

# Mortality and morbidity from infectious and non-communicable diseases in Greece during Axis/Nazi military occupation (1941-1944)

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## SUMMARY

Greece has been severely damaged by the Second World War and the subsequent military occupation of the country by the Axis forces headed by Nazi Germany. The Greek society and economy were dislocated as a result of plundering of the country's vital resources, as well as enforced payments, instead paid to the occupying forces. The dramatic food shortages and famine appeared plaguing especially large cities. There is very limited information on the trends of mortality and morbidity (1941-1944) at a national level. The morbidity and mortality statistics of the General Statistical Service of Greece were assessed and the incidence morbidity and mortality rates have been calculated. As denominator population we used the population of Greece according to 1940 census. The morbidity due to exanthematic typhus, typhoid fever, dysentery and meningitis has been elevated over the period 1940-1944. An elevated specific mortality due to tubercu-

losis, malaria and typhoid fever was observed over the period 1940-1941. Regarding non-communicable diseases, the mortality due to hemorrhagic stroke was increased after 1940. In conclusion, we found that the Axis/Nazi military occupation of Greece had considerable health effects on infectious diseases and hemorrhagic stroke mortality. Deaths ostensibly due to infectious diseases (e.g. tuberculosis or malaria), were expedited by the hunger famine of the period under investigation. With regard to the elevated mortality due to hemorrhagic stroke, we believe that the stressful events of occupation and famine have triggered increased psychosocial stress which in turn may have increased the risk of hemorrhagic stroke mortality during the period of Axis/Nazi occupation of Greece.

*Keywords:* mortality, morbidity, famine, Axis, occupation, Greece.

## INTRODUCTION

Greece has been severely damaged by the Second World War and the subsequent military occupation of the country by the Axis forces headed by Nazi Germany.

During that military occupation, the Greek society and economy were dislocated as a result of plundering of the country's vital resources, as well as enforced payments paid to the occupying forces. The national infrastructure and transportation network of the country have been destroyed. Dramatic food shortages and malnutrition appeared plaguing especially large cities. The coupon rationing of food was introduced. During this period of Axis occupation, a major food crisis evolved

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into famine at various point times in various Greek localities [1]. There are several published reports on the health status of the population of large Greek cities during Second World War and the subsequent occupation of the country. These reports indicated profound deterioration in the health status of the population of large cities (e.g. Athens, Piraeus, and Ermoupolis) [2-4]. Nevertheless, to our knowledge there is very limited information on the trends of mortality and morbidity (1941-1944) at a national level. Consequently, the aim of our ecological study was to investigate the national trends of mortality and morbidity among the Greek population during the period 1938-1944.

**METHODS**

The morbidity and mortality statistics of the General Statistical Service of Greece were assessed and the incidence morbidity and mortality rates have been calculated. As denominator population we used the population of Greece according to 1940 census. In-

cidence rates (cumulative incidence) for mortality and morbidity have been calculated. The nominator of the incidence was the new cases or deaths and the denominator consisted of the population of Greece during the 1940 census. Absolute and relative frequencies were calculated. Statistical analysis was performed with the use of Excel software.

**RESULTS**

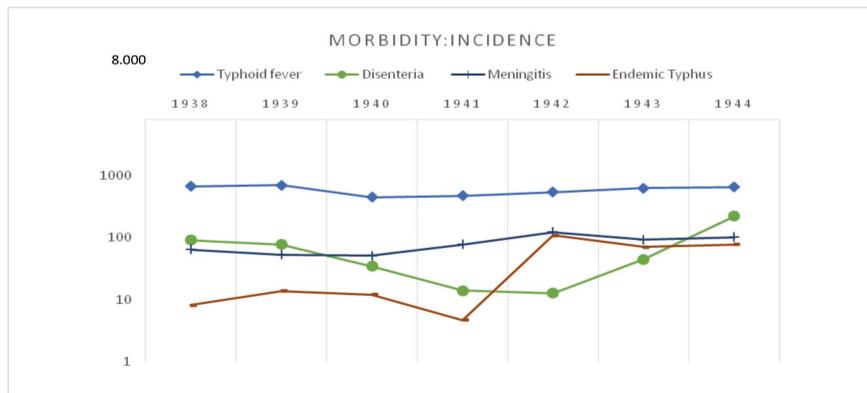
The evolution of morbidity and mortality trends are illustrated in Figures 1 and 2, and Tables 1 and 2.

