abdomen was very tender, but the tenderness could not be localized, and nothing abnormal could be felt. The temperature varied between 99.5° and 104.6°, and after three days considerable dilatation of the heart was noticed. The urine was tested on admission, and on subsequent occasions, but no albumen was found. On the tenth day, however, blood was found to be present, and the spleen at the same time could be easily felt. The blood continued to be present, and the albumen increased to 2½ per cent. (Esbach), while granular casts were found on microscopical examination. The temperature was irregular up to 102° for another ten days, when it sank to normal, and the renal and pulmonary signs, the latter of which showed considerable delay in clearing up, subsided at the same time. The patient made a good recovery.

Pneumococcal peritonitis is a severe, and often a fatal, condition. It may occur as a complication of pneumonia, or it may have a primary origin, and perhaps be followed by pneumonia, as happened in the second of the two cases which I shall now quote. In the majority of cases occurring in childhood this condition is a primary one, and is generally of the encysted form—that is, the purulent exudate is localized, and is usually found in the lower part of the abdomen. A secondary peritonitis, on the other hand, is, as a rule, diffuse, and is less common. The first of the two peritonitis cases which I have to bring to your notice illustrates the involvement of the pericardium and pleurae, in addition to the peritoneum, secondarily to an attack of pneumonia.

CASE X.—*Double Lobar Pneumonia: Double Empyema: Pyopericarditis: Peritonitis: Death.*¹

Ethel W., aged 4½ years, came of a family in which there was a history of tubercle and chest troubles. She had had pneumonia following measles two years previously. About five weeks before admission to hospital she passed through an attack of pneumonia, which involved both lungs, the crisis occurring on the fifth day. The signs in the lungs, however, did not clear up, dullness persisting at both bases and moist sounds being audible on both sides of the chest. Towards the end of the second week it was noticed that her abdomen began to swell, and it gradually became larger. The breathing became more embarrassed and the child lost flesh. On admission the temperature was 100.2°, it having been previous to this, practically normal after the initial fever, and the pulse was 140. The heart's apex beat could be neither seen nor felt, but the sounds were best heard over the fourth costal cartilage. There was dullness over both lower lobes of the lungs with greatly diminished breath sounds and absence of vocal fremitus. The abdomen was much distended and afforded ample evidence of fluid. Paracentesis of both sides of the chest was performed, pus being withdrawn from the left, but not from the right. On the operating table a little more pus was withdrawn from the left pleura by means of a needle, but on resecting part of a rib no further collection could be found. The patient was very collapsed afterwards, and the cyanosis increased. On the assumption that the respiratory difficulty might have been caused by the pressure of the fluid within the abdomen, the peritoneum was tapped some twenty-four hours later and 43 oz. of pus were removed. The breathing improved, and the abdomen was opened in the middle line below the umbilicus, when 3 to 4 pints of thick yellowish-green pus were evacuated, drainage tubes being inserted into each loin. The child, however, never rallied, and death occurred suddenly two days later. The temperature, except on admission, never rose above 99.6°. At the post-mortem examination there was no meningitis. The pericardium was distended by 16 oz. of thick greenish pus. There was generalized pleurisy over both lungs and a small empyema on either side posteriorly. The lungs were oedematous, and the left lower lobe was very congested, but no signs of consolidation remained. The peritoneum was uniformly covered by a thick layer of lymph, which had caused numerous adhesions, shutting off here and there small isolated collections of pus. The lymphatic glands were not enlarged. Cultures of the pus from the pleurae, pericardium, and peritoneum yielded pure cultures of pneumococcus.

The case seems to have been one of primary pneumonia with secondary infection of the other serous membranes. There was no evidence, however, to show that the peritoneum had become infected by direct extension from the pleurae. The diaphragm did not show any signs of disease, and the pelvic peritoneum was more extensively involved than the upper. On the other hand, there was no evidence that the peritonitis was due to an infection from the alimentary tract or from the pelvic organs, which were normal. The pyopericarditis was entirely undiagnosed. The other case is an example of a primary infection of the peritoneum:

CASE XI.—*Pneumococcal Peritonitis: Secondary Pneumonia: Death.*²

Edith H., aged 5 years, when 15 months of age had an attack of "inflammation of the bowels." Since then she had been healthy, but for the past few months had had occasional abdominal pain, worse at times after food. There had been no vomiting, and the bowels were regular. Five days before admis-

sion she woke with severe pain in the abdomen, and vomited, the temperature being 103°. The pain continued, and diarrhoea persisted after a dose of castor oil, but the vomiting ceased. The abdomen became distended and somewhat rigid, especially in the lower part, and the temperature continued high. When seen the patient's aspect suggested pneumonia rather than peritonitis, the face being flushed and the respirations quickened. The abdomen was distended and only slightly tender; it was resonant, and afforded no evidence of free fluid. There were signs of consolidation over the lower lobe of the left lung, and some crepitations and coarse râles at the right base. A blood count showed a leucocytosis of 15,000. Laparotomy was deferred, as the case did not seem to be one of septic peritonitis, and the presence of pneumonia suggested that it was a pneumococcal infection. The dullness on the right side of the chest became more marked and more extensive, so that fluid was suspected. Exploration, however, was negative. The abdomen continued distended, and some diarrhoea with very offensive stools followed. Antipneumonic serum was given on two occasions without any noticeable benefit. The temperature then fell, and the lungs showed signs of resolving, the abdomen at the same time becoming much less distended and the diarrhoea ceasing. Some induration was felt in the hypogastrium, but operation was further deferred in order that the child might be in a better condition as the lungs improved. A sudden change, however, occurred. The temperature rose and the abdomen rapidly became enormously distended, with signs of intestinal perforation. Laparotomy was immediately performed in the middle line of the hypogastrium, when free gas and 8 oz. to 10 oz. of thick greenish fluid containing flakes of lymph were evacuated. The intestines were extensively matted together, so that it was impossible to find a perforation. Many incisions for the purpose of irrigation and drainage were consequently made, but the child, as was only to be expected, died three days later from septic intoxication. At the necropsy general adhesive peritonitis and small collections of very inspissated green pus were found. Between the liver and the diaphragm was a large abscess entirely shut off from the general peritoneal cavity. No perforation could be found. Both lungs showed areas of collapse and slight pneumonic consolidation. Films from the pus within the abdomen showed the presence of the pneumococcus.

