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ON CELEBES**

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Section I

I. PUBLIC HEALTH AND ENVIRONMENTAL FACTORS INFLUENCING HEALTH AND SANITATION

1. Public Health Department. a. Organization.

(1) The island of Celebes was divided into two administrative regions called residencies. On the north was the residency of Manado, which had the city of Manado as its capital. On the south was the residency of Celebes and depend-

encies, with Makassar as capital. To the residency of Manado belonged the Sangihe and Talaud Islands off northern Celebes. To the residency of Celebes belonged the Salajar Islands off southern Celebes, the Banggai Islands east of Celebes, the Toekangbesi Archipelago off southeastern Celebes, and the islands of Boetoeng, Moena, and Kabaena. The islands of Boetoeng, Moena, and Kabaena and the Toekangbesi Archipelago, together with the counties of Poleang, Roembia, and Laiwoei of the southeastern peninsula, constitute the adminis-

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trative district of Boctoeng and Laiwoei, with capital at Kendari and a total population of 310,500 persons.

(2) Both in Manado and Makassar there were chief public health physicians. These officials, together with the chiefs of the Public Health Services of the Moluccas in Amboina and of the Timor Archipelago in Koepang, were responsible to the Inspector of the Public Health Service located in Makassar. The latter reported immediately to Batavia.

(3) In Celebes, as in other parts of the Netherlands East Indies, the Public Health Service was inseparably interwoven with the curative functions of the government physicians. Areas of this character had virtually no medical service other than that furnished by the government. Consequently, the medical officer acted both as health officer and as physician to the territory he served. Other medical personnel, nurses, vaccinators, and midwives served under his direction.

(4) At the beginning of 1939 the medical personnel of the Public Health Service for the residency of Manado consisted of 2 European physicians, 10 Indonesian physicians, 3 civilian physicians who did a certain amount of public health work, 6 military physicians who, in addition to their military duties, acted as public health physicians, 2 European nurses, 15 Indonesian nurses, 19 vaccinators, and 3 midwives (table I). One of the government physicians in Manado directed the leprosarium of Malalajang, one the tuberculosis sanitarium in Noöngan, one the government hospital in Manado. One of the European nurses was head nurse in the hospital of Manado and the other served in the psychopathic hospital.

(5) In the residency of Celebes and dependencies, the medical personnel of the Public Health Service consisted of 4 European physicians, 10 Indonesian physicians, 1 civilian physician who performed public health duties, 5 military physicians who, in addition to their military duties, acted as public health physicians, 1 European nurse, 40 Indonesian nurses, 38 vaccinators, 1 midwife, and 2 technicians (table I). One of the physicians of Makassar was director of the Regional Central Laboratory, one was director of the psychopathic hospital, and one was the consulting ophthalmologist of the Public Health Service.

b. Scope and estimate of effectiveness.

In view of the vastness of Celebes (76,000 square miles), the size of the population (more than 4,200,000 inhabitants), and the difficulties of communication and transportation, the medical personnel of the Public Health Service can hardly have been sufficient to cope with the most essential duties.

2. Water. a. The average annual rainfall ranges from 21 inches on the west coast of central Celebes to 184 inches in the eastern mountain area of central Celebes. Over most of the island the rainfall is more than 60 inches, and it exceeds 100 inches over a considerable area. Rainfall is quite evenly distributed throughout most of the Celebes. As a result, water is abundant, there are numerous streams with steady perennial flows, and many springs. Ground water is readily obtainable from shallow dug or drilled wells in many parts, especially in the alluvium-filled valleys and coastal plains. There are free-flowing artesian wells on several parts of the island, notably the tip and central portion of the north arm and the north part of central Celebes at the base of the east arm. The yield of most of these wells would be increased by pumping. In some areas, however, such as southeastern Celebes, there is a water shortage during the dry season. The plain of Paloe has been one of the driest areas of the Netherlands East Indies,

b. Most existing wells are primitive, uncased, dug wells only a few feet deep and yield small quantities. Natives commonly drink untreated river or shallow well water. During the dry season, such wells in the southwestern peninsula often run practically dry. Near the coast and on many of the nearby islands, the wells deliver brackish water, and drinking water has to be imported.

c. Stream water is usually turbid and highly contaminated. Spring water is somewhat more mineralized than the surface water, occasionally is warm, and is apt to be contaminated, particularly in limestone regions, where the streams often flow underground for some distance and come to the surface as great springs. Shallow well water is also apt to be contaminated as is also the water from existing deeper wells and artesian wells. Properly constructed and lo-

cated drilled wells should deliver a safe water supply.

d. Twenty-four towns are reported to have municipal water supplies. Most of these systems provide small quantities of water from wells, springs and sometimes surface sources, which in most cases is not treated. In many cases one or, at most, a few wells serve the whole

village. In general, less than one-third of the population is served, and the quantity available is less than 10 gallons per capita per day on the basis of the total population and less than 40 gallons per capita per day on the basis of the population served (estimated). Additional data concerning the municipal water supplies are given in the following tabulation.

Public Water supplies of Celebes

Place	Population	Source *			Treatment	Considered reliable by Dutch officials	Number of connections		Consumption (gallons per day)		
		Wells	Springs	Surface			Private and industrial connections	Public tap	Total	Per capita (total population)	Per capita (population served assumed 5 persons per connection)
Manado.....	23,700	x	x			x	1,511	33	275,400	12.0	36
Tondano.....	14,270	x	x	x		x	185		13,000	.9	14
Gorontalo.....	9,400	x	x	x							
Kampoengbaroe (Tolittoli).....				x							
Donggala.....	2,200	x		x			19	1	5,080	2.3	51
Paloe.....	33,259	x					137		22,700	.7	33
Poso.....	2,100	x		x							
Loewoek.....	7,906			x			64		21,700	2.7	53
Banggai.....		x	x								
Kendari.....	29,911			x	x		136	1	14,950	.5	22
Bacebaoc.....	1,500		x				163	16	76,000	5.1	93
Palopo.....	2,900			x	x						
Parepare.....	3,600	x	x				213		22,500	6.3	21
Makassar.....	84,000	x		x	x		2,699		349,700	4.2	26
Watampone.....		x	x			x					
Watansoppeng.....						x					
Total.....		10	7	9	3	5					

*Principal supply is underlined.

There are also public supplies at Kokas, Kolaka, Kolonodale, Madjene, Makale, Malili, Mamoedjoe, and Raha, but no details are available concerning these supplies.

3. **SEWAGE.** Some of the houses of the Europeans and the richer Chinese had cesspools or septic tanks. The rest of the people had no provisions for sanitary waste disposal. The result was intense pollution of the soil around homes. In many areas even the simplest type of privy was unknown.

4. INSECTS AND ANIMALS OF IMPORTANCE TO MAN AND THEIR CONTROL.

a. **Vectors of disease.** (1) *Mosquitoes.* (a) *Anopheles.* In Celebes at least 15 different anophelines are found (table II). Twelve of these are potential malaria carriers. *Anopheles*

sundaicus is an important vector in the coastal areas of southern Celebes, where the sea has formed salt water lagoons. Here *A. subpictus* also transmits malaria, but it has recently become apparent that in southern Celebes, as in other regions, *A. sundaicus* is a much more active vector than is *A. subpictus*. *A. sundaicus* breeds chiefly in brackish waters. This fact has been used to aid differentiation from the closely related *A. ludlowi*, which breeds in sweet water. *A. sundaicus* is found chiefly in coastal accumulations of stagnant saline waters, including not only lagoons but also fish ponds and similar collections. Such bodies of water are partly or wholly protected from tidal fluctuations. Since the larvae of *A. sundaicus* prefer sunlit waters, breeding usually does not occur in mangrove swamps. The presence of algae,

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however, favors breeding. *A. barbirostris*, ordinarily regarded as a vector of limited importance, has recently been found to show a high rate of natural infection in the interior of southern Celebes. It transmits filariasis as well as malaria. In some areas this species was found to be the sole vector of malaria; in other areas it was found in association with *A. hyrcanus* (*nigerrimus*?), both species showing a high index of infection. *A. barbirostris* breeds by preference in shaded vegetated stagnant waters, in rice fields, swamps, and fish ponds. *A. hyrcanus nigerrimus* likewise breeds in rice fields, swamps, and other collections of still or slowly moving water protected by vegetation. In the Netherlands East Indies this species shows marked preference for the blood of man and it enters houses readily.

In Minahasa the chief vector is *A. minimus*. This species is highly adaptable but is predominantly a stream-breeder. It prefers clear, cool, slowly flowing waters which are exposed to the sun or lightly shaded. It is avid for the blood of man and is a dangerous vector. In Minahasa *A. aconitus* is regarded as an accessory vector. This mosquito is able to breed in both stagnant and running water. Adults tend to enter human habitations. Minahasa is the long northern peninsula of Celebes between the Gulf of Tomini and the Celebes Sea.