*Morbidity*

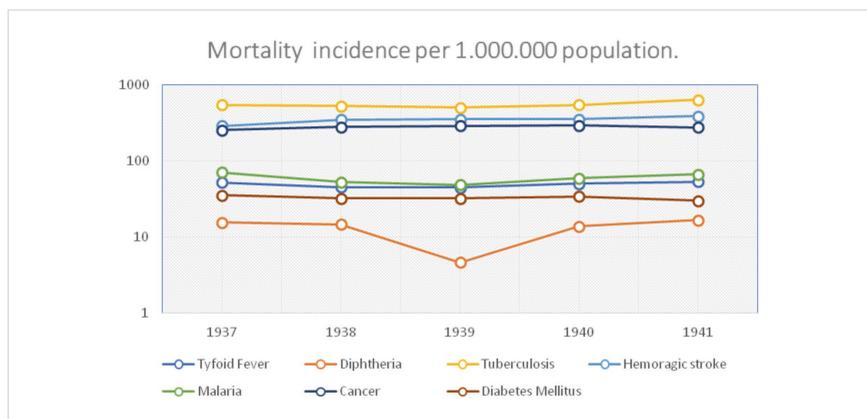
The morbidity due to exanthematic typhus, typhoid fever, dysentery and meningitis was elevated over the period 1940-1944.

*Mortality*

An elevated specific mortality due to tuberculosis, malaria and typhoid fever was observed over



**Figure 1**  
Morbidity: incidence per 1.000.000 population.



**Figure 2**  
Mortality incidence per 1.000.000 population.

**Table 1 - Morbidity per 1.000.000 population.**

Year	Typhoid Fever	Measles	Pertussis	Diphtheria	Flu	Meningitis	Dysentery
1938	667,48	1239,50	245,90	133,80	2572,30	64,6	91,80
1939	695,80	1064,30	231,40	140,80	7350,20	52,9	77,90
1940	446,20	1689,40	162,60	130,06	1268,60	50,9	34,50
1941	473,90	159,60	69,40	134,15	185,70	77,7	14,05
1942	543,80	87,40	101,60	110,45	28,50	122,2	12,80
1943	625,50	9,70	144,50	86,30	183,50	92,3	44,70
1944	649,20	8,60	37,90	95,02	101,15	101,1	221,70

**Table 2 - Mortality per 1.000.000 population. (Total population 7.335.000 at 1940).**

Year	Typhoid fever	Pertussis	Flu	Tuberculosis	Hemorrhagic stroke	Malaria	Cancer	Diabetes mellitus
1937	52,07	31,62	272,25	547,37	289,16	71,07	254,94	35,17
1938	45,1	25,3	163,6	525,56	349,42	52,92	277,70	32,17
1939	44,85	23,31	246,38	500,34	352,01	48,46	290,11	32,03
1940	50,03	23,99	150,2	544,1	351,46	59,36	293,66	34,21
1941	53,16	10,22	133,1	635,44	387,45	66,84	275,39	29,99

the period 1940-1941. Regarding non-communicable diseases, the mortality due to hemorrhagic stroke was increased after 1940. On the contrary cancer and diabetes mellitus mortality rates were decreased.

## ■ DISCUSSION

Our ecological study demonstrated that infectious diseases was a major determinant of mortality in Greece during the period of Axis occupation (1941-1944). In particular, tuberculosis mortality increased considerably after 1941. There are several lines of evidence based on the archives of a major chest hospital in Athens ("Soteria") suggesting that the absolute number of deaths due to tuberculosis was elevated in Athens during the Axis Occupation [5]. It is well known that malnutrition increases the incidence, severity and case-fatality of a variety of infections, including tuberculosis [6]. It should be noted that before the eruption of Second World War, tuberculosis was endemic in several parts of Greece. Available epidemiological data indicate that in 1938 tuberculosis mortality rate varied greatly within the country, being highest in Central, West Greece, Macedonia and Thrace and lowest in Crete and Peloponnesus [6-9].

