Protein-Calorie Deficiency Disease in Saint Lucia and the Effects of Preventive Measures on the Mortality of Infants and Young Children.

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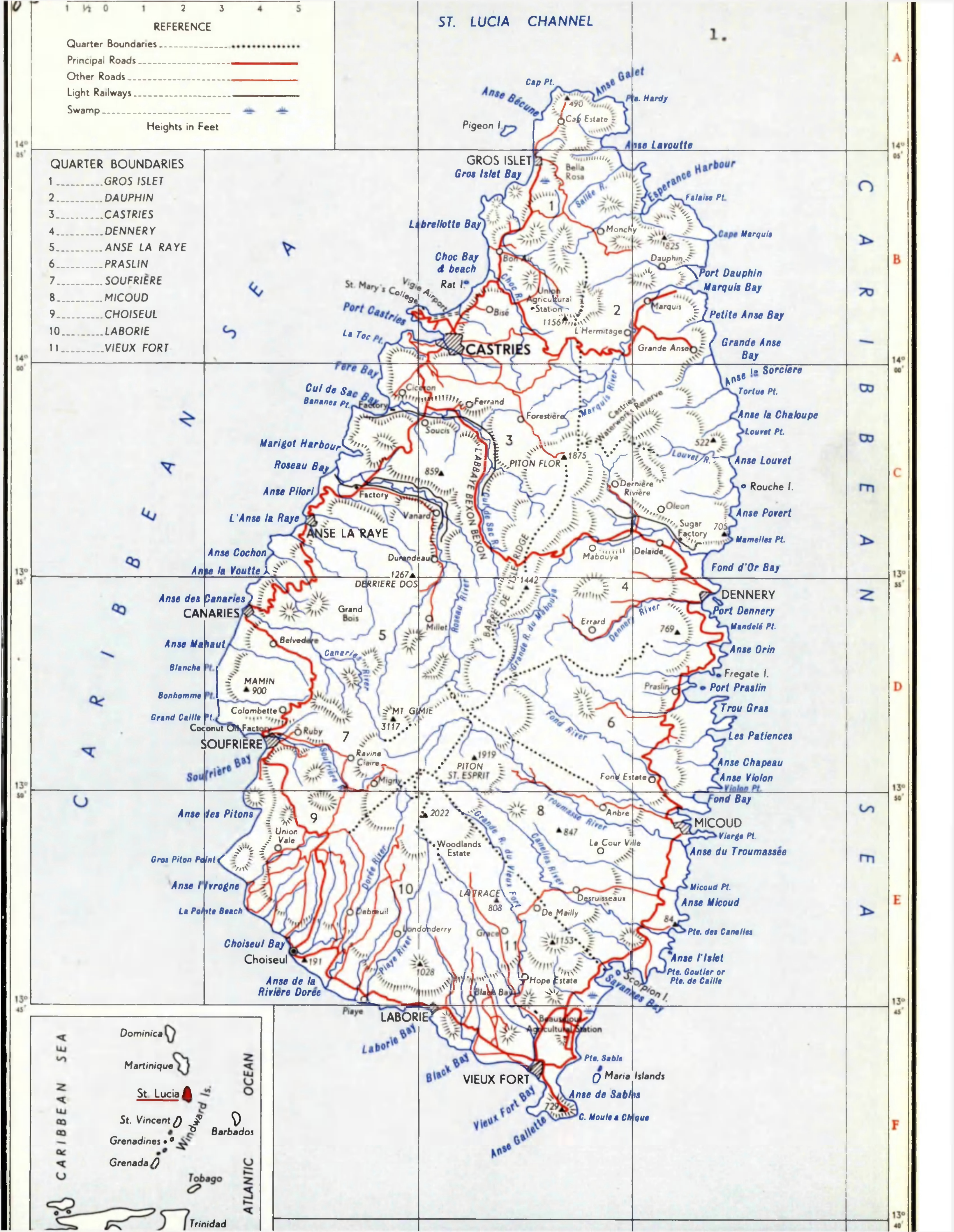
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QUARTER BOUNDARIES
1 GROS ISLET
2 DAUPHIN
3 CASTRIES
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ST. LUCIA CHANNEL
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Monchy
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Choc Bay & beach
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Choc R.
Union Agricultural Station
Marquis
Port Castries
Bisé
Petite Anse Bay
La Toc Pt.
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Fere Bay
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Anse l'Islet
Pte. Goutier or Pte. de Caille
Scorpion I.
Anse de la Rivière Dorée
Hope Estate
Savannes Bay
Black Bay
Piaye
LABORIE
Beausejour Agricultural Station
Laborie Bay
Pte. Sable
Black Bay
Maria Islands
VIEUX FORT
Anse de Sables
Vieux Fort Bay
C. Moule a Chique
Anse Gallette
Dominica
Martinique
St. Lucia
Windward Is.
St. Vincent
Barbados
Grenadines
Grenada
Tobago
Trinidad
ATLANTIC OCEAN
CARIBBEAN SEA

GENERAL INTRODUCTION:

St. Lucia, with a land area of 238 square miles and the second largest of the Windward Islands, lies at the Eastern edge of the Caribbean Sea between the latitudes $13^{o}42'$ and $14^{o}07'$ north of the equator. It is a British Colony and lies between another British possession, St. Vincent, to the south and the French island of Martinique to the north. The channels between each of these islands and St. Lucia are just above 20 miles in width.

In its long axis, approximately North-South, St. Lucia is 24 miles while at its widest point it measures 14 miles.

The present estimated population is 105,034. Apart from the main towns and villages of:-

		Population
Castries the Capital	-	28,000 including suburban areas
Soufriere	-	8,000 " " "
Vieux Fort	-	7,500 " " "
Dennery	-	5,000 " " "

other communities are small and tend to be located along the coast. In fact, Castries in its urban area and within its statutory boundaries has a population of 5,000 and the remaining 23,000 live in its environs which are really semi-rural suburban areas. Approximately 30% of the population lives in scattered clusters of a few houses along the main roadways or in the bush, often with access only along a narrow path, which may be one or two miles in length, leading from/

from one of the roadways.

The people are predominantly Negro or of mixed origin with small groups of Europeans and East Indians.

HISTORICAL:

During the 17th and 18th Centuries, St. Lucia's geographic position made it an island of immense strategic importance and its history during that period is one of bloodshed and almost continual warfare between the British and the French. Since the time of its discovery early in the 16th Century, the island has been seven times British and seven times French, Britain gaining final control in 1803 and her right to the island being finally recognised by the
(1) Treaty of Paris in 1814.

Apart from being a military fortress, St. Lucia was an island of sugar plantations and, in common with other Caribbean territories, the labour force was drawn from Negro slaves originating on the West Coast of Africa. The tribes, listed by Clarke, from which these slaves were drawn, are Aruba, Capoloan,
(2) Congo, Corymantin, Ibo, Mandino and Moco.

During these years the island was regarded by European troops as a death posting, malaria, yellow fever and dysentery accounting for mortality rates in excess of 80% per annum among the garrison at times. Much of Britain's military success in the Caribbean has been attributed to her early realisation that the Negro had a higher resistance than the European to the above diseases and es-
(3) pecially to yellow fever, and her consequent recruitment of Negro Battalions.

CLIMATE/

CLIMATE:

The island enjoys an equable climate common to small tropical islands and the North-East trade winds ensure almost constant air movement from the Atlantic across St. Lucia. The temperature range is from 70^{o} - 90^{o}F, the coolest months being from November to January and the warmest, July and August. The island lies within the Hurricane Belt and there is, during July to October, a constant threat from the violence of these tropical storms.

Rainfall varies considerably even within the small territorial limits of St. Lucia, the central mountainous area receiving an average annual precipitation of over 200 inches while the almost flat northern and southern points receive only 50 inches a year. Rain falls all year round but there are two ill defined, relatively dry periods during February - May and September - October, separated by the months of heaviest rainfall, July and August. During these latter months it is usual to experience a 12 - 18 inch rainfall within twenty four hours at least once a year.

The annual average daily humidity is 79% but this rises to almost 100% just before dawn each day.

Drought is not common but has occurred on occasions and because of the small size of the island and absence of any lakes or natural reservoirs is a serious event in this agricultural community.

GEOLOGY:/

GEOLOGY:

With the exception of two flat areas, comprising about one fifth of the total land area, at the northern and southern points of the island, the terrain is mountainous. The island is of volcanic origin and the mountains, rising steeply fro m the sea, are separated by deep narrow ravines and twisted spurs. A central mountain ridge (the Barre de L'Isle) runs like a spine from north to south and, from this, lateral ridges run east and west to the sea. The highest elevation, Mont Gimie, is 3,117 feet above sea level.

There are three larger valleys which contain relatively rich alluvial soil. These valleys are about 6 miles long, three quarters of a mile wide at their mouths and have steep sides rising to elevations of 1,000 - 1,500 feet.

There are no minerals of economic importance and the soil is, for the most part, shallow and infertile; geologists regard it as a young soil probably only about 5 million years old.

There is one volcano at Soufriere, part of the Eastern Caribbean Chain, which exhibits constant activity through fumaroles and hot sulphurous springs.

The topography and heavy rainfall result in a profusion of small rivers which flow mainly in narrow, steep-sided ravines. The longest river has a length of nine miles from source to sea. Because of the small drainage areas, short length and daily variations in rainfall, the volume of water in the rivers varies rapidly and considerably often from day to day.

There/

There are no lakes or large water bodies but many of the rivers drain into lagoons separated from the sea by sandbars. See map.

COMMUNICATIONS:

External communications from St. Lucia are now good. Inter-island air services operated by British West Indian Airways and Leeward Islands Air Transport provide links with international jet airports, as well as the other islands, several times daily. A new airport capable of accepting jet airliners has just been put into service in the southern part of the island.

At Castries, there is a natural deep-water harbour capable of taking ships of up to 15,000 tons gross. In addition to twice weekly banana boats sailing to the United Kingdom, there are regular passenger and cargo ships to and from Europe and North America.

Inter island sea trade is conducted by schooners and two small, but modern, steamships operated by the West Indian Shipping Company.

Internal communications by road are difficult because of the mountainous nature of the terrain but there is a road which runs round the coastline of the southern two thirds of the island and from which feeder roads run to inland villages and settlements. There are 229 miles of surfaced road, which are motorable except in occasional floods or after landslides, and a further 170 miles of dirt road which are usually suitable for ordinary vehicles but which, at other times, can usually be travelled by four-wheel drive vehicles.

Much/

Much of the transport between Castries and southern coastal towns and villages is undertaken by large motor launches. Lorry buses run daily from all villages to and from Castries.

GOVERNMENT:

Since 1814, St. Lucia has been a British Crown Colony. In 1951 a Constitution was introduced which provided for universal suffrage (over the age of 18 years) and a Legislative Council with ten elected representatives and two members appointed by the Administrator. Legislative Council is presided over by a Speaker and has the power to make legislation within the framework of the Constitution. In effect, the Council provides a certain measure of self-rule, only the Police Force, Foreign Affairs and certain matters of finance being controlled by London through the Administrator who is the Queen's representative on the island.

There are five Ministerial posts occupied by members of the ruling political party and the holders of these posts, together with the Crown Attorney and the Administrator, form the Executive Council of Government.

Elections are held every five years and, at present, two political parties are represented in Legislative Council.

THE ECONOMY:

The unit of currency is the British West Indian Dollar which has a rate of exchange of 4.8 dollars to the pound sterling or 1.7 to the United States dollar.

Although/

Although no longer a recipient of a direct Grant-in-Aid, the Colony is not an economically viable territory and receives aid from the United Kingdom in the form of Colonial Development and Welfare Funds which at present amount to some 350,000 pounds per annum.

The boom of bananas, as a cash export crop, in recent years has, however, resulted in a remarkable growth in the domestic budget with a consequent improvement in the island's economic status. The amounts of the Government Estimates and the quantities and values of banana exports for the years 1960 - 1965 are shown in TABLES I and II.

The economy is based on agriculture, bananas and copra being the major export products although the former is by far the more important. The amounts and value of the copra crop, for the years 1960 - 1965, can be seen in TABLE III.

Sugar, until 1960, the main crop and main export of the island, is no longer grown. This was a seasonal crop offering seasonal employment and one which had to be produced on large estates. Bananas are an all year round product, are fast growing and can be produced on small peasant holdings; these facts, and the establishment of a co-operative buying and marketing organisation, which buys virtually at the site of production, account for the popularity of this fruit. There are over 11,000 registered banana growers, many of them having little over an acre of land and working on the land often in a part-time capacity. Preferential tariff rates for the entry of West Indies bananas to the United/

TABLE I:

DOMESTIC BUDGET: ST. LUCIA 1960 - 1965
FIGURES IN $ B.W.I.

1960	1961	1962	1963	1964	1965	
5,660,589	6,653,419	7,271,872	7,546,975	8,546,966	10,139,589	

TABLE II:

BANANA PRODUCTION AND VALUE 1960 - 1965

Year	1960	1961	1962	1963	1964	1965
Production No. of Stems	2,646,060	3,551,563	4,262,937	4,507,530	5,177,086	6,309,455
Value - $ B.W.I.	3,481,589	5,313,241	5,859,600	6,335,318	8,167,274	9,240,002

TABLE III:

COPRA PRODUCTION AND VALUE 1960 - 1965

Year	1960	1961	1962	1963	1964	1965
Production - tons	3,759	3,825	3,377	4,289	4,505	5,017
Value - $ B.W.I.	1,278,060	1,300,500	1,148,180	1,458,260	1,531,700	1,705,780

United Kingdom provide a ready market outlet.

There are encouraging signs that Tourism is about to become a substantial supportive industry but a great deal of capital investment will be necessary before this industry can be developed into a major source of revenue.

Wages are, by tropical standards, reasonable; the current daily pay of a labourer being $2.40 (10 shillings). Labour is difficult to obtain for three main reasons - (1) the antipathy of the people and their dislike for being tied to a definite routine, (2) the practice that when the minimum amount of money to cover the necessities of life is earned, no more work is done until the money has run out and (3) the ease of growing bananas and the ready cash return obtained on cutting the fruit - a satisfactory remuneration for a minimum of work output. It is estimated that 1 acre of banana cultivation will yield $150 - 250 per annum depending on the quality of the soil and the grower's industry.

Small industries which are producing purely for the domestic market include a coconut oil factory, two rum distilleries and two aerated water factories.

The economist Carleen O'Loughlin in her survey report on the economic potential of St. Lucia stated:-

"Social conditions inhibit economic advance in many islands but the relationship is not always easily defined. It is significant that in St. Lucia, three mainly social problems must definitely be tackled if economic advance, particularly/

particularly of the peasant sector, is to be ensured. They are health, educa-
(4) tion and land tenure."