(b) *Aedes*. Eight different species of *Aedes* have been described from this area (table III). *Aedes aegypti* and *A. albopictus*, the two vectors of dengue, are widespread. *Aedes aegypti* is a domestic mosquito. It breeds in small collections of water, especially artificial collections, such as are formed in tanks, roof gutters, flower vases, or tin cans.

(c) *Culex and others*. Eleven different species of *Culex* have been reported (table III). *Culex quinquefasciatus* (syn. *C. fatigans*) is widespread. This is a nocturnal species and is commonly found in human habitations. It breeds in any small collection of stagnant water. Two species of *Mansonia* have been found. The latter are vectors of *Wuchereria malayi* but are less efficient vectors in the Celebes than is *Anopheles barbirostris*.

(2) *Lice*. *Pediculus capitis* is frequent in Celebes, but *P. corporis* and *Phthirus pubis* are rare, as is the case in the rest of the Netherlands East Indies.

(3) *Flies*. *Musca conducens*, *M. ventrosa*, *M. vetustissima* and *M. xanthomelas* have been reported from Celebes. It seems probable that most of the flies of Java would also be found on Celebes. Therefore, *Musca sorbens*, *M. crassirostris*, *M. planiceps*, and *M. corvina* can also be expected, together with *Orthellia chalybea*. In the harbors which have regular contacts with the outside world, occasional specimens of *M. domestica* may be found. Of the bloodsucking flies, *Tabanus atrimaculatus*, *T. factiosus*, *T. ceylonicus*, *T. flexilis*, *T. humillimus*, *T. immixtus*, *T. reducens*, *T. speculum*, *T. malayensis*, *T. fumifer*, *T. fuscicaudata*, *T. immanis*, *T. indianus*, *T. rufiventris*, *T. striatus*, *T. xanti*, *T. optatus*, *T. rubidus*, *T. succurvus*, and *T. spoliatus* have been described. *Chrysops dispar*, *C. fasciata*, *C. fixissima*, *C. flaviventris*, and *C. signifer* also occur. *Chrysozona cingulata*, *C. irrorata*, *C. javenica*, *C. pungens*, and the rare *Lissimas moestus* and *Neobolbodymia argentata* have been reported. Large numbers of *Phlebotomus perturbans* and *P. angustipennis* may be expected on Celebes. Although they do not play a role as vectors of disease in this area, they may be exceedingly disagreeable because of their numbers.

(4) *Fleas*. *Pulex irritans* has not been described from Celebes, but *Xenopsylla cheopis*, *X. astia*, *Ctenocephalides canis*, and *C. felis* all occur. The two species of *Xenopsylla* have been found in large numbers on the rat population of Makassar and neighborhood.

(5) *Mites and ticks*. Unfortunately, the information available about the mites of Celebes is unsatisfactory. In view of the occurrence of mite-borne typhus on this island, more complete data would be highly desirable. Of the mites which attack man, *Trombicula pseudoakamushi* has been found on Celebes, but no reports have been found on the occurrence of *T. deliensis*, the vector of mite-borne typhus in the East Indies Archipelago. *Sarcoptes scabiei* is common. The ticks *Boophilus annulatus* and *Rhipicephalus haemaphysaloides* have been described from Celebes. The latter species occurs especially in southwestern Celebes and in the central part of western Celebes. Chiggers abound in the jungles and the woods.

(6) *Rodents*. In Makassar, *Rattus norvegicus* and *R. concolor* are by far the most frequent. *Rattus diardii*, the house rat, is less prevalent.

In this city *R. concolor* has replaced *R. diardii* as house rat. In the fields *R. brevicaudatus* is found in large numbers. From southeastern Celebes *R. hoffmanni* and different species of the *Chrysomys*, *Xanthurus*, and the *R. hellwaldii* rajah group have been described. In northern Celebes *R. dammermanni*, *R.esticulus* and *R. norvegicus* have been found.

b. Snakes and other dangerous animals. Poisonous snakes in Celebes are the common krait, *Bungarius candidus*, the hooded cobra, *Naja bungarus*, the red-tail snake, *Doliophis intestinalis*, and a viper *Lachesis wagleri*. No poisonous snakes have been reported from the Salayer islands and from the Boetoeng group. On the Sangihe islands *Lachesis wagleri* has been found. In the sea around Celebes, poisonous sea snakes are *Platurus colubrinus*, *Hydrus platurus*, *Hydrophis brugmansii*, and the small water snake, *Enhydris hardwickei*, which is mildly poisonous.

The scorpions of Celebes are only slightly poisonous. *Hormurus australasiae*, *Chaerilus variegatus*, and *C. celebensis* can be expected. Crocodiles are numerous. The babirusa, a wild boar with dangerous tusks, is native to Celebes.

c. Pests. The bedbug, *Cinex hemipterus*, occurs in large numbers. Leeches are extremely common in the forests.

5. FOOD AND DAIRY PRODUCTS IN RELATION TO HEALTH. In the greater part of Celebes rice is the staple food. Rice, however, is usually not planted on irrigated fields but on dry soil, where its development depends on sun and rain. Corn is grown in the hills, where it is the main part of the popular diet. In marshy areas sago woods occur. In Kondari, for instance, the people depend chiefly on sago and fish. The chief domestic animals are buffaloes.

6. MISCELLANEOUS PROBLEMS OF SANITATION. **a.** Data about general death rates and infant mortality are sketchy. In 1930 Makassar had 85,000 inhabitants and a general death rate of 32.3 per 1,000. In 1934 this rate was 29.3, in 1937 it was about 27, and in 1938 it was 31 per 1,000. In Manado with 27,500 inhabitants the death rate was 22.4 per 1,000 in 1934, about 18.0 in 1937, and about 21 in

1938. The death rate in Tondano in Minahasa in 1930 during a measles and dysentery epidemic was 34 per 1,000. In 1931 it was only 27, and in 1932 it was 22 per 1,000. The death rates in the other districts of Minahasa also varied between 22 and 30 per 1,000. Not only measles and dysentery but especially malaria outbreaks always caused a sudden rise in the mortality figures. In southern Celebes the disastrous malaria epidemic of 1936 caused general death rates of 70 to 80 per 1,000.

b. Infant mortality rates in Minahasa in 1930, 1931, and 1932 averaged 196 per 1,000 live births, a rate which for tropical conditions was not too unfavorable.

Section II

MEDICAL FACILITIES

7. HOSPITALS. **a.** In the residency of Manado there were 28 general hospitals with 1,040 beds in 1939. In the residency of Celebes there were 32 general hospitals with 1,015 beds (table IV). One of these was located on Salajar island, one on Boetoeng, and one on Moona. Many of these hospitals were small and unsatisfactorily equipped. The military hospital in Makassar, where civilian patients were also admitted, and the government hospital at Manado, were satisfactorily equipped, as were a few of the smaller new hospitals, as for instance, the hospital in Parepare.

b. In addition, there were eight leprosaria in Celebes (table V). In Minahasa there were five leprosy clinics (Manado, Amoerang, Kakas, Tomohon, and Airmadidi). A psychopathic hospital with 305 beds was located in Makassar and one of 34 beds in Manado. In Noöngan in Minahasa there was a tuberculosis sanitarium with 70 beds. Seven tuberculosis clinics were spread over Minahasa (Manado, Tondano, Airmadidi, Tomohon, Amoerang, Gorontalo, Kotamabagoe).

c. Outpatient clinics were widely scattered throughout the island.

8. MEDICAL PRACTITIONERS. **a. Physicians.** Almost all the physicians in this area belonged to the Public Health Service (see par. 1a and table I). Three European physicians and two Indonesian physicians practiced privately in Manado, and three European physi-

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icians and four Indonesian physicians in Makassar (table I). Outside of the cities of Makassar and Manado the physicians not connected with the Public Health Service were missionaries working in small hospitals.

b. Dentists. In Makassar there were three dentists; in Manado two dentists were in private practice.

c. Nurses. In addition to the nurses mentioned in paragraph 1a, few Europeans worked in Makassar and Manado as private nurses. It seems reasonable to surmise that in the missionary hospitals, nurses not mentioned among the public health personnel were also working.

d. Midwives. Apart from the public health midwives, 16 midwives practiced privately in the residency of Manado and 6 in the residency of Celebes.

e. Pharmacists. There was only one pharmacist in Makassar. In all the other cities and villages the physicians performed the duties of pharmacists.

9. LABORATORIES. A well-organized and well-directed Regional Laboratory was located in Makassar. In 1938 this laboratory examined 42,300 specimens, only one-third of which were sent from the city of Makassar proper. The work consisted of bacteriological cultures, microscopic examination of blood and stool specimens, serological tests, examination of arthropods and rodents, and examination of water and food.

