MILITARY HYGIENE AND PATHOLOGY IN INDIA.

By Lieutenant-Colonel J. Mackenzie,
Royal Army Medical Corps.

VI.—CONCLUSION.
(Concluded from p. 109.)

"Whole regions of the earth which were formerly devastated by fever-pestilences and dysenteries have long been free from them, except in the milder forms in which they now occasion part of the ordinary mortality. England, which suffered at various periods as much as other countries, has shared in this exemption; and guided by the light of experience, we see no reason why India should form any exception to the rule, that in proportion as the conditions of health become better known and complied with, these diseases, the opprobria of imperfect civilization, should diminish both in frequency and in malignity.

"The evidence given before us by numerous witnesses, and also that contained in reports from the stations, clearly show that European troops during the period of their service in India are exposed to very important conditions besides those arising from climate.

"The excess which has hitherto been observed in the mortality of India is in every station due to nearly the same diseases. These diseases were for centuries equally fatal in the cities of Europe." (Report of the Royal Commission, 1863.)

Here we have perhaps the first challenge to the concept of "tropical
Military Hygiene and Pathology in India

diseases," to the idea that certain diseases are due to climate and therefore inevitable. This might almost be termed an "imperative concept," i.e., a false idea which dominates action—or inaction.

It is not perhaps generally realized that the mortality of the population from fevers, dysentery, plague, typhus and cholera was formerly higher in London than it is now in Calcutta. "In Britain it was the ravages of pestilence in the Middle Ages—of leprosy from the twelfth century, of the 'black death' from the fourteenth, of sweating sickness in the sixteenth, of cholera and small-pox—which compelled attention to the conditions which seemed responsible for such epidemics."

In 1320 the butchers in Smithfield were in the habit of digging pits to receive the offal of slaughtered cattle. In 1349 the "black death" raged in that locality "with singular violence." Plague again attacked London in 1361, its ravages being mainly attributable to "the corruption arising from the slaughter of cattle, sheep, etc., within the city." In consequence of this the practice was forbidden by Edward III.

London during the sixteenth century was in "a most disgusting and filthy state." In the streets which were extremely narrow and ill-paved, heaps of the most noisome filth were allowed to accumulate at assigned spots called "lay-stalls;" the sewers were very imperfect and badly constructed; the buildings were overcrowded, and the inhabitants dirty and uncleanly in their habits. Fifty died annually out of every 1,000. The expectation of life at birth was about twenty years!

In 1577, 300 persons who had attended the assize court at Oxford, together with the judge and sheriff, died of "malignant fever" (typhus) propagated from the filthy cells of the prison.

The population of England in the days of Queen Elizabeth was only 3½ millions.

Typhus, leprosy, "sweating sickness," epidemic scurvy, plague and virulent small-pox were all prevalent.

It may be mentioned that about 1739, barracks for soldiers were first built near London, "an innovation which excited a great deal of angry suspicion in the public mind."

The macaronis of George III's reign, and the beaux of George IV's had their "ague-fits," like folks of common clay.

Successive epidemics of cholera ravaged the country until 1866.

In the seventeenth century London, chiefly in the summer and autumn, suffered from the same diseases as Calcutta—fever, dysentery, cholera, with plague occasionally in addition.

The ravages of cholera in 1831 led to the first steps in administrative sanitary reform in England.
Water-carriage systems of sewage disposal came into use early in the nineteenth century.

In 1844 the Health of Towns Commission presented their report. Four years later, owing to a cholera scare, the Public Health Act of 1848 was passed: this Act gave local authorities power to borrow money for sanitary purposes. A general Board of Health was set up and the appointment of medical officers of health began.

In 1849 there was a second visitation of cholera, and in 1854 a third.

During the epidemic of 1854, of seventy-three persons who died of cholera in a certain street in London, sixty-one had drunk water from a pump polluted by sewers, while the people who did not use the water were not so severely visited. The water, on being analysed, was found to contain ninety-two grains of solid matter in the gallon, of which 7'8 grains were organic matter. One famous well was found to be draining a cemetery; its water was popular on account of its sparkling qualities. No doubt it had also plenty of "body."

