International Epidemiology of Cancer

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Within the range of this title I have chosen to limit consideration of the subject first to morbidity. Mortality data for many parts of the world are available from WHO, but their quality is very uneven, and the data generally refer to the whole of a country: only the developed countries can claim a reasonable degree of homogeneity of data for such areas. Cancer morbidity data come from cancer registries which, though scattered around the world, are much more plentiful in the more advanced countries, and scarce or non-existent in many places where they would be, for epidemiological and other reasons, very desirable. Nevertheless, they are usually reliable sources of data and more accurate in diagnosis than are death certificates since they will often be supported by histological reports or by the results of other investigative or therapeutic methods.

My general objective is to examine the variations in the manifestation of cancer across the world, in relation to different ethnic or national groups. As a principal source of data I have taken the latest (fourth) volume of that tabulation of international cancer morbidity data known as Cancer Incidence in Five Continents[1]. There are 104 populations or sub-populations included in the volume, each tabulated by sex, age and site for incidence rates, and each subject to checks and quality controls before admission. The volume represents the most comprehensive and homogeneous source of such data at present available.

Since the various populations differ so much in their structure by age and sex, some common 'denominator' is necessary in order to render them properly comparable. For this purpose the 'world standardised rate' (WSR) is probably the most useful. For any given population and site of cancer, the incidence rates by age are applied to a standard population — the 'world standard population', constructed originally by the Japanese epidemiologist, Segi, as a form of average between the very young populations of the developing countries and the rather older (in the sense of having a greater proportion of their people in the older age groups) pattern of the developed countries. Applied in this way the rates produce an 'expected' number of cases in the standard population from which the WSR is obtained. These rates can then be properly compared because they all result from the same basic population.

The list of sites is taken from the second chapter (Neoplasms) of the eighth revision of the ICD[2], which has been condensed to provide just over 40 sites for each sex. I have further condensed it by excluding certain sites mostly of minor importance, such as small intestine, bone, connective tissue, skin, male breast, chorion epithelioma, other female genital, eye, other endocrine, monocytic and other rare leukaemias, polycythaemia vera, myelofibrosis. Skin is an important site which it is unfortunate to have to exclude: melanoma is included but the squamous and basal celled forms of skin cancer are not, since many registries find it difficult to capture all such cases. These varieties seldom cause death, but they are useful indicators of exposure to carcinogenic agents such as ultra-violet light, e.g. intense sunlight, and a number of substances, e.g. hydrocarbons, occurring in various occupations.

Basis of Analysis

With the limitations mentioned above, the data source is reduced to a WSR for each of 104 populations and rather more than 30 sites, and for both sexes, providing more than 6,000 figures for comparison. In order to heighten the comparison and attempt to typify the patterns representative of the various groupings, I took first the upper 10 per cent of the WSRs for each sex and site, arranged in descending order of magnitude. Later, for greater simplicity, I took only the first five populations showing the highest rates within each site by sex, reducing the number of indices to just above 300 (Table 1).

Results

When placed in rank order, what is lost is the absolute value of the index, here the WSR. Sometimes the five values form a group close together in size and ordered by only small variations; sometimes one may stand out well above the others. In lip cancer, for instance, the WSR for males in Newfoundland is 22.8 per 100,000 and the next figure is 13.3, for Saskatchewan. It has been suggested that the very high rate of 22.8 relates to fishermen accustomed to repair their tattered nets by holding them in their mouths, or alternatively to the reflection of the sun from the water on to their lips. Nasopharyngeal cancer in Singapore Chinese men has a rate of 19.4, the next being 14.6 among Bay Area Chinese men, and then 7.1 for Los Angeles Chinese, the rate for Shanghai, the only representative of mainland China, being 5.6. Among women, the highest rate for tumours of the gall bladder is 22.2 in the American Indians of New Mexico, the next
rate being 12.3 for women in Warsaw City. The last example that I give is cervical cancer in Cali, Colombia, with a rate of 52.9, the next being 37.5 in Sao Paulo, Brazil.