In this case the abdominal infection seemed to be primary, the pulmonary signs not appearing until the third day. As no perforation could be discovered, it is possible that gas-forming organisms gained access to the peritoneal cavity through a damaged intestinal wall.

The cases related cover a wide area, and serve as illustrations of the difficulties at times attending the diagnosis of pneumonia and its complications in childhood, as well as reminders of the extensive ravages which the pneumococcus may bring about.

REFERENCES.

- ¹ Clogg, *British Journal of Children's Diseases*, 1907, vol. iv, p. 491.
- ² Clogg, *ibid.*, 1908, vol. v, p. 285.

HOSPITAL INFECTION OF TUBERCULOSIS

AS EXEMPLIFIED BY THE RECORDS OF THE RESIDENT STAFF OF THE MOUNT VERNON HOSPITAL FOR CONSUMPTION AND DISEASES OF THE CHEST FOR THE PAST FIFTEEN YEARS*

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A RECENT contribution¹ on the infection of consumption by Dr. Theodore Williams raises again the question of hospital infection, and refers to the original figures from the Brompton Hospital on this subject which have been so widely quoted as evidence of the comparative immunity from tuberculous infection of the resident medical and nursing staffs of special chest hospitals.

These figures, and others which have been brought forward, appear, however, to be compiled from the results of inquiries into the health of the former residents and nurses rather than from any actual medical examination of the individuals concerned, and are thus inconclusive. In one case—that of Victoria Park, given by Dr. Andrew in his Lumleian Lectures²—the information appears to have been simply obtained from the secretary of the hospital.

As a further contribution to this question, I propose to give some figures from the Mount Vernon Hospital which have at least the advantage of being compiled from actual examination of the individuals. As Dr. Williams's latest article gives particulars of the resident medical officers, I have added to my statistics particulars of the resident

* A paper read before the Medical Section of the Royal Society of Medicine, April 26th, 1910.

TABLE I.

Hospital.	Resident Medical Officers.		Dispensers.		Nursing Staff.		Female Servants.		Porters.	
	Total.	Became Phthisical.	Total.	Became Phthisical.	Total.	Became Phthisical.	Total.	Became Phthisical.	Total.	Became Phthisical.
Brompton, 1846-1867	154	8*	22	4	?	4*	?	1	20	0
„ 1867-1882					107	1	32	0		
„ 1882-1909, including Frimley	201	5†	23	0	—	—	—	—	137	7‡
Victoria Park (Dr. Andrew, 1884) ...	12	1	7	1	259§	1	—	—	34	1
Ventnor (quoted by Dr. Bulstrode, 1906)	—	—	—	—	208	6	407	2	—	—
Crooksbury Sanatorium (quoted by Dr. Bulstrode, 1906)	5¶	0	—	—	26¶	0	76	1	—	—
Totals	372	14	52	5	600 +?	12	515 +?	4	191	8

* Only one resident medical officer and one nurse contracted phthisis whilst at Brompton.

† One contracted phthisis from a *post-mortem* wound. The remaining four became consumptive after leaving Brompton.

‡ Five of these porters had to deal with the patient's clothing and bedding; another one was a pathological assistant, who became consumptive after an accidental wound.

§ Nurses and female servants are here included together. Thirty-three, in addition to the one referred to as phthisical, left because of illness, and of these "some, but certainly not all, were phthisical."

|| Three of these nurses appear to have had tuberculosis before going to Ventnor.

¶ One resident medical officer and four nurses had been phthisical before they came to Crooksbury.

medical officers, obtained, like those of Dr. Williams, by inquiry only. It will, I think, be seen that the risk of infection in hospital is not entirely a negligible quantity, though the risk is a small one and affects the nurses and servants of the institution rather than the members of the resident medical staff.

The figures I am able to give cannot be taken to show every case of possible infection from hospital work, since they only refer to evidences of infection which were apparent up to the time when the individual left the hospital; it is, of course, possible that other cases may have developed tuberculosis after leaving.

The original report of the Brompton Hospital staff was presented to the British Medical Association by Dr. Theodore Williams at the annual meeting in 1882.³ As it covered a period of thirty-six years the number of individuals who had been in residence must have been considerable, though it was perhaps impossible to give the actual numbers.

The accompanying table (Table I) will show the nature of the material at present available for judging of the risk of hospital infection in this country.

These figures furnish some curious results, for we find that the dispensers, who come least in contact with the patients, show the highest proportion of consumptives (9.61 per cent.), whilst the nurses and female servants, who are most continuously in the wards, furnish the smallest proportion of consumptives (0.98 per cent.). This does not include those who were in residence at Brompton before 1867, for the numbers are not given in the report.

The resident medical officers (3.76 per cent.) and porters (4.18 per cent.) come between the dispensers and the female staff with a somewhat close approximation in the proportion of consumptives.

The Brompton report of 1882 has been very widely quoted as evidence that infection does not occur in properly conducted hospitals for consumptives.* It may be that other hospitals have felt some diffidence in publishing any cases of apparent infection of members of the staff which might lay the institution open to the presumption of insufficient attention to precautionary details.†

The report does not, it is true, show complete immunity from tuberculosis amongst those who had been in residence, though only one resident medical officer out of 150 is said to have contracted the disease whilst in residence,

* Thus, in the first book which I took at random from my shelves in which reference is made to the matter, I read: "Although Brompton Hospital, London, has treated more than 15,000 cases of tuberculosis during the past twenty years, yet neither a nurse, a physician, nor an attendant has become infected."—*The Diagnosis and Treatment of Pulmonary Tuberculosis*. By F. M. Pollinger. Baillière, Tindall and Cox 1908.

† Dr. F. R. Walters says: "No instance of infection has ever been reported from any modern chest hospital with even elementary precautions about the expectoration."—*The Sanatorium Treatment of Pulmonary Tuberculosis*, p. 34. 1909.

and only one individual (or perhaps two) out of the many nurses and maidservants who resided in the institution during the thirty-six years with which the report deals. Nevertheless, it shows a surprisingly small incidence amongst those who have worked in the hospital as compared with the known prevalence of the disease amongst young adults in the general population of this country.