These epidemics of cholera led to the Infections Diseases Prevention Act of 1855 and to various commissions of investigation.

Epidemic diarrhoea, pulmonary disease, infant mortality and ague (malaria) came under investigation by the Privy Council.

By 1858 the death-rate had fallen to 25 per 1,000. In 1868 it was 20'6 per 1,000; the infant mortality-rate was 155.

Thereafter little real progress was made until the Act of 1872, which established Urban and Rural Authorities. The Privy Council still remained the Central Authority.

In 1875 Disraeli brought in an improved Public Health Act, by which the control of sanitary affairs was transferred to the Local Government Board. This Act has been described as "the Magna Charta of local law and local health." Before it "the streets were filthy places, the gutters running sewers, the yards and courts and alleys abominable and intolerable"—a state of things comparable with Calcutta until recent times, and with the Simla bazaar to-day.

To quote Sir George Newman: "Before that time sanitation was interpreted in large measure as a negative policy—in a word, the removal of nuisances; after that time sanitation received a new connotation, positive, constructive, remedial."

By the Ministry of Health Act, 1919, the powers and duties of the Local Government Board were transferred to the Ministry of Health.

As a result of the Public Health Acts and the setting up of efficient health organization in town and country, the death-rate in England has fallen to 12'3 per 1,000, and the infant mortality to 70. The expectation of life at birth is now fifty-five years. (In India it is twenty-three.)

The principal causes of the high death-rate in England included formerly those very diseases which we now call "tropical diseases."
In the "good old days" prior to the Public Health Acts, the principal causes of death in England in 1927, and the percentage of each, were:

- Diseases of heart and blood-vessels: 20
- Respiratory diseases: 15
- Cancer: 11
- Diseases of the nervous system: 9
- Tuberculosis: 8

Enough has been said to drive home the argument that climate is not responsible for the prevalence of diseases now spoken of as "tropical" and regarded as more or less inevitable. The "burning, implacable sun" is not guilty. What is responsible is failure to apply those health measures which have abolished the same diseases from England. It is a question of the stage of civilization, not of climate.

**Diagrams representing the relative annual mortality from all causes, Zymotic Diseases, Lung and Tubercular and other Diseases in the Male Population of England aged 15-45, in the Infantry of the Line Serving at Home, and in the European Army in the Presidency of Bengal.** (From the Report of the Royal Commission, 1863.)

The Lung and Tubercular Diseases comprise all those included in the Tubercular and Chest Diseases (exclusive of Heart Disease) of the Classification adopted by the Registrar-General of England.

Diagram No. III is constructed from a Table showing the Diseases of the European Forces in the Presidency of Bengal, for the sixteen years 1830-45.

Man, like every other form of life, perishes if his own waste products are not removed from his immediate vicinity. In England these waste products
are removed. In India they are not. In England public opinion is advanced and enlightened; money is forthcoming for health measures. In India "kismet" reigns. "Why should we spend money on these matters? If God wishes us to die, we die."

In the Army, however, "kismet" can be over-ruled.

Were a Commission to proceed to India to-day, and to place its findings alongside those of the Royal Commission of 1859-62, we should have the following:

Prior to 1862. 1926.

<table>
<thead>
<tr>
<th>Strength.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officers</td>
</tr>
<tr>
<td>Soldiers</td>
</tr>
</tbody>
</table>

Hospital admission rate (per 1,000).

| Officers | ? |
| Soldiers | 2,000 |

Average constantly sick (per 1,000).

| Officers | ? |
| Soldiers | 84 |

Death-rate (per 1,000).

| Officers | 38 |
| Soldiers | 69 |

Principal diseases. (Other ranks.)

Prior to 1862. 1926.

"Fever" (chiefly malaria). Malaria, dengue and sandfly fever.
Venereal diseases. Venereal diseases.
Cholera. —
Dysentery. Dysentery.
Diarrhoea. Diarrhoea.
Inflammation of liver. Inflammation of liver.
Liver abscess. —
Small-pox. —
Rheumatism. —
Heatstroke. Heatstroke.
Respiratory diseases. Respiratory diseases.
Tuberculosis. —

Baracks.

