

THE RESULTS OF SANITATION IN THE EFFICIENCY OF ARMIES IN PEACE AND WAR.*

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IT will be understood by the members of the Institute that in venturing to address them on the "Results of Sanitation in the efficiency of Armies in Peace and War," I do so by invitation of the Council. If I venture to accept so flattering an invitation, I do so not because I can hope to do justice to the subject, even if the time at my disposal were adequate. It is a subject which properly belongs to the philosophy of military history. It has never received sufficient attention, but there are not wanting indications that henceforth sanitation as an important factor in the maintenance of the fighting strength of an army in the field will receive definite recognition from military administrators and military commanders. I find an immense mass of material at my disposal, but I have resolved to limit myself to a few points which we may consider together with some profit to ourselves.

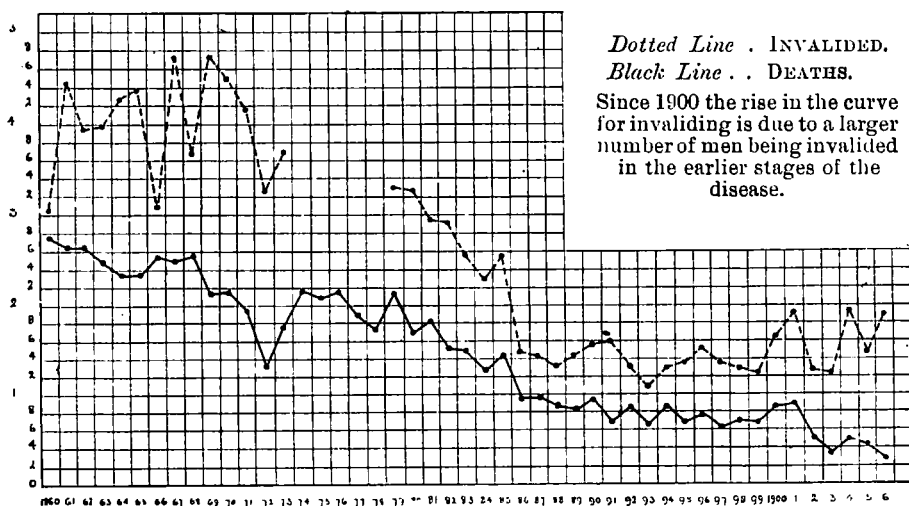
I wish to bring before you only certain cases of success that have crowned the work of the medical officers of the Army in past years, and before doing so I would like to say a few words as to the position of sanitation in the general scheme of army organisation. The Army leads a dual existence. At one time, like so many organic beings, it leads a purely quiescent life, that is peace; at another it develops a virulent stage, and that is war. Now sanitation occupies a totally different position according as the Army is quiescent or virulent. In the former state, in peace time, the measures of sanitation which we recommend are limited only by their cost. I may say that it is my experience and I think

*The statistics on which this paper is based were compiled by Lt.-Col. C. H. Melville, R.A.M.C., Professor of Hygiene at the Royal Army Medical College, who is also responsible for the Charts and the notes on the same.

4 Results of Sanitation in Efficiency of Armies in Peace and War.

that of most officers, that if a sanitary officer can make out a good case for any project of a sanitary nature, and the money is available to carry it out, he will not find that any difficulties will be put in his way, on purely military grounds. In war everything is different. To use an Americanism, "The army does not go to war for its health." In war, everything, sanitation included, must be subordinated to that leading principle of strategy, getting the greatest possible number of fighting men to the decisive point in the shortest time. If sanitation can help on this object then no one will welcome it more than the commander, whose reputation depends on his fulfilling the above strategical problem. But the sanitary officer who expects a

CHART I.
TUBERCULOSIS AT HOME AND ABROAD.
Ratios per 1,000 of Strength.



commander to delay his advance, with the sole object of saving life from preventable disease, without in any way forwarding his main strategical object, more than deserves the want of recognition that he will undoubtedly receive. Of course, if there is time in hand, a delay of a few days may enable the force that reaches the decisive point to be larger; the problem is not entirely one of time, it is also one of numbers. But the same great commander that said, "Heaven is on the side of the big battalions," also said, "Ask me for anything but time." You will be able to judge from the above the nature of the proofs of previous and probable success that the sanitary officer has to bring forward when submitting any scheme to

his commander-in-chief. He must show in peace time that he will save more money than his scheme will cost, in war time that his measures will not only not delay the Army, but that they will enable the commander to stand on the decisive spot with a larger number of men than he could in the neglect of those measures expect to have, and in either case his position and his arguments will be very much strengthened if he can show that on previous occasions other measures recommended by him, or similar measures recommended by others, have had the success that he now hopes to achieve.

As instances where sanitary measures have increased the efficiency of the Army in peace I will take four specific diseases in four different quarters of the globe. (1) Tubercular disease in the Army serving at home and abroad. (2) Cholera in India. (3) Enteric fever in India; and (4) Mediterranean fever in Malta.

Chart I., page 4, shows the yearly fluctuations in the invaliding and death-rates from tubercular diseases for the entire British Army at home and abroad, since 1860 inclusive.