The populations of Bombay and Poona are the only representatives of India, and in them we find tongue, mouth, oro- and hypopharynx, nose and sinuses, larynx and oesophagus, with cervix and penis also in Poona.

| KEY                      | NW(UK) = North West Region (United Kingdom) | Hawaii (Haw) = Hawaii, Hawaiian | Hawaii (F) = Hawaii, Filipinos | Bay Area (Ch) = Bay Area, Chinese |
|--------------------------|--------------------------------------------|--------------------------------|-------------------------------|---------------------------------|
| (Wh) = Whites            | (Bl) = Blacks                               | Hawaiians                      | Hawaiians                     | Bay Area (J) = Bay Area, Japanese |
| Sing. Ind. = Singapore,  |                                            |                                |                               |                                 |
| Indian                   |                                            |                                |                               |                                 |
| NWT = North Western      |                                            |                                |                               |                                 |
| Territories (Canada)     |                                            |                                |                               |                                 |
| **MALE**                 | **FEMALE**                                 | **Hawaii**                     | **Hawaii**                    | **Bay Area**                    |
| Tongue                   |                                            |                                |                               |                                 |
| Bombay                   | 10.2                                       | Poona                          | 18.3                          |                                 |
| Doubs                    | 7.8                                        | Poona                          | 18.0                          |                                 |
| Bas-Rhin                 | 7.4                                        | Hawaii (Wh)                    | 14.8                          |                                 |
| Poona                    | 7.2                                        | Puerto Rico                    | 14.3                          |                                 |
| Puerto Rico              | 6.0                                        | Bay Area (Wh)                  | 12.0                          |                                 |
| Mouth                    |                                            |                                |                               |                                 |
| Poona                    | 10.0                                       | Sing. Ind.                     | 107.2                         |                                 |
| Bas-Rhin                 | 9.6                                        | Bombay                         | 105.7                         |                                 |
| Sing. Ind.               | 8.8                                        | Poona                          | 96.8                          |                                 |
| New Orleans (Bl)         | 7.0                                        | Hawaii (Haw)                   | 96.2                          |                                 |
| Sao Paulo                | 6.8                                        | Hawaii (Wh)                    | 90.7                          |                                 |
| Hypopharynx              |                                            |                                |                               |                                 |
| Bas-Rhin                 | 11.6                                       | Hawaii (Wh)                    | 2.7                           |                                 |
| Doubs                    | 6.8                                        | NWT                            | 3.4                           |                                 |
| Geneva                   | 5.7                                        | Alameda (Bl)                   | 1.6                           |                                 |
| Antilles                 | 5.5                                        | Bay Area (Bl)                  | 2.1                           |                                 |
| Bombay                   | 4.7                                        | Bombay                         | 9.0                           |                                 |
| Oropharynx               |                                            |                                |                               |                                 |
| Bas-Rhin                 | 10.2                                       | Sing. Ind.                     | 10.2                          |                                 |
| Doubs                    | 8.7                                        | Bombay                         | 9.2                           |                                 |
| Geneva                   | 5.7                                        | Alameda (Bl)                   | 9.0                           |                                 |
| Neuchatel                | 4.4                                        | Alameda (Wh)                   | 7.9                           |                                 |
| Nasopharynx              |                                            |                                |                               |                                 |
| Sing. (Ch)               | 19.4                                       | Bay Area (Ch)                  | 7.7                           |                                 |
| Bay Area (Ch)            | 14.6                                       | Sing. (Ch)                     | 7.5                           |                                 |
| LA (Ch)                  | 7.1                                        | LA (Ch)                        | 4.0                           |                                 |
| Hawaii (Ch)              | 6.2                                        | Shanghai                       | 2.5                           |                                 |
| NWT                      | 6.2                                        | Hawaii (Ch)                    | 1.6                           |                                 |
| Larynx                   |                                            |                                |                               |                                 |
| Doubs                    | 17.6                                       | Bombay                         | 2.6                           |                                 |
| Varese                   | 16.0                                       | Poona                          | 2.2                           |                                 |
| Sao Paulo                | 15.8                                       | Detroit (Bl)                   | 2.0                           |                                 |
| Spain Navarra            | 15.0                                       | Sao Paulo                      | 1.9                           |                                 |
| Poona                    | 13.6                                       | Bay Area (Bl)                  | 1.8                           |                                 |
| Oesophagus               |                                            |                                |                               |                                 |
| Shanghai                 | 24.7                                       | Bombay                         | 10.7                          |                                 |
| Atlanta (Bl)             | 19.3                                       | Poona                          | 10.4                          |                                 |
| Sing. (Ch)               | 18.9                                       | Antilles                       | 8.7                           |                                 |
| Hong Kong                | 18.6                                       | Sing. Ind.                     | 7.7                           |                                 |
| Hawaii (Haw)             | 18.3                                       | Hong Kong                      | 5.5                           |                                 |
| Stomach                  |                                            |                                |                               |                                 |
| Nagasaki                 | 100.2                                      | Nagasaki                       | 51.0                          |                                 |
| Miyagi                   | 88.0                                       | Miyagi                         | 42.0                          |                                 |
| Osaka                    | 78.0                                       | Osaka                          | 38.5                          |                                 |
| Fukuoko                  | 75.0                                       | Fukuoko                        | 38.4                          |                                 |
| Shanghai                 | 55.7                                       | Cali                           | 27.3                          |                                 |

