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EXPERT COMMITTEE ON MALARIA

The Secretary of the Expert Committee on Malaria has the honour to communicate hereunder a note on:

MALARIA CONTROL IN ITALY

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The problem of malaria is one of the hardest that Italy's National Health Organization has had to face in the post-war period. The problem is a serious one not only because malaria is very widespread, but also from the economic and agricultural point of view. (When hundreds of thousands of workers are ill with malaria, large stretches of land are rendered unproductive as a result.)

Thanks to the reclamation of land, to an improved health organization, and to the use of new scientific discoveries, malaria had gradually diminished until, in 1940, the lowest morbidity and mortality rates were registered. The incidence of malaria notably increased during the first world war: in 1918 there were 11,477 deaths (mortality rate 324 per million) and 249,529 cases; then it diminished again, so that in 1940, 488 deaths (11 per million) and 92,301 cases were registered and the infection had entirely disappeared from many areas in which it had been endemic for centuries.

The changes brought about by the second world war again interrupted the downward curve of malaria. Not only did the infection increase in those areas where it was endemic, but it started anew in others, whence it had completely disappeared, and actually appeared in some places never infected before.

As shown in Figure No. 1, the first effects of the war were apparent in 1941, with an increase in the number of reported cases (118,221) and deaths (756); in 1942 these figures rose to 164,082 cases and 1,075 deaths, representing a rate of 24 per million. Few data are available for 1943, when Southern and insular Italy became a battlefield. It is certain, however, that in many zones malaria increased. The figures for 1944 are: 373,941 cases, 132,474 of which are primary and 241,467 relapses, with 318 malignant cases and 422 deaths.

This document is a continuation of the series of documents previously distributed under the symbol WHO.IC/Mal./. This series will henceforth be known under the symbol WHO/Mal./ but the continuity of the numbers remains uninterrupted.

In 1945 the reported cases amounted to 471,602, 49,588 of which were primary and 362,014 relapses, with 160 malignant cases and 386 deaths.

By comparing the 1945 data to those for 1944, one may notice a decrease in the total number of primary cases and a decrease in malignant cases and deaths, offset by an increase of relapses, which reflects the prevalence of malaria during the preceding years.

There was a further decrease in 1946, when the following figures were registered for the whole of Italy: 373,424 cases; 38,135 primary, 335,289 relapses, 110 cases of pernicious fever and 285 deaths.

The still more remarkable decrease in 1947 may be attributed to the intensive DDT campaign (see Table 6). Cases registered for this year reach a total of 210,044; of which 13,593 primary, with 58 malignant cases and 91 deaths.

Owing to the serious epidemic situation, the problem of malaria control during the immediate post-war period became so great and complex as to require the immediate co-ordination and use of all available means.

The very urgent problem with which the Public Health Administration was confronted was to rebuild and render as efficient as possible all the field services. This was attained:

- (a) - by strengthening the malaria control organization disrupted by the war;
- (b) - by instituting training courses for doctors and auxiliary personnel in charge of malaria control;
- (c) - by financing the technical programmes adopted by provincial anti-malaria committees in their respective territories;
- (d) - by insuring the distribution on a national scale of quinine and of the synthetic anti-malarial products supplied by the Allies as well as of chemicals required for malaria control (Paris green, oil, pyrethrum, etc.)

12 million "Italchina" (= atabrin) tablets, 50 million atabrin tablets, 70 tons of Paris green, 112,000 litres of pyrethrum insecticide liquid were distributed. Large sums were allocated by the Italian Government for the financing of the plans for malaria control by the provincial anti-malaria committees in those Provinces under the control of the Italian Government prior to the complete liberation of the whole national territory. Contributions granted to the Provinces of Calabria, Lucania, Puglia and Sardinia in 1944 amounted to 21,000,000 lire.

In 1945 these contributions were extended to Latium, Campania and Sicily and reached 85,000,000 lire; in 1946 contributions for all malaria-infected provinces amounted to 300,000,000 lire.

The Ministries of Agriculture, Forestry and Public Works also did their utmost to encourage and intensify the work of land reclamation.

In Campania, Latium and Veneto large flooded areas were rapidly drained; obstructions caused by the destruction of bridges were removed,

rivers and torrents were restored to their normal course; shell holes, which had become dangerous as breeding places for anopheles, were filled, and mined fields cleared. The first attempt in malaria control by the application of DDT carried out in 1944 by the Health Division of UNRRA in the Pontine marshes and by the Rockefeller Foundation in the Tiber delta gave rise to new hopes; in both instances results proved to be very satisfactory. The field research done in the following year with the collaboration of MISSIROLE, led to the conclusion that an anti-*imago* campaign alone, by means of residual DDT house-spraying succeeds in interrupting the transmission of malaria and rendering unnecessary other preventive measures.

In 1946 DDT was used even more extensively by UNRRA in collaboration with the Italian Government. The malarial zones of the Veneto-Emilia coast, of the Pontine marshes, of the Latina and Frosinone Provinces, of part of the Caserta and Grosseto Provinces, of zones in Sicily and in Southern Italy, were treated. In zones sprayed with DDT, anopheles and other domestic insects disappeared almost entirely; and primary cases of malaria became extremely rare. After these remarkable results our Public Health Dept., with the financial support of UNRRA, planned a five-year campaign for the eradication of malaria by means of DDT spraying on a national scale. The contributions of UNRRA, drawn out of the "Lire fund", i.e. funds obtained by the Italian Government by selling UNRRA goods, totalled about 1,180,000,000 lire, not including the cost of DDT and other material supplied free of charge by UNRRA itself.

