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CROSS-INFECTION IN CHILDREN'S WARDS

A REPORT PRESENTED TO THE BRITISH PAEDIATRIC ASSOCIATION BY THE FOLLOWING
AD HOC COMMITTEE:

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The term cross-infection is here used to denote any infection acquired by a patient in the hospital environment. Clinically, it is an infection arising during the course of another illness for which the patient was originally admitted to hospital, and may attack the respiratory tract, gastro-intestinal tract, wound, skin, or mucous membrane, or be manifested as one of the specific fevers.

Cross-infection is a constant anxiety to all concerned with the hospital care of sick children and infants, the latter particularly calling for special protective measures. A great deal has yet to be learned. No explanation, for example, has been given for one of its outstanding features—namely, its fortuitous onset. It is well known that, in spite of overcrowding and poor hygiene, one ward may for long be without manifest cross-infection, whereas another which has every facility and is staffed by well-trained nurses may suddenly be the site of a virulent outbreak. In spite of this it would be folly to ignore the value of adequate preventive measures.

Cross-infection which results in nothing more than a mild catarrhal illness, at times apyrexial, must not be dismissed lightly. There is evidence that this may be but the prelude to outbreaks of increasing severity culminating in a series of fatal illnesses. The virulence of the infection may apparently be increased by passage, and unless prompt measures are taken to control the initial outbreak there may be a calamity. Pemphigus neonatorum furnishes an example of this feature. An outbreak may begin with one infant having a single lesion no more than a few millimetres in diameter. Failure immediately to apply protective measures may be followed by the development of pemphigus in successive patients in whom the illness is progressively more severe, ending in a generalized toxæmia.

Cross-infection by infectious fevers, measles, or chicken-pox, for example, seriously hinders the work of a children's department, for such outbreaks necessitate the closure of a ward or wards for an indefinite period.

Whilst a good deal has been written about cross-infection in children's wards, the frequency, extent, and results of this have never been ascertained. In order to provide this information a special *ad hoc* committee was invited by the British Paediatric Association to present its views on the problem, and the Association has instituted an inquiry to collect evidence on the incidence of cross-infection. The obtaining of this evidence will take time, but the results of the inquiry will be published in due course. The report of the Committee which is here presented is a broad statement of our present knowledge on cross-infection, and, although suggestions are made as to how it may be controlled, opinion is still divided on so many points of detail that the report is more in the nature of

a preliminary discussion intended to bring before the profession generally, and those in charge of children's wards in particular, the many problems that have to be faced in the control of cross-infection. This procedure of issuing a report before the exact nature of the problem has been defined may justly be criticized, but it has been done deliberately in this way, in the belief that such a report may help hospital authorities about to create or to improve their facilities for the care of sick children.

General and Bacteriological Considerations

1. Inhalation: Respiratory Tract Infections

This is the most prevalent type of cross-infection, and accounts for much of the morbidity and many of the deaths in infants' and children's wards. It includes tonsillitis, rhinitis, otitis media, common cold, pneumonia, influenza, and infective hepatitis and the specific fevers—scarlet fever, diphtheria, whooping-cough, measles, chicken-pox, rubella, and mumps.

The haemolytic streptococcus, *Str. pyogenes*, which belongs to Lancefield's Group A, is one of the most frequent causes of inhalation cross-infection. Much of our knowledge gained in recent years on the sources and paths of spread of infection in hospital wards is based on studies of the epidemiology and serological typing of streptococcal infections in scarlet fever and measles wards, in otorhinological wards, and in the general medical and surgical wards in children's hospitals and departments. The protean manifestations of infections with *Str. pyogenes* are too well known to need further comment, except to re-emphasize that one and the same serological type may, by spread, cause scarlet fever in one child, tonsillitis in another, otitis in another, and wound infection in yet another, all in the same ward. The importance of the reservoir of *Str. pyogenes* in the human upper respiratory tract as a cause of cross-infection is in part due to the fact that it may have as its portal of entry not only the respiratory tract but also the skin (wound sepsis, infection of burns, erysipelas, impetigo).

The pneumococcus is a not infrequent cause of cross-infection in the respiratory tract, but it does not play such an important part in the epidemiology of hospital infections in this country as it appears to do in the U.S.A., where ward and family outbreaks of acute lobar pneumonia have been reported.