 Poor. Good.
Badly sited. Mostly well sited.
Badly ventilated. Mostly well ventilated.
Mud floors. Solid floors.
Drainage bad. Drainage fairly good.

Lighting.

Candles or oil lamps. Electric light or oil lamps.

Rations.

Calories barely sufficient. Calories barely sufficient.
Deficient in vitamins A and D. Deficient in vitamins A and D.

Cooking.

Very defective. Mostly good.

Cantonments.

Filthy bazaars and villages. Filthy bazaars and villages.
No health organization. Defective health organization.
High sick-rate in civil population. High sick-rate in civil population.
Prevailing diseases — same as for troops. Prevailing diseases — same as for troops.
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PRIOR TO 1862.

Causes of Disease in Troops.

- Badly sited stations.
- Bad drainage.
- Badly cited barracks.
- Proximity to unwholesome native towns and bazaars, with excreta exposed in all latrines and on ground.
- Absence of efficient health organisation in cantonments.

Troops kept in plains during malaria season.
- Barracks not screened against mosquitoes.
- Proximity to unwholesome towns and bazaars, with excreta exposed in all latrines and on ground.
- Absence of efficient health organisation in cantonments.

We are now in a position to make a fairly accurate comparison between the civil population of England prior to the Health Acts and the British troops in India prior to the Royal Commission:

<table>
<thead>
<tr>
<th>Civil population of England prior to the Health Acts</th>
<th>British troops in India prior to the Royal Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Fever&quot; (including malaria), Plague, Cholera, Dysentery, Diarrhoea, Small-pox</td>
<td>&quot;Fever&quot; (chiefly malaria), Venereal diseases, Cholera, Dysentery, Diarrhoea, Small-pox, Inflammation of liver, Liver abscess, Rheumatism, Respiratory diseases, Tuberculosis, Heatstroke</td>
</tr>
<tr>
<td>Rheumatism, Respiratory diseases, Tuberculosis</td>
<td>Venereal diseases</td>
</tr>
</tbody>
</table>

The Health Acts in England and the measures recommended by the Royal Commission in India have radically altered the picture:

<table>
<thead>
<tr>
<th>Civil population of England</th>
<th>British troops in India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatism, Respiratory diseases, Tuberculosis, Cancer, Diseases of the nervous system</td>
<td>Malaria, dengue and sandfly fever, Venereal diseases, Dysentery, Diarrhoea, Inflammation of liver, Heatstroke, Respiratory diseases</td>
</tr>
</tbody>
</table>

It is unnecessary to repeat in full the recommendations of the Royal Commission in 1863; most of them—especially those dealing with barracks and water-supply—were acted upon with excellent results, as shown in the comparative statistics given above and also in the following Table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Death per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1817-21</td>
<td>87.0 per 1,000</td>
</tr>
<tr>
<td>1876-85</td>
<td>16.0</td>
</tr>
<tr>
<td>1907-11</td>
<td>6.7</td>
</tr>
<tr>
<td>1926</td>
<td>3.1</td>
</tr>
</tbody>
</table>

That the health of the British troops in India, though greatly improved during the last sixty-five years, still compares unfavourably with the health of the troops at Home, is chiefly due to the gaps in the recommendations made by the Commission, gaps due to their want of accurate knowledge of the etiology of diseases, more especially of insect-borne diseases such as malaria and dysentery. These gaps we are now able, in large measure, to fill up.
Thanks to research work carried out during recent years, we are in a position to recommend measures which would in a few years reduce the sick rate to a figure approximating that of the troops at Home, leaving it to our successors to make yet a further advance in the light of knowledge to be acquired by further research.