To this fund - now greatly exceeded owing to the increase in prices - must be added the allocation made by the Italian Government to provincial anti-malaria committees, which are in charge of the organization and co-ordination of field services in every Province.

The plan is limited to the endemic areas of Peninsular Italy and Sicily (Sicily, Calabria, Lucania, Puglia, Campania, Lazio, Tuscany, Emilia, Veneto and Lombardy) while Sardinia, as we shall see further on, has a programme of its own based on a campaign carried out by anti-*imago* and anti-larval methods, aiming at the complete eradication of anophelines from the whole island.

The plan provides for the intensive treatment of the whole malarious coastal region in Sicily and in the Peninsula, up to the hills and following the rivers and torrents and the valleys, wherever possible, as far as the non-infected zones. Three of the malaria vector breeding areas were thus directly attacked, i.e. Sicily, Sardinia and Southern Italy (*A. Maculipennis* var. *labranchiae*); Sicily, Sardinia and Southern Italy (*A. myz* *superpictus*); and the Veneto-Emilia coast (*A. sacharovi* (*plutus*)).

An efficient organization is responsible for co-ordination, execution and control; it consists of:

- (a) - a central advisory committee;
- (b) - a central technical department attached to the High Commissariat for Hygiene and Public Health, which looks after the planning and general co-ordination of the work; the distribution of material, the general direction and supervision. Doctors specialized in malaria, sanitary engineers, surveyors and designers belong to it;
- (c) - provincial health offices and provincial anti-malaria committees for the field work.

In every Province there is a central warehouse, where all material and equipment are stored and where the DDT solution is prepared, and some other smaller stores scattered about according to local requirements. The spraying teams consist of five or six men under a foreman, supplied with pressure spraying pumps. Hudson spray pumps are employed as well as Galeazzi pumps, made in Italy, which are heavier and stand up better to rough usage: they give a conical whirling spray. Motor pumps are used for many-storied buildings. Each team has a vehicle for the transport of material and personnel to the place of work. In the country this is a motor car; in towns it may be either a horse-drawn cart or a handcart. DDT is sprayed mostly in the form of a 5% solution in kerosene; the watery emulsion is also used in places where transport is difficult. No noticeable differences have been found in the houses whether treated by one system or the other, as far as the results are concerned. Wall spraying is done starting from a height of about 5 feet upwards, for the anophelines do not rest on the lower part of the walls: ceilings are generally treated. The average amount of DDT used is about 1.50 grammes per square meter. In small villages and in the country all premises are treated: in the larger towns spraying is generally limited to a belt of buildings in the outskirts of the town or to those sections in which malarious conditions are present.

From Sicily to Lombardy a campaign is being waged to protect people from malaria. In 1947, the first year of the application of the nation-wide scheme, 506 communes were treated; 186 of them completely and 320 partially, the number of people protected amounting to 3,500,000.

Figure No. 2 shows the areas treated in 1947 with DDT.

The cost of the campaign amounted to 1,045,391,403 lire, 703,343,370 lire of which were used for DDT spraying and 341,998,033 lire for general expenses, diagnosis service and treatment, and anti-larval campaign in those zones where DDT had not been used.

In the following tables quantities and costs of material and work are shown:

Table 1

Quantity and cost of
Material

Material	Quantity	Amount in lire	Observation
Technical DDT 100%	Tons 156.5	187,800,000	Sums not allocated because DDT was provided by UNRRA.
Ylene DDT 26% (emulsion)	" 36.3	51,200,000	
Kerosene	" 3,082	189,190,514	
Spraying pumps	No. 1,800	14,355,892	1,000 were donated by UNRRA.
Barrels and working suits		9,774,584	
Total:	Lire	452,320,990	

Table 2

Quantity and cost of transport

Transport	Quantity	Cost in Lire	Observations
Heavy trucks	10		offered by UNRRA acquisition cost is not registered
Light trucks	71		
Fiat cars	16		
Jeeps and staff cars	15		
Repairs and upholding	-	18,728,115	
Spare tires	291	2,894,108	
Drivers	112	57,035,862	
Other transports	-	18,003,424	
Gasoline its.	477,827	31,721,718	
Oil Kg.	8,000	1,689,153	
Total: Lire		130,072,380	

Table 3

Quantity and cost of man-power

Man-power	Quantity	Cost in Lire	Remarks
Workmen & Foreman	2,221		
Working days	121,000	121,000,000	
Man hours	986,000		
Total: Lire		121,000,000	

Table 4 *

Summing up of DDT treatment cost

Subjects	Cost in Lire	Remarks
Material	452,320,990	Not including acquisition of conveyances.
Transport	130,072,380	
Manpower	121,000,000	
Total: Lire	703,393,370	

