air. Recirculation has not been generally adopted for several reasons. There has been a reluctance to accept filters as foolproof. There is much to be said for this viewpoint. In our experience filters which have appeared to fit perfectly have been shown after lengthy usage to have tiny leaks at the juncture of filter and casing. The air probably only passes through these tiny gaps when the efficiency of the filters diminishes and when the difference in pressure on the two sides of the filter rises. Experience in our own plant has shown that these minute air leaks occur when pressure differential is above 0.4 inches of water.

A second defect of recirculation is that, if complete, it tends to allow a build up of anaesthetic gas concentration. A more serious problem is the difficulty of getting proper direction of air flow between the rooms of the theatre suite. Zones of differential air pressure are difficult to achieve unless input of air is three or more times greater than the calculated removal of air.
Recirculation of air should never be complete as a minimum of six changes of fresh air per hour is required to remove odours and anaesthetic gases (M.R.C. report 1962, p. 950).

Complete Renewal of Air.

When air is not recirculated running costs are higher but the margin of safety is greater. The air must be drawn in from an area as free from contamination as possible. At the Victoria Infirmary the air inlet is on the roof. Repeated air sampling on the roof with a slit-sampler has shown no organisms or only isolated non pathogenic organisms in samples of 100 cubic feet of air.

Filtration.

The air passes through coarse cheap primary filters which are intended to remove dust particles. The air passes down a central shaft to the basement and through secondary filters. These are "Vokes Absolute" filters which filter down to 1μ. This is an unnecessarily high standard. Bacteria are carried on particles approximately 15μ in size. Blowers and Crew\(^57\) recommend Vokes K600 secondary filters (or equivalent) which are 99.5% efficient in filtering particles of 5μ and over. Shooter and Williams\(^58\) make the same recommendation. We have found that in winter the "Vokes Absolute" filters become "choked" with fine particles from "smog" and must be replaced at six week intervals. Between October, 1961, and October, 1962, this
involved replacing 121 filters at £17.10/- each - a total annual cost of just over £1,800. It is proposed to replace this type of filter with the cheaper yet efficient K600 filter.

Washing, Heating, Refrigeration.

The air after filtration is heated, washed and reheated. The humidity is controlled by the degree of "pre" and "post wash" heating. The washers consist of fine sprays and the water is re-circulated. This water can be circulated through a refrigeration plant, thus allowing cooling of the air to theatre.

The washing water presented two problems in November, 1961. Within six weeks of starting the ventilating plant it was found that 90% of the spray jets were blocked and that the "humidity low" electronic warning light was showing on the control panels. This was found to be due to evaporation. Although Glasgow water is very pure it was found that carbonate salts were crystallising out due, in the opinion of our biochemist, to a water concentration through evaporation in the order of 600 fold in six weeks. This was corrected by allowing an overflow of approximately 5% in volume daily. There has been no recurrence. The second problem was the profuse growth of an algae in the water tank. The water was made alkaline with eight parts per million phenolphthalein. The pH is maintained at 7.5. A
chemical, marketed as H & T 100, prevents the growth of algae at this pH.

There has been "heated" argument about the need for cooling of air in theatre suites. In general, surgeons, anaesthetists and theatre sisters have favoured air cooling. The opponents of refrigeration have postulated that if building design is good and if heat production in the theatre is limited, refrigeration in Britain is unnecessary. I cannot recommend too strongly that provision for cooling of air should be made for all theatres now. Having had experience of gross overheating in theatres our Architect and Consultant Engineer were repeatedly warned of this problem at all stages of planning and construction. Heat sources in the theatre were reduced to a minimum. The surgeons' bowls were reduced from the standard 14" to 12" in diameter to allow the instrument and bowl autoclave to be the minimum size of 14" x 26". The air ducts were heavily insulated and kept separate from all other services. In spite of these precautions during the summer when no space heating was provided, the average difference in air temperature between that leaving the plant room and that arriving at the air inlet in theatre was consistently 10°F. The average difference between the theatre air inlet and outlet temperature was 2°F. Without refrigeration our surgeons, who select a temperature of 68°F, would have been uncomfortable on average for seventy to eighty days per year. There can be no doubt that a perspiring, uncomfortable surgeon is likely to be less meticulous and gentle than one
who is cool and comfortable. The capital cost of installing refrigeration plant to allow an air temperature drop of 10°F below outside temperature in each theatre has been £1,200 per theatre. Our Architect and Engineer cannot find any explanation of the heat gain other than it is due to uptake from the building. One has no guarantee therefore that this heat gain will not be found in any new construction. It would appear that the financial outlay required to guarantee comfortable conditions is justifiable.

Air Distribution.

Within the rooms of the theatre suite the air must flow in the correct pattern. The general principles are that air should flow from the "clean" to the "less clean" area and that the vital area to be protected is the open wound.

In 1956 Shooter, Taylor, Ellis and Ross showed that the introduction of a flow of clean air across the operating theatre reduced the wound infection rate from 9% to 1%. From this experiment was evolved a system to produce general air turbulence by introducing air through high level grilles. This system rapidly dispenses bacteria released in the area of the wound. It has a serious disadvantage in that bacteria released near floor level may be carried up to the area of the operation. As long as nurses continue to wear dresses this method of ventilation will tend to disperse bacteria from perineal carriers.
The alternative method of ventilation is the "downward displacement" system. This system is employed in the new theatres at the Victoria Infirmary. Air is introduced through multiple diffusers in the ceiling. Louvres direct the air laterally parallel to the ceiling. This causes a non turbulent downward displacement of air which is uniform over the whole room. This piston effect pushes any released bacteria downwards. The effect is maximal when the air introduced at ceiling level is higher in temperature than that at floor level as convection currents are minimised. Hosing of floors has the triple effect of washing away contaminated material, producing a wet surface to which bacteria will stick and cooling the floor. The cooling effect could be improved in hot weather by having chilled water circulating in pipes embedded in the theatre floor.

The displaced air must find an outlet. In our theatre this has been provided by extracting air through outlet grilles situated at floor level in the corners of rooms. The extraction rate is regulated at one quarter the input rate. This system has the disadvantage that when doors are open there is a tendency for the extract fan to draw air from another room into the extract duct. This has not been detectable on smoke test when the extraction rate is no more than a quarter of the input rate. On one occasion, however, a marked drop in air input caused by "smog blocked" filters was undetected because of a defective warning circuit. Air input dropped by half and on testing with titanium tetrachloride vapour air could be seen to be drawn from corridor to theatre.
A better method of air disposal is that recommended by Blowers and Crew\textsuperscript{57}. Weighted balanced flaps at floor level are so adjusted that when all doors are shut air escapes from the air ports. When a door is opened the flaps close and air flows out the door.

**Air Flows.**

It is essential that sterile and clean zones as defined on page 351A are not contaminated by entry of air from less clean zones. To achieve this one must have differential pressure areas throughout the suite. The pressures achieved are very small and must not be compared to the levels produced in a pressure chamber. Variation in pressurisation is obtained by varying the rate of air changes from zone to zone. In the Victoria Infirmary suite there are three levels of pressurisation as shown on the plan (Appendix E). In the operating room and preparation room there are twenty changes of air per hour. In the anaesthetic room there are ten changes of air per hour. The static pressure across the bottom of the closed anaesthetic room door is .09" water. The sink room has no air inlet and positive extraction ensures a constant air flow from the theatre door and the preparation room hatch. This averages .3" water pressure under the closed sink room door. The theatre corridor and changing rooms have six changes of air per hour. Flow of air is from the theatre corridor to the hospital main corridor. This pressurisation is aided by the provision of two sets of swing doors.
This ventilation system has, when properly used, been most successful. Repeated slit sampling in the theatre gave levels varying from 0 particles per cubic foot to three particles per cubic foot. These levels were only achieved when staff movement was minimal and when the doors were shut. The level rose on occasions to five during much activity and when the door to the corridor was open. An interesting observation was that after cessation of door opening or movement the level fell to one or 0 particles within two minutes.

When the theatres were tested empty it was common to detect no particles in samples of 1,000 cubic feet. These results compare favourably to those published by Douglas. The theatre temperature most commonly selected is 68°F. Temperatures appreciably above or below this are never required.
Our anaesthetic staff are investigating the effect of high and low theatre temperatures on patients. Preliminary results show that with air input of 1,000 cubic feet per minute the rate of heating or cooling of the patient in theatre can be rapid. During a long operation it is important that the patient should not be overexposed at a high or low theatre temperature. Premedication drugs, especially atropine, affect the rate of heat loss of the patient.

The theatre electronic control panels allow a selection of temperature and humidity over ranges of 50-70% relative humidity and 60-80°F. This is an unnecessarily wide range and accuracy has had to be sacrificed at the upper and lower limit as the controls are calibrated at mid-point on the scale. It is recommended that the scale should be limited between 55-60% relative humidity and 65-75°F.

The Theatre Staff.

The theatre staff are potentially dangerous sources of staphylococci. Most of the factors we have considered are controllable. The staff is not. If one expects cooperation one must be tactful and reasonable. The theatre staff must have good washing and changing facilities. They must have comfortable and suitable clothing. They must be well trained and disciplined.
Changing Facilities.

The Victoria Infirmary changing rooms are sited in zone A and ventilated at six changes per hour as recommended in the M.R.C. report 1962. Separate accommodation has been provided for male doctors and for theatre orderlies. Nurses and female doctors share a changing room. The size of these areas would have been larger if more accommodation had been available. The lockers are specially designed to allow the doctor or nurse to lock up his clothes while theatre clothing can be left on an open shelf above and theatre boots or shoes can be placed on an open shelf below the locker. This arrangement keeps clean theatre clothes apart from contaminated outdoor clothing and footwear. Dirty theatre clothing is discarded in a soiled linen bag attached to a portable metal ring.

Showers are provided on a generous scale. They are regularly used. They are used, unfortunately, too frequently after leaving, rather than before entering, theatre. Showers before entering theatre are obviously the best available safeguard against the spread of staphylococci from perineal carriers. This viewpoint is frequently put to the surgical and nursing staff and pre-theatre showers are gaining in popularity. A daily count of bath towels used before 9.30 a.m. shows a steady rise.

Surgeons, anaesthetists and nurses have agreed to clean their nails with nail brushes in the changing room. Nail
brushes are difficult to sterilise and it is better to consider them as non-sterile.

Male staff wear green cotton theatre clothes. The vest sleeves are long. Vests and trousers are labelled with the individual's name and are made to measurements provided. We hope in the near future that nurses will instead of wearing theatre dresses, wear trousers. Paper masks and hats are provided.

The staff leave the changing room and proceed to the "scrub-up" area. The "washing troughs" were constructed in stainless steel to specification. The trough has only one piped outlet at the foot and is angled to prevent splashing. The water temperature is controlled by a Leonard Rada mixing valve. This removes the necessity of adjusting water temperature at each tap. The taps are foot controlled. Sterile liquid soap containing 3% hexachlorophene is delivered on elbow pressure from a wall fitting. Nail brushes are not provided.

Many different antiseptics have been recommended for hand washing in theatre. Beilby and Thompson tested phisohex (3% hexachlorophene in an anionic detergent), 2% hexachlorophene in soap, dettol cream, hibitane obstetric cream, chlorhexidine 3% in 95% alcohol and bar soap. Phisohex proved most effective in reducing the bacterial count on the hands. The residual effect of the phisohex was considerable. This was thought to be due to water precipitating phisohex as an insoluble layer on the skin.
Two per cent hexachlorophene in soap was shown to be second best. Smylie, Webster, and Bruce\textsuperscript{62} and Lowbury and Lilly\textsuperscript{63} obtained the same result.

Phisohex was tried at the Victoria Infirmary. Seven members of the theatre staff had moderate or severe skin reactions within one week of using phisohex. This high incidence was not found in any other area. We concluded that the water in Glasgow is very pure and that even the low levels of inorganic salts found in water in most areas may make phisohex less liable to cause dermatitis.

After hand washing the surgeon rinses his hands in 70\% alcohol for three minutes as recommended by Lowbury\textsuperscript{64}.

**Gloves.**

Thorough hand washing cannot ensure that bacteria will not be released from the surgeon's hands during the operation. Surgical gloves are worn as an additional protection. Gloves are liable to puncture. Devenish and Miles in 1939\textsuperscript{65} found that 24\% of gloves were punctured during operation. Penikett and Gorrill\textsuperscript{66} found that 30\% of gloves were punctured during operation. These surveys were made at a period when surgical gloves were used again and again. Testing for holes was difficult and patching was imperfect. Penikett and Gorrill\textsuperscript{66} perfected an electrical circuit which would be used to detect holes in gloves.
We now have disposable surgical gloves which are used once and discarded. These gloves are used exclusively at the Victoria Infirmary. If a surgeon or assistant realises that he has pricked his gloves during an operation he discards them, washes his hands and puts on a new pair of gloves.

In October, 1962, 500 consecutive pairs of disposable gloves used in theatre were tested for holes. They were filled with water under pressure until they contained three times their normal volume of water. Of individual gloves 7.8% contained one or more holes. We concluded that the use of disposable gloves can be supported because of the increased safety.

Gowning.

Gowns and hand towels are packed in single units or in threes. The gowns are of standard design and two sizes - large or medium. The gown buttons behind and has an appreciable overlap. The gown is put on at the theatre entrance, (see plan Appendix E).

Discipline.

Theatre staff must not commence duty if they are suffering from a condition likely to spread infection. A septic lesion is the most dangerous source of infection. McDonald and Timbury found that a surgeon with a furuncle
on his arm was the unsuspected cause of an outbreak of staphylococcal wound infection in six patients. Penikett and Knox found a nurse with a septic lesion to be the source of an outbreak of wound sepsis. Similar findings were reported by Shooter and others and by Howe.

The theatre superintendent lectures to nurses before they start theatre duties. The danger of concealing sepsis however minor is emphasised.

Three things in theatre cause a rise in the aerial dissemination of bacteria. Douglas and the M.R.C. report have shown that movement of staff in theatre or the opening of doors upset the downward flow of air and cause turbulent air currents which lift bacteria from lower levels. We have confirmed these findings in our own theatres.

Talking in theatre raises the bacterial count of the air. Hirchfield and Lambe pointed out that if one breathed quietly, did not talk, and used hand signals a mask was unnecessary.
The Patient.

The patient cannot arrive in theatre sterile but every effort should be made to see that he and his coverings are as clean as possible.

The cleaning process must begin in the ward. In the past too much emphasis has been placed on the preparation of the skin around the area of incision often to the neglect of cleanliness of the patient as a whole. In orthopaedic units it has been common to have elaborate skin preparation of the wound site for two or three days before operation. This involved amongst other things wrapping the area in sterile drapes for thirty-six hours before operation. Lowbury has shown that no antiseptic can remove organisms from the deeper layers of the skin. Skin preparation for lengthy periods does no good. It prevents the patient having a bath or shower on the day of operation. Sterile drapes merely lull one into a false sense of security. In the Victoria Hospital Group the use of sterile drapes and lengthy preparation has been discontinued. Shaving of the patient is completed the day before operation. On the day of operation the patient has a bath. Treatment of the skin is not commenced until the patient reaches theatre.

When the patient on the morning of operation goes for a shower his bed is changed with clean but not sterile linen. After his shower he is dressed in a clean gown and returned to bed to await premedication.
The theatre trolleys are different in style from the other type of hospital trolley. Theatre trolleys are held in the theatre suite and are used for theatre patients only. A trolley is swabbed down with savlon. The stretcher canvas is covered with an impervious antistatic cover which is also cleaned with savlon. The fabric pack containing clean but non sterile blankets, sheets and pillow are taken by the theatre orderly on the trolley when he goes to the ward to collect the patient. Theatre orderlies are in two groups. One group remains within the clean area of the theatre suite; the other group remains outwith the clean area. A red strip four feet wide marking the linoleum, walls and ceiling is situated on the theatre corridor as marked on the plan (Appendix E). This indicates the boundary between the two areas. No one is allowed to pass this red boundary without changing into or out of theatre dress.

The "outside theatre" orderly brings the patient from ward to theatre. At the red boundary this orderly cleans the theatre trolley wheels with savlon and pushes the trolley over the red barrier to the "inside theatre" orderly.

The patient is anaesthetised in the anaesthetic room on the trolley and wheeled into the theatre. At this point he is transferred to the theatre table. We think this method is the best practical compromise between prevention of cross infection and humane treatment of the patient.
Other methods of bringing a clean patient to the operating room table are employed. In Aberdeen Royal Infirmary the patient is transferred from an "outside" trolley to an inside trolley at an "Interchange Area". This is an area at the entrance of the theatre suite with raised "tramlines" fixed to the floor, effectively preventing a trolley being wheeled in or out of theatre. It is not considered that this additional lift from trolley to trolley of a premedicated patient is a sufficient advance on wheel swabbing to justify the adoption of the system.

Some hospitals use two operating tables per theatre. A table is wheeled to the junction of the clean and protective zone and the patient is transferred from the outside trolley to theatre table. This method is only now becoming practicable. A new lightweight operating table with large wheels is available. Standard operating tables have small wheels and are heavy. They damage terrazzo floors. When two lightweight tables per theatre are provided this method can be recommended.

The patient's skin is prepared in theatre.

Theatre Organisation.

If the work in a theatre suite is disorganised wound infection is likely to be common. The medical superintendent and theatre superintendent have a joint responsibility to ensure that selfish individuals do not cause disorganisation.
Nurses commence duty at 0800 hours and are expected to have an hour for lunch and finish duty at 1700 hours. All surgeons know that they must work within this pattern of nursing duty. If they start theatre late they must still stop for one hour between 1200 and 1400 hours and nurses must leave theatre for a proper meal. Unless a real emergency occurs theatre must finish by 1500 hours. The Theatre Superintendent has ordered the closure of theatre when there has been a deliberate attempt to extend a "cold list" beyond 1730 hours. The Medical Superintendent regularly inspects theatre books and notes the times that theatre lists end. When a surgeon is told tactfully that his surgery and his patients suffer if the nursing staff are kept working after a nine hour day, voluntary cooperation is usually achieved.

In all surgical units infected or potentially infected cases are held to the end of the list. Stewart and Douglas\textsuperscript{71} found that a "clean" case fourth or fifth on the operating list had a sevenfold greater chance of sepsis than the earlier cases. This work was, however, done in badly ventilated theatres. There was no association with duration of operation or size of wound. Girdlestone and others\textsuperscript{72} found that in a non ventilated theatre longer operations did increase the incidence of wound infection. There has been insufficient study in well ventilated theatres of the effect on wound sepsis of list order and length of operation. Until clear evidence emerges it is wise to keep clean cases to the
beginning of the list. The length of an operating session should be limited to three hours and no surgeon should do more than two such sessions in twenty-four hours.

**Surgery.**

Bad surgery and wound sepsis go hand in hand. Girdlestone and others\(^2\) considered that rough handling of tissues caused an increase in wound sepsis. Elek and Conen\(^2\) found that the presence of foreign material in a wound made it more susceptible to infection. Blair\(^2\) considered that ischaemia of a wound predisposes to wound infection. Burnett and others\(^4\) consider good surgical technique important in prevention of sepsis.

A good surgical technician who observes the principles of good surgery is likely to have less sepsis than the "butcher". Surgeons have commented on the increased incidence of haematoma and related sepsis. We are investigating the possible relationship of haematoma and the much used anaesthetic, Fluothane. This anaesthetic reduces blood pressure and minimises bleeding during operation. After the operation small bleeding points may ooze and cause haematomata. When ether was used as an anaesthetic bleeding tended to be profuse during operation and tiny vessels were tied off. This possibly prevented the formation of haematomata.
CROSS INFECTION IN WARDS.

Blowers in 1961 enumerated the four main principles of prevention of cross infection in wards. They are:

(a) Patients who may spread infection and those who are particularly liable to infection should be segregated.

(b) The ward staff should not be sources of infection.

(c) The environment should not harbour bacteria.

(d) The ward techniques employed should be those least liable to convey pathogenic organisms.

The position of the staff as carriers and sources of infection has been discussed under "Staphylococcal Carriers" and "Cross Infection in Theatres". The three remaining factors will be discussed under the headings — Isolation, The Environment and Ward Techniques. Another heading — Control of Drugs, is added.

Isolation.

Attempts to prevent cross infection in a surgical ward by barrier nursing are not likely to succeed. Shooter and others showed that in a surgical ward studied, only 13 of 186 strains of staphylococci studied caused infection.
Only three of these thirteen strains were responsible for infection in more than one patient. The types which produced the heaviest air contamination produced no infections. A few endemic strains of virulent staphylococci cause most outbreaks of wound sepsis.

Goodall\textsuperscript{74} Blowers and others\textsuperscript{75} and Colebrook\textsuperscript{76} recommended that patients suffering from lesions likely to spread infection should be segregated in separate accommodation outwith the ward unit.

This principle has been incorporated in the Victoria Infirmary ten year building programme. The Western Regional Hospital Board has approved a proposal to build an "Isolation Wing" in 1966. This wing is to be in a four storey building with ten beds per floor. The beds are to be in single room units. Each room unit will have its own shower, W.C. and wash hand basin. Each room will have positive pressure ventilation. It is felt that any lesser degree of isolation will be unsuccessful.

The provision of an isolation "block" rather than isolation rooms in each ward has two major advantages. The engineering services to each isolation room unit are costly. They can be most cheaply provided in a single compact building. This applies particularly to ventilation services. There can be much better "bed occupancy" in an isolation wing than in isolation rooms in wards. A suggested disadvantage is that the medical care is of a lower standard when the
patient is nursed outwith the surgical unit. Our private patients in the Victoria Infirmary are nursed in single rooms in a separate building and there has been no apparent or measurable diminution in medical care standards.

Patients who are debilitated because of age, dietary deficiency diseases, irradiation therapy and those who are on cortisone treatment may be more susceptible to staphylococcal infections. This view is supported by McDermott\textsuperscript{77}, and Stanley and Brooke\textsuperscript{78}. Stewart and Douglas\textsuperscript{71} did not find any association between advanced age and wound sepsis. Although there may be doubt about an association between old age and wound sepsis there seems abundant proof that patients on cortisone treatment and those receiving treatment by irradiation are particularly vulnerable to infection of wound or lung with staphylococcus aureus. These patients can be isolated in the isolation wing. When any patient is discharged from isolation the room and furniture should be washed down. The room can then be used to segregate a patient suffering from, or vulnerable to, sepsis.