Unfortunately, the invaliding rates for the years 1874 to 1878 inclusive cannot be shown, as during these years our Reports class tubercular diseases under enthetic diseases, and do not furnish separate figures. Taking the death-rate first, it will be seen that there has been a steady fall in the ratio of deaths during the period under review, broken by only two important rises. The first occurs in the years 1872 and 1873, and its effect is seen to last till well into the early eighties. The second rise occurs during the years 1900 and 1901, the years of the South African War, to which campaign it is undoubtedly attributable. The cause of the first and most important rise is difficult to estimate. Probably there was more than one cause at work, but the reports of the Army Medical Department give no information as to what these may have been.

The curve representing the variations of the invaliding ratio is much less regular than that representing those of the death-rate. The curve as a whole shows a marked fall, but this began much later than the fall in the death-rate. Owing to the gap in the statistics during the years 1874-1878, already alluded to, it is hard to say whether the fall commenced in 1872 or later. Once the fall began it was, however, very rapid, and lasted till 1893, since when, though with considerable oscillations, the curve has had a slightly upward tendency. This rise is probably due to the recognition of the potentially infective nature of all phthisical cases. The oscillations are less easy to explain. The rise in 1900 and 1901 may be attributed to the war, but those of 1904 and 1906 cannot be thus

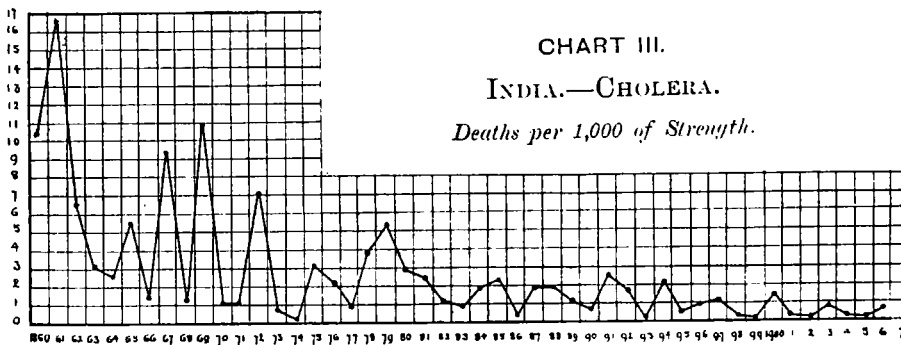
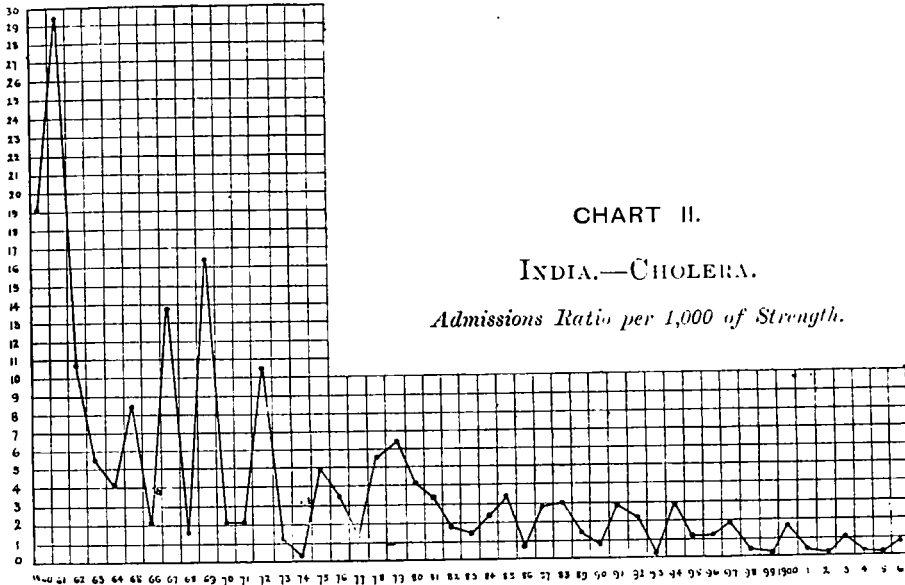
6 *Results of Sanitation in Efficiency of Armies in Peace and War.*

accounted for. Invaliding being the result not of an operation of nature, but of the opinion held by officers of the Medical Corps as to the effect of a disease on a man's fitness for the ranks, naturally fluctuates with the fluctuation of ideas on this point. However, apart from these fluctuations, the enormous decrease in the total wastage of the Army from tuberculous diseases is unmistakable. In the year 1860, with an Army of under 200,000, we lost by death and invaliding 1,143 men; in the year 1906, with an Army 230,000 strong, we lost only 590 men: a reduction of nearly 60 per cent. Coincident with this decrease in the wastage due to tubercular disease in the Army, we have a decrease in the prevalence of the same disease in the civil population. But the decrease in the military population has been greater than that in the civil population at the same ages. Taking the Army serving in the United Kingdom only (and obviously it would be unfair to compare the civil population of this country with the troops serving abroad), we find that the death-rate of the civil population at the military age has fallen since 1860 by 50 per cent., while that of the Army has fallen 90 per cent. To this latter must, however, be added the loss due to invaliding; and if we take it that half the men invalided for tuberculous disease would otherwise have died within their period of colour service (a rather liberal assumption), and add this amount to the death-rate, we find that the total loss from these diseases has fallen by 80 per cent. The difference in the amount of decrease between the civil population and the Army may therefore be fairly credited to changes in the soldier's life and surroundings during the above period.

