The Prevalence of Cancer

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I need first to distinguish between "cancer incidence", "cancer mortality" and "cancer prevalence". The term prevalence of cancer refers to the proportion of the living population at any one time who actually have one or other form of the disease. In all three cases, data only have real meaning if they are age-standardized.

In Britain there exists an efficient network of Cancer Registries which collect information about the incidence of new cases of cancer. It has been estimated that the Registries pick up at least 95% of new cases of cancer from the medical records and pathology departments of hospitals and in due course it is possible for them to match these records with death certificate data. From incidence and mortality data it is possible to infer prevalence rates but these inferences are only very approximate. Particularly inaccurate are figures for people who sequentially develop more than one primary cancer. Britain is in fact ahead of many other countries in the quality of the cancer incidence data that it collects. Until recently problems of confidentiality of death certificate data has held back the assemblance of data in interpretable form in France and Germany. In Britain cancer incidence and mortality can be related to decennial census data but in the United States interpretation of Cancer Registry data has been rendered difficult because reliable measures of the base population at risk are often not available.

I suspect that many of those attending this Symposium perceive cancer in its many forms as a common disease and a common cause of death. In so far as roughly one in four people in this country develop a cancer during their life-time and one in five people die from cancer, it is reasonable to regard it as a common phenomenon. However, it is important that we should be aware of the fact that perceived risk may differ by orders of magnitude from actual risk. Let me illustrate what I mean. Research on road accidents indicates beyond doubt

that hundreds of lives can be saved each year if the occupants of the front seats of cars wear safety belts at all times. One of the reasons why many people refrain from following advice to do so is a fear that the safety-belt will prevent escape from a burning vehicle after an accident. In fact the latter risk is remote. However, it is widely perceived as being as great or greater than the benefits offered by seat belt usage. Many peoples' perceptions of the prevalence of cancer are similarly distorted and false. Unreasonable fears of cancer, fanned by a sometimes misinformed and irresponsible press, lead some people to live in a constant state of anxiety , whereas some heavy smokers simply do not believe that the widely publicised evidence that smoking increases lung cancer risk might apply to them as well as to everyone else.

If we turn the clock back a mere 50 to 100 years, we find that there were so many diseases to fear that cancer did not figure particularly highly in most peoples' lists of dreads. Instead the main preoccupation was with problems such as the hazards of childbirth, perinatal mortality, deaths during childhood from rickets, diphtheria, scarlet fever and whooping cough and the scourge of people of all ages - tuberculosis. Against this background cancer was just one of many things to fear but not at the top of most peoples' lists.

The position 50 or more years ago was that cancer was perceived as a condition that required 'treatment'. The idea that cancer might be preventible only spread in popularity after the 2nd world war. Even as late as the early 1960's, it was much more difficult to obtain funds for research on cancer prevention than for research on new methods for treating cancer. This is because cancer was widely considered to be a disease of natural origin without avoidable cause. In fact there was already plenty of evidence that exposure to materials such as tar, pitch, unrefined mineral oils and sunlight predisposed to skin cancer. Also it was clear that exposure to certain aromatic amines in the dye stuff industry was associated with bladder cancer, and ionizing radiation was recognised as a potent cause of cancers of many sites. But for some reason the concept that most internal cancers arise independently of environmental influence persisted.

In striking contrast is the position today when it is widely held that almost all cancers are the result of exposure to environmental carcinogens and therefore preventible.

In some ways the pendulum has swung too far and more importantly it has swung in rather the wrong direction. The concept that environmental factors

determine the occurrence of most cancers is derived from information of two kinds. Firstly, the incidences of cancers of particular kinds varies widely between populations living in different parts of the world under different cultural conditions. This was poignantly illustrated by Doll (1977) from whose paper

Table 1 has been prepared. Theoretically, the differences shown in this table could be either genetic or environmental in origin. However, there is persuasive evidence from studies on people who migrate from one area and culture to another indicating that those who migrate and their progeny tend to assume the pattern of cancer incidences of their adopted country rather than sticking with those of their country of origin (Haenszel, 1970)