At present in the Victoria Infirmary the names of patients who are suffering from infectious or potentially infectious conditions are reported to the Medical Superintendent who is "Control of Infection" officer. He controls a small male ward and single room accommodation for up to eight female beds.

This temporary measure has been welcomed by the staff and is well used.
The Environment.

A ward must be clean and cheerful. Colourful, bright surroundings are good for the morale of patients and staff. It is possible to combine aesthetic appeal and surgical asepsis.

Floors.

Hospital floors are normally of wood, linoleum, or linoleum substitutes such as polyvinyl chloride. It has, until recently, been usual to polish floors. Polished floors have certain disadvantages. Normally a polished floor is unsealed and cracks between boards or linoleum joints harbour bacteria. Floor polishers are noisy.

During 1961 all the ward and corridor floors in the Victoria Infirmary were painted with a polyurethane seal. The substance leaves a hard and durable surface. It appears shiny yet is non-slip. It requires repainting approximately once per year. It is applied to wood, linoleum and similar surfaces.

Dust, papers etc. are removed from the floors daily by suction cleaner. Modern electrical vacuum cleaning machines are safe. They are fitted with filters which prevent bacteria being ejected from the machine into the air. They do tend, however, to cause unnecessary draught and noise.
In 1960 a central suction cleaning plant was fitted in the Victoria Infirmary. The wards and corridors have outlet valves into which hoses can be plugged. Dirt is removed quietly to the basement and is collected in large cannisters. This system has proved satisfactory and economical.

The polyurethaned floors require no polish. They are washed with an electrically operated machine which cleanses and dries the floor as it moves. Several germicidal chemicals have been used experimentally in this machine. These included a chemical "Permachem" which undoubtedly had a residual bacteriostatic and bactericidal effect. The control used was a simple detergent "Cinex Cleaner" and floor swabs taken daily over several weeks showed that there was no appreciable difference between the germicidal wash and the detergent control. We now use the detergent alone as germicidal chemicals such as Permachem, Dettoll and hexachlorophene are expensive.

Walls.

Wypkema and Alder\textsuperscript{79} showed that dirt on ward walls is not readily detached and is unimportant as a cause of cross infection. We have confirmed this finding. The dirt on walls in wards of the Victoria Infirmary is acidic, possibly due to sulphuric acid in "smog". Swabs tested for bacteriological growth are normally sterile.
Despite these findings the whole hospital is washed annually. This is done at a cost of £120 per ward per year.

The effect on morale is good. It is important that in teaching nurses and medical students the practice of hygiene and asepsis instruction should be given in a clean environment.

**Curtains.**

Curtains are essential for privacy. They must not, however, become sources of infection. Most of our wards have curtains of a light cotton fabric. They are washed every six weeks. Each ward has six spare sets of curtains. If there were a serious outbreak of sepsis the curtains could be autoclaved in the high vacuum autoclave. It would take five hours to sterilise all the ward curtains in the hospital.

Glass fibre curtains have been tried in a small ward as an experiment. They are attractive, are drip dry and are fire proof. Unfortunately they are expensive and have not worn well. Nurses are liable to get small glass fibres in their fingers.

**The Bed.**

The mattress, the blankets and the pillow are potential sources of cross infection. Mattresses are liable to soiling with discharges. It has been traditional in hospital to send them to a large downward displacement autoclave steriliser for sterilisation. This most frequently happened
on the death of a patient, irrespective of the cause of death. Hair mattresses withstood this abuse well but became stained and needed regular recovering. Modern interior sprung mattresses do not withstand autoclaving without damage.

In 1960 all mattresses in the Victoria Infirmary were covered with "Qualtex" mattress covers. These covers do not wrinkle and are impervious. They are never removed. After the discharge of each patient the cover is washed with "Savlon".

Blankets have long been considered as potentially dangerous in wards. Crone\textsuperscript{80} has shown that a temperature of over 60°C is required to kill bacteria during laundering. Woollen blankets do not withstand frequent washing at high temperatures. Thomas, West, and Besser\textsuperscript{81} recommended that if woollen blankets are used they should be sterilised in ethylene oxide.

In 1956 new materials such as cellular cotton and turkish towelling came into use for hospital blankets. Blowers, Potter and Wallace\textsuperscript{82} suggested Turkish towelling and cellular cotton as blanket material and recommended that they should be boiled during laundering. Schwabacher and others\textsuperscript{83} and Gillespie and Robinson\textsuperscript{84} supported this recommendation. In 1958 all blankets used in the Victoria Infirmary were changed to Turkish towelling. They are boiled at the laundry in a germicidal chemical "Cirrasol D".
Blankets are sent to the laundry after discharge of every patient.

Pillows present an extremely difficult problem and one which to date has not been solved. In the first two chapters of this thesis we have seen that patients in hospital rapidly acquire virulent strains of staphylococci in their noses. The patient's pillow becomes heavily contaminated during sleep.

After the discharge of every patient the pillows should be sterilised. Arrangements have been made to have them sterilised in formalin vapour in a "Sparkhall Steriliser". There is, unfortunately, a large discrepancy between the estimated number of pillows which should be sterilised and the actual number sterilised. This has partly been due to an insufficient number of pillows in circulation. This has been corrected. It would appear that when a ward sister gets new pillows she is reluctant to exchange new contaminated pillows for old sterile pillows.

Plastic pillow covers have been tried experimentally. They clean easily but are unacceptable to the patient. When breathed upon condensation makes them unpleasant. We are starting experiments using pillow covers of disposable bonded fabric. It is hoped that these will protect the pillow from contamination and yet remain acceptable to the patient.
Blinds.

Roller blinds cause dissemination of dust and bacteria each time they are raised or lowered. In 1960 we experimentally replaced the roller blinds in two wards with aluminium venetian blinds. These were attractive but were difficult to keep clean. In 1962 we departed from the hospital tradition of darkening the ward after lunch and removed all blinds from two wards. Privacy was maintained as the bed curtains can be pulled round to cover the ward windows. This experiment has been successful and all ward blinds are being removed.

Washing Facilities.

Adequate washing facilities must be provided in wards for patients and staff. In March, 1961, a surgical ward at the Victoria Infirmary was closed to allow major improvements. This prototype ward was opened in October, 1961, and has been in use since that date.

Three wash hand basins were provided in the ward for staff. The water temperature is controlled by a mixing valve at 100°F and the tap has elbow control. Paper towel dispensers are situated at each basin. By providing easily available washing facilities the nurse and doctor are encouraged to use them more frequently. The slunje, toilet and washing facilities in the Victoria Infirmary are situated at the end of long rectangular wards. It proved
impracticable to re-site them near the ward centre as recommended in recent reports \(^{85, 86, 87}\). The washing and bathing facilities were provided in one annexe and dirty utility facilities in another.

Wash hand basins were provided on the scale of one per five patients. One bath and two showers were provided for twenty-two patients. Patients are not allowed to use the bath pre-operatively. Boycott\(^{88}\) showed that in twenty cultures of swabs taken from baths after use all gave positive results. The organisms cultured included \(B. \) coli, \(S. \) faecalis and \(S. \) aureus. Showers are less likely to cause cross infection. The bath is used only when immersion in water is indicated for medical reasons. Baths, basins and showers are cleaned with a hot detergent hypochlorite solution.

The slunge facilities were improved during the ward upgrading. The bedpan washers available up to 1960 were not capable of sterilising. In each of our ward slunges we had provided washers. From 1959 onwards redundant theatre instrument boilers were transferred and installed in ward slunges. They have made good sterilisers. Darmady and others\(^{89}\) reviewed the position in 1961 and recommended that the "Dishlex" bedpan washer and steriliser was the best available machine.

The ward dirty utility room was fitted with a stainless steel mackintosh slunge and a "Dishlex" machine. This combination has proved satisfactory.
We have in 1963 installed a Mark III "Vernsid" machine which disposes of disposable bedpans and urinals. Much work has been done on earlier models of this unit and verbal and written reports from Edinburgh Royal Infirmary and Robroyston Hospital have been received. The earlier models were noisy and had mechanical problems. Bowie pointed out that the addition of a protective door would make the machine bacteriologically safer. It is felt that, with improvements to this machine the use of disposable bedpans and urinals will help to reduce cross infection in wards.

Air Conditioning.

Mechanical ventilation of wards is necessary. Positive pressure ventilation to the ward and extract ventilation in the dirty utility room and W.Cs. as recommended by Wightman is desirable. With improvement in filter design 75% recirculation of air would be acceptable and would reduce maintenance costs. An experimental plant will be installed with this specification in a ward which is being upgraded in May, 1963.
Ward Techniques.

Medical and nursing techniques in wards deserve careful study. Wound dressings should be done with the same attention to aseptic ritual as a lumbar puncture. At present the supply of sterile packs and instruments is in advance of information regarding their proper use.

Surgical wounds should not be inspected or dressed until the sixth post-operative day unless there are clear surgical indications to do otherwise. By the sixth day the wound should have healed and made the introduction of bacteria to the wound impossible.

Every hospital must have a clearly defined drill for the use of C.S.S.D. products at their disposal. The matron, sister tutor and ward sister must all agree on the technique to be employed in each individual procedure. The packaging of C.S.S.D. products will influence the technique employed.

A booklet outlining in detail a method of performing all nursing and medical procedures employed in hospital is being prepared. The methods described will suit the packaging of sterile products issued from South Glasgow Central Sterile Supply Department. The demand for this information has come from the users of C.S.S.D. products.

Many common procedures require attention. Green and Penfold, Mirvesh and a Lancet editorial drew attention
to the potential danger of the clinical thermometer as a vehicle of cross infection.

At the Victoria Infirmary each patient has his own thermometer which is retained in 70% alcohol. After the discharge of a patient his thermometer is washed in savlon and the alcohol is changed.

Sisters can be kept interested in these details of ward technique by discussing them at Study Days.

Control of Drugs.

The dangers of indiscriminately using antibiotics has already been discussed. This danger was realised in 1958 and measures were adopted to minimise this danger.

A committee consisting of a Consultant Surgeon, a Consultant Physician, the Chief Pharmacist and the Medical Superintendent drew up an approved list of drugs. This list has been revised at approximately six monthly intervals. A copy of this list is attached as Appendix F. Only the drugs listed may be used in the Victoria Hospital Group. The Chief Pharmacist may substitute one trade product for another. No new drug is added to the list without the committees' approval. No new drug is added to the list without the removal of one from the list.
A careful check is kept on antibiotics. They are controlled as recommended by Barber\textsuperscript{93}. They are used in rotation and new antibiotics are held in reserve.

Antibiotics are, when dangerous, packaged in the safest possible form. Streptomycin, which is liable to cause sensitivity in nurses handling it, must be kept away from the nurses' skin. Streptomycin is now issued in cartridges which are used in special syringes. When used in this way the drug does not touch the nurses' skin.

Nurses are lectured on the dangers of allowing antibiotic solutions to be spilled. They are warned that even traces of antibiotic in the dust of hospitals can lead to the emergence of antibiotic resistant strains.

An investigation of sepsis in clean surgical wounds was carried out over six months. This investigation is continuing and is part of a wider investigation into anaesthetics, suture materials and techniques.

A standard stamp

<table>
<thead>
<tr>
<th>WOUND STATE</th>
<th>DAYS POST OP.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAN</td>
<td></td>
</tr>
<tr>
<td>STITCH RED</td>
<td></td>
</tr>
<tr>
<td>STITCH RED WITH PUS</td>
<td></td>
</tr>
<tr>
<td>FRANK SEPSIS</td>
<td></td>
</tr>
</tbody>
</table>

is used on each case sheet. Each case is classified before operation as clean or potentially infected. Amongst the latter group is included obvious sepsis such as a breast abscess and operations on the large bowel and rectum. This classification and the inspection and grading of wounds is done by the surgical registrar in each of the three units. Surgical registrars rotate and during this survey a rotation occurred.
Wounds were for the purpose of this investigation classified as "clean" or "dirty". When there was stitch redness which disappeared without pus formation within ten days of operation the wound was classified as "clean". When pus occurred, even when restricted to one stitch the wound was classified as "dirty".

The results were:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Number of wounds</th>
<th>Number of clean wounds</th>
<th>Number of dirty wounds</th>
<th>% of dirty wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>931</td>
<td>921</td>
<td>10</td>
<td>1.07%</td>
</tr>
<tr>
<td>B</td>
<td>882</td>
<td>878</td>
<td>4</td>
<td>0.45%</td>
</tr>
<tr>
<td>C</td>
<td>812</td>
<td>810</td>
<td>2</td>
<td>0.25%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2625</strong></td>
<td><strong>2609</strong></td>
<td><strong>16</strong></td>
<td><strong>0.7%</strong></td>
</tr>
</tbody>
</table>

This survey has not been conducted in a manner which enables the results to withstand critical statistical analysis. One would have preferred an independent clinician to inspect and grade wounds. This never appears likely to be practicable. Phage typing of all staphylococcal infections is to be introduced on March 1st, 1963. This it is hoped will allow the tracing of a dangerous phage type.

Despite these shortcomings it is felt that such a survey is useful. It produces a baseline on which one can improve and highlight weak points in the hospitals' defences against
the staphylococcus. Nine of the ten cases of wound infection in unit A were operated upon by a senior surgeon who is near retirement. Although he is cooperative in introducing new methods and materials to his theatres he does not think that he, himself, can be a source of infection. He does not, for example, always wear a mask in theatre.
Conclusions.

By improving theatre facilities, ward facilities and by providing sterile materials for operations and ward procedures, the incidence of infection of clean wounds has been reduced from 6.7% to 0.7%.

It would appear that infection is most frequently introduced in theatre. If money is limited, priority should be given to theatre improvements and to the supply of sterile theatre instruments, dressings and fabrics.

A comparison of the results achieved in three surgical units would indicate that the "human element" is very important. One cannot eliminate bacteria unless the surgeon and his assistants can mentally visualise them.

The incidence of infection in surgical wounds must be recorded accurately. Phage typing of all staphylococcal infections will make the early detection and prevention of an epidemic of wound sepsis easier.

Prevention of wound sepsis is a team responsibility involving the entire hospital staff. Pathogenic bacteria cannot be eliminated from hospital. The war against sepsis cannot end. The team's effort must be planned, vigorous and continuous.
Appendices.

Appendix A. Brochure – South Glasgow Central Sterile Supply Department.

Appendix B. Cost of Large Scale Central Sterile Supply, Weymes, C., The Hospital, March, 1963.


Appendix E. Plan of Four Theatre Suite, Victoria Infirmary, Glasgow.

Appendix F. Glasgow Victoria Hospitals – Prescribing of Drugs.
References.

1. Hospital Infection Yesterday and Today. Barber, M.

2. Medical Aspects in the Control of Hospital Acquired
   Staphylococcal Infections. Schrech, K.M.

3. Virulence and Phage Patterns of Antibiotic Resistant
   Staphylococcus in Hospital. Alder, V.G.
   Gillespie, W.A. Thompson, M.E.M.

4. Spread of Staphylococcus in a Surgical Ward.
   Shooter, R.A. Smith, M. Griffiths, J. Brown, M.
   Williams, R.E.O. Ripon, J. Jevons, M.P.

5. Epidemic Staphylococcus. Williams, R.E.O.

6. A Survey of Staphylococci Isolated in Hospital Practice.
   Bradley, J. Meynell, M.J.

   Barber, M. Burston, J.


63. "Disinfection of the hands of Surgeons and Nurses".


65. Control of Staphylococcus Aureus in an Operating-Theatre.

66. The Integrity of Surgical Gloves Tested During Use.


86. The Design of Ward Units, Ninewells Hospital, Dundee. Wightman, A. Ibid.
   Pearson, W.A.A. Ibid.

88. The Disinfection of Baths and Basins. Boycott, J.A.

89. Disinfection of bedpans. Darmady, E.M. Hughes, K.E.
    Jones, J.D. Prince, D. Verdon, P. Journal of

90. Clinical Thermometers as a possible source of Cross-
    Infection in Hospital. Green, J.B.M. Penfold, J.B.

91. Clinical Thermometers and Cross-Infection in Hospitals.
    Mirvinish, I. South African Medical Journal, 1956,

92. The Tainted Thermometer. Editoria. Lancet, 1956,
    Vol. 11, p. 559.

93. Staphylococcal Infection in Hospital. Barber, B.
    Proceedings of the Royal Society of Medicine, 1956,
    Vol. 49, p. 266.
SOUTH GLASGOW CENTRAL STERILE SUPPLY DEPARTMENT
SOUTH GLASGOW
CENTRAL STERILE SUPPLY
DEPARTMENT
INTRODUCTION

In April, 1961, it was decided to widen the scope of the Victoria Infirmary Central Sterile Supply Department in order to carry out large scale practical experiments in Central Sterile Supply. The Victoria Infirmary C.S.S.D. started as a syringe service in 1958. By April, 1961, it had developed into a department supplying syringes, theatre packs, and ward instruments. Other items such as drainage tubes, disposable catheters and disposable dressings were bought pre-sterilised from manufacturers. All boiler sterilisers were removed from wards early in 1961.

At that time those interested in the development of Central Sterile Supply Departments were asking questions which only large scale experiments could answer. It was decided by the Western Regional Hospital Board to enlarge the Victoria C.S.S.D. into a South Glasgow C.S.S.D. and to use it for experiments in production and distribution.

In the year between April, 1961 and April, 1962, the C.S.S.D. has expanded rapidly. At the present time (April, 1962) the South Glasgow C.S.S.D. is issuing fabrics to twenty-two theatres in six hospitals and ward instruments to 1,500 beds in seven hospitals. Mixed ward packs are produced at present at the rate of 25,600 per week. The Victoria Infirmary Casualty Department is also supplied from C.S.S.D. Within a few months the number of theatres supplied will rise to thirty and the beds to three thousand.

In view of the current interest in Central Sterile Supply it was thought profitable to review the information so far obtained in developing this service and to present facts and costs which might be of assistance in planning new Central Sterile Supply Departments. In doing this it is not suggested that the solutions presented are ideal or that no problems remain to be solved. Experience is showing, however, that certain processes have an optimal scale of economic production. This scale of production indicates the number of beds or theatres which can be economically grouped round a Central Sterile Supply Department. When these factors are related to geography one gets an indication of the pattern in which Central Sterile Supply Departments should develop. It can be shown that if production is optimal and if distribution is over a selected number of beds and a selected geographical area a C.S.S.D. can compete with trade suppliers. The margin of saving is not large enough to allow haphazard development of Central Sterile Supply Departments competing with each other. It is now proposed to discuss certain aspects of the South Glasgow C.S.S.D. and to draw some conclusions. Many important points such as control of sterility will be insufficiently discussed. Attention will be specifically directed to the problems of organisation and administration as these are the particular factors which will influence the development of C.S.S.D.'s.

South Glasgow C.S.S.D. has developed in three parts. This division was occasioned initially by accommodation problems. Experience has shown that three separate work flows are involved and that perhaps if accommodation presented no difficulties it might not be desirable to put them in one building. The three parts are C.S.S.D. 1—dealing with instruments and syringes; C.S.S.D. 2—dealing with theatre packs and fabrics; C.S.S.D. 3—dealing with ward dressing packs.

The C.S.S.D. Superintendent is an experienced nurse who has worked in a variety of wards as Sister and who has had theatre experience. She is responsible to the Group Medical Superintendent who is also an administrative medical officer of Western Regional Hospital Board.
CENTRAL STERILE SUPPLY DEPARTMENT

Function

This department produces sterile metal instruments in aluminium containers for use in wards, casualty and other departments.

Accommodation

500 sq. ft. working area. Locker, canteen, bulk store, sterile store, and other facilities are provided elsewhere.

Equipment

1 Ultrasonic washer.  
6 ft. of stainless steel benching with cupboards under and overhead.  
1 Infra Red Conveyor Belt Oven.  
2 Work Tables.

2 Capping Machines.  
1 Hot Air Oven.  
60 Trays.  
1 General Trolley.  
80 Linear ft. of 18 in. Shelving.

Staffing

1 Supervisor (Staff nurse grading) 50 per cent. time.  
3 Assistants (Ancillary Staff grade 3).  
1 Instrument Technician (50 per cent. time).  
1 Domestic (25 per cent. time).

Work Method

1. Dirty instruments and tubes are emptied from paper bag containers. Instruments (suspended on a special bracket which holds 200 instruments) are washed in the ultrasonic washer. A non-ionic detergent is used. The instruments are rinsed and transferred to wire trays. The aluminium containers are washed by hand using a brush. They are rinsed and placed in wire trays.

2. Instruments and containers are dried by placing them on the hot top of the Instrument rack held over Ultrasonic Washer
infra red conveyor or when urgently required they are passed through the conveyor.

3. Instruments are sorted into types and inspected. Damaged instruments are repaired by the technician or sent to trade repairers. Instrument joints are oiled as required with 75 per cent. silicone in ether.

4. Instruments are packed in aluminium tubes. To allow packaging in cylindrical tubes of even diameter the instruments are specially jointed to allow them to fold into a long straight narrow shape. This specification has not increased the price. The instruments are packed in type groups—scissors, dressing forceps, spencer wells forceps, mosquito forceps, dissecting forceps, probes and Bard Parker Handles. The tubes are sealed with a tinfoil top in a capping machine. A colour code plus a description embossed on the cap identifies the contents.

5. The tubes are loaded in trays and passed through the infra red oven. They are subjected to a controlled temperature of 180°C for 14 minutes. The
trays which cool rapidly are stacked and the tubes are packaged 18 to a cardboard carton.

6. Many special sets and instruments are prepared in this department. Spinal needles, sternal puncture needles, special syringes, etc., are packaged in glass tubes sealed with foil caps and sterilised in the hot air oven. These sets while requiring special preparation do not in relation to total output take long to produce. Cutting down sets are packed in foil trays, wrapped in paper and are then autoclaved in C.S.S.D. 2. The range of articles produced is listed at Appendix A.

Problems
This department now producing instruments for a large casualty department and 1,500 beds is working below capacity. It is estimated that this department with one infra red conveyor belt oven can comfortably cope with 3,000 beds.

A standby conveyor belt oven is not required. The present model is five years old and has not been out of commission when required for more than an hour.

Delivery of stocks of instruments from the trade has been a major problem. The quantities required to serve hospitals on a daily delivery five days per week is approximately:

Infra Red Conveyor Belt Oven
One manufacturer has quoted two years delivery. With a rapid national expansion of this service, increasing demand is likely to aggravate the position.