Now the greatest change that has occurred in the daily life of the soldier in the past fifty years has undoubtedly been in the direction of better housing. What his surroundings were at the beginning of that period may be judged from the report of a Royal Commission appointed in the year 1857 to investigate the condition of Barracks and Hospitals in the United Kingdom. I will not trouble you with extracts from that report. Suffice it to say that about a quarter of the Army at home lived in rooms affording them less than 350 cubic feet per man, while only about 6 per cent. of the whole force were provided with more than 550 cubic feet of air space per man. Since the sitting of that Commission, and as a result of its report, the housing of the soldier has gradually been improved. Old barracks have been altered and new ones built on improved plans, and *pari passu* with these changes and improvements the wastage from tuberculous disease has lessened till it stands at the present figure. I think I may therefore, in respect of this

class of disease, place to the credit of sanitation the increased efficiency that has resulted from the presence in the ranks of the Army to-day of the men who, under the conditions that prevailed fifty years ago, would have been dying in hospital or invalided to civil life.

The second illustration which I shall take to elucidate the subject



of my paper is that of cholera in India. This disease, within the recollection of many of us still serving, used to be a constant and most unwelcome visitor at all our up country stations.

Charts II. and III. show in graphic form the admissions and deaths

8 *Results of Sanitation in Efficiency of Armies in Peace and War.*

per 1,000 of strength for this disease for the entire European Army in India from the year 1860 till the year 1907.

The first feature that strikes one in looking at these curves is the enormous fluctuations to which they are subject in the '60's and '70's. In the former decade especially the Army seems to have been liable at any moment to the most devastating attacks of cholera. Thus in 1861 there were over 1,500 admissions and nearly 1,000 deaths from this disease. The terrible nature of this outbreak may be better demonstrated by saying that the Army of India in 1869 lost from cholera alone nearly three times as heavily as it lost in 1906 from all causes combined. Heavy as this visitation was when we take the whole Army, its severity becomes even more terrifying when we consider the fate of individual units. In the year under consideration the 27th Foot at Morar lost one sixth, the 51st at Meean Meer one quarter, and the 94th at the same station one third of its effective strength. And this mortality was not spread over the whole year. A few weeks at the outside covered the whole of these awful tragedies.

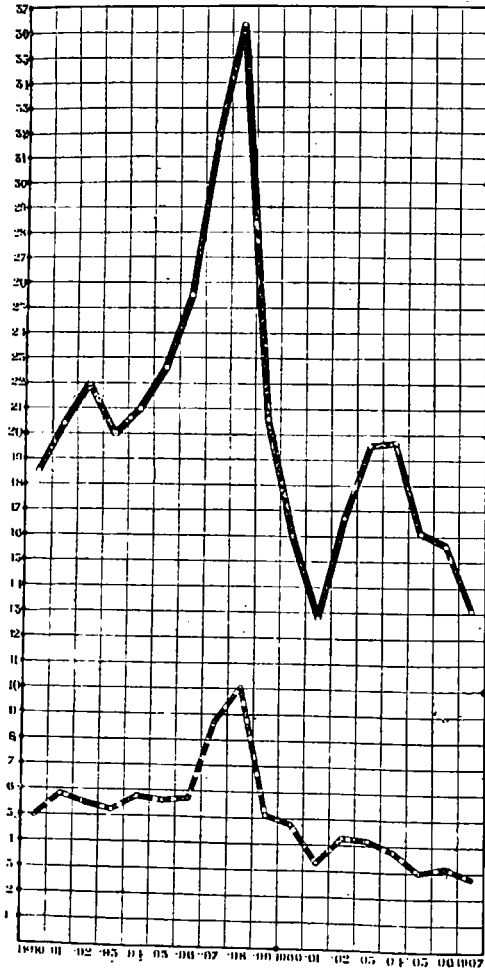
Little wonder that in the face of these appalling calamities, so inexplicable in their origin, so mysterious in their progress, and so erratic in their incidence, men of the clearest intellects seem to have lost their powers of weighing evidences or of logical deduction. The literature of cholera in the days before the advent of Koch teems with the most wonderful theories, all ingenious, and all as futile as the private soldiers' well known tale that the disease followed the path of the wandering Jew. Theories of miasm, of telluric waves, of epidemic constitution, followed one another in endless succession, and it was not till the discovery by Koch in the year 1884 of the vibrio of cholera, that any logically grounded method of prevention could be adopted. True before that time attention had been paid to the quality of the drinking water, but not so much as being a cause, or rather the vehicle of the cause, of specific disease, as influencing indirectly general health and well being. This attention, however, undoubtedly did good, and to it may be attributed the diminished incidence of cholera in the '80's and early '90's. It was not, however, till 1894 that a severe outbreak of this disease at Lucknow, which was clearly and scientifically traced to the use of contaminated sand in the filters of the corps attacked, demonstrated to every one far and wide that water, and water alone, was the vehicle by which the vibrio of Koch was admitted to the human body. Sporadic outbreaks still no doubt occur, and living as the Army has to do, an oasis of cleanliness in a desert of filth, it cannot hope to escape such occasional blows; but anything in the

nature of the catastrophes of the '80's, or the periodical visitations of the '70's and '80's, is now out of all practical calculation, and that this is so is due to the recognition of the hygienic principle that water is the

CHART IV.

