of mud. Those who claim that the result of any balneological or spa treatment is due to such absorption have the burden of proof laid on them.

Beneficial results, therefore, depend on physical qualities and effects, such as temperature, specific gravity, consistency, and percussion. The action may be, first, mechanical. The weight on the joints is reduced and movements of weakened muscles are thus aided. This is a very important action. Secondly, it may be thermal. A warm medium will raise the temperature of the skin and increase the rate of peripheral circulation. Together with the mechanical action, this may greatly relieve pain and at the same time assist movement. Peat and mud baths combine mechanical and thermal effects to a greater extent than water, and the deep mud pools are of special value in osteo-arthritis and fibrositis. A cold medium is stimulating, as everyone appreciates from sea-bathing, but it has little part in the treatment of chronic rheumatism.

Thirdly, there is the percussion effect. This may combine the good results of heat, massage, and movements, as is shown in whirlpool baths. The same result may be achieved by the massage douche, performed with various types of needle baths and jet douches. The physical action may have some physiological effects on the kidney and cardiovascular system, but there is little evidence that balneological treatment directed against chronic rheumatism achieves appreciable results of this kind, and exaggerated claims have often been made in the past.

The effects here described are those of balneotherapy, and the treatment can be made available anywhere. In the past such substitutes for spas have too often been

incomplete and on an unsatisfactory basis, by reason of the large financial outlay involved, but there is no reason why they should continue to be so.

All spa and most balneological treatment is influenced by the length of time devoted to it. Patients desire the maximum effect in the minimum of time and look for intensive treatment. They would possibly do better if they arrived at the maximum effect in the maximum time, but duration is largely controlled by the purse and by opportunity, and partly by the mental outlook of the patient. Experience has led to general agreement that a course of treatment should not exceed a few weeks, and that longer periods cause debility. But the course can be repeated after an interval.

The question of the value of the internal use of spa and medicinal waters is a thorny one. Reports of so-called researches, often widely disseminated through the post, have in the past been little more than advertising propaganda. So far as chronic rheumatism is concerned, there is at present no satisfactory evidence of any special beneficial effect, even in the presence of radio-activity. Of course the general health of many individuals will benefit from a period under a regulated regime.

Indications and Contraindications.—Balneotherapy and spa treatment for chronic rheumatism are contraindicated in advanced diseases of the heart, lungs, and kidneys, and in all conditions of severe debility. In rheumatoid arthritis simple hot-water baths aid movements at joints and help to relieve pain, but other balneological treatment in general is contraindicated. Balneotherapy is of special value in osteo-arthritis and in the intramuscular forms of fibrositis.

FACTORS PREDISPOSING TO RESPIRATORY DISEASE IN THE PRE-SCHOOL CHILD*

BY

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In preventive medicine a study of predisposing factors is clearly of primary importance. In such study lies the best hope of controlling and preventing overt disease.

Thirty years ago, when the rate of infant mortality was about 140 per thousand, infective disease of the digestive tract headed the list of causes of this high death rate. But to-day, largely as a result of intelligent prevention of the underlying causes of diarrhoeal diseases, the rate of mortality has fallen to about 60 per thousand, and the list of causes, now much reduced, is headed by infections of the respiratory tract. This high incidence of fatal respiratory disease is even more marked in children over the age of 1 year. Thus, if we take a ten years' average from 1923 to 1933 of deaths in the County of London of children between the ages of 1 and 2, we find the total rate to be 18.7 per thousand living, of which measles, whooping-cough and pneumonia combine to provide 12.32 per thousand living, or over 60 per cent. of the total deaths. The battle front against mortality in the pre-school child has shifted from the digestive to the respiratory tract.

Peculiarities of Respiratory Disease in the Child

I

The respiratory mechanism has to start work quite suddenly within a few minutes of the moment of birth. In this respect it differs from almost all the other systems of the human organism. It is true that the circulation under-

goes profound modification shortly after birth. The digestive tract also will, in the ensuing days, have new experiences to undergo; the skin will suffer new insults. But in all these organs the change is gradual as compared with that with which the respiratory tract is confronted. Nature seems to prefer curves to angles, evolution to revolution, and, although in fact the changes which occur in the lungs are now known not to be quite so rapid as they were once thought to be, still they are sufficiently revolutionary to throw a temporary strain on the respiratory mechanism.

II

This rather abrupt introduction to its life's work may account for a peculiarity of the respiratory tract in young children which I want to take as my second point—namely, its liability to infection. Respiratory disease, and especially infective disease, has a very high incidence in the first two or three years of life. A sharp decrease in this incidence occurs between the ages of 3 and 4 years.