Another interesting finding of our study is that specific mortality due to malaria was elevated during 1941. It should be noted that malaria was endemic in Greece during the 19<sup>th</sup> and 20<sup>th</sup> century. In particular, specific mortality from malaria in Greece increased from 7.94/10,000 population in 1925 to 10.24/10,000 population in 1930. There is some epidemiological evidence that malaria reduced life expectancy at birth by five years [10]. The sanitary campaigns against malaria in Greece started in the beginning of the 20th century. An intensive antimalarial campaign took place in Greece over the period 1930-1940. Rockefeller Foundation (RF) played a key-role in the organization of anti-malaria campaign by assigning a team of malaria experts to advise the Greek government and to train Greek scientists. Unfortunately, the eruption of World War II and the subsequent occupation of the country by the Axis military forces led to the disruption of the antimalarial campaign; as a result, the deaths due to malaria have been exponentially increased in several Greek regions. In Thessaloniki (1942) the deaths due to malaria were 182 times higher in comparison to 1940 [11]. However, apart from the disruption of antimalarial campaign over the period 1941-1944, the starvation and hunger of the Greek population during the winter of 1941-1942

could be an additional cause in the etiology of the increased malaria mortality and morbidity in the occupied Greece. It has been suggested that famine and hunger forced their victims to consume their domestic animals. Consequently, these animals may not have provided a blood meal for the anopheles' mosquito. Thus, mosquitoes were compelled to feed exclusively on humans and this mechanism could partly explain the increased risk of malaria in several regions of the occupied Greece [12].

We have reported increased morbidity due to exanthymatic (epidemic) typhus. Epidemic typhus has been described as a war-related hazard. It is well known that this disease caused in the past enormous morbidity and case fatality among civilians and soldiers [13]. In 1941 - during the Greek-Italian War - an epidemic of typhoid fever had begun from Florina (West Macedonia, Greece) and expanded to Central Greece and Athens [5]. It is worth of note that the epidemic had a broad impact on the general population of Athens. It affected both poor and rich neighborhoods of the city. The previous data from Greece complies well with published information from countries in the II World War Areas and especially in the Balkan Peninsula. In particular, Yugoslavia experienced a severe outbreak of epidemic typhus in 1944 during the military operations of the Yugoslav Armed Resistance Forces against the Nazi occupying troops [13].

Valaoras in his seminal work investigated the deaths among Athenians over the period October 1941-April 1942 [2]. In particular, he conducted an ecological study and aimed to explore the relation between deaths and daily bread ratios and daily mean temperature. He reported a pattern of increased mortality which took the form of successive epidemic curves. Interestingly, these waves did coincide - but not always - with the interruptions in daily bread rations. However, these waves of increased deaths did coincide with the waves of low daily temperature. The conclusion appeared inevitable that there was a synergy between starvation and low air temperature which resulted in a mass mortality of the population. Furthermore, a caloric intake insufficient for normal weather conditions became grossly inadequate following the extra expenditure of energy during the cold spells over the period October 1941-April 1942.

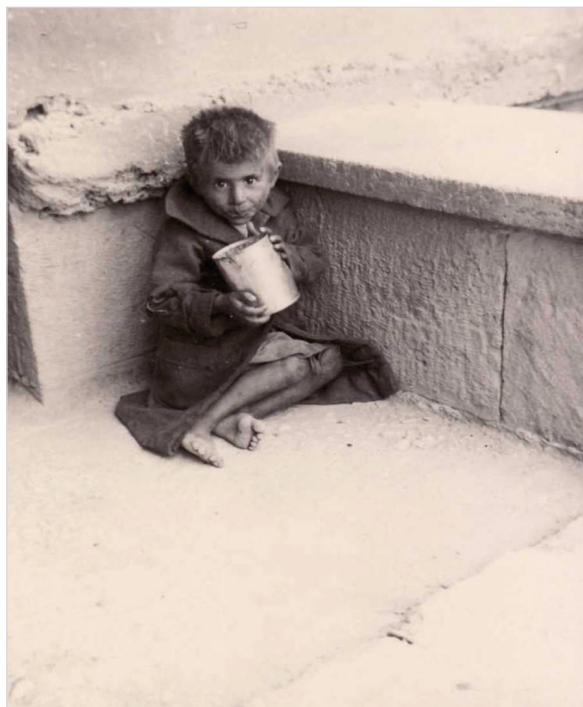
It should be noted that the primary factor in the