Dr. Williams, in his most recent report, seems to recognize a possibility of infection in general hospitals, since he states that, though amongst the house-physicians none was affected during residence at Brompton, two subsequently died of acute phthisis when holding resident appointments in hospitals where cases of advanced consumption are admitted.

It is, I think, certain that residence in a well-regulated hospital or sanatorium for consumptives involves no great risk of infection; on the other hand, there are certain duties incidental to the care of consumptives which involve some risk, and therefore necessitate special precautions—such duties, for example, as cleansing sputum cups and flasks, handling soiled handkerchiefs, clothing, or bedding, and the performance of autopsies. Risks of direct infection from patients coughing—droplet or spray infection from sputum—or from general air infection from dried sputum should be practically non-existent in the wards of a well-ordered hospital.

Such as they are, the risks will therefore not be common to all the residents in the institution, but will vary with the special duties of the different members of the staff.

The visiting physicians may be left out of consideration; they are not living amongst the consumptives, and there should be little or no risk in examining the patients.

The out-patient physicians probably run some risk, since they examine a large number of patients at each visit, most of whom have not been instructed in the precautions necessary to minimize any possible danger to others.

The resident medical officers are in less close and less constant relation to the patients than the nurses, and their risk, if we exclude the performance of autopsies, and possibly some danger in laryngoscopic examinations, is also slight.

The nurses are the most exposed to infection, and if there is any risk we should expect to find evidence of it in the incidence of consumption amongst the nursing staff. It is to be regretted that in his most recent communication in reference to the Brompton Hospital staff, Dr. Williams has left the nurses out of consideration. Wardmaids, scrubbers, laundrymaids, and porters have special risks from dried sputum which make precaution in their work necessary; these individuals also do not readily appreciate the need for attention to detail, and soon neglect precautions if supervision is relaxed. We might expect that a certain percentage of residents, nurses, and servants would become consumptive, without therefore concluding that they became infected.

whilst engaged in the institution, and in consequence of their work there.

In order to assess the special risk attending work in a hospital for consumptives, we must endeavour to show that the incidence of the disease is proportionately greater amongst those engaged in such institutions than it is amongst those fulfilling similar duties in other hospitals, or else be able to trace the source of infection in individual cases, and show at least a probability of a definite relation between their special work and the contracting of the disease. The first condition—that is, the statistical comparison between the staffs of general hospitals and those of the special hospitals in relation to the incidence of consumption—is hardly possible; not only are the data difficult to obtain, but a very large proportion of the medical and nursing staffs of the special hospitals have been previously engaged in general hospitals, or pass on to the latter. A comparison might easily be made between the incidence of consumption amongst those who have been engaged in the special hospitals and amongst the general adult population, but this would be of little value unless the comparison were restricted to individuals of similar social grade and comparable kinds of employment. Even in respect of cases of consumption occurring in individuals engaged in special hospitals, whose duties expose them to definite risks, it is necessary to show that they were free from disease when they commenced their duties before we can reasonably infer that they became infected through their work. The statistics from Mount Vernon have a certain value from this point of view, since in the case of the nurses and servants every individual was thoroughly examined on entry, and, in the great majority of those who were accepted, again on leaving. It is the rule at the Mount Vernon Hospital that every member of the nursing staff, every maidservant, and every man or boy employed in or about the hospital (engineers, porters, etc.), shall be examined before being definitely engaged, and again on leaving. The chest is carefully examined, under the same conditions as obtain in the examination of the patients, by one of the visiting physicians detailed for this duty. This has been my duty for the past fifteen years, and from the records which have been kept the following notes and statistics have been compiled. As I also see all members of the staff who are reported to be out of health, there should be little chance of their developing consumption without it being detected. Nurses naturally shrink from a thorough examination of the chest by residents with whom they are daily in communication; thus, if they find themselves failing in health, and suspect that their lungs may have become affected, they may keep the matter to themselves, and leave the hospital rather than report sick. Compulsory examination on entry by one of the visiting staff, besides ensuring the physical fitness of new members of the resident staff, paves the way for similar examination by the physician on the slightest hint of danger. I have several times been asked to examine nurses or servants merely because they or their friends had got a little nervous about possible infection. The origin of this practice at Mount Vernon is not without significance. A nurse (L. E. D.) came to the hospital from a provincial consumption hospital, and it was noticed that she had a hacking cough. She was persuaded to have her chest examined, and I found active mischief in the lungs, from which she died some six months later. According to her own account she had been off duty for an attack of acute bronchitis, and before she had completely recovered she was put on special duty to look after an advanced case until his death. It seems probable that, being in a condition of special susceptibility on account of her illness, she became infected from this patient. To avoid a similar occurrence in the future I suggested the systematic examination of all nurses and servants on entering on their duties and on leaving, which has now been carried out for over fifteen years. The numbers of which I have kept records comprise: From the Hampstead Hospital, 167 sisters and nurses, 92 maidservants, and 6 men and boys; and for the Northwood Hospital, 68 sisters and nurses, 73 maidservants, and 14 men and boys—a total of 420 persons. A certain proportion of these were rejected on the medical examination, others did not remain more than a few weeks, and some left without notice or were dismissed summarily for breaches of dis-

cipline or misconduct, so that the numbers examined on leaving will be considerably fewer than those mentioned above. It will be seen that evidences of past or present tuberculosis of the lungs were detected by medical examination in a not inconsiderable proportion of the applicants for posts as nurses or maidservants, the condition being frequently unsuspected by the individual herself.

In addition to the above, there have been 33 resident medical officers, 3 dispensers, and a porter and caretaker at the out-patient department, about whom particulars are available.

We may divide the inquiry into three parts:

The proportion of those desiring to enter the service of the hospital who have, or have previously had, some tuberculous manifestations.

The evidence pointing to tuberculous infection whilst in residence in the hospital and the extent of the risk.

The evidence of subsequent development of tuberculosis after leaving the hospital.