The diphtheria bacillus has been shown to have the same source and mode of spread as infections of the upper respiratory tract with *Str. pyogenes*. Cross-infection with *C. diphtheriae* has been found to be of common occurrence even in diphtheria wards, and, although then without clinical significance, it prolongs the carrier state, with consequent delay in discharge of patients from hospital.

Outbreaks of whooping-cough (*H. pertussis*) are of less frequent occurrence in hospital wards, but may have serious consequences.

The virus diseases are often causes of outbreaks of infection, and are difficult to control. Children with measles are peculiarly susceptible to cross-infection with *Str. pyogenes*, which is commonly responsible for otitis media.

2. Ingestion: Gastro-intestinal Tract Infections

These include gastro-enteritis of infants, epidemic diarrhoea of the newborn, bacillary dysentery (*B. sonnei*), occasionally typhoid or paratyphoid fever, and, more rarely, food-poisoning with *Salmonella* organisms. Thrush, too, may be considered in this group. Outbreaks of gastro-enteritis among infants in hospital wards are common, and may have a case-fatality rate as high as 70%. Although organisms of the dysentery or *Salmonella* group have been identified as the cause of some outbreaks, in most instances no known pathogen has been found, and the possibility that the infection may be due to a virus cannot be dismissed. In this connexion it should be recalled that diarrhoea and vomiting in infancy are often due to infection outside the alimentary tract—notably the upper respiratory tract, especially the middle ears. Thus a child admitted to a ward with a streptococcal or other pyogenic infection—e.g., tonsillitis or otitis media—may by cross-infection produce an upper respiratory infection in another infant, and so cause a parenteral gastro-enteritis.

Outbreaks of typhoid and paratyphoid fevers occasionally occur, but rarely do they arise from infection in the ward. They are more commonly conveyed to the patient in some food infected by a missed case or a carrier among the food-handling staff. It is the nurse who is most in danger of contracting infection from a patient in a ward with an enteric fever.

3. Implantation: Infection of Wounds, Skin, and Mucous Membrane

In surgical wards, otorhinological wards, and wards in which burns are treated, pathogenic bacteria—in particular the pyogenic cocci *Str. pyogenes* and *Staph. aureus*, but also *B. proteus* or *Ps. pyocyanea*—may readily be introduced, either into clean wounds or burns or to lesions already infected, unless the strictest aseptic dressing technique and other precautions are taken to prevent it. The prophylactic and therapeutic use of sulphonamide drugs or penicillin should not be made the occasion for any relaxation in the preventive measure involved in good nursing and aseptic principles. In addition to cases of burns, children after removal of tonsils and adenoids are highly susceptible to infection with *Str. pyogenes* at the operation site, with otitis media or mastoiditis as a not infrequent sequel.

The commonest infections of the skin which may spread in wards are impetigo, ringworm, scabies, and pediculosis. In recent years there seems to have been an increasing incidence of outbreaks of pemphigus neonatorum due to *Staph. aureus* among newly born infants in maternity units and nursing homes, often accompanied by cases of staphylococcal conjunctivitis ("sticky eye"). There is evidence to show that pemphigus neonatorum and staphylococcal conjunctivitis are caused by *Staph. aureus* from the nose or throat or skin of adults in the infants' environment, and it may be a mother, doctor, or nurse, or even a laundress who, through handling napkins or garments with hands infected from the nose or throat or elsewhere, is the source of infection. Moreover, the attendant or parent may be the victim and so become a further source of infection. In outbreaks in infants' nurseries the same serological type of *Staph. aureus* has been isolated not only from skin lesions but also from infants with conjunctivitis in the affected nursery, from the noses of nursing staff, from the dust and air in the nursery, and from the infants' blankets, clothing, and bath. It might also here be mentioned that disinfectants of the liquor chloroxylenolis group, while highly effective against *Str. pyogenes*, are of very little use against staphylococci, and may give a sense of false security if used as hand antiseptics in infants' wards. Mastitis among mothers in maternity units is being noted with increasing frequency, and has been associated with the same epidemiological and bacteriological findings as in pemphigus neonatorum.

The most important infections of mucous membranes, other than those of the upper respiratory tract, which includes the mouth with thrush infection, are vaginitis and conjunctivitis, now less commonly due to the gonococcus.

