

The Effect of Migration on the Risk of Nasopharyngeal Cancer among Chinese¹

Philip Buell

San Francisco Bay Area Resource for Cancer Epidemiology, California State Department of Health, Berkeley, California 94704

Summary

The Chinese in California have an incidence of nasopharyngeal cancer roughly of the order of magnitude of the very high rate in Southeast Asia. Filipino migrants to California have a nasopharyngeal cancer risk intermediate to the high risk for Chinese and the low risk for Caucasians. A study of nasopharyngeal cancer mortality over the period 1958 to 1972 shows a gradient of lower risk of the disease in the second and third generation of Chinese in California. While a genetic explanation of the racial susceptibility cannot entirely be ruled out, it can be said that the Chinese are at a very high risk of the disease, partly because of unusual exposure to an environmental agent.

California has a Chinese population of about 180,000, perhaps the largest such population outside of Asia. Considering the well-known high incidence of NPC² among Chinese, California appears to be an appropriate place to study trends in the disease among Chinese immigrants and their offspring.

Materials

Preliminary incidence data for the year 1969 are available from the local operation of the Third National Cancer Survey in the San Francisco-Oakland Standard Metropolitan Area, where 88,000 Chinese reside. For the more extensive analysis of trends and differences in the NPC risk among different generations of Chinese, it is necessary to use the greater volume of data provided by the death certificate files for all of California. During the years 1949 to 1972, there were 139 deaths from NPC among Chinese males and 32 among Chinese females. Possible methodological objections to the use of death certificate data are discussed in the analysis.

The enumerated populations at risk are found in the decennial census publications appropriate to the calendar periods analyzed, with the exception of the census of 1970; for this year, it is necessary, at this time, to use One-in-One Hundred Public Use Census Sample computer tapes purchased from the United States Bureau of the Census. Two

such tapes have been combined to form a 2% sample estimate of the Chinese population by age, sex, nativity, and parentage. Because the standard errors of such estimates must be large, some caution would be necessary in interpreting any differences in NPC rates, unless such differences are substantial.

Results

Incidence. Preliminary 1969 results from the cancer incidence survey in the San Francisco-Oakland Standard Metropolitan Area disclosed an NPC incidence rate of 17.8/100,000 Chinese males and of 0.9/100,000 white males. Rates are age standardized, with the use of the Standard World Population given by Doll *et al.* (4) and, as Table 1 shows, the rate for Chinese in California is of the order of magnitude of rates for Chinese in Hong Kong (5) and Singapore (5), and somewhat higher than the rate for Chinese in Hawaii (1). The precise level of the rate in the San Francisco-Oakland area may be in question because some Chinese may come from overseas for treatment in San Francisco and be counted inadvertently as residents. Nevertheless, the magnitude of the racial difference is not in question.

Mortality. Chart 1, *left side*, reveals that Chinese males born in the United States (2nd generation) have age-standardized rates of mortality from NPC some 15 times higher than the rates for white males over the period 1950 to 1970 (data of 1949 to 1972); foreign-born Chinese males (1st generation) have NPC mortality rates some 30 times higher than do whites. Furthermore, no decrease in rate among Chinese is evident over the period. Rates for Chinese females are not shown because they are based on such small numbers, but they clearly have an excess risk of NPC, although there is a male predominance (2).

These mortality data can be considered a reasonably good index of incidence of NPC because 2 major objections can be met. First, a death certificate study may be inadequate if diagnostic information is not specific. However, Chart 1, *right side*, shows that if cancer deaths coded to "pharynx, unspecified" are included with "nasopharynx," the differences between rate levels are maintained. Second, group differences in duration of survival after diagnosis may cause a bias. Nonetheless, a recent, unpublished analysis of relative 5-year survival rates for NPC, using California Tumor Registry data, shows only minor differences: 29% for foreign-born Chinese males, 29% for those born in the United

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² The abbreviation used is: NPC, nasopharyngeal cancer.

Table 1
Incidence rates of cancer of the nasopharynx in Chinese and white populations

Rates are age standardized to the world standard population given in Ref. 4.

Area	Reference	Chinese males	White males
San Francisco-Oakland, 1969		17.9	0.9
Hong Kong, 1965-1969	2	24.7	
Singapore, 1960-1964	2	20.2	
Hawaii, 1960-1964	3	10.4	1.1

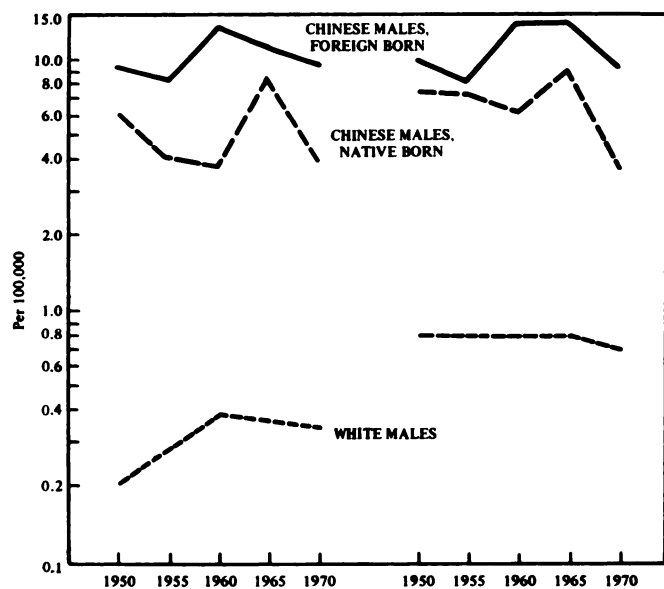


Chart 1. Age-standardized rates of mortality from cancer of the nasopharynx, 1950 to 1970: Chinese and white males, in California. *Left curves*, nasopharynx; *right curves*, nasopharynx plus pharynx unspecified.