III

Accompanying this high incidence is a high virulence. The severity of infectious respiratory disease is much greater in the first three years than it is later. An organism which causes quite a benign infection in an adult may be responsible for a very severe or even fatal infection in an infant. After the age of 3 or 4 is passed, respiratory disease, both in its course and in its sequelae, approximates much more to the adult type. This is in part due to the great relative growth of the respiratory organs which has taken place, in part to the greater measure of immunity which the child has acquired, and in part to the increased stability which the older child possesses.

IV

This question of the relative instability of the infant is important in this connexion. Perhaps one of the most obviously unstable things about an infant is its heat-

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regulating mechanism. Now the respiratory tract, and especially the bronchial tree, performs a most important part in the function of temperature regulation in surroundings which are subject to rapid and frequent changes. I shall return to this question of the effect of temperature changes, and especially changes of humidity, when we come to consider preventive measures in more detail.

V

When speaking of the respiratory tract as a heat-regulating mechanism I stressed the part played by the bronchial mucosa. It is noteworthy how relatively large the bronchial tree is in the young child as compared with the adult. In this fact lies the explanation of the relative frequency of bronchial and bronchogenic infections. Moreover, the relatively large trachea and bronchi connote a large volume of dead-space air to be moved with each respiration. The useful air—that is, air useful for gaseous exchanges in the alveoli—is proportionately small, and the tendency for the respiratory rate to rise markedly in the presence of even mild respiratory infections is thus explained.

VI

As the last of these generalizations on the subject of the peculiarities of respiratory disease in the child I would invite you to consider the protective mechanism with which children are equipped for defending from infection this highly vulnerable respiratory tract. You are familiar with the preponderance of lymphoid tissue in the child as compared with the adult. In the white cells of the blood, for instance, the adult ratio of lymphocytes to polymorphs is reversed in the child, there being 75 per cent. of lymphocytes in the blood of the infant. The fixed deposits of lymphoid tissue are similarly preponderant.

The portal of entry for infective organisms into the respiratory tract is guarded by a complete ring of lymphatics, with aggregations of lymphatic tissue in nodes, the most important of which are the adenoids at the back of the naso-pharynx, the tonsils, and the superficial and deep cervical glands. These nodes form the second line of defence of the upper respiratory tract against infection. In this respect they are of great protective value, and it is regrettable that a fashion arose for removing them. Fashions, even fashions in surgery, change, however, and nowadays we find an increasing and proper tendency to give the tonsil its due and to leave it alone so long as it is healthy and performs its work.

The disadvantage of this system of lymphatic defence lies in its tendency to give chronicity to what are originally acute infections. When the acute attack of coryza or tonsillitis is over the tonsils and cervical glands may continue the battle in a quiet, chronic way, which prevents or delays complete recovery. This chronic inflammation may so damage the lymphatic mechanism as to make its complete recovery impossible. It is in these circumstances that the surgical removal of the focus of sepsis, a chronically inflamed tonsil, or the drainage of a cervical abscess, is called for.

Unfortunately, not all the lymphatic nodes which defend the respiratory tract are accessible to this surgical treatment. I have dealt so far only with the lymphoid ring at the upper opening of the respiratory tract. There are also, of course, the peribronchial nodes and the glands at the hila of the lungs, and it is important to remember that, though they cannot be seen and palpated in life, they are the site of conflicts similar to those which we see going on in the throat and neck.

Such, then, are the general considerations underlying any study of respiratory disease in the child. We may now take up in more detail the various clinical syndromes

associated with respiratory infections, and the causative factors determining the course the infection will take.

Congenital Defects

In the very young infant there may be certain congenital defects which predispose to respiratory disease.

Prematurity is the first of these. Even when prematurity is not accompanied by debility due to illness of the mother, as it so often is, it is necessarily associated with a relative lack of vitality, of the power to continue independent life; in no department is this so obvious as it is in the respiratory system. We find in the respiratory system of the premature child an exaggeration of all those susceptibilities and attributes which we have already considered as the peculiarities of the mature child. In nursing these premature children we lay special stress on the temperature and humidity of the air they breathe; recognizing that benign organisms, normal inhabitants of the nose and mouth of adults, may be pathogenic to them, we wear masks to prevent the possibility of droplet infection. It is not my intention to discuss in detail the management of the premature baby, but these principles may with profit be applied to the nursing of normal babies. Insistence on the wearing of masks while tending these babies by nurses, mothers, or even by doctors suffering from colds or sore throats, for instance, might save many normal infants from attacks of bronchitis and broncho-pneumonia. The absence of the coughing reflex, and sometimes of a swallowing reflex too, brings added danger to the premature baby when feeding is attempted. The inhalation of food is liable to be followed by broncho-pneumonia, and can only be avoided in these very immature babies by tube-feeding.