It will be seen from the above that certain diseases prevalent in 1861 have practically disappeared from the statistics of to-day. These are given below, along with the causes of their disappearance.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cause of disappearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera</td>
<td>Improved water-supplies; improved barrack conservancy;</td>
</tr>
<tr>
<td></td>
<td>notification; isolation; infected areas placed out of</td>
</tr>
<tr>
<td></td>
<td>bounds.</td>
</tr>
<tr>
<td>Liver abscess</td>
<td>Use of emetine in amoebic dysentery; improved barrack</td>
</tr>
<tr>
<td></td>
<td>conservancy.</td>
</tr>
<tr>
<td>Small-pox</td>
<td>Vaccination; notification; isolation.</td>
</tr>
<tr>
<td>Rheumatism</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Improved housing and mode of living.</td>
</tr>
</tbody>
</table>

Apart from injuries and minor septic diseases, chiefly acquired during games (the latter also by insect bites), and respiratory diseases—of whose etiology we are still remarkably ignorant, there remain:—

- Malaria, producing the largest number of admissions.
- Venereal diseases, producing the highest number of constantly sick.
- Heatstroke, the principal cause of mortality.
- Dysentery, responsible for a large amount of sickness, misery and inefficiency.
- Inflammation of liver, both of which disable whole garrisons at certain seasons.
- Sandfly fever, Dengue,

None of these is limited to the tropics. All of them—with the possible exception of heatstroke—can be exterminated, not by change of climate, but by man.

When these diseases have been brought under control, the troops serving in India will become as healthy as any body of men in the world.

The immediate problem, then, as regards the health of the Army in India is the prevention of malaria, venereal diseases, dysentery, dengue and sandfly fever. If we do not for the present aim at the complete extermination of these and allied diseases we may nevertheless hope to reduce them approximately to the dimensions they occupy among the troops at Home.

What amount of reduction does this require? A comparison of the admission rates will serve as a guide.

The net difference between the admission rates of these diseases at Home and in India is 309 per 1,000, India being in excess of that amount.

In the following Table all diseases have been given which cause an admission-rate of 10 per 1,000 or over in either country and the figures for which differ to any appreciable extent in the two countries. It will be noted that in only three cases, viz., influenza, “other infectious diseases” and tonsillitis, is the admission-rate at Home greater than that in India: in all other diseases the Indian rate is higher.
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ADMISSION RATES PER 1,000, 1926.

<table>
<thead>
<tr>
<th>Causes</th>
<th>At Home</th>
<th>India</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td>333·1</td>
<td>649·5</td>
<td>316·4</td>
</tr>
<tr>
<td>Dysentery</td>
<td>0·4</td>
<td>15·7</td>
<td>15·3</td>
</tr>
<tr>
<td>Influenza</td>
<td>33·9</td>
<td>7·2</td>
<td>26·7</td>
</tr>
<tr>
<td>Malaria</td>
<td>1·6</td>
<td>165·3</td>
<td>163·7</td>
</tr>
<tr>
<td>Sandfly fever</td>
<td>18·6</td>
<td>18·6</td>
<td></td>
</tr>
<tr>
<td>Venereal diseases</td>
<td>21·4</td>
<td>62·1</td>
<td>40·7</td>
</tr>
<tr>
<td>Dengue</td>
<td>26·6</td>
<td>26·6</td>
<td></td>
</tr>
<tr>
<td>Other diseases due to infection</td>
<td>10·8</td>
<td>1·6</td>
<td>9·2</td>
</tr>
<tr>
<td>Nervous system</td>
<td>5·1</td>
<td>10·6</td>
<td>5·5</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>19·0</td>
<td>23·1</td>
<td>4·1</td>
</tr>
<tr>
<td>Inflammation of tonsils</td>
<td>36·1</td>
<td>27·3</td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td>2·2</td>
<td>12·0</td>
<td>9·8</td>
</tr>
<tr>
<td>Other diseases of digestive system</td>
<td>38·0</td>
<td>59·4</td>
<td>21·4</td>
</tr>
<tr>
<td>Organs of locomotion</td>
<td>17·4</td>
<td>27·2</td>
<td>9·8</td>
</tr>
<tr>
<td>Areolar tissue</td>
<td>20·7</td>
<td>49·7</td>
<td>29·0</td>
</tr>
<tr>
<td>Injuries (general and local)</td>
<td>45·7</td>
<td>86·2</td>
<td>40·5</td>
</tr>
</tbody>
</table>

The reduction of the admission rate of these diseases in the troops in India to the figure obtaining at Home would wipe out the difference.