4. Sources of Infection

The main sources of cross-infection in hospital wards are: (i) Manifest clinical cases. (ii) The patient who is incubating a disease and may be in a highly infectious state. (iii) The ambulant, missed, or subclinical case, unrecognized because of its mildness. (iv) The carrier, who may be convalescent or "healthy." The latter group, which may include both nurses and doctors, is of great importance, as the potential danger can be discovered only by laboratory investigation.

Infection is spread by the secretions, excretions, and discharges of patients, staff, and visitors, and may have its origin in the respiratory tract and its annexes, the gastro-intestinal and urinary tracts, the skin and mucous membrane, septic wounds, burns, or abscesses.

5. Paths of Spread of Infection

These are by contact with contaminated material, either by direct personal contact or by mediate contact with infected clothes, bedding, ward articles, and food. The vectors of infection may be flies. A very important part is played by air-borne infection with droplets, droplet nuclei, and dust, especially in infections having as portals of entry the upper respiratory tract and skin.

It is important to remember (a) that the skin of the fingers and hands, and the hair, may harbour organisms identical with those present in the nose and throat; (b) that the skin of the fingers and hands is particularly liable to contamination with infected material either directly or by contact with infected fomites and dust from furniture and floor; (c) that the pocket-handkerchief, while still the least inconvenient mask against spread of droplet infection from coughing and sneezing, is a vehicle of infection from the upper respiratory tract to the hands and the air.

Droplets and droplet nuclei charged with bacteria are discharged into the air from the nose and mouth, and either settle on the floor, bedclothes, or ward equipment to dry and become redistributed with the dust, or remain suspended as floating particles to be wafted about the ward and inhaled, thereby transmitting infection over a considerable distance. Organisms such as *Str. pyogenes* may remain viable in dust for as long as six months if unexposed to the bactericidal action of sunlight.

Ward Routine

1. Admission of Patients

Every patient should be examined by an experienced medical officer before being allowed to enter the ward. This officer is a key man in the prevention of infection, and his duty should not be left to any medical officer who happens to be available. A history should be obtained of previous infectious diseases, of recent contact with infection, and of immunization. If there is a risk of the patient's bringing an infection into the ward then the urgency of his admission should be reconsidered and, if possible, admission postponed.

Attention must be paid to the throat, nose, ears, and skin; and swabs of the throat should be taken as a routine and, at the discretion of the admitting officer, also of the bowel, skin, and nose. He should direct the admission of the patient to an isolation-room for at least 48 hours if there is the slightest suspicion of infection, or until such time as the patient is declared free from infection. Special admission-wards tend to form a bottle-neck unless there is an adequate number. It is estimated that for an open ward of 20 cots there should be at least four admission-rooms. If isolation-rooms are available for ward nursing, then the number of admission-rooms needed will be less.

If on admission an infection is found to be present which may pass to others in the ward, then the infected child should be admitted only to a closed cubicle or isolation-room. If only an open ward is available the child should be barrier-nursed and placed in the ward as far away from especially susceptible children as possible—e.g., if he has streptococci in his throat he

should not be put near any infants or any cases of rheumatism or nephritis.

Type of Case Admitted to Wards.—There is much to be said on clinical and teaching grounds for a unit of medical and surgical cases. There is, however, a danger in admitting certain types of surgical cases to an open ward, because of the risk of wound contamination and because, in turn, an infected wound may be the source of spread of haemolytic streptococci or other infection throughout a ward. Consideration should therefore be given to segregation of special surgical cases—e.g., burns and ear-nose-and-throat cases; those with otorrhoea are a potent source of ward infection, and should always be isolated.

Infants, because of their greater susceptibility to cross-infection and the more serious effects cross-infection may have in them, constitute a special problem. No infant under 1 year old should be exposed to infection. Direct infection from ward dust and droplet infection from other children can be prevented only by nursing infants in cubicles or isolation-rooms. Even this does not do away with the risk of infection from nurses or faulty management. It is essential, therefore, to admit babies only into isolation-rooms or cubicles and to keep them there throughout their stay in hospital. It is an all-too-familiar tragedy for a healthy baby admitted to hospital for a surgical operation—e.g., pyloric stenosis or hare-lip—to die of a gastro-enteritis contracted from ward infection. If, however, only an open ward is available, the infant should be barrier-nursed, and by careful spacing and placing of the cots between non-infected older children the risk of cross-infection may be reduced.

