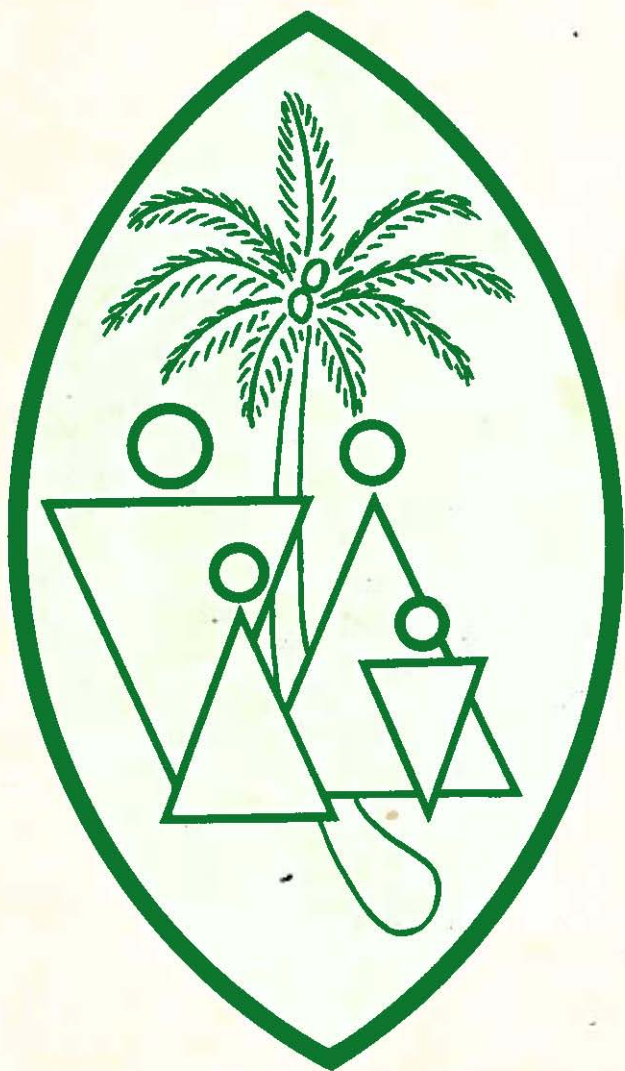


A HISTORY OF HEALTH ON GUAM



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Oliva, Olivia and Michelle

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GUAM: THE ISLAND

Guam is the southernmost island of the 420 mile long chain of fifteen islands which constitutes the Marianas district of Micronesia. The island has a total land area of 212 square miles, is 30 miles long by 4 to 11 miles wide and, in outline, resembles the imprint of a left foot implanted on a roughly north-south axis. The northern half or "toe" of Guam is composed of a series of uplifted coral terraces ranging from 200 to 600 feet in height. The relatively thin soil and underlying faulted limestone of this area permit rapid percolation of rain water. Consequently there are no streams or rivers and water supplies for this region are obtained from numerous wells.

Guam's rolling southern half, dominated by a chain of mountains whose peaks reach as high as 1,344 feet, is primarily of volcanic origin. Here a heavy clay soil permits only slow absorption of rain water and rivers and streams abound. Drinking water for the southern area is provided by a system of reservoirs and holding tanks.¹⁰⁵

Located but 13 degrees above the equator, Guam enjoys a year-round tropical climate. Daily temperature extremes generally range from 76 to 87 degrees Fahrenheit with the mean average daily temperature being about 81°F. The recorded all-time high and low are 93°F. and 63°F. respectively. Annual rainfall averages about 85 inches. During the rainy season stretching from July through November, rain will fall an average of 23 to 25 days each month accumulating 8 to 14 inches monthly. During the January to May dry season, rain can be expected to fall on 15 to 19 days each month for monthly precipitation totals of 2 to 4 inches. June and December are considered transition months.¹⁰²

During Guam's rainy season, the relative humidity ranges from an average of about 75% in the daytime to about 85% at night; dry season humidity readings will average 10% lower. Brisk easterly tradewinds refresh the island most of the year although they may disappear when needed most during the height of the rainy season. Paradoxically, this is also the time of year that the island is most likely to be visited by typhoons spawned in the Western Pacific. While the typhoon season is generally reckoned as beginning in July and ending in November, these storms may occur at other times of the year as well.¹⁰²

Typhoons have probably dealt heavily with the island of Guam and her people since time immemorial. The first destructive typhoon to occur in historical times passed by on September 8, 1671 leaving most native homes, a recently completed stone church and thousands of breadfruit and coconut trees leveled in her wake.⁶

Rarely does a year pass during which at least one typhoon or tropical storm has not made her presence in the vicinity of Guam felt by high winds, rain and heavy seas. Particularly destructive typhoons are recorded as occurring in August of 1848 and during the month of November in 1913 and 1940. Another especially destructive period began with the typhoon of April, 1949. It was followed in November of the same year by a second typhoon and by a third in May of 1950. This triple attack was a serious setback to the island's economy in general and to its agricultural resources in particular. The island enjoyed a brief respite

until October 1953 when another typhoon inflicted severe damage, particularly in the northern part of the island.¹⁸

Slightly more than nine years later on the night of November 11, 1962, what was probably the most destructive storm ever to hit Guam came ashore. With sustained winds of 180 miles per hour and gusts to 207 m.p.h., scarcely anything could stand in the way of Typhoon Karen as she cut a wide swath of destruction from east to west across the densely populated central waist of the island. Despite adequate warning and the general use of typhoon-proof shelters, nine deaths were recorded. An estimated 78% of the privately owned residential and commercial structures on the island were destroyed and total damage was estimated to be \$40 million.^{6,82}

Earthquakes, too, have exerted a strong influence on the island of Guam. Situated near the western arm of the system of earth faults that rim the Pacific, the island is subjected to an almost continuous series of earth tremors, most of which, fortunately, are of too small a magnitude to be noticed by island residents.

Birthpains of earthquakes and tidal waves undoubtedly accompanied the volcanic activity that built the chain of underwater peaks that were to eventually emerge as the Mariana Islands. Of cataclysmic proportions too must have been the earth movements that lifted former coral reefs to form Guam's northern plateau. Severe earthquakes have struck frequently in historic times also. Between 1825 and 1936, 19 quakes of sufficient strength to be felt by the islanders were recorded; of these 10 were severe enough to cause structural damage to buildings.¹⁵ What was perhaps the most destructive quake of modern times occurred on September 22, 1902. Virtually every masonry building on the island was damaged if not entirely destroyed.¹⁸ In many parts of the island cracks appeared in the ground spewing forth, in some cases, columns of water or sulphurous fumes.⁶

THE PEOPLE

Guam was the first island of the vast Pacific to be discovered by Europeans, the first to be colonized by commercial interests and the first, but by no means the last, whose population was to be decimated by this confrontation with western civilization.¹

The original inhabitants of Guam, known as Chamorros, are thought to have been a Malaysian race that migrated from southeast Asia. Both linguistic and archeological evidence link the Chamorros to the Philippines, in fact Magellan's Malaysian interpreter-slave reportedly was able to converse with both the natives of Guam and those of Cebu in the Philippines.^{1,100}

Whatever their origin, the Chamorros were by all accounts a healthy race. They were described as tall, robust, and amazingly strong by European standards.⁶ For almost 150 years after their "discovery" by Magellan's fleet in 1521, they continued to live as their ancestors had, only infrequently playing host to wandering explorers and adventurers who dropped anchor in the island's inviting bays seeking replenishment of their provisions. During this time, however, Spain had been subjugating the Philippines and extending her influence throughout the East Indies. Profits from this lucrative trade flowed back to Spain via the Americas

rather than westward around the great barrier of the African continent. The Marianas, being the only landfall between Acapulco and Manila, principal Spanish ports on opposite sides of the Pacific, assumed strategic importance.⁶²

Accordingly, on June 15, 1668, the first serious attempt to colonize the Marianas began when five priests of the Jesuit order and a garrison of thirty-five soldiers stepped ashore on Guam. Although at first genial hosts, the Chamorros soon grew disillusioned when they found that fulfillment of the ambitious Spanish plans for a thriving colony meant long hours of tilling fields or building roads and other civic improvements. In addition to the imposition of forced labor, zealous priests tried to enforce a new code of living to replace existing deeply ingrained cultural institutions. After a single year of apparent progress, a rebellion erupted that was to prove to be the prelude to a quarter century of almost continuous warfare. While the population of Guam alone had been estimated at 50,000 in 1669, by 1720 the total Chamorro population of all the Mariana Islands had been reduced to less than a thousand persons, probably not a single adult male among them.^{6,18,62}

With peace established at the price of the extinction of a race, there began a long period of slow rebuilding. With contributions from their Spanish rulers, from Mexican colonists, Philippine political prisoners, laborers and tradesmen, Japanese merchants, and from an occasional British, American or German seaman who had had his fill of life on the high seas, there eventually arose a distinctive new people to replenish the land. These were the modern Guamanians, proud of their ancient Chamorro ancestors, retaining much of the flavor of their Spanish heritage and, more recently, enthusiastically adopting yet a new role as citizens of the United States of America.

POLITICAL DEVELOPMENT

The matrilineal society of the ancient Chamorros was ruled by district chiefs whose power was based on inherited wealth in the form of land and special prerogatives such as the right to make certain types of shell money.¹⁰⁴ Although Guam was apparently never unified under the rule of a single monarch or king, the chiefs of the Agana district were acknowledged as the most powerful and frequently served as social arbiters in a complex culture that included a rigid caste system.^{6,18}

With the arrival of the Spanish, centralized authority was established, initially in the form of a military commander and eventually as a governor appointed by the royal court in Madrid. Although the authority of the governor was absolute, a semblance of self-government was permitted in the selection of district administrators who replaced the former native chiefs. These were appointed by the governor from a slate of three names presented by village leaders.¹⁸

As a result of the 1898 Treaty of Paris which formally ended the Spanish-American War, the United States of America for the first time in its history found itself among the ranks of the colonial powers. Although the Americans, who according to their Spanish predecessors were all barbarians and heretics, were at first regarded with suspicion, their efforts to improve the lot of island residents, particularly in the areas of public education and health, soon won such nearly

universal approval that the American Governor could report by 1908 that Guamanians had become both "loyal and devoted" to the United States.¹⁸

Placed under the administration of a branch of the military services (Navy Department) due to its strategic importance, it is probably not surprising that an attitude of benevolent paternalism characterized the new government of the Territory of Guam. While for whatever reason reluctant to grant Guamanians the full range of political freedoms that American history books and newspapers led them to covet, to the credit of the U.S. Naval governors it must be said that they tolerated and encouraged progress, however slow, towards realization of these ambitions.

One significant step in this direction was the establishment of the First Guam Congress in 1917. Although serving strictly in an advisory capacity and composed entirely of islanders appointed by the Governor, it provided a platform for the expression of popular opinion on matters of local interest.

In 1930, further progress towards self-government was advanced by the inauguration of a revitalized Second Guam Congress. Although again all legislation was subject to approval by the governor, in this case the legislators were selected by popular election. During this period Guamanians were particularly active in seeking to advance their quest for increased local self-government and United States citizenship. This effort reached its zenith when in 1936 two representatives of the Guam Congress, supported by funds raised by popular subscription, left for Washington, D.C. to present their petition directly to the U.S. Congress. While succeeding in having an interview with President Roosevelt and gaining the support of a number of senators, the bill introduced in their behalf failed to pass.^{5,18,75}

Further progress was temporarily interrupted when the Imperial Japanese Army invaded Guam in December of 1941. There followed what was to be for the Guamanians their darkest period since the Spanish campaigns of subjugation. Making no pretense of fostering a democratic form of government, the Japanese promptly put an end to the liberties to which Guamanians had become accustomed. An example of the treatment they could expect was presented immediately after the invasion when a young Guamanian who refused to help lower the American flag still flying in the capital city of Agaña was decapitated on the spot.⁷

Although Agaña had been the population center of pre-war Guam, most families moved to their ranches in the countryside for the duration of the occupation. There they were able to raise food to supplement the ever shrinking supplies of rationed staples. If they were fortunate, they only saw representatives of the military administration on those occasions when they arrived to confiscate their produce.⁷²

As the tides of war began to turn against the Japanese and it became apparent that the Americans would soon attempt to retake the island, conditions took a decided turn for the worse. Most able bodied men were forced to work on the construction of new air fields, beach defenses and elaborate cliffside tunnel shelters. Lest they escape into the jungle, the men were frequently held in stockades under primitive sanitary conditions and were unable to visit their families.^{18,52}

As the American invasion forces neared Guam in early July, 1944, any remaining pretense of humanitarianism disappeared. All residents were forced to march on foot to what were to become concentration camps—the Guamanians had to construct all shelters and other facilities from material they could scavenge in the nearby jungle. Those who loitered in the towns or were unable to keep up with the line of march were summarily executed.^{20,59,90}

After the liberation of Guam, there followed a two-year period under a military government devoted primarily to the reconstruction of a devastated island. Undoubtedly influenced by the intense loyalty, often at great personal sacrifice, that was shown to the United States during the war years, political events began to move with what must be considered dazzling speed when viewed within an historical perspective.