* See Fig, No.3

Table 5
Summary of work carried out

Area of treated zones	ha.	2,500,000 (= 6,175,000 acres)
Population protected	inhab.	3,500,000
Rooms treated	n.	2,027,455
Surface sprayed	sq. m.	126,089,258 (= sq.ft.1,357,098,688)
DDT employed per sq. m.	grammes	1.45 (= 135 mgm. per sq.ft.)
DDT employed per person	grammes	52
Cost per sq. m.	lire	5.57 (= about \$0.01)
Cost per person	lire	200.96 (= about \$0.33)
Percentage on the total cost of expenses for materials		64%
ditto for transport		19%
ditto for labor		17%

The results obtained in 1947 in those areas treated with DDT house spraying are most encouraging; the anopheles have almost entirely disappeared; primary cases of malaria are very few and even relapses are very rare. In those provinces where DDT spraying has been very carefully and skilfully done, the number of cases during the summer months greatly diminished, thus proving that many cases hitherto considered as relapses, were merely cases of re-infections.

The malaria morbidity curve in Latium (Fig.No.4) and in Veneto (Fig.No.5) following the spraying of DDT, are characteristic; its peak reached in Spring is caused by relapses, while from May onwards, transmission of infection being interrupted, the malaria curve decreases steadily, instead of rising to reach the summer morbidity maximum, as had been the case in previous years, due to new infections.

Figure No. 7, which compares the 1946 and 1947 data for the whole of Italy, shows the extent and importance of this decrease. The following table illustrates this comparison:

Table 6

	1946	1947	Decreases	
			Absolute figures	Percentage
Primary cases	38,135	13,817	24,318	63.76
Relapses	335,289	194,718	140,571	41.92
Total	373,424	208,535	164,889	44.15
Pernicious cases	110	59	51	46.36
Deaths due to all forms	285	93	192	67.36

In accordance with the five-year scheme planned, treatment by DDT was to be greatly increased in 1948. All the scattered populations of malarious zones were to be protected by house spraying and such endemic areas in some districts as were not treated last year, will now be sprayed.

About 100 tons of DDT, 2,000 tons of oil (used as a solvent) and 800 tons of DDT emulsion in xylol (26% solution, to be emulsioned in water) will be used.

With the above quantities, a total surface of 177,000,000 sq. m. will be sprayed and 5,000,000 inhabitants protected. The cost of the 1948 campaign will amount to about 1,400,000,000 lire (\$2,330,000).

The problem of malaria control, though still serious in spite of the decreased morbidity and mortality, seems to be moving towards a happy solution. It may, however, be too soon to draw deductions from the good results so far obtained during the first year of DDT spraying on a national scale. It has been fairly easy to control the situation in the Pontine marshes or at Cassino, where epidemics due to contingent causes occurred; but control will probably be more difficult in those areas in which anophelines have been constantly finding favourable conditions for their development.

What has been done so far, however, entitles us to hope that it may be possible to interrupt the transmission of malaria by killing domestic anopheles with the aid of DDT. If no new factors occur during the next few years, our hopes of freeing the entire national territory from this century-old plague, or at least of reducing it to unimportant proportions, seem to be well founded.

Most interesting and impressive is the antimalario-campaign which is being carried out in Sardinia. While on the Continent and in Sicily the use of DDT aims at the eradication of malaria by means of house spraying, in Sardinia the present experiment aims at the complete eradication of anopheles from the whole island, by spraying all houses, buildings, stables, etc. with DDT during the inter-epidemic period and by starting an anti-larval campaign in the Spring, to cover all possible anopheles breeding places. This campaign is being administered through an organization called ERLAAS (Ente Regionale per la Lotta Anti Anofelica in Sardegna) and it is financed through the High Commissariat for Hygiene and Public Health, from the UNRRA Italian Government Lire Fund and the Rockefeller Foundation, and it is directly supervised by staff members of the International Health Division of the Foundation.

The island of Sardinia lies in the Mediterranean, West of the Italian mainland, and has an area of about 24,000 square kilometres and a population of 1,231,662 inhabitants. It is a mountainous country with extensive swamps near certain points of the sea coast. For centuries Sardinia has been considered as one of the most dangerous areas as far as malaria is concerned. the principal vector being Anopheles labranchiae, which is indigenous in the island. The plan for the eradication of anophelines from Sardinia was conceived in 1945, but the project did not get under way until 1946, when an island-wide entomological survey was carried out.

The first DDT anti-*imago* campaign started in November 1946 and lasted till June 1947. During this time an island-wide DDT house-spraying campaign was completed, covering 257,671 buildings totalling 1,504,547 rooms, and affecting some 1,082,395 inhabitants. The work was carried out in 47,339 working days, and 85 tons of technical DDT dissolved in 1,640 tanks of 26% solution, emulsified in 1,707,202 liters of water were used.

During the Summer of 1947 a "trial" anti-larval programme was started in the south-western part of the island, which covers about one-third of the total surface of Sardinia. The purpose was to study the best technique to be used and to perfect the organization of the wider campaign planned for the following year. The entomological service showed that 10 mgm of DDT per sq.m. was sufficient for the

purpose, the best solution being a 2.5 percent commercial DDT in diesel oil with the addition of 0.75 of Tritoⁿ-x-100 to increase the spreading power.