A further point to consider in ward planning is that in the case of babies the admission of the mother may be desirable, either for breast-feeding or to conduct the nursing. Accommodation for this purpose will be necessary, and will be discussed later.

2. Nursing Staff

Next to careful pre-admission examination, the quality of nursing is the most important single factor in controlling cross-infection. However ideal the design of a ward may be, it will not achieve its purpose unless the nursing staff is able to carry out its duties with skill and understanding of the problems involved. The sister in charge of a children's ward should, in our opinion, be "children-trained" and hold the R.S.C.N. certificate, with fever training as a very desirable addition. She should not have more than 20 acutely sick children under her care. The more the ward is subdivided the heavier are the nursing duties, and a children's ward needs more nurses per patient than most other hospital departments. For a ward of 20 beds there should be at least two trained staff nurses for day duty and two for night duty, and the total number of nurses should approximate one per patient for the 24 hours. The practice of leaving only one or two probationer nurses in charge of a ward at night is a common cause of a breakdown in anti-infection measures.

Student nurses should be instructed by a pathologist or senior medical officer in the dangers of cross-infection and how to avoid them, and should be given simple practical demonstrations in bacteriology. Only by imparting to them a knowledge of the problems involved can one expect their intelligent co-operation.

Health of Nurses.—A sick nurse does not do her work well and is a potential source of infection to her patients. All nurses should be encouraged to "report sick" even for minor complaints, for the latter may produce a serious condition if passed on to an infant. Sore throats, the common cold, nasal sinusitis, and skin and dental infections are the main dangers that are too often neglected. Gastro-intestinal upsets should also be reported. If a nurse is found to be harbouring infection likely to be dangerous to her charges she should be removed from duty. A medical officer should be responsible for the general health of the nursing staff, and the nurse should have ready access to him. On entering hospital a nurse should undergo a complete examination before acceptance for training. This should include height and weight measurements, history of past infectious diseases, skiagrams of chest, and Mantoux test, Schick test, and blood counts. Repeat examinations should be made every six months, or at any departure from normality. Student nurses should be actively immunized

against diphtheria and the enteric fevers. Nurses previously immunized should be Schick-tested, and, if negative, given a "boosting dose." If positive, they must be fully immunized. Nurses must be taught to keep themselves healthy; many nurses do not make full use of their off-duty periods to take open-air exercise. Facilities for open-air games should be provided. Hospitals should accept greater responsibility for the health of their nurses than they have done in the past.

3. Nursing Technique

This has been largely described in the M.R.C. War Memoranda—No. 6, "The Prevention of 'Hospital Infection' of Wounds," and No. 11, "The Control of Cross-Infection in Hospitals"—and only some of the salient features will be mentioned here.

Washing.—Ideally, every member of the nursing and medical staffs, and all students, should wash their hands before and after attending to or examining each patient. In practice this is seldom done, but it should be insisted on for every patient who is known to be harbouring infection, and after possible contamination by secretions, excretions, or discharges of any child. Nurses should "scrub up" before and after attending to the toilet of the mouth or anus of any child as they would when "doing a dressing." Ample and conveniently situated washing facilities must be provided for this purpose. The wearing of rubber gloves may be helpful in preventing soreness of the nurses' hands from frequent washing.

Masks.—Laboratory tests show that impermeable ("cellophane") masks, or masks made of three or more layers of gauze of not fewer than 44 threads per inch, are fairly efficient for preventing dispersal of organisms until the masks themselves become the emitters of bacteria. They must be worn to cover the nose as well as the mouth. Masks must be worn by all attending infants or any child with a wound, and in the latter case the patient himself should wear a mask during dressings. A liberal supply must be provided, for the masks must be changed frequently. When discarded, they should be put immediately into disinfectant solution and left in until washed. In no circumstances should masks be put into pockets or be left lying about.

Gowns.—These should be worn by nurses handling any suspected or known infectious case. They should cover uniforms completely (including the sleeves). A separate gown should be worn for each patient, and after use it should be placed on a peg or stand with its outside outwards.