Section III

DISEASE INFORMATION

10. Diseases of Special Military Importance.

a. Malaria. (1) Celebes is a highly malarious island. There were only a few places where malaria did not occur or where it was rare. In recent years, the city of Makassar has been practically free of malaria and in the northern arm of Celebes, in Minahasa, the so-called lake districts near Tondano and Kakas have been malaria free. Many other districts in Minahasa, however, were highly malarious, as, for instance, Tonsea and Airmadidi.

(2) The southwestern arm of Celebes was devastated by serious epidemics almost every year. In 1936 such an outbreak was reported

from Boeloekoemba, Sindjang, Watampone, and Loewoek. In 1937 Watampone and Djenepono were seriously affected; in these areas the parasite index rose to 70 percent. In many villages of Bira the parasite index was 100. The southeastern arms and the central part (Toradja area) of Celebes are also notoriously malarious.

(3) The vectors of malaria differ in different areas of Celebes. In Minahasa, especially in the mountainous interior, *Anopheles minimus* is the main vector. In southwestern Celebes it had always been thought that *A. subpictus* was the anopheline that transmitted malaria. In recent years new data have been collected indicating that *A. sundaicus* is a much more important vector in this area than is *A. subpictus*. In many parts of the coast of Celebes, salt water lagoons are favorite breeding places for *A. sundaicus*. In 1938 in Djenepono, 2.5 percent of *A. subpictus* was naturally infected with malaria, whereas 54 percent of *A. sundaicus* was infected.

(4) In southwestern Celebes *A. barbirostris* has recently been proved to be an important vector. Until a few years ago it was not believed to play an outstanding role in the transmission of malaria. *A. barbirostris* had been found to be naturally infected only in a few areas of Sumatra (Kisaran on Sumatra's east coast and Groot Mandailing in Tapinnoeli), but even in these regions the natural infection rate was very low (0.36 and 0.55 percent). Then in 1938, in three different epidemics in southwestern Celebes, *A. barbirostris* was shown to be the main vector. In the Javanese immigration colony of Wono-redjo near Malekoe in Malili, it was the only vector and showed a natural infection rate of 13 percent. In Boetoeng near Parepare the natural infection rate was found to be 11 percent. Here, however, *A. barbirostris* was not the only vector, because *A. hyrcanus* showed a natural infection rate of 8.7 percent. The population affected in this area consisted of laborers imported from parts of southwestern Borneo. South of Lake Tempe in Singkang in Watampone, during a malaria epidemic among the local population, the only infected mosquito was *A. barbirostris*, but the natural infection rate in this area was only 1.6 percent. Finally, in 1939, *A. barbirostris* was the vector in epidemics in Bonthain and in Boeloekoemba. In

all these areas *A. barbiostris* attacks man with great ferocity. Whereas in the rest of the Netherlands East Indies *A. barbiostris* prefers cattle, it is strongly anthropophilic in Celebes. It has been stated that slight morphological differences exist between *A. barbiostris* found in southwestern Celebes and *A. barbiostris* found in the rest of the Netherlands East Indies. (5) Information about malaria vectors in the rest of Celebes is much less specific. The incidence of malaria in many other areas, including parts of the southeastern peninsula and the interior, is however as high as in southwestern Celebes.

b. Bacillary dysentery. (1) In Celebes bacillary dysentery was a common disease. In the northern part of Celebes no differentiation of the dysentery bacilli has been made, but the laboratory in Makassar has given ample information about the strains of southwestern Celebes. In the city of Makassar, Flexner bacilli were more frequently found than were Shiga bacilli; outside of Makassar the reverse was true. Of 862 strains isolated in the regional laboratory of Makassar, 600 belonged to the Shiga strain, 231 were Flexner bacilli, 25 Sonne, and 6 Schmitz bacilli. Even in the city of Makassar, Shiga bacilli were not rare as they constituted about 20 percent of the strains isolated. (2) The frequency of bacillary dysentery is indicated by the fact that in 1937 in southern Celebes 4,040 cases were reported. Specific figures are available for the following subdivisions:

Subdivision	Number of cases
Boeloekoemba	375
Bone	355
Bonthain	140
Djeneponto	284
Pangkadjene	194
Rantepao	199
Sindjang	624
Watampone	775

In the same year the subdivision of Loewock in the southern part of Manado residency reported 284 cases.

(3) In 1938 in the southern part of Celebes, 4,520 cases were reported. In this part of Celebes, not only the Shiga but also the Flexner bacilli have given rise to dangerous epidemics. In the Javanese colony of Wonoredjo, near

Malekoe, a Flexner-Y epidemic caused many fatalities in 1938. Prospecting expeditions in the Roembia-Poleang and Kendari areas of the southeastern peninsula are reported to have suffered severely from dysentery.

(4) In the northern part of Celebes, dysentery was not less frequent. In 1939 Gorontalo reported more than 100 cases, other districts in the northern arm more than 200. The disease was especially common in Tomohon.

c. Typhus. (1) *Scrub typhus.* In 1934 the laboratory at Makassar reported one case of scrub (mite-borne) typhus in a European. This was the first case reported from Celebes. In 1939 it was reported that the disease occurred regularly in Minahasa, where it was even more frequent than flea-borne typhus. Most of the patients had no "scrub history" and primary lesions were only rarely found. Although systematic investigations in this field are not available, it seems probable that this disease is a frequent cause of fever in Celebes. The local vector has not been determined. *Trombicula pseudo-akamushi* has been reported from Celebes, but *T. deliensis*, the probable vector in New Guinea, has not been described.

(2) *Murine typhus.* In 1939 flea-borne murine typhus, the so-called shop typhus, was recognized as occurring regularly in Minahasa. The disease must also occur in the southern part of Celebes as the laboratory at Makassar has occasionally recorded a few cases.

d. Filariasis. Filariasis has been reported from nearly every part of Celebes. Only a few areas were known to be virtually free. No cases have been found in the city of Makassar itself. Near Minahasa the infection occurs on the north and south coasts of the subdivision of Gorontalo, but the infection rate is not high. There are several heavily infected areas within Minahasa, as for instance, the region around Manado and Bolaang-Mogondow. Other districts with a high filaria index are the southern part of the plains of Paloe, Donggala, the Todjo coast near Poso, the hills near Madjene, Simpang, Malili, Kolonadale, Kawata, Kendari, and the Roembia-Poleang area. In those regions the infection index varies between 15 and 50 percent, and a good deal of elephantiasis has been seen. Most of the cases in Celebes are due to *Wuchereria malayi*. *W. bancrofti* is

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relatively rare but is found together with *W. malayi* in the southern part of the area around Mamoejoe and near Kolonadale. It is the sole form found in Boetoeng, Moena, and Kabaena, the islands off the tip of the southeastern peninsula. Filariasis is especially frequent in marshy regions near stagnant water and becomes rarer with increasing altitude. In Celebes infection with *W. malayi* is transmitted by *Anopheles barbirostris* and by species of *Mansonia*, especially *M. annulipes*. Careful investigation has shown that in Celebes *A. barbirostris* is the most active vector. In Mamoejoe 3.7 percent of *A. barbirostris* have been found to be naturally infected. Another survey showed that in this area 8.9 percent of *A. barbirostris* harbored filariae, whereas *M. annulipes* was found to be infected to the extent of 2.7 percent. Experimental infection has shown that the filariae developed much more constantly and much more rapidly in *A. barbirostris* than in *Mansonia*.

e. Venereal diseases. Specific information about venereal diseases in Celebes is scanty. Gonorrhoea is frequent among natives throughout the island. Syphilis among natives is said to be limited mainly to the harbor cities.

f. Skin diseases. As in the rest of the Netherlands East Indies, scabies, fungus diseases, tropical ulcers, and pyodermatitis are frequent ailments. Fungus infections are commonly acute and quite resistant to treatment. Minor skin lesions are likely to become infected and to result in prolonged subacute or chronic ulcers.

11. DISEASES OF POTENTIAL MILITARY IMPORTANCE. a. Amebic dysentery. Amebic dysentery is common throughout Celebes. In Minahasa it has been estimated that about 25 percent of the patients with dysenteric stools suffer from amebic dysentery.

b. Common diarrheas. Diarrhea of unknown cause is one of the most frequent ailments in this area. It may well be that some of these diarrheas are caused by *Salmonella*. On the other hand, the rarity with which paratyphoid A, B, and C have been isolated in the laboratory of Makassar should be kept in mind. A great many of these so-called common diarrheas may possibly have been cases of undiagnosed bacillary dysentery.

c. Dengue. Dengue occurs regularly, especially among new arrivals, but serious epidemics have not been reported for several years. As both *Aedes aegypti* and *A. albopictus* abound in this area, occasional epidemics must be expected.

d. Respiratory tract infections. Epidemics of a disease resembling influenza have been reported every year from Celebes, though the exact etiology has not been determined. Other infections of the respiratory tract are not uncommon. The night temperature in the mountains may be low, and considerable differences between day and night temperature may favor the development of acute respiratory infections. In this part of the tropics pneumonia occurs frequently among the natives; the fatality rate is high. The pneumonia mortality rate in Minahasa in 1931 was more than 200 per 100,000.