THE POPULATION:

In common with other developing countries in Central and South America, St. Lucia is facing a rapidly expanding population with a rate of natural increase in the region of 3% per annum:- TABLE IV.

Emigration figures have varied considerably in recent years but reached a considerable figure in 1961 which accounts for the very small numerical increase in population over 1960 despite the rate of natural increase being 29.8 per 1000 during the year.

The 1960 Census Report indicated the following racial make-up of the island's population:- Negro 67%, Mixed 25%, East Indian 3%, White 0.5% and other races, or not stated, 4.5%. Most of the mixed category are of Negro/White
(5) origin with a very much smaller proportion of mixed Negro/East Indian blood.

The same Report shows that, of the total population, 44.3% was in the age range 0-15 years and that 20.8% were females in the child-bearing years, between 15 and 45 years. The proportion of the population which potentially draws on the Maternal and Child Health Service is, therefore, considerable.

SOCIAL AND CULTURAL ASPECTS:

The social and cultural patterns of the people of St. Lucia are complex, owing/

TABLE IV:

ST. LUCIA: POPULATION, BIRTH AND DEATH RATES AND RATE OF NATURAL INCREASE 1959 - 1963

Year	1959	1960	1961	1962	1963
Population (End of year)	93,755	94,718	94,809	96,841	99,084
Birth Rate /1000	44.2	49.2	42.3	40.0	40.2
Death Rate /1000	14.0	13.6	13.0	12.4	10.8
Rate of Natural Increase /1000	30.2	31.8	29.8	28.7	29.4

owing their origins to the results of a blending of patterns from several parts of West Africa, France and the United Kingdom, and to a lesser extent from India, the whole being tempered by the local environment and the, until recently, relative isolation from the rest of the world.

The Negro slave, torn from his homeland and the cultural ties of his tribal way of life, and thrown together with other Negros from a variety of African tribal societies, was not encouraged by his owner to retain any of his native customs or beliefs. Subsequently he was forced into the acceptance of Christianity. Having lost all of his cultural and social heritage and the security of his tribal law, he made every effort to replace these by embracing the beliefs and culture of his owner; he imitated to the best of his ability but, being uneducated and therefore not in a position to understand fully what he was trying to adopt, he became spiritually lost or at least, confused. Obeah, or witchcraft, a semi-religious relic persisting from his African past, and Christianity, which was being forced upon him by his overlords, vied with one another for his spiritual attention. Add to this the alternating French and British cultural influences and one is left with a picture of a man confused and having no firm foundation upon which to establish or develop a sound culture or social pattern.

The family did not exist as a unit or group. No male slave could form firm attachments to a woman or children who were liable to be removed and sold independently of one another. Plantation owners did, however, encourage their female/

female slaves to bear children but the fathers were usually selected because of their physique and work ability, or were the overseers who had the right to co-habit with any slave who took their fancy, and the unions were purely casual affairs.

From such a situation, the slave suddenly found himself a free man in the 1830's. With his new found freedom he decided that he would, in future, work only for himself and then as little as was absolutely necessary. It was as a consequence of this that East Indiand were brought to the West Indies as indentured labour; for some reason there were relatively few brought to the Windward Islands compared with Trinidad and British Guiana but these unfortunate people were despised by the free Negro, and regarded as being far inferior to slaves. A slave had at least some intrinsic value but the indentured labourer was a dispensible tool of the plantation owner.

The St. Lucian's attitude to work and responsibility has changed very little from these days but there are signs that gradual changes are being brought about by the economic pressures on the individual which form part of the growing pains of a developing country.

Even to-day, marriage, is not a common event among the lower social groups of the community. Young girls and young men associate freely from the time they attain puberty and it is usual for a girl to have had several children, each by a different father, by the time she reaches her early twenties. Following on this, many do enter into a common law association with one partner by/

by the time they reach the age of thirty and the man accepts the responsibility for all of the woman's earlier children. Illegitimacy is no stigma and unwanted or neglected children are rare, unlike the situation existing under the more stringent social laws of Europe or North America.

This is essentially a matriarchal society, the grandmother being the central figure of the family. She is the person who keeps and cares for the illegitimate offspring of her daughters and she therefore exerts a great influence over the method of upbringing to which the children are subjected.

Despite the fact that 90% of the population are baptised Roman Catholics, 66% of all births are illegitimate. This may be an indication of the spiritual intensity with which Christianity has been accepted although it is probably a combination of all the factors and influences to which the earlier slave society was subjected and a carry over of the slave's attitude to the lack of permanence of a family unit.

Today the social pattern is again being disturbed by external influences through the media of the cinema and radio and there are political pressures demanding that the people exert themselves beyond their former limits and perhaps, unfortunately, to an extent for which their educational and cultural background has failed to develop them.

There is, and has been for several decades, compulsory primary education from the age of 5 to 15 years but the schools and teaching staff in many areas fall/

fall far short of adequacy. Many of the teachers themselves have had no more than a primary education. Despite this, 70% of the population over 5 years is regarded as being literate.

There are three Secondary Schools with good scholastic records but educational inadequacies probably present the greatest problem facing St. Lucia to-day.

The official language and, the one taught in schools, is English, but outside of Castries it is rarely heard. The language in general usage is a French patois which is non-grammatical and cannot be written; this adds to the difficulties of education especially among the older age groups who have either never learnt English, or having learnt it at school, have not used it for so long that they have largely forgotten it.

HOUSING:

Housing conditions are poor but do not reach the low levels found in the Near and Far East or in South America. The middle and upper class houses are good and are built either of concrete or wood but the lower socio-economic groups live, for the main part, in small, one or two roomed, unpainted houses which are overcrowded and lacking in sanitary facilities. Recently,subsidised low cost housing units have been built by Government and some of the large plantations and these are providing good standards of accommodation but the numbers so far produced have been small and have made little impression on the/

the overall picture.

Some sanitary facilities have been provided over the past five years under a Public Health Department programme, aided by C.D.& W. Funds and materials provided by UNICEF, which provides pre-cast concrete pit latrine units and small potable water supplies for rural settlements.

Family size ranges from three to sixteen persons but for purposes of calculating health needs, the average family size is accepted as five.

SANITATION:

Outside the central part of Castries, sanitary standards are low. Supplies of potable water in all towns and villages are deplorably inadequate and in most rural areas are non-existent. Even in Castries, which has a modern water treatment plant (rapid sand filtration and chlorination), the demand has so outgrown the plant capacity that water supplies are cut off for long periods daily.

Middle and upper class houses have water supplied from the mains or from individual rain water catchment tanks but people in the lower socio-economic bracket have to draw their water from roadside stand pipes in the towns and from springs, wells or rivers in rural areas.

Sewage disposal poses a problem equal to that of inadequate water supplies. Only the central part of Castries has a public sewer but houses with indoor water supplies in other areas have disposal through septic tanks with soil percolation of the effluent. Since 1959, an Environmental Sanitation Programme/

Programme has been in operation - 8,500 pit latrines have been installed beside rural houses, 7 laundry/bath units have been constructed, 18 wells dug, 12 springs protected and 7 small community water supplies constructed.

The findings of a small survey in 125 houses of the usage of such sanitary facilities as existed in one valley in 1964 can be seen in TABLE V. Of the 102 latrines associated with these 125 houses, 77 were regarded as being in an unsatisfactory state of repair. The habits and preferences of the people lead (6) them to defaecate into running natural water if possible.

In summary of the water situation; of the 22,000 houses on the island, 2,000 have piped water indoors, 1,000 have piped water in the yard and 10,400 have reasonable access to a roadside stand pipe, a protected spring or well. The remainder have no nearby source of piped water.

It is estimated that 11,600 houses are without sanitary means of excreta disposal.

TABLE V - SANITARY SURVEY OF 125 HOUSES in CUL DE SAC VALLEY

a) Source of Domestic Water

Source	Number of Users	Percentage
Well or Spring	107	85.5
River	18	14.5
TOTAL	125	100

b) Laundry Site

Site	Number of Users	Percentage
River	101	80.8
Laundry Unit	24	19.2
TOTAL	125	100

c) Bathing Site

Site	Number of Users	Percentage
River	104	83.2
Bath Unit	21	16.8
TOTAL	125	100

d) Latrine Accommodation

Site	Number	Percentage
Latrine	102	81.6
No Latrine	23	18.4
TOTAL	125	100

VITAL STATISTICS:

In the Colony, the Registrar of Civil Status is responsible for the collection and compilation of vital statistics. Possibly as a result of the establishment and organisation of the Roman Catholic Church more than the demands of the Law, statistical information regarding births, deaths, marriages, etc., is very accurate, although the preparation and presentation of the Registrar's Annual Report is rather tardy. The most recent report is for the year 1963 and figures for the years subsequent to this have been personally collected from the Registrar's office. The Infant Mortality Rates in 1964 and 1965 present a remarkable picture but the accuracy of the rates for 1964 has been corroborated by Dr. K. Standard of the Department of Preventive Medicine of the University of the West Indies. Some pertinent statistics have already been given under the paragraph "Population" and will not be repeated here.

Those statistics which have a bearing on the subject of this paper are the Infant Mortality Rate and the proportion of the total annual deaths which is accounted for by the mortality of the child population under the age of 4 years. The rapid and dramatic fall in the Infant Mortality Rate over the period 1962-1965 is unique in the British West Indies and has brought St. Lucia from the island with the second highest rate to among those with the lowest within a space of two years, i.e. from 1962 to 1964. There has, however, been a general decline of Infant Mortality Rates in all

of/

of the islands over the same period but this has been a gradual decline from rates in excess of 100 to around the rate of 70/1000 live births.

The Infant Mortality Rates of St. Lucia from 1959 to 1965 are shown in TABLE VI.

Until 1963, almost 50% of the total annual deaths occurred within the first two years of life, at which ages the age specific death rates exceeded those of the United States by 25 times in the first year of life and 29 times in the second. TABLE VII illustrates the change which has occurred in the proportion of deaths under 4 years, to the total deaths, between the years 1961, 1963 and 1964.

HEALTH SERVICES:

Almost all of the health facilities in the island fall under the Government Health Services; the exceptions are one private medical practitioner in Castries and a few nurses who are engaged in private practice.

Approximately 12½ per cent of the island budget is devoted to the provision of the annual capital and recurrent expenditures of the Health Services but, for certain Public Health projects, additional monies are provided by Colonial Development and Welfare Funds and materials and equipment are donated by UNICEF.

The Service, covering both preventive and curative facilities, comes within the portfolio of the Minister of Education, Health and Social Affairs and is under the administrative control of a Chief Medical Officer. A simple administrative/

TABLE VI - INFANT MORTALITY RATE PER 1,000 LIVE BIRTHS

ST. LUCIA 1959 - 65

Year	1959	1960	1961	1962	1963	1964	1965
I.M.R.	110.3	107.1	100.7	102.9	78.4	37.9	47.8

TABLE VI-A - NUMBERS OF LIVE BIRTHS, INFANT DEATHS AND INFANT MORTALITY RATE /1000 LIVE BIRTHS 1962 - 1965

Year	Live Births	Infant Deaths	I.M.R.
1962	3935	405	102.9
1963	3981	312	78.4
1964	4696	177	37.9
1965	4352	208	47.8

TABLE VII - NUMBERS OF DEATHS IN EACH YEAR

0 - 4 YEARS OF AGE, 1961, 1963 and 1964

NUMBER OF DEATHS						Percentage of Island's Total Deaths
Year	0-1 yrs.	1-2 yrs.	2-3 yrs.	3-4 yrs.	Total	
1961	408	192	21	12	633	51.4
1963	312	141	49	18	520	48.6
1964	177	34	11	5	227	21.0

administrative diagram is given in Figure I.

With a small department and close professional co-operation a high degree of integration of curative and preventive services has been possible and, apart from his immediate responsibilities, the Medical Officer of Health exercises a high measure of control over all medical services outside of Victoria Hospital. For example, the seven District Medical Officers, operating both curative and preventive services in their districts, work to a large extent within the policies of the Medical Officer of Health and are responsible to him for general health conditions within their statutory boundaries.

There are sixteen Health Centres throughout the island, three of these being combined Health Centre/Casualty Hospital Units. In addition, there are five "Calling Stations" which are, in effect, satellites of Health Centres and are visited by the staff of the parent Centre. Each Health Centre is staffed by a resident Nurse/Midwife and a nursing aide; the Medical Officer visits twice each week to conduct general clinics but also holds a watching brief over the Midwife's activities at her maternal and child health clinics. The hospital units are run by a Medical Officer with the assistance of a Sister and two Staff Nurses.

Victoria Hospital with 220 beds is located in Castries and is the island's main hospital; included in the bed total above are 50 beds in the Tuberculosis Wing. There is a medical staff comprising a Physician, Surgeon, Tuberculosis Officer and two Residents.

There is no Psychiatrist and the 140-bed Mental Hospital is run by one of/.

