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# Epidemiology of cancer in ethnic groups

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**Abstract** Substantial differences in the level and patterns of cancer have long been known to exist. Thus, breast cancer mortality in England & Wales in 1908-1912 was ten times higher than in Japan. Today the risk differential is six-fold. The major geographical differences in cancer risk throughout the world are mentioned and the significance of study of changes in cancer risk in migrant populations is emphasised. Thus, while cancer of the large bowel is still relatively uncommon in Japan, the incidence in US Japanese is currently higher than in both US Whites and Blacks. As the Japanese have not changed their genes, it is likely that the higher levels of risk in the US are due to the environment. Within Singapore there are substantial differences in the risk of cancers of the nasopharynx and oesophagus between the various Chinese dialect groups.
The information available on ethnic differences in cancer risk in the UK are reviewed. Current analyses are flawed by failure to distinguish between ethnic groups coming from the same continent. The collection of data on ethnic group at the 1991 census and the recently introduced requirement that this also be collected in hospital records will permit direct calculation of incidence and replace anecdote by fact.

The substantial differences in the level and patterns of cancer in various parts of the world have long been known. Hoffman, the actuary to the Prudential Assurance Company, was among the first to systematically collate data on mortality, observing, for example, that breast cancer mortality in women in England & Wales in 1908-1912 was ten times greater than in Japanese women (Figure 1), a differential which is still more than six fold. In his book he discusses the many theories advanced to explain such differences showing that the debate on nature versus nurture was already of long standing.[1]

## Significance of migrant studies

Many ethnic minorities are the result of migrations. In the 1940's Kennaway was the first to realise the importance of study of migrant populations in the elucidation of the reasons for ethnic differences in cancer risk, pointing out that "the very high incidence of primary cancer of the liver found among negroes in Africa does not appear in negroes in the United States of America and is therefore not of a purely racial character. Hence the prevalence of this form of cancer in Africa may be due to some extrinsic factor which could be identified".[2] Since these prescient words were written the causal role of the Hepatitis B carrier state and of exposure to the mycotoxin Aflatoxin B has been elucidated and the distribution of these factors can explain much of the geographical and ethnic variation. In the 1960's Higginson and Oettlé comparing cancer incidence in the Bantu and "Cape Coloured" of South Africa with that of the US population suggested that there was an exogenous component in about 70% to 80% of cancers and that if the causes could be identified prevention was theoretically possible.[3]

The work of Haenszel and Kurihara in the 1960's, on the mortality of Japanese migrants to the US, showed that while the high levels of stomach cancer obtaining in Japan slowly fell in the migrants, those for colon cancer rose rapidly (Table I), suggesting that, as the genetic composition of the migrants had not changed, their risk was influenced by the new environment.[4] In contrast, the risk of breast cancer increased only slightly. In the US today the highest large bowel cancer incidence rates are observed in the US Japanese and the granddaughters of the migrants now have breast cancer risks much closer to those of the US white population[5] (Table II). That similar changes occurred in Polish migrants to the United States lends further credence to the hypothesis. However, as is evident in Table III, breast cancer risk in Polish migrant women rose to US levels in the migrants themselves,[6] suggesting that the soil had already been prepared before migration and, unlike Japanese women, required only a relatively short period of residence in the United States before risk increased. These findings would be consistent with slow changes in dietary patterns in women influencing, in turn, hormonal patterns.

**Table I** Change in cancer mortality on migration from Japan to the USA[a]

| Group | Stomach M | Colon M | Lung M | Breast F |
|---|---|---|---|---|
| Japanese | 100 | 100 | 100 | 100 |
| Japan-born Americans | 72 | 374 | 306 | 166 |
| US Whites | 17 | 489 | 316 | 591 |

[a] The mortality rate in Japan is considered to be 100 and the other rates are given as a percentage of this reference rate.(Data from ref. 4.).

**Table II** Age-adjusted breast and large bowel cancer incidence rates for selected ethnic groups in the US, 1983-1987[a]

| Group | Breast F | Large Bowel M | Large Bowel F |
|---|---|---|---|
| Blacks (SEER) | 89.2 | 38.6 | 32.3 |
| Japanese (Los Angeles) | 72.7 | 54.5 | 39.5 |
| Whites (SEER) | 65 | 46.5 | 33.2 |

[a] Data from ref. 5. For further information on the SEER areas see ref 14.