Dressings.—The technique of ward dressing is fully described in the M.R.C. Memorandum No. 6, referred to above. Dressings done in an open ward are a source of air- and dust-borne infections, so that a separate room provided with efficient ventilation and specially equipped for doing dressings and minor surgical procedures should be an essential part of any ward unit.

Napkins.—Destructible napkins are preferable (cellulose or gamgee tissue types). After a baby has been changed they should be immediately placed in a dressing-pail and covered with disinfectant; they should then be transferred to a special ward-bin and incinerated. If it is not possible to obtain destructible napkins ordinary ones will have to be used. The same ward procedure must be carried out and the napkins taken to the laundry in the ward bin. Napkins should be boiled and washed in a separate machine in the laundry and afterwards handled only with strict attention to cleanliness.

Linen.—Bed linen should not be sorted in the ward, but be sent direct to the laundry. Linen soiled with excreta should be put in disinfectant before being sent. Ordinary washing of "woollies" in the ward by hand is not a guarantee of sterilization, and the use of a disinfectant may be necessary.

Towels.—Nurses and others drying their hands on a communal towel may convey infection to other users. The use of the roller towel is to be condemned, and tissue towelling which can be burnt is the safest, if not the most comfortable, material to use.

"Task Nursing."—Many wards have adopted the method of allocating separate tasks to each nurse. Thus one nurse is responsible for the changing of all babies, another for the feeding, and another for dressings. This procedure has much to commend it.

4. Prevention of Infection via Food

The kitchen should be considered as one of the most important departments of a hospital. Wash-basins with elbow taps should be provided so that the staff can wash their hands under running water. Ample storage accommodation must be provided for cooked and uncooked food, adequate refrigeration must be available, and all windows fly-proofed. The fly menace should be attacked vigorously by the use of D.D.T. The kitchen staff must realize the importance of their work and the dangers inherent in unclean methods of handling food.

So far as is possible only those interested in the preparation of food should be chosen for work in the kitchen, and the remuneration paid them should be commensurate with the responsibilities they carry. Work in the kitchen should be considered as the highest level of domestic work in a hospital.

Milk forms the most important part of the dietary in a children's ward. It also forms a perfect culture medium, and especial care must be taken to ensure cleanliness and protection from contamination. The source of supply should be subject to special scrutiny. Frequent samples should be submitted to bacteriological examination. If a sample of the milk is taken on its arrival at the hospital, especially if it be delivered in a churn, and a further sample of the same milk is taken six hours later, useful comparisons can be made. A further useful test is to rinse out the ward vessels with sterile water and examine the rinsing for *B. coli* and other organisms. This test should be carried out on vessels that have been "cleansed" for the reception of milk, and should be done without previous warning. All milk should, of course, be efficiently pasteurized and stored in refrigerators. The use of dried milks overcomes the problem of unsafe liquid milk. It must be remembered, however, that dried milks may be just as easily infected by faulty technique during their preparation as may liquid milk.

A special room should be set aside for the preparation of infants' feeds. Nurses working in the milk kitchen should be specially trained in the dangers of food contamination. They should prepare all feeds under aseptic conditions so far as is possible. Masks and gown should be worn and any nurse with an infection, especially of the bowel—e.g., even a transient diarrhoea—should be kept off duty.

5. Ward Hygiene

The main methods now available for reducing the infective content of air are as follows:

Methods for Removing or Killing Organisms while Air-borne

(a) *Good Ventilation.*—This is of the first importance in reducing air-borne infection. Fresh air in amount equal to 8 to 10 changes per hour should be introduced, although this demands expenditure on heating in winter and needs careful attention to the avoidance of draughts. It is recommended that expert architectural advice be obtained to ensure that existing or proposed wards have satisfactory ventilation and lighting. The fee involved and the cost of alterations are negligible in comparison with the benefit to patients and staff. In all systems of ventilation it is important to arrange the air-flow so as to carry dust and infective particles away from patients rather than towards them. Mechanical systems of ventilation have not always proved satisfactory, and need careful selection and design for the particular conditions present in each building in which they are used. The provision of large windows admitting plenty of daylight is a valuable aid in killing bacteria on the floor and elsewhere in a ward. The interposition of glass does not prevent this effect, although it reduces it. The action occurs even under winter conditions in this country. In this connexion the importance of balcony space should be stressed not only for its own virtues in nursing sick children but because balcony spacing provides extra light and ventilation to the patients. Children should be nursed in the open air as much as possible and, provided they are warmly clad, feverish patients, especially those with respiratory infections, benefit greatly. Ward temperatures should not be above 60° F. (15.6° C.)—except in nurseries for the newborn. To counter low temperature adequate and suitable clothing should be provided rather than artificial heating. Overheating and poor ventilation promote the spread of respiratory infections.