On May 30, 1946 the interim military rule ceased, a civil government under the administration of the Navy Department was established and full civil liberties were restored. In June of the same year voter registration was held and the following month elections were held for the first post-war Guam Congress.⁹¹

On August 7 the following year the Acting Secretary of the Navy granted the Guam Congress the sole right to modify existing Guam law and, in addition, the power to override vetoes of legislation by the Governor (overridden measures were submitted to the Secretary of the Navy for final action).¹⁸

In September of 1949, President Truman transferred responsibility for the administration of Guam from the Department of the Navy to the civilian Department of the Interior and appointed Guam's first civilian governor. The following month legislation was introduced in the U.S. Congress that was to fulfill the aspirations for which two generations of Guamanians had labored. Passed by Congress and signed into law by President Truman, what was to be known as the Organic Act of Guam became effective on July 21, 1950. On that date, the sixth anniversary of the liberation of the only United States soil to be occupied by enemy forces during World War II, the Guamanian people were granted full U.S. citizenship and increased self-rule.¹⁸

The most recent and perhaps most dramatic event in Guam's long history of political development occurred in November of 1970 when island residents went to the polls to select their first elective governor. Carlos Garcia Camacho took the oath of office on January 4, 1971 to become the 109th governor of Guam since 1676. Now, with both a popularly elected legislative body and chief executive, it could truly be said that self-government had come to Guam. While this brings us to the present in our review of the political development of Guam, it would perhaps be shortsighted to consider this the final destination in what has been a long and eventful journey towards self-government. Many Guamanians have expressed a desire to see Guam join the union of states that constitutes the United States of America, just as her former sister territories of Alaska and Hawaii have. Perhaps this ambition too will be realized at some future date.¹⁹

ECONOMIC DEVELOPMENT

The economy of the ancient Chamorro inhabitants of Guam was based primarily on gardening in jungle clearings, the gathering of wild fruits and vegeta-

bles and fishing. Members of the highest class of the native society, known as *matua*, were the principal landowners and controlled most of the wealth of the island. Certain prestigious occupations, such as fishing and canoe building, were reserved for them also. Descent and inheritance were through the mother's brother—nephews rather than sons became heirs.^{18,103}

While the Chamorros had lived in numerous small villages that formed an almost continuous chain along the island's beaches and fertile river valleys, by 1680 the Spanish had begun to force them to concentrate in a few large villages where more control could be exercised over their activities. Most villagers could now no longer seek their livelihood in the immediate vicinity of their residence and a pattern of working and residing in separate areas frequently far removed from each other was established. While this custom imposes no particular discomfort on the island resident of today, when "shanks mare" or a carabao cart were the only transportation alternatives it must have posed a considerable inconvenience and was undoubtedly wasteful.¹⁰³

Food for the Spanish garrison was raised on lands confiscated by the Crown. These royal estates amounted to approximately 10% of the total area under cultivation at that time. Labor for the royal estates was obtained in a variety of ways. Sharecroppers could work the land and receive a share of the produce, a labor tax was instituted which required that time be spent on projects specified by the government, convict labor was imported from the Philippines and improvident individuals were frequently reduced to signing contracts to work until they had cleared their accumulated debts.¹⁰³

The garrison in Guam received an annual cash grant from their superiors in Mexico to pay the salaries of soldiers and civil servants. With these funds clothing and other goods which could not be manufactured locally were purchased. This might have served as the nucleus on which a viable economy could be built but the Spanish governors, who had the sole right to import goods, sold these at exorbitant prices and pocketed the profits. As a result, what little coinage came to the island generally, by one means or another, found its way into the Governor's purse where it remained to provide a comfortable hedge against retirement.¹⁰³

As a result of poor economic policies by its administrators and a lack of any special natural resources, the island suffered economic stagnation. Since it produced little of value, serving only as a water and provision depot for infrequent ships crossing the Pacific, it soon became a burden on the Mexican treasury and the annual grant for administrative purposes was reduced from 20,000 pesos to 8,000. As Spain began to decline as a major power, her colonies were increasingly left to their own resources and even the few well-intentioned governors of Guam were hard pressed to maintain deteriorating conditions. In 1815 the last State Galleon visited Guam and thereafter the island was dependent on the chance visits of merchantships, warships or whalers for contact with the outside world.^{78,98}

During the second quarter of the nineteenth century Guam was an important port of call for American and British whalers. Although this presented a new opportunity for a significant boost to the local economy, again most of the money earned by natives for supplies of water, wood, pork, fresh fruits and vegetables quickly found its way into hands of unscrupulous government officials.¹⁰³

By the end of the Spanish occupation of Guam, what had once been an island paradise had been allowed to deteriorate into a tropical slum. With the advent of American rule, an improvement in sanitary conditions was to be a major preoccupation but the need to improve economic conditions was recognized also. Among the first new laws promulgated was one which, as of February 22, 1900, abolished "...Human Slavery or Peonage in the Isle of Guam." By this law all contracts for personal labor were annulled and persons bound by such contracts were permitted to work for money to pay off their debts. To eliminate exorbitant prices, another part of the vicious cycle which had previously kept much of the population in perpetual debt, permission was granted for native merchants to have goods imported via U.S. Navy ships, thus creating healthy competition in a previously monopolistic market.¹⁸

Although major abuses had been corrected, economic progress during the first half of the twentieth century was slow. Guam is poor in natural resources. Insufficient forestation remained to support serious lumber production and no mineral deposits of consequence had been discovered. Although a few merchants had managed to develop successful business enterprises, their progress was limited by the size and character of their potential market. An event that was particularly helpful to the development of the island's economy was the establishment of the island's first banking institution in 1915. Known as the Bank of Guam, it was capitalized with \$15,000 transferred from the treasury of the Naval Government. It proved so popular and so stimulated island business that by 1917 assets amounted to \$109,216.98.¹⁸

Copra was produced as a cash crop and was the island's largest single industry in pre-WW II days. In 1937 the value of the copra exported from Guam was put at \$157,051.92 (U.S.). Despite the use of improved techniques such as mechanical driers, by 1940 the value of copra exports had plummeted to \$50,552.86, due both to falling world market prices and a developing preference of many Guamanians to earn their living working for the Naval or Island Government or in private business.⁴⁵

By the end of WW II many of the copra plantations had been destroyed and by 1949 this industry had, for all practical purposes, ceased to exist. Even the family ranches were generally neglected as most Guamanians sought paying jobs. In contrast to the pre-war subsistence agricultural economy, post-war Guam could be likened to a metropolitan area, as dependent on off-island sources of food and other necessities as any city of comparable size would be dependent upon sources beyond its own corporate limits for the same goods.³⁹

In 1961 the basis for an economic upsurge was laid when the requirement that visitors to Guam obtain a military security clearance was suspended. In 1963 the Guam Tourist Commission was established to help expand the island's economic base by encouraging the development of tourist-oriented industries. Whereas in 1964 Guam had less than 50 transient rooms to accommodate visitors, by 1968 this had been increased to 500 rooms. Between 1964 and 1968, the number of visitors to Guam remaining 24 hours or longer increased from 1,975 to 18,000 and spending by tourists increased from \$210,000 to \$3,000,000.¹⁰⁸

Guam is now served by four airlines licensed as international carriers, some giving twice daily service while as recently as 1966 a single airline provided only two flights weekly to Guam. Further evidence of a healthy economic future for the Territory includes continued diversification. Latest developments in this area include the establishment of a 29,500 barrel-per-day fuel refining plant and a 1 million case-per-year brewery. With a gross territorial product that has increased from \$70 million in 1961 to \$350 million by 1971, Guam's economic future does indeed look bright.⁵⁷

ORGANIZATION OF HEALTH SERVICES

Little information is available about the organization of health services on Guam during the Spanish administration. At least as early as 1856, however, it apparently was customary for a "surgeon" to board arriving vessels and examine the passengers for the presence of communicable diseases.³

With the advent of the American administration, preventive medicine and health care assumed an important role. While administratively there existed both a Medical Department, Naval Government of Guam and a Department of Health, Island Government of Guam, for all practical purposes they functioned as a single agency since the same personnel served both organizations.⁵⁷

As first organized in 1900, health services were provided by 3 naval medical officers and a Guamanian leper hospital attendant. By 1920 staffing had been increased to 8 physicians, 30 corpsmen, 8 Navy nurses, 14 native nurses and 2 dental surgeons. Staffing remained at about this level until the Japanese invasion. During this period one medical officer was assigned to act as Health Officer. His duties were to assure the purity of water and food supplies, provide for proper sewage disposal, oversee the general sanitation of the island and investigate any communicable disease that might occur among island residents, military or civilian.
18,35,45,77

No official records of health activities during the Japanese occupation are known to have survived the war. Although health services were offered free of charge to civilians who came to the hospital, many were reluctant to do so except in dire emergency.^{52,56} This is not surprising in view of the treatment they experienced at the hands of non-medical occupation personnel.

That this period did not develop into one to be noted for particularly poor health may perhaps be attributed to several factors. The Americans had been enthusiastic vaccinators and sufficient "herd immunity" may have been established to protect the population against many diseases for the duration of the occupation. Secondly, most residents of the larger villages, Agaña in particular, left their town homes to live on relatively isolated ranches. Although sanitary facilities there were in many cases minimal, 40 years of health education effort had provided at least the rudiments of the knowledge necessary to lead a healthful existence.

The role of the native nurses who had been trained prior to the war was also particularly important during this period. By the time the nursing school was closed by the Japanese, there had been approximately 89 graduates.⁵⁶ They, together with a single Guamanian physician, constituted the principal source of health care for the indigenous population of the island, numbering at that time

about 23,000 persons.¹⁰⁷ Among the myriad problems they faced, perhaps the most critical was a shortage of medicines. All drugs had been confiscated by the Japanese and although the nurses were at times able to smuggle medicine out of the hospital to aid sick Guamanians, they frequently had to resort to the use of locally available home remedies.⁵² It is not surprising that this period saw a rebirth of the folk medicine art that earlier had been threatened with extinction.

When the Americans returned to Guam in 1944, health services were again organized as they had been before the war, the Department of Health being responsible for all health related services. Effective July 1, 1964 under civilian administration, health service functions were divided between two agencies; the Guam Memorial Hospital and the Department of Public Health and Welfare. The hospital provided medical treatment, certain rehabilitation services and, at a later date, mental health services.

The Division of Public Health of the Department of Public Health and Welfare was responsible for maintaining adequate health standards for the community. This was to be accomplished through immunization programs, sanitation inspections of private and public facilities, special programs to control specific contagious diseases such as tuberculosis and leprosy, and the provision of public clinics for the early detection of disease. Although the division does provide treatment services in a few instances such as to prevent or control incapacitating disease complications or epidemics, its activities are primarily preventive in nature.
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The Division of Welfare (later renamed the Division of Social Services) assumed duties which, under the military administration, had been administered by the Guam Chapter of the American Red Cross. Services rendered by the division include old age assistance; medical assistance for the aged; aid to families with dependent children and to the blind or disabled; and general assistance, protective, corrective and counseling activities for young people to curb the problems of juvenile delinquency and school dropouts.⁵¹

Further reorganization had occurred by 1971 when the importance of two activities formerly within the Division of Public Health was recognized and each was elevated to divisional status. These became the Division of Dental Health and the Division of Environmental Health Services.

An indication of the current commitment of the Government of Guam to the preservation and improvement of the health and well-being of island residents may be gained by a review of expenditures for those purposes. With a civilian population of approximately 60,000, total government expenditures for Fiscal Year 1971 were \$54,761,177.44. Of this total, operation and maintenance of Guam Memorial Hospital accounted for \$4,539,708 while expenditures of the Division of Public Health amounted to \$1,891,466.70. Guam Memorial Hospital had a medical staff roster of 52 physicians (9 employed full-time) and 4 dentists and employed approximately 120 nurses. Public Health employed full-time 3 physicians, 3 dentists, 1 veterinarian and 48 nurses. Public Health also employed several physicians on a part-time basis to conduct its numerous clinics.