I.—Evidence of Previous Tuberculosis in Applicants for Appointments.

For the purposes of this inquiry we may take all the applicants who were examined on entry as to their physical fitness. Some of these were rejected at once as unfit for the duties required of them, others were allowed to remain though not physically sound, and were kept under observation. These were informed of the condition of the lungs, and were told that they would probably improve under the hygienic conditions observed in the hospital, and given the option of remaining. Most of them improved very considerably, and remained well; one or two did not improve, and left after a few months. It is noteworthy that of those who were found to have signs of tuberculosis, a large proportion were quite unaware of any such mischief, even when the signs showed active lesions. Others were aware that they had tuberculosis—quiescent or arrested—although they generally withheld the information on this point until it had been detected on examination.

The returns for Hampstead extend over fifteen years, those for Northwood only cover a period of five years.

The individuals examined on entry are comprised in the following table:

	Hampstead.	Northwood.	Total.
Matrons, sisters, and nurses ...	167	68	235
Female servants	92	73	165
Men and boys	6	14	20
Total individuals	265	155	420

Amongst these there was evidence on entry of previous infection with tubercle as follows:

	Hampstead.	Northwood.	Total.
In nursing staff	25	7	32
In female servants	6	7	13
In men and boys	0	0	0
Total individuals	31	14	45

This gives a proportion of nearly 14 per cent. of the nurses and 8 per cent. of the maids who had been infected with tuberculosis before they applied for duty at Mount Vernon. There were in addition a few nurses and maids whose lung signs were not entirely satisfactory, and suggested a possible slight attack of tuberculosis; but as the evidence in this direction was by no means conclusive, I have not included them in these returns. Of the 45 individuals who gave evidence of previous infection, 8 nurses and 1 maid had scars in the neck from old strumous glands, and 1 maid had an enlarged cervical gland which appeared to be actively tuberculous; 3 nurses and 4 maids had signs of old pleurisy, and of these, 2 nurses and 1 maid gave a history of repeated attacks—three in each case. Of the remaining 28 individuals, the majority had signs

pointing to arrested or healed mischief in the apex of the lungs, whilst in 10 the signs pointed to still active tuberculosis in the lungs. One nurse had signs in the lungs as well as a scar in the neck.

Of those who, as the result of examination, were considered to have had tuberculous infection of the lungs, some were unaware of anything having been wrong; even those with active mischief—as, for example, the case (Miriam T.) detailed below—seemed to have no suspicion that their lungs were affected. Two or three were known to have been in hospital with pulmonary tuberculosis at some previous date, and some others as the result of inquiries eventually confessed to having been under treatment for consumption.

Some of the nurses and servants included in the above returns as previously infected were rejected as unfit, two were admitted as in-patients instead of being accepted for duty. Only one nurse (L. E. D. referred to previously) is known to have died of the disease, though one maid is still in the hospital as a patient.

Most of those who were taken on duty improved considerably during their residence. Four developed active mischief later, while doing duty in the hospital. It will be noted that 136 per cent. of the applicants for appointment on the nursing staff presented evidence of tuberculosis, recent or remote, whilst of the servants applying only 7.8 per cent. showed signs of previous infection. This marked difference demands investigation, especially as tuberculosis is essentially a disease of the poor, and would be more prevalent in the class to which the servants belong than in that from which the majority of the nurses are drawn. Age might possibly have some influence, for some of the maids were younger than any of the nurses, and had not reached the age at which pulmonary tuberculosis is most common. The difference might be to some extent explainable on the supposition that the affected nurses might have selected such a hospital because the conditions of life were specially favourable to their condition, whereas the maids, coming from a more ignorant and prejudiced class, would avoid a consumption hospital if they had any suspicion that their lungs were not sound. In a few of the cases the nurses acknowledged that they had applied for posts at Mount Vernon because they thought it would be a good place for them as they had had their lungs affected, and it is generally known that a certain proportion of both medical officers and nurses in the various sanatoriums for consumptives have previously been patients at similar institutions. It is, however, impossible to overlook the possibility that previous occupation may afford the explanation of the greater proportion of nurses, as compared with servants, who have become affected with tuberculosis. Leaving out the cases of pleurisy and of strumous glands, we have 10 per cent. of the nurses and only 4 per cent. of the servants giving evidence of tuberculous infection. It seems possible that the nurses having been engaged in attending the sick and residing in hospital—at least during their training—may have become infected from their patients or have had their resisting power lessened by the effects of hospital work and residence. Many of the “nurses” were, however, probationers with no experience of nursing and no previous hospital residence, and, on the other hand, some of the maids had been employed in hospitals.

Of the tuberculous individuals, 17 (16 nurses and 1 maid) had had previous hospital residence, being nearly 37 per cent. of all who showed evidence of tuberculous infection. Of the tuberculous nurses alone, 48.5 per cent. had been in hospital.

The probable influence of hospital residence may be seen by the following comparison:

A.—Proportion of those who had previously resided in hospital who showed signs of tuberculosis (excluding cases of strumous glands):

Nurses ...	16 out of 70 = 22.75 per cent.
Maids ...	1 out of 17 = 5.28 ”
Both ...	17 out of 87 = 19.54 ”

B.—Proportion of those who had never been in residence in hospital who showed signs of tuberculosis (excluding glands):

Nurses ...	17 out of 166 = 10.24 per cent.
Maids ...	12 out of 147 = 8.16 ”
Both ...	29 out of 313 = 9.26 ”

Whether the influence of hospital residence, as shown above, was in the way of direct infection from tuber-

culous patients, or was due to the effect on the general health rendering the individual more susceptible to infection from any source, or in causing a latent tuberculosis (due to infection before entering the hospital) to become active, it is, of course, impossible to determine. In any case it seems that the influence of general hospital residence cannot be altogether disregarded, since the proportion of tuberculous cases in those who had previously resided in hospital was twice as great as that amongst those who had never worked in hospital.