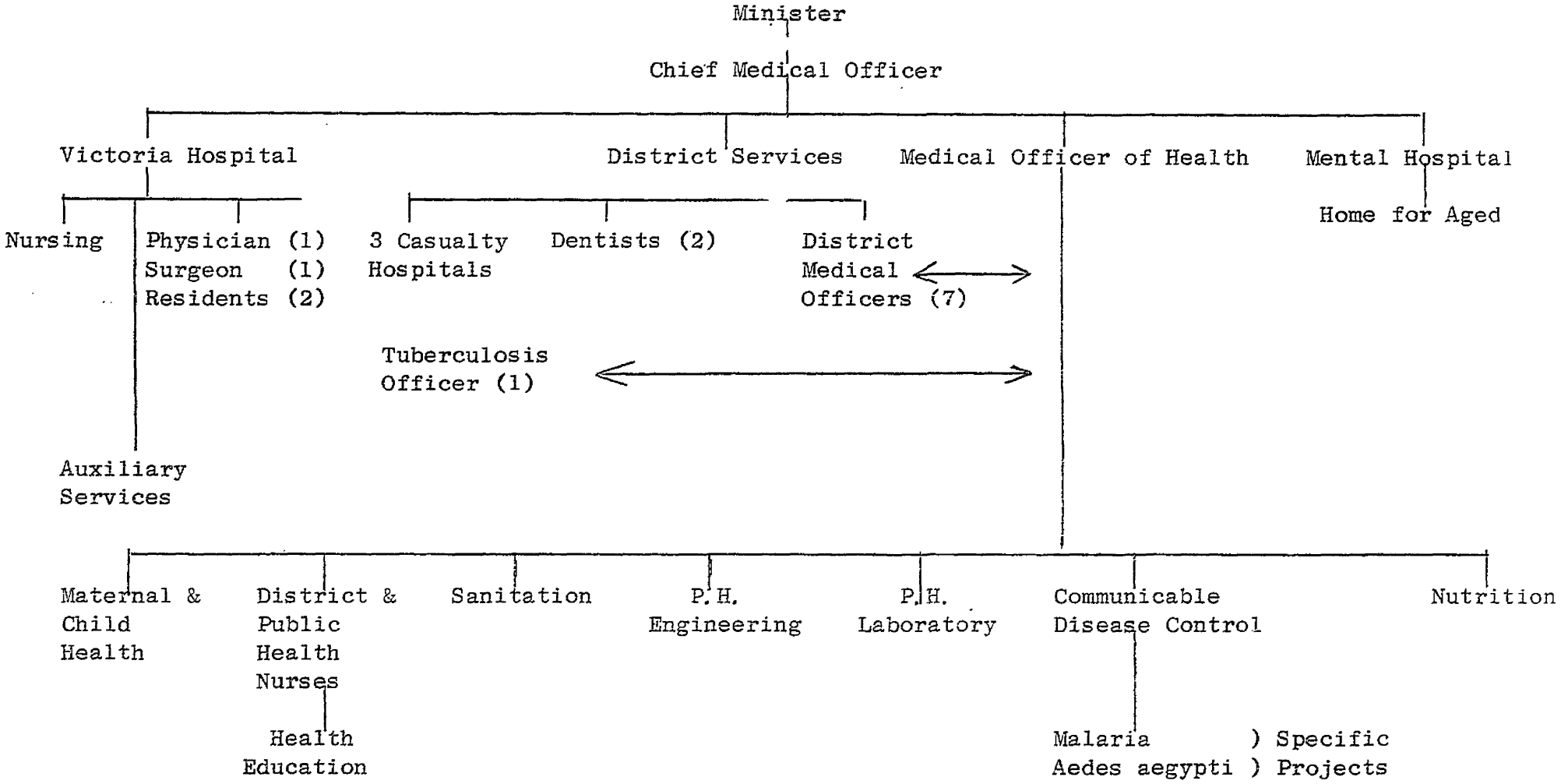


FIGURE I - Administrative structure - St. Lucia Health Services.

of the District Medical Officers in addition to his other duties.

Two Dentists are employed at the main Health Centre in Castries and, in addition to daily clinics there, they visit the out-district hospitals twice monthly.

With an establishment of fourteen Medical Officers for a population of 100,000, the patient/doctor ratio is high, 7,000/1. If administrative officers and specialists are excluded, there is a patient/general practitioner ratio of 14,000/1.

COMMUNICABLE DISEASES:

The greatest Public Health achievement of the past decade was the eradication of malaria, the island being officially declared free in August 1963. Occasional cryptic cases of P.malariae have been detected up till December 1964 but, apart from one small episode in May 1963, there has been no transmission of the disease since 1958.

The remaining problems in the field of communicable diseases are those of gastro-intestinal infections, helminthiasis and schistosomiasis. The prevalences, of schistosomiasis and helminthiasis among 640 schoolchildren (7) in the age range 4-14 years in the Cul de Sac Valley, are shown in TABLE VIII.

Yaws is still found but since the last area of high prevalence was the subject of a campaign in October 1964, the disease is now regarded as being (8) at a level controllable by routine health services.

Gastro-enterities in infants and young children is exceedingly common and carries a heavy mortality. It and its severity will be discussed later in relation/

TABLE VIII - PREVALENCE OF S. MANSONI AND OTHER HELMINTHS IN SCHOOLCHILDREN OF FIVE LOCALITIES IN CUL-DE-SAC VALLEY

	Prevalence percent in 640 Children			
LOCALITY	S. mansoni	N. americanus	A. lumbricoides	T. trichiura
Ravine Poisson	73.5	26.5	43.6	52.1
Bexon	67.3	24.6	64.0	70.6
Forestierre	11.2	39.4	62.0	63.4
Ciceron	39.7	30.9	58.2	76.2
La Croix	20.3	35.7	79.4	83.3
TOTAL	45.9	31.4	61.4	69.1

relation to protein-calorie-deficiency disease.

The childhood illnesses, measles, chickenpox and whooping cough conform to the pattern found in small island communities, visiting in epidemic cycles at 3 - 4 year intervals. Since the last epidemic of whooping cough in 1961, routine immunisation, with Triple Vaccine (Diphtheria, Pertussis, Tetanus) of pre-school children attending clinics, has been practised during the past three years and it is hoped that this will either prolong the free interval or prevent any visitation in epidemic proportions. These diseases tend to be more severe in the individual patient than those seen in the United Kingdom, but unless they occur in an already under-nourished child, they do not carry a high mortality rate.

The veneral diseases, syphilis and gonorrhoea, have a high incidence and are difficult to control because the sexual promiscuity of the populace makes thorough contact tracing an impossible task in the light of the serious shortage of staff.

Pulmonary tuberculosis poses a problem and, although the mortality from this disease has been falling steadily over the past ten years, the notification rate has been rising during the past three years as a result of improvements in case finding measures. A random survey recently conducted by the Health Service indicates that the prevalence of tuberculosis in the community is about thirteen cases per 1,000 of the population.

Epidemic poliomyelitis has not yet appeared in St. Lucia but Wells in
(9) 1959 found high levels of antibodies, to all three polioviruses, among children/

children on the island. All three types are undoubtedly endemic to the community and a few cases of "infantile paralysis" are seen annually; over the past three years two cases of paralytic poliomyelitis have occurred in visitors from the United States.

This general introduction may appear lengthy especially in relation to the volume occupied by the main study, but it is believed that a reasonable understanding of the social, economic and health conditions obtaining on St. Lucia is essential for a full appreciation of the main study especially since the reader may not be fully familiar with this part of the world.

Protein-calorie-deficiency disease in children has its roots in every facet of life of the community, be it social, educational, economic, agricultural or cultural.

PROTEIN-CALORIE-DEFICIENCY DISEASE:

Protein-calorie-deficiency disease is more commonly referred to, inadequately, by medical personnel in the Tropics, as malnutrition. From habit, and for ease of reading, the term malnutrition is used in the text synonymously with the term protein-calorie-deficiency disease. It includes two marked clinical entities, marasmus and kwashiorkor, and intermediate or mixed forms of these conditions.

Malnutrition in tropical countries is a condition of the earlier years of life except in those areas where food shortage leads to severe under-nutrition throughout all age groups. It has variously been described from many regions of the world and its aetiology and epidemiology varies considerably from country to country and from region to region.

It is now generally accepted that although kwashiorkor in typical form represents the end result of a reasonably adequate calorie intake in which the proportion of dietary protein is inadequate, the marasmic syndrome is
10) the result of inadequacy both of total calories and of the protein content of the diet. Many cases are difficult to categorise and the usage of the term protein-calorie-deficiency to cover all cases is better than attempting to place a definite diagnosis of either kwashiorkor or marasmus.

The present study is not a clinical one and it would be irrelevant and unnecessary to write descriptions of the two syndromes included within the term protein-calorie-deficiency disease.

A/

A deficit of over 15% of average body weight for age is often used as a determination of malnutrition but many children who fall into this category represent normal healthy individuals who are below average weight. The determining factor in diagnosis of malnutrition must always be the overall clinical picture.

Treatment, of the well developed case, at home is often difficult under the conditions found in developing countries and if the policy of home treatment is pursued, a large proportion of patients die. Apart from the cases which are easily recognisable clinically, there are a large proportion of children who are in a borderline state and these 'latent' cases are easily precipitated into frank malnutrition by some intercurrent infection, either gastro-enteritis or one of the childhood trilogy, measles, whooping cough or chickenpox. There is a significant relationship between infection and malnutrition, or vice versa, but the exact mechanisms and influences involved have yet to be defined. In Guatemala, it has been established that the severity of the diarrhoeal diseases increases with the degree of malnutrition but it has also been established that a moderately severe diarrhoeal illness can precipitate a child into a (11) state of malnutrition, under which circumstances he becomes prey to recurrent (12) diarrhoeal disease of increasing severity. The exact interplay, however, between diarrhoeal disease and deteriorating nutritional states has yet to be determined.

MALNUTRITION IN ST. LUCIA:/

MALNUTRITION IN ST. LUCIA:

Until recently in St. Lucia, little serious attention was paid to malnutrition as a problem of preventive medicine although there was no doubt of the high morbidity and mortality from the condition.

Between August and September 1961, the Interdepartmental Committee on Nutrition for National Defense (I.C.N.N.D.) of the United States Defense Department, conducted a nutritional survey in the West Indian Islands of Trinidad and Tobago, St. Lucia, St. Kitts, Nevis and Anguilla. The Committee's report was published in 1962 and, commenting on the dietary survey conducted in St. Lucia, states:-

"Answers to the 24-hour recall indicated that the average caloric intake
13) at all six locations (in which surveys were conducted) was adequate."

The Report states further that the average protein intake of St. Lucia was "quite good". Unfortunately, the total number of persons studied was small and in the instances of young children and infants was too small to be of any value at all in indicating average nutritional status. It is true, however, that the adult in St. Lucia is well nourished and has an acceptable intake of dietary protein.

In 1962, the Food and Agricultural Organisation (F.A.O.) organised a seminar to report on nutrition in the Caribbean. In an attempt to generalise on the situation, the Report listed, as factors contributing to the problems of malnutrition in the under two year olds of the area, ignorance, resistance to change, poverty/

poverty, poor hygiene and the high cost of locally produced food. One further factor contributing to overall nutritional difficulties in the area was the
(14) lack of ambition which restricted the output of fishermen and farmers.

In St. Lucia in late 1962, no detailed and listed information was available and all the knowledge of the epidemiology and aetiology of malnutrition was obtained from the impressions of practitioners on the island; these impressions were, however, sufficient to allow an appreciation that the epidemiological pattern was different from that of Latin America, where 40% of cases occur in
(15) children over the age of 4 years, and that the problem in St. Lucia was one of a younger age group, probably under two year olds.

Although St. Lucia is a poor territory, dire poverty in the individual is rare and subsistence at a near starvation level is unknown because of the ready availability of natural foodstuffs. The economy is based to a large extent on peasant farming and local foodstuffs are derived from this source and from fishing. The minimum annual income is $400 (85 pounds) and a labourer earns $2.30 (10/-) a day. The island enjoys a tropical island climate with abundant rainfall and sunshine and the vegetation is consequently luxuriant; fruits and many vegetables grow in a wild or semi-wild state while cultivated food crops include bread-fruit, banana, citrus, avocadoes, coconuts, yams, peas, beans, cristophene, dasheen, lettuce, marrow, cucumber, rice, tomatoes, turnip, cassava, coffee and cocoa. Small livestock, chickens, pigs, sheep and goats are universally kept outside of Castries and even in the suburban areas of that/

that town. Many peasants own one or two cows and, although adults drink the milk produced, it was never offered to young children, being considered unsuitable. Fish is readily available in local waters but poor marketing facilities and the attitudes of the fishermen result in an inadequate supply at other than coastal villages. Because of the habit of growing many foodstuffs in small garden areas, certain vegetables tend to be expensive to buy on the local market.

From birth to age of 3-4 months, the infant was breast fed and fared well but he tended to be partly or completely weaned at an early age and was offered no substitute for breast milk. He existed largely on a carbohydrate diet often of caloric insufficiency. Meat, fish and other protein rich foods were withheld because they were regarded as unsuitable and the cause of worms. A diet of arrowroot and bush tea was fairly typical of that offered to weanlings. If lucky, he was given some proprietary baby food but in inadequate amounts; this was an economic factor, the poorly educated mother invariably buying the most expensive food in the belief that it was best - if given adequately this would have resulted in 25 - 50% of a poor family's income being required purely to
16) feed its youngest member.

A somewhat similar aetiology of malnutrition was described in Jamaica but
17) in that country, poverty was stated to be an important factor. It is certainly a much more organised and much larger country with an employed population rather than a peasant farming one and the two islands are, therefore, not strictly comparable.

In/

In 1960, supplies of powdered skimmed milk were sent to St. Lucia by UNICEF and packets of this milk were distributed free of cost to mothers of young children. The administration and organisation of the distribution service was poor and there was no supportive programme; most of this milk found its way on to the local market where it could be purchased at very reasonable prices. Supplies to the island were stopped early in 1962.

THE EXPANDED NUTRITION PROGRAMME:

In December, 1962, the Government of St. Lucia and agencies of the United Nations agreed on a new programme designed to improve the nutritional status of the children of the island and pave the way for improved agricultural practices in the future by providing schoolchildren with facilities for and instruction in, good farming methods. There were three main branches of this Programme and these were operated by Government personnel, the United Nations providing equipment and supplies and technical advice when required. The three branches were:-

1. The provision of nutrition education in schools and the allocation of free milk powder to primary school children.
2. The establishment of school gardens and the instruction of children in good agricultural techniques.
3. The improvement of the nutritional status of infants and young children by the provision of free milk powder to infants, pre-school children and pregnant and nursing women supported by an intensive nutrition education programme/

programme directed at the mothers of young children.

This present study is concerned, in part, with that aspect of the Programme falling under paragraph (3) above.

To implement this programme, a staff consisting of 1 Education, 2 Nutrition Demonstrators and supporting clerical and transport personnel was provided by C. D. & W. funds while UNICEF provided powdered skimmed milk and all of the equipment and demonstration utensils required. This group of people worked under the direction of the Medical Officer of Health while the whole Nutrition Programme was under the control of a co-ordinating and policy making committee comprising the Chief Medical Officer as Chairman, the Agricultural Superintendent, the Education Officer and the Medical Officer of Health.

To implement the proposals under paragraph (3) above, the relevant part of the Nutrition Programme was integrated with the Maternal and Child Health Services. This virtually involved the complete reorganisation of the Child Health Service in being at that time for, there having been no Medical Officer of Health for several years, this aspect of medical care was being given scant attention and attendance figures were extremely poor. Regular and routine attendance of infants at the clinics was virtually unknown.

In the early stages, in-service training courses in nutrition and child care were given to the District Nurses and the District Medical Officers were advised of the proposed method of operation of the Maternal and Child Health clinics. These clinics were to be run twice weekly by the Nurses and in cases of/

MATERNAL AND CHILD HEALTH — CHILDREN

CASTRIES HEALTH CENTRE

CHILD - Date of Birth — Date of Joining.

NAME:

Address: M.F. Leg. Illeg.

Condition - Healthy, Pny., Full-time, Premature (Month?):

Abnormalities:

Feeding:

Sleeping: Separate Cot. With Mother.