The final all-out campaign for the elimination of malaria was started in October 1947. It consisted of two co-ordinated parts: a winter programme of residual DDT spraying, designed to eliminate the bulk of female anophelines wintering in the island, followed by an intensive summer programme of larviciding with DDT in fuel oil sprayed on every possible breeding area in a weekly cycle.

Not taking into account the material supplied by UNRRA (DDT, means of transport etc.) to a total value of approximately 778,000 dollars, 500,000,000 lire were spent on Sardinia in 1947. The budget of expenses for 1948, as drawn up by ERLAAS, amounts to 2,070,000,000 lire, while expenditure amounting to 215,000,000 lire is budgeted for 1949 (when actual checking of species eradication will take place).

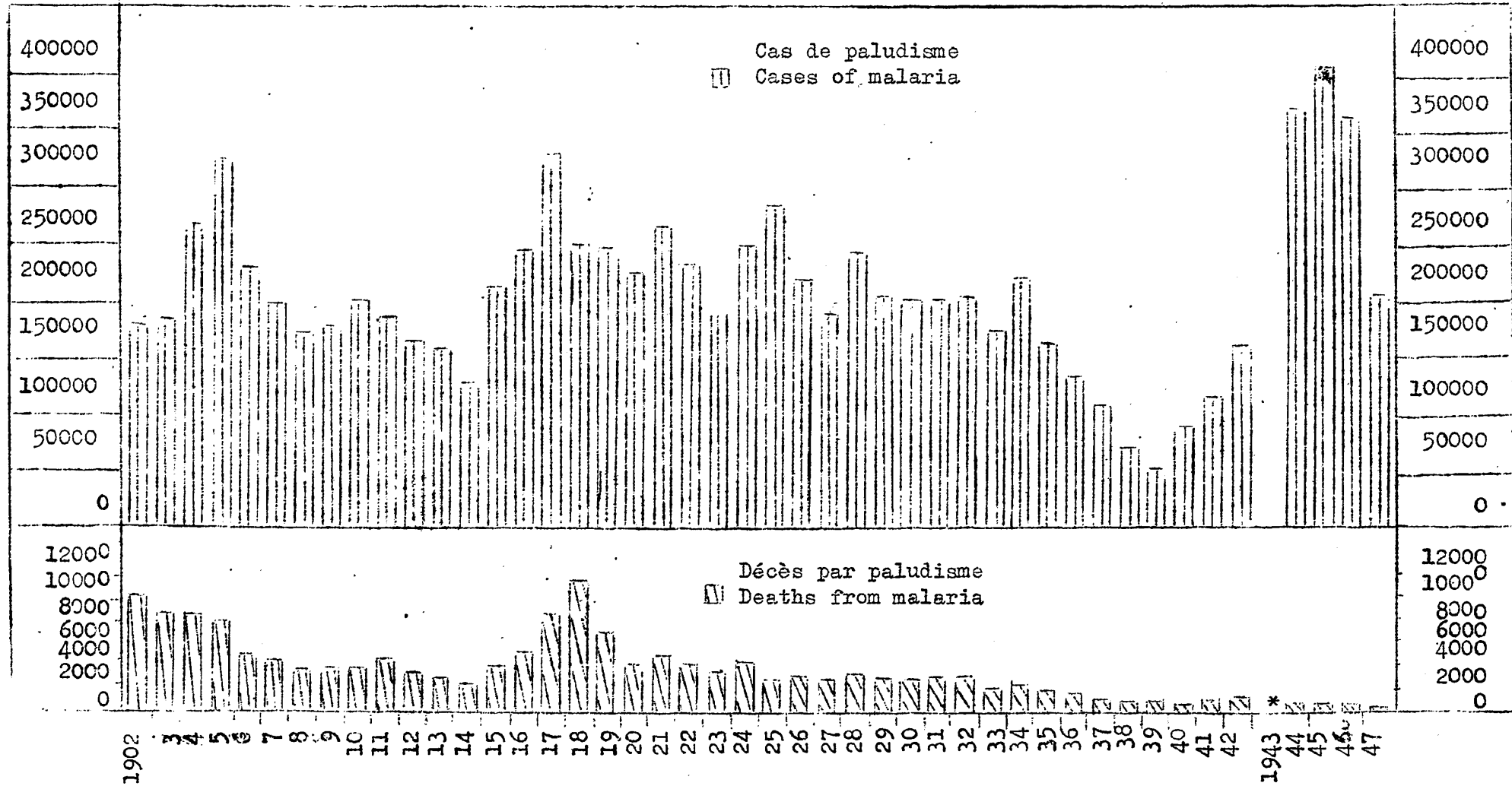
This campaign, then (not counting the UNRRA and Rockefeller Foundation contributions) will cost some 2,785,000,000 lire (about \$4.600.000)

Fig. No.1

HAUT COMMISSARIAT A L'HYGIENE ET A LA SANTE PUBLIQUE

HIGH COMMISSARIAT FOR HYGIENE AND PUBLIC HEALTH

Cas de paludisme et de décès par paludisme en Italie, 1902-1947
 Cases of malaria and deaths from that disease in Italy, 1902-1947



Les statistiques de 1943 manquent par suite des événements de guerre
 1943 Statistical data lacking owing to war events

Fig. No.2

REPUBLIQUE D'ITALIE
ITALIAN REPUBLIC..