II.—*The Evidence Pointing to Tuberculous Infection whilst in Residence at Mount Vernon Hospital.*

The nursing staff of a hospital would seem to be most exposed to any risk there might be of direct infection through the air (by droplet infection, or from the general infection of the air of the wards from dried sputum) since their duties bring them into close personal relation with the patients for many hours a day. They probably have also to collect the soiled handkerchiefs, the used sputum cups and flasks, and to make the beds of the more advanced or febrile patients. Their risk would probably equal that of the near relatives and household of a consumptive patient who is confined to the house, except that the regulations of a well disciplined institution ensure attention to prophylactic detail, which may be neglected in the average household. The maids are not so continuously in the wards or so closely in attendance on the patients, and their risk should be much less, but they might be expected to be less careful in carrying out precautionary regulations. Some of the men have special risks in connexion with the destruction of sputa, the disinfection of clothing and bedding, or in the *post-mortem* room.

If we were to rely upon the account which could be obtained from the individuals themselves we should only have to report a single nurse at Hampstead as having become consumptive whilst in residence, and possibly two at Northwood, who developed tuberculosis—one in the hand and the other in the foot—though these latter may not have been aware of the nature of the mischief. If, however, we look at the results of examination, as shown in Table II (p. 1043), we see reason to doubt whether such a report would furnish a complete record of those who developed tuberculosis during their residence. Several of those recorded in this table had no definite symptoms of ill health, and the majority had no suspicion that they had become infected with tuberculosis.

It will be seen on reference to the table that, excluding doubtful cases,* 14 members of the nursing staff, 5 maid-servants, and 2 men developed tuberculosis during their residence in the hospital. Of those, 5 nurses, 3 maids, and 1 man had been found on entry to have signs indicating previous infection. These cannot, therefore, be properly included in estimating the proportion of residents who may have become infected in the hospital. One of the maids who developed tuberculosis, and who ultimately died of the disease, contracted the infection apart from her duties (see case R. H. detailed below).

In calculating the percentage of cases of possible infection, only those members of the staff who remained in residence for three months or longer are included in the total of the residents, except in two cases who developed tuberculosis within three months of commencing their duties.

In making a critical examination of the cases referred to above as having developed tuberculosis during residence, we find that of the Hampstead staff 5 of the nurses may be considered to have developed tuberculosis in the lungs without any reasonable doubt, and of these 2 were recognized as tuberculous on entry. In 3 others the signs suggested pulmonary infection, but were not absolutely conclusive. In the remaining case (W. J.) if the swelling on the ankle was due to tuberculosis it must be considered rather as the development of a latent infection than as an infection occurring whilst in residence, the activity being possibly due to a lowering of the resisting power by hospital work and residence—the influence of the hospital

* Most of the cases which I have called doubtful, both in the list of those who showed evidence of tuberculosis on entering the service of the hospital, and in that of the individuals who developed tuberculosis whilst in residence, had more definite physical signs of changes in the lungs—catarrh, consolidation, or induration—than many patients who are admitted into the wards as cases of pulmonary tuberculosis and sometimes proved to be tuberculous. These “doubtful” cases have not been included as tuberculous in any of the calculations of percentages.

TABLE II.—Table of Cases Developing Signs of Tuberculosis (Definite or Suspicious) during Residence in Mount Vernon Hospital, 1894 to 1909 inclusive.

No.	Occupation.	Initial.	Age.	Date of Entry.	When Signs were Noted.	Condition Noted on Examination.	Remarks.
<i>Hampstead.</i>							
1	Probationer nurse.	E. R.	17	April, 1895	Aug., 1897	Pleurisy left base	Developed cough six months later.
2	Nurse	M. T.	27	?	Sept., 1894	Creaking râles left back	Signs disappeared in about a month; doubtful.
3	Probationer nurse.	G. A.	19	Oct., 1899	Sept., 1900	Deficient resonance and interrupted breath sounds at right apex; had lost weight two or three months	Right apex showed quiescent mischief on entry.
4	Nurse	M. M.	25	Feb., 1900	Nov., 1900	Harsh bronchial breathing and crepitations right apex; few crepitations left apex	Now well. (See report below.)
5	Probationer nurse.	E. S.	19	Feb., 1903	April, 1905	Deficient resonance; high pitched breath sounds; prolonged expiration right apex; harsh breathing left apex; temperature, 100.2°	Left apex showed quiescent mischief on entry; had had pleurisy.
6	Sister	J. G.	31	Aug., 1904	July, 1905	Inconstant crepitations right lower lobe; much thinner	Left the hospital; believed to be well; doubtful.
7	Probationer nurse.	E. H.	23	March, 1905	Dec., 1905	Fine crepitations right front	Left the hospital; doubtful.
8	Probationer nurse.	E. D.	18	Feb., 1906	Oct., 1906	Bronchitic râles more marked on left; pleural friction left side	Seemed well on leaving the hospital, but her health broke down six months later.
9	Nurse	W. J.	20	May, 1906	Nov., 1906	Swelling of left ankle; no redness	Very bad family history of tuberculosis; ankle got quite well; doubtful.
10	Nurse	E. T.	23	April, 1907	Jan., 1908	Harsh breathing with prolonged expiration right apex	Possibly physiological; doubtful.
11	Wardmaid ..	R. H.	21	Oct., 1902	April, 1905	Cough a.m.; creaking râles left supraspinous fossa; moist crepitations right apex; tubercle bacilli in sputum	Died 1908. (See report.)
12	Between maid ..	C. B.	14	Oct., 1902	April, 1905	Few crepitations right apex	Probably temporary catarrh; doubtful
13	Wardmaid ..	J. M.	21	May, 1905	Aug., 1905	Crepitations below right clavicle and in right supraspinous fossa; disappear on coughing	A delicate girl.
14	Between maid ..	S. A. B.	17	Sept., 1903	July, 1904	Deficient resonance right apex; few post-tussive crepitations suprascapular region; deficient resonance left apex; moist crepitations after cough; tubercle bacilli in sputum	Admitted to wards.
15	Maid	E. D.	18	Nov., 1893	Feb., 1895	Harsh breath sounds and fine crepitations left apex; temperature 99° to 100.2° p.m.	Father phthisical; remained till 1897 and kept well.
16	Maid	B. C.	18	?	Feb., 1896	Deficient resonance both apices; creaking râles right supraspinous fossa; swollen cervical glands left side	Father died of phthisis; the lung signs were due to old tuberculosis before entry.
<i>Northwood.</i>							
17	Nurse	E. H.	32	Nov., 1905	Jan., 1906	Occasional crepitations below both clavicles	October, 1907; creaking râles both apices, constant on right; had tuberculous cervical glands, aged 15. (See report); still on duty in the hospital.
18	Probationer nurse.	J. W.	26	Dec., 1907	March, 1908	Tuberculous finger from splinter	(See report.)
19	Probationer nurse.	W. E.	21	March, 1905	Oct., 1906	Tuberculous metatarsal joint	(See report.)
20	Probationer nurse.	J. D.	19	May, 1907	Jan., 1908	Acute tonsillitis; pleurisy left side	Probably rheumatic; complete recovery; left April, 1908.
21	Nurse	G. M.	25	Jan., 1905	Jan., 1906	Deficient resonance left apex; crepitations in both supraspinous fossae	Had pleurisy and pneumonia two years before entry.
22	Housemaid ..	L. M.	16	Nov., 1908	Jan., 1909	Tenderness and swelling in palm of hand	(See report.) Lungs showed old mischief on entry.
23	Housemaid ..	R. S.	16	Aug., 1906	May, 1907	Deficient resonance, prolonged expiration, and some crepitations above left clavicle	Left August, 1908; still keeps well; doubtful.
<i>Men.</i>							
24	O.P. porter and caretaker (Fitzroy Square)	H. J.	40	Oct., 1906	Nov., 1907	Old mischief both apices; active on left lung	Died in the hospital; was invalided from army for hæmoptysis.
25	Engineer (Hampstead)	W. C.	29	Aug., 1906	May, 1908	Fine crepitations at left apex. Tubercle bacilli in sputum	Still on duty; now well. (See report.)
26	Page (Hampstead)	E. M.	18	Oct., 1903	Oct., 1909	Catarrhal condition right apex	Still on duty; doubtful.