12. SERIOUS DISEASES OF NONMILITARY IMPORTANCE BUT LIKELY TO AFFECT SMALL NUMBERS OF TROOPS. a. Tuberculosis.

(1) As in the rest of the Netherlands East Indies, tuberculosis is common in Celebes. The most detailed data had been obtained from Minahasa. It should be pointed out that in this area the population has reached a higher stage of civilization than in the rest of Celebes, and sanitary conditions there are better than anywhere else in the island. It can, therefore, be assumed that the tuberculosis figures in Minahasa are somewhat more favorable than in the other divisions of the island.

(2) In 1931 the tuberculosis mortality rate was 167 per 100,000 in Minahasa. In the same year the death rate in the registration area of the United States for all forms of tuberculosis was 67.8. Tuberculin tests (Pirquet) performed on nearly 11,000 individuals in Minahasa showed that of 1,554 children between 11 and 15 years, 31 percent had a positive reaction, whereas among persons 20 to 30 years of age, 50 percent of the reactions were positive. In 1938, in a study of 1,083 of the 1,200 inhabitants of the village of Noöngan in Minahasa, only 16 percent of the children between 5 and 14 years and 40 percent of the older adults had a positive Pirquet reaction. Active tuberculosis was found in 0.64 percent of the population. It should be stressed that the latter somewhat more favor-

able data were obtained in an isolated rural population.

b. Leprosy. (1) In 1939 there were 4,518 known cases of leprosy in Celebes. In the subdivisions of Madjene and Mamasa (population 184,000) there were 638 leprosy patients in 1929. About 700 lepers were known in Minahasa. In 1937, the following cases of leprosy were reported from various parts of Celebes:

Locality	Number of cases
Gorontalo	127
Kotamabagoe	11
Madjene	210
Makassar	117
Manado	420
Paloe	70

(2) During 1937, examination of different body fluids and excreta in the Makassar laboratory revealed 157 new cases of leprosy. It may be assumed that the total figure of 4,518 lepers is much smaller than the actual number of leprosy cases present in Celebes.

c. Cerebrospinal meningitis. Although in recent years no serious epidemics have been reported, the disease has occurred regularly in large areas of Celebes. Every year the laboratory in Makassar reported a few cases, three in 1937 and four in 1938.

d. El Tor cholera. (1) Much interest has been shown in a few cases of a cholera-like condition that has been described from southwestern Celebes. The Netherlands East Indies were free from cholera from 1921-1937 except for nine cases which occurred at Batavia in 1927, all imported from Singapore. Between September 1937 and 1940, however, a small "cholera" outbreak developed in some native hamlets situated along the coast of southwest Celebes and somewhat inland in the government districts of Pangkadjene, Gowa, Barroe, and Maros. Cases also occurred on Salemo, Sanaana, and Samatelloe-laee, small islands of the Spermonde Archipelago off the coast about 40 miles north of Makassar, and two cases occurred in Makassar itself.

(2) The clinical picture was typical for cholera. The case fatality was 65 percent, as is usually seen in this disease. Wells and water jars used by "cholera" patients in southern Celebes were examined and found to be contaminated,

where wells belonging to the neighboring houses were not contaminated. Of 217 contacts of 40 "cholera" cases, 29 were found to excrete "cholera" bacilli. A few of these infected contacts later showed characteristic signs of cholera but none of them died. Of 183 probable contacts examined in 1937-1938, not one was infected, but in 1940 some healthy noncontacts were found to be carriers. In one village where there had not been a single suspected case, 1.3 percent of the population were found to be carriers. Of 17 carriers, 11 were under the age of 16 years.

(3) Epidemiologically and bacteriologically, this "cholera" epidemic in Celebes showed a few remarkable points. There was hardly any tendency to epidemic spread. In each of 14 villages, only 1 case occurred, in each of 4 villages 2 cases, while in only 1 village were 5 cases observed. With a few exceptions there was never more than 1 case per family. These epidemiological data indicate differences from usual cholera epidemics. In addition, bacteriologic examinations showed the presence of cholera-like vibrios which were definitely hemolytic, if examined in 2- or 3-day broth cultures according to the hemolysin test of Greig. Although as far as the immunological reactions were concerned, these Celebes vibrios belonged to the genuine cholera organisms (subgroup OI of Gardner and Venkatraman, Heiberg type I), their hemolytic properties seemed to indicate that they belonged to the El Tor vibrio (type Ogawa). It should be added that the vibrios were only weakly hemolytic and that their hemolytic properties could be demonstrated only by the technic of Greig. When they were tested by the hemolysin test of Taylor in 2-day-old peptone water cultures no hemolysis occurred. Even so, in the opinion of most Dutch bacteriologists, these Celebes vibrios were identical with El Tor vibrios. This vibrio, which was first recognized in 1905, had been considered up until 1937 as nonpathogenic and, as far as known, had never been isolated in typical cholera cases.

(4) In view of extensive studies of this organism, it was concluded that there was hardly any reason to distinguish the disease in south Celebes as "enteritis choleriformis Tor" as had been proposed, but the conclusion was that in south Celebes cholera actually occurs, probably

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endemically. The two cases discovered in the harbor town of Makassar were reported as cholera and have been mentioned as such in the "Bulletin de l'Office International d'Hygiène Publique." The harbor was, however, not officially declared infected. The question why weakly hemolytic cholera strains have been recovered from cholera patients only in southern Celebes and not in other areas may well be connected with the widespread interest which for 25 years has existed in the Netherlands in the problem of the El Tor vibrios.

e. Plague. In Java plague has been endemic since 1911, when the disease started in the eastern part of the island. The disease began to extend westward in 1935, but has shown only a slight tendency to spread to the other islands of the archipelago. In 1922, cases occurred in Tandjoengbalei, an island of the Riouw archipelago, in Palembang on Sumatra and in Makassar on Celebes. In Makassar 115 cases occurred between 1922 and 1930, but none have been reported since 1930. The peak of this small epidemic was in 1927 when 40 cases were observed. No cases have been reported from Celebes outside Makassar. Whereas the plague bacillus reservoir in Java consisted of the Malayan house rat (*Rattus diardii*), in Makassar *R. norvegicus* and *R. concolor* were infected just as frequently as was *R. diardii*.

13. DISEASES CAUSING HIGH MORBIDITY OR MORTALITY RATES AMONG NATIVE PEOPLE.

a. Frambesia (yaws). Frambesia is common in natives throughout Celebes. The districts of Loewoek, Bira, and Singkang have been especially mentioned for their high incidence of frambesia, but in the rest of Celebes the incidence is probably just as high. In Singkang in 1 year, 16,600 injections of neoarsphenamine were given for the treatment of frambesia.

b. Typhoid fever and paratyphoid fevers. (1) Although accurate statistics are not available, typhoid fever is fairly common in Celebes. In 1935 there were 153 cases of typhoid fever reported in Manado, in 1936 there were 148, in the next year 79. In 1936 there were 26 cases in the city of Makassar and 14 cases around Makassar. In 1937 there were 26 cases reported in Makassar. In Minahasa the typhoid mortality rate amounted in 1932 to 14.3

per 100,000 (the rate for the United States for the same year was 3.6).

(2) Paratyphoid fevers were said to be much less frequent than typhoid. In contrast to the rest of the Netherlands East Indies paratyphoid A apparently was extremely rare. Paratyphoid B and C were reported but only occasionally. Whereas the regional laboratory in Makassar reported hundreds of cases of bacillary dysentery each year, paratyphoid bacilli were found only very rarely.

c. Trachoma. Trachoma prevails throughout Celebes. It is frequent along the rivers and relatively rare in the isolated mountain villages. In 1935 in the Watampone area 4.7 percent of 13,882 inhabitants were proved to suffer from trachoma. None of the villages was free from the disease. In Tempe the infection was found in 8.9 percent, and in Lengkang in 8.4 percent of the people examined. Even these figures are lower than the infection rate found on Java. In the rest of the villages of southern Celebes, 1 to 5.7 percent of the inhabitants suffer from trachoma. The disease is much less frequent in northern Celebes. In Gorontalo, trachoma is even said to have been rare.

d. Conjunctivitis. During the East monsoon which brings the dry weather between June and September the atmosphere is often dusty; conjunctivitis is of common occurrence at this time.

e. Helminthiasis. (1) *Nematode infections.* *Ascaris lumbricoides* and *Ancylostoma duodenale* are common intestinal parasites in Celebes. Infection rates vary, but in many areas more than 50 percent of the people carry these parasites. From the reports published the impression is obtained that *Trichuris trichiura*, *Enterobius vermicularis*, and *Strongyloides intestinalis* occur less frequently.