HEALTH SERVICES FACILITIES

The date that the first hospital was established on Guam is not known but one may have existed as early as 1667 since the Colegio de San Juan de Letran constructed in that year was at times used as a hospital. Staffed at the most by two military doctors and two corpsmen (there were no nurses in those days), the services of this facility were generally limited to caring for Spanish military or administration personnel and their families. Guamanian patients, for better or for worse, were treated at home.⁹⁵

Visitors to Guam as early as 1818 reported that lepers were confined to isolated houses but it was not until 1890 that an attempt was made to gather all leprosy patients in a hospital especially constructed for that purpose near the village of Pago. An interesting aspect of this endeavor was the means by which it was financed. Due to the extreme shortage of funds available for any public improvement projects, the Governor used the profits from the sale of beef and pork produced on the neighboring island of Tinian to support the hospital. Within two years, however, a typhoon had destroyed the facility and patients were dispersed throughout the island once again.^{93,95}

With the arrival of the first American administrators in 1899, free dispensaries were established in Agana and Port Luis d'Apra. In their first year of operation, 1,141 islanders (about 10% of the native population) were treated. As the primitive condition of island roads made travel difficult and hazardous, a navy ship was also outfitted to serve as a floating clinic to serve the otherwise isolated coastal villages of the southern part of Guam.^{6,91,93} By 1920 outpatient clinics staffed by corpsmen had been established in 6 outlying villages and an additional 6 villages had aid stations manned by a patrolman or school teacher trained in first aid.⁹⁵

A hospital for lepers to replace the one destroyed by the typhoon of 1892 was built at Asan in 1899 but it in turn was destroyed by another storm in 1900.^{63,91} In 1902 a hospital-farm was established for lepers in the Tumon Bay area and patients were confined there as they came to the attention of health authorities. An intensive search ordered by the Governor in that year turned up 20 cases who were being hidden by well-meaning, if misguided, friends and relatives. In 1907 the U.S. Congress made a special appropriation to support the care and treatment of leprosy patients; by this time residents of the colony numbered 85.^{93,103}

Although a modest inpatient facility for the general care of military personnel was established in temporary quarters by 1900, it was not until 1901 that a civilian hospital was constructed, largely through the efforts of the wife of then Governor Seaton Schroeder. Named the Maria Schroeder Hospital in her honor, it continued to operate as a municipal hospital until 1910 when it became Ward I of the U.S. Naval Hospital, serving both Guamanians and military dependents. In 1905 a 10 bed civilian hospital and dispensary was established through public subscription. Known as the Susana Hospital, again in honor of a Governor's wife who spearheaded the effort, it served as a ward for women and children until it was destroyed by the earthquake of 1909. Before the year was out, however, the Navy had constructed another facility to take its place. This structure

was labeled Ward III. The same year the temporary military hospital established in 1900 was replaced with a permanent structure to be known as Ward II.

By 1911 the need for additional civilian hospital services not provided by the Naval Hospital (Wards I, II, and III) was apparent. The construction of a second Susana Hospital was financed by public subscription. Total cost was \$1,500 for building materials — labor for its construction was donated by island residents.^{63,84}

Again to help alleviate crowded conditions a 30-bed civilian tuberculosis hospital was constructed in 1916 on a hill overlooking the principal complex. This site was chosen because it was felt that the brisk breezes to be enjoyed in that area would be particularly beneficial to TB patients. This structure was in use until after 1930 when it was necessary to temporarily return the TB patients to the main hospital complex. Construction of a modern two story concrete addition to provide them with new quarters was interrupted by the Japanese invasion.⁶³

All hospital facilities except the new TB wing were destroyed during the closing days of the war. As American forces landed, temporary field hospitals were established in secured areas of the Agat and Anigua beachheads. Later both the civilian and military wards were moved to a complex of Butler buildings in the village of Tamuning. The civilian ward, renamed Guam Memorial Hospital in 1946 in honor of the Guamanian casualties of WW II, came under civilian administration in 1950 and in 1956 moved into a modern reinforced concrete 236 bed structure nearby. It now serves a civilian population of more than 60,000 persons, generally filled to an occupancy rate in excess of 100% of its originally intended capacity. Due to certain design deficiencies which make it impractical to expand the present facility, studies are currently underway to design an entire new hospital complex to serve Guam's civilian community.^{55,61,63}

The U.S. Naval Hospital moved from its temporary buildings to a typhoon-proof 350 bed structure overlooking the city of Agana in 1954. In addition to caring for active duty military personnel and their dependents throughout the Western Pacific, it cooperates with civilian authorities of Guam and the Trust Territory of the Pacific Islands by providing both routine consultative and emergency services.

The earlier policy of providing village level services was continued after the war also. In 1970 the Division of Public Health operated 11 village clinics that provided complete well child and maternal care services as well as cancer detection services, family planning information and home care supervision. Central clinics located in two additional strategically located villages also provided dental health and communicable disease control services as well as chronic disease supervision and some crippled children services.²⁵

RESEARCH FACILITIES

Since 1956 the National Institute of Neurological Diseases and Stroke has maintained a permanent staff on Guam, generally consisting of a neurologist acting as officer-in-charge, a consulting physician, technical support personnel (several of whom are graduates of the former Navy School of Medical Practitioners) and

a clerical staff. While their principal mission has been to investigate the epidemiology and pathogenesis of the ALS-PD disease complex as seen in the Marianas, therapeutic trials of several drugs have been conducted also. Of those drugs tested, L-dopa has shown some promise for the treatment of patients with symptoms of Parkinsonism-dementia.⁹²

The second and at present only other facility on Guam devoted primarily to research, some of which has an impact on public health, is the Marine Biology Laboratory of the University of Guam. Built in 1970, the first increment of the Laboratory is located at the edge of Pago Bay on the island's rugged east coast.

Important studies conducted by the Laboratory thus far have been concerned with establishing base-line ocean environment data for the Agana Bay and Tanguisson Point areas (the former being the site of an existing sewage outfall and proposed new sewage treatment plant, the latter the site of an electrical power generating plant which discharges heated water into the sea). Other activities include assisting in the investigation of ciguatera fish poisoning incidents on Guam and in the Trust Territory of the Pacific Islands and a study of the extent to which local fishes are contaminated with heavy metals such as mercury and arsenic.²⁸

INDIGENOUS MEDICAL BELIEFS AND PRACTICES

An early observer of Guam's native population remarked that as "... they know few infirmities so they know few medicines, and cure themselves with a few herbs which necessity and experience have taught them to be possessed of some virtue."⁶

The Chamorros believed in the immortality of the soul and the skulls of departed ancestors were carefully preserved in plaited baskets which occupied a prominent place in each household. The souls, or *aniti*, were not necessarily confined to these baskets but it was hoped they would accept them as their earthly abode when not traveling to and fro on whatever business or mischief they wished to conduct. It was believed that the *aniti* were possessed of supernatural powers which they would be willing to use to assist those they favored or harm those who dared to incur their wrath.⁶

While there was no organized priesthood to enforce Chamorro religious beliefs, a class of professional sorcerer known as *makahna* existed who were believed to possess special abilities to converse with the *aniti* and, with their help, control the weather, produce abundant or poor crops and bring health, illness or even death to island residents.^{6,18}

By the end of the Spanish military campaigns to subjugate the Marianas, the *makahnas* had been eliminated but two less powerful groups arose to take their place. These were the *kakahna* who retained some supernatural powers and are believed to be able to cause illness as well as cure it, and the *suruhana* whose vocation is limited to the use of herbs to treat illness (see Appendix 2, Medicinal Plants of Guam).^{6,18} Although their activities are frowned upon by health authorities, as late as 1972 at least 24 "herb doctors" were known to be practicing their art on Guam; several of these had reputations as *kakahna* as well.

MEDICAL AND PARA-MEDICAL EDUCATION

Education available to Guamanians during the Spanish period consisted of elementary reading, writing, arithmetic and Spanish grammar and generally was provided only for acolytes of the church.¹⁷

Under American administration school attendance between the ages of 8 and 14 was made compulsory in 1900. Classes for adults were also provided and the same year it was decreed that every adult resident must learn to write his name. By 1917 the first high school classes were offered and the first high school facility opened its doors in 1923.^{17,18}

The lack of competent medical personnel had long been a problem on Guam. In 1819, two injured soldiers of the Spanish garrison had to be treated by the surgeon of a passing ship. One author states that the first official medical officer arrived in 1873. An Irish doctor who had come to Guam with the whaling fleet jumped ship to set up private practice but he apparently did not remain on the island long as the only reference to his activities concerns an incident in 1851.^{18,70}

Probably anticipating that military medical officers would continue to be available for the supervision of medical services, the American administration decided that the most efficient means of improving local health care would be to create a corps of local women trained to provide nursing services. Accordingly in 1905 eight Guamanian women were recruited to begin a three-year period of on-the-job training as nurses at the Susana Hospital.⁵⁶

A formal curriculum for the instruction of midwives was started by Navy Medical Officers in 1907 and some of the recently trained Guamanian nurses served on the teaching staff. In 1911, the first 3 U.S. Navy nurses to be assigned to Guam arrived to formally establish the U.S. Naval Hospital School for Native Nurses.⁵⁶

One of the early problems encountered by the school was difficulty in recruiting students. Although native girls willing to undergo the rigorous training were not lacking, parents steeped in Spanish tradition frequently were unwilling to permit their daughters to leave their homes. This problem was to a large degree eliminated when Maria Roberto, a respected Agana matron, was appointed to the position of Chief Native Nurse. Initially her primary duty was to act as the official chaperone for the student nurses. She lived with them, worked with them in the hospital and, when they were off duty and wished to return home, she saw to it that they were delivered safely to their parents.²⁷

During the early years of the nursing school classes were loosely organized and instruction was largely by the apprenticeship method. The first formal curriculum was two years in length. In the early thirties it was increased to three years and revised to provide more time for academic instruction in such subjects as anatomy and physiology, pharmacology, bacteriology and contagious diseases. Graduates of the school were issued licenses which had to be renewed annually. Those who wished to practice midwifery had to attend a 3 month session of specialized post graduate training before they were granted special licenses.^{56,76}

By the time the school of nursing was closed by the Japanese in 1941, at least 89 graduates had received their commencement pins. During the war years these women were in many cases the only source of medical care available to the

Guamanian people. After the liberation of Guam, the nursing school was re-established in June of 1945 with a faculty of ten U.S. Navy nurse educators. The initial class of 12 students included some of those whose formal training had been interrupted by the war.⁵⁶

When responsibility for the administration of Guam was transferred from the Navy to the Department of Interior in 1949 the school of nursing was closed. The then College, now University of Guam soon acted to fill this void, however, by establishing a two year nursing program leading to an Associate in Arts degree and eligibility for entrance to the examination for licensure as a registered nurse. In addition to both academic and laboratory instruction at the University, students receive practical nursing experience by working at Guam Memorial Hospital, the U.S. Naval Hospital and village health centers maintained by the Division of Public Health.

A Guam School For Practical Nurses was opened in January of 1962 offering a curriculum patterned after those of approved schools of practical nursing in the U.S. Of the ten initial students, nine completed the course and were licensed as Practical Nurses. Unfortunately, before a second class had been admitted, Typhoon Karen destroyed most of the school's facilities and it was not reopened.⁵⁶

In an attempt to further improve medical care for the rapidly expanding island population, on March 15, 1946, the Navy established a School of Medical Practitioners which offered a four-year course in general medicine leading to eligibility for certification as a Medical Practitioner. Promising students from Guam, American Samoa and the Trust Territory of the Pacific Islands were admitted to the program. While it was recognized that the course could not duplicate the caliber of training available in established medical schools of the United States, graduates were expected to be able to diagnose and treat ailments commonly encountered in their areas and to distinguish medical or surgical cases that would require referral for specialized care.⁹¹

In 1947, a companion School of Dental Practitioners was also established. Attending the same basic courses with student Medical Practitioners during the first two years of their training, they spent the remainder of their four-year curriculum receiving more specialized training and clinical practice. Graduates of the program were deemed sufficiently trained to do general extractions, fillings, periodontal work and, to a lesser degree, apply prosthetic appliances.⁹¹

With the advent of civilian government in 1950 and the passage of stringent medical and dental practice acts, both the medical and dental practitioner schools were closed. Although barred from practicing medicine or dentistry on Guam, several of the graduates continued their education and serve today in various other positions in health-related fields.