MOTHER - Name Age M.S.W.

A.N. Attendance at Centre.

KAHN TEST

Character of (Present Para.

Confinements (Previous Misc.

Previous Children No. Still-born Dead Living

Ages and Condition of Living

If at work (nature of)

FATHER - Occupation

B.O. - BREAST ONLY B.P. - BREAST PARTLY A. - ARTIFICIAL

S. - SUITABLE N. - UNSUITABLE W. - WEANED

G. - GOOD F. - FAIR P. - POOR I. - ILL. YES - NO.

FIRST YEAR REPORT

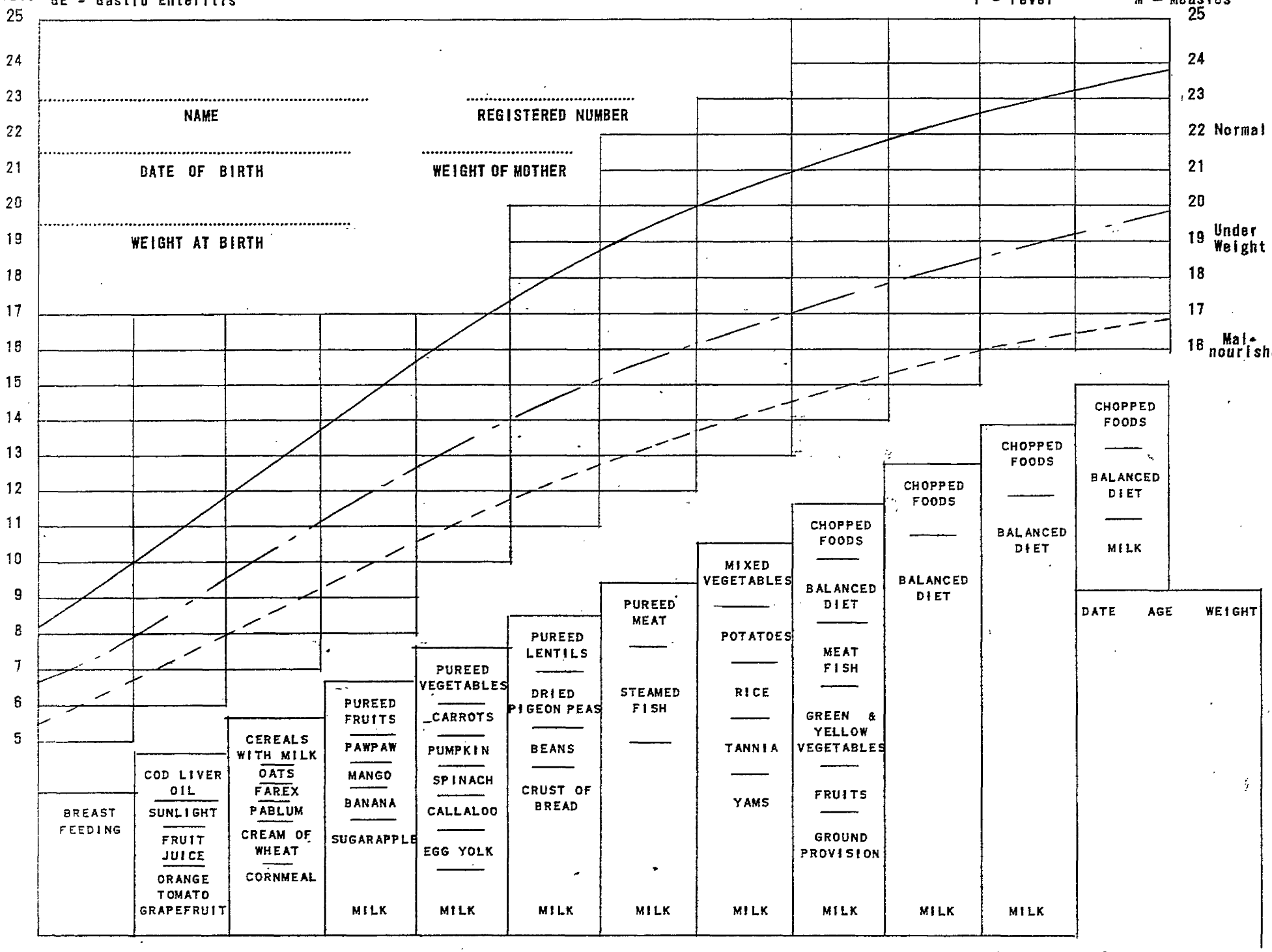
DATE	AGE (MONTHS)	WEIGHT LBS.	WEIGHT OZ.	NOTES ON FEEDING, CONDITION AND ILLNESSES	SEEN BY DOCTOR

CLASSIFICATION OF WEIGHT DURING FIRST YEAR OF LIFE

W - Whooping Cough
GE - Gastro Enteritis

D - Diarrhoea
F - Fever
V - Vomiting
M - Measles

CHART I.



of difficulty, referral to the Medical Officer was to be made. Standard routine examinations of pregnant women were adopted and, in the case of infants, monthly visits were decided upon, at which the infant would be weighed, the mother interviewed on the infant's progress and dietary supplements since the previous visit and, where necessary, given advice to overcome deficiencies or difficulties. Immunisation with Triple Vaccine (Diphtheria, Pertussis, Tetanus) was given, the course running from the fourth to the sixth month. On attendance at the clinic after registration, each infant and pre-school child received a monthly allocation of 4½ lbs. of milk powder while a similar allocation was made to each woman from the sixth month of pregnancy to the third month post-partum. During 1964, because of shortage of milk powder throughout the world, UNICEF was required to cut the monthly allocations to 3 lbs. per recipient.

Weight records were kept both on clinic cards and on charts which had been designed for use in Puerto Rico (Chart I), because no data was available from which to compile local average growth curves, but the suggested food additives were altered slightly to suit locally available produce. Each month the Nurse advised the mother of the food supplements to be added to the child's diet.

The person selected to fill the post of Nutrition Educator was a Public Health Nurse and of the two Nutrition Demonstrators, one had a Diploma in Domestic Science while the other had Home Economics as one of her School Certificate subjects. Both the Demonstrators had in-service training courses locally/

locally and subsequently worked for two weeks under the direction of a World Health Organisation non-medical Nutrition Officer.

The Nutrition Educator directed the activities of the two Demonstrators and also prepared and gave lectures to pregnant women and mothers at the Clinics. The Demonstrators gave practical lessons to groups of mothers arranged into classes of twenty by each Nurse at her Health Centre. The course of lessons lasted for five, once weekly, sessions and had the following programme:-

Lesson 1. The correct preparation and use of skimmed milk powder.

Lesson 2. Hygienic preparation of baby's food.

Lesson 3. Preparation of local foodstuffs for the young baby.

Lesson 4. A balanced diet for your child and household economics.

Lesson 5. Kitchen and home hygiene.

Mothers were encouraged to participate in the food preparation at these lecture/demonstrations, to ask questions and discuss their problems freely.

Early in the programme, the demand for places in the classes became so great that the selected twenty were greatly outnumbered by uninvited guests and it was with difficulty that everyone was assured that they would eventually get a place in one of the class groups. Grandmothers, as has been previously mentioned, play a large part in the rearing of the children and, as they are a superstitious group bound to the old ways and not easily adaptable to new ideas, they were accepted at the classes. Indeed, it turned out that it was often the grandmother who brought the child to the Clinic for his routine visit.

The/

The lessons were given in the local patois tongue in all areas.

Every available publicity outlet was used, radio, newspapers, films and by posters which were made by the Nutrition Staff and Nurses from pictures cut out of used magazines and supplemented by a motto or a few catch words.

A further word is necessary on the use of the growth curve and chart used in this project. The growth chart is marked with two curves on the tenth percentile above and below the average. At each visit, the infant's weight was plotted, in addition to being noted on a clinic card, to enable the Nurse to see at a glance any tendency for an infant to drift from an acceptable rate of growth. Despite the use of a Puerto Rican chart, this proved a very efficient record system and was highly satisfactory to the Nurses using it.

The use of the Puerto Rican chart was intended to be a temporary expedient, to be replaced eventually by a similar chart prepared from the weight records of local, normal infants. See appendix.

PURPOSE OF THE PRESENT STUDIES:

The purpose of the studies undertaken was really a threefold one initially:

1) The definition of the epidemiology of malnutrition within the community.

2) The determination of the aetiological factors involved.

3) The evaluation of the success, if any, of the measures being taken in attempt at prevention of the condition and observation of any change in the epidemiological pattern which occurred coincidentally with a change in morbidity or mortality resulting from the preventive measures being employed.

The studies were conducted over the period of three years during which the author was responsible for the Public Health and Preventive Medical Services of the island and were begun with no other purpose than enabling the best possible operation of the nutrition and child care programmes in the light of the findings. They were considered to be especially necessary because the basic information, upon which any project must be founded, was not available in any exactitude. From the findings which evolved as the studies progressed, minor changes were made from time to time in the operation of the integrated service and especially in the educational techniques employed.

1) Epidemiological Studies:

From the beginning of activities in December 1962, malnutrition was made a notifiable disease. This was a very useful measure in ascertaining the age and sex distribution of cases but in many other respects it proved to be of limited value.

As/

As in all notifiable conditions, the accuracy of returns is dependent on the interest and enthusiasm of the individual medical officer in the field and while some of them co-operated extremely well, not only in respect of notification but in taking an active interest in the preventive measures, a few displayed little interest (or perhaps a lack of appreciation of themethods of preventive medicine) and were content to leave the responsibility for notification to their nurses or dispensers without ensuring that the required returns were made. This same attitude is displayed, and not only in underdeveloped countries, to diseases which the medical officer regards as commonplace or relatively unimportant; it has been noticed, however, that in St. Lucia the more serious communicable diseases, leprosy, typhoid and yaws are notified accurately and reliably. Gastro-enteritis and dysentry are further examples of diseases which occur so commonly that notification is not taken seriously.

The criteria for diagnosis of malnutrition cannot be rigid since there is no definite recordable line separating the healthy child in the lower range of weight for his age fro m the child who is slightly malnourished. In addition, the child with kwashiorkor and gross resultant oedema may not be far below acceptable weight. In circumstances where biochemical investigations are unavailable, the clinical impression of the physician is the only criterion of diagnosis of the condition.

Over a period of time the standards of diagnosis, by the individual physician, may change in the absence of rigid guide lines. This was illustrated at one point during the period under review ehen, despite a rapidly falling/

falling death rate, case notifications remained about the same level as formerly. The therapeutic regime at Victoria Hospital, the District Hospitals and Clinics had remained unchanged. On being questioned about this situation, several medical officers stated that with the changing pattern of cases being seen at the clinics, they were presently notifying mild cases which they had omitted to notify during the period when many severe cases were being presented to them.

For these reasons, certified causes of death have been used in obtaining confirmation of the age distribution of cases within the community and for purposes of study of the seasonal variations of incidence. Deaths have also been used to form the basis of evaluation of the success of the project.

As will be seen by study of TABLES IX and X and Figures 1 and 2, illustrating the age distribution of 179 notified cases and 115 deaths from malnutrition, there is close agreement and in this respect there has been little
.6) hindrance caused by the incompleteness of notification.

There is no difference in incidence between urban and rural areas - this is not surprising for in an island as small as this, and with such small settlements, there is little difference between urban and rural areas and the designations are hardly usable in their normal context.

Of the 179 cases from which Table IX was compiled, 88 were male, 82 female and in 9 instances the sex was unspecified. There is no significant sex variation. The mean age at notification was 15.4 months and the mode occurred in the 10-12 month age group. Of the total cases, 85.5% were notified between the 4th and 24th month of life. In all of the cases occurring after the 36th month, it/

TABLE IX

Age distribution in months of 179 notified cases of malnutrition

Age (Mths.)	No. Cases
0 - 3	6
4 - 6	24
7 - 9	24
10 - 12	35
13 - 15	25
16 - 18	19
19 - 21	11
22 - 24	15
25 - 27	2
28 - 30	2
31 - 33	3
34 - 36	4
36 +	9
TOTAL	179