excessive mortality of the Greek population during the German occupation was starvation. Indeed, as Valaoras pointed out, starvation was the underlying cause of death for several thousands of Athenians during that time. We can also reasonably speculate that deaths ostensibly due to tuberculosis, for example, were expedited by the hunger famine of the period under review. Interestingly, the Nazis imposed food rations based on racist basis with Germans receiving biggest food rations in Nazi occupied territories of Greece, with little spared for Greek population. In fact, the Greek population in Athens during the winter 1941-1942 received only 53,15 gr of bread. On the contrary the members of the German community in Athens received 1771,85 gr of bread per week, and also 354,37 gr of meat, 88, 59 gr butter, 354,37 gr olive oil, 177,18 gr rise or legumes, 177,18 gr pasta, 177,18 gr sugar, 17,71 gr coffee, 8,85 gr tea and 3,54 gr egg [3,14,15]. This practice was in line with the Nazi policy in the occupied Poland. Both Polish and Jewish population was considered by German authorities to be "sub-human" (Untermensch) and as such targeted for extermination. Under Nazi plans, deliberate starvation of what were considered "sub-humans" was considered. In particular, by 1941, the official ration provided 2613 calories daily for Germans in Poland, 699 calories for Poles, and 184 calories for Jews in the Warsaw ghetto [16].

But over and beyond infectious diseases we also found an increase in mortality due to hemorrhagic stroke. There is qualitative evidence that psychosocial stress was increased in Athens during the period of Axis occupation [17]. Furthermore, there is some meta-analytical evidence that increased psychosocial stress was an independent determinant of stroke (including hemorrhagic stroke). In addition, there are some potential mechanisms to explain the association by which psychosocial stress may influence the risk of stroke. For instance, psychosocial stress is related to increased catecholamine release, which may increase arterial blood pressure [18].

There are several limitations to our study which should be considered in the interpretation of the results. We used as the denominator population the population census of 1940. Given that the absolute number of Greek population declined during the period 1941-1944, we believe that the calculated morbidity and mortality rates are un-

derestimated. There are data quality concerns with both the morbidity and the mortality data. A first limitation is the low completeness level of the data. Unfortunately, mortality data were not available for the period 1942-1944. Taking in to account the specific historical context of the period 1941-1944, we can also anticipate an under registration of both morbidity and mortality rates. Nevertheless, the most important limitation of the data is the possible misclassification of the death cause. There is some evidence from Athens and Ermoupolis (Syros) that malnutrition and famine accounted for 40-70% of the deaths during the winter of 1941-1942. In particular, 1314 out of 3096 deaths (42.5%) in Athens in January 1942 were directly attributed to famine [19]. The major death causes during this period were: starvation, hunger, general exhaustion, and cachexia. Similarly, in Ermoupolis (Syros) during the winter 1941-1942, 70% of death causes were related to famine [4]. It should be underlined that the data on causes of death were based on analyses of death certificates. Interestingly, the official mortality statistics did not include malnutrition/famine as cause of death. Perhaps this could be explained due to the



**Picture 1** - Starving child in Athens, 1942. Private collection George Chandrinos.

specific socio-political and military circumstances related to the occupation of Greece by the Axis/Nazi forces over the period 1941-1944.

In conclusion, we found that the Axis/Nazi military occupation of Greece has had considerable health effects on infectious diseases and hemorrhagic stroke mortality. It should be stressed that deaths ostensibly due to infectious diseases (e.g. tuberculosis or malaria), were expedited by the hunger famine of the period under investigation. With regard to the elevated mortality due to hemorrhagic stroke, we believe that the stressful events of occupation and famine have triggered increased psychosocial stress which in turn may have increased the risk of hemorrhagic stroke mortality during the period of Axis/Nazi occupation of Greece.

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#### Conflicts of interest

None to declare.

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