Identification of instruments in tubes was difficult until the manufacturer agreed to emboss descriptive names on the foil cap. They offer this as a free service when quantities of 64,000 of each name are purchased. This identification could be improved if the embossed letters were of a contrasting colour or of uncoloured tin foil.

Control of the temperature on the old model conveyor belt oven has proved difficult but has been overcome by checking it daily with armoured plated thermocouples and by putting voltage controls on each projector. New model infra red belts have automatic controls.

CENTRAL STERILE SUPPLY DEPARTMENT

The function of this department is to pack and sterilise disposable and non disposable fabrics, disposable gloves, rubber tubing and drains for theatres and labour rooms.

Staffing

Supervisor (S/N grading) 50 per cent. time.
5 Assistants (Ancillary staff grade 3).
Steriliser Attendant (male).
1 Domestic (25 per cent. time).

Accommodation

1,000 sq. ft. working area. Storage facilities, canteen and staff changing accommodation is provided elsewhere.
Equipment

2 x 10 cu. ft. high vacuum autoclaves.
Work table 10 x 4 ft. with transilluminated area 5 x 3 ft.
45 ft. of workbench, 3 ft. high and 2 ft. 6 ins. wide.
110 ft. of shelving, 18 ins. deep at 18 ins. intervals.
90 ft. of shelving, 24 ins. deep at 18 ins. intervals.
1 heat sealing machine.
1 steriliser loading trolley.
Polythene tub trolley.
6 "Evertau" chairs.

Work Method

Sorting—Laundry bags containing mixed clean C.S.S.D. linen are opened. The linen is unfolded, inspected on the transilluminated work table, refolded in the correct manner and placed on the adjacent storage shelves. Linen requiring repair is sent to the hospital sewing room.

Preparation—Preparation work is performed at the workbenches. Swabs are tied in bundles of twelve. Abdominal packs are bundled in sixes.

Pack Assembly—Assembly of various packs, gowns, etc., is done in different work flows, one run at a time. When, for example, major abdominal packs are assembled the sequences would be as follows.
Assistant A is responsible for supplying assistants B and C, who are assembling the packs, with linen and dressings from the storage shelves.

The inner wrap, a 60 ins. x 76 ins. green sheet, which forms the theatre trolley drape, is doubled and spread across the work table by assistants B and C. They then enclose the pack contents in this, parcel fashion. The two side flaps forming the final fold are secured on top with heat seal tape.

At this stage the pack is set aside to await the outer paper wrap. In practice, assistant A is usually free to do this. The pack is then identified and dated and placed on a trolley ready for the autoclave.

Sterilisation—Assembled packs are sterilised in the autoclaves and passed to the storage shelves. Autoclaves require frequent routine maintenance and daily checks. Each day the vacuum must be checked with a direct vacuum gauge. The temperature inside the autoclave is checked by using thermocouples. One should be left permanently in the chamber drain as a check on the autoclave thermometer. One should be placed in a standard test drum containing 27 huck towels, each folded three times (eight thicknesses). Brownes tubes and test spores should be inserted in each load. The range of packs produced is listed at Appendix B.

Problems

A major problem is the maintenance of the autoclaves in perfect working order. Present models have imperfect components, particularly valves and have inadequate gauges. Only well trained staff using the monitoring equipment intelligently can diagnose minor steriliser defects. An integrator is a most useful device which compensates for defects in the autoclave. It prevents completion of a cycle until the required temperature has been maintained for the requisite time.

Laundry services present difficulties. C.S.S.D. areas cannot coincide with laundry service areas. It must frequently happen that one C.S.S.D. receives
clean linen from four or more laundries. All linen must belong and be marked by the C.S.S.D. Close liaison between the C.S.S.D. superintendent and laundry managers is necessary.

Standardisation of pack contents and restriction of the variety of packs used is essential. The ideal pack should be adequate for the purpose for which it was designed in 95 per cent. of cases and surplus materials from the pack should not exceed 5-10 per cent. The variety of packs can be limited by supplying a range of separately packed supplements. Standardisation is best achieved by issuing trial packs to selected critical users for use and comment. Considerable experience has been obtained in this field in many centres and it should no longer be necessary to repeat this process in every new C.S.S.D.

**CENTRAL STERILE SUPPLY DEPARTMENT**

The function of this department is to produce sterile disposable ward packs and supplementary packs in *competition with commercial suppliers.*

**Staffing**
- Supervisor (Staff Nurse grade).
- 9 Assistants (Auxiliary Staff grade 3).
- 1 Steriliser attendant (male).
- 1 Domestic (50 per cent. time).

**Accommodation**
- 2,000 sq. ft. bulk store.
- 4,350 sq. ft. working area plus changing and common room facilities.

**Equipment**
- 2 x 15 cu. ft. high vacuum autoclaves.
- 1 18 ft. conveyor belt.
- 2 heat sealing machines.
- 720 ft. of shelving 2 ft. wide at 18 ins. intervals.
- 2 General purpose trolleys.
- 1 Polythene tub trolley.
- 8 “Evertaut” chairs.

**Work Method**

Raw materials—cardboard cartons, paper, cotton wool, gauze, foil gallipots are transported by trolley from the bulk store to a room adjoining the work room. Here outer wraps are removed and the individual items are stacked on open shelves within the workroom.
Two main functions are performed in this workroom. Individual items are prepared—e.g., paper drapes are folded. A particular type of pack is then prepared from individual items. The keywords in this department are "mass production" and "work study." It is inevitable, therefore, that the focal point should be a conveyor belt. There are ten work positions at the conveyor belt and packing bench; these are shown on the plan of this area. The number of assistants on the assembly line varies according to the pack being produced. A typical work sequence would, for example, be the assembling of large dressing packs as follows.

Five assistants at the assembly line, in positions A, B, C, D and E, select the pack contents from the bench shelving around their work area and wrap them in a Sterifield sheet. The pack is then put into a heat sealed bag and passes on the conveyor to the sealing position. The assistants at the sealing machines, G and H take the packs from the conveyor belt, seal them, and they are ready for packing into Bripac boxes at positions K and J. If only one packer is available the sterilising attendant assists when he is free or alternatively the packs are returned to the conveyor belt and carried to the terminal collecting bin to be boxed later. A 20 ins. x 10 ins. x 6 ins. Bripac box contains 16 large dressing packs. The boxes are stacked on the pre-sterilising shelves to await autoclaving.
After sterilisation the boxes are labelled sterile, dated and stored on the “post sterilisation” storage shelves. From here the Bripac boxes are packed three to a large cardboard carton.

The present output of large ward packs is 400 per hour. This includes time spent on preparing individual items. One 15 cu. ft. autoclave can cope with this volume. When it is remembered that this department must compete with commercial producers the temptation to over-insure by installing larger autoclaves is more easily resisted. The range of packs produced is given at Appendix C.

Problems

The main problem is inter C.S.S.D. standardisation. Manufacturers are given widely varying specifications for sizes and qualities of materials such as paper drapes and cardboard containers. Unless standardisation and bulk buying is achieved it will be difficult for any but the largest units to compete with industry. Major economies can be achieved by buying direct from the paper mill in tons instead of from distributors in sheets. There is obviously much scope for bulk buying on central contracts.

Work study is extremely important. Processes are repetitive and seconds are important. The whole of this department is experimental and any part of it is easily adaptable.

Mechanisation could with profit be increased if properly designed machinery were available. At present in spite of much investigation, a suitable paper-folding machine has not been found. A machine rolling cotton wool balls would reduce the cost of sterile cotton wool balls but the machinery at present available is too large to be economical at our present scale of production.

Distribution

Principles

(a) The Central Sterile Supply Department tops up hospital or “hospital group” sterile stores on indent.
(b) The hospital sterile store holds three days to three weeks supply depending on the nature of the items.
(c) The hospital sterile store tops up the ward store to an agreed level without indent.
(d) Delivery to hospital sterile store is a C.S.S.D. responsibility.
(e) Delivery from the hospital sterile store is the hospital responsibility and below hospital sterile store level the C.S.S.D. superintendent acts only as adviser.

Staff

One driver-storeman (relief driver is provided from hospital transport pool).
Theatre Suite Sterile Store

Instrument Dispenser in Casualty Dressing Room
Equipment

One 3-ton van with internal dimensions 14 ft. long x 6 ft. 7 ins. broad x 6 ft. 6 ins. high. It is unracked and has smooth lino floor and smooth white walls.

Method

Instruments from C.S.S.D. 1 and packs, etc., from C.S.S.D. 2 are taken from individual departments daily and stored in the Victoria Infirmary Central Sterile Store. This large store of 500 linear ft. x 21 ins. shelf space, has a double role. It stores all sterile goods from C.S.S.D.'s 1 and 2 awaiting issue to other hospital sterile stores. It also acts as the Victoria Infirmary hospital sterile store.

The produce of C.S.S.D.'s 1 and 2 is not bulky. At present the three ton van is used for delivery. When production from the three departments increases it is proposed to use a 15 cwt. van for distribution from C.S.S.D.'s 1 and 2. The packs and instruments are delivered daily to hospital sterile stores. Indents await the driver-storeman at each hospital sterile store and he leaves the items requested. A copy of the indent is used in costing.

Delivery from C.S.S.D. 3 is made in the three ton van. A large hospital will take a van load of 7,000 mixed ward packs valued at £350 in a single delivery. This will last a 500 bed acute general hospital between one and two weeks.

From the hospital sterile store the hospital storeman tops up wards and departments, usually by trolley. The average 25 bed ward requires a ward sterile store of approximately 15 linear ft. of 24 ins. shelving. This is best provided as a clean utility room outside the ward. It is desirable that the ward dressing trolley can be wheeled into this room. Simple dispensers which allow tubes containing instruments to be used in sequence are helpful. A bank of these dispensers is useful in the casualty department dressing room. Special items which are infrequently used such as lumbar puncture needles are held centrally in an emergency store to which all wards have access 24 hours per day. This can be combined with an emergency drug store.

The return of soiled articles to C.S.S.D. is in two channels. Dirty linen goes to the hospital's laundry and is returned from the laundry to the C.S.S.D. On average each piece of theatre linen is used three times in two weeks.

Dirty instruments from ward dressings go into paper bags. These bags go into ward dirty instrument containers. These are rubber buckets with lids and are clearly marked "dirty instruments." They have thin disposable polythene liners. These liners containing the dirty instruments are removed, crimped, and placed in the hospital dirty instrument trolley. This is a rectangular polythene bath lined with a thin disposable bag and mounted into a four wheel chassis. The bath is removed from the chassis at the dirty instrument room. This is a small room adjacent to the hospital sterile store. The bath of dirty instruments is removed to C.S.S.D. 1 in the C.S.S.D. delivery van. No special van is needed.
Problems

Packaging is at present a difficult problem. The three ton van carries a maximum load when it is unshelved. It is difficult to provide canopies to load and unload under cover because of the height of the van. It is essential that the Bripac boxes containing packs should be kept clean and dry during transport. These are at present packed in cardboard cartons in which bulk supplies have been delivered. A supply of new cartons, guaranteed spore free, is awaited.

Shelf life of items is not a problem. Items as packaged have been shown to have a shelf life of many months. The date of sterilisation is marked on each pack. The hospital store and ward store must have a definite issue drill to ensure that sterile goods are used in sequence.

Costing

The South Glasgow C.S.S.D. is intended to supply within a few months.

3,000 beds in mainly acute hospitals.
30 operating theatres.
6 labour rooms.
2 casualty departments.

The following facts are intended to act as an indication of capital costs and running costs where the scale of production is comparable. Production on a smaller scale is inevitably more expensive. Once a C.S.S.D. is equipped and holds an adequate stock of raw materials then the total cost of operating should be passed on to the consumer as a charge against individual items.

CENTRAL STEREILE SUPPLY DEPARTMENT

CAPITAL EQUIPMENT

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>12ft. Stainless Steel Fitments (Easifit)</td>
<td>£280.00</td>
</tr>
<tr>
<td>2 Work Tables</td>
<td>£55.00</td>
</tr>
<tr>
<td>2 Capsuling Machines</td>
<td>£60.00</td>
</tr>
<tr>
<td>1 Hot Air Oven</td>
<td>£150.00</td>
</tr>
<tr>
<td>1 General Purpose Trolley</td>
<td>£30.00</td>
</tr>
<tr>
<td>60 Trays (Infra red Sterilising)</td>
<td>£45.00</td>
</tr>
<tr>
<td>80 Linear ft. 18 ins. Shelving</td>
<td>£60.00</td>
</tr>
<tr>
<td>1 “Dawe” Ultrasonic Washer</td>
<td>£1,000.00</td>
</tr>
<tr>
<td>1 Infra Red Conveyor Belt Oven</td>
<td>£705.00</td>
</tr>
</tbody>
</table>

**Total Cost:** £2,385.00
### CENTRAL STEREILE SUPPLY DEPARTMENT 2

#### CAPITAL EQUIPMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Manlove Alliott 10 cu. ft. autoclaves at £2,245 each</td>
<td></td>
<td>£4,490 0 0</td>
</tr>
<tr>
<td>1 Polythene Tub Trolley</td>
<td></td>
<td>35 9 0</td>
</tr>
<tr>
<td>1 Steriliser Loading Trolley</td>
<td></td>
<td>20 0 0</td>
</tr>
<tr>
<td>1 Work Table, 10 ft. x 4 ft. with transilluminated area</td>
<td></td>
<td>52 0 0</td>
</tr>
<tr>
<td>45 ft. Work Benching 3 ft. x 2 ft. 6 ins.</td>
<td></td>
<td>30 0 0</td>
</tr>
<tr>
<td>110 ft. Shelving 18 ins. deep with 18 ins. intervals</td>
<td></td>
<td>200 0 0</td>
</tr>
<tr>
<td>90 ft. Shelving 24 ins. deep with 18 ins. intervals</td>
<td></td>
<td>210 0 0</td>
</tr>
<tr>
<td>1 Heat Sealing Machine</td>
<td></td>
<td>35 0 0</td>
</tr>
<tr>
<td>8 Adjustable Chairs (Evertaut)</td>
<td></td>
<td>58 17 9</td>
</tr>
</tbody>
</table>

**Total**: £5,131 6 9

### CENTRAL STEREILE SUPPLY DEPARTMENT 3

#### CAPITAL EQUIPMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 15 cu. ft. High Vacuum Autoclaves at £3,000 each</td>
<td></td>
<td>£6,000 0 0</td>
</tr>
<tr>
<td>1 18ft. Conveyor Belt</td>
<td></td>
<td>280 0 0</td>
</tr>
<tr>
<td>2 Heat Sealers</td>
<td></td>
<td>70 0 0</td>
</tr>
<tr>
<td>720 ft. Shelving 2 ft. wide with 18 ins. intervals</td>
<td></td>
<td>471 0 0</td>
</tr>
<tr>
<td>2 General Purpose Trolleys</td>
<td></td>
<td>30 0 0</td>
</tr>
<tr>
<td>1 Polythene Tub Trolley</td>
<td></td>
<td>35 9 0</td>
</tr>
<tr>
<td>6 Evertaut Chairs</td>
<td></td>
<td>42 17 9</td>
</tr>
</tbody>
</table>

**Total**: £6,929 6 9

### Value of Stocks of Central Sterile Supply Departments at 1st January, 1962

<table>
<thead>
<tr>
<th>Department</th>
<th>Stock Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.S.S.D. 1</td>
<td>£5,878</td>
</tr>
<tr>
<td>C.S.S.D. 2</td>
<td>£4,031</td>
</tr>
<tr>
<td>C.S.S.D. 3</td>
<td>£3,644</td>
</tr>
</tbody>
</table>

(See Appendix D, E, F)

Stock of pre-sterilised trade items at 1st January, 1962: £866 9s. 6d. (See Appendix G)

### Annual Salaries and Wages based on Present Staffing Level

<table>
<thead>
<tr>
<th>Department</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.S.S.D. 1</td>
<td>£2,388</td>
</tr>
<tr>
<td>C.S.S.D. 2</td>
<td>£3,566</td>
</tr>
<tr>
<td>C.S.S.D. 3</td>
<td>£4,915</td>
</tr>
</tbody>
</table>

### Running Costs for Materials for Six Months

<table>
<thead>
<tr>
<th>Department</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.S.S.D. 1</td>
<td>£1,164 7s.</td>
</tr>
<tr>
<td>C.S.S.D. 2</td>
<td>£2,315 8s.</td>
</tr>
<tr>
<td>C.S.S.D. 3</td>
<td>£3,065 5s. 9d.</td>
</tr>
</tbody>
</table>

(See Appendix H, J, K)
Cost of ward instruments per average general hospital bed - - - - £2 10 0
Cost of ward instruments per average gynaecological hospital bed - - - - 5 0 0
Capital cost of instruments per 1,000 primary casualty department attendances per annum - - - - 30 10 0
Sterilising cost per instrument or instruments in one metal container - - - - £0 0 2
Capital cost of linen per operating theatre (See Appendix L) - - - - 450 0 0
Cost of preparing and sterilising a major abdominal pack (this cost does not include depreciation or replacement of linen) (See Appendix M) - - - - 1 11 52
Cost of preparing and sterilising a minor pack (this cost does not include depreciation or replacement of linen) (See Appendix N) - - - - 0 8 312
Cost of preparation and distribution of a large ward dressing (See Appendix O) - - - - 0 0 23
Cost of preparation and distribution of a small ward dressing (See Appendix P) - - - - 0 0 7
Cost of preparing one gauze supplementary pack size 1—12 ins. x 12 ins. gauze square (See Appendix Q) - - - - 0 0 6
Comparison of cost of doing 100 major ward dressings using C.S.S.D. dressings with the cost of doing the equivalent number of dressings using commercial supply packs (See Appendix R) - - - - -

Conclusions
1. Disposable items produced in plastic and sterilised by irradiation can only be supplied from trade sources. They can be supplied to ward and departments from pharmacy, from general stores, or from hospital sterile store.
2. Procedures in C.S.S.D.'s 1, 2 and 3 are quite separate and unless production is very small separate work flows should be provided.
3. C.S.S.D.'s 1 and 2 deal chiefly with materials which are reprocessed. These costly materials must be used as frequently as possible. Dirty instruments should be returned daily to facilitate washing. A small van is adequate for delivery to and from C.S.S.D.'s 1 and 2. The area of delivery must be limited as relatively small quantities are transported daily.

It seems logical that C.S.S.D.'s 1 and 2 should form one unit preferably in one building. The unit should be sited where 80 lb. boiler steam pressure is cheaply available. In an area of high population density, up to 5,000 beds might be supplied from one centre. In country districts this number might have to come down to 1,500 beds.

Central Sterile Supply Department 3 produces entirely disposable items. Shelf life of the packs produced is many weeks. Production to be economical must be on a very large scale. Work flow is quite different from that of Central Sterile Supply Departments 1 and 2. The larger the production the cheaper is the product. The existing C.S.S.D. 3 could employ profitably 14 assistants per shift (existing 9) without overloading either accommodation or plant and could work a double shift. Transport charges are small in relation to the value of load. The van carries 7,000 ward packs valued at £350. The operating cost of the van is approximately 15s. per hour. Economical delivery can therefore be over a wide area.

The present C.S.S.D. 3 could, if required and without additional equipment, cover the needs of 10,000 beds in mainly acute hospitals. The smallest number of beds which it is economical to provide is probably 2,000.
Appendix A

Packs Produced in Central Sterile Supply Department

More than 90 per cent. of the instruments used in the wards and departments are the fold flat type and are packed in 20 c.c. Alka aluminium tubes and sterilised in the infra red conveyor oven. Special needles, etc., require to be sterilised in the hot air oven and for identification purposes, are packed in glass tubes. Some instruments, e.g., needle holders, not available in the fold flat variety and cut down sets, involving a number of instruments must be packed in paper and sterilised by steam.

The three groups are as follows:

Infra Red Conveyor Oven

Packed in 20 c.c. aluminium tubes which are sealed with foil caps.

- Dressing Set—3 Dissecting Forceps, non-toothed.

Single Instruments

- Spencer Wells Forceps.
- Mosquito Forceps.
- Sinus Forceps.
- Clip Removing Forceps.
- Dissecting Forceps, non-toothed.

- Dissecting Forceps, toothed.
- Probe.
- Stitch Scissors.
- Bard Parker Handle.
- 20 c.c. Syringe.

Hot Air Oven

Packed in glass tubes of varying sizes which are sealed with foil caps.