Can this reduction be effected? and if so, how?

Further analysis shows that insect-borne diseases are to a large extent accountable:

\[
\text{Excess} = 15·8 = \text{Flies} \\
\text{Malaria} = 163·7 = \text{Mosquitoes} \\
\text{Dengue} = 26·6 = \text{Sandflies} \\
\text{Sandfly fever} = 18·6 \\
\]

If we assume that liver cases (+ 9·8) and "other" diseases of the digestive system (+ 21·4) are allied to the dysentery-diarrhoea group, the total is raised to 255·4.

Admission rate, India = 649·5 per 1,000
Excess over Home rate due to insect-borne diseases = 255·4

394·1 as compared with the Home admission rate of 333·1

From which it appears that concentration on this group of diseases, of whose etiology our knowledge is for practical purposes complete, would bring the admission-rate in India down to roughly 400 per 1,000.

Can this be done? and is it worth doing?

In these days the acid test of finance must be applied to all proposals.

THE FINANCIAL EFFECT.

To quote Dr. Parkes—"It has been proved, over and over again, that nothing is so costly in all ways as disease, and that nothing is so remunerative as the outlay that augments health, and in doing so augments the amount and value of the work done."

Dr. Andrew Balfour has recently given some interesting facts and
figures in connexion with the results of health measures. A life is computed as being worth about £500 to the community. In 1926 there were 15,000,000 cases of sickness drawing benefits in England: 27,000,000 weeks of work were lost, and the loss of wages to the workers was over £30,000,000.

Professor Collis, quoted by Dr. Balfour, "considers that medical science properly applied to British industry would result in an annual saving in labour turnover of over £60,000,000, in lost time of over £50,000,000, in industrial convalescence of many millions more, and that to assess the total saving at £140,000,000 a year would be quite reasonable and within the range of possibilities."

Fortunately, financial considerations in connexion with the health of the Army in India do not run into hundreds of millions. Much smaller figures will serve.

Table A (p. 170) was prepared to show the result of health measures carried out in 1924-25 (chiefly anti-malarial measures).

In this Table the only financial savings shown are those on hospital diets and medicines. The total saving was of course much greater.

A conservative estimate of the all-in cost of maintaining a British soldier in hospital in India is arrived at as follows:

| Number of British officers and soldiers in India | 59,372 |
| Cost of maintenance of British military hospitals in 1926-27 (including supplies and services) | Rs. 1,14,12,536 |
| With 3.5 per cent of the personnel constantly sick in hospital, the daily charge of hospital treatment works out as follows: | |
| 3.5 per cent of 59,372 = 2,078 |
| 2,078 \times 365 = 758,470 bed days |
| Daily cost | 1,14,12,536 \div 758,470 = Rs. 15 per diem |

(N.B.—Army Form N. 7528 (Statement of Cost), used in military hospitals at Home as a key to hospital expenditure, is not in use in India.)

But this is not the total cost.

The figure given above for "cost of maintenance" does not include certain important items—such as rentals, repairs to buildings, cost of administrative medical staffs, clothing, &c. Including these, it has been estimated that the maintenance of British troops in hospital in India costs over Rs. 20 (thirty shillings) per bed-day.

A sum of over 57 lakhs of rupees (£400,000) is therefore expended annually on maintaining in hospital in India, the excess of sick (18,667) as compared with the number of sick at Home.

This amounts to 285 lakhs of rupees (£2,000,000) in five years.