Haut Commissariat à l'Hygiène
et à la Santé publique
High Commissariat for Hygiene
and Public Health

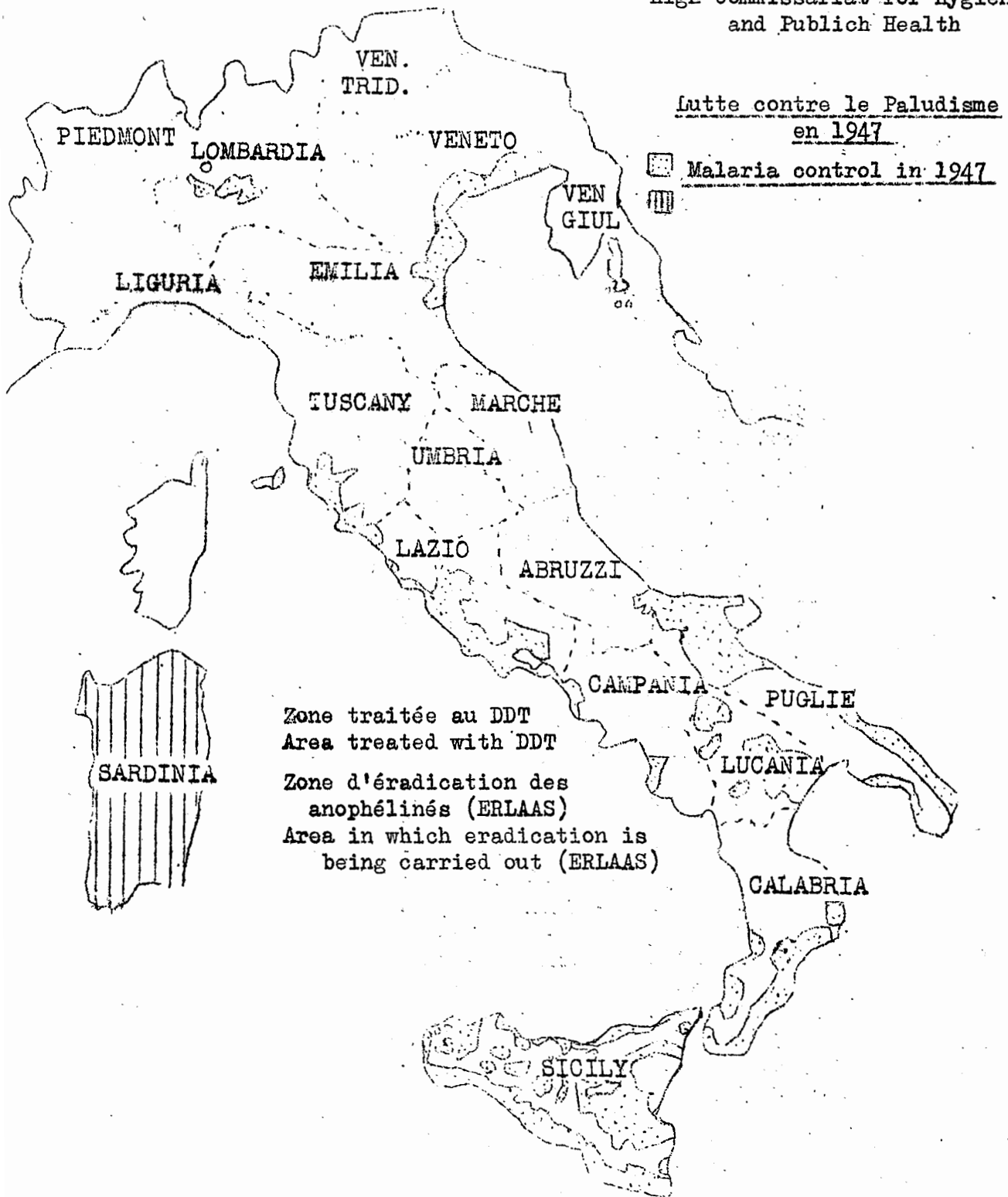


Fig. No.2Résumé des renseignements:

Zones traitées	2.500.000 hectares
Population protégée	3.500.000 habitants
Pièces d'habitation traitées	2.027.455 unités
Superficie traitée	126.089.258 m ² .
Heures d'ouvrier	968.000
DDT technique employé	192,8 tonnes
DDT au m ²	1,45 grammes
DDT par habitant protégé	52 grammes
Coût de la campagne au DDT	703.393.370 lires
Coût au m ²	5,57 lires
Coût par habitant protégé	200,96 lires
Pourcentage du coût du transport par	
rapport au coût total	19 pour cent
Pourcentage du coût du matériel par	
rapport au coût total	64 pour cent
Pourcentage du coût de la main-d'oeuvre	
par rapport au coût total	17 pour cent

Summarized data:

Area treated	2,500,000 hectares
Population protected	3,500,000 inhabitants
Rooms treated	2,027,455 units
Surface sprayed	126,089,256 sq. m.
Man-hours	968,000
Technical DDT used	192.8 tons
DDT per sq. metre	1.45 grammes
DDT per inhabitant protected	52 grammes
Cost of DDT campaign	703,393,370 lire
Cost per sq. metre	5.57 Lire
Cost per inhabitant protected	200.96 Lire
Percentage of cost of material to	
total cost	64 per cent
Percentage of cost of transport to	
total cost	19 per cent
Percentage of cost of labour in relation	
to total cost	17 per cent.