(2) *Schistosomiasis.* *Schistosoma japonicum* has been found in only one area of Celebes, around isolated Lake Lindoe in the mountains of the Toradja region (2,700 feet). About 50 percent of the population living on the shores of this lake have been found to carry the ova of *S. japonicum*. Intestinal signs were not observed, but many people had remarkably large spleens, larger than could be explained by chronic malaria alone. Two autopsies showed splenic

and hepatic lesions due to schistosome infection. Human beings, dogs, and deer were found to be infected. No snails of the genus *Oncomelania* were found in Lake Lindoe, nor was any other snail discovered shedding furcocercous cercariae. Such cercariae were, however, found in snails of the genus *Lymnaea* in Lake Poso (1,500 feet) in central Celebes. From no other area in Netherlands East Indies have infections with schistosomes been reported.

(3) *Echinostomiasis*. Around Lake Lindoe in Celebes the Toradjas are heavily infected with *Echinostoma lindoense* (37 spines). The first intermediate host in Celebes is a planorbis-like snail, *Anisus sarasinorum*; the second intermediate host is the freshwater mussel, *Corbicula linduensis*. The patients acquire the parasite by the consumption of insufficiently cooked or raw fresh water mussels. There is also another snail which can act as the second intermediate host, *Viviparus javanicus rudipellis*. As this snail is not eaten in this part of Celebes, its practical importance in the transmission of the disease must be negligible. In the coastal area near Makassar and near Lakes Poso and Rano Dompelas snails infected with the metacercariae of a 37-spined echinostoma have been found, but no human carriers of *Echinostoma lindoense* could be discovered. Sporadic infections with *Euparyphium ilocanum* are encountered in the coastal areas of Celebes and near Lake Poso.

14. MISCELLANEOUS DISEASES. **a. Smallpox.** Widespread vaccinations have almost stamped out smallpox in the Netherlands East Indies. In Celebes a small epidemic of smallpox occurred in 1931 in Kawangikatan in Minahasa. In 1936 there were 75 cases in Boeol in the residency of Manado and three cases in Paloe. Between 1936 and 1940 no cases were reported.

b. Diphtheria. Diphtheria occurs regularly in Celebes. Although no serious epidemics have been described recently, the laboratory in Makassar reported a certain number of positive cultures every year. There were 25 cases in 1936 and 33 cases in 1938. In the same year 18 carriers were discovered.

c. Leptospirosis. Weil's disease was first reported in Celebes in 1933, when four cases were recognized. In 1934 there was one case, in

1938 another. All cases observed in Celebes were due to *Leptospira bataviae*. In 1938 it was found that 18 percent of 77 *Rattus norvegicus* in Celebes were infected with leptospira, 10 percent of 211 *R. concolor*, 1.5 percent of 212 *R. diardii*, and several dogs. In *R. norvegicus*, *Leptospira bataviae* were present, in *Rattus concolor*, the nonpathogenic *L. javanica*, which was also found in the few infected house rats. From a dog in Makassar a strain was cultivated which was serologically identical with the Australian type "Ballico." Neither in human beings nor in animals has *L. icterchemorrhagiae* been discovered.

d. Rhinoscleroma. In the Netherlands East Indies several foci of rhinoscleroma are known. There are at least two in Sumatra, one in eastern Java, and one in Minahasa, near Tomohon. The main focus in this latter area is in Kasoeratan, a small and isolated village. Cases have also been found in Tombatoe, in Leilem, and in Malelajang.

e. Nutritional diseases. (1) In general, nutritional diseases have not been frequently recorded in Celebes. Occasionally the crops of maize have failed, and scarcity of food has resulted. This is probably less frequent in Celebes than in other parts of the Netherlands East Indian Archipelago. In 1936 scarcity of food occurred in Loewoek where cases of beriberi were also observed. There was a scarcity of food in Rampi in Masamba in 1937. In Kendari in southeastern Celebes, the people live mainly on sago and fish. Here malnutrition and beriberi are not rare. Xerophthalmia occurs regularly in the mountains of the Minahasa.

(2) Goiter is endemic in extensive areas of the mountainous interior of Celebes. The following districts have been especially mentioned:

- Bolaang Mongondow
- Mountains near Manado
- Tomata (Manado)
- Majoemba (Manado)
- Upper and southern Mori
- Paloe
- Bone (Bitoeng and Tjinenoenng)
- The mountains near Koelawi
- Galoempang
- Masamba
- Parepare

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Rantepao
Enrekang

In some of these places (Rantepao, Galoempang) many cases of cretinism have also been found.

Section IV

**SUPPLEMENTAL DATA ON ISLANDS OFF
SOUTHEASTERN CELEBES**

15. GENERAL. a. The islands off the tip of the southern peninsula consist of four groups, Boetoeng Island, Moena Island, Kabaena Island, and the Toekangbesi Archipelago. Administratively these islands were joined with Poleang and Roembia counties and the Laiwoek region, the most eastern part of southeastern Celebes (capital Kendari), to constitute the Boetoeng and Laiwoek district. About 139,000 people live on Boetoeng. There are 78,000 on Moena and about 60,000 on the Toekangbesi Archipelago.

b. Boetoeng Island is about 100 miles long and 35 miles broad at its widest part. It has an area of 1,500 square miles. It is separated from the island of Moena by the narrow Boetoeng Strait through which runs a strong current. The island consists mainly of elevated coral and limestone covered with poor, dry soil. Water is obtained with difficulty; the population relies on shallow wells. Along the axis of Boetoeng Island runs a chain of limestone hills 600 or 700 feet high covered with woods. Extensive areas of humus can be used to grow co:n and taro-like roots; the cultivation of rice is impossible. Associated with Boetoeng Island are many other small islands, including Kadatoeng (North Island), Sioempoe (South Island), Watocatas (Lizard Island), Matassa, Pandjang, Pendek, and Kaholiban.

c. Moena Island has an area of 1,230 square miles. It is less mountainous than Boetoeng and in the northwestern part is flat and has fertile clay soil. The southeastern part is very hilly. The capital is Raha.

d. Kabaena Island, 300 square miles in area, is very mountainous and consists partly of limestone, partly of volcanic rock. The southern part is completely uninhabited. In the northern part a certain amount of agriculture is possible on small table lands between the

mountains. The largest village is Dongkala, situated on the east coast

e. The Toekangbesi Archipelago consists of numerous coral islands, which have a total area of 180 square miles. The most important island is Binongko, which has 12,500 inhabitants.

16. HEALTH AND MEDICAL SERVICE. The Public Health Service in this region was taken care of by a public health physician on Kendari, one in Baeobae on Boetoeng, and one in Raha on Moena Island. These officials were responsible to the inspector of public health in Makassar. Hospitals were situated in Kendari (30 beds), Baeobae (42 beds), and in Raha (32 beds).

17. WATER. In many of these areas water is scarce; the population relies upon rainwater and dug wells. Water is more difficult to obtain in the southern part of Boetoeng than in the northern.

18. MOSQUITOES. Data about the mosquito fauna of this region are shown in tables VI and VII.

19. NUTRITION. The general *nutritional condition* of the population of this area has been hardly satisfactory. The people eat sago or corn and sometimes taro. Beriberi outbreaks were not rare and in recent years, especially from Kendari, outbreaks of beriberi have been reported.

20. MALARIA. This whole area is notorious for its high malaria rate. The people of Boetoeng, for instance, avoid the northern part of the island because of the frequent fevers, though the southern part of the island appears to have nearly as much malaria. In 1922 the splenic index of the coastal villages of Boetoeng varied between 50 and 100 percent. There is no area in this region where cases of malaria do not occur in great numbers.

21. DYSENTERY. Statistics about dysentery cannot be obtained. It seems certain, however, that the disease is frequent in this area. The inhabitants of Boetoeng, for instance, never drink river water during the dry season because they know that this practice may lead to dysentery.

22. SKIN DISEASES. Skin diseases are very frequent. Travelers in these islands comment upon the frequency of skin ailments. Many of these diseases are probably due to secondary infections.

23. FRAMBESIA. This is notoriously frequent in the Toekangbesi Archipelago, and there is no reason to surmise that the incidence of this disease is less on the other islands.