A fraction of this amount, judiciously expended over a period of five years on approved health measures, would reduce the hospital admission rate amongst the troops in India from over 600 to about 400 per 1,000, or approximately the Home level, with an annual recurring saving thereafter of 36½ lakhs (£255,000).
<table>
<thead>
<tr>
<th></th>
<th>British</th>
<th>Indian</th>
<th>Total</th>
<th>British</th>
<th>Indian</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Average annual strength</td>
<td>58,614</td>
<td>134,742</td>
<td>193,356</td>
<td>57,378</td>
<td>136,473</td>
<td>193,851</td>
</tr>
<tr>
<td>2. Admissions to hospital</td>
<td>35,569</td>
<td>57,014</td>
<td>92,583</td>
<td>36,069</td>
<td>48,601</td>
<td>84,670</td>
</tr>
<tr>
<td></td>
<td>Ratio per 1,000</td>
<td>658:0</td>
<td>428:1</td>
<td>494:3</td>
<td>629:6</td>
<td>355:8</td>
</tr>
<tr>
<td>3. Total treated in barracks</td>
<td>54,207</td>
<td>152,463</td>
<td>206,670</td>
<td>78,288</td>
<td>149,220</td>
<td>227,503</td>
</tr>
<tr>
<td></td>
<td>Ratio per 1,000</td>
<td>1,607:2</td>
<td>1,354:2</td>
<td>1,480:9</td>
<td>1,564:3</td>
<td>1,093:4</td>
</tr>
<tr>
<td>4. Average number constantly sick (hospital)</td>
<td>1,557:95</td>
<td>2,422:17</td>
<td>4,020:12</td>
<td>1,750:19</td>
<td>2,052:05</td>
<td>3,802:84</td>
</tr>
<tr>
<td></td>
<td>Ratio per 1,000</td>
<td>31:70</td>
<td>18:05</td>
<td>22:19</td>
<td>30:50</td>
<td>15:04</td>
</tr>
<tr>
<td>5. Average number constantly sick (barracks)</td>
<td>1,281:53</td>
<td>2,062:11</td>
<td>3,343:64</td>
<td>1,055:15</td>
<td>1,569:65</td>
<td>2,624:20</td>
</tr>
<tr>
<td></td>
<td>Ratio per 1,000</td>
<td>21:86</td>
<td>16:50</td>
<td>17:29</td>
<td>18:91</td>
<td>11:50</td>
</tr>
<tr>
<td>6. Deaths</td>
<td>246</td>
<td>772</td>
<td>1,018</td>
<td>166</td>
<td>547</td>
<td>713</td>
</tr>
<tr>
<td></td>
<td>Ratio per 1,000</td>
<td>4:20</td>
<td>5:73</td>
<td>5:26</td>
<td>2:59</td>
<td>4:01</td>
</tr>
<tr>
<td>7. Average sick time to each soldier (days)</td>
<td>11:60</td>
<td>6:61</td>
<td>18:12</td>
<td>11:14</td>
<td>5:49</td>
<td>7:16</td>
</tr>
<tr>
<td>8. Total working days lost</td>
<td>680,010</td>
<td>800,174</td>
<td>1,480,184</td>
<td>658,819</td>
<td>749,217</td>
<td>1,408,036</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>3:17</td>
<td>1:91</td>
<td>2:22</td>
<td>3:05</td>
<td>1:50</td>
</tr>
<tr>
<td>9. Average duration of each case of sickness (days)</td>
<td>17:63</td>
<td>16:61</td>
<td>16:43</td>
<td>17:71</td>
<td>15:29</td>
<td>16:38</td>
</tr>
<tr>
<td>10. Cost of hospital diets (less cost of rations)</td>
<td>Rs. 8,20,848</td>
<td>Rs. 3,89,451</td>
<td>Rs. 12,09,399</td>
<td>Rs. 7,08,650</td>
<td>Rs. 2,79,005</td>
<td>Rs. 9,87,654</td>
</tr>
<tr>
<td>11. Cost of medicines, &amp;c. (Budget figures)</td>
<td>Rs. 14,00,000</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Saving 1925**

As a result of health measures

- 10,823 admissions to hospital
  - 57:1 per 1,000
- 49,167 admissions to barrack treatment
  - 257:3 per 1,000
- 487:93 constantly sick in hospital
  - 2:57 per 1,000
- 689:44 constantly sick in barracks
  - 3:60 per 1,000
- 305 lives
  - 1:58 per 1,000
- 0:96 days
- 182,148 working days
  - 0:26 per cent
- 0:05 days