(b) *Adequate Bed-spacing.*—This ranks second in importance only to good ventilation, and the common 6 ft. (1.8 m.) between cot centres is too small. At least 9 ft. (2.75 m.) is needed—and preferably 12 ft. (3.6 m.). Proper bed-spacing goes a long way to reduce droplet infection from case to case. A problem naturally arises here in the question of "extra beds." So far as is possible, the putting up of extra beds should be resisted, but if the emergency does arise then the medical officer in charge must review his bed-positioning and place his extra bed where the risk of cross-infection is minimal, taking into account not only the site of the cot but also its position in regard to the other patients in the ward.

(c) *Use of Ultra-violet Rays.*—Low-pressure mercury-vapour lamps may be used for irradiating the upper portions of hospital wards with ultra-violet rays. They have been tried extensively in America and on a small scale in this country. Provided that there are not too many lamps and that they are removed from direct vision, no goggles need be worn, since normal ceiling paints and

plaster reflect very little U.V.R. The effectiveness of this type of irradiation is greatest in air of low humidity and on freshly emitted moist organisms; dust practically nullifies the bactericidal action of U.V.R. This method is most useful in rooms of a ceiling height of not less than 12 ft. (3.6 m.). A portable U.V.R. apparatus of suitable design may prove to be a useful adjuvant when disinfecting isolation-rooms and furniture.

(d) *Use of Chemical Disinfectants.*—It is easy to disinfect air by chemical treatment under laboratory conditions, but to do this as a continuous routine in hospital wards is troublesome and as yet of uncertain value. Chemical disinfection of air should in the present state of our knowledge of this method be reserved for special occasions or special places, or during epidemics of air-borne disease. The chief disinfectants known to be effective against fresh moist organisms in concentrations that are harmless or nearly harmless to human beings are: (i) hypochlorous acid; (ii) resorcinol; (iii) propylene glycol; (iv) tri-ethylene glycol; (v) lactic acid.

Methods of Preventing the Re-dispersal of Organisms After Emission and Sedimentation

(a) *Removal of Dust.*—Wards should be designed to prevent dust accumulation. Walls should be smooth, with rounded corners; there should be no horizontal ledges, even at doors; furniture should be built in, with as few movable pieces as possible. Dry dusting and dry sweeping of floors should be prohibited. The most effective method of keeping down dust from floors is the use of spindle oil on floors of wood or linoleum. For floors of terrazzo, cement, or asphalt oiling is unsuitable; but wet sweeping, or sweeping with sawdust moistened with calcium chloride, is helpful. Vacuum-sweeping is better than dry dusting, although large numbers of organisms pass through the walls of the dust-bag of the ordinary portable domestic sweeper; hence vacuum-sweeping into a centralized piping system is preferable. The time-honoured custom of floor-washing with water from a bucket is most unsatisfactory. Special machines which provide a continuous supply of clean water are available, and should be used.

(b) *Oiling of Bedclothes.*—It is now fully proved that ordinary blankets, sheets, pillow-cases, and pyjamas or nightgowns form immense reservoirs of bacteria which are freely scattered in the air when patients move or when beds are made. This emission can be avoided to a large extent by applying a small percentage of a suitable oil—e.g., triton oil—to these articles in the final stages of laundering. Laundries will need expert advice in this matter when this process is first introduced. Dermatitis from the oiling of garments and blankets is not a risk if it is done properly, and this measure alone will greatly reduce the number of bacteria present in a ward.

6. Prevention of Cross-infection by Subdivision of Ward

It follows from the foregoing discussion on air-borne infection that isolation of children in separate rooms must decrease cross-infection. It is on this basis that the subdivision of wards by various types of "cubicles" has been devised. The open ward, however, has certain merits. Children are able to talk and play together, supervision is very much easier, and teaching of students is pleasanter and more practical. In planning a children's ward the aim should be to produce a unit which is designed to reduce cross-infection to a minimum, and which at the same time is practicable to work and will preserve for the child and nursing staff something of the homely, happy atmosphere of the open ward without its attendant dangers.