INDIA.—ENTERIC FEVER.

Admissions and Deaths. Ratios per 1,000 of Strength.



The rise between 1890 and 1898 is generally attributable to cumulative infection of the latrines, etc., by the dry earth system of removal. The fall in 1899 is partly attributable to the presence of a large number of protected men consequent on the high incidence of fever during 1898. This was assisted by the fact that after the outbreak of the South African war in October, 1899, drafts of young soldiers no longer came out to India, the Army in that country becoming steadily older and less susceptible to this disease. It is to be noted too that in 1898 the sanitation of the Army, which had up to that date been in the hands of the Quarter-master General's Department, was brought under the Principal Medical Officer of Her Majesty's Forces in India. In addition in 1898 a sanitary officer was specially appointed to Army Head Quarters, the first holder of the appointment being Major A. M. Davies, R.A.M.C., and in 1900 and 1901 sanitary officers were posted to the head-quarters of the four commands, Punjab, Bengal, Madras, and Bombay. The low rate of incidence continued throughout the South African war, and the rise in 1902 is attributable to the re-opening of reliefs consequent on the termination of that war. The fall since 1904 is attributable to the recognition of the dangers of latrine infection, and the measures taken to combat the prevalence of flies. Some credit must, however, be given to the administrative changes alluded to above, which introduced a scientifically organised system of sanitation throughout India.

vehicle of the cause of cholera, and to the application of that principle to the exigencies of the soldier's life.

We now come to my third illustration, enteric fever in India. The curve (Chart IV.) shows the admission rate for this disease in the Army of India since the year 1890.

10 *Results of Sanitation in Efficiency of Armies in Peace and War.*

Now at first sight this chart does not seem very illuminating, nor in fact to do much credit to the efforts of the sanitary officers of the Army of India. Here we can show no such creditable reduction as in the case of cholera. And this point is of great interest. Here we have two diseases caused by germs, neither of them provided with spores, and therefore apparently not differing materially in their powers of resistance to external influences, both evacuated from the human body by means of the intestinal discharges, both entering the human body by the mouth, and yet the measures which have proved so efficacious in the case of the one, have proved not only inefficacious in the case of the other, they have seemed almost to have favoured the spread of the disease. At more than one station the introduction of a pure water supply has been followed by an increased prevalence of enteric fever. Quetta, that important station on our Beluchistan frontier, is a very good instance. Now of course I do not for one moment wish you to suppose that I hold the heresy above suggested. I only point out this fact, for a fact it undoubtedly is, to show how careful one must be in arguing that measures successful with one disease are necessarily successful with another, however similar the two diseases may seem to be in their mode of origin. It was not till about the year 1898 that attention became diverted, in the case of enteric fever, from drinking water as a cause of this disease to methods of conservancy. I will not trouble you with a detailed description of the conservancy methods in use in cantonments in India; suffice it to say that they consist in pail and cart removal system combined with the use of dry earth as a deodorant, the details of the system on which its success entirely rests being left to depend on the personal care and attention of the two most careless individuals on earth, the uninstructed British private and the native sweeper. The opportunities afforded by the carelessness of men were boldly seized upon by the all-pervading fly. By the energy of this enterprising insect, filth was rapidly and unostentatiously conveyed from the latrine to the dining-room, and any existing focus of infection given every opportunity of widening its area. In the past two or three years particular attention has been paid to the agency of infected latrines and flies as causes of enteric fever, and it is to this attention that, in the opinion of the majority of sanitary officers having practical experience of enteric fever in India, the diminution in this disease during the last few years has been due. During the last few years, it is true, we have learnt much more than we knew previously of the influence exerted by the so-called "bacillus carriers," and our attention is now directed to these men, and to all men who have lately come through an attack of the

disease. But the latrine as the source, and the fly as a potent means of dissemination of the poison existing there, will always attract the chief attention of the practical sanitarian. I do not propose to do more than refer in passing to the effects of inoculation for enteric fever, but I may say that the latest results show that the incidence of the disease can be reduced 60 per cent. by this means, while at the same time the inoculated man has, if attacked, twice as good a chance of recovery as the uninoculated man, and we confidently look forward to even better results in the future.

It has taken us many years to arrive at any very safe conclusions as to the causation and prevention of enteric fever in India, but I think, and my opinion is shared by those most conversant with the situation, that we have now begun, if I may use the expression, to feel our feet in this difficulty, and hope that before long, in the case of this disease as in that of cholera, we may be able to look on enteric fever as merely an occasional visitor, and not as a persistent and most unwelcome guest.

My fourth and last illustration is that of Mediterranean fever in Malta.

The facts in the case of this disease are so extraordinary, and the history of its prevalence has so dramatic a *dénouement* that the simplest statement is alone adequate to its recital. I will not trouble you with curves, or columns of figures. In the year 1904 there were 320 cases of Mediterranean fever in the garrison of Malta; in the year 1905, 643; in the year 1906, 161; in the year 1907, 11 cases; and up to to-day in the year 1908—2.