residence is in this case, at the most, indirect. There are thus only three cases of probable infection amongst the nurses during the past fifteen years which may be attributed to their work and residence at Hampstead.

Of the Northwood staff, two nurses developed signs in the lungs which pointed to tuberculous infection. One of these had suffered from strumous glands at the age of 15, and it is therefore conceivable that she had latent tuberculosis on entry; if so, the period of latency extended over seventeen years. The case of pleurisy cannot, in my opinion, be considered as an instance of tuberculous infection except on the supposition that all pleurisies are tuberculous. The pleurisy was preceded by an attack of tonsillitis which suggests a possible rheumatic origin. The case of tuberculosis of the finger is interesting, as it seems almost certainly to have been the result of local infection from a splinter of wood from the ward table which she ran into the finger. The case of tuberculosis of the metatarsal joint is less clear, as it is difficult to see how infection occurred, unless it were through the finger which she crushed in the door some weeks previously. (See Case W. E. detailed below.)

Excluding those who were rejected as unfit on the admission examination, or for other reasons did not

remain over three months, we have 155 nurses and 62 maids at Hampstead and 60 nurses and 52 maids at Northwood.*

We have, then, the following proportion of cases of probable infection:

	Total.	Developed Tuberculosis.	Excluding Previous Tuberculosis.
HAMPSTEAD—			
Nurses	155	5, or 3.22 per cent.	3, or 1.93 per cent.
Maids	62	4, or 6.42 "	2, or 3.22 "
Both	217	9, or 4.14 "	5, or 2.30 "
NORTHWOOD—			
Nurses	60	4, or 6.6 per cent.	2, or 3.3 per cent.
Maids	52	1, or 1.9 "	1, or 1.92 "
Both	112	5, or 4.46 "	3, or 2.67 "
BOTH INSTITUTIONS TOGETHER—			
Nurses	215	9, or 4.18 per cent.	5, or 2.32 per cent.
Maids	114	5, or 4.38 "	3, or 2.63 "
Both	329	14, or 4.25 "	8, or 2.43 "

* The comparatively large number of maids at Northwood is due to the fact that the laundry for both hospitals is at the Northwood branch.

Taking Table I for comparison, it will be seen that, excluding the Brompton returns before 1867, where the total number of nurses and servants is not given, we have:

Nurses 600, of whom 8 became consumptive—1.3 per cent.	
Maids 515, " 3 " " 0.58 "	

It will, I think, be evident that the return of those who became infected with tuberculosis is obviously incomplete, as might be expected if the figures are obtained by inquiry only.

It may be well to point out here that the hospital at Hampstead is an older building than that at Northwood, and that all kinds of chest cases, including some quite advanced cases of consumption, are admitted to the wards, whilst the much newer hospital at Northwood is for early cases of pulmonary tuberculosis, and may be described as a model of the palatial type of sanatorium for consumptives.

Of the maids at Hampstead, 6 developed signs in the lungs suggesting tuberculous infection. In two of these the disease became acute, and one of them (R. H.) died. In the fatal case it will be noted (see case below) that there is sufficiently clear evidence that infection was contracted outside the hospital. In one other case the lungs showed signs of old mischief on entry. Two of the other three cases are open to doubt, and I have failed to trace the girls since they left the hospital. At Northwood two maids appear to have become infected. One of these—L. M., recorded below—is interesting as a case of probable local infection through a cut. She had signs on entry of previous infection of the lung. The other case gave doubtful signs in one lung. She remained at her work, and though she has now left the hospital I have ascertained that she keeps quite well.

Of the men, only two have showed any signs of mischief in the lungs. One of these was a caretaker at the offices in Fitzroy Square and out-patient porter there. He developed active tuberculosis, and ultimately died in the hospital; he had been invalided out of the army for hæmoptysis. The other case was the engineer at Hampstead, whose duties included the destruction by burning of the contents of the sputum cups and flasks. He was never obliged to go off duty, though he remained under my care for six months. He is now perfectly well, and is still on duty at the hospital. It may be mentioned that all the men employed in the hospital are periodically examined every three months.