**Rs.** 3,27,595

**Rs.** 3,20,380
If the admissions are reduced by about 40 per 1,000 in each year—a reasonable expectation, the financial saving would be as follows:—

\[
\text{Rate per 1,000 (40) \times strength (55) = 2,200 admissions saved. (in thousands)}
\]

\[
3,500 \times 17 = 57,400 \text{ bed-days saved.}
\]

\[
57,400 \times Rs. 20 = Rs. 1,148,000 \text{ or } £20,000 \text{ saved in one year.}
\]

From the experience of the last four years, during which the expenditure of small sums has produced minor but quite definite results, it is estimated that the expenditure of ten lakhs (£70,000) annually for a period of five years would prove itself a gilt-edged investment, with a capacity for appreciation not surpassed by the shares of a successful gramophone company.

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenditure (lakhs)</th>
<th>Admission rate per 1,000</th>
<th>Saving in rupees (lakhs)</th>
<th>Annual</th>
<th>Progressive total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year</td>
<td>10</td>
<td>500</td>
<td>7\frac{1}{2}</td>
<td>7\frac{1}{2}</td>
<td>7\frac{1}{2}</td>
</tr>
<tr>
<td>Second year</td>
<td>10</td>
<td>520</td>
<td>7\frac{1}{2} + 7\frac{1}{2}</td>
<td>15</td>
<td>29\frac{1}{2}</td>
</tr>
<tr>
<td>Third year</td>
<td>10</td>
<td>480</td>
<td>7\frac{1}{2} + 15</td>
<td>30</td>
<td>39\frac{1}{2}</td>
</tr>
<tr>
<td>Fourth year</td>
<td>10</td>
<td>440</td>
<td>7\frac{1}{2} + 22\frac{1}{2}</td>
<td>37\frac{1}{2}</td>
<td>77\frac{1}{2}</td>
</tr>
<tr>
<td>Fifth year</td>
<td>10</td>
<td>400</td>
<td>7\frac{1}{2} + 30</td>
<td>37\frac{1}{2}</td>
<td>112\frac{1}{2}</td>
</tr>
</tbody>
</table>

At end of sixth year: 50 lakhs = 112\frac{1}{2} lakhs

*The admission rate for 1928 is expected to be about this figure.*

The recommendations of the Royal Commission of 1850-62 were carried out by the expenditure of large sums of money. The Indian budget for 1866-67 contained a grant of £1,800,000, the first instalment of a sum of £10,000,000, to be devoted within the next ten years to the erection of suitable barracks and hospitals. No one would suggest that this money was wasted. It would be easy to prove that the expenditure made at that time has resulted in enormous financial savings.

We are now in a position to take another step forward and to reduce in a few years the sickness and hospitalization of the troops in India to approximately what they are at Home.

It is obviously desirable, for many reasons, that this should be done. It is also perfectly feasible.

Our imaginary Commission of 1929, having arrived at this point, might now be expected to draw up a summary and recommendations somewhat on the following lines:—

**Summary.**

The health of the British troops in India is on a lower level than that of the troops at Home, owing to the prevalence of (1) certain “tropical diseases,” and (2) venereal diseases. The so-called “tropical diseases” are largely insect-borne and can be prevented by the application of suitable measures. Venereal disease constitutes a more difficult problem.

In detail, the unsatisfactory state of health is due to:—

(1) Malaria, which is chiefly responsible for the high admission-rate;

(2) Venereal diseases, to which is due the high rate of “constantly sick”;
Military Hygiene and Pathology in India

(3) Heatstroke, in most years the principal cause of mortality;
(4) Dysentery and allied diseases, causing a large amount of sickness and inefficiency;
(5) Sandfly fever, both of which, at certain seasons, disable whole garrisons in important stations.

The excess of preventable disease, as compared with the troops at Home, costs annually in hospital treatment a sum of approximately fifty-seven lakhs of rupees (£100,000), or in five years 285 lakhs (£2,000,000).

The expenditure of a fraction of this sum, spread over a period of years, would bring about a large reduction in hospitalization and would result in a saving, year by year thereafter, of a sum not much less than the capital sum originally expended.

Less invaliding means less expenditure on hospital ships and on replacements. Less sickness means that a smaller garrison would suffice.