**Table III** Change in cancer mortality rate on migration from Poland to the USA[a]

| Group | Stomach M | Colon M | Lung M | Breast F |
|---|---|---|---|---|
| Poland(1959-1961) | 38 | 3 | 17 | 6 |
| Poland-born Americans (1950) | 34 | 14 | 36 | 19 |
| US native whites(1950) | 10 | 13 | 31 | 22 |

[a] The rates given in the table are age-adjusted to the world standard population. (Data from ref. 6)

## Geographical differences in cancer risk

Estimates of the cancer burden in the 24 demographic regions recognised by the United Nations reveal large differences not only in pattern but in level.[7,8] The EC cancer mortality atlas[9,10] shows large variation in the cancer patterns of western Europe. While this publication reveals fascinating differences within the EC such as the abrupt transition from a very high risk for oesophageal cancer in north-east France to a low risk on the other side of the Belgian border, and the very high levels of this cancer

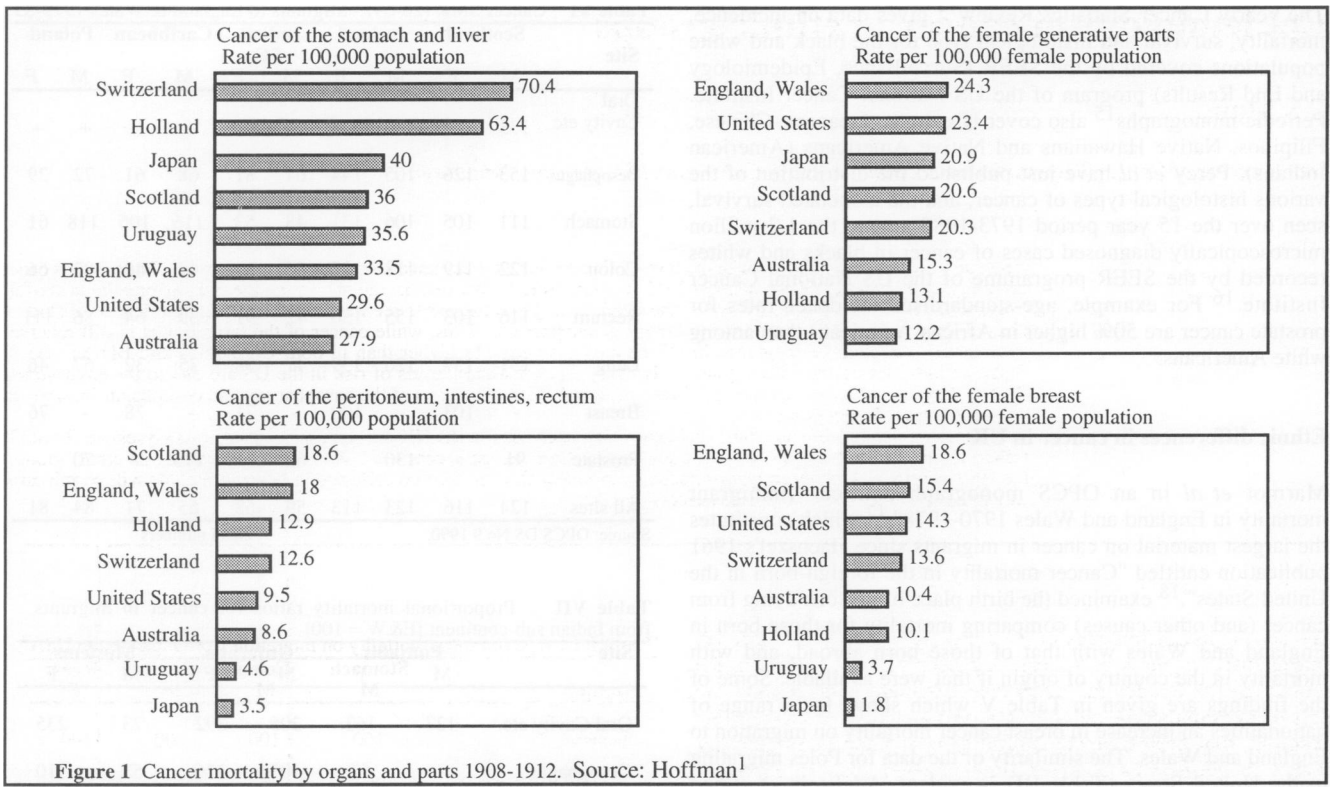


**Figure 1** Cancer mortality by organs and parts 1908-1912. Source: Hoffman[1]

in Scottish and Irish women compared to elsewhere, data on minority ethnic groups are not included. Further, although cancer mortality data are more widely available, they are influenced by the success of treatment, and information on incidence is to be preferred.

The cancer incidence data of good quality[a] published in Volume VI of Cancer Incidence in Five Continents[5] exhibit very large differences across the world: 150-fold for cancer of the nasopharynx (Hong Kong/Brazil); 50-fold for primary liver cancer (Shanghai/Nova Scotia); 70-fold for cancer of the prostate (Atlanta blacks/Tianjin); 300-fold for malignant melanoma of the skin (Queensland/Madras). The differential for malignant melanoma of the skin in Queensland and Madras, parts of the world with prolonged sunshine, reflects a genetically determined absence of melanin in the Australian population; that for primary liver cancer reflects the prevalence of Hepatitis B carrier state.

While there is strong evidence for a genetic basis for susceptibility to nasopharynx cancer, the reasons for the very large international differences in prostate cancer remain to be uncovered. Even within the United States the risk of prostate cancer varies substantially between the black and white populations, being twice as common in blacks.