24. FILARIASIS. Filariasis is common throughout these islands. Conditions here have been studied carefully since it has been found that on the island of Celebes itself, almost all the filaria cases are caused by *Wuchereria malayi*, whereas on the islands to the south of Celebes only *W. bancrofti* is found. In Kamaroe on northeastern Boetoeng, seven patients with lymph scrotum were studied, four of whom were infected with *W. bancrofti*. In Ereke on Boetoeng, six out of eight cases with lymph scrotum had *W. bancrofti*. In Baoebaoe, however, 39 inhabitants were examined, but no microfilariae were found. In one of the villages near Raha on Moenar Island, 71 percent of the population were found to be suffering from filariasis, and on Kabaena Island 28 of 96 people examined showed the presence of *W. bancrofti*. During a survey of this island 30 patients with lymph scrotum were encountered. On Wowoni, an island off Kendari, 45 percent of the inhabitants were suffering from filariasis.

On Kabaena Island *Anopheles aconitus*, *A. leucosphyrus haeckeri*, *Culex fatigans*, and *C. alis (vishnui?)* have been found to be naturally infected with filaria. As in the rest of the Netherlands East Indies *Culex quinquefasciatus* is not an effective vector; of 201 specimens caught, only one was found to be infected.

25. LEPROSY. Leprosy is widespread in this area. In 1937 enough chaulmoogra oil to treat 50 patients with leprosy was sent to Baoebaoe.

26. MEASLES. Formerly dangerous measles epidemics raged in this area. In 1921 an epidemic of this character with a fatality rate of 10 to 30 percent was reported from Boetoeng.

27. INFECTIOUS JAUNDICE. Infectious jaundice was observed on Moena Island in 1935.

28. LEPTOSPIROSIS. The possibility of leptospirosis was seriously considered, but serological and bacteriological tests proved to be negative.

Section V

SUMMARY AND RECOMMENDATIONS

29. HEALTH AND SANITATION. a. Diseases. The chief diseases of military importance in Celebes are malaria, bacillary dysentery, filariasis, and scrub typhus. Most of Celebes is highly malarious, and the southwestern part of the island has had serious outbreaks almost every year. Bacillary dysentery is common and many of the cases are severe. Scrub typhus is probably much less common than malaria and dysentery, but little exact information is available. Filariasis occurs in almost every part of Celebes. There is much gonorrhea but probably little syphilis, except in the ports. Dengue occurs regularly among new arrivals.

b. In addition to those precautions ordinarily carried out for military forces, the following recommendations are considered of special importance.

(1) *Water.* Although before the war water from the few available public supplies could be consumed without additional treatment, it is doubtful whether the normal supervision has continued during Japanese occupation. Even safe water may be contaminated through distribution in unsanitary containers. Therefore, all water should be regarded as potentially dangerous and should be boiled or chlorinated before use. Ice made from local water supplies should be considered unsafe for drinks.

(2) *Sewage.* No reliance should be placed on the availability of any sewage-disposal facilities. Plans must therefore be made for local disposal of sewage and other wastes. In view of the prevalence of enteric diseases, special attention must be given to the careful disposal of sewage by approved methods in order to guard against pollution of water and soil and access by flies. Native employees must be provided with their own toilets and must be compelled to use them.

(3) *Malaria control.* Because of the vital importance of malaria (and secondary importance of dengue and filariasis), careful plans for mosquito control should be made before troops

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embark for any part of this area. Such preliminary plans should include provision for specialized personnel, antimalaria supplies and indoctrination of all troops in preventive measures. Specific control measures should include—

(a) Use of bed nets issued as individual equipment at the port of embarkation and thus available for use immediately upon arrival until proper screening of buildings and barracks has been accomplished.

(b) Use of head nets, gloves, and other protective clothing where indicated.

(c) Liberal use of insect repellents.

(d) Proper selection of camp sites. Location on high ground affords no absolute protection because in all of these areas malaria often occurs in the hills. Camp sites should be chosen preferably 1 or 2 miles from important breeding places and from native habitations, barns, and cowsheds, so as to be beyond the effective flight range of mosquitoes. Stream banks should also be considered as possible storehouses of infected malaria carriers. Sites should be selected so that native villages are not on the windward side of the camp and doors of all buildings should open away from the wind, if possible. If for military reasons it is necessary to make permanent camp sites in areas in close proximity to native villages, consideration should be given to moving these villages to other locations.

(e) Thorough screening of all quarters, not merely of those to be occupied in the evenings or at night. Entrance vestibules with a screened door at each side (mosquito lock) will be necessary to exclude the mosquitoes. Strict avoidance of outdoor moving picture shows is essential.

(f) Use of pyrethrum sprays in native habitations within mosquito flight range of camps (1 to 2 miles) and in all tents, barracks, mess halls, recreational and other buildings. The new insecticide spray (QM Insecticide, aerosol) is especially suitable.

(g) Although antimalarial measures may have to be varied according to the specific area and the vector that is locally important, careful clearing and draining of ditches and gutters is necessary in all malarious districts. Fish ponds are dangerous breeding places. Salt water fish ponds and salt water lagoons must be

drained or connected with the ocean in order that the tide may enter freely. Fresh water fish ponds must be cleaned or drained. The same must be done to fish ponds on rice fields. Rice fields should not be in continuous cultivation. Sufficient time should elapse between crops to permit complete drying of the fields. Oiling of the salt water lagoons is usually unsatisfactory because of the prevailing winds. The results with Paris green are somewhat better, but the material must be applied once every week.

Measures like clearing, draining, and filling of potential breeding areas should be used with discretion. Unless competent entomological advice is available, clearing should not be used as a malaria control measure in Celebes as it is often followed by man-made malaria in the areas where *A. sundaicus* acts as vector (coastal zones of South Celebes) and in the hills and mountains of the coastal areas of Celebes where *A. maculatus* is an important vector. When clearing is necessary, special mosquito-control measures must be instituted at once and vigorously maintained. Draining of stagnant water, although always advisable, may not be sufficient; running brooks are habitats of *A. maculatus* larvae and it is often necessary in the *maculatus* area to transform brooks into subterranean passages. The filling of marshes in areas where *A. maculatus* acts as vector is an excellent measure but requires special precautions. It is quite possible to dig away enough of a hill to expose the ground water and thus produce an area of seepage eminently suitable for *A. maculatus*.

(h) Adequate supplies of antimalarial drugs sufficient for 100 percent suppressive treatment should be available for use everywhere in this area and should be employed at the discretion of the surgeon.

(4) *Filariasis*. Filariasis occurs in almost every part of Celebes. The most important vector is *Anopheles barbirostris*, which breeds in rice fields and in deep shaded swamps. Camps should not be placed near such bodies of water. The irrigation of rice fields should be interrupted from time to time. Swamps should be drained or oiled. Both rice fields and swamps can often be treated with Paris green. Habitations should be sprayed, and contact with natives should be kept to a minimum.

(5) *Dengue*. Under ordinary conditions the mosquito-control measures recommended in (3) above will be of assistance in the control of dengue. In addition, the policing of buildings and grounds and the regular inspection of water containers will be necessary. It will be remembered that *Aedes aegypti* frequents small collections of water, such as vessels and gutters in and around human habitations.

(6) *Venereal disease control*. Venereal diseases are prevalent, sexual contacts easily made, and the native population little disturbed if signs of these ailments develop. Venereal disease programs with comprehensive educational campaigns and adequate recreational facilities for troops are urgently necessary. Large supplies of approved prophylactic materials should be provided, and prophylactic stations should be easily accessible to all troops. Contacts with the local health authorities aiming to increase the opportunities for treatment of the civilians may sometimes be advisable.

(7) *Food*. If local eating establishments are used by military personnel, thorough inspection of these places, including those vending soft drinks and dairy products, should be carried out. Even in these establishments, however, raw fruits and vegetables should be avoided. Troops should be cautioned as to the dangers of eating in unapproved establishments or in native homes. Because of the high incidence of intestinal infections, unusual care must be exercised in the collection, storage, and preparation of food in Army mess and post exchanges. Kitchens and mess halls should be carefully screened. The presence of native food handlers about Army messes should be considered as a potential danger. If their help cannot be avoided, their number should be maintained at a minimum, those so employed should be carefully selected by physical and bacteriological examination in accordance with Army regulations, and strict discipline maintained as to cleanliness of person.

(8) *Control of rickettsioses*. Mite-borne (scrub) typhus is present in Minahasa and very possibly

elsewhere in Celebes. As seen in New Guinea, the disease occurs especially in workmen and soldiers who have been clearing grassy areas (kunai grass), since mites live in the moist zone at the base of the grass stalks. All prospective camp sites should be thoroughly cleared of grass and the areas burned over before they are occupied. As far as possible, native laborers should be used for clearing. In New Guinea infection has not been found in the deep jungle. Liberal use should be made of available insect repellents. The current Army typhus vaccine does not protect against scrub typhus. Special attention should be given to bathing and to inspection of the lower parts of the body, especially after men have been in grassy land. Troops in these areas should be cautioned as to the importance of protective clothing, that is, trouser legs should be tucked into boots and long sleeves should be worn.