Fig. No.3

HAUT COMMISSARIAT A L'HYGIENE ET A LA SANTE PUBLIQUE

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Proportion des dépenses afférentes au matériel, au transport et à la main d'oeuvre par rapport au coût total de la lutte antipaludique au DDT pour 1947

Proportion of expenditure for materials, transport and labour in relation to the total cost of malaria control by means of DDT, for 1947.

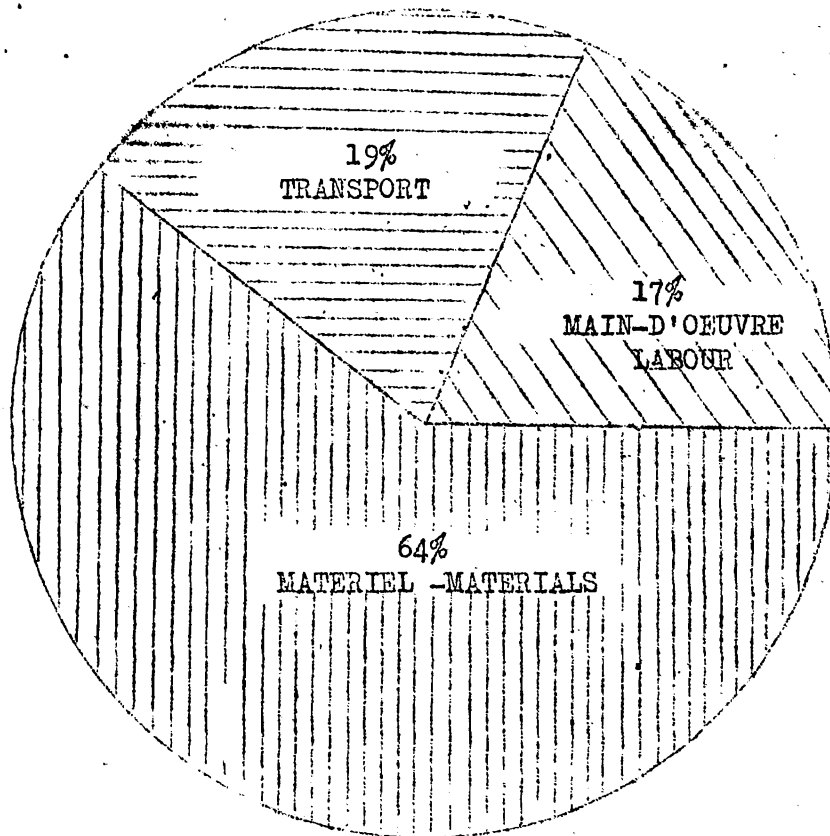
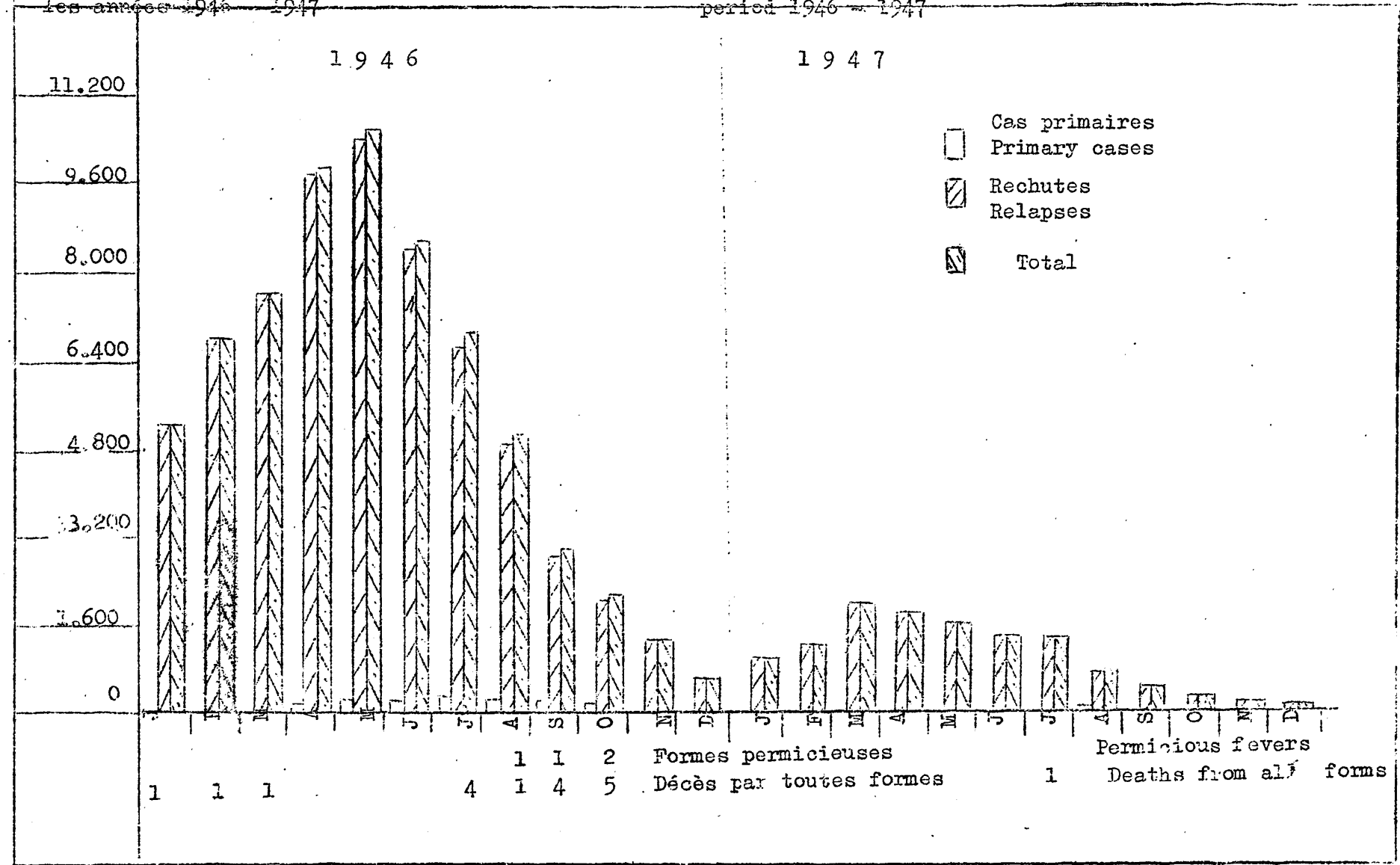