Individual Isolation Measures

(a) *Isolation Unit.*—The policy of converting wards into isolation units—e.g., by dividing a standard 20-bedded ward into two rows of glass rooms (technically called "cells") with a central service corridor, is not entirely satisfactory. However conscientiously the nursing rules are followed, cross-infection, especially with virus diseases, may occur. The reason for failure is the difficulty in preventing the corridor atmosphere from being a vehicle of infection. Air currents may be reduced, if not completely controlled, by the partial air-conditioning system, or an ultra-violet lamp over each unit door may be used to form a protective screen. Units should be made of glass walls, though the lower 2 ft. (60 cm.) may be of steel or wood. In building, care must be taken to avoid horizontal ledges where dust may settle in the junction between the steel and the glass. Glass allows children to see their neighbours and thus reduces their sense of loneliness and, of course, allows easier nursing supervision. Each unit must have good daylight, ventilation, and heating. Its size must be such that a bed or cot can be moved in and out easily and that there is plenty of room for all nursing attention and for minor operative procedures—e.g., lumbar puncture. Doors should be capable of being opened by elbow or foot, not by hand. Every unit should, ideally, be provided with its own wash-basin, but in the interests of economy these may have to be situated

in the corridor, and one basin may have to serve for more than one unit. When each can be fitted with its own wash-basin, the latter should be of such a design that it may be used for bathing a baby as well as for nurses' hand-washing. Infants should not be bathed in a communal bath, which may convey infection.

(b) *Cubicles*.—By these are meant ward divisions by partitions not reaching to the ceiling, and varying from 7 to 9 ft. (2.1 to 2.75 m.) in height. For small babies this method may be satisfactory, but with older children, who may stand on their cots, even 9 ft. is barely high enough. Cubicles have the great advantage of being cheaper to build than separate rooms, and their open tops allow of easier ventilation. Opinion is divided on their value as compared with separate rooms or cells, and, although they may give a sense of false security, they at least indicate to the nurse and doctor the need for care.

(c) *Complete-isolation Room*.—Children, even babies, dislike being by themselves. The size and equipment of such rooms should be as described for isolation units. Ideally, the front should face south or south-west, and be provided with a verandah or balcony with french windows opening upon them, so that cots can be wheeled out. Outside partitions, which are theoretically necessary, are unsightly, and may be entirely, or in part, dispensed with provided patients occupying the verandah at the same time are carefully selected and spaced. If several floors are used, lifts must be provided and adequate measures taken to ensure that children cannot climb out of windows or over balcony walls or railings. If conversion of an existing ward to include cubicles or rooms for isolation be contemplated certain considerations are necessary before deciding on the required number. The patient most in danger from cross-infection is the infant, and as he is less likely to miss the company of other children he should be specially considered. All babies under 1 year old should be nursed in isolation. So far as accommodation permits, the age limit for isolation should be raised to 2 years, but for older children it should be reserved for preliminary observation on admission, children with suspected or proved infection, and the very ill child to whom a cross-infection might be fatal. In subdividing an open ward some space will be lost and the number of beds reduced. This loss of beds must be set against the lessened risk of infection, with a shorter hospital stay, so that the annual admission rate will not be reduced. The actual number of isolation cells needed per ward will vary with the type and age of case admitted, but at least 25% of the beds should be isolated.

7. Other Desiderata in a Ward Unit

In planning a ward unit other facilities not hitherto stressed must be provided, all of which have a direct or indirect bearing on the question of cross-infection. These are:

(a) *Separate Room for carrying out Special Procedures*.—Dressings and minor procedures of a septic character should never be carried out in an open ward where wound contamination is likely. A special efficiently ventilated room should be set aside for this purpose, to which the children can be taken. The room should be considered as an operating theatre, with all its associated aseptic techniques practised.

(b) *Accommodation for Mothers*.—In the case of mothers feeding their babies at the breast, provision must be made for them to live in the hospital so that breast-feeding can be maintained—in itself a most valuable measure against cross-infection. The practice of admitting mothers to live with and conduct the nursing of their babies, whether breast- or bottle-fed, has much to commend it. Accommodation should therefore be provided for this purpose. It is desirable to have available specially designed flats or houses where mothers can live with their babies.