(9) *Cholera*. Although cholera has not occurred in this area for several years, under present conditions the disease would spread rapidly if introduced. In neighboring areas a few cases have occurred. In the fall of 1943 approximately 150 cases occurred in Japanese troops in Mainal; a cholera-like disease is endemic in southern Celebes. The procedures outlined in previous paragraphs for the protection of food and water are applicable. Immunization is required, and in areas where cholera cases occur stimulating doses may be necessary periodically.

(10) *Diseases of the skin*. Serious infections often follow minor wounds. All personnel should be impressed with the necessity for giving immediate first-aid treatment to all wounds, burns, abrasions, and insect bites regardless of size and apparent harmlessness. Daily bathing is highly desirable where water supplies make this possible. Thorough drying of all skin folds (toes, crotch, scrotum, armpits, groin) is imperative for the prevention of fungus infections. Army issue foot powder should always be applied after the bath.

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Table I. Physicians in Celebes and dependencies

	Government public health physi- cians	Military physi- cians acting as public health physi- cians	Private practi- tioners
Residency of Celebes:			
Banggai (Banggai Islands)	1		
Baoebaë (Boetoeng Is- land)		1	
Boentoeng (Salayer Island)	1		
Boelockoemba	1		
Bonthain	1		
Kendari	1		
Makassar	5		8
Madjene	1		
Mamoedjoe		1	
Masamba	1		
Palopo		1	
Pangkadjene	1		
Parepare		1	
Raha (Moena Island)	1		
Rantepao			1
Rapang	1		
Singkang	1		
Watampone		1	
Residency of Manado:			
Airmadidi	1		
Amoerang	1		1
Beo (Taland Island)	1		
Gorontalo	2		1
Kolonodale		1	
Kolongan Atas	1		
Kotamabagoe	1		
Langoan	1		
Liroeng	1		
Loewoek		1	
Manado	3	1	4
Noënggan	1		
Paloe		1	
Poso		1	
Tahoena (Sangihe Island)	1		
Tolitoli		1	
Tomohon			1
Tondano	1		
Wangkoy			1
Wantampone		1	

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Table II. Anophelines of Celebes

1. *A. aconitus*: widespread.
2. *A. barbirostris*: widespread.
3. *A. barbumbrosus*: Poso, Madjene, Paleleh, Manado.
4. *A. hyrcanus*: widespread.
5. *A. karwari*: Toradja area, Madjene, Mandar.
6. *A. leucosphyrus*: Paleleh.
7. *A. leucosphyrus hackeri*: Mamoedjoe, Toradja area, Madjene, Tolitoli.
8. *A. maculatus*: Toradja area, Watampone, Balangnipa.
9. *A. minimus*: Minahasa, Paleleh, Poso, Paloe.
10. *A. parangensis*: Manado, Minahasa, Paloe, Makassar.
11. *A. subpictus*: widespread.
12. *A. sundaicus*: Southwestern Celebes.
13. *A. tessellatus*: Manado, Minahasa, Paleleh, Toradja area, Polewali.
14. *A. umbrosus*: Poso, Madjene.
15. *A. vagus*: widespread.

From: Swellengrebel, N. H., and Rodenwaldt, E.: Die Anophelinen von Niederländisch Ostindien. 3d edition. Jena, Gustav Fischer, 1943.

Table III. Culicines of Celebes

1. *Aedes aegypti*.
2. *A. albolineatus* (Sangihe Island only).
3. *A. albopictus*.
4. *A. lineatopennis*.
5. *A. poicilius*.
6. *A. scutellaris*.
7. *A. vexans*.
8. *A. vigilax*.
9. *Armigeres malayi*.
10. *A. obturbans*.
11. *Culex annulirostris*.
12. *C. bitaeniorhynchus*.
13. *C. fuscana*.
14. *C. fuscocephalus*.
15. *C. gelidus*.
16. *C. quinquefasciatus*.
17. *C. sinensis*.
18. *C. sitiens*.
19. *C. tritaeniorhynchus* var. *siamensis*.
20. *C. vishnui*.
21. *C. whitmorei*.
22. *Mansonia annulata*.
23. *M. longipalpis*.

From: Bonne-Wepster, J., and Brug, S. L.: Nederlandsch-Indische Culicinen, Geneesk. tijdschr. v. Nederl.-Indië 77: 615-618, 1937.

Table IV. General hospitals of Celebes and dependencies

I. RESIDENCY OF CELEBES (1,015 beds):		
A. Celebes Proper:		
1. Bonthain.....	Government.....	50 beds.
2. Enrekang.....	District.....	24 beds.
3. Kaboengka.....	Estate.....	30 beds.
4. Kendari.....	District.....	30 beds.
5. Kolaka.....	District.....	20 beds.
6. Madjone.....	District.....	150 beds.
7. Makassar.....	Military.....	160 beds.
	Salvation Army.....	14 beds.
	Private.....	16 beds.
	Mission.....	(?)
8. Malili.....	District, Auxiliary Hospital.....	20 beds.
9. Mamoedjoe.....	District.....	20 beds.
	Military.....	(?)
10. Mara.....	District.....	10 beds.
11. Maros.....	Private.....	13 beds.
12. Masamba.....	District.....	30 beds.
13. Palopo.....	District.....	40 beds.
	Military Infirmary.....	12 beds.
14. Pangkadjene.....	Private.....	15 beds.
15. Parepare.....	District.....	40 beds.
	Military Infirmary.....	8 beds.
16. Rantepao.....	Mission.....	52 beds.
17. Rappang.....	District.....	14 beds.
18. Sinbkang.....	District.....	45 beds.
19. Watan Soppeng.....	District.....	20 beds.
20. Watampone.....	District.....	60 beds.
	Military Infirmary.....	8 beds.
21. Wawotobi.....	District.....	24 beds.
B. Salayer Island:		
1. Boetoeng.....	Private.....	18 beds.
C. Boetoeng Island:		
1. Baebaeoe.....	District.....	42 beds.
	Military Infirmary.....	(?)
D. Loena Island:		
1. Raha.....	Mission.....	32 beds.
II. RESIDENCY OF MANADO (1,040 beds):		
A. Manado Proper:		
1. Ambang.....	Estate.....	14 beds.
2. Amcoerang.....	Mission.....	16 beds.
3. Gorontalo.....	Government.....	44 beds.
4. Kaloewatoe.....	Mission.....	(?)
5. Kolonodle.....	District.....	32 beds.
	Military Infirmary.....	8 beds.
6. Kolongan Atas (in Sondar near Manado).....	Mission.....	44 beds.
7. Kotamobagoe.....	District.....	35 beds.
8. Liroeng.....	District.....	20 beds.
9. Loewoek.....	Estate.....	58 beds.
	Military Infirmary.....	12 beds.
10. Malinso.....	Estate.....	8 beds.
11. Manado.....	Government.....	124 beds.
	Mission.....	(?)
	Military Infirmary.....	8 beds.
12. Modajak.....	Estate.....	80 beds.
13. Palace.....	District.....	50 beds.
	Military Infirmary.....	8 beds.
14. Poigar.....	Estate.....	20 beds.
15. Poso.....	District.....	50 beds.
	Military Infirmary.....	8 beds.
16. Talawaan.....	Estate.....	40 beds.
17. Talisse.....	Estate.....	8 beds.
18. Tiniawangko.....	Estate.....	25 beds.
19. Tentena.....	Mission.....	22 beds.
20. Tobelomgng.....		(?)
21. Tolitoli.....	District.....	18 beds.
	Military Infirmary.....	(?)
22. Tomohon.....	Mission.....	130 beds.
23. Tondano.....	Mission.....	30 beds.
B. Sangihe Islands:		
1. Taheona.....	Mission.....	50 beds.

From: Geneeskundig Jaarboekje voor Nederlandsch Indië, 1939, volume II.

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Table V. Special hospitals in Celebes and dependencies

	Beds
A. Leprosaria:	
1. Lerang (Lariang)-----	177
2. Madjene (Kampong Baroe)-----	(?)
3. Malili-----	221
4. Malalajang-----	120
5. Palopo (Kalang Kalang)-----	41
6. Rantepao-----	57
7. Singkang-----	7
8. Watoesampo-----	49
B. Psychopathic hospitals:	
1. Makassar-----	305
2. Manado-----	35
C. Tuberculosis sanitaria:	
1. Noöngan-----	70

From: Geneeskundig Jaarboekje voor Nederlandsch Indie, 1939, volume II.