Fig. No.4

HAUT COMMISSARIAT A L'HYGIENE ET A LA SANTE PUBLIQUE
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LATIUM -- Evolution du paludisme durant
les années 1946 - 1947

LAZIO - Trend of malaria during the
period 1946 - 1947



ENEPIE -- Evolution du paludisme durant
les années 1946 - 1947

ENETO - Trend of malaria during the
period 1946 - 1947

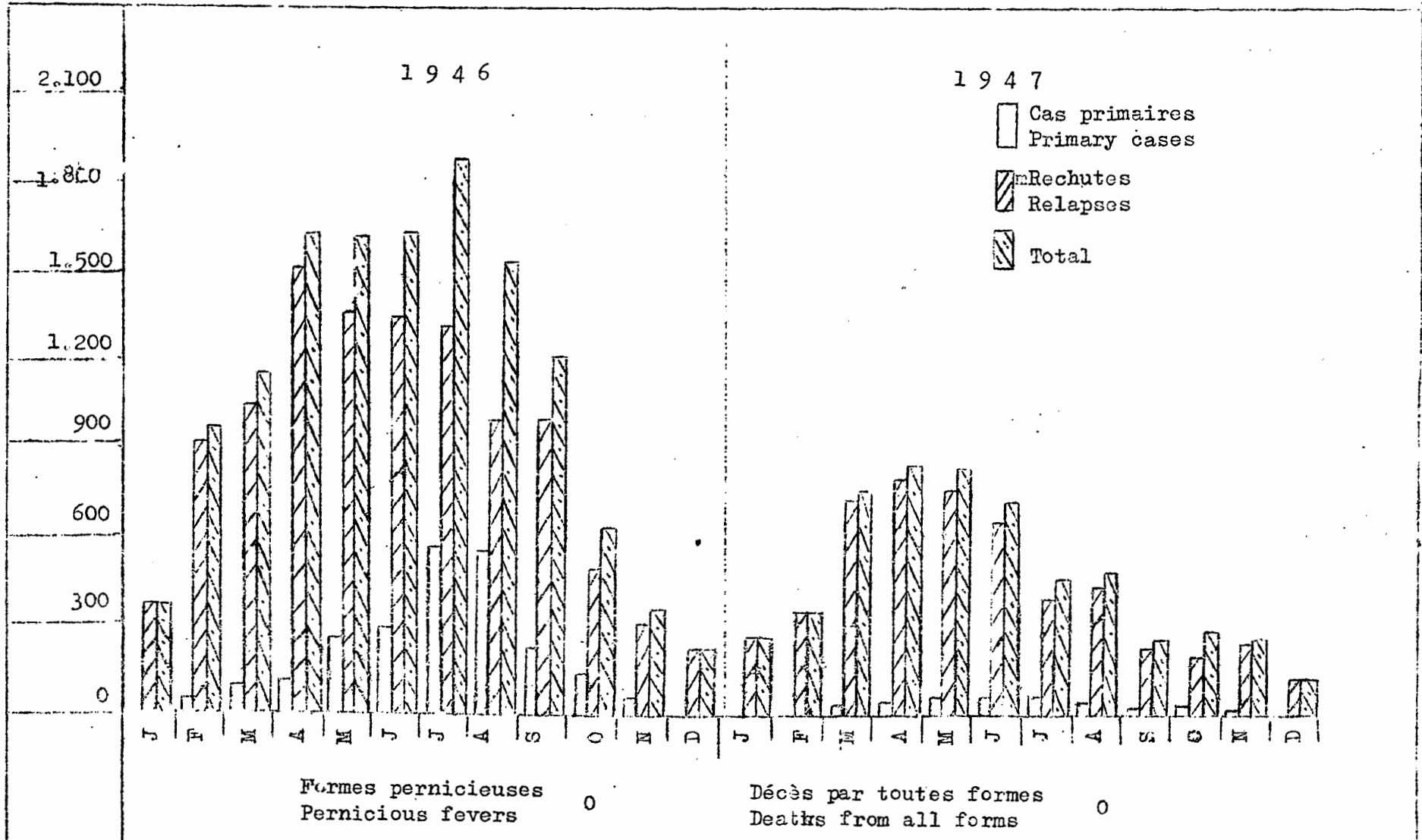


Fig. No.6

HAUT COMMISSARIAT A L'HYGIENE ET A LA SANTE PUBLIQUE