- Aspirating Needle
- Lumbar Puncture Needle
- Liver Biopsy Set
- Sternal Marrow Set
- Pentothal Mixing Set
- Trocar and Cannulae
- Southey’s Tubes
- Catheter Adaptor
- Insulin Syringe
- Tuberculin Syringe

High Vacuum Autoclave (packed in heat seal bags)

- Stitching Set: 1 Dissecting Forcep, non-toothed
- 1 Dissecting Forcep, toothed
- 1 Needle Holder
- Vaginal Speculae
- Mayo Scissors
- Eye Scissors
- Angled Forceps
- Spinalmanometer
- Rotanda Syringe (this is first wrapped in protective tissue)

Cutting Down Set: 4 pairs Mosquito Forceps

- 1 pair Dissecting Forceps, non-toothed
- 1 pair Dissecting Forceps, toothed
- 1 pair Eye Scissors
- 1 Bard Parker Handle
- 1 Aneurysm Needle
- 1 Skin Needle and Black Silk

This Cutting Down Set is packed in a tinfoil tray and wrapped in a Sterifield sheet which forms the sterile field when the set is in use. The outer cover is a heat seal bag to which a pre-sterilised cannulae and catgut are taped after sterilisation.
APPENDIX B

Theatre Packs Produced in C.S.S.D. 2

Major Abdominal Pack

10 Green Dressing Towels
 1 Medium Drape
 1 White Dressing Towel
 1 Disposable Sterifield Sheet (suture book)
48 Raytec Swabs 4 ins. x 4 ins., 32 ply
12 Plain Swabs, 4 ins. x 4 ins., 32 ply (skin cleansing)
12 Raytec Abdominal Swabs 12 ins. x 12 ins. 24 ply

Minor Abdominal Pack

8 Green Dressing Towels
 1 Medium Drape
 1 Sterifield Sheet
24 Raytec Swabs
10 Plain Swabs

Perineal Pack

1 Lithotomy Sheet (with leggings)
 5 Green Dressing Towels
12 Raytec Swabs
12 Plain Swabs

D. and C. Pack

2 Green Dressing Towels
 1 Hernia Towel
 1 Cautery Towel
8 Plain Swabs
1 Gyn Pad

Ear Pack

4 Dressing Towels
 1 Mastoid Towel
24 Plain Swabs, 2 ins. x 2 ins.
 4 Cotton Wool Balls
 2 Gauze Squares
 2 3 ins. Crepe Bandages
12 Cotton Wool Pellets
Half-inch Packing
 1 in. Packing

Nose and Throat Pack

4 Dressing Towels
6 Plain Swabs, 2 ins. x 2 ins.
Half-inch Packing
 1 in. Packing

Eye Pack

3 Dressing Towels
 6 Plain Swabs, 2 ins. x 2 ins.
12 Dental Rolls
12 Eye Swabs
 1 Eye Towel
 2 Eye Pads
 1 3 in. Eye Bandage

Three Gowns, Three Hand Towels

1 Sister's Gown
 2 Surgeons' Gowns
 3 Hand Towels

One Gown, One Hand Towel

1 Surgeon's Gown
1 Hand Towel

Supplementary Packs

1 Medium Drape
 1 Large Drape
12 Plain Swabs
12 Raytec Swabs
6 Raytec Abdominal Swabs
2 Green Dressing Towels
6 Green Dressing Towels
2 White Dressing Towels
6 White Dressing Towels
6 Hand Towels
1 Hernia Towel
6 Hernia Towels
3 Wound Towels
 2 4 in. Wool Rolls
 2 6 in. Wool Rolls
Theatre Gamgee, 12 ins. x 12 ins.
Spica Gamgee, 18 ins. x 12 ins.
Cotton Wool, 12 ins. x 12 ins.
2 Raytec Gauze Rolls (48 ins.)
Anaesthetic Swabs "E" (Emergency)
Anaesthetic Swabs (Multiple)
6 in. Crepe Bandages
 4 in. Crepe Bandages
 1 in. Ribbon Gauze
Half-Inch Ribbon Gauze
Stockinette, 4 ins. and 6 ins.
Hip Stockinette, 8 ins. x 24 ins.
12 Dental Rolls

TWENTY-THREE
APPENDIX C

Packs Produced in Central Sterile Supply Department 3

Heat seal bags are used for all packs.

Comprehensive Packs

Large Dressing Pack: 1 Sterifield Sheet, 20 ins. x 20 ins.
10 Large Cotton Wool Balls
4 Dressing Pieces, 4 ins. x 4 ins., 16-ply
1 Gallipot 3 ins.

Small Dressing Pack: 1 Sterifield Sheet
5 Large Cotton Wool Balls
2 Dressing Pieces
1 Gallipot

Vaginal Pack: 1 Sterifield Sheet
8 Cotton Wool Balls
1 Dressing Piece
1 Gyn. Pad

Ear Pack: 2 Cotton Wool Balls
6 Ear Wires

Eye Pack: 3 Cotton Wool Balls
1 Eye Pad

Supplementary Packs

2 Dressing Pieces, 4 ins. x 4 ins.  Eye Pad
12 Dressing Pieces, 4 ins. x 4 ins.  Ear Pad
12 Dressing Pieces, 2 ins. x 2 ins.  Gauze Packing, half-inch
6 Cotton Wool Balls  Gauze Packing, 1-inch
12 Cotton Wool Balls  Safety Pin
1 Gamgee Square, 12 ins. x 12 ins.  Glass Connection
2 Drapes (Sterifield 20 ins. x 20 ins.)  Spigot
2 Hand Towels

Foil Ware

Bowl, 4 ins.  Tray, 7 ins. x 5 ins. x 1 in.  Gallipot, 3 ins.
APPENDIX D

Value of Stocks of Central Sterile Supply Department 1 at 1st January, 1962

**Expendable**

- 3,800 Alka Metal Tubes 20 c.c. - - - - £157
- 350,000 Alu-Pharm Seals - - - - 350
- 42 Gross non-disposable needles - - - - 50
- 1 Gross L.P. needles - - - - 45
- 48 Gross Aspirating needles - - - - 40
- 1,000 Non-disposable syringes - - - - 400

**Non Expendable**

**Instruments**

- 160 Catheter Adaptors - - - - £42
- 56 Aneurysm needles - - - - 42
- 54 Catheter Introducers - - - - 26
- 130 Clip removing forceps - - - - 101
- 206 Dissecting Forceps (Eye) N.T. - - - - 70
- 138 Dissecting Forceps (Eye) toothed - - - - 80
- 5,600 Dissecting Forceps 5 ins., plain - - - - 1,888
- 320 Mosquito Forceps - - - - 268
- 164 Sinus Forceps - - - - 112
- 400 Artery Forceps - - - - 275
- 200 Scalpel handles - - - - 40
- 288 Metal probes, 6 ins. - - - - 32
- 84 Iris scissors - - - - 52
- 2,930 Stitch Scissors - - - - 1,480
- 18 Rotanda Syringes - - - - 158
- 30 Vaginal speculum - - - - 80
- 48 Needle holders - - - - 90

**Total**

£5,878

APPENDIX E

Value of Stocks of Central Sterile Supply Department 2 at 1st January, 1962

- 821 Pkts. x 100, 4 x 4 x 32 ply Gauze swabs - - - - £720
- 500 Pkts. x 100, 3 x 3 Green Zobec swabs - - - - 104
- 150 Pkts. x 100, 4 x 4 x 32 ply Raytec swabs - - - - 155
- 2,400 12 x 12 x 24 ply Abdominal swabs - - - - 176
- 7,000 Pairs Disposable gloves - - - - 626
- 9,000 Yards green cotton for use as follows:—
  - Large Drapes
  - Medium Drapes
  - Dressing Towels
  - Hernia Towels
  - Lithotomy Sheets

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 2,250

**Total**

£4,031
APPENDIX F

Value of Stocks of Central Sterile Supply Department 3 at 1st January, 1962

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Dimensions</th>
<th>Value (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>480 Bripac Boxes 20 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>-</td>
<td>94</td>
</tr>
<tr>
<td>480 Bripac Boxes 10 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>-</td>
<td>62</td>
</tr>
<tr>
<td>480 Bripac Boxes 5 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>-</td>
<td>46</td>
</tr>
<tr>
<td>7,400 No. 1 Dressing Packs</td>
<td>-</td>
<td>-</td>
<td>416</td>
</tr>
<tr>
<td>8,800 No. 2 Dressing Packs</td>
<td>-</td>
<td>-</td>
<td>375</td>
</tr>
<tr>
<td>14,700 No. 5 Swab Packs</td>
<td>-</td>
<td>-</td>
<td>153</td>
</tr>
<tr>
<td>6,700 Vaginal Packs</td>
<td>-</td>
<td>-</td>
<td>237</td>
</tr>
<tr>
<td>7,000 Foil Bowls 4 ins.</td>
<td>-</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>9,000 Foil Trays, 7 ins. x 5 ins. x 1 in.</td>
<td>-</td>
<td>-</td>
<td>72</td>
</tr>
<tr>
<td>30,000 Foil Gallipots, 3 ins.</td>
<td>-</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>200 Rolls Kleenex Towels</td>
<td>-</td>
<td>-</td>
<td>68</td>
</tr>
<tr>
<td>20,000 Biscuit Bags, 12 ins. x 12 ins.</td>
<td>-</td>
<td>-</td>
<td>23</td>
</tr>
<tr>
<td>20,000 Aseptor Bags, 19 ins. x 4 ins. x 15 ins.</td>
<td>-</td>
<td>-</td>
<td>92</td>
</tr>
<tr>
<td>300 Rolls Autoclave Tape, three-quarter inch</td>
<td>-</td>
<td>-</td>
<td>144</td>
</tr>
<tr>
<td>40,000 Sheets Sterifield Paper, 20 ins. x 20 ins.</td>
<td>-</td>
<td>-</td>
<td>230</td>
</tr>
<tr>
<td>14,000 Thermoseal Bags No. 1</td>
<td>-</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>159,000 Thermoseal Bags No. 3</td>
<td>-</td>
<td>-</td>
<td>306</td>
</tr>
<tr>
<td>115,000 Thermoseal Bags No. 6</td>
<td>-</td>
<td>-</td>
<td>330</td>
</tr>
<tr>
<td>8,000 Thermoseal Bags No. 8</td>
<td>-</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>74,000 Thermoseal Bags No. 9</td>
<td>-</td>
<td>-</td>
<td>107</td>
</tr>
<tr>
<td>18 ct x 5,000 Large Cotton Wool Balls</td>
<td>-</td>
<td>-</td>
<td>57</td>
</tr>
<tr>
<td>224 Pkts. x 100, 2 ins. x 2 ins. x 12 ins. Ply Swabs</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>1,500 Pkts. x 50, 4 ins. x 4 ins. x 16 ins. Ply Swabs</td>
<td>-</td>
<td>-</td>
<td>269</td>
</tr>
<tr>
<td>22,700 Gamgee Pieces, 12 ins. x 12 ins.</td>
<td>-</td>
<td>-</td>
<td>436</td>
</tr>
</tbody>
</table>

£3,644

APPENDIX G

Stock of Pre-Sterilised Trade Items in Use at 1st January, 1962

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Value (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 Female Specimen Catheters</td>
<td>-</td>
<td>111 17 6</td>
</tr>
<tr>
<td>288 Intracath Placement Units (Large)</td>
<td>-</td>
<td>120 0 0</td>
</tr>
<tr>
<td>288 Intracath Placement Units (Medium)</td>
<td>-</td>
<td>120 0 0</td>
</tr>
<tr>
<td>144 Intracath Placement Units (Small)</td>
<td>-</td>
<td>60 0 0</td>
</tr>
<tr>
<td>72 Warnes Drainage Tubes (Large)</td>
<td>-</td>
<td>7 4 0</td>
</tr>
<tr>
<td>144 Warnes Drainage Tubes (Standard)</td>
<td>-</td>
<td>14 8 0</td>
</tr>
<tr>
<td>12,500 2 c.c. Steriseal Syringes, Disposable</td>
<td>-</td>
<td>250 0 0</td>
</tr>
<tr>
<td>5,100 5 c.c. Steriseal Syringes, Disposable</td>
<td>-</td>
<td>140 0 0</td>
</tr>
<tr>
<td>14,800 Disposable Needles, Steriseal</td>
<td>-</td>
<td>123 0 0</td>
</tr>
<tr>
<td>21 Boxes x 250 Seralet Lancets</td>
<td>-</td>
<td>20 0 0</td>
</tr>
</tbody>
</table>

£866 9 6
### APPENDIX H

**Running Costs for Materials for Central Sterile Supply Department 1 for the six months from September, 1961, to February, 1962**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alka Metal Tubes 20 c.c.</td>
<td>-</td>
<td>247.00</td>
</tr>
<tr>
<td>Alu Pharm Seals for above</td>
<td>-</td>
<td>100.00</td>
</tr>
<tr>
<td>Needles Hypo, Non-disposable</td>
<td>-</td>
<td>101.80</td>
</tr>
<tr>
<td>Needles, Serum No. 1</td>
<td>-</td>
<td>1.16</td>
</tr>
<tr>
<td>Needles, Serum No. 6</td>
<td>-</td>
<td>2.11</td>
</tr>
<tr>
<td>Needles, Lumbar Puncture</td>
<td>-</td>
<td>46.16</td>
</tr>
<tr>
<td>Needles, Aspirating</td>
<td>-</td>
<td>36.15</td>
</tr>
<tr>
<td>Needles, Curved Cutting No. 9</td>
<td>-</td>
<td>1.10</td>
</tr>
<tr>
<td>Non-disposable Syringes, All Types</td>
<td>-</td>
<td>615.00</td>
</tr>
<tr>
<td>Fleischman Adaptors</td>
<td>-</td>
<td>11.11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>£1,164.70</strong></td>
</tr>
</tbody>
</table>

### APPENDIX J

**Running Costs for Materials for Central Sterile Supply Department 2 for the six months from September, 1961, to February, 1962**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves, Disposable and Non-disposable</td>
<td>-</td>
<td>523.51</td>
</tr>
<tr>
<td>Green Cotton Material for Drapes, etc.</td>
<td>-</td>
<td>1,321.12</td>
</tr>
<tr>
<td>Zobec Swabs, 3 ins. x 3 ins.</td>
<td>-</td>
<td>45.16</td>
</tr>
<tr>
<td>Raytec Swabs, 4 ins. x 4 ins. x 32 ply</td>
<td>-</td>
<td>311.05</td>
</tr>
<tr>
<td>Raytec Swabs, 12 ins. x 12 ins. x 24 ply with tapes</td>
<td>-</td>
<td>73.84</td>
</tr>
<tr>
<td>Gauze Swabs, 4 ins. x 4 ins. x 32 ply</td>
<td>-</td>
<td>40.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>£2,315.80</strong></td>
</tr>
</tbody>
</table>

### APPENDIX K

**Running Costs for Materials for Central Sterile Supply Department 3 for the six months from September, 1961, to February, 1962**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bripac Boxes 20 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>524.16</td>
</tr>
<tr>
<td>Bripac Boxes 10 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>89.78</td>
</tr>
<tr>
<td>Bripac Boxes 5 ins. x 10 ins. x 6 ins.</td>
<td>-</td>
<td>96.12</td>
</tr>
<tr>
<td>Bought from trade suppliers until opening of C.S.S.D. on February, 1962</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dressing Packs, Large No. 1</td>
<td>-</td>
<td>268.26</td>
</tr>
<tr>
<td>Dressing Packs, Small No. 2</td>
<td>-</td>
<td>196.17</td>
</tr>
<tr>
<td>Dressing Packs, Swab No. 5</td>
<td>-</td>
<td>157.16</td>
</tr>
<tr>
<td>Dressing Packs, Vaginal</td>
<td>-</td>
<td>88.10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>£204.16.10</strong></td>
</tr>
<tr>
<td>Item</td>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Foil Containers, 4 in. Bowls</td>
<td>78 3 6</td>
<td></td>
</tr>
<tr>
<td>Foil Containers, 7 ins. x 5 ins. x 1 in. Trays</td>
<td>48 13 6</td>
<td></td>
</tr>
<tr>
<td>Foil Containers, 3 in. Gallipots</td>
<td>9 15 10</td>
<td></td>
</tr>
<tr>
<td>Kleenex Towels, Rolls</td>
<td>83 13 0</td>
<td></td>
</tr>
<tr>
<td>Biscuit Bags, 12 ins. x 12 ins.</td>
<td>31 19 4</td>
<td></td>
</tr>
<tr>
<td>Aseptor Bags</td>
<td>46 0 0</td>
<td></td>
</tr>
<tr>
<td>Asst. Paper Bags, White, 5 ins. x 4 ins.</td>
<td>1 2 11</td>
<td></td>
</tr>
<tr>
<td>Asst. Paper Bags, White, 6 ins. x 7 1/2 ins</td>
<td>2 7 6</td>
<td></td>
</tr>
<tr>
<td>Autoclave Tape</td>
<td>227 12 1</td>
<td></td>
</tr>
<tr>
<td>Sterifield Paper</td>
<td>253 15 0</td>
<td></td>
</tr>
<tr>
<td>Thermoseal Bags, No. 1</td>
<td>71 4 6</td>
<td></td>
</tr>
<tr>
<td>Thermoseal Bags, No. 3</td>
<td>4 4 0</td>
<td></td>
</tr>
<tr>
<td>Thermoseal Bags, No. 6</td>
<td>198 1 6</td>
<td></td>
</tr>
<tr>
<td>Thermoseal Bags, No. 8</td>
<td>12 3 0</td>
<td></td>
</tr>
<tr>
<td>Thermoseal Bags, No. 9</td>
<td>95 14 0</td>
<td></td>
</tr>
<tr>
<td>Wool Balls, Large</td>
<td>60 9 8</td>
<td></td>
</tr>
<tr>
<td>Gamgee Rolls, 1 lb.</td>
<td>14 14 0</td>
<td></td>
</tr>
<tr>
<td>Gamgee Pieces, 12 ins. x 12 ins.</td>
<td>266 19 11</td>
<td></td>
</tr>
<tr>
<td>Ribbon Gauze, Assorted</td>
<td>16 0 0</td>
<td></td>
</tr>
<tr>
<td>Gauze Swabs, 4 ins. x 4 ins. x 16 ply</td>
<td>459 10 8</td>
<td></td>
</tr>
<tr>
<td>Gauze Swabs, 2 ins. x 2 ins. x 12 ply</td>
<td>40 6 3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£3,065 5 9</strong></td>
<td></td>
</tr>
</tbody>
</table>

**APPENDIX L**

Cost of Linen supplied by Central Sterile Supply Department per Average General Operating Theatre

1,000 yards green cotton at 5s. per yard - - - - - - £250 0 0

Cost of making into assorted items, 50 hours x 3s. 6d. per hour - - - - - - 8 15 0

Cost of 200 gowns at 25s. each - - - - - - 250 0 0

**Total** - - - - - - £508 15 0

**APPENDIX M**

Cost of preparing 100 Major Abdominal Packs

48 Raytec Swabs 4 x 4 x 32 ply - - - - - - 49 16 0
12 Abdominal Swabs 12 x 12 x 24 ply - - - - - - 88 2 0
12 Gauze Swabs 4 x 4 x 32 ply - - - - - - 10 12 0
1 Sterifield Sheet - - - - - - 0 10 4
1 Sheet Wrapping Paper - - - - - - 0 16 8
6 In. Tape - - - - - - 0 2 0
Labour (3 girls working 5 hours) - - - - - - 2 18 0
Sterilising - - - - - - 0 5 0

100 Major Abdominal Packs cost - - - - - - £153 2 0

1 Major Abdominal Pack costs - - - - - - £1 10 7

**Erratum**

Appendix 'M' Sterilising
For 5/- read £5
### APPENDIX N

Cost of preparing 100 Minor Abdominal Packs

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raytec Swabs 4 x 4 x 32 ply</td>
<td>24</td>
<td>£24 18 0</td>
</tr>
<tr>
<td>Gauze Swabs 4 x 4 x 32 ply</td>
<td>12</td>
<td>£10 12 0</td>
</tr>
<tr>
<td>Sterifield Sheet</td>
<td>1</td>
<td>£0 10 4</td>
</tr>
<tr>
<td>Sheet Wrapping Paper</td>
<td>1</td>
<td>£0 16 8</td>
</tr>
<tr>
<td>6 in. Tape</td>
<td>1</td>
<td>£0 2 0</td>
</tr>
<tr>
<td>Labour (3 girls working 2 1/2 hours)</td>
<td></td>
<td>£1 9 0</td>
</tr>
<tr>
<td>Sterilising</td>
<td></td>
<td>£3 0 0</td>
</tr>
</tbody>
</table>

100 Minor Abdominal Packs cost: £41 8 0

1 Minor Abdominal Pack cost: £0 8 3 1/2

### APPENDIX O

Cost of preparing 100 Large Dressing Packs

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterifield (Paper) Sheets (200)</td>
<td>2</td>
<td>£11 0 7</td>
</tr>
<tr>
<td>Foil 3 in. Gallipot (100)</td>
<td>1</td>
<td>£0 1 11</td>
</tr>
<tr>
<td>Large Cotton Wool Balls (1,000)</td>
<td>10</td>
<td>£0 12 9</td>
</tr>
<tr>
<td>Gauze Swabs 4 x 4 x 16 ply (400)</td>
<td>4</td>
<td>£1 8 10</td>
</tr>
<tr>
<td>No. 6 Sterisal Bag (100)</td>
<td>1</td>
<td>£0 5 8</td>
</tr>
<tr>
<td>1 in. Autoclave tape (100 x 1 in.)</td>
<td></td>
<td>£0 0 4</td>
</tr>
<tr>
<td>Labour (Estimated on C.S.S.D. 3 staff working for 14 mins.)</td>
<td></td>
<td>£0 7 6</td>
</tr>
<tr>
<td>Sterilising</td>
<td></td>
<td>£0 3 0</td>
</tr>
<tr>
<td>Distribution</td>
<td></td>
<td>£0 8 0</td>
</tr>
</tbody>
</table>

100 Large Dressing Packs cost: £4 1 3

1 Large Dressing Pack costs: £0 0 9 3/4

### APPENDIX P

Cost of preparing 100 Small Dressing Packs

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterifield Sheets (200)</td>
<td>2</td>
<td>£11 0 7</td>
</tr>
<tr>
<td>3 in. Gallipot (100)</td>
<td>1</td>
<td>£0 1 11</td>
</tr>
<tr>
<td>Cotton Wool Balls (500)</td>
<td>5</td>
<td>£0 6 4 3/4</td>
</tr>
<tr>
<td>4 x 4 x 16 ply Swabs (200)</td>
<td>2</td>
<td>£0 14 5</td>
</tr>
<tr>
<td>No. 6 Bag (100)</td>
<td>1</td>
<td>£0 5 8</td>
</tr>
<tr>
<td>1 in. Autoclave tape (100 x 1 in.)</td>
<td></td>
<td>£0 0 4</td>
</tr>
<tr>
<td>Labour (Estimated on C.S.S.D. staff working for 14 mins.)</td>
<td></td>
<td>£0 7 6</td>
</tr>
<tr>
<td>Sterilising</td>
<td></td>
<td>£0 2 6</td>
</tr>
<tr>
<td>Distribution</td>
<td></td>
<td>£0 6 0</td>
</tr>
</tbody>
</table>

100 Small Dressing Packs cost: £2 19 9

1 Small Dressing Pack costs: £0 0 7 1/2
APPENDIX Q

Cost of preparing 100 Gamgee (Supplementary Pack)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 ins. x 12 ins. Gamgee (100)</td>
<td>-</td>
<td>£1 18 5</td>
</tr>
<tr>
<td>No. 6 Bag (100)</td>
<td>-</td>
<td>0 5 8</td>
</tr>
<tr>
<td>1 in. Autoclave tape (100 x 1 in.)</td>
<td>-</td>
<td>0 0 4 1/2</td>
</tr>
<tr>
<td>Labour</td>
<td>-</td>
<td>0 3 8 1/2</td>
</tr>
<tr>
<td>Sterilising</td>
<td>-</td>
<td>0 1 9</td>
</tr>
<tr>
<td>Distribution</td>
<td>-</td>
<td>0 0 4</td>
</tr>
</tbody>
</table>

100 Gamgee (Supplementary Pack) cost: £2 10 2 1/2

APPENDIX R

Comparison of cost of doing 100 major ward dressings using Central Sterile Supply Department large ward dressing and supplement with the cost of doing the same number of dressings using a commercial supplier’s pack.