This extraordinary change dates from the discovery that the Maltese goat acted as a constant host to the *Micrococcus Melitensis* and excreted that germ in its urine, and even more importantly in its milk. The use of goat's milk was prohibited in barracks in June, 1906, and simultaneously with that order Malta fever ceased to exist as far as the military garrison of Malta was concerned. (The majority of the 161 cases of this disease that I have mentioned above as occurring in the year 1906 were admitted before this administrative measure was adopted). The whole history of sanitation in our Army shows no climax so striking, no other preventive measure so surely based on experimental observation, and so supremely successful when put into execution.

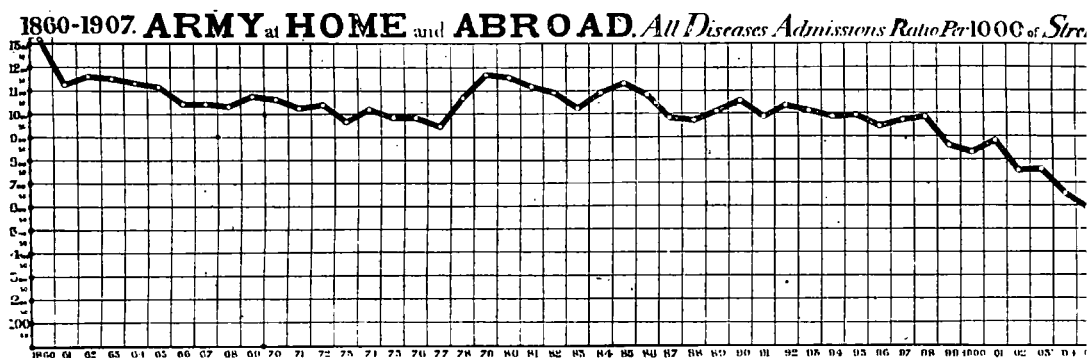
I have now given you three instances wherein purely sanitary measures, the provision of better air in tuberculosis, of better water in cholera, and of better milk in Malta fever, have directly increased the efficiency of the Army by keeping its ranks full. In the case of the fourth disease, enteric

12 *Results of Sanitation in Efficiency of Armies in Peace and War.*

fever, I have shown that we may confidently hope that by improved methods of conservancy we may in this case also attain our object. The case cannot yet, however, be considered complete.

The natural man has an inborn dread and distrust of statistics. He knows well, each man in his own work, how difficult it is to judge from tables alone, and how very misleading may be the deductions that can be drawn from an imposing array of figures. More especially is this the case when these figures apply to a science with the working of which he is himself unacquainted, and this feeling is intensified when that science is not studied as a whole, but parts only are taken for examination. So far I have given you the effects of sanitation as shown in the case of four diseases or groups of disease, and it would be open to any one to say that

CHART V.



The rise in the admission rate, beginning in 1877 and lasting until 1892, was probably attributable to the introduction of the Short Service System, and the Departmental Medical System at about the same time.

I have chosen my facts to fit in with my theories, and so to prove my case. The only practical tests of the health of an army are two.

Firstly.—How many men are absent from duty on account of sickness, and secondly, how many men are lost to the Army every year by deaths and invaliding.

If in the course of a number of years we find that progressively fewer men are absent from duty on account of sickness, and fewer men lost year by year from the ranks by death and invaliding, then we can only refer these changes to the dissemination of a knowledge of those natural laws which collectively form the science of Hygiene, and that application of those laws to the circumstances known as environment, which we call sanitation.

As regards the first, the curve, Chart V., shows the number of men admitted to hospital per 1,000, roughly, that is, the number admitted

from a battalion of infantry at full strength, year by year since 1860, and the diagram, Chart VI., shows the number of men constantly absent from their duty in every battalion in the United Kingdom on account of sickness in the years 1860, 1867, 1877, 1887, 1897, and 1907.

As regards the curve showing admissions, you will notice that the fall, though not continuous, has been on the whole fairly steady, and of late years very rapid. Thus in the year 1860 every man in the Army was

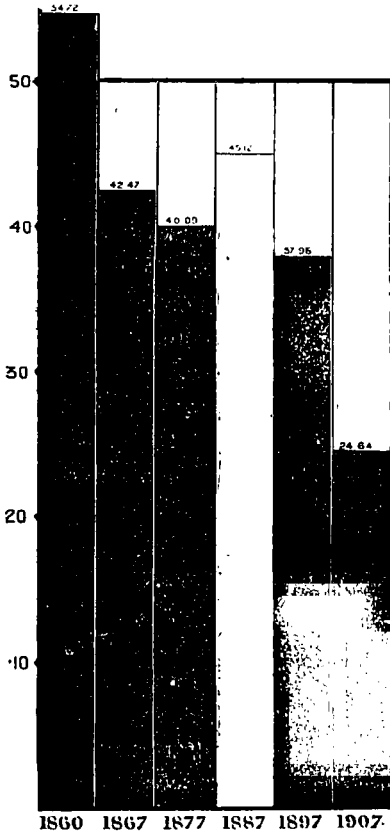


CHART VI.
ARMY AT HOME.—NUMBERS
CONSTANTLY SICK.

Ratio per 1,000.