Fig. 1

AGE DISTRIBUTION OF 179 NOTIFIED CASES OF MALNUTRITION - ST. LUCIA

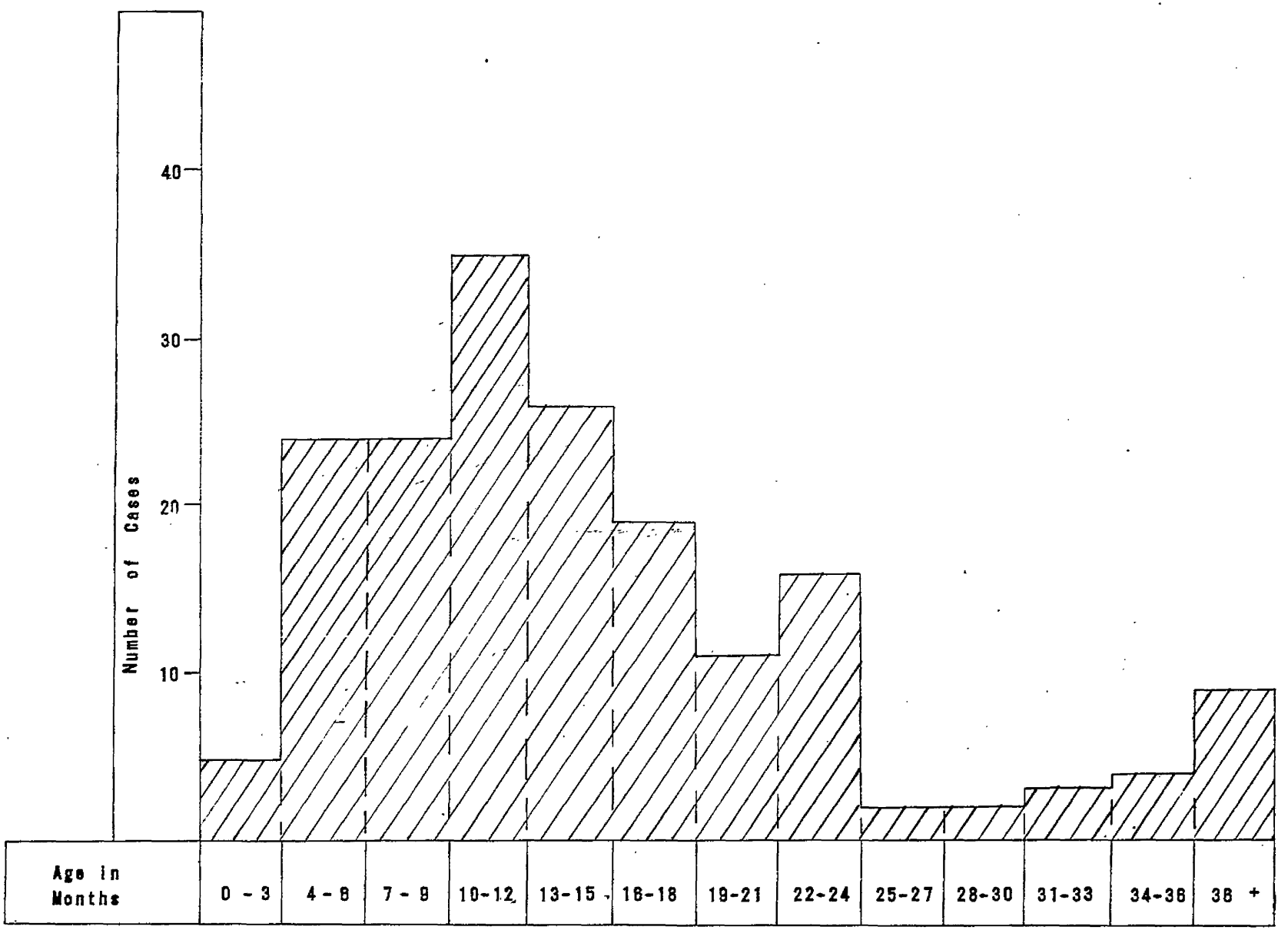


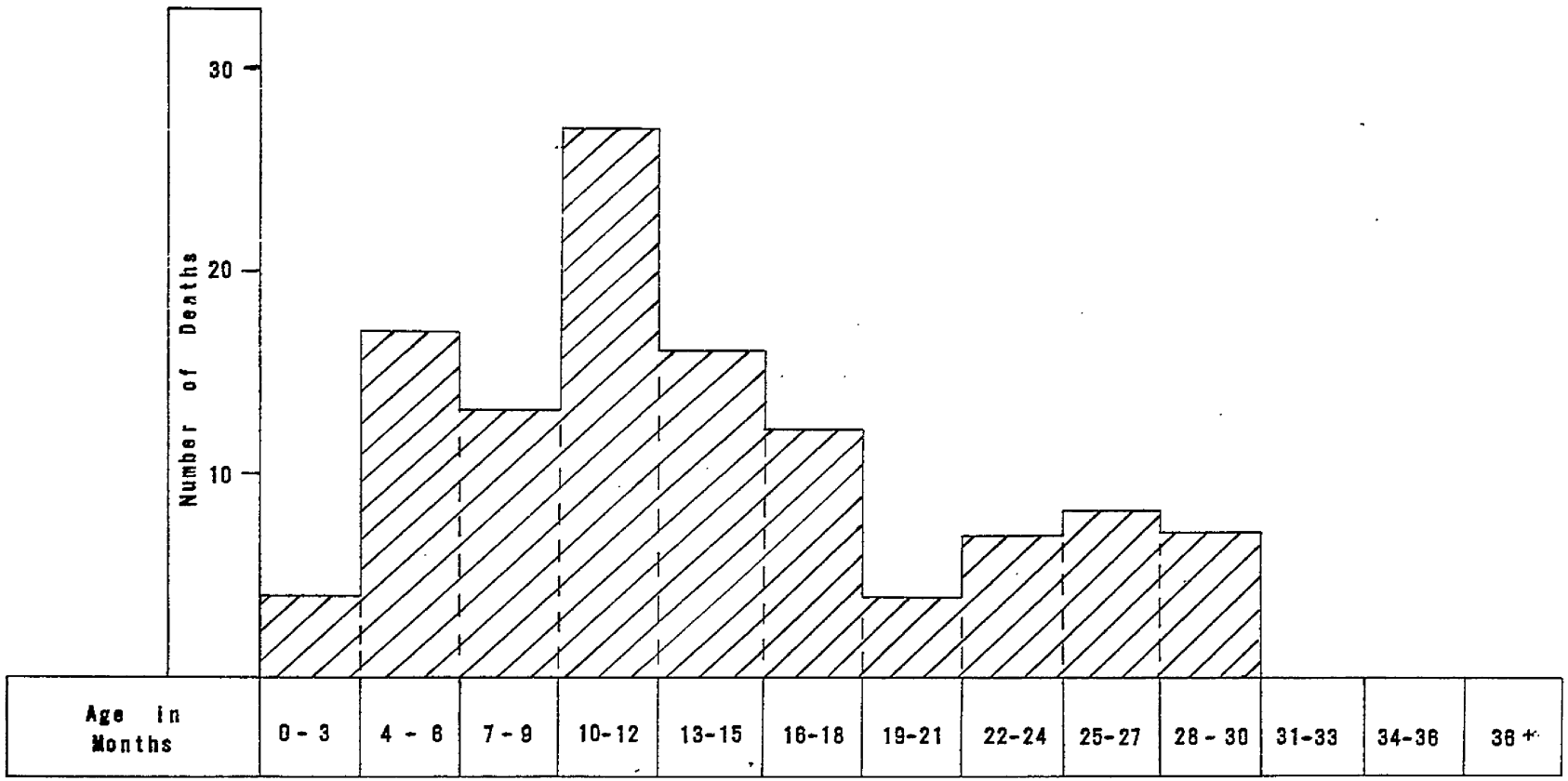
TABLE X

Age at Death of 115 cases of Malnutrition

Age (Mths.)	No. Cases
0 - 3	4
4 - 6	18
7 - 9	14
10 - 12	28
13 - 15	16
18 - 18	12
19 - 21	4
22 - 24	6
25 - 27	7
28 - 30	6
31 - 33	-
34 - 36	-
36 +	-
TOTAL	115

Fig. 2

AGE DISTRIBUTION OF 115 DEATHS FROM MALNUTRITION - ST. LUCIA



it was shown, subsequent to notification, that there was underlying pathology or deliberate neglect.

Of the 115 deaths recorded in Table X, 58 were in males and 57 in females. The mean age at death was 13 months and the mode was at age 10 - 12 months. 85.3% of the deaths occurred between the 4th and 24th month.

To determine whether or not there was any seasonal variation in the mortality from malnutrition, death certificates for the years 1962 (the year before the study) and 1963 (the first year of the study) were examined and deaths recorded by calendar month as in TABLE XI. Figure 3 shows graphically the comparative seasonal pattern. The highest mortality in both years occurred within the period March - June and the low mortality periods fell toward the end of the year in the months September - December. It is probably significant in relation to this pattern that the mango season, with consequently increased and heavy fly breeding, falls between the end of February and the end of June and that this is also the time of year when the incidence of gastro-enteritis reaches its peak.

A review of hospital admissions during the three year study period revealed that of the 178 cases admitted, 100 were diagnosed as marasmus and 78 as kwashiorkor. As in the notification and death figures, there was no significant sex variation although there were slightly more females than male admissions. The average age on admission was 13.1 months.

There were 21 deaths from these 178 cases (13 marasmus and 8 kwashiorkor) giving/

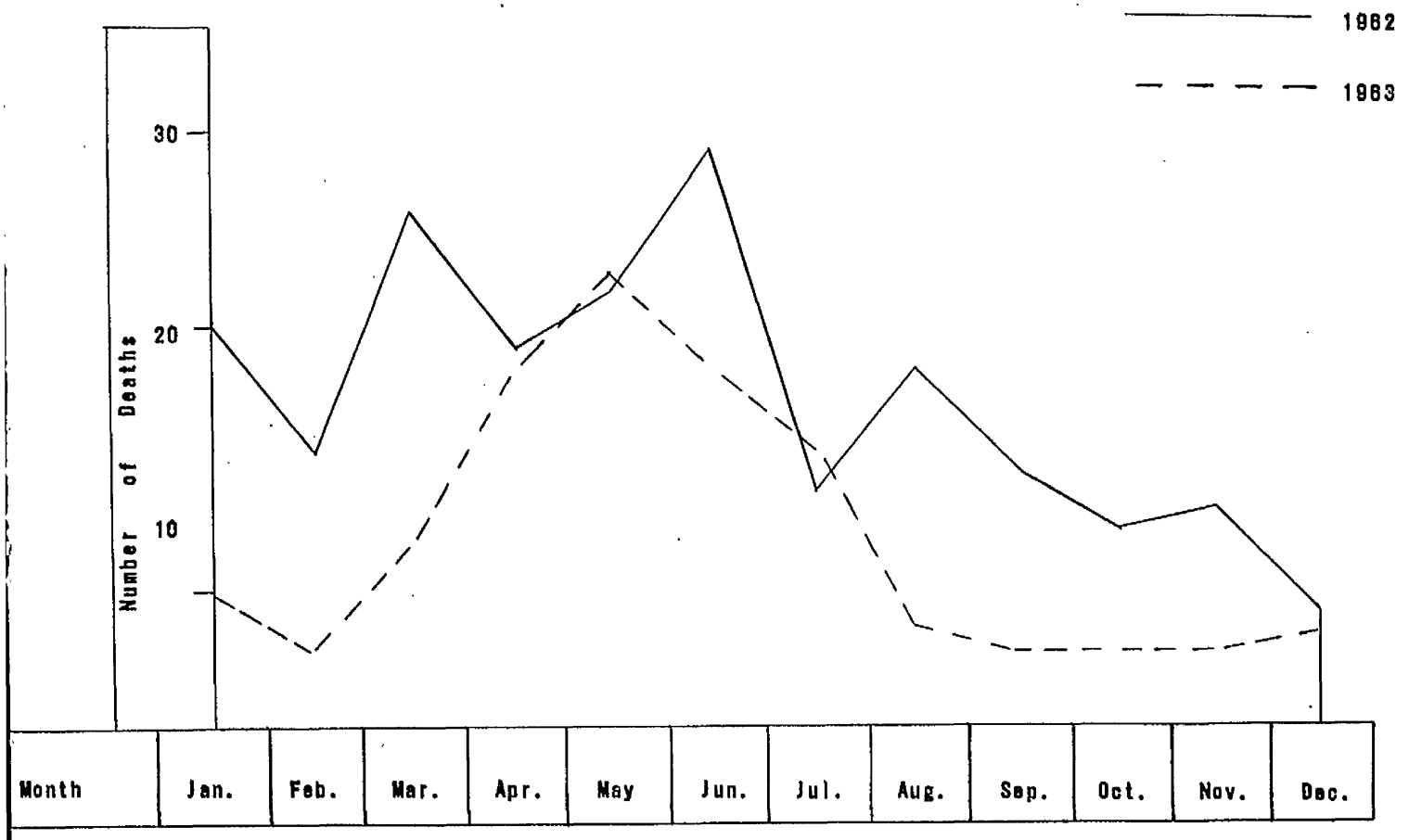
Table XI

DEATHS FROM MALNUTRITION BY CALENDAR MONTH - 1962 and 1963.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1962	20	14	26	19	22	29	12	18	13	10	11	6	200
1963	7	4	9	18	23	18	14	5	4	4	4	5	115
Total	27	18	35	37	45	47	26	23	17	14	15	11	315

g. 3

DEATHS FROM MALNUTRITION BY CALENDAR MONTH - 1962 and 1963.



giving a hospital mortality rate of 11.8%. Of the deaths, 75% occurred within seven days of admission.

The admissions by sex, with diagnosis and average age at admission are summarised for the years 1963 - 1965 in TABLE XII. The Malnutrition Unit at Victoria Hospital was established in October 1962 and there are, therefore, no records prior to that time. The three months of 1962 were excluded from study and only the three full calendar years included.

2) Determination of aetiology:

In the initial stages, aetiological information was not recorded but was gathered from interviews with the mothers, grandmothers and relatives of children found to be suffering from malnutrition. The information obtained confirmed that the aetiological pattern was as has already been described under the chapter "Malnutrition in St. Lucia" and that protein-caloric-deficiency disease had its roots in ignorance of infant and child feeding methods, superstition and erroneous beliefs. The development of malnutrition in a child was regarded fatalistically and mothers who had lost several children from this condition were regarded as being the objects of evil forces and obeah. Antrobus describes a similar attitude in St. Vincent where the condition is attributed to "maljo" (18) or the evil eye.

Food shortage and poverty were not shown up as significant aetiological factors, and this was confirmed by the fact that the other members of the family/

TABLE XII

Summary of Malnutrition admissions to Victoria Hospital 1963 - 1965

Year	Admissions			Diagnosis		Average Age (Months)
	Male	Female	Total	Marasmus	Kwoshiorkor	
1963	31	40	71	41	30	13
1964	28	35	63	31	32	13.25
1965	25	19	44	28	16	13.5
TOTAL	84	94	178	100	78	13.1

family received an adequate diet and protein was well represented in that diet. This latter fact confirms the findings of the I.C.N.N.D. Survey Team.

By the end of 1964, however, after the large reduction in deaths from malnutrition, it was becoming apparent that a state of equilibrium had been reached and the mortality was still too high to allow any feeling of complacency. This base-line level of mortality showed no sign of being broken through and with the help of an experienced Health Visitor from the Save the Children Fund, a survey was undertaken into the socio-economic background of families in which the disease was still occurring; every reported case of malnutrition from the
(19) northern third of the island was investigated.

The survey sheet reproduced on the next page was prepared and completed in the instance of each family. The Health Visitor was a local nurse (S.R.N., S.C.M.) who had formerly been a Nursing Sister at Victoria Hospital and was subsequently trained and employed as Child Care Officer by the Save the Children Fund. She was fluent in the patois language and well known in the community. Even so, it was not easy to obtain the desired information and accurate figures and information was usually acquired only after several months of regular home visiting. Survey questionnaires were completed for 42 families by the end of the author's association with this branch of the Health Service.

In the interpretation of the results of this survey, it was found that accuracy was obtained only in the objectively answered questions and that the subjective answers had to be largely ignored. For example, the answers given to/

NAME ..... AGE ..... WEIGHT .....

Legitimate: Yes / No Mother's age ..... Father's age .....

Lives with ..... if mother works, left with ...

.....

Father Working / No Mother Working / No Is Father at home Yes / No

Does Father contribute to child's upkeep Yes / No How much? .....

Total family weekly income? ..... Money spent weekly on food .....

Rent .....

Meat, Fish, Eggs & Milk .....

Baby Foods .....

Rum & Tobacco .....

Are parents literate Yes / No

How long was child breast fed? .....

Does he receive milk in diet? .....

Does he receive eggs, meat, fish, cheese & vegetables .....

House: Number of rooms ..... Owned or rented .....

Number of Occupants ..... Water supply .....

Latrine accommodation Yes / No

Siblings: a) Alive b) Dead

Did any siblings suffer from malnutrition? .....

How many siblings died under 2 years? .....