Comparison of ethnic groups within the same country reduces, but does not eliminate, the likelihood of artefact as various segments of the population may either not have access to medical care or not avail themselves of the medical services. The Cancer Mortality Atlas of the People's Republic of China[11] revealed signal differences in the site distribution and level of malignant disease, differences which have been used as an epidemiological research resource (for a review see[12]). However the level of medical services varies across this vast nation and artefact is possible. In contrast, in Singapore, a very small country, the high level medical services are available to all. Nonetheless, the Hokkien, Teochew and Cantonese Chinese of Singapore still exhibit substantial differences in cancer pattern (Table IV).[13]

There is no reason why cancer would be more likely to be diagnosed in one of these language groups than in another and the fact that the differentials are frequently in opposite directions (higher levels of nasopharynx cancer in Cantonese and of oesophageal cancer in Hokkien and Teochew) supports the validity of the findings. Comparison with cancer mortality in the provinces of origin in China reveals a similar pattern.[11]

**Table IV** Relative risks for selected cancers for major Singapore Chinese dialect groups[b]

| Site | Baseline Hokkien | | Teochew | | Cantonese | |
|---|---|---|---|---|---|---|
| | M | F | M | F | M | F |
| Nasopharynx | 12.3 | 3.7 | 1 | 1.09 | 1.47 | 2.01 |
| Oesophagus | 13.3 | * | 1.13 | * | 0.27[c] | * |
| Stomach | 39.2 | 17.6 | 0.85 | 0.68 | 0.38 | 0.56 |
| Colon | 16.6 | 13.5 | 0.89 | 0.86 | 0.87 | 1.02 |
| Liver | 27.7 | 6.9 | 0.86 | 0.94 | 0.91 | 1.06 |
| Lung | 74.3 | 20.8 | 0.92 | 0.91 | 0.70 | 1.16 |
| Prostate/Breast | 4.2 | 21.4 | 1.08 | 0.71 | 1.15 | 0.95 |
| Cervix uteri | - | 11.4 | - | 0.82 | - | 0.86 |
| All sites | 254.6 | 147.9 | 0.93 | 0.82 | 0.76 | 0.97 |

[b] The age adjusted relative risks for Teochew and Cantonese are expressed as a proportion of the incidence rate for Hokkien 1983-1987.
* very small numbers.
[c] For underlined values 95% confidence interval excludes unity.
(Table based on ref. 13.)