MATERNAL AND CHILD HEALTH

The general non-military stable population of Guam is characterized by comparatively large families and confronted with relatively low income and high living costs. Dietary habits are often unsatisfactory because of the changing cultural patterns and the scarcity and/or high cost of meat, fish, fresh produce, and dairy products. These factors plus the lack of understanding and apprecia-

tion, by many mothers, of their own health needs as well as those of their children, lead to too frequent pregnancies and a number of other conditions detrimental to good maternal and child health.⁷⁹

Specific problems include a high rate of premature births. There is a statistically significant association between prematurity and infant and neonatal mortality and some types of maternal morbidity. A comparison of the premature birth rates of Guam, Hawaii, and the U.S. for the year 1969 is as follows:⁸¹

Guamanian.....	102/1000 live births
Hawaiian	83/1000 live births
U.S. White.....	72/1000 live births

Guamanian babies on the average weigh less at birth than caucasian babies in the United States. The median birth weight of the liveborn Guamanian child was 3,180 (6 lbs. 15 oz.) grams compared with 3,310 (7 lbs. 4 oz.) grams for United States whites in 1966.⁷⁹

Neonatal deaths, particularly early neonatal deaths, reflect maternal and developmental factors associated with the fetus as well as factors associated with the delivery. The incidence of neonatal deaths in Guam has been shown to be highly associated with lack of prenatal care. A comparison of the neonatal mortality rates for Guam, Hawaii, and the U.S. are given below for 1966. The average rate for the years 1965-1967 was used for Guamanians since the low number of annual neonatal deaths results in significant yearly variations.⁸¹

Guamanian (average 1965-1967)	18.5/1000 live births
Hawaiian (1966)	15.7/1000 live births
U.S. White (1966)	15.6/1000 live births

The infant mortality rate is generally believed to provide an index of general health conditions, since it reflects environmental factors and those conditions which are usually preventable by public health measures. A comparison of the infant mortality rates for Guam, Hawaii, and the U.S. is given below for 1966. Again the three-year average (1965-1967) is used for Guamanians.⁸¹

Guamanian (1965-1967)	25.2/1000 live births
Hawaiian (1966)	18.9/1000 live births
U.S. White (1966)	20.6/1000 live births

Studies on the mainland have indicated that child spacing is a significant factor in accounting for infant mortality. Where pregnancies are closely spaced, the infant and fetal mortality risk is increased. Even with high birth orders such as those prevalent in Guam, it is possible to have a spacing pattern which would reduce infant and fetal loss.⁷⁹ The new United States standard certificate of birth, adopted for use in Guam beginning January 1, 1969, contains information about spacing so that it will be possible in the future to analyze this variable as a factor in local infant mortality.⁷⁹

A study by the School of Public Health, University of Hawaii, conducted in 1969 sampled the female population of Guam concerning contraceptive knowledge, attitude and practices. The results of the study were summarized as follows: "There seems to be no great objection to contraception; in fact, it can be said that there is a general desire to know more about family planning. The majority of sample women express the desire to have not more than four children: two boys and two girls; and the ideal interval between pregnancies is two to three years. Many of the ever-pregnant women, however, have exceeded their desired number of children, and few have managed the ideal pregnancy interval.

"This sample shows two major groups of women who are most receptive to family planning services. There is a large group of older women, having over four children (exceeding the number they desire), who *want* contraceptive advice; this group needs family planning services immediately. There is another group of younger women, for the most part as yet unmarried, and some of them as young as fifteen, who indicate that they want to *learn* about contraception in order to plan their families in the future; this group needs family planning education."¹⁰⁹

One out of every ten births on Guam is to an unwed mother. Unwed mothers have been reluctant to seek prenatal and postnatal care, thus contributing to an elevated infant mortality rate. The combined infant and fetal mortality rate is almost 50 percent higher for unmarried mothers as compared with married mothers.

Maternal morbidity is associated with premature births, hence, neonatal deaths. Maternal morbidity often causes the occurrence of various birth defects. Because of insufficient reporting and the small population base of Guam, maternal morbidity and mortality rates are unusable in any analysis. However, low income populations living elsewhere in the U.S. are known to have relatively higher maternal morbidity and mortality rates than their more affluent counterparts.

Among preschool age children there appears to be a high incidence of iron deficiency anemia, dental caries and intestinal parasitism. It is also suspected that undiagnosed and untreated chronic illnesses exist secondary to lack of treatment of acute disease. This is in part due to the fact that many parents do not recognize these problems and, therefore, do not seek medical treatment.⁷⁹

Middle ear infection often goes untreated in the preschool years because mothers fail to recognize this as a disease. Probably as a result of this there is a high incidence of hearing loss in school age children. As shown in a recent study the frequency of hearing loss in Guamanian school children is four times that of school children in the U.S.²⁹ In addition, more than 40 children suffering from hearing loss as a result of the rubella epidemic in 1964 have been identified and provided with special education.¹⁰¹

The existence of minor health problems such as pediculosis (head lice) and intestinal parasitism suggest the existence of suboptimal living conditions, the need for more effective health education programs and better enforcement of environmental sanitation codes.

In any relatively isolated population of small size where intermarriage among a limited number of families over a long period of time occurs as it has on Guam, there is always an increased chance for the generation of inherited factors which

either give rise to certain defects or predispose the individuals so endowed to diseases or other health problems. That genetic factors should be recognized as an important potential source of health problems in Guam is suggested by the extremely high incidence of Amyotrophic Lateral Sclerosis-Parkinsonism dementia and a high incidence of diabetes. Other atypical conditions occurring on Guam that may be associated with genetic factors include an unusual excess of male births and a high rate of male fetal and infant mortality.²⁹

Two programs of the Department of Public Health and Social Services concentrate on the problems of maternal and child health. These are the Maternal and Child Health Program and the Crippled Children Services Program. The general objective of the Maternal and Child Health Program is to improve the health of mothers and their infants and children. It is estimated that over half of the local mothers giving birth each year on Guam receive prenatal and postpartum care from Public Health facilities. Clinics for women are held at six convenient localities throughout the island. Regular examination by physicians, medication, special education classes and counselling by nurses, laboratory studies, cancer detection, and family planning services are provided. In addition public health nurses teach classes on infant care for all new mothers in the Obstetrical Ward at the hospital. High-risk mothers are offered special care during pregnancy through a Maternal-Infant Care Project.

Child Health Services are provided beginning at four weeks of age by nursing and doctor's clinics held at 14 health centers located in nearly every village of the island.

Special in-service training has increased the abilities of the public health nurses in the area of Child Health Services. Primary attention is devoted to assisting the mothers to provide care that will prevent the many preventable health problems that now exist on the island. Vaccinations, laboratory studies, vision testing and medication are provided to all patients. Those with special problems are referred for specialized care. The school age child is served through the school health program. All the same services are offered and the public health nurses cover all elementary schools on the island.²⁵

In 1970 a new family planning grant proposal submitted by the Director of Maternal and Child Health was funded in the amount of \$57,018 to be used in expanding and improving existing family planning services. The MCH Director also attended a two week family planning training course for physicians sponsored by the Center for Disease Control.²⁵

The present Crippled Children Services (CCS) Program has been in operation since December 11, 1969. It provides both medical and paramedical services for children with mental and/or physical handicaps and those with potentially crippling conditions.

For the purposes of the CCS Program, a crippled child has been defined as a person under 21 years of age residing in Guam who is suffering from a condition or conditions resulting from congenital anomaly or acquired through disease, accident, or faulty development which hinder him from achieving his full physical, mental or social potentialities. The primary objective of this program, therefore, is to help rehabilitate or develop potentialities to the maximum by providing

medical, surgical, social, physical therapy, occupational therapy, or psychological services as needed. The unique aspect of the CCS Program is its ability to provide coordinated case management for children whose handicaps require long-term multiple services which, because of chronicity, complexity and financial burden, cannot be effected by private care alone.

All cases are considered individually, but to be accepted for CCS care, a child must be considered to be capable of rehabilitation. Since funds, personnel and facilities will always be limited in relation to need, criteria are set for assigning priorities which include such factors as prognosis for life, reasonable expectation of cure or restoration of useful function, availability of accepted forms of treatment, and expense in each particular case. Treatment is limited to those unable to obtain it privately for financial or other reasons. Prepaid medical insurance, including Medicaid, is utilized first whenever possible to reduce program costs.²⁵

NUTRITION*

With the change in Guam's economy from a rural subsistence type to one based on employment by the military, local government, or private enterprise, food produced locally by agriculture and fishing began to play a less important role in island eating habits. This shift brought about a dietary change from predominantly natural fruits, vegetables, meats and fish to a diet containing more sugar, soft canned foods, sweetened drinks and other "convenience" type food products.

Superimposed on an increased dependence on relatively expensive manufactured or processed imported foods is the problem of a relatively low average family income of \$3,987 (as compared with a U.S. average family income of \$5,948—both figures for 1968). These factors, together with the high cost of both locally produced and imported fresh fruits and vegetables, tend to further restrict the quality and variety of the typical Guamanian diet.⁷⁹

A study of the diets of Guamanian mothers and children conducted in 1956 under the auspices of the South Pacific Commission showed that although there was no overall insufficiency of food and that protein consumption was relatively high for a Pacific Basin community, in many instances a scarcity of fresh fruits and vegetables in their diets resulted in insufficient intake of certain vitamins and minerals including iron, calcium, thiamine, riboflavin, ascorbic acid and vitamin A.⁷²

A food survey of elementary school children in 1961 also supported the belief that food intakes were not balanced nutritionally. It indicated that their diets generally lacked enough green and yellow vegetables, fruits and milk thus providing minimal or sub-minimal intake of vitamins A and C, riboflavin, calcium and iron.⁷⁹

There are several specific health problems on Guam which may be related to inadequate or inappropriate diets. During the two-year period 1967-1968,

*Prepared with Teresita Del Banco, acting Public Health Nutritionist.



HOSPITAL STAFF DURING THE JAPANESE OCCUPATION OF GUAM. This picture was taken about 1943. All of the Guamanian nurses and some of the Japanese personnel have been identified (see Appendix 4). Photo: Flores Memorial Library.



BY THE END OF WORLD WAR II, nearly all of the homes in most villages had been destroyed or heavily damaged. Photo: Flores Memorial Library.



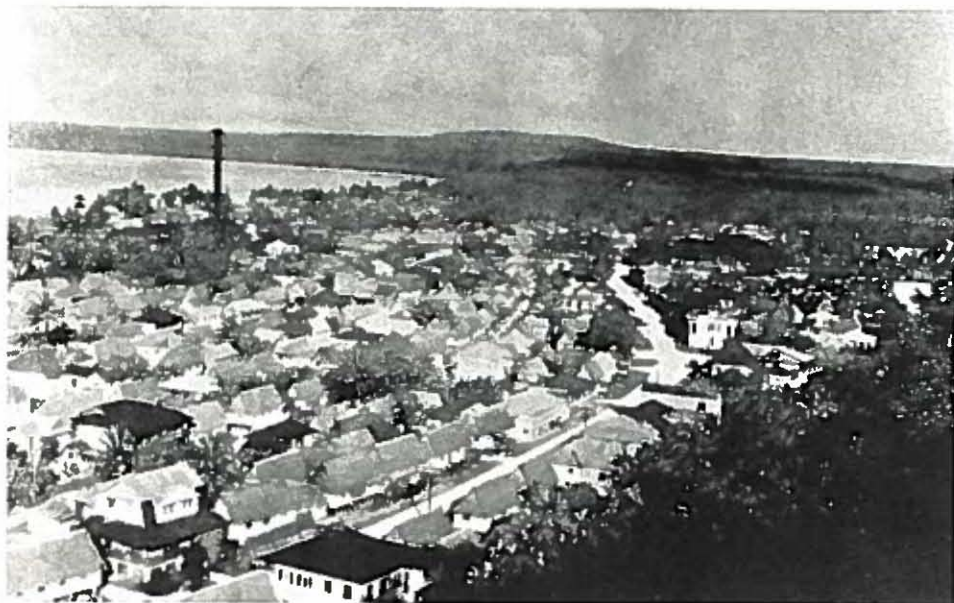
WORKING TOGETHER as best they could under primitive conditions, Father Oscar L. Calvo and Dr. Ramon M. Sablan ministered to both the spiritual and physical needs of Guamanians uprooted from their homes and thrown together in an isolated jungle camp known as Manengon during the summer of 1944. Originally established in July as a concentration camp by the Japanese who feared that Guamanian civilians would aid the returning U.S. forces, Manengon arose literally overnight as an estimated 10 to 15 thousand persons scavenged jungle materials to provide themselves with some protection against the first storms of the annual rainy season. Nearly 5,000 persons had to remain in the camp for about a month following the invasion as pockets of armed resistance by Japanese forces were eliminated and temporary housing and sanitation facilities were constructed in the island's war-ravaged villages.⁹⁹ Photo: Flores Memorial Library



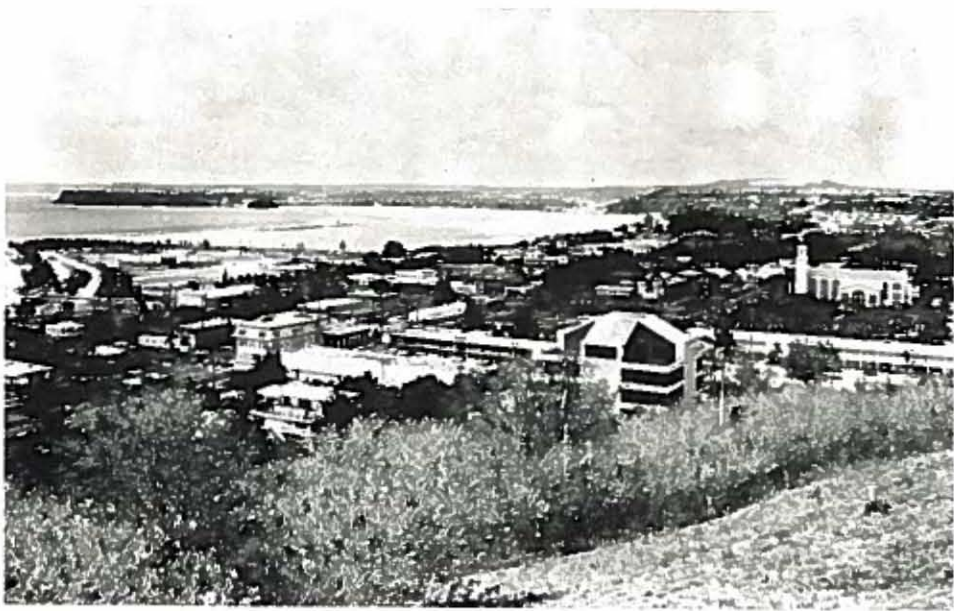
MARIA SCHROEDER HOSPITAL. Built in 1901 to care for the civilian population of Guam, the Maria Schroeder Hospital became Ward I of the Naval Hospital complex serving eligible Guamanians and military dependants after the new Susana Hospital for civilians was constructed in 1911. Photo: Micronesian Area Research Center (MARC), University of Guam.