(c) *Accommodation for Parents*.—Parents are naturally anxious to be at hand if their children are seriously ill, and accommodation for them should be available.

(d) *Provision for Examination of Out-patients*.—From time to time children are brought to the ward unit for examination but not necessarily for admission. This is not a good policy, but if it must be done there should be a separate waiting-room and examination-room, which will prevent the introduction of infection from outside.

After 30 years' service in providing the more severely wounded ex-Service men with the means of living a useful life in the community, the Princess Louise Scottish Hospital for Maimed and Limbless Sailors and Soldiers has decided to build a modern hospital on the site of its present establishment at Erskine, on Clydeside. In the years 1939-45 approximately 3,000 men from Scottish regiments, the Royal Artillery, Royal Engineers, Royal Marines, Royal Navy, and Merchant Navy were admitted to the hospital. There are now 148 patients, some of them airmen, including 68 surgical, 42 medical, 38 paraplegic, and there are also 64 pensioners. The hospital appeals to the people of Scotland to help to replace the present buildings, erected shortly after 1916.

NUTRITION IN VIENNA IN NOVEMBER, 1945

BY

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A report has already been made on nutrition in Vienna in early September, 1945 (Pyke, 1945). At that time, although the Allied Council had been established, adequate food rations were not being distributed in the city. On Sept. 23, however, it was decided that rations providing at least the minimum nourishment needed for subsistence should be distributed throughout Vienna. At first, although similar rations were issued in different parts of the city, each national element comprising the Allied Council brought in supplies for the feeding only of that population living in the sector of Vienna administered by itself. At the beginning of October, however, it was agreed to pool all food, so that the Austrian authorities could distribute as nearly as possible the same ration throughout Vienna.

Although the Allied Council ration scales represented a substantial improvement on those previously obtainable in the city, they were only sufficient to provide a bare nutritional minimum. Furthermore, the provision of vitamin C and vitamin A was entirely dependent on potatoes and vegetables, supplies of which were uncertain, and in addition, so far as children and pregnant women were concerned, the adequacy of the diet was contingent on at least a minimum amount of milk being available. A further overall weakness of all the ration scales was a shortage of calcium.

As was inevitable in the light of the uncertain and divided administration of Vienna, in the event, exact standardization of the ration was not found to be completely possible. The fact that supplies during the two weeks covered by the survey were greater or less in one zone than in another is probably not significant. The difficulties of food distribution made it impossible for issues to be equal at all times. For example, during the first week there was a double issue of fat in the Russian sector. This was made to compensate for a failure to distribute fat during the previous week.

Individual Food Consumption

In Vienna a number of factors are likely to affect the composition of the diet eaten by an individual. Although the nature of the food is broadly contingent upon the composition of the ration, there are, besides the general fact that rations are taken into a household and not usually eaten by an individual, the influence of communal meals on the diet and the availability of unrationed foods from gardens or from the black market. A further possibility is that rationed foods may be exchanged for clothes or other goods. In order to assess the composition of the diet actually being eaten by different sections of the Viennese population in November, 1945, a number of groups of individuals were interrogated about the food they had eaten during the previous 24 hours. The assessment of the nutritional value of the diet was made in the same manner as that described in the previous report, written in September.

Normal Consumers

Two groups of normal consumers were investigated. These were taken at random from queues in public offices in the XIIth and XIIIth districts. The composition of the diets eaten, as derived from calculations made on the data collected, is shown in Table I.

TABLE I.—Composition of the Average Daily Diet Eaten by Normal Consumers in Vienna, Nov. 7-16, 1945

	Cal.	Prot. (g.)	Fat (g.)	Ca (mg.)	Fe (mg.)	Vit. A (i.u.)	Vit. B ₁ (mg.)	Rib. (mg.)	Nic. Acid (mg.)	Vit. C (mg.)
Bz. XII (15 people: 7 men, 8 women)	1,630	59	18	190	17	220	1.70	0.75	11	26
Bz. XIII (20 people: 9 men, 11 women)	1,750	60	16	240	17	130	1.70	0.70	10	19

NOTE.—A deduction has been made to allow for the loss of vitamin C in cooking.