Apart altogether from finance, there is to be taken into account the very substantial saving in life, invaliding, sickness and inefficiency, training days and general health.

Recommendations.

(1) That, with a view to eradicating malaria, the following measures be adopted:—

(a) To the fullest extent compatible with internal security, the garrisons of malarious stations should be removed to the hills during the months of malarial infection (August—October).
(b) Barracks sufficient to accommodate the whole of the troops not so withdrawn should be rendered mosquito-proof.
(c) Subsidiary measures:—(i) periodical fumigation of barracks to destroy mosquitoes; (ii) propaganda by lectures, cinematograph films, &c.; (iii) use of mosquito-nets (of proper mesh) in unproofed barracks; (iv) measures directed against mosquito breeding; (v) efficient lighting of barracks; (vi) use of electric fans in the malaria season to ensure movement of air; this is especially necessary during the hour before sunrise and the hour after sunset.

Of these measures it is considered that withdrawal to the hills and screening of barracks are the most reliable and the most certain to produce a reduction of malaria.

(2) That in dengue stations the barracks be mosquito-proofed; steps should also be taken to prevent mosquito-breeding in, upon, or in the neighbourhood of barracks.

(3) That in sandfly fever stations the breeding ground of sandflies be identified and suitably dealt with; repellents should be freely employed during the short and definitely-known season of infection.
(4) That in all stations latrines (both European and Indian) be rendered fly-proof, and that in the worst dysentery stations a water-carriage system of sewage disposal be introduced as soon as possible. In this connexion it may be stated that there are no difficulties which cannot be overcome by efficient sanitary engineering.

(5) That for the prevention of venereal disease, close co-operation with the civil authorities be established, especially in the seaport towns and in civil and military stations, such as Bangalore; that barracks and institutes be made as attractive as possible by electric lighting, provision of literature, games and cinemas, and the organization of social life.

(6) That a comprehensive programme of research be drawn up with a view to the elucidation of the various problems connected with the treatment of malaria, dysentery and gonococcal infection, the short fevers, jaundice, anti-typhoid inoculation, respiratory diseases, beriberi and epidemic dropsy, and other military problems.

A further considerable reduction of disease incidence and improvement of hospital treatment may be confidently expected to follow the provision of up-to-date laboratories at all the larger stations, with modern equipment and properly trained personnel.

(7) That in all the larger cantonments a Central Health Office be set up as an integral part of the cantonment administration, and that the Health Officer (who should be the senior military medical officer) be provided with a suitable whole-time staff of clerks and sanitary inspectors; in the larger cantonments an Assistant Health Officer should also be appointed.

(8) That cantonment authorities be responsible for the organization of efficient measures for safeguarding the health of the inhabitants, and in particular for the following:—

(i) The supply of wholesome and sufficient water for drinking and washing.
(ii) The prevention of the pollution of water.
(iii) The provision of adequate means for the disposal of excreta, where possible, by means of sewerage and utilization of sewage.
(iv) The regulation of streets, highways and new buildings.
(v) The healthiness of dwellings.
(vi) The removal of nuisances and refuse.
(vii) The inspection of food.
(viii) The suppression of causes of disease and regulation in case of epidemics.
(ix) The regulation of markets.
(x) The public lighting of towns, bazaars and villages.
(xi) The organization of child welfare.
(xii) The registration of deaths and sickness.

(9) That in each district the Assistant Director of Medical Services, assisted by his Deputy Assistant Director of Hygiene, should have control over the health organization in cantonments; that the D.D.M.S of the
Command should have super-control; and that the whole organization throughout India should come under the general supervision of the Director of Medical Services at Army Headquarters.

(10) That matters relating to the health of the troops be co-ordinated under the term "Army Health" instead of "Hygiene," the scope and significance of which are imperfectly understood by staff and regimental officers, and the use of which is to some extent disabling.

There is reason to believe that the above measures would in a few years reduce the hospital admission rate in India to a level with the Home rate, and would eventually render the British troops in India as healthy as any body of men in the world.

"Qui non prohibet quod prohibere potest assentire videtur."

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