U.S. NAVAL HOSPITAL, AGANA, GUAM. Completed in 1954, this modern complex provides medical care for U.S. armed forces personnel and their dependents stationed throughout the Western Pacific. Photo: U.S. Public Health Service.



PRE-WAR AGANA, GUAM. Narrow, unpaved streets and closely spaced houses made the provision of sanitation services difficult. Note the site of the island's power station (tall stack in the left center), upwind from the island's most densely populated area. Apparently this was before the era of serious concern for environmental pollution. Photo: MARC.



THE CITY OF AGANA, 1973. No longer the most populous village of Guam, Agana remains the seat of government and much of the Territory's business is conducted here.



WASHING CLOTHES IN THE AGANA RIVER. Although the Agana River was not generally used as a source of drinking water, epidemics were attributed to contact with the pollution it acquired in its course to the sea. Note the outdoor privy on the far bank. Photo: Flores Memorial Library.



RAIN IS THE LIFE-BLOOD OF THE LAND, but excessive amounts in a short period can wreak havoc. A typhoon passing to the south of Guam in October of 1924 dropped 33.09 in. of rain in 48 hours. In the resulting floods, many homes were destroyed as the Agana River cut a new channel to the sea through the San Antonio district of Agana. Photo: Flores Memorial Library.



RESIDENTIAL AREA, CIRCA 1920. Constructed largely of local materials, the typical family home of this era not only lacked modern conveniences such as running water but was subject to frequent damage by the elements. Photo: Flores Memorial Library.



RESIDENTIAL AREA, 1973. The majority of homes constructed today are modern typhoon-proof concrete structures. Pictured above are homes provided by the Government of Guam for low-income families who are charged a nominal rental fee consistent with their means.



GUAM MEMORIAL HOSPITAL. This modern 236 bed reinforced concrete building has served Guam's civilian community since 1956. Due to certain design deficiencies which make it impractical to expand the present facility, studies are underway to design an entire new hospital complex.

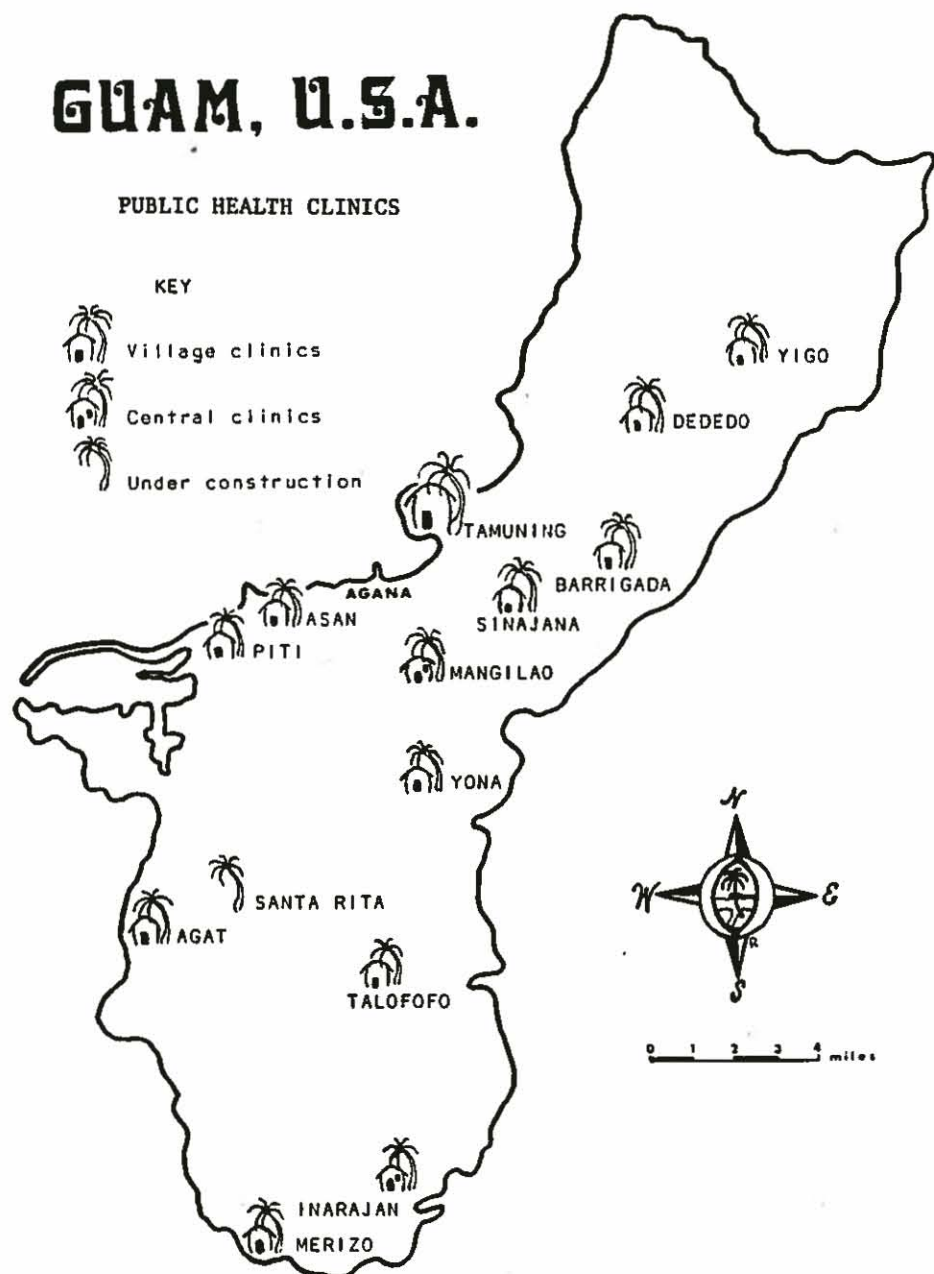
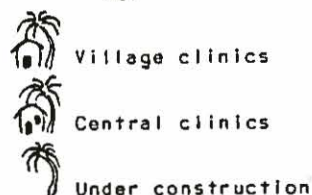


CENTRAL PUBLIC HEALTH AND SOCIAL SERVICES DIAGNOSTIC AND TREATMENT FACILITY. Dedicated in February of 1973, this building serves as the headquarters for some 300 employees charged with improving the health and well-being of island residents.

GUAM, U.S.A.

PUBLIC HEALTH CLINICS

KEY



THE TERRITORY OF GUAM, U.S.A. Largest of the Mariana Islands chain, Guam serves as both a geographic and cultural hub of the Western Pacific.

277 persons (68 children under the age of 14) were admitted to Guam Memorial Hospital with a primary or associated diagnosis of iron deficiency anemia. These statistics excluded those admitted with anemia secondary to blood loss. The high incidence of dental caries and gingival inflammation among children is thought to be largely the result of inadequate diet. In 1969, approximately 98% of all school children had 1 or more carious teeth. It was estimated that about 60% of these children had some form of gingival inflammation. It is felt that inadequate nutrition may also be a contributing factor in the high incidence of active TB in the territory. In 1969, the incidence of new active cases of tuberculosis in Guam was 75/100,000 compared to 21/100,000 for the continental United States. The median birthweight of liveborn Guamanian infants for years 1965 through 1967 was 3,180 grams (6 lbs. 15 oz.) compared to 3,310 grams (7 lbs. 4 oz.) for infants born in the continental United States which also suggests inadequate diet.⁷⁹

The first post-war public health nutrition program was started in 1961 by a nutritionist whose activities included preparation of nutrition education materials such as a basic nutrition chart using locally available foods, diabetic and obesity leaflets, special diet sheets, a diet manual, meat cookery pamphlets, etc. Diabetic, obesity and prenatal classes were held at various area health centers and in-service training was offered for public health nurses, students of the Guam School of Practical Nursing and elementary school teachers. Consultative services were rendered to various groups and agencies upon request. The introduction and successful passage of a Rice Enrichment Law requiring the addition of thiamine, riboflavin and iron supplements to imported rice was a major accomplishment of the nutrition section during this period.

During the period from 1965 to 1968 there was no public health nutritionist on Guam. As a result, the nutrition program dissipated for lack of direction and much headway gained in terms of nutrition education was probably lost. Another nutritionist arrived in March of 1968 but left in October of the same year. Activities during her brief stay included food preparation demonstrations of commodity foods (foods distributed to needy families under a program which was begun in 1968 by the Office of Economic Opportunity), group in-service training, collection and circulation of nutrition information and coordination with other agencies responsible for food services.

During the period 1968-1970 a Maternal and Child Health program staff worker with a degree in Food and Nutrition was assigned to carry out diet counselling in maternity clinics and work with public health nurses to enable them to provide more effective nutrition counselling. Nutrition was made a subsection of the Health Education Section, Department of Public Health and Social Services, in July of 1970. Activities of the section now include nutrition counselling and education in both public clinics and private homes, group in-service training sessions, dissemination and collection of nutrition information including preparation, revision and printing of nutrition and diet pamphlets and the local "Basic Foods" chart, preparation of color slides showing nutritious local fruits and vegetables and presentation of a weekly television feature on nutrition.

Contact with other programs responsible for food services, nutrition education or diet instruction has also been reestablished. These include the Food Commodity Program (which became a section in the Division of Social Services in January of 1970 and supplies supplemental foods to low-income families), a School Lunch Program started in 1957 and a School Breakfast Program, started in 1968. At present there are 32 public and 12 private schools participating in the latter programs which are designed to provide low-cost highly nutritious meals for school-age children.

ENVIRONMENTAL HEALTH

When the first American governor arrived on Guam, he found sanitary conditions to be generally poor. The capital city of Agana, which was then home to approximately 50% of Guam's population of 9,676 persons, was in a particularly deplorable state. There the streets were narrow and unlit, dusty in the dry season and rivers of mud during wet months. Animals used for transport left the streets both dirty and smelly. There was no electricity, no sewer system and no running water. A particular problem in the Agana area was that of obtaining safe drinking water. Due to its vulnerable position enclosed by high cliffs on one side, the sea on another and a river running through its center, the city was subject to frequent flooding. At these times flood waters carried contamination into wells and, as a result, epidemics of water-borne disease were commonplace. Accordingly, when a supply of pure piped water first became available in 1910, all wells in Agana were ordered to be filled in.^{92,95}

By 1937, 1,038 of the 1,616 dwellings in Agana had a source of running water (usually one faucet located either outside or inside near the kitchen) but only 339 had flush toilets. The dawning of each new day brought the sound of squeaking wheels to those fortunate enough to be able to remain abed as carts drawn by the village residents carried the night's accumulation of human waste to be dumped at the edge of the bay.⁴³

Although some progress was made in encouraging owners of private dwellings not equipped with flush toilets to construct bore hole latrines or to use public latrines, it was not until post-war reconstruction began that real advances were made in providing for adequate disposal of sewage.

Garbage disposal, once organized, was conducted by police prisoners in Agana and by private contractors in the other population centers of Sumay and Agat.³⁹ It was disposed of at a number of public dumps and, in some cases, directly into the sea. After the war the collection of garbage was taken over by the Department of Public Works and by 1970 a single government supervised sanitary landfill site was provided for all civilian dumping.

Rodents and monitor lizards (the principal sin of the latter being their predilection for eggs and young chickens) were once subject to bounties of a few cents each.⁸⁷ Although this was effective in keeping the population of these pests within acceptable bounds, the program was eventually discontinued, perhaps due to reports that some individuals had established rodent farms for the sole purpose of collecting bounties. The Government of Guam for a time employed rodent trapping crews but this too was discontinued as it was felt that the elimina-

tion of rodent food sources and harborages through sanitation code enforcement, as well as consultation with individuals experiencing particular rodent problems, would be a more efficient and permanent solution to this problem.