A. Central Sterile Supply Department Packs

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 C.S.S.D. Large Dressing packs</td>
<td>-</td>
<td>£4 1 3</td>
</tr>
<tr>
<td>50 per cent. require a 12 ins. x 12 ins. gamgee square at 6d. each-</td>
<td>-</td>
<td>1 5 0</td>
</tr>
</tbody>
</table>

Total: £5 6 3

B. Commercial Supplier’s Pack

<table>
<thead>
<tr>
<th>Content</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrapping Sheet</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Sterifield Sheet</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Gallipot</td>
<td>3 in.</td>
<td>-</td>
</tr>
<tr>
<td>Cotton Wool Balls</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Gauze Swabs</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Gamgee Square</td>
<td>1 7 1/2 ins. x 7 1/2 ins.</td>
<td>-</td>
</tr>
</tbody>
</table>

Cost: 15 s. 6d.

100 Packs at 15 s. 6d.: £7 10 0

15 per cent. require Gamgee Square larger than

7 1/2 ins. x 7 1/2 ins. | - | 0 7 6 |

Total: £7 17 6
The C.S.S.D. will deal with all sterile supplies for each department except for theatre instruments (which will be dealt with locally).

The pharmacy will serve the whole of the Hull (A) Group, and for convenience will be located on the ground floor. The pharmacy will handle all sterile water requirements and in addition to normal supplies, there will be piped distilled water for various purposes, including the mechanical bottle washing machine.

Further Developments

Further developments to provide laundry, residential accommodation for medical and nursing staff, training school, and group administrative offices.

Architects, Consultants and Contractors

The architects are Messrs. Yorke, Rosenberg & Mardall. The consulting engineers are Messrs. R. W. Gregory & Partners, the structural engineers Messrs. Felix J. Samuely & Partners, and the quantity surveyors are Belfield & Everest. The main contractors are Trollope and Colls Ltd.

The Cost of Large Scale Central Sterile Supply

CAMERON WEYMES, M.B., CH.B., D.P.H.
Group Medical Superintendent, Glasgow Victoria Hospital Group

The South Glasgow central sterile supply department started as a hospital central syringe service in the Victoria Infirmary. At this time the only other centralisation of sterilisation was that of theatre and ward dressings and fabrics. The wards and theatres prepared their own dressings which were double wrapped in balloon cloth and sent to a centrally situated downward displacement autoclave for sterilisation. Visits to Portsmouth and Musgrave Park in 1959 stimulated interest and a Victoria Infirmary C.S.S.D. was started in 1960. Production was planned on an "item" basis. In this method instruments are packaged separately and are linked with the separately packaged disposable ward dressings at the dressing trolley. This system fundamentally differs from the comprehensive pack where the instruments and ward dressing are included in a single pack. The advantages of the item method of production and packaging are:

(a) The capital cost of setting up the service is less.
(b) The individual hospital or user can vary the method of performing a particular clinical procedure.
(c) From (a) and (b) it is obvious that it is easier to expand this system rapidly on a regional basis.

The C.S.S.D.'s initial target was to provide the Victoria Infirmary but this was later raised to the Victoria Hospitals Group and now the present target is 25,000 beds for ward dressings, 5,000 beds for ward instruments and 150 to 200 theatres for theatre fabrics and dressings. At present ward dressings are being supplied to 7,500 beds, ward instruments to 3,000 beds and theatre packs to 40 theatres. It is the Western Regional Hospital Board's plan to change many existing syringe sterilising departments to instrument sterilising departments on a bed basis of between 1,000 and 2,500 beds. The falling cost and improved quality of disposable syringes is making the sterilisation of glass syringes on anything but the largest scale uneconomical. The staff, accommodation and processing equipment used in existing syringe service departments can be used to sterilise ward instruments. The sterilisation of theatre instruments has not as yet been considered a C.S.S.D. responsibility and at present most theatres sterilise their own instruments in high speed, high pressure, downward displacement autoclaves within the theatre or theatre suite. The development of the "trolley top" system of supply of wrapped theatre instruments might, however, in the future involve the C.S.S.D.

Aims

Early in 1962 the Western Regional Hospital Board authorised the change of the Victoria Infirmary C.S.S.D. to the South Glasgow C.S.S.D. as a large scale experiment. We had the following objectives in view:

(1) Large scale production and distribution of sterile dressings and instruments.
(2) An accurate assessment of production and distribution costs.
(3) A comparison of costs of items with the same or similar items produced by commercial firms.

Production Methods

It was impossible to provide a building large enough to house all parts of the C.S.S.D. under one roof. The service has therefore developed in three parts: C.S.S.D. 1 providing sterile ward instruments; C.S.S.D. 2 providing packs of theatre fabrics, dressings, gloves, etc.;
C.S.S.D. 3 providing ward packs. Each of these three parts is physically separate and there is, in addition, a bulk store for raw materials of 4,000 sq. ft.

C.S.S.D. 1 produces sterile instruments, most of which are packed in aluminium containers for use in wards, casualty and out-patient departments. The working area is 500 sq. ft. The staff consists of: 1 supervisor (staff nurse grading) 50 per cent. of time; 3 assistants (ancillary staff grade 3) full time; 1 domestic, 25 per cent. of time. With the addition of 1 assistant (50 per cent. of time) this staff will be adequate to cope with expansion up to 5,000 beds.

The dirty instruments returned from the hospitals served are washed in an ultrasonic washer. They are dried and packed into aluminium tubes, which are sealed with named foil tops. All instruments used are "fold flats"—specially jointed to allow them to fold into a long, straight, narrow shape. The tubes are passed through an infra-red conveyor belt oven and are subjected to a controlled temperature of 180°C for 14 minutes. They are then packed 24 to a cardboard carton, which becomes the unit of issue. Special composite sets, such as cut down sets, spinal puncture sets etc., are prepared in this department and then autoclaved in C.S.S.D. 2.

In C.S.S.D. 1 it is difficult to get a proper work flow. The staff required is approximately one girl per 1,000 beds served. Experience in serving up to 3,000 beds from C.S.S.D. 1 would indicate that because of geography, a tendency to hoard in wards and the necessity for frequent deliveries, the maximum number of beds should not exceed 5,000. There can be no even work flow as there is such a large variety of instruments and packaging. A service to less than 2,000 beds is costly as the equipment is under utilised and "overheads" are relatively high.

C.S.S.D. 2. This department prepares and sterilises linen and dressings in pack form for theatres and labour rooms. The working area is 1,000 sq. ft. The staff consists of: 1 supervisor (staff nurse grading) 50 per cent.

of time; 5 assistants (ancillary staff, grade 3); 1 steriliser attendant (male); 1 domestic, 25 per cent. of time. At present this staff is not working to capacity, and it is estimated that the optimum staff requirement is approximately one person per 8 theatres or labour rooms.

The focal point of C.S.S.D. 2 is a large work table. Here linen is inspected, folded and operation packs are assembled. The packs are sterilised in one of two 10 cu. ft. high vacuum, high pressure autoclaves. Autoclave requirements for C.S.S.D. have been and are still being over-estimated. One 10 cu. ft. autoclave with one in reserve can between 8 a.m. and 4 p.m. sterilise all the requirements (exclusive of theatre instruments) of 40 theatres.

C.S.S.D. 3. The staff consists of: 1 supervisor (staff nurse grading); 14 assistants (ancillary staff grade 3); 1 steriliser attendant (male); 1 domestic, 50 per cent. of time. Accommodation is 4,350 sq. ft. working area. It is estimated that this area will be adequate, when production is increased, to cover 20,000 to 30,000 beds.

The focal point in C.S.S.D. 3 is a slow moving conveyor belt. The assistants work at benches on either side of the conveyor belt preparing disposable ward packs. These are inserted in heat seal paper bags and the bags are then dropped on to the conveyor belt and carried along to the end where they are sealed in heat sealing machines. The sealed bags are packed in bri-pac boxes which become the units of costing and of issue to wards. Sterilisation is carried out in one of two 15 cu. ft. high vacuum, high pressure autoclaves. One 15 ft. autoclave can sterilise the ward dressing requirements of 8,000 beds. It takes one assistant working full time to meet the sterilising potential of each cubic foot of autoclave space.

Distribution

South Glasgow C.S.S.D. delivers to the following hospitals:

GROUP A.—Supplied with Ward Dressings, Ward Instruments and Theatre Fabrics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Glasgow Victoria Hospitals—1,467 beds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>54 (Private mixed)</td>
<td>508</td>
</tr>
<tr>
<td>Victoria Infirmary (Teaching)</td>
<td>—</td>
<td>128</td>
<td>223</td>
<td>26</td>
<td>44</td>
<td>33</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>508</td>
</tr>
<tr>
<td>+ 10 theatres</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mearnskirk General Hospital</td>
<td>6</td>
<td>240</td>
<td>180</td>
<td>22</td>
<td>100</td>
<td>50</td>
<td>—</td>
<td>40</td>
<td>—</td>
<td>—</td>
<td>682</td>
</tr>
<tr>
<td>+ 4 theatres</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philpshill Orthopaedic Hospital</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>177</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>177</td>
</tr>
<tr>
<td>+ 1 theatre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bellefield Geriatric Hospital</td>
<td>26</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>—</td>
<td>100</td>
</tr>
</tbody>
</table>
A three ton van, similar to a furniture van, with internal dimensions of 14 ft. x 6 ft. 7 in. x 6 ft. 6 in. high is used for deliveries. It delivers to hospital or hospital group sterile stores. From these stores distribution within the individual hospital becomes a hospital responsibility and can be done on a pharmacy, stores or special C.S.S.D. network. Most of the hospitals served follow a “topping up” method at ward level.

Accounting

Up to date a triple copy, no carbon required, indent has been used. The indent is prepared at the hospital sterile store in triplicate and two copies are sent to the C.S.S.D. The two copies are sent with the delivery to the hospital sterile store and the receiving officer signs for them. One of these copies is sent to the Victoria Hospitals Board of Management who from indents prepare monthly accounts and send them to the boards of management of the hospitals supplied. This system has proved satisfactory, except that the no carbon required indent, which it was thought would simplify the indenting procedure, has proved unsatisfactory. The backing plate was frequently omitted and figures were being carried through to unused indents. This caused confusion. It is now planned that a triple copy indent will be used, using normal paper with carbon sheets and that the indents instead of being pre-printed will be handwritten.

Capital Cost

The capital cost for equipment for C.S.S.D. 1 was £2,385. The two costly items were an ultrasonic washer and an infra-red conveyor belt oven. The cost of providing instruments to be used in C.S.S.D. 1 was £3 10s. per bed for general beds and £5 per bed for gynaecological and obstetric beds. The average instrument requirements per bed assessed over 3,000 general hospital beds are:
The capital cost of equipping C.S.S.D. 2 was £5,131, of which two 10 cu. ft. autoclaves accounted for £4,500.

The cost of supplying linen and gowns to prime the pipe line was £400 per theatre or labour room.

The cost of equipping C.S.S.D. 3 was £7,000, of which two 15 cu. ft. high vacuum autoclaves accounted for £6,000.

The cost of the van was £1,130 and it is devalued over five years. The operating cost of the van, including wages, petrol, depreciation etc., is 2s. 1½d. per mile.

Depreciation and Losses of Non-disposable Items

(a) Linen. All linen used in the service is marked C.S.S.D. and is dated when it goes into use. After discussion with laundry managers and theatre sisters it has been assessed that each piece of linen will survive 120 launderings. On this basis a charge per each usage of each piece of linen has been estimated as follows:

<table>
<thead>
<tr>
<th>Material Cost and Yardage Required</th>
<th>Cost of Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Towel</td>
<td></td>
</tr>
<tr>
<td>Dressing Towel</td>
<td></td>
</tr>
<tr>
<td>Large Drape</td>
<td></td>
</tr>
<tr>
<td>Medium Drape</td>
<td></td>
</tr>
<tr>
<td>Lithotomy Sheet</td>
<td></td>
</tr>
<tr>
<td>Hernia Towel</td>
<td></td>
</tr>
<tr>
<td>Hand Towel</td>
<td></td>
</tr>
<tr>
<td>Gowns</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charge for Use Per Article</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Towels</td>
<td></td>
</tr>
<tr>
<td>Dressing Towels</td>
<td></td>
</tr>
<tr>
<td>Large Drape</td>
<td></td>
</tr>
<tr>
<td>Medium Drape</td>
<td></td>
</tr>
<tr>
<td>Lithotomy Sheet</td>
<td></td>
</tr>
<tr>
<td>Hernia Towel</td>
<td></td>
</tr>
<tr>
<td>Hand Towel</td>
<td></td>
</tr>
<tr>
<td>Gown</td>
<td></td>
</tr>
</tbody>
</table>

(b) Ward Instruments. In 12 months ending 1st November, 1962, 20,000 instruments were in circulation. The relative proportions of these instruments by types has been given under the distribution of instruments per bed.

Losses were:

<table>
<thead>
<tr>
<th>Item</th>
<th>No. at risk</th>
<th>Value</th>
<th>Losses</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter adaptors</td>
<td>160</td>
<td>£26</td>
<td>0</td>
<td>£26</td>
</tr>
<tr>
<td>Sinus forceps</td>
<td>447</td>
<td>£324</td>
<td>1</td>
<td>£323</td>
</tr>
<tr>
<td>Dissecting forceps</td>
<td>11,529</td>
<td>£3,602</td>
<td>16</td>
<td>£3,618</td>
</tr>
<tr>
<td>Artery forceps</td>
<td>3,768</td>
<td>£538</td>
<td>0</td>
<td>£538</td>
</tr>
<tr>
<td>Clip removers</td>
<td>231</td>
<td>£231</td>
<td>0</td>
<td>£231</td>
</tr>
</tbody>
</table>

The total in value of losses compared to the value of instruments at risk was 7½ per cent. As a result of this check the depreciation on instruments has been fixed at 10 per cent. per annum.

Item Costing

Each pack produced by each of the C.S.S.D.s. is costed on the basis of raw materials, labour charges, depreciation etc., in the following manner:

Minor Operation Pack

Depreciation on Pack of 8 dressing towels
Depreciation on 1 medium drape
Depreciation on 1 large drape
Laundry charge on 10 x 2½
1 Sterifield sheet, 20 in. x 20 in.
1 Sheet stereosil, 10 in. x 15 in.
24 Raytee swabs, 4 in. x 4 in. x 32 ply
12 Plain swabs, 4 in. x 4 in. x 32 ply
Labour charge, 1 girl for 5 minutes at 1½d. per minute
Sterilising charge
Distribution charge
Administration

<table>
<thead>
<tr>
<th>Material Cost and Yardage Required</th>
<th>Cost of Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Towel</td>
<td></td>
</tr>
<tr>
<td>Dressing Towel</td>
<td></td>
</tr>
<tr>
<td>Large Drape</td>
<td></td>
</tr>
<tr>
<td>Medium Drape</td>
<td></td>
</tr>
<tr>
<td>Lithotomy Sheet</td>
<td></td>
</tr>
<tr>
<td>Hernia Towel</td>
<td></td>
</tr>
<tr>
<td>Hand Towel</td>
<td></td>
</tr>
<tr>
<td>Gown</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charge for Use Per Article</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Towels</td>
<td></td>
</tr>
<tr>
<td>Dressing Towels</td>
<td></td>
</tr>
<tr>
<td>Large Drape</td>
<td></td>
</tr>
<tr>
<td>Medium Drape</td>
<td></td>
</tr>
<tr>
<td>Lithotomy Sheet</td>
<td></td>
</tr>
<tr>
<td>Hernia Towel</td>
<td></td>
</tr>
<tr>
<td>Hand Towel</td>
<td></td>
</tr>
<tr>
<td>Gown</td>
<td></td>
</tr>
</tbody>
</table>

The following price lists are estimated on this basis:

**SOUTH GLASGOW CENTRAL STERILE SUPPLY DEPARTMENT**

**PRICE LIST**

_C.S.S.D. 1 (with effect from 1st August, 1962)_

<table>
<thead>
<tr>
<th>Unit Pack</th>
<th>Description</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box (24)</td>
<td>Dressing</td>
<td>£7</td>
</tr>
<tr>
<td>1s.</td>
<td>Stitching</td>
<td>1</td>
</tr>
<tr>
<td>1s.</td>
<td>Cutting down</td>
<td>12</td>
</tr>
<tr>
<td>Box (24)</td>
<td>S.W. forcep</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Mosquito forcep</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Sinus forcep</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>C.R. forcep</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Dis. (toothed) forcep</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Dis. (non-toothed) forcep</td>
<td>7</td>
</tr>
<tr>
<td>1s.</td>
<td>Iris forcep</td>
<td>3</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Probe</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>B.P. handles</td>
<td>7</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Scissors stitch</td>
<td>12</td>
</tr>
<tr>
<td>1s.</td>
<td>Scissors Mayo</td>
<td>6</td>
</tr>
<tr>
<td>1s.</td>
<td>Scissors eye</td>
<td>6</td>
</tr>
<tr>
<td>1s.</td>
<td>Vaginal speculae</td>
<td>8</td>
</tr>
</tbody>
</table>

**Sundry**

1s. Dirty inst. bags | 14
1s. Indent books C.S.S.D. 1 | 1 10 0
1s. Indent books C.S.S.D. 2 | 1 10 0
1s. Indent books C.S.S.D. 3 | 1 10 0

**Needles and Syringes**

1s. Aspirating needle, 14g | 1 6
1s. Aspirating needle, 15g | 1 6
1s. Aspirating needle, 16g | 1 6
### C.S.S.D. 2

<table>
<thead>
<tr>
<th>Unit Pack</th>
<th>Description</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>£ s. d.</td>
</tr>
<tr>
<td>1s.</td>
<td>Major abdominal pack</td>
<td>1 16 0</td>
</tr>
<tr>
<td>1s.</td>
<td>Minor abdominal pack</td>
<td>1 12 0</td>
</tr>
<tr>
<td>1s.</td>
<td>Perineal pack</td>
<td>1 7 6</td>
</tr>
<tr>
<td>1s.</td>
<td>D. &amp; C. pack</td>
<td>1 3 9</td>
</tr>
<tr>
<td>1s.</td>
<td>Nose and throat pack</td>
<td>1 3 6</td>
</tr>
<tr>
<td>1s.</td>
<td>Ear pack</td>
<td>1 8 6</td>
</tr>
<tr>
<td>1s.</td>
<td>Eye pack</td>
<td>1 4 9</td>
</tr>
<tr>
<td>1s.</td>
<td>Labour room stitching set</td>
<td>1 3 9</td>
</tr>
<tr>
<td>1s.</td>
<td>Forceps delivery pack</td>
<td>1 6 0</td>
</tr>
<tr>
<td>1s.</td>
<td>Normal delivery pack</td>
<td>1 4 0</td>
</tr>
<tr>
<td>1s.</td>
<td>3 gowns/3 hand towels</td>
<td>1 3 0</td>
</tr>
<tr>
<td>1s.</td>
<td>1 gown/1 hand towel</td>
<td>1 1 6</td>
</tr>
<tr>
<td>1s.</td>
<td>Medium drape</td>
<td>1 1 3</td>
</tr>
<tr>
<td>1s.</td>
<td>Large drape</td>
<td>1 1 3</td>
</tr>
<tr>
<td>Box (12)</td>
<td>12 plain swabs</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (12)</td>
<td>12 raytee swabs</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (8)</td>
<td>6 abdominal swabs</td>
<td>1 3 4</td>
</tr>
<tr>
<td>Box (10)</td>
<td>2 green dressing towels</td>
<td>1 9 6</td>
</tr>
<tr>
<td>1s.</td>
<td>6 green dressing towels</td>
<td>1 2 3</td>
</tr>
<tr>
<td>1s.</td>
<td>6 hand towels</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Box (12)</td>
<td>12 Raytec swabs</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Box (12)</td>
<td>12 Raytec swabs</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Box (12)</td>
<td>Crepe bandage 6 in.</td>
<td>1 2 0</td>
</tr>
<tr>
<td>Box (12)</td>
<td>Crepe bandage 4 in.</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (12)</td>
<td>Crepe bandage 3 in.</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (24)</td>
<td>Crepe bandage 2 in.</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Box (16)</td>
<td>Ribbon gauze 1 in.</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Box (16)</td>
<td>Ribbon gauze 4 in.</td>
<td>1 1 2</td>
</tr>
<tr>
<td>Box (12)</td>
<td>Stockinette 4 in.</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (12)</td>
<td>Stockinette 6 in.</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Box (20)</td>
<td>Hip stockinette 8 in. x 24 in.</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Box (12)</td>
<td>12 dental rolls</td>
<td>1 6 8</td>
</tr>
<tr>
<td>Box (10)</td>
<td>1 x-ray bag</td>
<td>1 0 0</td>
</tr>
<tr>
<td>(18 pair)</td>
<td>Surgeons' gloves, size 5½, 6, 6½, 7, 7½, 8</td>
<td>2 0 6</td>
</tr>
</tbody>
</table>

### C.S.S.D. 3

<table>
<thead>
<tr>
<th>Unit Pack</th>
<th>Description</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>£ s. d.</td>
</tr>
<tr>
<td>Box (16)</td>
<td>Large dressing</td>
<td>1 1 6</td>
</tr>
<tr>
<td>Box (18)</td>
<td>Small dressing</td>
<td>1 1 4</td>
</tr>
<tr>
<td>Box (20)</td>
<td>Vaginal dressing</td>
<td>1 1 8</td>
</tr>
<tr>
<td>Box (18)</td>
<td>Ear dressing</td>
<td>1 4 6</td>
</tr>
</tbody>
</table>

- **Theatre Packs**
  - Box (18) Eye dressing...
  - Box (30) 2 dressing pieces (S)...
  - Box (60) 2 dressing pieces (M)...
  - Box (10) 12 dressing pieces 4 in. x 4 in....
  - Box (12) 12 dressing pieces 2 in. x 2 in....
  - Box (20) 6 cotton wool balls (S)...
  - Box (40) 6 cotton wool balls (M)...
  - Box (20) 12 cotton wool balls...
  - Box (20) Ward gauze 12 in. x 12 in....
  - Box (20) Ward gauze 7 in. x 7 in....
  - Box (20) Ward gauze 9 in. x 4½ in....
  - Box (12) 12 drapes...
  - Box (30) 2 hand towels...
  - Box (50) 20 dressing swabs...
  - Box (50) Eye pad...
  - Box (50) 1/2 in. packing...
  - Box (50) 1 in. packing...
  - Box (30) Gyn. pads...