 HIGH COMMISSARIAT FOR HYGIENE AND PUBLIC HEALTH

EMILIE - Evolution du paludisme durant
 les années 1946 - 1947

EMILIO - Trend of malaria during the
 period 1946 - 1947

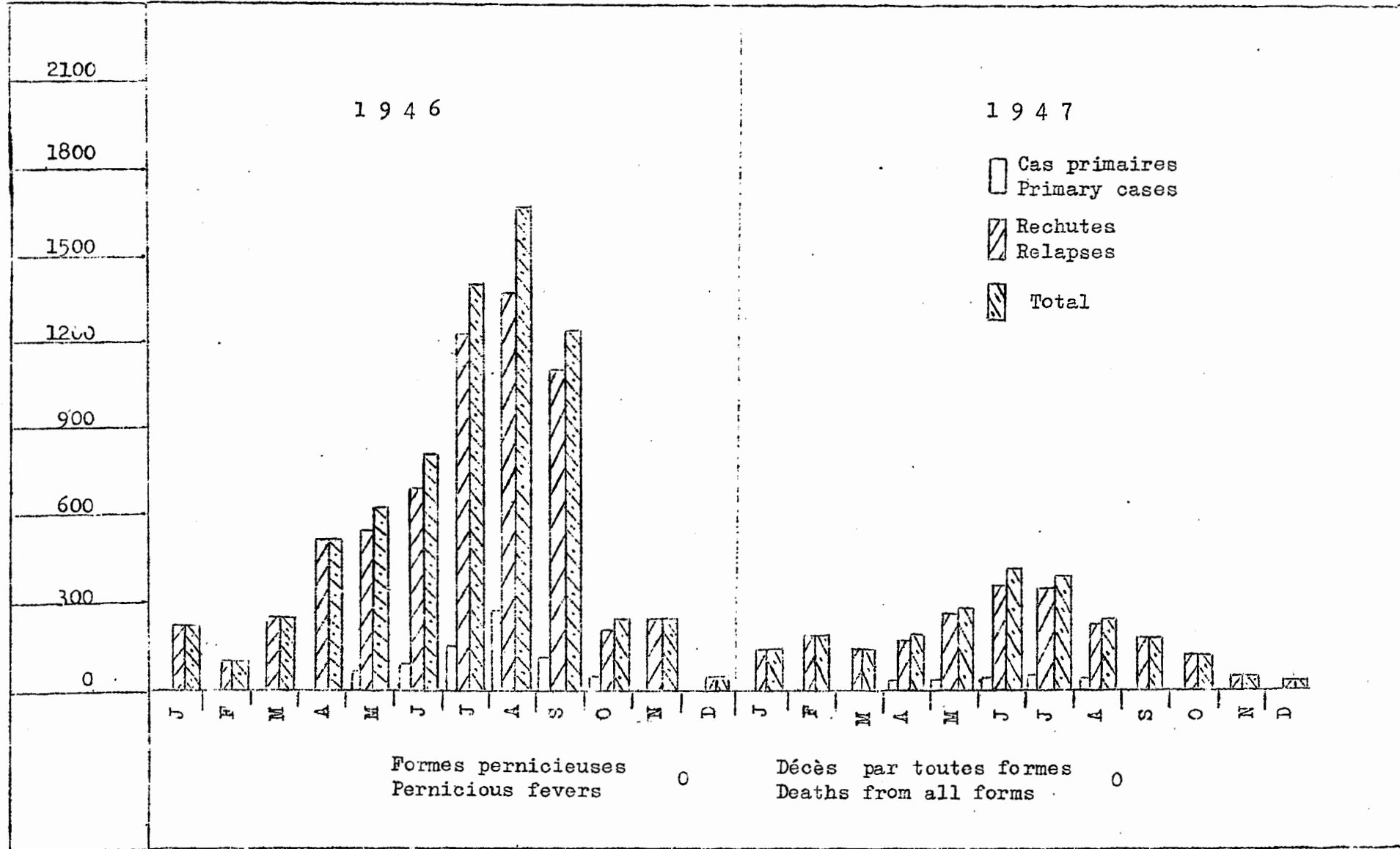


Fig. No.7

HAUT COMMISSARIAT A L'HYGIENE ET A LA SANTE PUBLIQUE

HIGH COMMISSARIAT FOR HYGIENE AND PUBLIC HEALTH

ITALIE

ITALY

Evolution du paludisme en 1946 et en 1947

Trend of malaria during the years 1946 - 1947