Two epidemics of mosquito-borne illness are known to have occurred on Guam; dengue in 1944, apparently transmitted by *Aedes aegypti* and Japanese B encephalitis (JBE) in 1948, for which *Culex annulirostris* has been incriminated as the vector. An intensive *A. aegypti* eradication program launched after the dengue outbreak was apparently successful in at least temporarily eliminating both the vector and the disease as no specimens of *A. aegypti* were recovered again until the species was reintroduced in 1970 (by which time its ecological niche had been occupied by *A. albopictus*, another efficient vector of dengue) and serological surveys have demonstrated dengue antibodies only in sera from persons born before the *A. aegypti* eradication campaign.⁵⁸

From December 1947 through March of 1948, 54 cases of encephalitis were reported by physicians on Guam. Five of the cases terminated fatally. Subsequent studies showed that epidemics of JBE and mumps had occurred simultaneously. At least 1,647 cases of mumps were recorded; serological studies suggested that infection rates for JBE were as high as 80% in some villages. All fatal encephalitis cases had been infected with JBE virus one had mumps also. This epidemic was of particular interest as it was the first time that an epidemic due to JBE virus had been recognized within the tropics. It is suspected that an extended period of rain provided the conditions necessary for the epidemic to occur; that no autochthonous cases of JBE have been reported since suggests that some factor of Guam's environment, perhaps the absence of a suitable reservoir, did not permit the disease to become endemic.⁵⁸

In 1966 and again in 1969 several cases of malaria occurred on Guam in which the possibility of local transmission could not be ruled out. Since the civilian Government of Guam had not yet established a vector control program, the assistance of the U.S. Public Health Service was sought in evaluating the current vector situation and making recommendations for future action. A survey by U.S.P.H.S. personnel showed that as of 1969 Guam had five species of *Aedes* mosquitoes, including *A. albopictus* which is known to be a capable dengue vector and *A. vexans* which can transmit JBE virus as well as Eastern, Western and St. Louis Encephalitis viruses; one Anopheline mosquito, *A. subpictus indefinitus*, which is a potential vector of malaria; 7 *Culex* group mosquitoes of which *Culex tritaeniorhynchus*, the most important vector of the JBE virus and *Culex quinquefasciatus*, the primary vector of Bancroft filariasis are representatives; and *Mansonia uniformis*, the vector of Malayan filariasis. In addition to these mosquitoes, a number of filth-inhabiting flies and *Xenopsylla cheopsis*, the principal vector of plague, are present on Guam.⁵⁸

As a result of this survey and the accompanying recommendations, a Vector Control Branch was established within the Bureau of Environmental Health and Consumer Protection. Surveys of mosquito breeding sites are currently underway and as men and equipment become available island-wide surveillance and control activities will be initiated.

Surveillance of the food industry is also an important aspect of Guam's environmental health program. During 1969, 13,432 inspections of public establishments were conducted. Food poisoning incidents are less frequent than might be expected in view of Guam's tropical climate; the majority of those investigated have been due to staphylococcal intoxication.

Guam at present has a multi-source drinking water supply system. The portion of the system operated by the U.S. Navy, utilizing a reservoir and modern water treatment plant, serves the Naval Station and civilian villages of the southwestern portion of the island. The relatively isolated villages of Guam's southern and southeastern coast each have individual spring or river origin water supply systems. The water supply for the northern half of the island is obtained from numerous wells sunk in the limestone plateau of that area.

While the water in the Navy system is chlorinated sufficiently to maintain some free-chlorine residual at all points in their distribution system, chlorination of the civilian water supplies is sporadic due to the difficulties of maintaining chlorinators at the numerous individual sources. In this situation contamination of ground water reserves is a serious potential problem, particularly in the limestone plateau area where there is an absence of deep soil layers to provide natural filtration and purification. Under these conditions wastewater may travel directly to the aquifer via cracks or channels in the underlying limestone.

Unfortunately little has been done thus far to protect Guam's water shed areas. If unrestricted development and use of these areas is permitted and contamination of the aquifer does occur it will become necessary to seek new sources of drinking water supplies or to build expensive water treatment facilities. In either case the island would then be faced with a serious economic and health crisis.

COMMUNICABLE DISEASE PROBLEMS

Leprosy and yaws were for many years the diseases which commanded the most attention of health authorities on Guam. Fortunately, with the advent of modern chemotherapy they have ceased to be serious public health problems. Yaws has for all practical purposes been eradicated although a few elderly victims of gangosa still remain to remind us of a less fortunate era. Six new active cases of leprosy were discovered in 1969 and 3 in 1970; they were treated on an outpatient basis and their immediate household contacts will be examined annually for at least 5 years.^{24,25}

Tuberculosis continues to be a serious public health problem and although the incidence of new active cases continues to drop as the result of an intensive case-finding, chemoprophylaxis and treatment program inaugurated in 1966 to replace the routine use of BCG, the rate is still nearly four times that of the continental United States (the rate of new active TB cases was 122 per 100,000 population in 1967 and 68/100,000 in 1970).^{24,25}

This is gratifying progress considering that from 1905 to 1970 deaths from TB exceeded the number of deaths from all epidemics occurring during that period (1/2 of the deaths of persons between the ages of 15 and 30 also being due to TB) and that even as late as 1952 TB was the greatest single cause of death on the

island, accounting for 22 deaths and a mortality rate of 71/100,000 population that year.⁴⁷ As bovine tuberculosis has not been reported on Guam and since all immigrants to the island are carefully screened, reactivation of old cases is probably the most critical factor in controlling the current problem.⁸⁶

As elsewhere throughout the world, the incidence of venereal disease appears to be on the increase in Guam. Two cases of syphilis and 39 cases of gonorrhea were reported to the Division of Public Health in 1960 as compared to 8 cases of syphilis and 275 of gonorrhea in 1970.

Intestinal parasitism was a major problem at the turn of the century. A stool survey in 1918 revealed a prevalence of hookworm infestation ranging from 66% for residents of rural ranches to 92% in a southern village, the island average being 72%. There did not appear to be significant age or sex distribution differences.³⁴ A subsequent survey in 1923 indicated that the prevalence of roundworm infestation was 95.2%; of whipworms, 71.2% and of hookworms, 25.9%. Only .9% of the stools examined contained no parasite ova. At this time the prevalence of hookworm infestation was slightly higher in adults than children, the reverse was true in the case of roundworm infestations.³⁸ Deaths, particularly of young children, were occasionally attributed to parasitism; hookworm disease and ascariasis accounted for two each in 1925 and ascariasis alone accounted for 5 deaths as late as 1930.^{39,41} Although of doubtful long-term value, this problem led the Naval health authorities to institute routine annual or semi-annual deworming campaigns for all school children.⁴⁰

By 1947 the prevalence of intestinal parasitism had been reduced to an estimated 40%.⁴⁶ This improvement can probably be attributed to generally improved sanitary conditions and elevated personal hygiene standards rather than treatment of individual cases. It is apparent, however, that intestinal parasitism must still remain a public health concern since review of Public Health Laboratory records for 1970 showed that 40.8% of the stools examined that year contained adults or ova of one or more parasites (*Ascaris*, 18%; *Trichuris*, 24% and hookworms, 2%).

Typhoid fever broke out among U.S. Marines soon after they landed in 1899 and the disease remained endemic even after most dwellings in Agana were supplied with safe water. Some outbreaks were associated with contact with the Agana River which became highly polluted on its serpentine course to the sea through the village from which it gained its name.³⁸ With the provision of sewers in Agana following the war and the general use of flush toilets, typhoid has become a rarity. Only three cases have been recorded since 1954; one of these is known to have been contracted off-island.

A high rate of hearing loss exists among Guamanian school children (at least four times that of children in North American cities) and disqualifications of Guam youths for military service due to hearing loss are correspondingly high. Although no specific agent was incriminated, it has been noted that 50.3% of the school children with hearing loss exhibited evidence of otitis media. It has also been observed that severe hearing loss was twice as common and perforation of the ear drum seven times as common among children having 5 or more sibs and it has been suggested that education of parents to seek early medical treat-

ment when their children develop symptoms of middle ear infection would do much to solve this problem.²⁹

The problem of deafness among young children was further aggravated when Guam experienced a rubella epidemic in 1964. Largely due to the anticipated needs of these children, the Department of Public Health and Social Services established a Hearing and Speech Center in 1968. Within one year the Center had identified and evaluated 40 deaf children and initiated a pre-school program designed to eventually enable them to be integrated into regular classes with their normal-hearing peers.¹⁰¹

Immunization continues to be an important part of Guam's public health program. During 1970 approximately 10,000 school children were immunized against measles, rubella, polio, diphtheria, pertussis and tetanus. Included in these activities was a project conducted in cooperation with the National Center For Disease Control to demonstrate the effectiveness of a tri-valent measles-mumps-rubella vaccine.²⁵

ZOONOSSES

Although it was stated as recently as 1950 that the only zoonosis on Guam was tapeworms (type not specified), this assumption may have been overly optimistic.⁸⁶ As previously mentioned, epidemics of dengue and Japanese B encephalitis occurred during the forties. Dogs on Guam are frequently infected with ascarids; it is not unreasonable to assume that cases of visceral larva migrans occasionally occur. A serological survey of 180 local stray or abandoned dogs begun in 1970 showed that slightly more than 1% had been exposed to leptospiral organisms, a level considerably lower than has been reported elsewhere. Two cases of human brucellosis were reported to public health authorities in 1958, a single case of leptospirosis was reported in 1967. Although Guam has no dairy or beef herds and no surveys for disease among the scattered individual cattle have been reported, zoonoses of bovine origin are not likely to become serious public health problems in view of the small number of these animals present and their relative isolation. Two cases of trichinosis were reported in 1958; that the incidence of this disease is no higher can perhaps be attributed to cultural influences which dictate that pork be thoroughly cooked. Cases of ichthyosarcotoxism occur occasionally although fatalities are rare. At least one death due to the sting of a marine shell of the genus *Conus* has been recorded. One instance of *Echinococcus* infestation in a monkey has been reported. Recent surveys indicate that as high as 20% of local dogs may be infected with *Dirofilaria* or *Dipetalonema* filaria, although no instance of human infestation with either of these parasites has been recorded on Guam. Human salmonellosis is reported regularly if not frequently; a recent case was associated with imported pet turtles that died shortly before the patient became symptomatic. *Angiostrongylus cantonensis*, the parasite causing eosinophilic meningoencephalitis, is also known to be present on Guam.

Perhaps the most dramatic occurrence of a zoonosis on Guam was an epizootic of rabies in 1967. A total of 89 cases involving six species (primarily dogs and cats) were detected over a period of seven months. Fortunately there were no human cases. An intensive stray animal control program was apparently success-

ful in eliminating the disease from the island and in December 1971 local health authorities were able to recommend that Guam be officially declared rabies-free. To prevent the re-entry of rabies to Guam, a 120 day quarantine period for all imported carnivorous mammals is being strictly enforced.³²

CHRONIC DISEASE PROBLEMS

Diseases of the heart and blood vessels are the current leading cause of death on Guam, accounting for 10.7% of all deaths in 1970. Since the majority of these deaths occur in older age groups and since Guam has a relatively young population (60% of the non-transient population being under 20 years of age, only 13.1% 45 or older) it can be anticipated that mortality due to these diseases will be even higher in the future.^{25,80} An epidemiologic study of Chamorro residents of Rota, Guam and California suggests that the stresses of sociocultural discontinuity resulting from rapid westernization may also be associated with the apparent increased incidence of coronary heart disease.⁸⁹

Malignant neoplasms were the second most frequently reported cause of death in Guam during 1970. As in the case of diseases of the heart and blood vessels, it is suspected that the apparent increase in the importance of this health problem parallels similar trends in other countries rather than there being any unique responsible etiological factor in Guam's environment. Again in both cases education of the public will continue to be the principal means used by health authorities in their attempt to control these problems while awaiting scientific break-throughs that will provide the tools for a more specific means of attack.^{25,80}

Although a more in-depth analysis of the problem needs to be made, it is clear that diabetes mellitus is an important health problem on Guam. Its prevalence on Guam was 13.2/1,000 population in 1968 as compared to a rate of 10.7/1,000 population for the continental U.S. in 1964. Diabetes mellitus was listed as the principal cause of 4.2% of all deaths on Guam in 1970; this probably represents only about one-half of the deaths in which it was a contributing factor. This disease is particularly prevalent among older women and may be related to a high incidence of obesity.⁸⁰

In 1952, an unusually high incidence of a generally rare chronic degenerative disease of the central nervous system known as amyotrophic lateral sclerosis (ALS) was noted on Guam. After intensive case finding efforts were initiated, it was estimated that ALS occurred on Guam with a frequency 100 times greater than in any other region of the world. A high incidence of another relatively rare disease syndrome known as Parkinsonism-dementia (PD) was noted at that time and similarities in age of onset, duration and familial pattern led investigators to suspect that ALS and PD as seen on Guam represented different clinical manifestations of a single disease process.^{67,88}

Continuing investigation as to the etiology of the ALS-PD complex, or "Guam Disease" as it has been referred to, has failed to clearly incriminate hereditary, diet, or environmental factors. Recent research has centered on an attempt to isolate an infectious agent, perhaps a "slow" virus such as is known to cause scrapie in sheep, but thus far these efforts have been fruitless also. Studies are also underway to determine if Guamanians who leave Guam have the same rates

of ALS-PD as do those who remain on the island and to see if Caucasians who have lived on Guam for extended periods have higher rates of "Guam Disease" than would normally be expected. Attempts are also being made to see if clusters of motor neuron disease or degenerative CNS disease exist on other islands of Micronesia as they do on Guam. For the present, however, it can only be said that while there must be causes for the ALS-PD complex as seen on Guam and these causes must be more concentrated here than anywhere else in the world, past studies have only been successful to the extent that they have provided some indication as to what factors are *not* involved.^{12,68,88}