- **Miscellaneous**
  - Box (50) Glass connections small...
  - Box (50) Glass connections medium...
  - Box (50) Glass connections large...
  - Box (50) Spigot...
  - Box (50) Safety pins...
  - Box (50) Spatulae...
  - Box (10) Foil
  - Box (10) Bowls
  - Box (8) Trays
  - Box (12) Gallipots

The unusually high cost of syringes was caused by a very high breakage rate. The method of packaging and distribution of instruments is in general unsuitable for syringes. It has been decided, rather than run an independent syringe service, to change over fairly rapidly to disposable syringes.

### Cost to the Individual Hospital

The following lists show the total cost of C.S.S.D. items bought from South Glasgow C.S.S.D. and from the trade over a period of three months. The Victoria Infirmary, a 500 bedded teaching hospital, has a high bed occupancy and a rapid turnover. The rate of usage of C.S.S.D. items is likely to be as high as any hospital in the country. It should not be taken as typical of the average hospital. Some of the peripheral hospitals supplied use C.S.S.D. 1, 2 and 3 items at only 1/5th of the rate of the Victoria Infirmary.

The total cost to the Victoria Infirmary for all C.S.S.D. items works out at 3s. 11d. per bed per day or £72 11s. 7d. per bed per year.

### Cost to Victoria Infirmary of C.S.S.D. 1 Items for the Period 1st August, 1962 to 31st October, 1962

<table>
<thead>
<tr>
<th>Pack</th>
<th>Items</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dressing set</td>
<td>£ s. d.</td>
</tr>
<tr>
<td></td>
<td>Stitching set</td>
<td>1 1 63</td>
</tr>
<tr>
<td></td>
<td>Cutting down set</td>
<td>1 7 0</td>
</tr>
<tr>
<td></td>
<td>Instruments—Single</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Spencer Wells forcep</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Mosquito forcep</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Sinus forcep</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Clip removing forcep</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Dissecting forcep non-toothed</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Dissecting forcep toothed</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Probes</td>
<td>58 20 0</td>
</tr>
<tr>
<td></td>
<td>Scissors, 12 in.</td>
<td>175 105 0</td>
</tr>
<tr>
<td></td>
<td>Scissors, Mayo</td>
<td>120 3 0</td>
</tr>
<tr>
<td></td>
<td>Scissors, 12 3/4 in.</td>
<td>78 1 0</td>
</tr>
<tr>
<td></td>
<td>Bard Parker handle</td>
<td>16 5 0</td>
</tr>
</tbody>
</table>

---

**The Hospital, March, 1963**
### THE HOSPITAL, March 1963

#### COST TO VICTORIA INFIRMARY OF C.S.S.D. 2 ITEMS FOR THE PERIOD

<table>
<thead>
<tr>
<th>Items</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST AUGUST, 1962</td>
<td>31ST OCTOBER, 1962</td>
</tr>
<tr>
<td>£</td>
<td>s. d.</td>
</tr>
<tr>
<td>Major abdominal</td>
<td>367</td>
</tr>
<tr>
<td>Minor abdominal</td>
<td>911</td>
</tr>
<tr>
<td>Perineal</td>
<td>94</td>
</tr>
<tr>
<td>D. &amp; C.</td>
<td>285</td>
</tr>
<tr>
<td>Nose and throat</td>
<td>220</td>
</tr>
<tr>
<td>Eye</td>
<td>98</td>
</tr>
<tr>
<td>Ear</td>
<td>123</td>
</tr>
<tr>
<td>3 gowns/hand towels</td>
<td>2,070</td>
</tr>
<tr>
<td>Supplementary pack</td>
<td>520</td>
</tr>
<tr>
<td>1 medium drape</td>
<td>867</td>
</tr>
<tr>
<td>1 large drape</td>
<td>237</td>
</tr>
<tr>
<td>12 Raytec swabs 4 x 4 x 32</td>
<td>96</td>
</tr>
<tr>
<td>6 abdominal swabs 12 x 12 x 24</td>
<td>32</td>
</tr>
<tr>
<td>6 green dressing towels</td>
<td>36</td>
</tr>
<tr>
<td>6 white dressing towels</td>
<td>629</td>
</tr>
<tr>
<td>3 hand towels</td>
<td>119</td>
</tr>
<tr>
<td>1 small towel</td>
<td>4</td>
</tr>
<tr>
<td>1 hernia towel</td>
<td>169</td>
</tr>
<tr>
<td>3 bandage rolls</td>
<td>74</td>
</tr>
<tr>
<td>2 in. wool rolls</td>
<td>3</td>
</tr>
<tr>
<td>2 in. wood rolls</td>
<td>8</td>
</tr>
<tr>
<td>1 theatre gauze 12 in. x 12 in.</td>
<td>29</td>
</tr>
<tr>
<td>1 Spica gauze 18 in. x 12 in.</td>
<td>8</td>
</tr>
<tr>
<td>1 small wool 12 in. x 12 in.</td>
<td>5</td>
</tr>
<tr>
<td>2 Raytec gauze rolls</td>
<td>7</td>
</tr>
<tr>
<td>Anaesthetic swabs</td>
<td>27</td>
</tr>
<tr>
<td>Anaesthetic swabs E</td>
<td>17</td>
</tr>
<tr>
<td>Crepe bandage 6 in.</td>
<td>31</td>
</tr>
<tr>
<td>Crepe bandage 4 in.</td>
<td>19</td>
</tr>
<tr>
<td>Crepe bandage 3 in.</td>
<td>7</td>
</tr>
<tr>
<td>1 roll ribbon gauze ½ in.</td>
<td>2</td>
</tr>
<tr>
<td>1 roll ribbon gauze 1 in.</td>
<td>4</td>
</tr>
<tr>
<td>Stockinette 4 in.</td>
<td>5</td>
</tr>
<tr>
<td>Stockinette 6 in.</td>
<td>6</td>
</tr>
<tr>
<td>Hip stockinette 8 in. x 24 in.</td>
<td>4</td>
</tr>
<tr>
<td>12 dental rolls</td>
<td>1</td>
</tr>
<tr>
<td>Gloves</td>
<td>25</td>
</tr>
<tr>
<td>6½</td>
<td>66</td>
</tr>
<tr>
<td>7</td>
<td>77</td>
</tr>
<tr>
<td>7½</td>
<td>81</td>
</tr>
<tr>
<td>8</td>
<td>134</td>
</tr>
<tr>
<td>36</td>
<td>97 4 0</td>
</tr>
</tbody>
</table>

**Total** | 3,680 0 0

### COST TO VICTORIA INFIRMARY OF C.S.S.D. 3 ITEMS FOR THE PERIOD

<table>
<thead>
<tr>
<th>Items</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST AUGUST, 1962</td>
<td>31ST OCTOBER, 1962</td>
</tr>
<tr>
<td>£</td>
<td>s. d.</td>
</tr>
<tr>
<td>Large ward dressing packs</td>
<td>216</td>
</tr>
</tbody>
</table>
Small ward dressing packs       247  172 18 0
Vaginal dressing packs          60   59  0 0
Ear dressing packs              18   4  1 0
Eye dressing packs              16   3  2 0
2 dressing pieces 4 x 4 x 16 ply 150  46 17 6
12 dressing pieces 4 x 4 x 16 ply 168  84  0 0
12 dressing pieces 2 in. x 2 in.  122  22  8 0
6 cotton wall balls (small)     111  18 10 0
12 cotton wool balls            226  33 18 0
2 drapes sterifield sheet       216 121 10 0
2 hand towels                   190  85 10 0
1 eye pad                       26   11 14 0
1 gyn. pad                      376 156 13 4
1 safety pin                    2    9 0 0
1 spigot                        35   35  0 0
1 glass connection (small)      2    1 0 0
1 glass connection (medium)     2    1 0 0
1 glass connection (large)      2    1 0 0
2 wooden spatulae               6    1 17 6
18 in. gauze packing 1/2 in.    5    6 5 0
18 in. gauze packing 1 in.      5    10 0 0
Foil:
1 bowl 4 in.                    459  91 16 0
1 tray 7 in. x 4 in. x 1 in.    522  91 7 0
1 gallipot 3 in.                330  20 12 6
2 dressing pieces medium        701 438 2 6
6 cotton wall balls             251  83 13 4
Ward gangee 12 in. x 12 in.     558 334 16 0

I wish to thank Miss E. Currie, C.S.S.D. superintendent, Mr. J. Black, stores officer and Mr. D. Pollok, C.A., A.C.W.A., who compiled the trading account, for their invaluable help in the preparation of this article.
Central Sterile Supply

C. Weymes, M.B., Ch.B., D.P.H., Group Medical Superintendent, Glasgow Victoria Hospital Group

Central sterile supply has evolved in the last few years as a development of central sterile syringe services. It can be defined as the supply of sterile articles from a central source, for all of the sterile procedures performed in a hospital. Experience in central syringe services showed that it was practicable and economical to wash and sterilise syringes centrally, and to distribute them over considerable distances. The introduction of modern, high vacuum, high pressure autoclaves made possible the effective sterilisation of fabrics. The high capital and maintenance costs of these sterilisers made it necessary to limit their number and to increase the output of each. This trend has acted as a stimulus to the development of Central Sterile Supply Departments (C.S.S.Ds.). In the last few years there has been a growing appreciation of the wastage of trained nurses’ time in doing simple repetitive procedures such as preparing dressings and sterilising instruments. Experimental C.S.S.Ds. have in the last two or three years shown that it is more economical to use unskilled but organised labour for the preparation and distribution of sterile materials.

Sterilising Methods

Of the many possible methods of sterilisation only three have proved really practicable. These are by gamma radiation, dry heat and steam under pressure. Plastic materials such as disposable syringes, catheters, drainage tubing, drainage bags etc. can best be sterilised by gamma radiation. This method involves costly plant and the use of radioactive materials. At the present time it does not seem a practicable proposition to use irradiation as a sterilising agent in a Hospital Service C.S.S.D. Plastic items must therefore be supplied from trade sources. The two methods of sterilisation available therefore in C.S.S.Ds. are dry heat and high pressure steam. Theatre instruments which are costly and highly specialised are best sterilised within the theatre suite in a rapid instrument steriliser.

Work Flows

There are three main work flows involved in a C.S.S.D. The first involves the washing and sterilisation of instruments for wards, casualty and outpatient departments. Dirty instruments are washed and this can most conveniently be done in an ultrasonic washer. After drying they are packaged. A convenient method of packaging is to insert instruments singly, or in groups, into aluminium tubes which are sealed in a special machine with a coloured tinfoil cap on which the name of the instrument is embossed. If a cylindrical tube of uniform diameter is used the instruments must be specially made to allow them to fold flat. The tubes of instruments are sterilised at 180°C by passing them through an infra-red conveyor belt oven. Packaging of the instruments individually allows the doctor or nurse a greater choice of method in performing individual procedures. The tubes of instruments are packaged in cardboard boxes and delivered to the user hospitals.

The second flow involves the sterilisation of theatre and labour room fabrics. These are made up into packs such as major abdominal packs, minor operation packs, packs of gowns, hand towels, drapes etc. Clean linen returning from the laundry is inspected and refolded. On a large work bench it is assembled into the various packs. The packs are doubly wrapped, the inner layer being of fabric which will form the instrument trolley drape. The outer wrap is of steam permeable paper. The packs are sterilised in high vacuum, high steam pressure autoclaves. A convenient size of autoclave is 15 or 20 cu. ft. These autoclaves require very careful maintenance.

The third flow involves the preparation of packs and dressings for ward, casualty and outpatient department use. The contents of these packs are entirely disposable. Paper drapes have replaced linen, and tinfoil gaiilputs have replaced stainless steel. This work flow is best done on a factory system with a conveyor belt as the focal point. The packs are wrapped in paper and packed in steam permeable boxes such as Bripac. The Bripac box becomes the unit of issue to wards and departments.

Scale of Production

Experience in the South Glasgow C.S.S.D. suggests that there is an optimum scale of production for each of these three work flows. In flow 1—the sterilisation of instruments—in a work area of approximately 500 square feet, seven girls could produce instruments for 5,000 hospital beds. Only one ultrasonic washer and one infrared steriliser would be required. Even with this number of assistants it is difficult to keep a continuous work flow going. When fewer than five assistants are employed it is impossible to have a smooth work flow. In flow 2—the preparation of theatre packs—nine assistants can produce packs for 50 theatres in an area of 1,000 square feet on a single shift per day. This output could be doubled if shifts are doubled. In flow 3, where ward packs are produced, in a work area of about 4,500 square feet, fifteen assistants can produce 10,000 mixed ward packs per shift. Here again production could be cheapened by having two shifts per day.

Size of C.S.S.Ds.

This optimum production must now be related to geography and consumer demand. The production of
instruments to cover 5,000 hospital beds and the production of theatre fabrics to cover fifty theatres involves roughly comparable geographical areas. It would be logical and economical to combine these two work flows in accommodation within one building as a sub-regional C.S.S.D. supplying two to four hospital groups, depending upon the density of population. Ward packs should be produced in a factory serving a much wider area—probably one large region or two smaller regions. This regional C.S.S.D. could be sited separately or linked with one of the sub-regional C.S.S.D.s.

**Distribution**

The method of distribution must be carefully considered at an early stage as it is closely related to the method of packaging. In the South Glasgow C.S.S.D., the unit of issue for ward packs is Bripac boxes in three sizes. Ward instruments are packed 20 tubes per cardboard box—size (11½ × 8 × 5½) inches. A strong cardboard carton is used as the unit of distribution. It is (23 × 11½ × 20) inches. It will contain 12 small Bripac boxes, six intermediate Bripac boxes or three large Bripac boxes, or eight boxes of instruments. Theatre packs also fit this box.

A large three ton van with a smooth floor and smooth walls is used for deliveries. It will hold 140 cardboard cartons containing 7,000 mixed ward packs. The value of such a load is approximately £350. The cost of distribution is small in relation to the value of the load. It is approximately 1% of the value of the load up to 50 miles and 1½% of the value of the load for every further 100 miles. This is the ideal solution for distribution from the regional C.S.S.D. A smaller truck of 15 cwt. or 1 ton size would be adequate for delivering instruments and theatre packs from a sub-regional C.S.S.D.

**Hospital Sterile Store**

Delivery from the three parts of a C.S.S.D. should be to a hospital sterile store. This is a large, shelved room which acts as the sterile store for a hospital or group of adjacent hospitals. Shelves require to be 18 inches deep and at (16–18) inch intervals. Approximately three-quarters of a linear foot of shelving is required for each acute bed served. Next to it a small room of approximately 20 square feet is required for the storage of dirty instruments collected from the wards. Delivery from C.S.S.D. to hospital sterile store is a C.S.S.D. responsibility. An indent is sent from the hospital sterile store to the C.S.S.D. on a printed indent form or forms.

**Hospital Distribution**

Distribution from hospital sterile store to wards, theatres and departments is a hospital responsibility. A ward sterile store is best situated outside the ward itself and requires approximately a half linear foot of shelving for each acute bed. It is recommended that ward, theatre and casualty sterile stores should be topped up daily from the hospital sterile store without indent.

**Dirty Return**

After use in theatre, dirty linen is sent to the hospital laundry and returned directly to the C.S.S.D. All linen used in theatre belongs to and is marked C.S.S.D. There must be close liaison between C.S.S.D. superintendent and laundry manager and it will frequently happen that one C.S.S.D. deals with six or more laundries.

Dirty instruments are discarded, say at ward dressings, into paper or thin polythene bags. At the end of the dressing, these paper or polythene bags are put into the rubber ward instrument bucket which has a thin polythene liner. These dirty instruments are collected from the ward on a special round daily. A porter wheels round a heavy polythene tub mounted on a four wheel chassis on this collection. This polythene tub has itself a thin polythene liner to prevent soiling of the tub. The liner is lifted out of the ward instrument bucket and placed in this container. The tub is wheeled to the hospital dirty instrument store and removed from its chassis. The driver storeman, when he delivers to the hospital sterile store, brings a clean empty tub from the C.S.S.D. and takes away a tub containing dirty instruments. The instruments in this tub are triple wrapped and can be safely transported in the clean van which delivers the sterile goods. The sterile goods are themselves triple wrapped.

**Costing**

The following is the basis for the costing used at the C.S.S.D. The Western Regional Hospital Board authorised the establishment of a C.S.S.D. and provides all capital equipment, including instruments and theatre linen. Thereafter the total cost of processing, including labour, raw materials, steam, electricity, water, repairs, replacement of linen and instruments, distribution etc. are passed on to the consumer. This is best done on an item basis. To sterilise a pair of stitch scissors in an aluminium tube and to distribute to the hospital sterile store costs 2½d. To sterilise and distribute a large ward dressing costs 9½d.

An indent is prepared at the hospital sterile store on a triplicate “No Carbon Required” indent. These indents are serially numbered. One copy remains in the book and two copies are passed to the C.S.S.D. One copy is returned to the hospital sterile store, when items are delivered, and one copy is passed to the Board of Management responsible for the C.S.S.D., where it is costed from a price list. Recovery charges from the Boards of Management using the C.S.S.D. are issued monthly.

**Control**

As the C.S.S.D. area covers several Boards of Management, control must be ultimately vested in the Regional Board. A superintendent is required to organise the day to day work of a C.S.S.D. Nurses, pharmacists, laboratory technicians and people with experience in industry have all been suggested as being suitable for the post. To each of the two groups the job is new but each group has a basic training which is valuable. In practice the most difficult part of a C.S.S.D. superintendent's work is liaison with doctors, matrons and sisters. The superintendent must be able to discuss intelligently the setting for a theatre or the details of technique in performing a liver biopsy. The technical side of pro-
duction is simple, and where elaborate machinery is used expert advice is available. To a trained nurse appointment to the post of superintendent of a large C.S.S.D. means promotion; to a chief pharmacist or deputy chief pharmacist it does not. If a more junior pharmacist accepts a post in a C.S.S.D. for even a few years he or she is likely to find it difficult to re-enter hospital or retail pharmacy.

The C.S.S.D. superintendent cannot be directly responsible to a Regional Board official or committee. She requires to see someone in executive authority frequently about day to day expansion and development of the service. This person should be a doctor. An interested group medical superintendent is best equipped to fill the position of C.S.S.D. medical director. All medical superintendents in Scotland are administrative medical officers of the Regional Board and can in this capacity act directly on behalf of the Regional Board. The medical director must know a good deal about the technical side of production but need not be an engineer or a bacteriologist. His main function is to see that organisation and production develop on efficient lines and to advise and support a C.S.S.D. superintendent in difficulties with medical committees and matrons. He must also ensure that the financial control is adequate but not unduly complicated.

The C.S.S.D. superintendent requires, especially where work flows are in different buildings, assistance at charge-hand level. It is desirable but not essential that these supervisors should be nurses. The supervisors must be capable of standing in for each other and of deputising for the C.S.S.D. superintendent during her absence.

Education

Without a proper educational service a new C.S.S.D. is doomed to failure. Before delivery of materials is made to a hospital group a lot of preliminary work has to be done. The user hospital must know how the materials are packaged and there must be careful discussion about delivery, storage, issue and accounting. The method of using the materials must be discussed with doctors, matrons, sister tutors, ward sisters and nurses. There is no point in giving a nurse instruments and dressings in unusual wraps if she does not know how to use them. Films and film strips are probably the best methods of passing on this information. After the service has begun there must be frequent follow up visits by the C.S.S.D. superintendent who must be prepared to discuss problems with any one using the service.

For the next year or two new C.S.S.D.s. must be prepared to educate the medical and nursing public in general. The C.S.S.D. superintendent spends a lot of time showing visitors around her C.S.S.D., explaining the benefits and the difficulties of operating such a service.

Effect on Hospital Running Costs

The provision of a comprehensive C.S.S.D. service appreciably alters the running costs of the hospitals using the service. The cost of drugs and dressings will rapidly fall, but the new heading C.S.S.D. will appear. The cost of operating and replacing ward sterilisers will disappear. There will be a saving in nurses’ time. Where other measures, such as central dish washing, central vacuum cleaning, central medical suction, the central supply of piped gases etc. have been introduced this saving in my experience can amount to one nurse per ward. Installation and running costs of high vacuum, high steam pressure autoclaves will be entirely eliminated in most hospital groups. It can be seen therefore that there must be adjustments in the different headings of hospital running costs. If there is an overall increase in expenditure as a result of providing a C.S.S.D. service it should be small.

If there can be standardisation of pack contents between C.S.S.D.s. substantial savings would result. Materials such as paper, tinfoil caps, dressings, gamgee etc. are bought in very large quantities. Standardisation of these basic materials would result in central contracts being large enough to attract very keen competitive tenders. C.S.S.D.s. would benefit as they would not require to buy and store large quantities of materials as is presently necessary.

Summary

The methods of production in a C.S.S.D. are briefly discussed. An opinion is given as to the size and distribution of the two types of C.S.S.D.s. required in Scotland. The larger regional C.S.S.D. will produce ward packs for a region. The small sub-regional C.S.S.D. will supply theatre packs for 50 theatres and instruments for up to 5,000 beds. The problems of distribution and costing, control and education are discussed.
APPENDIX D

VICTORIA INFIRMARY

Opening Ceremony

NEW LABORATORIES
THEATRE SUITES AND
TEACHING UNIT
The Secretary of State for Scotland, The Right Honourable JOHN S. MACLAY, C.M.G., M.P., will open the New Laboratory and Theatre Block at a ceremony in the Lecture Room, at 10.45 a.m. on Monday, 16th October, 1961.
The Right Honourable JOHN S. MACLAY, C.M.G., M.P.
Secretary of State for Scotland,
Bailie GORDON REID, J.P.
Chairman, Victoria Hospitals Board.
<table>
<thead>
<tr>
<th>Project</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Laboratories</td>
<td>£275,000</td>
</tr>
<tr>
<td>Equipment</td>
<td>£37,000</td>
</tr>
<tr>
<td>4 Theatre Suite</td>
<td>£78,000</td>
</tr>
<tr>
<td>Equipment</td>
<td>£53,000</td>
</tr>
<tr>
<td>Visitors' Entrance</td>
<td>£9,000</td>
</tr>
<tr>
<td>Ward 17</td>
<td>£20,000</td>
</tr>
</tbody>
</table>
The departments open to visitors include . . .