It is hardly possible to form any definite conclusion as to the influence, if any, of hereditary predisposition, since the numbers of those individuals in whom reliable information on this point is available is too small to be of any value. So far, however, as the figures give any indication, it would appear that the evidence points to the conclusion that it is undesirable that those who have a family history of tuberculosis should take work as nurses or maids in a special hospital for consumption. Of the Northwood staff, in whom the family history has been recorded, it appears that out of 71 nurses and 80 maids—a total of 151—of whom 22 gave a history of tuberculosis in the family, 9 nurses and 8 maids showed signs of previous tuberculosis on entry, and 3 others developed tuberculosis in residence. Thus we have 20 cases of tuberculosis in 151 individuals, or 13.24 per cent. Of these 20 cases of tuberculosis, 5 gave a history of tuberculosis in the family (25 per cent.), and 15 had no family history of tuberculosis (75 per cent.). Putting the figures in another way, we have 129 women with no family history of tuberculosis, and of these, 15 developed tuberculosis before or during residence—a proportion of 11.6 per cent. Of 22 women with a tuberculous family history, 5, or 22.7 per cent., developed tuberculosis. Thus the incidence of tuberculosis was considerably greater amongst those who belonged to tuberculous families. The numbers are, however, too small to be of any value.

The information as to family predisposition is less complete in the case of the Hampstead staff.

The average stay in the hospital is about the same for both nurses and servants, namely, about eighteen months; this is, of course, excluding those who did not stay as much as three months. Individual nurses and maids

remained in the hospital several years, one as much as ten years and several for five years and over. It should be mentioned that a large proportion of the nurses are probationers who only come for one year, passing the remaining two years of their training in a general hospital.

III.—Development of Tuberculosis since Leaving the Hospital.

I have not made any systematic attempt to estimate the proportionate number of nurses and maids who have developed tuberculosis since they left the Mount Vernon Hospital. In the first place, it has been found almost impossible to get into communication with a large proportion of the former nurses and maids, the maids especially being most difficult to trace after a few years. In the second place, such information as can be obtained is not altogether reliable, and cannot be corroborated by personal examination. I have obtained information regarding a considerable number of past nurses, and amongst those there has not been a single case of tuberculosis reported.

I have been the less persistent in seeking information since I have preferred to restrict this report as far as possible to facts ascertained by personal physical examination.

Resident Medical Officers.

Although I have at different times examined several of the resident medical officers at their request, there has not been the same systematic examination of these residents as of the nursing staff and servants. Nevertheless, since the other reports which I have quoted for comparison give particulars of the resident medical officers, I give similar particulars.

Out of 33 past residents to whom I have written, 27 have replied, 1 is known to be dead. Of the 27 from whom I have recently had communications, all but 4 are able to state that they have never suffered from tuberculosis either before, during, or since their residence at Hampstead or Northwood. They generally agree that their residence did them good rather than harm, and several of them speak of putting on considerable weight whilst in the hospital.

Of the 4 exceptions, 2 had suffered from pulmonary tuberculosis before they came into residence, the disease having been arrested. Both of these remain well and at work.

One other pricked his finger at a *post-mortem* examination, which led to a local infection of the hand. After about two years the hand became quite well. He is now, some twenty years later, still in good health. The remaining one developed several so-called tuberculous warts on the hands during residence nearly twenty years ago. Most of them have been cut out, and all are perfectly well; his general health has remained good. He writes that he quite recently reacted strongly to Calmette's test, but is in perfect health.

The dispensers, the secretarial staff, and the visiting medical and surgical staff furnish no cases of tuberculosis.

It would appear from the experience of the Mount Vernon staff that the risk of infection with tuberculosis in a special chest hospital is very small, and is apparently little, if at all, greater than in a general hospital. It is, perhaps, doubtful if there is any greater risk to the workers in any well ordered hospital than amongst the general mass of town dwellers of similar social position. Infection with tuberculosis does occasionally occur as a result of the duties of a nurse, but probably not more frequently amongst the nurses in a hospital for consumptives than amongst the general body of nurses. Every occupation has its special risks, and the possibility of infection is one which members of the medical and nursing profession accept as a matter of course. The risk of tuberculous infection, even in a hospital for consumptives, appears to constitute a very slight danger.

ILLUSTRATIVE CASES.

Unsuspected Tuberculosis of Lung Detected by Examination on Entry.

Miriam T., aged 21. Was examined on entry as wardmaid in November, 1908. She had been wardmaid at the Great Yarmouth Hospital. She was found to have active and advanced tuberculosis at the apex of the left lung entirely unsuspected. She was admitted to the wards as a patient.

* Including some nurses and maids who were transferred to Hampstead, and are counted in the Hampstead figures in the other statistics in this paper.

There was impaired resonance with prolonged expiration at the right apex. Diminished resonance, prolonged expiration, and moist crepitations over the greater part of the upper lobe and at the apex of the lower lobe on the left side. Tubercle bacilli were found in the sputum. She remained in the hospital (Hampstead and Northwood) until October, 1909, when she left much improved. She has not been at work since, but wrote at Christmas that she felt well and was anxious to get a situation as soon as possible.

Apparent Infection during Residence in Hospital.

Probationer Nurse Marie M., aged 25. Examined on entry, February, 1900, and found healthy. In November, 1900, she was reported to me, having got thinner and lost weight. She was easily tired, slept badly, and suffered from headaches.

I found the breath sounds harsh at the right apex, where there were some inconstant crepitant râles. A week later crepitations were detected at both apices, and she was put off duty. A month later the signs were more definite, especially at the right apex. She remained under my care for about five years before I could certify that the mischief was completely arrested. During this time she spent three and six months respectively at sanatoriums, the second occasion being in consequence of activity in the left lung, the right being quiescent.

For the last three years—July, 1902, to July, 1905—she was on night duty at the hospital. During the whole period she never had any expectoration. She has, since leaving the hospital, held posts at private sanatoriums, and remains well, reporting herself to me for examination at intervals when in London.

Nurse M. was engaged for some months before her breakdown in charge of the out-patient waiting room, and it seems possible that she became infected from the out-patients, who are not sufficiently careful in the matter of expectoration until they have been instructed in the necessary precautions. The out-patient department at Hampstead has since been closed.