DENTAL HEALTH

Dental caries with resultant loss of teeth was extremely rare among young Chamorros, perhaps due to the absence in earlier days of modern highly refined convenience foods. However, the fondness of their race for the nut of the betel palm or, more specifically, the lime and pepper leaf concoction chewed with the betel nut to heighten its narcotic effect, led to the production of extensive lime accretions, particularly on the facial surface of the molars. These calcium salt deposits increased with age, first being noticeably present at about 35, and in many cases led to gingivitis, alveolar disease and eventual loss of teeth.⁶⁹

This situation has changed considerably, and generally for the worse, with the advent of the modern era. Although addiction to betel nut chewing had declined somewhat, the incidence of dental caries had increased to such an extent that by 1927 the Governor's annual report cited this as a serious public health problem. That year a survey of the dental health of 118 intermediate school pupils showed that the teeth of 80 were in "poor" condition: only 6 were considered perfect. To help improve this situation the island's first civilian dentist was recruited in 1928 by the Naval Government to provide free dental treatment for school age children.⁴⁰

Unfortunately, dental health has not improved significantly since then. Another survey of school children in 1956 revealed that "nearly all" had dental caries, with an average of 5.2 carious teeth per child.⁸⁰

Although no claim can be made as to solving the problem of dental caries on Guam, progress in ameliorating its effects continues. Responsible for providing for the dental health of all children through 16 years of age, the Public Health Dental Clinic saw 15,475 patients in 1970. Recognizing that treatment alone will not provide an answer to the problem, emphasis was placed on education to develop good eating and dental hygiene habits. Construction of a second clinic to serve residents of the southern end of the island was begun in 1970 and, with the hope that it will prove to have a profound effect on Guam's dental health picture in the near future, a one-year Dental Auxiliary Training Program in cooperation with the University of Guam was inaugurated in January of 1971.²⁵

The Dental Auxiliary Training Program has since graduated classes of 8 in 1971 and 17 in 1972. A large proportion of these graduates are now employed in Public Health Dental Clinics where they perform traditional functions of both dental assistants and dental hygienists in addition to some functions that have previously been restricted to the dentist.

MENTAL HEALTH

The incidence of mental health problems among Guamanians is believed to have been relatively low before the advent of urbanization, rapid economic expansion and their accompanying tensions.¹⁰¹ In his report of 1920, the governor stated that all cases of mental illness encountered that year were confined for "...short periods of reclusion at the Tumon Farm where isolation, quiet, rest and freedom from friends and associates restored their mentality to such an extent that they were released as fit for society."³⁵ Patients requiring treatment not available on the island were, before World War II, sent to facilities in the Philippines, a total of eight being cared for there in 1938.⁴¹ After the war, patients requiring specialized care were referred to Hawaii.

In 1953, Guam Memorial Hospital's Psychiatric Ward had 6 beds but no psychiatrist, depending on Navy personnel when specialized professional care was needed.⁴⁸ By 1969 a definite commitment had been made to provide a local full-service mental health agency and funds were provided for what was to be known as the Guam Mental Health Center. In 1970 a psychiatrist arrived to spearhead the development of the new agency and a clinical psychologist, an administrator with special training in public health and several social workers and psychiatric aides were eventually added to the staff. The Center now provides a full range of services including an inpatient ward, a partial-hospitalization ward, an after-care or follow-up program, emergency services and education-consultative services.²¹

An interesting aspect of the Partial-hospitalization Program, which provides a "half-way house" for patients who no longer require hospitalization but are not yet able to fully adjust to a return to society, is the method of issuing passes. These are granted in graduated steps based on the individual behavior of patients as judged by a Grounds Pass Committee which is composed of both staff members and patients.²¹

The education-consultative services offered by the Center are considered to be a particularly important aspect of the over-all program. These include working with teachers and school counselors in helping "problem" children make a healthy adjustment to school, consultation with personnel of both adult and juvenile correctional institutions and the courts, providing in-service training for public health nurses and presenting television programs and special workshops for the general public.²¹

MENTAL RETARDATION

The determination of marginal mental deficiency is complicated on Guam by an interplay of cross-cultural difficulties that may obscure the true picture in many cases. A pilot study has also shown that the prevalence of slow learners is in many cases due to strictly physical problems such as chronic earaches, tonsillitis, and sight or hearing defects rather than low mentality per se.⁸⁵

A Government of Guam Division of Vocational Rehabilitation survey of 9,846 heads of household in 1968 recorded 685 individuals that were considered to be "mentally slow". Of these, 535 were between the ages of 5 and 19.²⁶ Unfortunately, the prevalence of brain damage among this or other groups due to

specific causes such as stroke, head injuries, anoxia and infectious or parasitic agents is not known.⁸⁰

Among the facilities which provide services for the mentally retarded are the Crippled Children Services Program and the Speech and Hearing Clinic of the Department of Public Health and Social Services, the Division of Vocational Rehabilitation and Brodie Memorial School for Exceptional Children.

The Brodie Memorial School, which now provides vocational and scholastic training for approximately 150 mentally retarded children, is of particular interest. It began operation in 1960 with a class of 6 children under the auspices of a private organization, the Marianas Association for Exceptional Children. The original structure was built entirely with donated labor and materials. In 1961, the Guam Legislature appropriated the first government funds for its operation and in 1963 it was integrated into Guam's public school system.¹¹

ACCIDENTS

An area of increasing concern is that of motor vehicle accidents. Motor vehicle deaths accounted for 63.3% of all accidental deaths in 1968 when accidents were the second leading cause of death. That same year Guam's death rate of 10.3 per 100,000 vehicle miles was exceeded only by Puerto Rico of all the U.S. states and possessions. Traffic accidents are not only tragic but also quite costly; they represented a loss to the residents of Guam of nearly three million dollars in 1967. A study of those involved in motor vehicle accidents showed that they generally belong to the younger age groups of drivers and most frequently are young unmarried males.⁷⁹

Defensive driving is a must for every driver on Guam. Guam's roads are naturally slippery due to dust from the coral rock used in their construction. Since the number of motor vehicles on the island has increased tremendously in recent years without a corresponding increase in public roads, there is also a need for some form of a public transportation system to reduce the current congestion of the island's limited highway system (traffic density was estimated to be 138 vehicles per mile of paved roadway in 1969). Because of the great increase in the number of tourists who wish to operate motor vehicles while visiting Guam, some means must also be established to inform this group as to how local driving regulations and conditions may differ from those of their homelands.⁷⁹

Drowning is the second most frequent cause of accidental death in Guam, and occurs predominantly among males. A surprising problem is the fact that many local people do not know how to swim. Many people are also unaware of the special dangers associated with water activities and some of those who consider themselves good swimmers are not knowledgeable of basic water safety measures. There are strong currents in some areas that may prove fatal even to the experienced swimmer, especially if he is alone. Even the shallow waters of Guam's inviting bays and lagoons conceal broken bottles, sharp coral, rusty cans, remnants of war ordinance and beautiful but deadly cone shells and other poisonous sea life that are hazardous to beachcombers and swimmers alike.^{79,80} To control these and other causes of accidental injury and death, major emphasis is placed on education, both in school classrooms and through public news media, to make

the public aware of hazards that exist on Guam and to enable them to understand how to deal with or avoid them.

OUTLOOK FOR THE FUTURE

In general it can probably be said with some justification that Guam's progress in economic, political, health and social areas has exceeded even the most ambitious dreams of the island's leaders of fifty years ago. While most of the serious problems extant in that earlier era have been solved, new problems of perhaps no less serious nature have already risen to confront us or can be expected to appear on future horizons. For example, while mortality due to infectious disease has decreased dramatically, problems connected with the chronic degenerative diseases and automobile traffic injuries have increased in like proportion.

While the people of Guam now generally enjoy the conveniences of a modern affluent society, the fact that they have also become an affluent society of itself threatens to curtail these same benefits. Cognizance must also be taken of the fact that while Guam was once able to slumber beneath a protective cloak of relative isolation, modern transportation has made us neighbors to the four corners of the earth. Only time will tell whether island leaders will have the foresight and courage to provide the leadership that will be necessary to permit Guam's continued rapid development without jeopardizing the progress that has been made in the past.

APPENDIX

I. Epidemics Reported on Guam

- Circa 1700 — A distressing but apparently self-limiting skin disease broke out amongst the Chamorro population soon after the advent of the first mission. It presumably was introduced by Filipino convicts brought to Guam to aid in the "reduction" of the natives.¹⁰³
- 1849 — First influenza epidemic.¹⁰³ Another source reports an epidemic of "severe diarrhea and anemia" for the same year which subsided when food supplies from the Philippines arrived.⁷⁰
- 1856 — The day before the American schooner "Frost" arrived from Manila the body of a young man who had died of smallpox was thrown overboard. Although the military surgeon recommended to the governor that all those on board be quarantined for at least three days, Silvestre Torres Palomo, a prominent Guamanian, and his servant debarked the next day. The servant was the first of 3,463 persons to die of smallpox (181 additional persons died of "complications") during the nine month epidemic leaving only 4,724 residents on the island.³
- 1861 — Measles.⁶⁶
- 1878 — Measles; nearly every child and many adults affected. mortality 20%.⁷⁰
- 1882 — Whooping cough; nearly 400 children died.⁷⁰
- 1888 — Measles.⁶⁶
- 1889 — Measles, mortality was approximately 16%.⁷⁰
- 1898 — Whooping cough.⁷⁰
- 1899 — Acute anterior poliomyelitis; left many patients with disabilities, generally flaccid paralysis of the lower extremities.⁷⁰
Typhoid fever, apparently endemic on the island, broke out among the first group of U.S. Marines to land. Health authorities were apparently pessimistic about their abilities to treat the victims as one marine who unexpectedly survived was later able to visit the grave that had been prepared for him.³¹
- 1912 — Mumps; 6,320 cases reported, no known deaths.
Continued coincident with the 1913 measles epidemic.⁶⁶
- 1913 — Measles; 6,884 cases, 43 deaths. All schools were closed and all public gatherings forbidden for a period of several months.⁶⁶
- 1918 — Influenza; 853 deaths.⁷¹
- 1921 — Dengue; no fatalities.³⁶
- 1922 — Typhoid; twenty-eight cases, 8 deaths between August and December.³⁷
- 1923 — Bacillary dysentery (flexner strain); 150 cases, 40 deaths.^{22,38}
- 1924 — Bacillary dysentery; epidemic started in Santa Cruz district along the Agana River. Two hundred-thirty nine cases treated at the hospital, 29 deaths.³⁹ One source reports 147 deaths due to bacillary dysentery for the period 1924-1925.⁷¹
- 1932 — Measles; epidemic of undetermined origin began in June and lasted six months. Those 1-5 years old were most affected, few cases were observed over 16 years of age. There were 2,063 known cases, 152 deaths.⁷¹

- 1933 — One hundred five native babies under two years of age were admitted to the hospital with a diagnosis of "Cholera infantum," no specific cause was found. There were 14 deaths; parents were advised to boil drinking water for infants.⁴²
- 1934 — Measles; 2,100 cases, 152 deaths.⁵⁸
- 1935 — Whooping cough; "widespread," 15 deaths.⁷¹
- 1938 — Whooping cough; 149 deaths.⁷⁴
- 1944 — Dengue; affected many military personnel.⁵⁸
- 1947 — Japanese B encephalitis; 54 cases, 5 deaths. Mumps; 1,751 cases, no deaths among those with mumps infection only.⁵⁸
- 1948 — Measles; 5,000 cases, 13 deaths. Several cases of postmeasles encephalitis were observed.⁵⁸
- 1957 — Poliomyelitis; outbreak was aborted by the administration of 25,324 inoculations of Salk polio vaccine. An influenza epidemic affected approximately 15% of the population and accounted for three deaths.⁵⁰
- 1958 — Mumps; 1,268 cases.*
- 1958-59 — Scabies; 1,246 cases.*
- 1964 — Rubella; 459 cases.¹⁰¹
- 1965 — Infectious hepatitis; 64 cases required hospitalization during the last 6 months of 1965, 18 during December alone.*
- 1970 — Staphylococcal food poisoning; approximately 150 of 800 students, teachers and guests at a high school luncheon affected, 26 hospitalized overnight. Chicken kelaguen incriminated.*
- 1972 — Staphylococcal food poisoning; 77 of 350 construction camp residents affected, 58 hospitalized overnight, no deaths.
Imported dried fish incriminated.*
- 1972 — Influenza; an average of 92 influenza cases were reported during each of the first 8 months of 1972, 1,684 were reported in September, 350 in October and 101 in November. No deaths due to influenza were reported.*

*From official records, Office of the Territorial Epidemiologist, Department of Public Health and Social Services.