(A) The New Building.

**BASEMENT** - Plant room for theatres and services.

**GROUND FLOOR** - Bacteriology and Pathology Laboratories.

**FIRST FLOOR** - Biochemistry and Haematology Laboratories and Twin Theatre Suite.

**SECOND FLOOR** - Central Sterile Supply Department.
Department of Medical Illustration.
Teaching Suite.

**THIRD FLOOR** - 4 Theatre Suite.

(B) New Visitors' Entrance - On the ground floor of the Hospital.

(C) Ward 17 - A modernised surgical ward on an upper floor of the Hospital.
NOTES ON DEPARTMENTS

General.

The new building is steel framed. The steel stanchions divide the outside walls of the building into bays of 10 feet. This provides rooms of widths of 10 feet or of multiples of 10 feet. The rooms are 20 feet deep. Internal partitioning is of plywood insulated construction. The ceilings are of "Burgess" tiles and the grid is continuous throughout each floor of the building irrespective of partitions.

Heating is effected by circulating hot water through coils above the "Burgess" tiles. Services—water, gas, steam, etc.—can be provided at any point from ceiling or floor. This method of construction gives the maximum usable floor area and permits of future adaptation of the building at a minimum cost. Vertical ducts in the centre of the building accommodate all drainage services and air ducts between plant room and theatres etc. A central vacuum system is provided for cleaning floors etc.

Basement.

The basement, which is equivalent in area to the other floors, is almost entirely filled with calorifier plant, central vacuum plant, theatre ventilation plant, Rothwell system plant and electrical switch rooms.

Bacteriology Department.

It is the intention that so far as possible the ordinary simple day-to-day clinical bacteriological examinations required by the clinicians of the Victoria Infirmary and local General Practitioners will be done in the new laboratory. Such tests as the 'phage typing of bacteria, complement fixation tests, microbiological assays required in deficiency diseases, etc., and all research activity will continue to be conducted at the main sectoral laboratory at Mearnskirk Hospital. Space consuming work, such as media preparation, will also be done at Mearnskirk and the media as required will be transported to the Victoria laboratory.

One of the new pieces of equipment in this department is a Ziess Photomicroscope. This instrument, which incorporates a dark-ground, phase contrast and bright light microscope, is capable of photographing the view under all the conditions in which the microscope operates. This allows for permanent records of the view actually seen and eliminates much tedious repetition and multiplicity of preparation, especially for demonstration and teaching purposes.

Pathology Department.

The Pathological Laboratories are planned with particular regard to economy of space and of effort, and automatic processing machines have been installed wherever possible. Thus, in routine histology, the layout has been devised to provide an even flow of work round the laboratory, eliminating cross-currents and counter-
currents. Surgical specimens are received in the trimming room where the pathologist cuts and trims the necessary blocks of tissue. After fixation these are taken to the first bench in the adjoining histology laboratory and placed in automatic tissue processing machines in which they are dehydrated, cleared and impregnated with paraffin without further handling. The preparation of paraffin blocks for the microtomes must inevitably be done by hand but there are labour-saving devices such as a paraffin dispenser to deliver molten wax through a warm tap, and electrically-heated wax-trimming knives. Sections are cut on rotary microtomes and floated out on thermostatically-controlled water baths which are recessed and fitted flush with the bench top. After drying in hot air ovens the mounted sections are transferred to automatic tissue staining machines which stain, dehydrate and clear the sections. The final cover-slip mounting and labelling is done by technicians at the bench nearest the doorway through which the sections are taken to the pathologists. All reports are made on dictating machines which is quicker than longhand reporting and saves time for the clerical staff.

Glassware and specimen containers are washed in a hot water-jet washer which has been specially modified by the makers to give the best results with the various types of glassware actually in use in the laboratories.

This semi-automation of routine work relieves technical staff for special staining methods and more highly skilled tasks such as histochemistry, radio-active isotope and auto-immunity techniques for which there are separate laboratories.

New equipment in these special laboratories include:

1. A refrigerated microtome for histochemical studies of tissue sections which can be cut at controlled temperatures between $-5^\circ$ C. and $-50^\circ$ C.

2. A tissue drier which dries tissues at controlled temperatures between $-10^\circ$ C. and $-50^\circ$ C. This instrument also is for use in histochemistry.

3. An ultrasonic disintegrator for disruption of suspensions of microorganisms and tissue cells in the preparation of intra-cellular antigens in the study of auto-immune diseases and for “test tube” studies of enzyme systems.

4. A refrigerated super-speed Centrifuge giving controlled temperatures down to $-15^\circ$ C. and R.C.F. values up to 30,900 G. This machine spins down all suspended material after tissues have been disintegrated or homogenised, leaving only soluble antigens, enzymes, nuclear material, etc.

5. An electro-automatic microscope camera. This device has just been produced by a famous German firm and, we believe, this is the first instrument to be installed in this country. The electronically-controlled camera calculates, at the touch of a button, the exposure time from 1/100th second to an hour or more, for photomicrographs in monochrome or colour with transmitted or incident light, dark field, phase contrast, or fluorescence-microscopy.
New Biochemistry Department.

The new department provides accommodation for clinical biochemistry on a more adequate scale than formerly.

The laboratories extend for the whole of the north side of the first floor. They are four in number: (1) the main laboratory for general routine work, (2) a somewhat smaller laboratory to deal with analyses for metabolic balance studies, and (3) and (4) two small laboratories in which graduate members of the staff may undertake specialised investigations. To reduce to a minimum the distance between laboratories and major instruments, a balance room and an instrument room have been planned about half-way along this suite of laboratories.

The design of the laboratories is conventional, on the bay principle in the case of the larger laboratories 1 and 2. The only novel feature is the refrigerator room in laboratory 2. In addition to use as a refrigerator for general purposes, procedures which require low temperature can be done here.

On the south side of the corridor there are rooms for the two senior biochemists, an office, a waiting room, in which patients undergoing tests can be accommodated in comfort, an examination room where medical examinations or special tests such as basal metabolic rate determinations can be done, and a wash-up room for washing and drying of glassware—This latter room contains a large automatic glassware washing machine which will reduce considerably the time and manual labour involved in this task.

Apparatus.—With the construction of a new Biochemistry Department, the opportunity was afforded for the provision of such new scientific apparatus as was considered necessary for the up-to-date equipment of the laboratories. This new equipment includes not only increased numbers of pieces of standard apparatus, such as centrifuges, spectrophotometers, chemical balances of the new single-pan type for rapid yet accurate weighing, incubators, ovens and constant-temperature water baths, but the following new instruments:—

(1) Technicon Autoanalyser.—This apparatus introduced automation into the field of clinical biochemistry—a very necessary step on account of the ever-increasing number of tests that hospital laboratories are called upon to perform, and which would demand progressive additions to laboratory staffs if solely manual analytical methods were adopted.

The essential principle of the Autoanalyser is that all volumetric measurements, the basis of manual analytical techniques, are avoided. From the time of setting up the instrument for any given procedure, the operation of the Autoanalyser is completely automatic and depends essentially on a specially designed pumping procedure, whereby samples of the test fluids and standards are aspirated serially into the apparatus, mixed with diluents and later reagents and passed successfully through a dialysing, a heating bath, a photoelectric colorimeter, and a recorder. In the latter there is graphed on a moving chart the amplified signal produced by
the passage of the coloured solutions of tests and standards through the colorimeter, as a function of the concentration of the substance under analysis.

The Autoanalyser can perform 20, 40 or 60 separate analyses of the same sort per hour, the rate depending on the particular procedure being done. To date, analytical methods for this instrument have been devised for fourteen different substances in biological fluids.

(2) Automatic chloride meter—another example of automation in clinical biochemistry. This instrument performs the standard analysis of chloride by interaction with silver ions. The latter are produced by a coulometric current at a steady rate from a silver electrode dipping into the test fluid. The time taken to precipitate all the chloride is measured by a seconds time-counting device, which is switched off automatically when all the chloride has been precipitated. The timing device is calibrated so that it records the actual chloride concentration in the test fluid in milli-equivalents per litre.

(3) The "Chromoscan" recording and integrating reflectance densitometer.—This apparatus measures and records automatically as a graph the varying intensity of dye-stained bands of protein fractions on electrophoresis strips of paper, etc. The procedure involves photo-electrical measurement of the intensity of reflection of a light beam of particular wave-length from the surface of the electrophoresis strip as the latter is moved automatically past the light source.

(4) Locarte Fluorimeter.—A sensitive fluorimeter providing excitation light of wave-lengths from the ultraviolet through the visible range, which will enable fluorimetric analyses of the following kinds to be done: catechol amines in biological fluids, urinary oestrogens, and certain vitamins.

(5) SP 900 Flame Photometer.—This instrument extends the range and the precision of analyses that can be undertaken by the process of emission flame spectrometry, in that, by means of a quartz prism in place of coloured glass filters, the wave-length at which the intensity of the emission spectrum is read can be more
accurately controlled. This instrument will extend the range of flame spectrometric analyses to calcium, magnesium and iron in biological fluids, as well as to sodium and potassium.

(6) Combined automatic titrator and pH meter.—Besides acting as a standard pH meter, this instrument can also be used as an automatic titrator, whereby titrations are carried out automatically either to any desired pH or at a constant pH.

It is confidently expected that with new apparatus, the range of chemical determinations available to clinicians for diagnostic purposes will be extended. The introduction of "automation" into the laboratory will do much to remove the limitations hitherto imposed by shortage of staff in relation to ever-increasing demands on the laboratory.

Haematology Department.

Haematology consists of a single technical laboratory divided into two sections, one for routine work and the other for special investigations. Thus technicians can be switched immediately from one section to the other depending on the flow of work.

In the routine section there is an electronic blood cell counter which performs both red and white blood cell counts. Haemoglobin is estimated on a photoelectric absorptiometer by the cyanmethaemoglobin method using a new cyanide preparation which is relatively non-toxic. Haematocrits are performed by the micro-haematocrit method using capillary tubes thus saving both space and time. Phase contract microscopes are available for platelet counting and for the study of fresh living cells.

In the special section detailed investigations may be undertaken in haemolytic and other anaemias, bleeding states and leukaemias. Close liaison is maintained with the Histology Department for the study of enzyme systems in blood cells and radio-active isotope studies will be possible in the future. An electrophoresis apparatus is available for the separation of abnormal haemoglobins.

One technician is seconded to the Cardiology Department for the control of anticoagulant therapy, prothrombin times being estimated with the aid of a photo-electric prothrombin meter.

Blood Transfusion.

The Blood Bank Laboratory undertakes all the routine blood grouping and cross-matching for the hospital including that for the heart-lung machine. Rh grouping is done as a routine but investigation of rare Rh sub-groups, Lewis, Kell etc., can also be made.

The blood bank refrigerator was built into the laboratory and is of the "walk-in" type. It has special cooling tiles which will keep the refrigerator at safe temperature levels for 18 to 24 hours should the electricity supply fail. As an additional precaution there is a recording thermometer which actuates a constantly visible temperature chart. Should the temperature fall below or rise above the safe limits a warning bell is operated.

A refrigerated centrifuge is available which will take full-sized blood bank bottles
thus enabling packed cells to be obtained rapidly while maintaining the blood at refrigerator temperatures.

In order to save time in washing and cleaning glassware many disposable plastic tubes are used in Haematology and Transfusion. For the glassware that must be washed both ultrasonic and hot water-jet washers are available and are shared with the Biochemistry Department.

Twin Theatre Suite.

Two small badly-ventilated theatres have been completely reconstructed and enlarged to provide a twin theatre suite. This suite will be used initially for E.N.T. and Eyes and later for E.N.T. only. The suite has air conditioning, including refrigeration. The Rothwell sterile water system serves these theatres. Instruments and bowls are washed in an ultrasonic washer and sterilised in one of two small high-speed sterilisers. The windows are fitted with electrically-operated blinds which operate between the double glazing.

Central Sterile Supply Department.

This unit is one of three which collectively will give a central sterile supply service to South Glasgow hospitals. This unit is designed to produce theatre packs on a large scale. The sterilisers consist of two 10 cubic feet Manlove Alliott high vacuum models.

Teaching Suite.

There is a large lecture room which is divisible into two rooms and which is fitted with blackboards, screens and electrically-operated blinds. The cork floor and the "Burgess" tiled ceiling improve the acoustics of the room. Two Leitz 2 × 2 projectors and a Bell and Howell 16 mm. projector are included in the equipment of this room.

The Library.

The library which has been built up mainly since the early 1940's now contains 1,597 bound volumes of Medical and Scientific Journals. It subscribes to 63 Periodicals.

A feature of the library is the comprehensive collection of Cumulative Indices.

The reference library, which so far contains only 38 volumes, is at present being enlarged.

The possibility of providing library facilities for post-graduate students and general practitioners is being considered.

The Pathological Museum.

The museum is laid out in bays and the specimens are displayed in glass-fronted, shelved cupboards. So far as possible the specimens are arranged according to anatomical systems with a colour code for rapid reference. In accordance with modern
practice, the total number of specimens has been reduced in order that quality may be increased and interest stimulated.

One bay of the museum will be kept free for special demonstrations in bacteriology, biochemistry and haematology in addition to pure pathology. A bench which extends for the whole length of the museum is available for microscope specimens and for study. The demonstrations, which will be changed frequently, will be open to general practitioners in addition to the medical and nursing staffs and to pre- and post-graduate students. It is hoped that these demonstrations, plus the facilities provided by the medical library, will prove useful and attractive to colleagues in general practice.

Experimental Workshop.

The workshop is equipped with lathe, drills, circular saw, sanding machine and all necessary hand tools for working in metal, wood and plastics. All the museum jars are made to measure here but, in addition, special equipment is designed and supplied for use in wards, theatres and laboratories. A highly successful syringe dispenser for the central steriliser unit has recently been designed and is now being developed by a commercial firm. Multi-purpose fitted instrument trays for use in wards and special departments have also been designed from time to time. The scope of this type of work will be increased in the new workshop with the comprehensive equipment provided, thus overcoming the waste of time and money inevitably associated with procuring specially designed material commercially. The workshop is also of very great value in setting up displays and demonstrations of teaching material.

Students' Common Room.

This is a rest room provided for the use of under-graduates attending the Hospital.

Department of Medical Illustration.

So far as we are aware this is the first department of its kind to be planned and built as such and not merely fitted into existing buildings. It consists of a studio, a preparation and finishing room, an office and filing room and two dark rooms, one for monochrome and one for colour. It is equipped with full-sized and 35 mm. cameras and all types of clinical photography, document copying, X-ray reductions, specimen photography and photomicrography will be undertaken. The water supply to the developing and washing baths in the dark rooms is filtered and the temperature is thermostatically controlled. The voltage to the enlargers and to the photomicrographic equipment is stabilised in order to eliminate mains fluctuation.

This department also prepares illustrated material for demonstrations, teaching, lectures and publications, and advice is given on the best methods of presenting such material. In order to maintain high standards descriptive matter is largely printed, not typed.

The department lacks a medical artist but the services of an artist may be obtained in special cases.
CENTRAL STERILE SUPPLY DEPARTMENT.
4 Theatre Suite.

This suite is of interest as it is probably the first 4 theatre suite built in Scotland to the specification of the “Hospital Building Bulletin on Operating Theatre Suites.” This floor has an overall area of 8,100 square feet, compared with the Bulletin’s recommended area of 8,700 square feet. The area is therefore smaller than it would have been had more space been available.

The 4 theatre suites are identical and are allotted on the basis of one per major unit. Each theatre has a small, high-speed, non-vacum autoclave which will sterilise instruments and bowls in three minutes. Each theatre suite has an ultra-sonic washer for washing of instruments. Theatre packs are provided from the Central Sterile Supply Department on the floor below. Packs are delivered by an electrical lift to the issue store on the upper floor. Sterile water to all theatres in the block will be provided by the Rothwell system. Water is sterilised centrally and distributed to one point in each theatre preparation room through tin-lined copper piping. The draw-off points are sterilised with raw steam before each withdrawal of water. The temperature of the water can be adjusted by a Leonard/Rada mixing valve.

The theatre lamps are fitted with 35 mm. cameras.

All the theatres are air conditioned and the air conditioning includes refrigeration. They are designed to give the highest pressure in the theatre and preparation room, a lower pressure in the anaesthetic and sink room and a still lower pressure in the corridor. The corridor pressure, will be higher than normal atmospheric pressure.

The recovery room is limited in size and accommodates five patients. Electrical points, suction points and piped oxygen are provided for each bed. Patients will be held in this room as long as they require supervision or treatment by an anaesthetist.

New Visitors’ Entrance.

This entrance is designed to bring patients in to the mid point of the Hospital vertically and horizontally and to give covered accommodation for about 300. Visiting to the Hospital will be staggered and only one-third of the wards will be visited at one time.

Ward 17.

This is a prototype conversion which will in principle be adopted progressively in all the wards of the Hospital. The ceiling has been lowered and fitted with “Burgess” tiles and the heating is above the “Burgess” tiles. The ward has been divided into 2-bedded and 4-bedded bays and a nurses’ station has been provided. The services to beds are in ducts concealed in the walls and in the partitions dividing the bays. Beds are provided with bedhead lights, a nurses’ call system, a radio system, electric plug points, piped oxygen and piped suction. The illumination of the ward is indirect lighting recessed in the top of the partitions. The ward is fitted with a piped vacuum system for ward cleaning. Generous provision has been made for linen storage, for articles of central supply, and for patients’ clothes, bed cages, etc.
ACKNOWLEDGEMENTS

The architects for the Laboratories, Theatre Suite, Ward 17 and Visitors’ Entrance are Messrs. Watson, Salmon and Gray of Glasgow and London in collaboration with the Board of Management and the Chief Architect, Western Regional Hospital Board.

The Surveyors for the four works are Messrs. John Baxter, Dunn and Gray of Glasgow.

The General Contractors for the Laboratories and Theatre Suite are Messrs. Thaw & Campbell Ltd., of Glasgow, the sub-contractor for joinerwork and fittings for these works being Messrs. John Cochrane & Co. Ltd., of Glasgow.

The Consultants for the Engineering services of Heating, Lighting and Power and Ventilating are Messrs. Donald Smith, Seymour & Rooley, of Glasgow, London and Manchester, in collaboration with the architects and the Chief Engineer, Western Regional Hospital Board.

LIST OF CONTRACTORS

Principal Contractors - Messrs. Thaw & Campbell Ltd.,
136 Paton Street, Glasgow, E.1.

Sub-Contractors,
Joinerwork Contractor - Messrs. John Cochrane & Co., Ltd.,
70 Dobbies Loan, Glasgow, C.4.

Plumberwork Contractors - Messrs. Alexander MacDougall & Co. (Engineers) Ltd.,
9-13 Gorbals Lane, Glasgow, C.5.

Plasterwork Contractors - Messrs. Holmes & Jackson Ltd.,
373 West George Street, Glasgow, C.2.

Tilework Contractors - Messrs. Galbraith & Winton Ltd.,
48 Balnain Street, Glasgow, C.4.

Terrazzo Work Contractors - Messrs. A. De Cecco Ltd.,
99 Clyde Ferry Street, Glasgow, C.3.

Glazierwork Contractors - Messrs. Baillie & Telfer Ltd.,
18-20 Wilton Street, Glasgow, C.4.

22
Asphaltwork Contractors - Messrs. The Limmer & Trinidad Lake Asphalte Co. Ltd., 4 Woodside Place, Glasgow, C.3.


Lift - - - - - Messrs. Ellis & Macdougall Ltd., 12 Sawmillfield Street, Glasgow.

Precast Floors - - - - Messrs. Siegwart Fireproof Floor Co., 26 Blythswood Square, Glasgow, C.2.

Metal Windows - - - Messrs. Henry Hope & Sons, 1 Blythswood Square, Glasgow, S.2.

Lino Floors - - - - Messrs. Korkoid, 1-7 Montrose Avenue, Glasgow, S.W.2.

Metal Railings - - - Messrs. Wm. G. Renfrew, Arthurlie Street, Barrhead.

Heating Engineers - - Brightside Heating & Engineering Co., Ltd.

Sub-Contractors - - Stillsound Insulation Ltd. Kennedy Fisher Ltd.

Ventilation Engineers - - Wm. Pyle & Co.

Sub-Contractors - - L. Sterne & Co., Ltd. J. D. Insulating Co., Ltd.

Electrical Engineers - - Instalite Ltd.

Rothwell System - - Chas. F. Thackray Ltd. 10 Park Street, Leeds.
APPENDIX F

GLASGOW VICTORIA HOSPITALS

PRESCRIBING OF DRUGS
This report of the Staff Association Committee has been accepted as an official guide to prescribing.

The chief pharmacist has been instructed to implement its recommendations with effect from 1st January, 1960.

Iron Haematinics.

1. Ferrous Sulph. Co. Tablets  
   Cost each: 0.039d
2. Ferrous Gluconate Tablets  
   Cost each: 0.087d
3. Iron Dextran (Imferon - Benger)  
   Cost each: 4/-d. per 5ml. amp.
4. Iron Saccharate (Ferrivenin-Benger)  
   Cost each: 2/7½d
5. Jectofer (Astra-Hewlett) 100mg. Fe. in 2 ml.  
   Cost each: 2.5d
6. Iron Edetate (Sytron-P.D. & Co.) 60mg. Fe. in 10ml.  
   Cost each: 0.75d
7. Ferraplex B - Ferrous Sulphate, copper carbonate,  
   Vitamin C, Vitamin B complex (Beecham)  
   Cost each: 0.75d

Other organic compounds are even more costly and bear purchase tax, e.g., Succinate, Fumarate, and Aminoate.

There would seem to be no indication for an intravenous iron preparation.
**Throat Lozenges**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Domiphen bromido (Bradosol - Ciba)</td>
<td>0.72d</td>
</tr>
<tr>
<td>2.</td>
<td>Dequalinium chloride (Dequadin - A. &amp; H.)</td>
<td>1.0d</td>
</tr>
<tr>
<td>3.</td>
<td>Chlorhexidine diacetate (Hibitane - I.C.I.)</td>
<td>1.75d</td>
</tr>
<tr>
<td>4.</td>
<td>Benzyl penicillin (1,000 units)</td>
<td>0.3d</td>
</tr>
<tr>
<td>5.</td>
<td>Tyrothricin &amp; Benzocaine (Tyrozets, Tyrosolven)</td>
<td>0.45d</td>
</tr>
<tr>
<td>6.</td>
<td>Benzocaine Compound (Euphagin-Camden)</td>
<td>0.7d</td>
</tr>
<tr>
<td>7.</td>
<td>Cinchocaine (Nupercaine - Ciba)</td>
<td>0.8d</td>
</tr>
</tbody>
</table>

* Tetrazets - Bacitracin, tyrothricin, neomycin & benzocaine. 4.5d

* Consultants' signature.
Bronchodilators.