The thick line at the "50 per 1,000" level indicates the theoretical strength of a half-company in a battalion.

admitted once to hospital in the year, and every third man twice. By 1875 the admissions had fallen so that only one admission was recorded per man. For 17 years from that date affairs were not so prosperous, and it is not till 1892 that the number of admissions was again so low as it had been in 1875. What the causes of this rise were it is hard to say; the change from long service to short, the substitution of the departmental medical system for the old regimental system (a change which like all changes however advisable and however beneficial in the long run, was bound to affect to a certain extent unfavourably the

14 *Results of Sanitation in Efficiency of Armies in Peace and War.*

relations of the doctor to the soldier, more especially where the supervision of the soldier's life was concerned), and probably other causes also, may have combined to increase the sick rate of the Army. However this may be, the 15 years since 1892 form a marked contrast to those preceding that date. From one admission to every man in 1892 we have fallen to very little over half that number in 1907.

Let us turn to the numbers constantly sick: the numbers that is, absent from military training every day owing to their being in hospital. In the diagram, Chart VI., page 13, you will see represented the number of men absent every day from duty in a battalion of infantry at full strength in the United Kingdom in the years 1860, 1867, 1877, 1887, 1897, and 1907. I have confined myself to the figures of the United Kingdom, since I have been unable to obtain those for the whole Army for the earlier years. The thick black horizontal line represents the strength of a half company in our theoretical battalion, and you will see whereas in 1860 more than a full half company was missing from parade, in 1907 only one-half of that body were absent and in hospital.

Now a man in hospital in the army is not in the same position as a man in civil life. The latter loses all his wages, the former still draws his pay, not in full, since a certain amount is deducted for hospital stoppages, but he still draws from the State the sum on an average of 9d. a day while doing no work. Thus every man constantly sick for a year costs the State in pay only, I am not considering other charges, nearly £14 per annum. In 1860 there were 5,346 men constantly sick at home, in 1907 there were 2,655. This difference of 2,691 men less in hospital represents a saving of £37,674 from this cause alone. The loss of money due to pay unearned is of course not the only loss incurred by the State on account of each man in hospital. Not only is the man not doing his work, he is forgetting his work. But I will not labour this point. There is an old saying that "money talks," and £37,000 odd golden sovereigns talk, I think you will agree with me, fairly loudly.

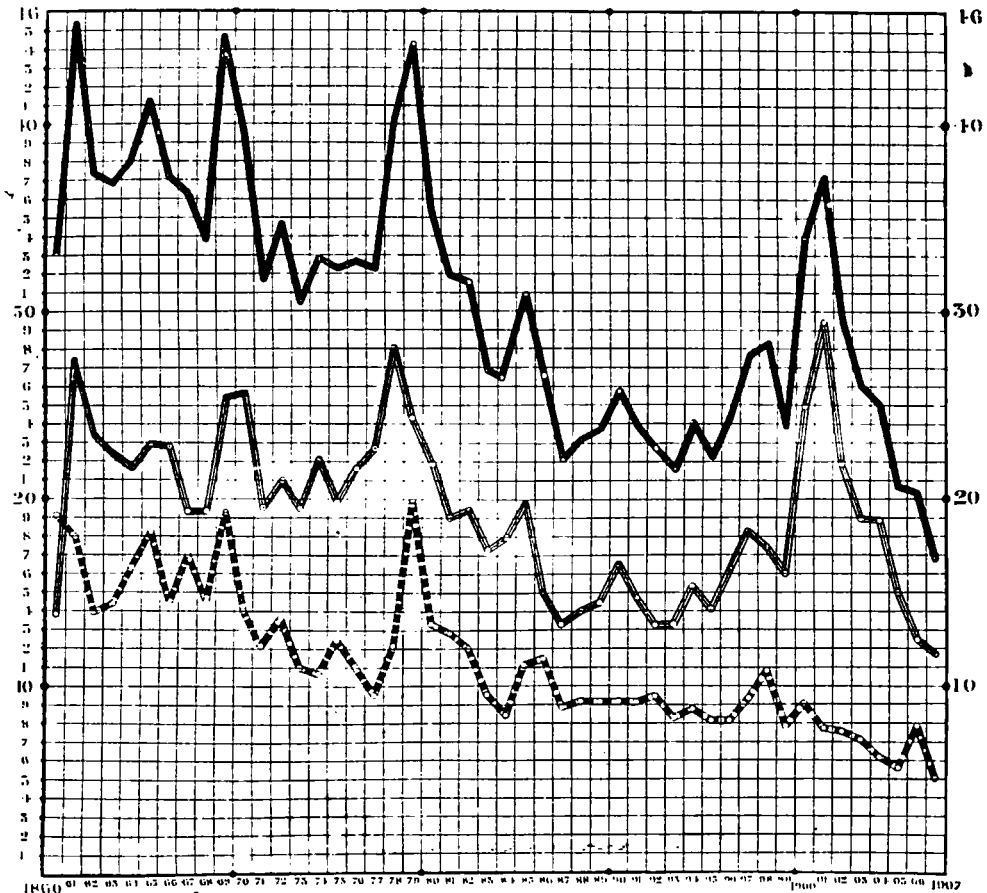
Let us now turn to the question of total loss to the service from death and invaliding.

The curves, Chart VII., page 15, show the variations in these since 1860.

The lowest line shows the deaths, the second the invaliding, and the highest line these two ratios added together. It is to this line that I would especially direct your attention. The two forms of loss cannot in fact be dissociated, a fall in the death-rate may be explained by a rise in the invaliding rate; but a fall in both rates together can only be explained in one way, and that is by improved health. Here again the fall, though not continuous, has been steady, far steadier than that shown

by the admission rates. You will at once see that the period of high admissions between 1887 and 1892 (see Chart V., page 12) is not reproduced in these curves, a fact which goes to show that those high admission rates

CHART VII.
ARMY AT HOME AND ABROAD.—ALL DISEASES.
Ratio per 1,000 of Strength.