The medical student is taught that genetic and environmental factors interact in the causation of disease. This is as true for cancer as for any other type of disease and it certainly is not true that the contribution of genetically-determined susceptibility is so small that it can be ignored. This is strikingly the position in the case of skin cancer. Among men aged between 35 and 64 living in Queensland, Australia, there occur 200 skin cancers for every 1 skin cancer in Bombay. Bombay and Queensland are situated at similar latitudes North and South of the equator, respectively. Thus the extent of exposure to the skin-cancer-causing solar-derived ultraviolet B-radiation is similar in the two locations. The difference in skin cancer risk is almost entirely determined by difference in skin-cancer susceptibility between the people living in the two regions. The population of Queensland is largely of Celtic origin. Characteristically Celts have pale skins which, on exposure to the sun, burn easily without tanning. People with skins of this kind are far more likely to develop skin cancers than people with pigmented skins or swathy white skins which tan easily. Thus it is mainly a genetic difference which determines the 200-fold difference in skin-cancer risk between Queensland and Bombay. (see Table 1). During the evolution of modern day man there was a period when white-skin was advantageous in temperate and cold climates because vitamin D is more easily synthesised in white skin exposed to sunlight than in pigmented skin. Nowadays vitamin D requirements are easily met in other ways so that, socio-political considerations apart, dermatologists are agreed that whiteness offers no advantages. For people with Celtic-type skins, sun-bathing is positively dangerous unless the skin is protected.

There is much less risk once a sun-tan has developed. During recent years sun-tan preparations containing Bergamot oil have come on to the market. One ingredient of the oil is a chemical called 5-methoxypsoralen (5-MOP) which facilitates the rapid development of a tan on exposure to the sun. One might expect the enhancement of tanning in this way to aid protection (Forlot, 1980). However this benefit has to be weighed against a possible risk. Laboratory experiments have shown that 5-MOP can increase skin cancer risk in albino hairless mice exposed to ultraviolet light of a normally farily harmless wavelength (Zajdela and Bisagni, 1981). Thus, it is debatable whether the skin of such mice is an appropriate model for human skin and whether the risks associated with 5-MOP outweigh the benefits or vice versa (Anon, 1981). What is not in doubt is the folly of sun-bathing by pale-skinned people unless they intellignetly protect their skins from cancer-inducing ultraviolet radiation. Among the ingredients of sun-tan preparations are chemicals which filter off the harmful rays. These chemicals are referred to as 'sunscreens'. There is an urgent need for the sun-worshipping public to be better informed about sunscreens so that they can choose the most appropriate product for their particular complexion and for the sun-exposure conditions which they anticipate.

For people in this country, the real risks of skin cancer from exposure to the sun, especially if they travel to sunnier places, are far greater than the perceived risks. For them the tanned skin would lose its glamour if they could see the ageing effects on the dermis from relatively brief exposure without proper protection. Mortality data for skin cancer simply do not tell the true story, because skin cancer is fortunately rarely fatal. Perhaps the following advertisement (Figure 1) would be more persuasive.

Fig 1 next here

As I said earlier, important clues concerning the role of environmental factors have been derived from studies on people who migrate from one country and culture to another. Most regretably for socio-political reasons the Office of Population and Censuses was debarred from collecting information on race and country of birth in the recent census. This is a tradegy from the viewpoint of the cancer epidemiologist because it will prevent him from continuing the important task of distinguishing genetic form environmental factors in cancer causation and hinder his chances of identifying particular environmental causes. In theory, clues regarding the affects of new environmental factors of cancer risk should come from both cancer incidence data and cancer mortality data. Moreover, they should come earlier from incidence data. In practice, several factors diminish