## Ethnic differences in cancer in the United States

Minority ethnic groups in the United States have evinced great interest in having up-to-date information on their cancer experience to support demands for better facilities. Ethnic differences have been extensively and continuously studied from both the descriptive statistical and the aetiological points of view.

[a] However there is likely to be under-ascertainment of cases and bias in the stages of certain cancers registered e.g. Melia *et al.* (1995) Problems with the registration of cutaneous malignant melanoma. *BJC*; **72**:224-228.

The yearly Cancer Statistics Review[14] gives data on incidence, mortality, survival and histological type for the black and white populations covered by the SEER (Surveillance, Epidemiology and End Results) program of the US National Cancer Institute. Periodic monographs[15] also cover Hispanics, Japanese, Chinese, Filipinos, Native Hawaiians and Native Americans (American Indians). Percy *et al* have just published the distribution of the various histological types of cancer, and the associated survival, seen over the 15 year period 1973-1987 among the 1.2 million microscopically diagnosed cases of cancer in blacks and whites recorded by the SEER programme of the US National Cancer Institute.[16] For example, age-standardised incidence rates for prostate cancer are 50% higher in African Americans than among white Americans.

## Ethnic differences in cancer in UK

Marmot *et al* in an OPCS monograph entitled "Immigrant mortality in England and Wales 1970-1978",[17] which constitutes the largest material on cancer in migrants since Haenszel's 1961 publication entitled "Cancer mortality in the foreign-born in the United States",[18] examined the birth place of persons dying from cancer (and other causes) comparing mortality for those born in England and Wales with that of those born abroad, and with mortality in the country of origin if that were available. Some of the findings are given in Table V which show, for a range of nationalities an increase in breast cancer mortality on migration to England and Wales. The similarity of the data for Poles migrating to the United States (Table III) is evident. Adelstein *et al* had shown similar results in a previous study of Polish migrants.[19]

**Table V** Standardised mortality ratios for breast cancer in migrants to England & Wales: comparison with country of origin[a]

| Country of origin | Homeland | England & Wales |
|---|---|---|
| Scotland | 96 | 98 |
| Eire | 98 | 88 |
| France | 64 | 79 |
| Poland | 45 | 97 |
| Spain | 40 | 64 |
| US | 84 | 94 |
| Caribbean | 55 | 73 |

[a] The mortality in England & Wales is set at 100. (Based on ref. 17.)

A more recent analysis[20] presents the Standardised Mortality Ratio (SMR) and Proportional Mortality Ratio (PMR), for the age groups 20-69 and 70 and over, by country of birth for deaths occurring in 1979-1983 (Table VI). There has been little change since an earlier publication (Table VII). However, about half of the Caribbean population and about one third of the Indian/Pakistani/Bangladeshi population is UK born and does not enter into these analyses. This publication contains an excellent discussion of many of the problems of interpretation of their findings.

Marmot *et al* concluded "In contrast with American (i.e. Haenszel's) observations, rates of cancer of the intestine, breast, prostate and other sites do not appear to have changed within first generation Asian and African immigrants and changed only partly in Poles".[17] This intriguing contrast with the American experience was perhaps due to the shorter residence of most immigrants in England and Wales, usually less than 20-30 years, (migrants from India, the Caribbean and other Commonwealth countries arrived mainly after 1960, Poles during 1940-1949) and/or to a greater resistance to change in diet and life style.[6] As Steiner, writing about migrants in the 1950's noted "...factors such as climate, altitude, temperature...may differ at once...On the other hand, certain environmental factors, some of which may be cultural, change more slowly after migration. The choice of food and culinary practice, occupational exposures, sanitary habits, economic levels and other factors may gradually change over a period of years..."[21]