APPENDIX

2. Some medicinal plants of Guam including English and Guamanian common names.*

- Abutilon indicum* (Indian mallow or Matbas) The seeds are laxative.
- Annona muricata* (Soursop or Laguana) The red part of several leaves, together with several flowers of the male papaya, are boiled to make a tea which is beneficial to asthma sufferers.
- Artemisia vulgaris* (Mugwort or Yetbas Santa Maria) An infusion of the leaves is useful in treating ulcers.
- * *Artocarpus incisus* (Breadfruit or Lemae) For sores that fail to heal, cut the trunk of the Lemae, collect the accumulated sap 24 hours later, chew it until pliable and apply to the affected area. It will bring away the unhealthy tissue when removed.
- Asclepias curassavica* (Milkweed or Asuncion) The root is used as an emetic, the juice of the leaves is useful in treating intestinal parasitism.
- Barringtonia asiatica* (Chinese lantern tree or Puting) To treat ciguatera fish poisoning, prepare a tea from the bark.
- Bixa orellana* (Lipstick tree or Achote) For headache or stomach ache crush the leaves and bind them over the affected area.
- Boerhaavia mutabilis* (Glueweed or Dafau) The root is used to treat dropsy and asthma.
- Cananga odorata* (Ilang-ilang) For pneumonia, boil the flower buds with the root of the Nunu and drink the liquid as required.
- Cardiospermum halicacabum* (Balloon vine or Bombillas) The root is laxative.
- Cassia alata* (Ringworm brush or Acapulco) Leaves are used to treat skin diseases, especially ringworm.
- Cassia fistula* (Golden shower tree or Canalistula) Fruit pods are laxative, leaves are used to treat fevers.
- Cassia sophora* (Edible senna or Amot tumaga) Bark tea is used to treat diabetes. For skin itch (dermatophycosis), pulverize dried leaves and root bark, mix with honey and apply to affected areas.
- Centella asiatica* (Indian pennywort or Yahn-yahn) Leaves are used for intestinal complaints and fevers or applied externally to reduce inflammation.
- Cleome viscosa* (Spider-bower or Mongos paluma) The seeds are used internally as a vermifuge, externally as a counter-irritant plaster.
- Clitoria ternatea* (Blue pea or Bukike) The seeds are used as a laxative, the root as a cathartic.
- Cocos nucifera* (Coconut or Mahson) Water of the unripe coconut is used as a diuretic.
- Colubrina asiatica* (Colubrina or Gasoso) Lather formed from the leaves is used for dandruff or baldness.
- Crinum asiaticum* (Antidote lily or Piga-palayi) The bulb is chewed for emetic effect. To relieve sprains or bruises, cover both sides of several leaves with coconut oil, warm by passing over a candle and bind to affected area.
- Desmodium gangeticum* (Tick-trefoil or Atis-aniti) The roots are used for fevers and catarrh.

- Desmodium triflorum* (Creeping tick-trefoil or Agsom) The leaves are used for fevers.
- Dodonaea viscosa* (Switch-sorrel or Lampuaye) The leaves are used for fevers.
- Erythrina variegata* (Coral tree or Gaogao) An ointment prepared by mixing the fluid obtained from boiled leaves of the Gaogao with coconut oil is used for the relief of painful joints.
- Euphorbia hirta* (Hairy spurge or Golondrina) The leaves are used for bronchitis and asthma (formerly for tuberculosis).
- Euphorbia neriifolia* (Cow's tongue or Lengua-i-baca) For headaches, prepare a tea from strips of the bark.
- Hernandia ovigera* (Jack-in-the-box or Nonag) Juice of the leaves is used as a depilatory. Seeds and young leaves are used as a laxative.
- Hibiscus rosa-sinensis* (Red hibiscus or Flores rosa) To treat cellulitis or draining abscesses, pulverize leaf buds and apply them to the affected parts.
- Ipomoea indica* (Island morning-glory or Fofgu) The root is a powerful cathartic.
- Ipomoea pes-caprae brasiliensis* (Beach morning-glory or Alalag-tasi) For the treatment of boils or draining abscesses, crushed leaves may be applied directly to the affected areas.
- Jasminum grandiflorum* (Spanish jasmine or Hasmin) Leaves are chewed to treat mouth ulcers.
- Jasminum officinale* (Jasmine or Hasmin dikiki) The pulverized root mixed with coconut oil has been used to treat cases of ringworm.
- Jatropha curcas* (Physic nut or Tubatuba) Seeds are purgative, leaves are used topically for eczema.
- Kalanchoe pinnata* (Air plant or Siempre-viva) Crushed leaves are used to treat Herpes Zoster.
- Lagenaria siceraria* (Gourd or Tagua) A tea prepared from the leaves acts as a laxative and is prescribed for numerous ailments.
- Lawsonia inermis* (Henna or Cinnamomo) An ointment prepared from the leaves is used to speed the healing of cuts, bruises and ulcers.
- Lycopersicon esculentum* var. *cerasiforme* (Cherry-tomato or Tomates caputi) Boiled pulverized leaves are used to relieve teething pains of babies.
- Mangifera indica* (Mango or Mangga) Gum obtained by scarifying the trunk and branches is mixed with lime juice and coconut oil to treat various diseases of the skin.
- Melia azedarach* (Chinaberry or Paraiso) The inner bark of the root has cathartic and emetic properties and is used to treat various intestinal complaints. Poultices prepared from the leaves were once used to treat leprosy and scrofulous ulcers; a paste prepared from the flowers has been used to treat pediculosis and scalp itch.
- Melochia compacta* var. *villosissima* (Rhea or Atmahadyan) Cellulitis and boils may be treated by crushing the leaves and binding them to the affected area.
- Moringa oleifera* (Horseradish tree or Malungai) The root is used to make a rebe-facient plaster and powdered seeds are used as a tonic or to treat fevers.
- Ocimum basilicum* (Sweet basil or Atbahakat) A tea prepared from the seeds has been used to treat urinary-tract afflictions.

Phaseolus radiatus (Mungbean or Mongos) A broth prepared by boiling the beans is recommended for Herpes Zoster.

Phyllanthus amarus (Fly-roost or Maigo-lalo) The milky sap promotes healing of skin sores, the crushed leaves are used to treat scalp itch and fresh root is eaten as a remedy for jaundice.

Phyllanthus marianus (Phyllanthus weed or Gaogao uchan) A tea prepared from the entire plant is used to treat complaints of back pain.

Piper betle (Betel pepper or Pupulo) For relief of headaches, leaves are rubbed with coconut oil, warmed over a candle and then bound to the head.

Polyscias scutellaria (Saucer-leaf or Platito) A mixture of root and leaf is used as a diuretic.

Premna obtusifolia (False elder or Ahgao) A bark tea is used for neuralgia.

Psidium guajava (Guava or Abas) From the leaves a douche may be prepared which is useful in treating vaginitis and promoting conception.

Sandoricum koetjape (Wild mangosteen or Santol) The crushed root is mixed with vinegar and water for the treatment of diarrhea or dysentery.

Sesbania grandiflora (Katurai) The green pods are eaten as a laxative salad.

Sida rhombifolia (Broom weed or Escobillyan dalili - also E. apaka or E. adumelon) Boiled leaves are used to prepare poultices for skin ulcers and sores.

Tacca leontopetaloides (Arrowroot or Gabgab) Starch prepared from the tubers is used as an ingredient in many medicinal teas and as a food for patients suffering from diarrhea or dysentery.

Tamarindus indica (Tamarind or Kamalindo) The pulp of the fruit, mixed with water, is recommended as a mild laxative for children.

Vigna marina (Seaside bean or Akangkang malulasa) Equal quantities of A. manulasa, Ahgao and Agalonde leaves may be pulverized and wrapped in a gauze bag to make a tea effective in treating various fevers and pneumonia.

Vitex trifolia var. *bicolor* (Chaste tree or Agalonde) Pillows of the aromatic crushed leaves are said to relieve headaches. Both the leaf and the root are used in the preparation of tonics.

Zea mays (Indian corn or Mais) The kernels are roasted and ground to prepare a coffee-like beverage useful in treating kidney ailments.

* The author cannot vouch for either the efficacy or safety of the remedies in this list; they have been included here solely for their ethno-botanical and historical value. The nomenclature used generally follows that of Stone (Stone, Benjamin C. Flora of Guam. Micronesica 6 (complete) July 1970). The assistance of Mr. Jose C. Barcinas, Sr., Guam Department of Agriculture, and numerous other local informants is gratefully acknowledged.

APPENDIX

3. Leading causes of death on Guam: Number of deaths and approximate rate per 100,000 population.

CAUSE	1925 ³⁹	RATE
	NUMBER	
1. Bacillary dysentery	32	192
2. Tuberculosis	13	78
3. Typhoid fever	8	48
4. Hookworm	2	12
5. Ascariasis	2	12
6. Measles	1	6
7. Peritonitis	1	6
TOTAL DEATHS	97	583
TOTAL POPULATION	16,648	—

CAUSE	1930 ¹¹	RATE
	NUMBER	
1. Tuberculosis	22	119
2. Pneumonia	9	49
3. Asthma	9	49
4. Diarrhea or dysentery	6	32
5. Ascariasis	5	27
6. Still born	5	27
7. Malnutrition	5	27
8. Nephritis	3	16
9. Pregnancy	2	11
10. Tetanus	2	11
TOTAL DEATHS	78	421
TOTAL POPULATION ¹⁰⁷	18,509	—

CAUSE	1960*	NUMBER	RATE
1. Diseases of the heart and arteries.		61	91
2. Diseases of early infancy and prematurity unqualified.		37	55
3. Pneumonia and other diseases of the respiratory system.		30	45
4. Accidents other than motor vehicle**		29	43
5. Vascular lesions of the central nervous system.		18	27
6. All other diseases of the nervous system and sense organs***		17	25
7. Malignant neoplasms		15	22
8. Motor vehicle accidents		14	21
9. Tuberculosis, pulmonary		10	15
10. Meningitis non-meningococcal		6	9
TOTAL DEATHS		351	524
TOTAL POPULATION ¹⁰⁷		67,004	—

*From the Annual Report, Office of Vital Statistics (1960) and other official records.

**Does not include the deaths of 80 transients which occurred as the result of an aircraft accident, September 1960.

***Primarily Amyotrophic lateral sclerosis-Parkinsonism dementia

CAUSE	1970 ²⁵	NUMBER	RATE
1. Heart diseases		38	45
2. Malignant neoplasms		34	40
3. Certain diseases of early infancy and immaturity unqualified.		34	40
4. Cerebrovascular disease		28	33
5. Amyotrophic lateral sclerosis and Parkinsonism dementia.		22	26
6. Motor vehicle accidents		22	26
7. Pneumonia, all types including newborn.		21	25
8. Diabetes mellitus		15	18
9. Diseases of the liver, gallbladder and pancreas.		12	14
10. Accidents other than motor vehicle.		11	13
TOTAL DEATHS		355	418
TOTAL POPULATION ¹⁰⁷		84,966	—

APPENDIX

4. Hospital Staff During the Japanese Occupation of Guam*

- | | |
|---|---|
| 1. Catalina Taitingfong Thomas (Nurse) | 20. Rose Taitano (Nurse) |
| 2. Petronila Materne Borja (Nurse) | 21. Simplicia Salas Galinada (Nurse) |
| 3. Soledad Demapan Tai (Nurse) | 22. Chief Pharmacist's Mate Oska |
| 4. Rosa Farfan Mendiola (Nurse) | 23. Chief Pharmacist's Mate Shiguro |
| 5. Cristina Lizama Parks (Nurse) | 24. Nurse Supervisor Suzuki |
| 6. Magdalena San Nicolas (Nurse) | 25. Pharmacist's Mate Kishino (Laundry) |
| 7. Josefina Ahlam Meno (Nurse) | 26. Orderly |
| 8. Maria Flores (Nurse) | 27. Chief Pharmacist's Mate Sato |
| 9. Rita Gogue James (Nurse) | 28. Chief Pharmacist's Mate Sening-kashi (Records Office) |
| 10. Ana San Nicolas Sanford (Nurse) | 29. Orderly Suzuki |
| 11. Joaquina Siguenza (Nurse) | 30. Pharmacist's Mate Tajima |
| 12. Maria Matanane Tuncap (Nurse) | 31. Juan Onedera (Interpreter) |
| 13. Antonia L. Guerrero Arceo (Nurse) | 32. Jose Megofna (Interpreter) |
| 14. Socoro Manalisay Rivera (Nurse) | 33. Orderly Takahashi |
| 15. Amanda Guzman Shelton (Chief Nurse) | 34. Kangocho Miura (Accountant) |
| 16. Engracia Lujan Flores (Nurse) | 35. Captain Miyasaki (Surgeon) |
| 17. Concepcion Tenorio Slotnick (Nurse) | 36. Doctor Yamamoto (or Inodo) |
| 18. Catalina Santos Burger (Nurse) | 37. Orderly Takashi |
| 19. Maria Aguon Garcia (Nurse) | 38. Orderly |

*Identification of personnel was provided through the courtesy of Mrs. Shelton who served as Chief Nurse from 1934 to 1948.

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