the value of such data. Firstly, the data collected are sometimes unnecessarily crude. Different histological types are not distinguished and sites of origin are not precisely defined. For the brain, for instance, even benign and malignant neoplasms are not distinguished. For the prostate non-metastasising cancers of microscopic dimensions discovered on detailed examination of multiple sections of hypertrophic glands are lumped together with fatal metastasising cancers. In the case of the uterine cervix, the apparent incidence of new cases increases whenever there is a campaign to encourage women to submit themselves for smears. So, although the quality of data relevant to cancer incidence and mortality collected in Britain is generally high compared with other countries, there is nevertheless plenty of scope for improvement. Particularly worrying are the persistently low necropsy rates. Many of us regard post-mortem examinations as repugnant when they concern the bodies of those who have been near and dear to us. Also in the case of old people we tend instinctively to feel that post-mortem examination is unnecessary. "The poor old soul had to die of something - let's leave him/her in peace now that he has passed-on" perhaps sumarises what we feel. However, from a scientific point of view these attitudes are holding back our understanding of the prevalence of cancer and the factors which affect it. It has long been known that when cancers arise following exposure to a known carcinogen there is, almost invariably, a long interval between first exposure and the apparent onset of the disease. Through careful post-mortem examination we can get a better insight into what may be happening during the interval. I am a member of the school of thought which believes that humans accumulate pre-cancerous conditions as they pilgrimage through life. In the case of the more exposed areas of skin the process is easy to see. Lesions called 'keratoses' appear on the backs of hands and forearms and on faces. We take most of these to our graves but a minority progress to cancers. If you look at the weather beaten face of the old Celtic Queenslander, you will see plenty of keratoses. In this country the prostate gland is also known to accumulate precancerous lesions with age (Franks, 1956) and the same is undoubtedly true of other internal organs. Furthermore, in some cases by the time of death there has already been a silent progression from the precancerous state to non-symptomatic cancers of microscopic origin. A systematic study of the bodies of old people could give us a far better understanding than we now have of the increasing prevalence of many kinds of cancer with age, and of the factors which determine whether and when a pre-cancerous lesion progresses to a true cancer.

At present the overall necrospy rate in the United Kingdom averages at about 25%. However, many of the necropsies are insufficiently detailed to throw light on the incidence of precancerous lesions and cancers of microscopic dimensions and

the necropsy rates for those who live to ripe old age are far below the average.

During the past 2 or 3 years there has been a furore eminating from the United States concerning the likely contribution of exposure to chemicals at work to the incidence of cancer. I do not wish here to go into the motivation of those who, by the distortion and misinterpretation of data and misuse of statistical methods put it about that nearly 40% of cancers in males might be due to occupational factors (see Peto, 1980 for commentary). According to an important paper by Sir Richard Doll and Richard Peto, which is just about to be published (Doll and Peto, 1981), occupation is a far less important determinant of cancer prevalence (in the United States) than other environmental factors over which man has control (see Table 2) and there is no evidence that the contribution to cancer risk from this source has been increasing.

Table 2 near here

According to their detailed calculations, dietary and smoking habits are determinants of two-thirds of all cancers. The figures in Table 2 illustrate the point I was making earlier about the discrepancies between perceived and actual risk. The ever-continuing sequence of scares in the lay media about cancer hazards from factors such as food additives, medicines and environmental pollution is very much at variance with Doll and Peto's best estimates of the true contributions of these factors.

As to the contribution of dietary factors this is a topic of increasingly active research. But one fact is already abundantly clear, the age-standardized death rate from cancer of the breast in different countries (Figure 2) is closely associated with total dietary fat intake (Carroll, 1975).

Fig 2 near here

Summary and conclusion

In conclusion I must reiterate the point that we do not have precise information on the prevalence of cancer, that is to say, on the proportion of living people who have one or other form of the disease. Such data are not collected but can to some extent be calculated from the incidence data collected by Cancer Registries and Mortality data collected nationally. In any case the picture obtained by such calculations may be misleading in so far as we have negligible informaton on the incidence of precancerous lesions and of cancers of

microscopic dimensions. Although environmental factors are comparatively more important than genetic ones, it is a mistake to assume that the latter can be ignored. This is well-illustrated by the influence of skin colour on susceptibility to solar-induced skin cancer. There is an urgent need for more detailed necropsies on a higher proportion of people who die especially old people. More detailed necropsy data would help us to identify the role environmental carcinogens play and to recognise new cancer hazards as they arise. If our definition of cancer were stretched to include cancers of microscopic dimensions then I have no doubt that from middle life onwards the prevalence of the disease would be found to be 100%. This possibility provides added impetus for research on factors which facilitate progression from precancerous to cancerous and from slow-growing to rapid-growing lesions.