Cleft palate and hare-lip are fairly common congenital defects that may predispose to respiratory disease. When either of these defects, especially the former, is present, it is difficult to avoid infection of the nose and naso-pharynx. If this infection is not controlled it easily spreads through the short, wide Eustachian tubes of the infant to the middle ear, and gives rise to a chronic otorrhoea, which further debilitates the child. The only way to avoid these infections is to carry out a very thorough antiseptic toilet of the nose and mouth before every feeding.

Congenital laryngeal stridor, due to an exaggeration of the ordinary flexibility of the infantile larynx, is a defect which usually disturbs the alarmed mother much more than the child. In severe cases the inspiratory stridor is accompanied by some indrawing of the lower intercostal spaces, evidence that the efficiency of ventilation of the lungs is in fact impaired. These children go on quite well as a rule, and gradually the stridor disappears, but in the face of even a mild respiratory infection they fare extremely badly.

Atelectasis, a failure of a lung or part of a lung to expand, is the last congenital defect which I will mention. As I have already indicated, some degree of atelectasis must be regarded as physiological in the first few hours of life, but it is to the persistence of this non-aerated lung or patch of lung that the diagnosis of atelectasis is applied. Sometimes the failure to expand is due to obstruction of a bronchus by fluid inhaled in the infant's first efforts to breathe. But, whatever the cause, the bronchus leading to the unaerated lobe will very soon become filled with mucus, and this forms an ideal medium for the growth of organisms. The infection easily spreads to the lung beyond, which, being unexpanded, has a deficient blood supply. The result is a pneumonia which often proves fatal. The advisability of some form of artificial insufflation in these cases is a moot point. If the atelectasis is due to a blocked bronchus, insufflation will at best be useless; it may result in blowing a loose plug of mucus more firmly into a bronchus. It is a procedure which, unless very carefully

controlled, carries with it the risk of damage, by over-distension, to healthy areas of lung. A procedure that is free from risk and often attains the required result is that of stimulating the natural respiratory mechanism by the administration of CO₂. The exaggerated respiratory movements which may be excited by the administration of CO₂ often result in the aeration of the atelectatic areas.

Chronic Naso-pharyngeal Infection

Apart from these congenital defects there are certain other conditions, occurring generally in older children, which predispose to respiratory infections. Chronic infection of the adenoids and tonsils has already been mentioned. Apart from their effect as foci of infection, the hypertrophy which they are liable to undergo as the result of chronic infection converts these lymphoid masses into mechanical hindrances to free respiration. I need not paint for you the well-known picture of the child suffering from adenoid hypertrophy, with its open-mouthed, almost idiotic, facies, its mal-formed palate and nose, its sunken chest and round shoulders, its running ears. The treatment of the condition is surgical, but to be effective surgery must be followed by a course of re-education in proper breathing and proper posture. The child must be taught to stand up straight and breathe with the ribs as well as with the diaphragm. Further, it must be taught to breathe through the nose.

The causes of chronic infection of the nose and throat and of the accessory nasal sinuses are probably many, but I cannot help feeling that proper instruction in blowing the nose would be valuable in prophylaxis. The sniff which is so popular a substitute for the handkerchief among the children attending welfare centres is not only unaesthetic but, as a means of draining the nasal cavity, surgically unsound.

Dental Caries

Carious and septic teeth probably play some part in infections of the upper respiratory tract, but their importance is very difficult to assess. In the first place they are themselves an expression of some nutritional defect, possibly a vitamin deficiency. I have seen, however, so many cases of advanced caries in the first teeth of children whose diets have apparently been adequate and who, in all other respects, are perfectly normal, that I wonder whether the nutritional defect, if such there be, is not perhaps antenatal.

In the second place, the treatment of caries is often delayed until extraction is the only possible course. The wholesale extractions which are sometimes practised give rise to shrinkage of the alveolar margins and a debility due to edentulous dyspepsia which may do more harm than the condition which it was designed to cure. My own opinion is that carious milk-teeth, if kept clean by brushing, do little harm, and, though unsightly, can usually be safely left alone in those cases where they cannot be filled.