Has child been a patient before? Yes / No

to questions on family weekly expenditure were completely misleading and, in many instances, the stated expenditure greatly exceeded the income. Income was known with certainty in all cases. The question on breast feeding was badly phrased and would have been better in the form "How long was the child regularly breast fed?". Most children were stated to be breast fed for satisfactory periods but, in fact, they were being put to the breast infrequently and irregularly, usually in an attempt to soothe a crying child rather than feed it.

Several interesting facts were, however, elicited - TABLE XIII (a) to g)).

All of the families were from the lower social groups and all were living under overcrowded conditions (on a basis of 2 persons/room being acceptable). The room density varied from 2.25 to 9. This is, however, the normal housing situation in St. Lucia and is probably of no significance in the aetiology of malnutrition.

The per capita weekly income of the family, in the study group, varied from $1 to over $5 and in one instance was $11.

40 of the 42 families had latrine accommodation and 24 drew their water from the mains via road standpipes. 10 others obtained water either by roof catchment or from protected springs.

37 (88%) of the children lived with the mother, but of these mothers, 26 (70%) were working and left the children at home each day (and in several instances often at night also) in the care of persons who ranged from a nine year old sister to a room-mate.

In/

TABLE XIII

a) LIVING WITH MOTHER

	YES	NO	TOTAL
No.	37	5	42
%	88	12	100

b) LIVING WITH WORKING MOTHER

	YES	NO	TOTAL
No.	26	11	37
%	70	30	100

c) LITERACY IN MOTHER

	LITERATE	ILLITERATE	TOTAL
No.	13	29	42
%	31	69	100

d) LITERACY OF MOTHER IN 16 FAMILIES WITH PREVIOUS DEATHS UNDER TWO YEARS

	LITERATE	ILLITERATE	TOTAL
No.	2	14	16
%	13	87	100

e) PREVIOUS DEATH UNDER TWO YEARS IN FAMILIES WITH MORE THAN ONE CHILD

	No. Families	No. Families with previous death under Two years.	No. previous Deaths.
No.	36	16	20
%	100	44	56

f)

	Families with Death Under Two Years	Diagnosed Malnutrition	Diagnosed Other or Unknown
No.	16	13	3
%	100	81	19

g) PER CAPITA FAMILY INCOME OF 42 FAMILIES

Income $	1 - 2	2 - 3	3 - 4	4 - 5	5 plus
No.	9	7	10	6	10
%	21.5	16.5	24	14	24

In the group, 29 (69%) of the mothers were illiterate but of the 16 families which had experienced previous deaths in children under the age of two years, 14 (87%) mothers were illiterate.

From the 36 families with more than 1 child, there had been a previous child death under two years in 44.4% of them and from this latter group, there had been previous deaths from malnutrition in 81%. In one family where there had been six child deaths, five of the deaths were certified as having been due to malnutrition.

Within the 42 families studied there had been a total of 189 children born of whom 40 (21%) had died under the age of two years.

The illegitimacy rate of 80% of children in the study group is of no significance where the overall illegitimacy rate is 66% and where in the lower social groups, marriage is an exceptional practice. All of the fathers, natural or adopted, contributed toward the child's upkeep.

Three of the children being studied had been treated previously for malnutrition.

The hard core of persistent cases were found to be coming from a section of the population which could be relatively easily defined:- the illiterate, working mother who had suffered previous deaths under the age of two years among her children. All three criteria were found in 33.3% of the cases studied and one or more was present in 85.6% of them.

EVALUATION OF RESULTS

It had originally been hoped to evaluate the preventive measures taken on the basis of:-

1) Reduction in notifications of malnutrition.

2) Reduction in the mortality from the condition.

3) The impact of reducing case incidence and mortality on the Infant Mortality Rate and the proportionate deaths occurring under the age of 4 years.

As a further observation, any change in the epidemiological picture was to be noted and, if possible, interpreted.

The difficulties of using notifications, as an accurate measure of efficacy of the project, have already been discussed but the notification returns for the years 1963 - 1965 are given in TABLE XIV. Because of their probable inaccuracies they will not be used as a yardstick nor will any further attention be paid to them.

The regime of treatment in the Malnutrition Unit remained unaltered during the course of this study, and there is no possibility that improved therapy in hospital was responsible in any way for the reduction in mortality. The death rate of admissions to the Unit during each of the three years, the average duration of stay of fatal cases and the average duration of stay of all admissions are seen in TABLE XV.

The number of admission fell in each succeeding year as did the case mortality rate and the average duration of hospitalisation of all admitted cases. There/

TABLE XIV

MALNUTRITION NOTIFICATIONS
1963 - 1965

	1963	1964	1965
Number of Notifications	234	246	131

TABLE XV

MALNUTRITION ADMISSIONS, MORTALITY RATES AND AVERAGE DURATION OF STAY OF THOSE ADMISSIONS 1963 - 1965

Year	1963	1964	1965
Number of Admissions	71	63	44
Number of Deaths	13	5	3
Death Rate Percent	18.3	7.9	6.9
Average Stay Admission Deaths in days.	8.3	12.2	8.0
Average Stay all Admissions in days.	48.3	36	39

There was a one third average prolongation of life after admission of those cases which died in 1964 as compared with 1963 but this was not maintained in 1965. Those cases which died were severe and all had contracted an infection either before or shortly after admission. It is inferred from the figures in this table that while the death rate fell, this was due to the admission of less severe cases than in preceding years. The reduction in the numbers of admissions would also indicate that the case load, and/or severity of the cases, being seen in the districts, was much less in 1965 than in 1963.

The number of deaths from malnutrition and the infant death rate from malnutrition per 1,000 live births (calculated on the basis of 58% of malnutrition deaths occurring under the age of one year) for the years 1961-1965 are shown in TABLE XVI and Figure 4 shows graphically the number of deaths during each annual quarter from January 1961 to December 1965. The seasonal distribution of these deaths for the years 1963 - 1965 and the age distribution of deaths in 1963 and 1964 are tabulated in TABLES XVII and XVIII and Figure 5 illustrates, diagramatically, the comparative age distribution in these two years; the seasonal distribution for 1964 and 1965 is graphically represented with that of 1963 in Figure 6.

From the commencement of the exercise, there was a dramatic and rapid decline in the number of deaths from malnutrition and this appears to have reached a base-line level of about 40 deaths per annum in 1964/65. The peak in the period April - June 1963 coincided with a measles epidemic and a severe epidemic/

TABLE XVI

ANNUAL DEATHS FROM MALNUTRITION 1961 - 1965

Year	1961	1962	1963	1964	1965
Deaths from Malnutrition	229	200	115	38	40
Infant Malnutrition death rate per 1000 live births	33.1	29.4	16.7	4.7	5.3

TABLE XVII

MALNUTRITION DEATHS BY MONTH 1963 - 1965

Year	Number of Deaths												Total
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1963	7	4	9	18	23	18	14	5	4	4	4	5	115
1964	10	4	3	2	1	2	0	1	2	9	2	2	38
1965	5	5	4	0	3	1	4	1	2	8	3	4	40

TABLE XVIII

MALNUTRITION DEATHS BY AGE IN MONTHS 1963 - 1965

Year	Number of Deaths													Total
	0-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	36 +	
1963	3	18	14	28	16	12	4	6	7	1	0	0	6	115
1964	6	7	1	13	7	2	0	2	0	0	0	0	0	38
Total	8	25	15	41	23	16	4	8	7	1	0	0	0	153