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Table 1

Geographical variation in incidence (men aged 35-64)

Cancer site	High risk area	Ratio	Low risk area
Skin	Queensland	200:1	Bombay
Oesophagus	N.E. Iran	300:1	Nigeria
Bronchus	England	35:1	Nigeria
Stomach	Japan	25:1	Uganda
Liver	Mozambique	70:1	Norway
Prostate	USA (Negro)	30:1	Japan

from Doll 1977

Table 2

Best estimates of proportion of fatal cancers attributable to different factors in USA

	%		%
Tobacco	30	Pollution	2
Alcohol	3	Industrial products	<1
Diet	35	Medicines and Medical procedures	1
Food Additives	<1	Geophysical factors including sunlight	3
Sexual behaviour	7	Other including ? infection	14
Occupation	4		

from Doll & Peto 1981

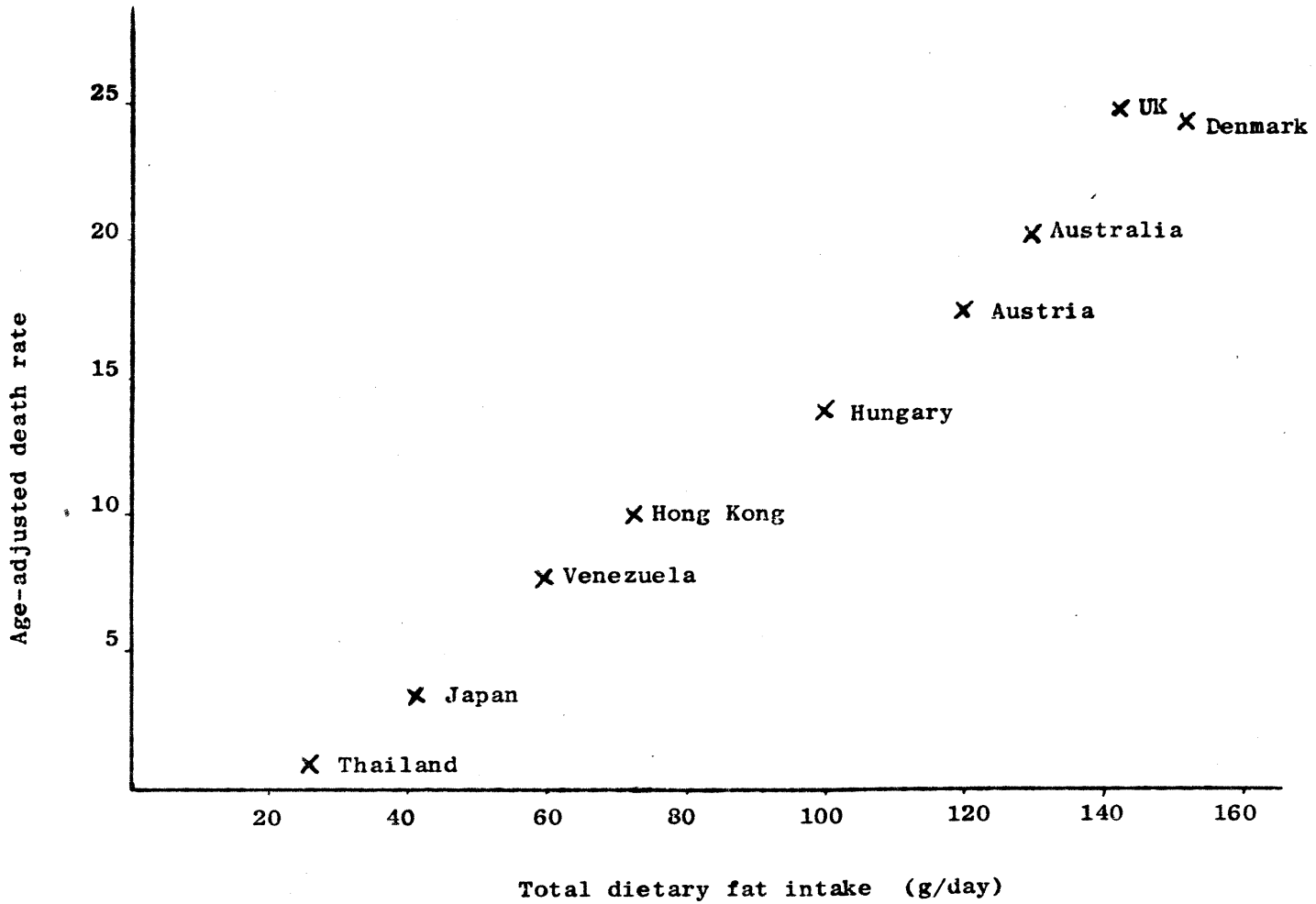
Figure 1

How to become a wrinkled old prune and get skin cancer

1. Have a pale Celtic-type skin.
2. Sun-bathe as often as possible.
3. Don't use sunscreens or moisturizers

Figure 2

Association between breast cancer death rate and dietary fat



from Carroll 1975