Influence of Diet

This brings me to another factor which may play a part in the causation of respiratory disease in the child—namely, diet. Direct infection from infected food is not common. Nevertheless the influence of diet on respiratory disease is undoubted, and this influence is exerted chiefly through the fat-soluble vitamins. Of course malnutrition in the sense of underfeeding or partial starvation will lessen a child's resistance to infection. There is, however, a strong association between rickets and infections of the respiratory tract. The connexion is not absolutely clear. In cases of severe and long-standing rickets with gross deformities of the thoracic cage the lungs have been found to be in a state of partial atelectasis. Such patients may be observed in life to have very little power of costal respiration, and the ill-ventilated bases of the lungs are

obviously favourable sites for pneumonic processes. But in milder cases of rickets, where there is no gross mechanical defect, the liability to catarrhal infections, especially of the upper respiratory tract, has been frequently noted. A tendency to colds and bronchitis is one of the early symptoms associated with mild rickets. It is hard to correlate these infections with vitamin D deficiency, and it may be that they are in fact due to lack of vitamin A, the other fat-soluble vitamin, which has an anti-infective factor. The results of research directed to this point are not as yet conclusive, but the clinical fact is well established that children whose diets are deficient in eggs, meat, fish, butter, and cod-liver oil are peculiarly prone to respiratory infections.

In welfare centre practice the difficulties of ensuring an adequate diet for the children and the nursing mothers are very great. The very low incomes upon which so many of these families have to subsist make an adequate intake of first-class fats impossible. Personally, I recommend the administration of cod-liver oil to all bottle-fed children from birth, and to the breast-fed babies from the age of 3 months until they have reached the age of 2 years. The vitamin content of the breast-milk of a working mother, who spends what little time she can get away from household duties in the smoke-filtered sunshine of London, depends almost entirely on the amount of vitamins in her food. The relative frequency of mild rickets in breast-fed babies leads one to conclude that this is insufficient. Ideally one should give the oil to the nursing mother, but in practice one finds that for one reason or another she does not take it. Either she dislikes it or she gives it to one of the older children.

Before leaving the subject of vitamins I want to emphasize how mistaken it is to regard them as something to be taken out of a medicine bottle. They are accessory food factors, and should normally be taken in the ordinary foodstuffs which compose the diet. The view of vitamins as medicines has led to their over-emphasis by food faddists; and now the pendulum is beginning to swing the other way and the voice of the scoffer is heard attempting to "de-bunk" the vitamins and to deny their importance in the diet. In this way the truth is obscured. It is a point to which the welfare centres might with profit give more attention. The reason why it is at present necessary to prescribe vitamin-containing preparations at welfare centres is because so many of the mothers shop unintelligently and cook badly. These things are a matter of education and, even if they are now being taught in the schools, as I hope they are, that does not affect the present generation of infants. Classes in cooking and simple dietetics should form part of the regular routine of every welfare centre. As a measure of preventive medicine such instruction would have far more value than the doctors' clinics.

Clothing

I have already mentioned the importance of temperature changes and changes of humidity in throwing a strain on the respiratory mechanism. We have to live in a world in which such changes are abrupt and frequent, and we wear clothing to assist our natural regulating mechanism and to minimize the strain. To achieve these ends clothing should be a poor conductor of heat, and yet permit the escape of water vapour from the body's surface.

Unfortunately, the cheapest of materials, cotton, has neither of these attributes, and is therefore not suitable for the underclothing of children. Actually cotton clothing, being hygroscopic, holds water, so that it interferes with cooling by evaporation from the skin during exercise, and cools the body when the exercise is over by evaporation of the moisture which it has retained. It acts as a wet pack, but at the wrong moment.

Overcrowding

No discussion of the factors contributing to respiratory disease in the child would be complete without some mention of the effect of bad housing and inefficient ventilation in favouring the transmission of infections. The subject is, however, too big to do more than mention it in passing. It is bound up with the problem of housing large numbers of people in comparatively small areas. For this reason the health visitor can often do little or nothing to ameliorate conditions which she knows to be productive of disease.

Pulmonary Fibrosis

Finally, in the list of respiratory diseases of which the predisposing factors are known and to some extent preventable, a place must be found for fibrosis and bronchiectasis. An acute type of bronchiectasis has been described occurring during the active stage of severe broncho-pneumonia; congenital bronchiectasis also occurs, but is rare. Most cases of bronchiectasis are secondary to fibrosis, so that from the preventive point of view it will be sufficient if we consider the causes of fibrosis of the lung. Peri-bronchial fibrosis in varying degrees may follow chronic bronchitis. This may show itself clinically as attacks of cough which last all through every winter, associated often with infected nasal sinuses and tonsils.