**Note:** The table data represents standardized rates for various cancers in different regions and ethnic groups, with the rates being calculated per 100,000 population.
These sites, especially the area of the mouth, have long been typical of India, but we find a very similar grouping in France (Bas-Rhin and Doubs), and several in Switzerland. The Swiss also include high levels of testis, bladder, lymphosarcoma, Hodgkin’s Disease, other reticuloses and leukaemia, some of which could be associated with the high standard of living typical of Geneva, Vaud and Neuchâtel.

The Chinese, represented chiefly by their migrant populations in Hong Kong, Singapore, Hawaii and California, show, in addition to the highest rates for nasopharynx, high rates for oesophagus, stomach, colon, liver, nose and sinuses, and thyroid. There are four registries in Japan itself, and the Japanese have, for both sexes, the highest rate of stomach cancer in the world; after them come Shanghai and the South American towns of Cali and Sao Paulo. Japanese in Nagasaki and Miyagi show high rates of gall bladder carcinoma, while expatriate Japanese have an excess of rectal cancer. Jews have high rates for rectum, and also for lip and ovary, but especially, in both sexes, for brain and nervous system.

Native Hawaiian women have the highest breast cancer rate, to which are added mouth, salivary gland, liver, bronchus, thyroid, lymphosarcoma and myeloma; for the men there are oesophagus, bronchus, lymphosarcoma, myeloma and myelocytic leukaemia. The Maoris, of both sexes, have very high rates for pancreas, bronchus, myeloma, myelocytic leukaemia, and for women, cervix.

Norway, Sweden and Denmark have high rates for ovary, other urinary, brain and nervous system, and for Denmark the testis, and for Norway, melanoma. In the Antipodes, New South Wales, South Australia and New Zealand whites have the top three rates in both sexes for melanoma, followed by some US whites and the Norwegians. Other forms of skin cancer are known to be high there and are likely to result from excess exposure to intense sunlight.

The sites found among American whites are breast, colon, melanoma, endometrium, bladder, Hodgkin’s disease, and lymphosarcoma, sites which could be said to be characteristic of a high standard of living. Among American blacks are found the highest rates of pancreas, prostate, myeloma, and bronchus. For the latter site the New Orleans blacks lead with a rate of 107.2, followed by the Maoris at 105.7, and the west of Scotland at 96.8; among women, the Maoris lead with 48.8.

These are the principal highlights, though the catalogue is far from exhausted. But apparently isolated facts form a poor diet and quickly amount to a surfeit. In some instances it is possible to put forward plausible ‘explanations’ for observed high rates, in others there is no clear relationship. A general conclusion would support an environmental rather than a genetic basis for most malignant disease, though culture patterns are evidently influential. The work of Haenszel[3] and his colleagues on comparing the pattern of cancer among emigrants with both host and parent countries has shown that there can be at least two manifestations of an effect: one that, with increasing period of residence, approximates the risk in emigrants towards the host’s risk, and another that requires a new generation, born in the host country, before a sizeable change is seen. One of the strongest arguments for the environmental effect is, of course, the large fraction of cancer attributable to cigarette smoking, now increasingly evident among women as male rates have reached saturation. Another is the striking change in the pattern of cancer in Japan as dietary habits change towards a western model. Though we may be able, from analysis of these data, to infer methods that may help to reduce or prevent certain kinds of cancer, there are still many variants that remain unexplained, and secular trends that elude a current rationale.

This article is based on a paper read at the Conference on Diseases in Ethnic Minorities held at the Royal College of Physicians in May 1984.

References
1. Waterhouse, J.A.H., Muir, C.S., Shanmugaratnam, K. and Powell, D.J. (1982) Cancer Incidence in Five Continents, Vol. IV. Lyon: IARC.
2. International Classification of Diseases — Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death (1967) Geneva: WHO.
3. Haenszel, W. (1975) in Persons at High Risk of Cancer, pp. 361-71. (ed J.F. Fraumeni.) New York: Academic Press.

Correction
We apologise for an error in the article ‘Metabolic Responses to Beta, Stimulants’ in Vol. 18 No. 3 (July 1984). Page 193, lines 7-10 should have read: ‘... In one report normal subjects were challenged with intravenous salbutamol before and after the administration of 1,600 micrograms of inhaled salbutamol daily for 2 weeks.’