States, and 26% for all males regardless of race. Prognosis is equally poor for any race.

Rates for United States-born Chinese run consistently lower than for foreign-born Chinese, a fact we might take to indicate that environmental factors are responsible for the disease. We cannot, however, be sure that genetic selection is not the cause of the lowered rate, especially since NPC strikes heavily at young and middle-aged adults, and it is known that Chinese immigrant males were forced to delay marriage and reproduction (2). If a downtrend appeared in the rates for the United States-born Chinese over time, it would support an environmental hypothesis, but the only evidence of this is the downturn in the rate in 1970 when "pharynx, unspecified" is added to "nasopharynx" (Chart 1, *right side*). This is hardly strong evidence.

However, there are now additional data on this point. The Chinese population has been in California for 100 years and considerable numbers of the 3rd and later generations are accumulating. Table 2 compares the NPC risk for 3rd- and 2nd-generation Chinese in the United States. The 3rd generation is composed of United States-born Chinese with both parents also born in the United States, and United States-born with 1 parent born in the United States and 1 foreign-born parent. The observed numbers

of NPC deaths in the 3rd generation are compared with the expected numbers of deaths based on age- and sex-specific rates for the 2nd generation of Chinese in the United States. Overall, the 3rd generation has less than one-half the NPC risk experienced by the 2nd generation, with 9 observed and 23.5 expected deaths. Those 3rd generation members with both parents United States born reveal an even greater difference between observed and expected numbers.

Although the 3rd generation has a considerably reduced risk of NPC, they are left with a 10-fold greater risk than Caucasians (9 observed *versus* 0.8 expected deaths, with the latter based on age- and sex-specific rates for Caucasians over the period 1958 to 1972).

Another Southeast Asian immigrant group in California, the Filipino population, consisting of 77,843 males and 61,016 females in 1970, contributes some information. There were 8 deaths from NPC among Filipino males during the period 1968 to 1972, for an age-standardized rate of 1.8/100,000. This is about 4 times the rate for white males, but only one-fifth of the rate for foreign-born Chinese males. No deaths of Filipino females were recorded. The result for males is consistent with an earlier analysis of 1956 to 1962 mortality records of NPC, which disclosed 6 deaths of Filipino males *versus* 1.32 expected, according to rates for Caucasian males (2).

Discussion

While the analysis is based on small numbers, there is a strong suggestion that successive generations of Chinese in the United States are at successively lower risk of developing NPC. It is important to consider a possible bias effect due to underenumeration of the Chinese population. A substantial number of the Chinese in San Francisco live in highly crowded, ghetto-like conditions in Chinatown, and it is fairly certain that there was some underenumeration in dwelling units shared by unrelated individuals, especially recent immigrants. An influx of new immigrants beginning about 1965 may have made this more of a problem in 1970 than during the earlier decennial censuses. Furthermore, underenumeration should not have been much of a problem in other parts of the state. While some bias from underenumeration may have affected the rates for foreign born during 1970, Chart 1 shows considerable differences in rates between foreign- and native-born Chinese at earlier decennial censuses. There is little reason to expect underenumeration of any consequence among 2nd and 3rd generation Chinese.

Ho (5) has expressed the hypothesis that the etiology of NPC is multifactorial, involving an environmental agent that may be ubiquitous and that acts together with other factors, including genetic, which are present only in people of high risk.

The current report, together with the report that Caucasians born in Southeast Asia may have a high risk of NPC (3), makes it fairly certain that at least 1 factor present in high-risk populations is an unusual exposure to an environmental agent. The agent seems to be more common in Southeast Asia, and has some connection with cultural

Table 2

Observed mortality from NPC in 3rd generation United States-born Chinese of California and expected mortality if they had the NPC rates experienced by 2nd generation United States-born Chinese of California

Expected numbers of deaths, based on age-specific rates for 2nd generation United States-born Chinese, were calculated for 3 5-year periods around 1960, 1965, and 1970.

	Decedents with 1 parent United States born			Decedents with both parents United States born			Total no. of 3rd-generation decedents		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Observed	4	2	6	3	0	3	7	2	9 ^a
Expected	4.8	5.9	10.7	7.3	5.5	12.8	12.1	11.4	23.5 ^a

^a Difference significant at $p = 0.001$, assuming number (9 observed) to be a Poisson random variable.

traditions and practices carried by those who migrate overseas. A role for gene action is not discounted entirely, but it is unlikely that the frequency of the gene in the population would change from the 2nd to the 3rd generation, although it could well have done so from the 1st (immigrant) to the 2nd generation (2). NPC occurs too infrequently among 3rd-generation Chinese to provide enough data for case-control studies of possible environmental agents, but that generation among the well population should demonstrate less exposure to any environmental agent identified in case-control studies conducted elsewhere.

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