But more serious is interstitial fibrosis in which the alveolar structure becomes involved. The two processes are frequently associated, and the distribution and degree are both very variable. Pneumonia, especially broncho-pneumonia, is responsible for the overwhelming majority of cases of this condition. The more chronic the inflammatory process the greater the probability of interstitial fibrosis resulting.

Measles and Whooping-cough

Above all other causes must be set the broncho-pneumonia associated with measles and with whooping-cough. The prevention of these two diseases presents peculiar difficulties, for in both the period of maximum infectivity precedes the appearance of the characteristic diagnostic symptom, the rash of measles and the whoop of whooping-cough. Both diseases are spread by droplet infection, and factors favouring their transmission are overcrowding, with inadequate ventilation. Specific preventive measures offer the best hope of controlling these diseases.

In measles the use of convalescent serum and adult immune serum as means of modifying the severity of the disease has been attended by satisfactory results. The attenuated attack leaves the child with the same measure of active immunity as is achieved by having unmodified measles, and since the serum is of human origin there is little danger of anaphylactoid phenomena. The chief difficulty at present is to get supplies of the serum. One looks forward with interest to the results of the clinical tests, at present proceeding, of the effects of placental extracts in producing a similar attenuation of measles. The results reported in America appear to be satisfactory.

On the efficacy of vaccines and convalescent serum in the prophylaxis of whooping-cough opinion is far from unanimous. My own experience is quite insufficient to put before you, but the reported results of vaccine prophylaxis in America seem to warrant a wider trial of the method in this country.

Conclusion

The successful prophylaxis of respiratory disease in the child is obviously of the greatest importance. The mortality in childhood and the morbidity in later life resulting from these diseases alone are still very high. I have tried to indicate some of the predisposing factors

which must be controlled if this mortality and morbidity are to be lessened. Their control is not entirely, perhaps not even largely, in the hands of doctors or welfare centres. Slums, overcrowding, smoke-abatement, the high cost of living, unemployment—all these things play their part. I suppose we must look to the politicians, with what hope we can muster, for their ultimate correction.

But there are ways in which the present public health services can, if they are intelligently worked, play a part not only in palliating the effects of these various adverse factors, but in educating those in charge of children to make the best of the facilities available.

LEPTOSPIRAL JAUNDICE, FOLLOWING BATHING INJURY

BY

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It has been suggested¹ that all sporadic cases of spirochaetosis icterohaemorrhagica should be reported. The disease appears to be more common than was formerly thought, and present-day methods of diagnosis and treatment can reduce the likelihood of a fatal termination in the severe cases. It is partly for these reasons and partly because the typical symptoms and signs led to the diagnosis being made on clinical grounds, because of the complications met with, and the interesting features in comparison with other reported cases, that this case is reported in detail.

Case Report

A boy of 17, a stripper in the hosiery trade, was admitted to the City General Hospital on August 11th, 1935. He had been on a camping holiday with other boys and woke up one morning with a severe occipital headache; he cycled twelve miles to his home on a very hot day, having a long drink of ice-cold water from a village pump (in regular use) while on the journey. On arriving home he collapsed. At night he had pains in the back and limbs and sweating. Headache on this second day was severe. He was disinclined to take food and on attempting light food vomiting occurred; this had continued up to the time of admission. On the third day the pains became more severe, and on the fourth there was continued epistaxis, which "appeared to ease the headache." He was admitted on the fifth day, when a slight jaundice was noticed. The urine was said to have been of a deeper colour than usual for the last twenty-four hours, and there had been marked constipation for five days.

The patient volunteered the information that he thought he had a splinter in his foot. Inquiry elicited the fact that while camping he had often bathed in a near-by canal. He had got the splinter in his foot during a bathe, two days before the onset of symptoms, when stepping on to the tow-path; he continued bathing after this. He said that rats were numerous and that he had frequently gone rat-catching in this vicinity. He remains quite positive about the length of time between the splinter entering his foot and the onset of symptoms.

CONDITION ON ADMISSION

When first seen on the fifth day his temperature was 101.2° F., his pulse rate 114. His general condition was good, but spasmodically he appeared to be in considerable distress due to limb pains. There was slight jaundice of the skin, the eyes also being icteric, with considerable episcleral hyperaemia. Dried blood was present around the nostrils; the tongue was dry and furred; the throat normal. The blood pressure was 126/80 mm. Hg; no abnormality was detected in the heart and lungs. Examination was unsatisfactory owing to spasms of pain, irregular breathing, and a troublesome hiccup, which had developed in the later part of the day. The abdomen was slightly distended, the liver edge