**Table VI** Cancer SMR (20-69) - Migrants to England & Wales 1979-83

| Site | Scotland | | Ireland | | Indian SC | | Caribbean | | Poland | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F |
| Oral Cavity etc | 133 | 116 | 206 | 144 | 108 | 202 | + | + | + | + |
| Oesophagus | 153 | 126 | 105 | 144 | 64 | 81 | 68 | 61 | 72 | 29 |
| Stomach | 111 | 105 | 106 | 131 | 48 | 53 | 116 | 106 | 118 | 61 |
| Colon | 122 | 119 | 118 | 117 | 56 | 64 | 43 | 40 | 82 | 66 |
| Rectum | 116 | 103 | 155 | 130 | 42 | 51 | 39 | 64 | 86 | 111 |
| Lung | 131 | 157 | 126 | 139 | 47 | 38 | 35 | 32 | 67 | 46 |
| Breast | - | 103 | - | 100 | - | 71 | - | 78 | - | 76 |
| Prostate | 91 | - | 130 | - | 62 | - | 175 | - | 70 | - |
| All sites | 124 | 116 | 123 | 113 | 59 | 68 | 65 | 71 | 84 | 81 |

Source: OPCS DS No.9 1990. + small numbers

**Table VII** Proportional mortality ratios for cancer in migrants from Indian sub-continent [E&W = 100]

| Site | Punjabis | | Gujaratis | | Moslems | |
|---|---|---|---|---|---|---|
| | M | F | M | F | M | F |
| Oral Cavity etc. | 127 | 163 | 205 | 392 | 73 | 235 |
| Oesophagus | - | 52 | 105 | 226 | 53 | 310 |
| Stomach | 5 | 18 | 50 | 62 | 40 | - |
| Colorectum | 37 | 8 | 84 | 18 | 22 | 25 |
| Lung | 24 | 20 | 18 | 8 | 41 | 42 |
| Breast | - | 20 | - | 8 | - | 85 |
| Cervix uteri | - | 15 | - | 43 | - | 19 |
| Prostate | 34 | - | 54 | - | 18 | - |

Source: Balarajan et al.(1984) BMJ: 289: 1185.

Analyses in the OPCS monograph (DS No.9 1990) comparing those born in the Indian sub-continent with those born in UK (total population), are flawed by the inclusion of persons, notably older persons, of European origin born in India returning to England & Wales on retirement who could not be distinguished from the others, other than by surname.

Black investigated, as part of a wider study of Italian migrants, cancer mortality in this rather small community in Scotland.[22] He found that, compared to the Scottish population, although risks for digestive tract cancer were generally lower in those born in Italy, stomach cancer risk was significantly higher in the male born in Italy. While lung cancer mortality for both sexes was lower in those born in Italy, larynx cancer was significantly commoner in males. Although not statistically significant, mortality from cancers of breast, uterus and ovary were consistently lower in the Italy-born.

In England and Wales, Swerdlow found the largest differences in risk of cancer incidence between Italy-born and natives of England and Wales were for some less common cancers: lip, nasopharynx, liver, placenta and thyroid.[23] Possible explanatory factors include: sun exposure in outdoor work (lip cancer); alcohol consumption (liver and larynx cancers); and hepatitis B (liver). For the more common cancers, the relative risks for the

two groups showed less difference, with a lower risk among Italy-born for lung cancer (presumably reflecting lower cigarette consumption in Italy than in the UK). Gastric cancer risk was higher for immigrants and in Italy relative to England and Wales, and breast, ovarian and testicular cancers were lower, reflecting similar patterns to the Scottish findings above.

Grulich *et al*[24] reported on cancer mortality in African and Caribbean migrants to England and Wales: Swerdlow[25] on mortality and incidence in Vietnamese refugees. Overall, cancer mortality was raised in West African males and non-significantly raised in West African females compared to mortality in the England and Wales born population. Much of the increased risk was due to very high rates of liver cancer in men, but rates were also raised for a wide range of other cancers in both sexes. Only lung and brain cancer had significantly decreased mortality. In Caribbean immigrants overall cancer rates were significantly low in both males and females. Mortality was significantly low for many cancers including colorectal, lung, testis and brain cancers. Mortality was significantly raised only for cancer of the prostate in males, of the placenta in females, and of the liver, non-Hodgkin's lymphoma and multiple myeloma in both sexes. Among Vietnamese refugees, overall mortality was low relative to England and Wales, with very low rates for colorectal and breast cancers. Increased mortality rates were observed for cancer of the stomach in both sexes, and for cancers of the nasopharynx and liver in males.