1. Ephedrine Hydrochlor. gr.\(\frac{1}{2}\) (30mg.)  
   Cost each: 0.06d.

2. Isoprenaline Sulph. 20mg.  
   (Neoepinine B.W. & Co.)  
   Cost each: 0.8d.

3. L-Isoprenaline Bitart. 15mg.  
   (Isolevin - Wyeth)  
   Cost each: 1.5d.

4. Choline theophyllinate 200mg.  
   (Choledyl A. & H.)  
   Cost each: 1.15d.

5. Etophylate Tabs. 250mg.  
   (Rona Labs. Ltd.) Ing. 500mg.  
   Suppos. 500mg.  
   Cost each: 1.57d.

6. Compound Tablets - Tedral -(Warner) is of much the same constitution as Franol (Bayer) except for double ephedrine content (25mg. versus 10mg.). It is also cheaper by 6\(\frac{1}{2}\)/100 tabs.

7. Tab. Aminophylline although cheaper (.07d. each) is not very effective causing much gastro-intestinal disturbance. Such too is the case with Theodrox (Riker) (1.08d.) each. Hence we recommend Tab. Choledyl as the effective oral aminophylline preparation.
### Intestinal Antispasmodics

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Atropine Sulph. 0.5mg. (gr. 1/120)</td>
<td>0.06d.</td>
</tr>
<tr>
<td>2. Atropine methonitrate (Eumydrin-Bayer) 1mg.</td>
<td>0.31d.</td>
</tr>
<tr>
<td>3. Dicyclomine hydrochloride 10mg. (Wyovin-Wyeth) (Merbentyl-Merrell)</td>
<td>0.69d. (0.78d.)</td>
</tr>
<tr>
<td>4. Bellergal-Sandoz-(Belladonna, Ergotamine, Phenobarb.)</td>
<td>1.41d.</td>
</tr>
<tr>
<td>5. Oxyphenonium Bromide (Antrenyl-Ciba) 5mg.</td>
<td>1.44d.</td>
</tr>
<tr>
<td>6. Tricyclamol 50mg. (Lergine-B W. &amp; Co.)</td>
<td>1.57d.</td>
</tr>
</tbody>
</table>

**Not recommended for stock.**

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Hyoscine N.-butylbromide 10mg. (Buscopan-Boehringer)</td>
<td>2.61d.</td>
</tr>
<tr>
<td>8. Pipenzolate methobromide 5mg. (Piptal-Benger)</td>
<td>3.0d.</td>
</tr>
<tr>
<td>9. Methylscopolamine bromide 2.5mg. (Paurine-Upjohn)</td>
<td>3.0d.</td>
</tr>
<tr>
<td>10. Propantheline bromide 15mg. Tabs. (Probanthine-Searle)</td>
<td>2.64d.</td>
</tr>
<tr>
<td></td>
<td>4/10d.</td>
</tr>
<tr>
<td></td>
<td>30mg. Inj.</td>
</tr>
</tbody>
</table>

The more highly priced antispasmodics have little, if any, advantage over atropine.
Oral Sedatives and Hypnotics.

Cost each.

Phenobarbitone \( \text{gr.} \frac{1}{2} \) 0.027d.

Butobarbitone \( \text{gr.} \frac{1}{2} \) 0.12d.

Barbitone Soluble 0.5G. 0.36d.

Quinalbarbitone (Seconal) \( \text{gr.} \frac{1}{2} \) 0.40d.

Glutethimide (Doriden-Ciba) 0.25G. 0.936d.

Sonalgan - Butobarb., codeine phos., and phenacetin 0.66d.

Dichloralphenazone (Welldorm) 1.2d.

Triclofos-monosodium (Tricloryl-Glaxo) 0.5G. 1.02d.

The above might be prescribed in preference to:-

Amylobarbitone (Sod. Amytal) 0.49d.

Pentobarbitone (Nembutal) 1.0d.

Sedormid 1.08d.

Sonergan 1.29d.

Sedaltine 1.44d.

Carbrital 1.68d.
Multivitamin Preparations.

Aneurin Co. Fort. Tabs.-Vit. B Complex (Becosym)
This preparation is more potent than:-
1. Beplex
2. Vitaplex
3. Lederplex

Lederplex should be restricted.

Multivite (A, B<sub>1</sub>, B<sub>2</sub>, C and D<sub>2</sub>)
Super Plenamins
Juvel
Calciferol 3,000 units
Ostelin High Potency 50,000 units
Ostocalcium D + calcium

Vitavel Syrup 6 fl. oz. 2/6d.
Befortiss Elixir 6 fl. oz. 2/6d.

The following should be restricted:-
1. Abidec
2. Viterra *
3. Vi-magna *

* Consultant's signature.
Tranquilisers.

1. Promazine Tabs. 25mg. (Sparine-Wyeth)  
   Amps. 100mg.  
   Cost each.  
   0.72d.   
   10.0d.

2. Chlorpromazine Tabs. 25mg. (Largactil M. & B.)  
   Ampoules 58/4d. per 100  
   Cost each.  
   0.84d.   
   7.0d.

3. Meprobamate 400mg. (Equinal-Wyeth)  
   (Miltown-Lederle)  
   (Mepavlon-I C.I.)  
   Cost each.  
   0.45d.

4. Trifluoperazine 1mg. (Stelazine-S.K. & F.)  
   Cost each.  
   0.72d.

5. Chlordiazepoxide 10mg. (Librium-Roche)  
   Cost each.  
   2.4d.

6. Imipramine 10mg. (Tofranil-Geigy)  
   Cost each.  
   1.7d.

7. Amitriptyline Tabs. 10mg. (Tryptizol-M.S. & D.)  
   25mg.  
   Cost each.  
   1.24d   
   2.16d.

8. Hydroxyzine 10mg. (Atarax-Pfizer)  
   Cost each.  
   3.16d.

9. Thioridazine 25mg. (Melleril-Sandoz)  
   Cost each.  
   1.2d.

    Cost each.  
    4.8d.

11. Methylpentynol Carbamate 100mg. (Oblivon C-Brit.Scher.)  
    Cost each.  
    0.54d.
## Drugs acting on the Cardiovascular System:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity and Details</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Digitalis folia tabs. gr.1</td>
<td></td>
<td>0.038d</td>
</tr>
<tr>
<td>2. Digoxin</td>
<td>0.25mg</td>
<td>0.24d</td>
</tr>
<tr>
<td>3. Quinidine Sulphate 0.2G.</td>
<td></td>
<td>1.08d</td>
</tr>
<tr>
<td>4. Procaine Amide Hydrochloride 0.25G (Pronestyl-Squibb)</td>
<td></td>
<td>1.92d</td>
</tr>
<tr>
<td></td>
<td>Procaine Amide Hydrochloride Inj. 10ml.</td>
<td>5/3d</td>
</tr>
<tr>
<td>5. Inj. Aminophylline 0.25G/10ml.</td>
<td></td>
<td>6.6d</td>
</tr>
<tr>
<td>6. Inj. Mersalyl 2ml.</td>
<td></td>
<td>1.92d</td>
</tr>
<tr>
<td>7. Chlorothiazide I.V. 0.5G (Lyovac Saluric-M.S. &amp; D.)</td>
<td></td>
<td>17/6d</td>
</tr>
<tr>
<td>8. Glyceryl Trinitrate gr. 1/130 and gr. 1/100</td>
<td></td>
<td>0.086d</td>
</tr>
<tr>
<td>9. Pentaerythritol Tentranitate 30mg. (Mycardol-Bayer) 10mg. (Peritrate-Warner)</td>
<td></td>
<td>0.36d 0.24d</td>
</tr>
<tr>
<td>10. Noradrenaline 2ml. (Levophed-Bayer)</td>
<td></td>
<td>11.8d</td>
</tr>
<tr>
<td>11. Metaraminol Bitartrate 10mg. (Aramine-M.S. &amp; D.)</td>
<td></td>
<td>2/6d</td>
</tr>
<tr>
<td>12. Mepheneteramine Sulph. 10ml. (Mephine-Wyeth)</td>
<td></td>
<td>9/1d</td>
</tr>
<tr>
<td>13. Hypertensin - Ciba 0.5mg. amps.</td>
<td></td>
<td>2/8d</td>
</tr>
<tr>
<td>14. Phenobarbitone and Theobromine (Theominal-Bayer)</td>
<td></td>
<td>0.34d</td>
</tr>
<tr>
<td>15. Guanethidine 10mg. (Ismelin-Ciba)</td>
<td></td>
<td>3.17d</td>
</tr>
<tr>
<td>16. Mecomylamine 2.5mg. (Inversine - M.S. &amp; D.)</td>
<td></td>
<td>1.15d</td>
</tr>
<tr>
<td>17. Pentolinium Inj. 5mg/cc. (Ansolysen - M. &amp; B.)</td>
<td></td>
<td>3/4d</td>
</tr>
<tr>
<td>18. Reserpine 0.25mg. (Serpasil-Ciba)</td>
<td></td>
<td>0.96d</td>
</tr>
<tr>
<td>19. Methyldopa 250mg. (Aldomet - M.S. &amp; D.)</td>
<td></td>
<td>5.3d</td>
</tr>
</tbody>
</table>
## Antihistamines

<table>
<thead>
<tr>
<th></th>
<th>Product Description</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Diphenhydramine 50mg. (Benadryl - P.D. &amp; Co.)</td>
<td>1.12d.</td>
</tr>
<tr>
<td>2.</td>
<td>Mepyramine maleate 100mg. (Anthisan - M. &amp; B.)</td>
<td>0.75d.</td>
</tr>
<tr>
<td>3.</td>
<td>Dibistin - (Ciba)</td>
<td>1.28d.</td>
</tr>
<tr>
<td>4.</td>
<td>Promethazine Hydrochlor. Tabs. 25mg. (Phenergan - M. &amp; B.)</td>
<td>0.93d.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.4d.</td>
</tr>
<tr>
<td>5.</td>
<td>Chlorpheniramine maleate (Piriton-A. &amp; H.)</td>
<td>1.54d.</td>
</tr>
<tr>
<td>6.</td>
<td>Actifed Tabs. - B W. &amp; Co.</td>
<td>2.28d.</td>
</tr>
</tbody>
</table>

Skin Department request also:-

- Tabs. Meclozine HCl. (Ancolan - B D.H.) | 1.56d. |
- Tabs. Calcium Sandosten Effervescent | 2.36d. |
- Phenergan Cream | 1/6d. |

The other preparations listed by the Pharmacist are of greater price and would not seem to confer extra benefit over those recommended.
Aperients.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Cost each.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emuls. paraffin liquid B.N.F. (Petrolager-Wyeth)</td>
<td>1d per oz.</td>
</tr>
<tr>
<td>2</td>
<td>Emuls. paraffin liquid with Phenolphthalein B.N.F. (Agarol - Warner)</td>
<td>1d per oz.</td>
</tr>
<tr>
<td>3</td>
<td>Milpar equivalent</td>
<td>1d per oz.</td>
</tr>
<tr>
<td>4</td>
<td>Senokot - Westminster Labs. Tabs Granules</td>
<td>0.16d.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6d per oz.</td>
</tr>
<tr>
<td>5</td>
<td>Pil. Phenolphthalein Co. (Alophen - P D. &amp; Co.)</td>
<td>0.11d</td>
</tr>
<tr>
<td>6</td>
<td>Magnesium Sulphate</td>
<td>0.3d per oz.</td>
</tr>
<tr>
<td>7</td>
<td>Glycerine Suppository 60 gr.</td>
<td>1.0d.</td>
</tr>
<tr>
<td>8</td>
<td>Dulcolax Suppository &quot; Tablets</td>
<td>5.0d.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.84d.</td>
</tr>
<tr>
<td>9</td>
<td>Disposable enema saline</td>
<td>1/4d.</td>
</tr>
<tr>
<td>10</td>
<td>Elixir Senna</td>
<td>2d per oz.</td>
</tr>
<tr>
<td>11</td>
<td>Elixir Cascara</td>
<td>4d per oz.</td>
</tr>
</tbody>
</table>
Sulphonamides.

Sulphadimidine 0.5G
This is suggested as the sulphonamide which might be used in place of:-
Sulphafurazole 0.5G (Gantrisan-Roche) 2.34d.
Sulphadiazine Tabs. 0.5G 0.96d.
   Inj. 1G/4ml. 9.4d.
Sulphatriad (M. & B.) 0.69d.
Sulphaguanidine 0.18d
Sulphamethoxypyridazine (Midicel-P.D. & Co.) (Lederkyn-Lederle) 7.04d.
Should be limited in usage.
Phthalylsulphathiazole 0.5G 0.714d.
Succinylsulphathiazole 0.5G 1.0d.
Sulphacetamide (Albucid-Brit. Schering) 0.5G 0.432d.
Note also Nitrofurantoin (Furadantin-S. K. & F.) 50mg. 2.0d.
Antibiotics.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzyl Penicillin 250mg. (Crystalline G)</td>
<td>2.68d.</td>
</tr>
<tr>
<td>Phenoxymethylpenicillin Tabs. 125mg. (Penicillin V)</td>
<td>3.1d.</td>
</tr>
<tr>
<td>Procaine Benzyl Penicillin 0.9 mega vials</td>
<td>1/6d.</td>
</tr>
<tr>
<td>Benzyl Penicillin 1 mega vials</td>
<td>1/-</td>
</tr>
<tr>
<td>Streptomycin Sulphate-Distampins 1G in 4 ml. amps.</td>
<td>1/11d.</td>
</tr>
<tr>
<td>Crystamycin single dose vials</td>
<td>16.2d.</td>
</tr>
<tr>
<td>Triplopen &quot; &quot; &quot;</td>
<td>1/6d.</td>
</tr>
<tr>
<td>Tetracycline 250mg. caps. (Achromycin V)</td>
<td>3.4d.</td>
</tr>
<tr>
<td>This might replace:</td>
<td></td>
</tr>
<tr>
<td>Oxytetracycline 250mg. caps. (Terramycin)</td>
<td>1/2d.</td>
</tr>
<tr>
<td>Chloramphenicol 250mg. caps.</td>
<td>1.5d.</td>
</tr>
<tr>
<td>Soframycin Tabs. 250mg.</td>
<td>1/5d.</td>
</tr>
<tr>
<td>Erythromycin propionylester laurylsulphate 250mg. caps. (Ilosone-Lilly)</td>
<td>8.3d.</td>
</tr>
<tr>
<td>Ampicillin 250mg. caps. (Penbritin-Beecham)</td>
<td>2/-</td>
</tr>
<tr>
<td>Cloxacillin 250mg. caps. (Orbenin-Beecham)</td>
<td>1/8d.</td>
</tr>
<tr>
<td>250mg. Inj.</td>
<td>6/9d.</td>
</tr>
<tr>
<td>The following should be restricted:</td>
<td></td>
</tr>
<tr>
<td>Neomycin Tabs. 0.5G</td>
<td>1/2d.</td>
</tr>
<tr>
<td>Albamycin T (Upjohn)</td>
<td>1/11d.</td>
</tr>
<tr>
<td>Methicillin 1G (Celbenin-Beecham)</td>
<td>12/-</td>
</tr>
<tr>
<td>Colomycin Inj. ½ mega</td>
<td>6/-</td>
</tr>
<tr>
<td>1 mega</td>
<td>8/8d.</td>
</tr>
<tr>
<td>Kanamycin 1G (Bayer)</td>
<td>30/-</td>
</tr>
<tr>
<td>Fucidin 250mg. caps. (Leo Labs.)</td>
<td>7/6d.</td>
</tr>
</tbody>
</table>
Analgesics.

Aspirin
Soluble Aspirin
A. P. C. Tabs.
Tab. Codein Co.
Sonalgin
Paracetamol Tabs. 0.5G

The above might take place of:-
Bufferin
Saridone
Tercin
Hypon
Anadine

Ergometrine Tartrate 1 mg. (Femergin-Sandoz)

This might replace:-
Cafergot

Morphine 10 mg. 15 mg.
Pethidine 25 mg. Tabs.
Pethidine 50mg. amps.
Methadone 5 mg. Tabs.
Methadone 10mg. amps.
Omnopon amps.

Phenazocine Hbr. 2 mg. amps. (Narphen-Smith & Nephew)

Dextromoramide Tabs. 5 mg. (Palfium - M. C. P.)
Dextromoramide Inj. 5 mg. ( " " )

Cost each.
0.048d.
0.096d.
0.094d.
0.202d.
0.72d.
0.213d.
1.0d.
1.2d.
0.29d.
0.65d.
0.6d.
3.36d.
3.48d.
1.5d.
0.168d.
1.5d.
0.316d.
3.7d.
2.34d.
9d.
2.28d.
5.35d.
Androgens.

- **Androsten.**

- **Testosterone Tab. 25mg.**
  - Tab. 50mg.

- **Testosterone Propionate Inj. 50 mgm.**

- **Testosterone isobutyrate 50mg. (Perandren-M)**

- **Testosterone phenylpropionate 50mg.**

**Cost each.**

- 1d.
- 3.24d.
- 6d.
- 7/1d.
- 3/10d.
<table>
<thead>
<tr>
<th>Oestrogens</th>
<th>Cost each.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stilboestrol 5 mg.</td>
<td>0.08d.</td>
</tr>
<tr>
<td>Dienoestrol 0.1 mg.</td>
<td>0.16d.</td>
</tr>
<tr>
<td>0.5 mg.</td>
<td>0.18d.</td>
</tr>
<tr>
<td>Ethinyloestradiol 0.05 mg.</td>
<td></td>
</tr>
<tr>
<td>Ethinyloestradiol 0.01 mg.</td>
<td>Methyltestosterone 3.0 mg.</td>
</tr>
<tr>
<td>(Mepilin - B.D.H.)</td>
<td>1.44d.</td>
</tr>
<tr>
<td>Inj. Oestradiol monobenzoate 50,000u. i.m. (Skin Dept.)</td>
<td>1/5d.</td>
</tr>
<tr>
<td>Progesterone (Skin Dept.) Inj. 2 mg.</td>
<td>6d.</td>
</tr>
</tbody>
</table>
## Anabolic Steroids

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methandienone Tabs. (Dianabol-Ciba)</td>
<td>5mg. 5.09d.</td>
</tr>
<tr>
<td>Durabolin amp. (Organon)</td>
<td>25mg/cc 7/-</td>
</tr>
<tr>
<td>Deca-Durabolin (Organon)</td>
<td>13/-</td>
</tr>
<tr>
<td>Ethylestrenol (Orabolin-Orgonon)</td>
<td>2mg. 5.28d.</td>
</tr>
<tr>
<td>Methylstanazole (Stromba-Bayer)</td>
<td>7.34d.</td>
</tr>
<tr>
<td>Norethandrolone (Nilevar-Searle)</td>
<td>10mg. 1/5d.</td>
</tr>
</tbody>
</table>

The last preparation is not recommended but listed to show its comparative price.
### Steroids

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cortisone Acetate Tabs.</td>
<td>25mg.</td>
<td>2.4d.</td>
</tr>
<tr>
<td></td>
<td>Inj. 25mg/cc per 5cc vial</td>
<td>7/0d.</td>
</tr>
<tr>
<td>2. Hydrocortisone Inj.</td>
<td>hemisuccinate 100mg. Intravenous</td>
<td>10/-d.</td>
</tr>
<tr>
<td></td>
<td>- acetate 25mg. 5cc Intra-articular</td>
<td>4/6d.</td>
</tr>
<tr>
<td></td>
<td>1cc</td>
<td>1/-d.</td>
</tr>
<tr>
<td>3. Prednisone</td>
<td>Tab. 5mg.</td>
<td>.72d.</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>Tab.</td>
<td></td>
</tr>
<tr>
<td>4. * Triamcinolone Tabs.</td>
<td>4mg.</td>
<td>1/2d.</td>
</tr>
<tr>
<td>5. * Methylprednisolone Tab.</td>
<td>4 mg.</td>
<td>1/2d.</td>
</tr>
<tr>
<td>6. * Dexamethasone Tab.</td>
<td>0.5mg.</td>
<td>8d.</td>
</tr>
<tr>
<td>7. * Fludrocortisone Tab.</td>
<td>0.1mg.</td>
<td>3.6d.</td>
</tr>
<tr>
<td>8. Betamethasone Tab.</td>
<td>0.5mg.</td>
<td>0.21d.</td>
</tr>
<tr>
<td>* Consultant's signature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predsol Retention Enema.</td>
<td></td>
<td>6/6d.</td>
</tr>
<tr>
<td>Synalar Ointment</td>
<td>15G</td>
<td>8/6d.</td>
</tr>
<tr>
<td>Betnesol - N Eye/Ear Drops</td>
<td>Cream 0.1% 15G</td>
<td>5/-d.</td>
</tr>
<tr>
<td>Hydrocortisone Applications.</td>
<td></td>
<td>5/3d.</td>
</tr>
<tr>
<td>Ointment</td>
<td>1% 15G</td>
<td>4/-d.</td>
</tr>
<tr>
<td></td>
<td>2½% 15G</td>
<td>13/-</td>
</tr>
<tr>
<td>Lotion</td>
<td>1% 20cc</td>
<td>6/6d.</td>
</tr>
</tbody>
</table>

Skin Department request also:

- Sofracort Spray | 14/6d. |
- Terracortril Ointment | 14/11d. |
- Adcortyl A with Graneodin | 15/-d. |
### Anticoagulants

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenindione Tabs. 50mg.</td>
<td>1.56d.</td>
</tr>
<tr>
<td>(Dindevan-Evans)</td>
<td></td>
</tr>
<tr>
<td>Warfarin Sodium Tabs. 5mg.</td>
<td>1.36d.</td>
</tr>
<tr>
<td>(Marevan-Evans)</td>
<td></td>
</tr>
<tr>
<td>Heparin 5cc 5,000 units/cc</td>
<td>6/-d.</td>
</tr>
<tr>
<td></td>
<td>26/3d.</td>
</tr>
<tr>
<td>25,000 units/cc</td>
<td></td>
</tr>
</tbody>
</table>