Broken Line, DIED. Shaded Line, INVALIDED. Black Line, TOTAL LOSS.

1861.—Severe outbreak of Cholera in India. 1878-80.—Wars in Afghanistan and S. Africa.
1865.—Cholera in India, New Zealand, and 1885.—Nile Expedition.
Shotan Campaigns. 1897.—Tirah Campaign.
1869. Severe outbreak of Cholera in India. 1899-1902.—South African Campaign.

were due not so much to causes seriously affecting the health of the Army, as to the factors connected with its interior economy. The years of the Afghan and South African Wars, 1878-79-80, show high rates, but eliminate these and you will see that till the late '90's the fall was

16 *Results of Sanitation in Efficiency of Armies in Peace and War.*

continuously maintained. The years '97 and '98 were those of Omdurman and the Tirah Campaign in India, and were also marked by a high incidence of enteric fever in the latter country. 1899, 1900 and 1901 were the years of the South African War, and though these curves do not show deaths actually occurring in the field, the effect of that campaign on invaliding is as you will see strongly marked. Since the war the old progressive decrease has re-commenced and continued uninterruptedly.

There is only one explanation possible of this continuous decrease in the loss to the Army by death and invaliding, accompanied as it has been by a continually diminishing number of men admitted to and remaining in hospital, and that explanation is improved health, the result of improved sanitation.

So much for times of peace. We now turn to war. Here, as I have already told you, the object of the sanitarian must be to assist the commander in his desire to place the largest number of effective men at the desired spot in the shortest time. The sanitary officer cannot influence the selection of the spot: that is decided by considerations obviously outside his purview and control, often indeed outside those of the commander himself. He cannot influence the time, except to lengthen it, but he can affect the number and efficiency of the men that can be present at that place and time. And it is to this that he must direct his undivided attention, always keeping in mind that the one unpardonable sin is delay. It is because sanitary officers have so often lost sight of this fact that generals have so often lost sight of them.

Now it may at once be conceded that it is to all intents and purposes hopeless to expect a force in the field to remain as healthy as a force in cantonments. The inevitable physical and mental stress, the fatigues of marching, insufficient and irregular meals, scanty and often bad water, and all the other thousand and one breaches of the rules of personal hygiene that are inseparable from campaigning, must inevitably tend to lower the general health and the resisting power of the men. A certain amount of disease is therefore inevitable. It may be said that this is begging the question. Why should meals be scanty and irregular, water bad and insufficient? Cannot organisation avoid these evils, and so save the soldier from these causes of preventable disease? Certainly organisation can, given time to work; but this is just what it often cannot have, and cannot expect to have. It was said, I forget now by whom, at the time of the South African War, that it would have been possible by precautions of a proper nature to have avoided the severe outbreak of enteric fever that occurred at Bloemfontein, in the early days of the occupation of that town; but that if these precautions had been rigorously enforced the

troops would never have got to Bloemfontein at all. Without entering into the merits of that particular statement, there is a good deal of truth in the argument that it contains. Let me repeat that an Army does not go to war to preserve its health, but to defeat an enemy. Any precaution that does not assist it to do so, far more any precaution that hampers it in doing so, is a dereliction of duty on the part of the sanitary officer who recommends it, and of the commanding officer who carries it out. Having said so much is not, however, to say that nothing can be done. Much can be done, and more will be done and more efficiently done, if the above truth be kept always in mind than if it is forgotten.

Of what can be effected I will adduce three examples. The first that of two campaigns waged at different times against the same enemy and in the same country, the only difference between the two being that on the first occasion the rules of health were disregarded, and in the second observed. My second example will be that of a campaign in which the troops occupied continuously for nineteen months the same position, but were neglected in the earlier months and carefully looked after in the later ones. My third will be that of a regiment which, in the dark days of sanitation, by a careful attention to its internal economy, as sanitation was understood in the eighteenth century, was successful in maintaining a standard of health unknown in the rest of the Army then and never surpassed since.

My first example is that of the Ashanti campaigns of 1854 and 1873, waged in the same country, against the same enemy, the latter of which was entirely successful, the former an absolute failure, the decisive factor being not the opposition offered, or the weapons carried by a feeble and despicable enemy, but the fact that in one case the rules of hygiene were known and observed, and that in the other they were probably not known and certainly ignored. In the campaign of 1854 the entire force melted away, all the men that did not die being invalided. In the campaign of 1873 the death-rate was 1·7 per 1,000. Similar examples might be given from the Walcheren campaigns, compared with other campaigns in the Low Countries; the Russian invasion of Turkey in 1826 compared with that of 1878. Instances might be multiplied almost indefinitely to prove that the absence of sanitation has in one instance wrecked an army, when other armies, composed of the same troops, fighting against the same enemy, on the same ground, have carried their campaigns to a successful conclusion by attending to this important condition.