Fig. 4

DEATHS FROM MALNUTRITION BY ANNUAL QUARTERS - 1961 - 1965

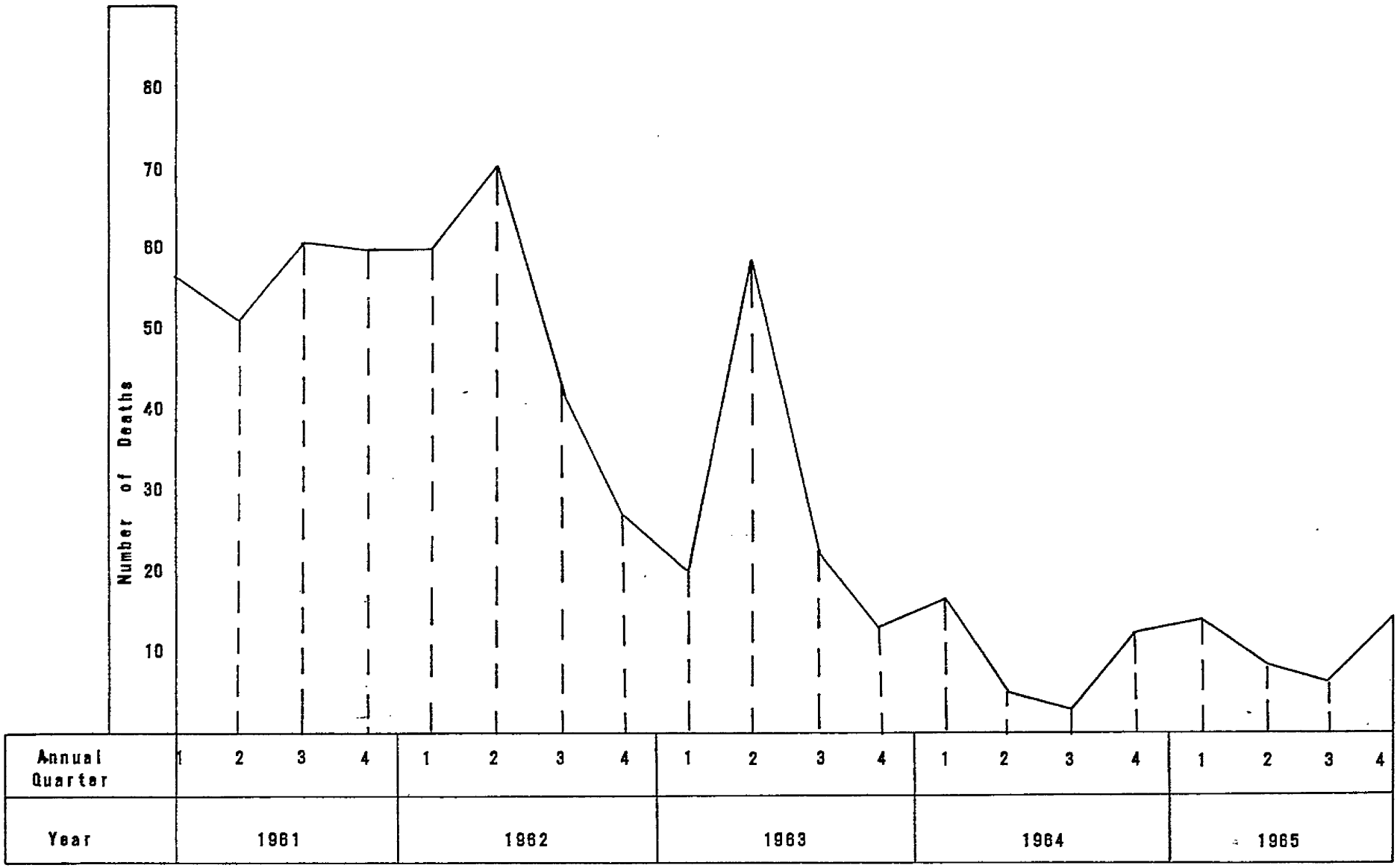


Fig.5

MALNUTRITION DEATHS BY AGE GROUP = 1963 and 1964

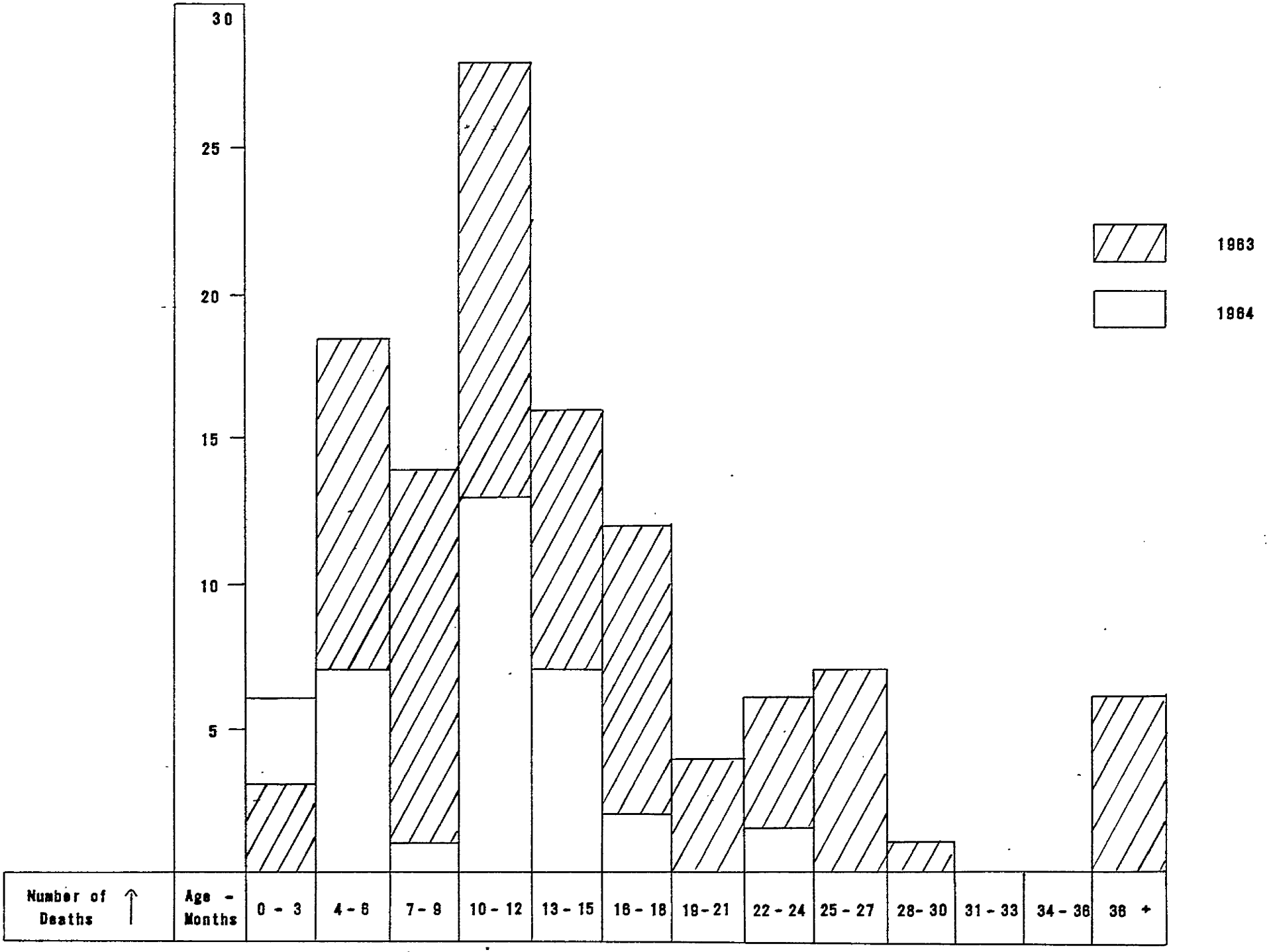
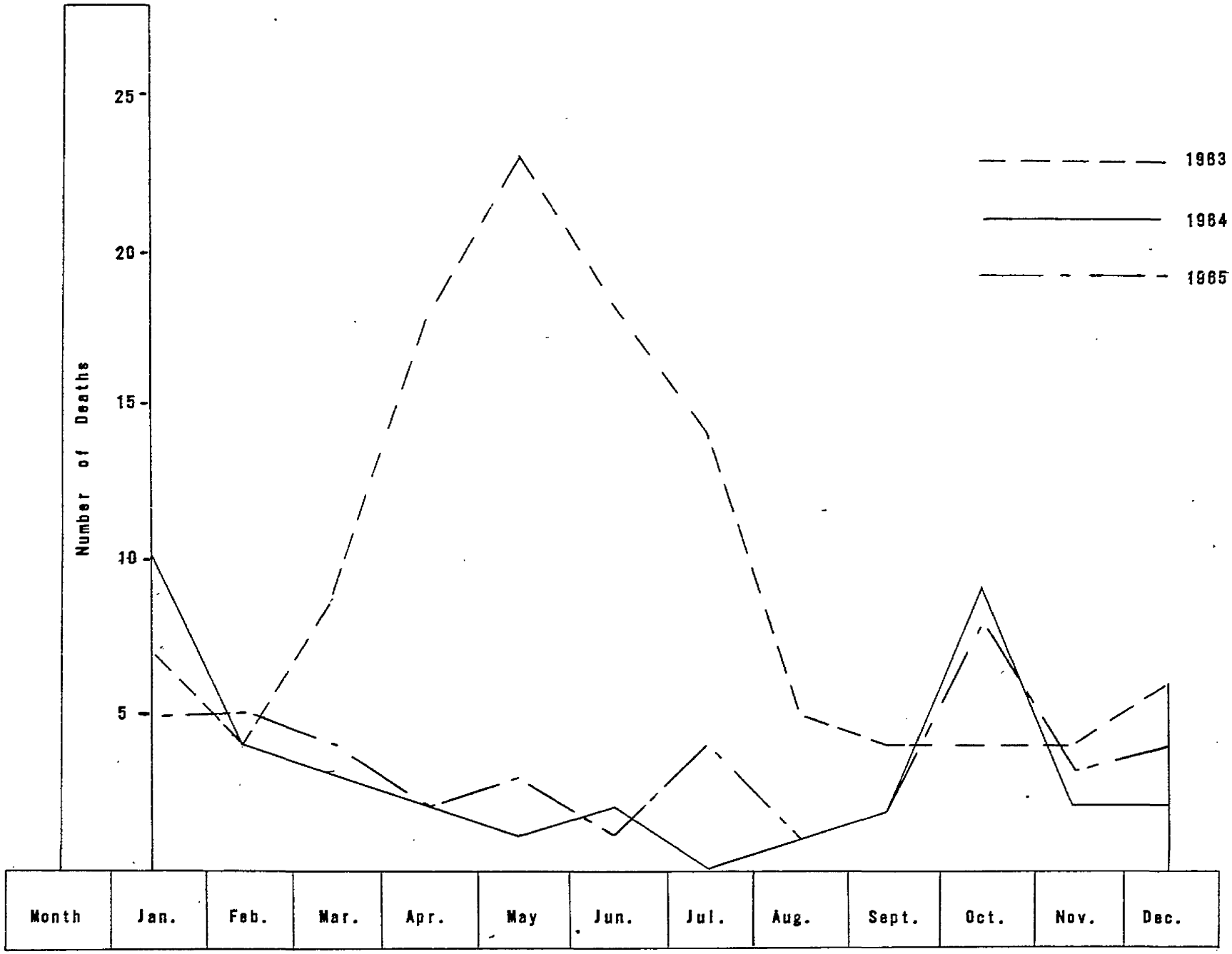


Fig. 6

SEASONAL DISTRIBUTION OF DEATHS FROM MALNUTRITION - 1963, 1964,. 1965.



epidemic of gastro-enteritis. Since that time, seasonal epidemics of gastro-enteritis (in the second quarters of 1964 and 1965) have not been associated with increased mortality from malnutrition. The seasonal distribution of deaths has, however, altered in 1964 and 1965 as compared with the patterns of 1962 and 1963. The high mortality peaks of the first half of the year have disappeared but peaks appeared in the fourth quarters of 1964 and 1965. These latter peaks were accounted for by the number of deaths occurring in October of each year, there being 9 deaths in October 1964 and 8 deaths in October 1965. No explanation for this situation can be given.

The modal age of death in 1964 was still the 10-12 month age group and the average age at death was 9.7 months (cf average age 13 months in 1963). In 1964, 29% of the deaths occurred during the second year of life as compared to 31.2% in 1963, when the average age at death was 13 months. In 1964, however, there was no death over the age of two years.

Although the modal age of death has remained unchanged, and only a slightly lower percentage of deaths occurred during the second year of life, there has been a proportionately greatly saving of life in the over two year olds and this has reduced the average age at death.

INFANT MORTALITY AND DEATHS UNDER 4 YEARS:

In 1962, prior to the introductions of the programme, the Infant Mortality Rate was 102.9/1,000 live births and had been remaining persistently above the 100/

100 mark. By 1963, it had fallen to 78.4 but an even greater reduction followed in 1964 when it fell to 37.9. In 1965 it rose to 47.8. Between 1961 and 1964, the percentage of the island's total deaths represented by deaths under the age of 4 years changed from 51.4% to 21.0%; in 1963, the first year of nutrition operations the figure was 48.6% (Table VII). One would expect no more in the first year of a project designed to improve the nutritional status of young children mainly by educational methods which had to fight for acceptance in the face of age old practices, superstitions and beliefs.

DISCUSSION:

Sufficient is now known about protein-caloric-deficiency disease throughout the world for it to be realised that, clinically, the disease forms a distinct entity even although there are often distinct and marked differences in its epidemiology from continent to continent or indeed, from country to country. The broad aetiology is well determined but there are differences in the importance of the several aetiological factors under differing cultural, social and environmental conditions.

It has been proposed by several workers that the age specific mortality rate in the 1-4 year age group forms a good guide to the nutritional status of a community or population. This criterion would be of doubtful accuracy in St. Lucia where it is now known that a considerable proportion of cases (50% of the notifications) and deaths (58% of deaths certified as due to malnutrition during 1963 and 1964) occur in infants under the age of 1 year. The proportion of all deaths which is accounted for by the age group 0-4 years is, under local conditions, a more reliable indication of the prevalence of malnutrition and of its effect on the death rate in young children. Similarly, if malnutrition is a disease of the 1-4 year olds in most countries, the relationship between this disease and the Infant Mortality Rate must be a much closer one in St. Lucia than in these countries, and for this reason the suggestion by Wills and Waterlow, that the consideration of the 1-4 years mortality in relation to the Infant Mortality Rate is a more specific index of nutritional status than the/

the 1-4 year mortality alone, must also be rejected in the consideration of St. Lucia's position.

From 1962 until 1964, the Infant Mortality Rate fell from 102.9/1000 live births to 37.9/1000 live births, and the age specific mortality rate for the 0-4 year old group fell from 51.4% of total registered deaths in 1961 to 21% in 1964. There is confirmation here that the age specific mortality rate can be markedly affected by the nutritional status of the 0-4 year age group within a community. The number of deaths from malnutrition were reduced from 200 in 1962 to 38 in 1964. The infant death rate from malnutrition /1000 live births fell, during the same period, from 29.4 to 4.7. These reduced levels were maintained during 1965 with a small rise of Infant Mortality Rate to 47.8/1000 live births and of malnutrition deaths to 40 (infant death rate /1000 live births - 5.3).

It is interesting that the sanitary standards of the population showed no apparent improvement over the period under study. The incidence of typhoid has been taken as a measurement of the level of sanitation and the number of cases occurring over the past ten years 1956-1965 are given in TABLE XIX. Helminthic diseases are prevalent throughout the community and toddlers are invariably harbouring one or more parasites, usually trichuris and ascaris but often hookworm also. Schistosomiasis is not common in the pre-school child and is rarely found in children under the age of two years.

From/

TABLE XIX

NOTIFIED CASES OF TYPHOID 1956 - 1965 - ST. LUCIA

Year	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Number of Cases	23	150	95	12	55	153	34	75	40	62

TABLE XX

DEATHS IN UNDER 2-YEAR OLDS FROM GASTRO-ENTERITIS 1960 - 1965 - ST. LUCIA

Year	1960	1961	1962	1963	1964	1965
Deaths	159	131	133	90	43	60

From the statistical evidence that 58% of malnutrition deaths occur in infants, the reduction of deaths from this disease between 1962 and 1965 would have, alone, accounted for a fall in the Infant Mortality Rate of approximately 34 points, i.e. from 102.9 per thousand in 1962 to 68.9 in 1965. The decrease in the rate was in fact 82% greater than this.

It is postulated that this greater fall was accounted for by two main reasons:-

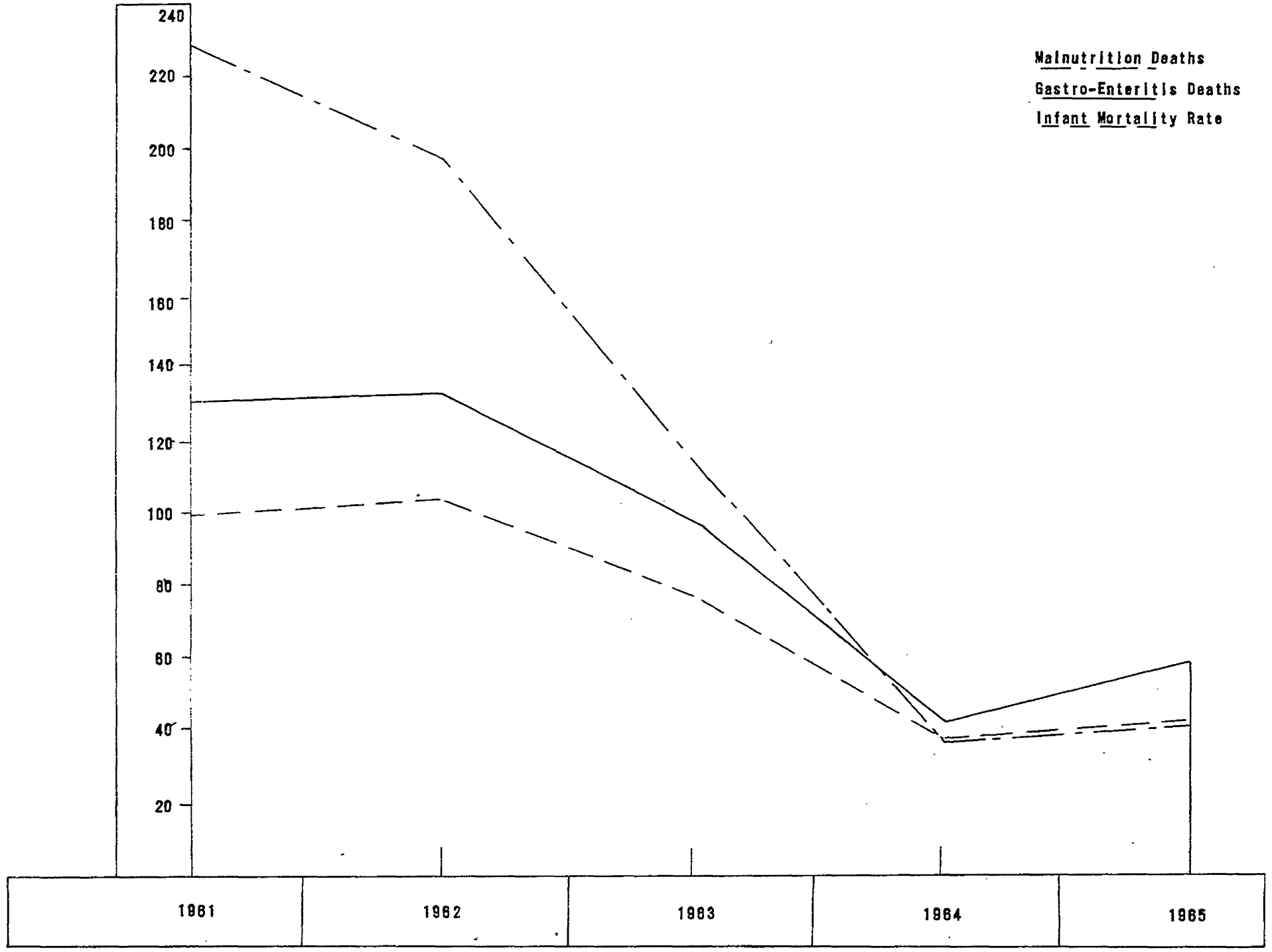
1) The improved nutritional status of the infant increased his resistance to infection and particularly to infections of the gastro-intestinal tract. The work being done at the Institute of Nutrition for Central America and Panama (INCAP) on the relationship between malnutrition and intestinal infection, although not yet completed, has indicated a close relationship between such infections and poor nutritional status. Either condition may precipitate the other, and the mortality rate from each disease rises markedly in the presence of the other.

The number of deaths from gastro-enteritis in children under the age of two years in St. Lucia from 1960-1965 is shown in TABLE XX.

Figure 7 illustrates graphically the fall in the mortality from malnutrition and gastro-enteritis and the decline in the Infant Mortality Rate from 1961 to 1965. The parallelism is obvious but the proportionately less fall in gastro-entiritis mortality, compared to malnutrition mortality, suggests that the relationship between these two conditions is/

Fig. 7

COMPARISON OF MORBIDITY FROM MALNUTRITION AND GASTRO-ENTERITIS WITH THE INFANT MORTALITY RATE: 1961 - 1965



is not a completely direct one. The level of community sanitary standards still exerts a strong influence on epidemic gastro-enteritis despite improvements in nutritional status. This is borne out by the increase in the number of deaths from gastro-enteritis in 1965 as compared to 1964, which was not accompanied by a similar increase in deaths from malnutrition. This consequence of a severe epidemic of gastro-enteritis during 1965 largely accounts for the rise in the Infant Mortality Rate over the preceding year.