Table VI. Anophelines of the islands off south-eastern Celebes

	Boe-toeng ¹	Moena ¹	Ka-bae-na ²
<i>A. aconitus</i> -----	—	—	+
<i>A. aikenii aikenii</i> -----	+	—	—
<i>A. barbirostris</i> -----	—	+	+
<i>A. kochi</i> -----	—	—	+
<i>A. leucosphyrus</i> -----	+	—	—
<i>A. leucosphyrus hackeri</i> -----	—	—	+
<i>A. maculatus</i> -----	+	—	+
<i>A. minimus</i> -----	+	+	+
<i>A. subpictus</i> -----	+	+	—
<i>A. sundaicus</i> -----	+	—	—
<i>A. tessellatus</i> -----	—	—	+
<i>A. vagus</i> -----	—	+	+

From: ¹ Swellenerrebel, N. H., and Rodenwaldt, E.: Die Anophelinen von Nederlandsch. Ostindien, Jena, 1932.
² Brug, S. L.: Filaria bancrofti-overbrengers op Kabaena, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië 27: 88-98, 1938.

Table VII. Culicine fauna of Boetoeng and Kabaena Islands

	Boetoeng ¹	Kabaena ²
<i>Aedes aegypti</i> -----	+	—
<i>A. albopictus</i> -----	+	+
<i>A. annandalei</i> -----	+	—
<i>A. soutellaris</i> -----	+	—
<i>Culex alis (vishnui?)</i> -----	—	+
<i>C. annulirostris</i> -----	—	+
<i>C. fusccephalus</i> -----	—	+
<i>C. quinquefasciatus</i> -----	+	+
<i>C. tritaeniorhynchus</i> -----	—	+
<i>C. whitmorei</i> -----	—	+

From: ¹ Bonne-Wepster, J., and Brug, S. L.: Nederlandsch-Indische Culicinen, Geneesk. tijdschr. v. Nederl.-Indië 77: 615-617, 1937.
² Brug, S. L.: Filaria bancrofti-overbrengers op Kabaena, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië 27: 88-98, 1938.

Table VIII. Celebes—average rainfall

	Makassar (inches)	Bonthain (inches)	Rantepao (driest area in N. E. I.) (inches)	Paloe (inches)	Tondaro (inches)	Manado (inches)
January-----	27.8	5.6	18.4	1.8	7.6	18.4
February-----	21.8	4.7	16.5	1.6	6.5	14.1
March-----	17.2	4.9	20.6	1.8	6.5	12.1
April-----	5.7	5.2	21.0	1.7	8.7	8.0
May-----	3.5	8.3	14.2	2.0	8.3	6.4
June-----	3.2	8.5	9.3	2.6	6.4	6.8
July-----	1.6	5.4	6.8	1.8	4.0	4.8
August-----	0.5	2.0	4.9	2.0	3.1	4.0
September-----	0.6	1.1	5.2	1.7	4.2	3.5
October-----	2.0	2.1	8.2	1.4	5.7	4.8
November-----	7.6	3.2	12.0	1.8	8.6	8.8
December-----	25.4	4.3	18.3	1.6	8.0	14.9
Average annual-----	116.8	55.2	155.3	21.8	77.1	106.5

From: Ekblom, T.: Les Races Suédoises de l'*Anopheles maculipennis* et leur Role Epidémiologique, Bull. Soc. path. exot. 31: 647-655, 1938.

BIBLIOGRAPHY

Prepared by the Office of The Surgeon General, United States Army, from data on file in the Medical Intelligence Division, Preventive Medicine Service. This matter is supplemented by the following reports and texts:

1. Annual Reports of the Public Health Service of the Netherlands East Indies in Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië.
2. BONNE, C., and SANDGROUND, J. H.: Bilharzia japonicum aan het Lindoe meer, Geneesk. tijdschr. v. Nederl.-Indië 80: 477-481, 1940 and 82: 21-37, 1942.
3. BONNE, C.: Echinostomiasis aan Het Lindoe Meer in Celebes, Geneesk. tijdschr. v. Nederl.-Indië 81: 1139-1167, 1343-1357, 1941 and 82: 3-21, 1942.
4. BRUG, S. L.: De Overbrenging van Filaria malayi te Kalawari (Paloe Manado), Geneesk. tijdschr. v. Nederl.-Indië 77: 1462-1470, 1937.
5. BONNE-WEPSTER, J., and BRUG, S. L.: Nederlandsch Indische Culicidon, Geneesk. tijdschr. v. Nederl.-Indië 77: 515-617, 1937.
6. BRUG, S. L.: Filariasis in Nederlandsch-Indië III, Geneesk. tijdschr. v. Nederl.-Indië 71: 210-240, 1931.
7. BRUG, S. L., and DE ROOK, H.: Filariasis in Nederlandsch-Indië, Geneesk. tijdschr. v. Nederl.-Indië 73: 264-279, 1933.
8. VAN EERDE, J. C.: De Volken van Nederlandsch Indië. Elsevier, Amsterdam, 1921.
9. JURGENS, A. L.: De Overbrenging van F. malayi in de Onderafdeeling Mamoedjoe, Geneesk. tijdschr. v. Nederl.-Indië 72: 953-960, 1932.
10. KISMAN, M.: Nier en Ureterstenen en het Voorkomen daarvan in de Minahassa (Celebes), Geneesk. tijdschr. v. Nederl.-Indië 81: 2682-2693, 1941.
11. KRYGSMAN, B. J., and PONTO, S. A. S.: De Tekenen van den Oost Indischen Archipel. Departement van Landbouw, Nyverheid en Handel. Veeartsenykundige Mededeelingen No. 79, 1932.
12. KÜNDIG, A.: Eenige Statistische Gegevens uit de Minahassa, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië 23: 167-194, 1934.
13. MACHSOES, M.: A. Barbirostris als Malaria Overbrenger in de Residentie Celebes. Geneesk. tijdschr. v. Nederl.-Indië 79: 2500-2515, 1939.
14. DE MEYERE, J. C. H.: Studien über Südostasiatische Dipteren, Tijdschr. v. Entomol. 60: 275-369, 1917.
15. DE MOOR, C. E.: Epidemic Cholera in South Celebes caused by vibrio El Tor, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië 28: 320-356, 1939.
16. OOMEN. Report of Meeting of the Minahassa Medical Society, Geneesk. tijdschr. v. Nederl.-Indië 81: 99, 1941.
17. Peace Handbooks issued by the Historical Section of the Foreign Section Vol. XIV. No. 85 Celebes. London, H. M. Stationery Office, 1920.
18. DE ROOY, N.: The Reptiles of the Indian Australian Archipelago. Leyden, M. J. Brill, 1917.
19. STEKHOFEN, S. J. H.: The Tabanids of the Dutch East Indian Archipelago, Treubia Vol. VI Supplement 1926. 551 pages.
20. SITANALA, J. B.: Voorkomen van lepra in de Nederl. Indische Archipel, Acta Leedensia 14: 224, 1939.
21. VAN SLEE, W.: Onderzoek naar het Voorkomen van Filaria te Mamoedjoe, Geneesk. tijdschr. v. Nederl.-Indië 70: 444-450, 1930.
22. Smithsonian Institution. U. S. National Museum. Card Catalogue on Arthropods of the Orient.

[TB MED 67]

23. STIBBO, D. C.: Sandbergen, F. J. W. H., in collaboration with Tellings, P. A.: Encyclopaedie van Nederlandsch Indië, Vol. 1-8. Gravenhage, Martinus Nijhoff, 1917-1939.
24. SWELLENGREBEL, N. H., and RODENWALDT, E.: Die Anophelinen von Niederländisch Ostindien. 3rd edition. Jena, Gustav Fischer, 1932.
25. TATE, G. Some Muridae of the Indo-Australian Region, Bull. Amer. Mus. Nat. Hist. 72: 512-580, 1936.
26. TESCH, J. W.: Over Filariasis en Elephantiasis byeen geïmporteerde Javaansche Bevolking in Celebes, Geneesk. tijdschr. v. Nederl.-Indië 77: 1434-1461, 1937.
27. TILAAAR, A.: De Resultaten van Thorax Doorlichting bij Onderwyzers in de Minahassa en de Bewoners van het Dorp Noöngan, Geneesk. tijdschr. v. Nederl.-Indië 79: 3452-3462, 1939.
28. THOMPSON, G. B.: A List of Siphonaptera, Temminckia 3: 137-150, 1938.
29. VENHUIS, W. G.: Voorloopige Entomologische Mededeelingen omtrent An. Barbirostris van Celebes, Geneesk. tijdschr. v. Nederl.-Indië 79: 2515-2519, 1939.
30. VAN DER WALLE, N.: Ratten en rattevlooiën van Macassar, Mededeelingen 21: 263-271, 1932.
31. WALCH, E. W.: Nederlandsch-Indische Trombiculae en verwante myten, Geneesk. Tijdschr. v. Nederl.-Indië 67: 922-933, 1927.
32. WAROUW, S. J.: Resultaten van trachoom onderzoek by enkele bevolkingsgroepen in Nederl.-Indië. Heademisch Proefschrift, Leiden, 1935.

[A. G. 300.5 (6 Jul 44).]

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For explanation of symbols, see FM 21-6.

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