Rose H., aged 21. Wardmaid. Entered the hospital in October, 1902, and was then quite healthy. In April, 1905, she was "run down," had some morning cough, and on examination was found to have harsh breathing and some moist crepitations in the apex of the right lung. Examination of the sputum showed the presence of tubercle bacilli.

She was taken off duty and put under treatment. She remained under treatment at Hampstead and Northwood until her death in 1908. It was found that this girl had become engaged to a patient who had tuberculous laryngitis, and who, when he left the hospital, took rooms at Hampstead. There were thus many opportunities of direct infection.

Jessie W., aged 26. Probationer nurse. Entered December, 1907. Healthy. In February, 1908, she ran a splinter into the left first finger whilst rubbing a ward table. A week later the finger was swollen and brawny, and Mr. Berry laid the track of the splinter open in the Royal Free Hospital, where the condition was pronounced to be tuberculous.

In October, 1908, the finger was practically well, but the nurse was very anaemic and not very strong. After a short time she improved considerably, and is now still on duty in the hospital.

Winifred E., aged 21. Probationer nurse. Entered March, 1905. She was anaemic, the weight was subnormal; she had a somewhat flattened chest but the lungs were healthy.

In the summer of 1906 she crushed one of her fingers in a door, and shortly after the finger showed signs of local suppuration. She went for a holiday to Switzerland, and soon after her return she was found to have lost 3 lb. in weight since her holiday; she was anaemic but there were no abnormal physical signs in the chest. In October, two months later, she complained of pain in the foot when walking. Mr. Berry examined the foot, which was slightly discoloured and swollen on the dorsum, and diagnosed tuberculosis of the metatarsal joint. She left the hospital a month later, and is now—October, 1909—perfectly healthy and well.

Lily M., aged 16. Housemaid. On entry in November, 1908, she was noted as tall and slight, with slight lateral curvature of the spine. The chest was healthy, except for a few creaking sounds on the left front. In January, 1909, she cut her hand with a knife. A few days later she broke some crockery, and thinks she got something into the wound of the previous cut. A week later there was swelling in the palm of the hand, which was tender on deep pressure. She was admitted into the Royal Free Hospital under Mr. Berry.

William C., aged 29. Engineer. Entered 1906. Was quite well until May, 1908, when he complained of pains in the chest and general weakness. On examination the only abnormal signs heard in the chest were a few rhonchi scattered throughout the lungs. He quickly improved, and felt well again, but about a month later he felt pain in the sternum and commenced to cough. No history of chest disease in the family. There was prolonged expiration at the right apex with a few crepitant râles. Rhonchi all over the back. At the left apex crepitations were heard both back and front. Tubercle bacilli were found in the sputa. A week later he had some pleurisy (dry) at the right base, and the physical signs at the right apex were more marked. By October 1st the chest was practically clear again, and he has since remained perfectly well. He is still on duty at the hospital.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, August 21st, 1909. ² *Lancet*, i, 1884, p. 837. ³ BRITISH MEDICAL JOURNAL, September 20th, 1882.

A Lecture

ON

MENINGITIS IN CHILDREN.

DELIVERED AT THE LONDON SCHOOL OF CLINICAL
MEDICINE.

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THERE are three varieties of meningitis to which children are specially liable—tuberculous; posterior-basic; and suppurative. Other forms of meningeal inflammation also occur, but, in comparison with these three, they are rare. It is still doubtful whether posterior-basic and cerebro-spinal meningitis should be differentiated from one another. The diplococcus which is found in the two disorders is apparently the same, the one being, in all probability, an attenuated variety of the other. The symptoms mainly differ in being comparatively mild in posterior-basic cases and in occurring principally in infants under one year of age; whereas in cerebro-spinal cases the manifestations are more acute, children are liable to its influence at all ages, it often occurs in epidemic form, and it is commonly associated with purpuric or other skin rashes.

TUBERCULOUS MENINGITIS.

Tuberculous meningitis in most instances depends upon an extension from an old-standing focus, frequently in the bronchial or mesenteric glands, but sometimes from a tuberculous process in the middle ear. Though it may occur at any age, the large proportion of cases develop between the second and fifth years of life. Where there is no obvious pre-existing tuberculous disease elsewhere, the onset is often so insidious that a definite diagnosis within the first week or two may be impossible. During this time there may be nothing more remarkable about the child than an unwonted peevishness and irritability, with restlessness at night and capriciousness as to food. He may, even thus early, complain from time to time of headache, or may inarticulately manifest discomfort by uneasy movements of his head. He desires to be left alone, and refuses to be amused in the usual way. His bowels become confined, and every now and again, for no apparent reason, he vomits without retching or effort, and independently of a previous meal. The restlessness at night is soon accompanied by startings in which the child wakes himself screaming, and by grinding of the teeth; while during the day he begins to manifest an unnatural drowsiness, and to assume a decubitus which is suggestive; he lies on his side with his hips and knees flexed, his arms close to his sides and acutely bent at the elbows, and his fingers, in a semi-unconscious way, constantly picking his nose or lips. He becomes increasingly irritable, and resents any form of movement. His headache is now more constant, and seems to be paroxysmally increased by light, noise, or any form of disturbance. Under the influence of such an exacerbation of pain he often clasps his head with both hands, and emits a short, sharp scream, which is described as the hydrocephalic cry. He wanders a little at night, and the pyrexia, which was at first insignificant and intermittent, is now continuous and generally higher in the evening than the morning. The pulse, which was at the beginning somewhat accelerated, becomes irregular, of full tension, and sometimes remarkably slow. The tongue is furred, the breath offensive, the urine thick and concentrated, and the bowels still obstinately constipated. The pupils are usually contracted, and slight ptosis of one eyelid or some degree of strabismus may develop. The muscles at the back of the neck stiffen, but there is very rarely any marked retraction of the head such as occurs in posterior-basic cases. Tremors of the head and limbs on movement are often noticeable. The abdomen may assume the hollowed-out appearance known as the "boat-shaped belly," and the *tâche cérébrale* can readily be elicited on scratching the skin.

Gradually the irritative symptoms characteristic of the invasion period of the disease subside. The child is now completely apathetic; he no longer complains of headache