Harkness[26] has examined the ethnic origin of persons with cancer of the nasopharynx in Scotland by scrutinising lists of persons reported to the Scottish Cancer Registry, finding that of the 213 cases of this tumour 7.5% had Chinese names, whereas the proportion of Chinese in the Scottish population is 0.2%.[27] The age-standardised incidence rate for the entire Scottish population was 0.3 per 100,000 population, that for persons with Chinese names was 13.7, a figure close to that for Chinese populations elsewhere. The relative risk for those with a Chinese name was thus 46. Even this exercise is subject to some error - the name Lee could be of Chinese or English origin. These findings have not yet been explored in aetiological terms.

Such indirect methods are time consuming and may be open to many sources of error and bias. **The direct computation of incidence rates is by far the most informative.** Given that the recent census[27] allowed respondents to denote their ethnic origin (white, black Caribbean, black African, black other, Indian, Pakistani, Bangladeshi, Chinese, other Asian, Irish and other) the infrastructure for assessment of denominators is now in place. There has, however, been no requirement to routinely record ethnic origin on hospital admission notes to provide the necessary numerator, nor is this information recorded on death certificates or by cancer registries. As from April 1995, collection of data on ethnic group for all patients admitted to NHS hospitals will be routine.[28, 29] It is important that the categories of ethnic origin correspond to those collected by the census. With such information on hospital discharge records, it would be automatically available to cancer registries.

While there will be problems of classification for mixed ethnicity and respondents may not always be consistent in their answers or wish to declare an ethnic appurtenance, the availability of both numerator and denominator should permit a much more accurate evaluation of the health problems of minority ethnic groups. Over time ethnic identity may become blurred through intermarriage. The US Bureau of Census used to classify persons of mixed ethnicity by the ethnic group of the father: currently it is the ethnic group of the mother which prevails.

The Australian census requires respondents to state length of residence in Australia and this information has been invaluable in assessing the extent and the significance of changes in risk over time. Thus the risk of the superficial spreading variant of cutaneous malignant melanoma was largely determined by the age at migration. For persons who migrated before the age of 10 the risk was the same as in the Australian born: for migrants after the age of 25 the risk was the same as in the country of origin.

## Explaining ethnic differences in cancer risk

There may be many reasons for variation in risk between ethnic groups. Diet, personal habits such as smoking, alcohol drinking and those associated with reproductive life, genetic constitution and socio-economic status may all be involved. Analysis is further complicated by changes in lifestyle among ethnic groups moving to new countries. Disentangling such factors, which are often confounded, is not easy. Carstairs and Morris have assessed, through census derived indicators, the influence of deprivation in Scotland.[30] Cancers commoner in the poorer strata of society included stomach and lung, in contrast to testis and malignant melanoma of skin which were commoner in the more prosperous. Such analyses have not been undertaken for the Scottish ethnic minorities due to an absence of appropriate numerator information. The excess of nasopharynx cancer in Chinese who originated from Guandong Province is consistent with findings from Hong Kong, Singapore and the US. This particular neoplasm is strongly influenced by genetic constitution, exposure to the Epstein-Barr virus and possibly dietary influences in early childhood.[31] Indeed, as Tanchou stated in 1843 "the cause of cancer is complex and is neither completely external nor completely internal".[32]

## Conclusion

The causes of cancer are best sought in groups of contrasting risk. Migrants frequently have an experience of malignant disease which is different from that of the host population and such differences may persist in the next generation. As the risk of cancer in migrants slowly approximates to that of the host country such studies become less useful with time. The discovery of risk factors is beneficial to migrant and host populations alike. Yet in some countries there has been a reluctance to identify migrants in official statistics and a reluctance on the part of migrants to be identified. Despite the obvious aetiological value of migrant studies little has been done to characterise their habits, dietary and otherwise, on arrival and to monitor their evolution over time.

The time has long since passed for impressions on the health of minority ethnic people in the United Kingdom to bebased on anecdote or indirect methods. As the provision of denominator data in the 1991 census will now be complemented by the systematic collection of numerator information on ethnicity in medical records, it should become easier to assess, on a factual rather than anecdotal basis, the cancer and other health problems of the various ethnic groups resident in Great Britain.

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