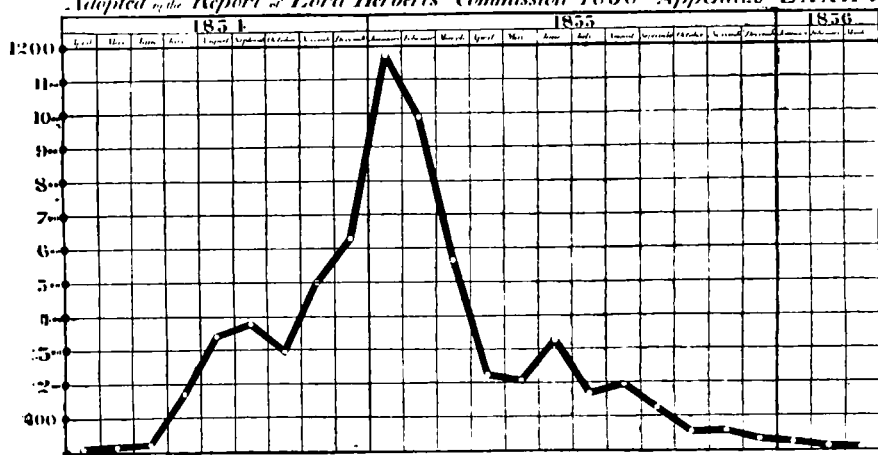
My second example is taken from the Crimean campaign. Throughout the greater part of this campaign the British troops were encamped on the heights above Sebastopol. What the sufferings of the men were

18 *Results of Sanitation in Efficiency of Armies in Peace and War.*

in that campaign is well known from the writings of the *Times* correspondent, Dr. Russell. The diagram, Chart VIII., shows the annual mortality per month in that Army from April, 1854, to March, 1856.

CHART VIII.

ANNUAL DEATH RATE OF ARMY IN THE CRIMEA *Adopted by the Report of Lord Herbert's Commission 1858 Appendix LXXII.*



Crimea invaded, 14.9.54.

First bombardment of Sebastopol, 12.10.54.

Battle of Inkerman, 5.11.54.

Severe hurricane and loss of many stores,

followed by snow and continuous bad weather, 14.11.54.

Assault on Redan, 18.6.55.

Fall of Sebastopol, 28.9.55.

The Crimea was invaded on the 14th September, 1854, and the first bombardment of Sebastopol took place on the 12th October of the same year. The campaign was virtually at an end by February, 1856. The mortality of the troops during the first winter is terrible to contemplate. In January, 1855, the annual rate of mortality was higher than that of London during the worst part of the Great Plague of 1665. In January, 1856, the mortality had fallen to 23 per 1,000 per annum. During the 22 weeks ending the 31st May of that year the mortality of the army before Sebastopol was only two-thirds of that of the troops at home during the same period. In the words of Lord Herbert's Commission, "Perhaps no army was ever better cared for, or more sanitary precautions taken in its behalf as regards drainage, both surface and sub-soil, cleanliness, ventilation of huts, diet, clothing, etc., than the army before Sebastopol" during the period mentioned. Now there is not the slightest doubt that given ordinary forethought the troops might have been as well huddled in the winter of 1855 as in that of 1856. The distance from the sea port of Balaclava was only a few miles, and the line of communications was safe. The progress of the siege would not have been in any way interfered with if the men had been comfortably housed,

there were no countervailing military objections to interfere with sanitation. The situation was pre-eminently one where the sanitarian might have been given a free hand not only without interfering with the operations of war, but with the result of considerably furthering them.

I now come to my third example.

The word "efficiency" is the keynote of this paper, and before concluding I would like to relate a very conspicuous instance of a regiment in which the very highest military efficiency went hand in hand with the very highest degree of health. The 7th Dragoon Guards, then known as the Black Horse, served in Flanders in the years 1742 to 1747. During this period it is related of this regiment that it never lost a man by desertion, never had an officer or man tried by general court-martial, never had a horse or man taken by the enemy, that it lost but six men by sickness, and had no fewer than 37 of its non-commissioned officers and men promoted to commissions for distinguished conduct.

The efficiency of this regiment and the health of its men were attributed unanimously by all who were in a position to judge, to the attention to the interior economy and welfare of the corps (that is to sanitation) paid by its colonel, Sir John Ligonier. This officer had the highest reputation as a fighting soldier, and also as a strategist. The battles of Malplaquet, Dettingen and Fontenoy, in all of which he distinguished himself by personal gallantry, bear testimony to the former quality, while the latest historian of the Seven Years War awards him the highest praise in the latter capacity. It is related of him that such was his anxiety for the welfare of his men that he maintained an additional medical officer in his regiment at his own cost. I have quoted this instance of Sir John Ligonier because one so often hears it said that attending to the health of the soldier is mollycoddling him. The battles of Dettingen and Fontenoy were no child's play, and Sir John Ligonier was no featherbed soldier, while the discipline demanded of the British soldier in the middle of the eighteenth century was as far removed from mollycoddling as any condition of life could well be.

Yet in this regiment, which distinguished itself above all others in that campaign in Flanders, under a commanding officer of whom Marshal Saxe said, "By one glorious action he has disconcerted all my projects," surrounded by other regiments suffering severely from the usual diseases of campaigns in those days, scurvy, fevers and dysentery, only six men died of disease in five years. I think that this incident of military history is as brilliant an illustration as can be given of the connection of sanitation with efficiency in war.