It is interesting to note that such a striking reduction in the Infant Mortality Rate is possible in the presence of unaltered, poor sanitary standards. The improvements in health of infants in St. Lucia would tend to refute the theory that the Infant Mortality Rate can be taken as an index of the sanitary status of a community. One must only speculate on the effect that co-incidental raising of sanitary standards would have had on the Infant Mortality Rate decline during the three years under review.

2) The generally improved level of infant and child care consequent on the attraction of these groups to routine attendance at the Child Health Clinics and the improved quality of the district nursing service as a result of in-service training.

At the commencement of the combined Child Health/Nutrition Programme there were/

were less than 300 infants in the whole island who attended the Health Centre Clinic in any one month. Today, the monthly average of regular attenders is over 2,500, i.e. over 62% of the infant population. The rate of growth during the first year of the operation (1963) can be seen in TABLE XXI where the monthly numbers of infants receiving free milk powder, and therefore registered attenders, are tabulated.

The educational activities of the project have been described earlier and it is this aspect which must take the main credit for the results obtained; skimmed milk powder, judiciously dispensed without charge, has made the educational programme possible and was the vehicle whereby mothers were attracted to the Child Health Clinic and which allowed early and remarkable improvement in the condition of undernourished infants and children, thereby giving the public practical proof that what they were being told at the clinic was correct and beneficial to their children.

The fatalistic acceptance of this deplorable and pathetic condition has largely disappeared as has the "maljo" belief of its occurrence.

The teaching techniques in such a programme must not be rigidly set for, as has been seen, altering circumstances may demand new approaches. Following the large fall in mortality in 1963 and 1964, the decline had stopped by 1965. A survey into the socio-economic conditions of the families, in which cases of malnutrition were still occurring at the end of 1964 and early 1965, proved to be of great value in resetting the educational approach to this hard core of cases. The pre-disposing factors of this group were elicited -

a)/

TABLE XXI

INFANTS RECEIVING FREE MILK POWDER BY MONTH - 1963

Month	Number of Recipients
January	392
February	362
March	497
April	477
May	838
June	1,178
July	1,389
August	1,357
September	1,162
October	1,935
November	1,530
December	2,089

a) The illiterate mother

b) The working mother

c) A previous family history of death in children under the age of two years.

One or more of these factors was present in 85.6% of the 42 cases studied, and all three factors were present in 33.3% of them.

With this knowledge, the clinic nurse can anticipate the infant at risk and can alter her approach to the mother by giving for example, simplified individual tuition and by making visits to the home to give practical instruction in situ. The effect of this modified approach remains to be seen as the survey data was processed only toward the end of 1965.

In-service training of nurses was invaluable and allowed the individual nurse to feel that she was an integral part of the project and not merely an arm of extension being used only as a tool by the Medical Officer of Health's Office.

In evaluating such a programme one must take into consideration the economic advancement of St. Lucia over the past few years and realise that the economic status of the average individual in the community has improved slightly. The attitude of the St. Lucian to work and to financial reward therefrom, however, is such that, apart from the peasant farmer who has benefitted greatly from the banana boom, the employed worker has benefitted less than the economic growth of the island would suggest. The result of increased wage rates has been, largely,

a/

a reduction in the individual's working week so that his "take home pay" has increased hardly at all.

The evaluation of a specific measure in reducing the Infant Mortality Rate in a developing community is difficult and although the evidence strongly supports the conclusion that improved nutritional status, as provided by free food supplement in the form of milk powder and education in infant and child feeding practices, has been responsible, other developments in the community must not be lost sight of - the influence, for example, of the cinema and radio (bringing outside influences to bear on the minds of the population) of improved communications (both internal and external), of a general susceptibility to change (largely in the light of the foregoing influences) and of general economic advancement.

It is possible that the project under review owes its success to the fact that it was introduced at the right time in relation to those other influences and that it might have failed if attempted at an earlier time.

The project has, however, proved that, even in an underdeveloped country with the problems of a low economy, inadequate health facilities and low educational status, great improvement in the health of infants and young children can be achieved by improving their nutritional status. The epidemiology and aetiology of protein-caloric-deficiency disease in St. Lucia indicate that the eventual solution of the problem is to be achieved by health education and not by the provision of food supplements although the latter provide a medium through which knowledge can be instilled in the population.

It is regrettable that the epidemiology and aetiology of protein-caloric-deficiency disease in St. Lucia were not completely established prior to 1963; it is possible that, had this been done, much useful information might have been obtained more accurately than has been possible in this study.

Outside assistance, such as that given to St. Lucia by the United Nations Organisation, is essential since an impoverished community of this size has no hope of providing the finance necessary to achieve betterment of the health of the children however good its intentions may be.

SUMMARY AND CONCLUSIONS:

St. Lucia is a small island lying in the group of Windward Islands in the Eastern Caribbean. In common with many tropical areas, protein-calorie-defieiency disease (commonly called malnutrition) presents both a public health and clinical problem.

The epidemiology and aetiology of malnutrition varies considerably throughout the tropical world and an attempt was made, in the studies presented, to define these aspects of the disease.

Although a poor community, individual poverty is rare and there has been a large improvement in the island's economic situation over the past five years. Foods of local varieties are plentiful and the average adult diet is adequate both in quantity and in its protein content.

Malnutrition has been found to be in St. Lucia a condition affecting children of between 4 and 24 months of age (85.5% of 179 notified cases in 1963 and 85.3% of the 115 deaths from this disease in 1963). 58% of the deaths occurred in the first year of life. There is no sex variation and no differing incidence between rural and urban areas although these terms are hardly usable in their normal context in a community such as this.

A study of hospital admissions for malnutrition from 1963 - 1965 was also made.

A combined nutrition/child health programme was begun in December, 1962 and the educational aspects of prevention were stressed although there was distribution of free food supplement (skimmed milk powder donated by UNICEF). Demonstrations/

Demonstrations and lessons in infant and child nutrition were made to mothers throughout the island.

At the commencement of this programme the mortality from malnutrition was very high, 200 in 1962 from an under 2 year old population of about 6,000, and the aetiology was found to be ignorance, superstition and ingrained, erroneous beliefs on infant feeding practices. Weaning, either partial or complete, is an early occurrence in St. Lucia. Poverty was not considered an important aetiological factor. Two years later, after a reduction in mortality to 38 in 1964, there appeared to be a hard core of persistent cases and deaths. A socio-economic survey carried out in 1965 among 42 families in which malnutrition cases were found, indicated that a definable social group was forming the hard core of persistence. This was the group in which illiteracy of the mother, a mother at work and a past history of deaths of children under the age of two were to be found; one factor or more was present in 86% of the cases and all three factors in one third of them. As a result of this survey, a modification of technique was introduced into the preventive programme.

In evaluating the effect of the programme on the child health picture, the Infant Mortality Rates and age-specific death rates of the 0-4 year olds were studied over a period commencing prior to the programme and ending in December, 1965. The Infant Mortality Rate fell from 102.9/1000 live births in 1962 to 47.8/1000 live births in 1965. The proportionate mortality of the 0-4 year olds relative to the total number of deaths in the community fell from 51.4% in 1961 to 48.6% in 1963 and 21% in 1964.

The/

The age and seasonal distribution of deaths from malnutrition were studied over the period 1962-1965 and a remarkable reduction noted, from 200 to 38 in two years; there was a change in seasonal pattern and this was discussed in relation to the associations between malnutrition and infection, especially gastro-enteritis. As an alternative to absolute fall in mortality, the infant death rate from malnutrition /1000 live births was calculated, on the basis of 58% of deaths from this condition occurring under the age of one year, and the rate fell from 29.4 prior to the commencement of the programme in 1962 to 4.7 in 1964; it rose slightly to 5.3 in 1965.

Little or no improvement in the level of sanitation of the community occurred during the study period.

It is concluded, bearing in mind the social and economic changes of the period, that the nutrition/child health programme has been a success and that the fall in Infant Mortality Rate, and 0-4 year age-specific mortality rate, has been occasioned by, not only the direct influence of lowered mortality from protein-calorie-deficiency disease, but also the beneficial effect of improved nutritional status, of the infant and young child, on the mortality from infectious diseases and more specifically the infective diarrhoeal diseases.

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During the three years of this project considerable practical assistance was given by Dr. J. Chopra, World Health Organisation, and Dr. St. Antuna, Food and Agricultural Organisation. Without the assistance of the United Nations, the work reviewed would not have been possible.

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APPENDIX:

The Rate of Growth of the Normal Infant in St. Lucia

From the weights, recorded at the Child Health Clinics, of 1200 normal infants (1-12 months of age), the average weight at each month of age, and the standard deviation, has been calculated and is reproduced in Table A1. A growth curve has been drawn from the results obtained - Figure A1.

(a) Comparison with growth measurements from the United States reveals that, while the St. Lucian infant compares favourably at birth with his American counterpart and keeps pace for the first six months of his life, he thereafter loses ground and the St. Lucian growth curve flattens.

Relative to Puerto Rican measurements which have been used in the clinics (Chart I), the St. Lucian infant average weight is in the upper range, within the tenth percentile line, for the first four months, in the middle range for the second four and falls to the lower range for the third four months of life. From having a weight advantage at one month, he gradually falls to a position of relative disadvantage at the age of one year.

It is appreciated that there are racial differences in these comparisons but it should be remembered that there is considerable racial variation within the population of St. Lucia. Even constructing separate curves for the races comprising the community, one would be left with a large section of mixed racial origin within which the proportinate racial influences would be impossible to determine/

determine. For practical purposes, therefore, a composite chart has to be used.

It is felt that the flattening of the St. Lucia Chart in the last four months of the first year of life, indicates an unacceptable growth rate in relation to that pertaining in other countries and there has, therefore, been no attempt, as yet, to replace the Puerto Rican chart, by one based on local measurements, for practical guidance of the Nurses in the clinics.

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Reference:

Stuart, M.C., and Stevenson, S.S., - Physical Growth and Development (Chap.), Mitchell-Nelson, Textbook of Paediatrics. Philadelphia, 1950.

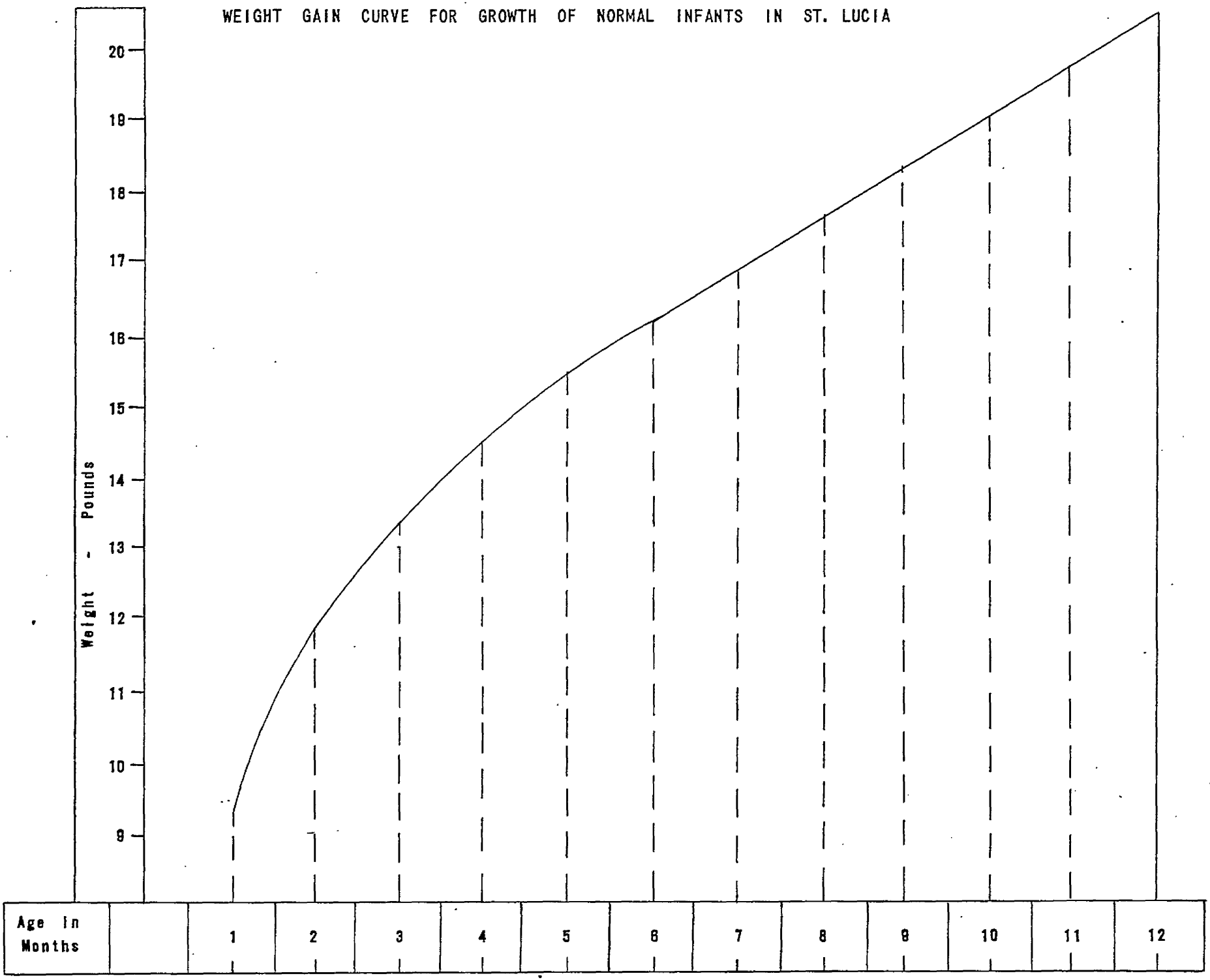
TABLE AI.

Average Weights of 1200 Infants: 1-12 months - St. Lucia

Age in Months	Average Weight (lbs.)	Standard Deviation
1	9.3	1.25
2	11.8	2.1
3	13.2	1.66
4	14.4	2.3
5	15.2	2.2
6	16.4	2.28
7	16.8	2.54
8	17.5	2.64
9	18.1	2.28
10	18.8	2.35
11	19.6	2.61
12	20.3	2.59

Average birth weight: 7lbs. 12½oz.

Chart 2


WEIGHT GAIN CURVE FOR GROWTH OF NORMAL INFANTS IN ST. LUCIA
Weight - Pounds
20
19
18
17
16
15
14
13
12
11
10
9
Age In Months
1
2
3
4
5
6
7
8
9
10
11
12