Update
Le point

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Les articles de la rubrique **Le point** *fournissent un bilan concis et fiable de la situation actuelle dans le domaine considéré. Des experts couvriront ainsi successivement de nombreux aspects des sciences biomédicales et de la santé publique. La plupart de ces articles auront donc été rédigés sur demande par les spécialistes les plus autorisés.*

Bulletin of the World Health Organization, 62 (2): 163-182 (1984)

Estimates of the worldwide frequency of twelve major cancers*

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By examination of incidence, mortality and relative frequency data an estimate has been made of the number of cancer cases in twelve common sites and of all cancers that occurred in 1975 in the 24 areas of the world for which the United Nations publishes population data. While several cancers are of importance in localized areas or regions, e.g., cancer of the larynx, these are infrequent on the world level and are not included in this review. While the relative importance of the selected sites varies from one area to another, on a global basis the first six ranking cancer sites in males are lung, stomach, colon/rectum, mouth/pharynx, prostate, and oesophagus; in females, they are breast, cervix uteri, stomach, colon/rectum, lung, and mouth/pharynx. Cancers of these sites, together with the leukaemias and cancers of the liver, bladder, and lymphatic tissues, account for 75% of the estimated 5.9 million new cancers that occurred in 1975. When the two sexes are combined, stomach cancers are in first rank, followed closely by lung; it is suggested that, given current trends, their rank order will soon be reversed. There are clear opportunities for prevention of cancer by controlling tobacco smoking, reducing infection by hepatitis B virus, and curbing the excessive intake of alcohol. The increasing adoption of high fat diets may lead to more cancers of the large bowel, breast, and prostate.

Cancer is increasingly recognized to be a global problem, and not one limited to the industrial nations. At present there is great variation in the patterns of cancer occurrence in the different regions of the world. Because it is predominantly a disease of the older age groups, its relative importance in any region will depend on the age composition of the inhabitants. The age structure of the population in developing countries is changing rapidly, largely as a result of a reduction in infectious disease mortality. The adoption of more "Western" life-styles also will probably increase the cancer risk. Since the developing countries currently contain some three-quarters of the global population, the size of the cancer problem and the investment needed for its control in all parts of the world are likely to increase considerably in the future.

This article presents an estimate of the overall burden of the common sites of cancer; it describes both the present size of the problem and also the potential value of preventive

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measures. However, preventive measures taken today will affect the cancer incidence only at some time in the future and a more reasonable assessment of the effects of preventive strategies requires that some projection of future cancer patterns is made: we thus speculate on how these patterns may change. None the less, it is clear that control of tobacco smoking alone would reduce the total burden by over a million cancers each year.

Since we are concerned with preventing cancer, we concentrate in this paper on its incidence—the number of new cases occurring—rather than on mortality. Cancer incidence rates (number of new cases per 100 000 population) are very strongly related to age. For any given community, therefore, the crude rate (total cases per 100 000 population) will be highly dependent on the age structure of the population. Many developing countries have very young populations, with over 40% of the total under 15 years old and less than 5% aged 65 years or more; in contrast, these percentages in Europe and North America are less than 25% under 15 years old, and more than 10% aged 65 or more. The crude incidence rates for cancer will therefore be lower in the developing countries than in developed countries, even if there is little difference in the age-specific rates. The actual *number* of cases occurring will also depend on the size of the population. Differences in the risk of developing cancer must be studied using age-specific or age-standardized rates. We have not attempted to estimate these, partly because the available data are, for many areas of the world, insufficient, and partly because our main concern is to estimate the actual *numbers* of new cancer cases occurring each year.

MATERIALS AND METHODS

In order to build up the global picture, we chose to study cancer patterns in 24 geographical areas for which population estimates and projections are regularly produced by the United Nations. These areas are shown in Fig. 1, and the population estimates for

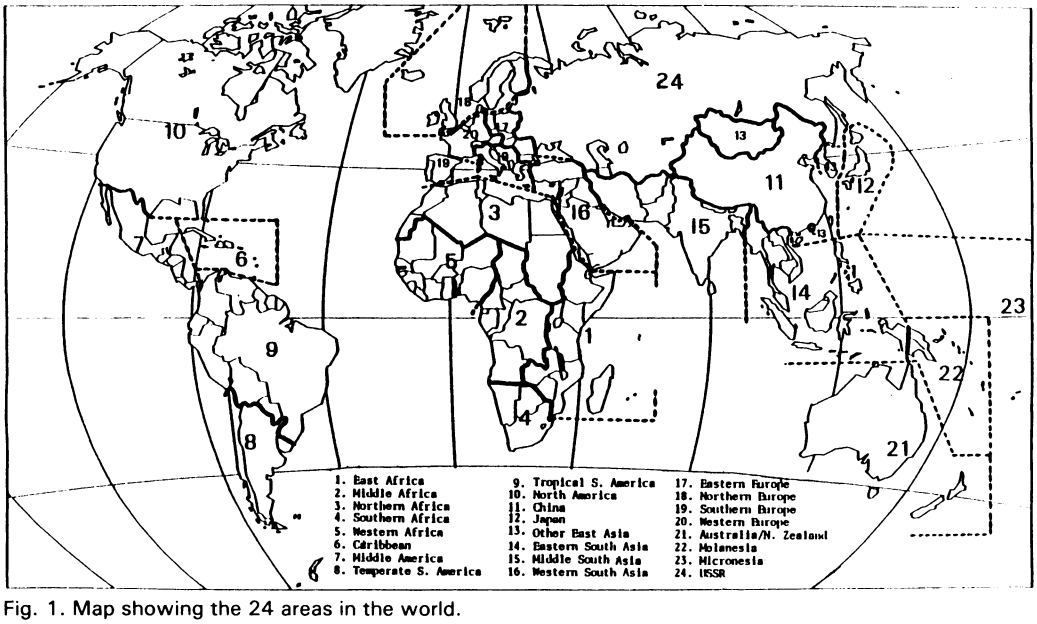

Fig. 1. Map showing the 24 areas in the world.

1975 in Table 1. The year 1975 was chosen as this was the midpoint of much of the cancer incidence and mortality data available.

For each of these areas, the cancer incidence rates for twelve common tumour sites have been estimated. The sites chosen were mouth and pharynx (140–149),[a] oesophagus (150), stomach (151), colon and rectum (153–154), liver (155), lung (162), breast (174), cervix uteri—invasive (180), prostate (185), bladder (188), lymphatic tissue (200–203), and leukaemia (204–207). These represent most of the common cancers for which data of reasonable quality can be obtained. Three of these (oral-pharyngeal, lymphatic tumours, and leukaemia) are groups of tumours of varying etiology and epidemiology; however, it is not always possible to study the subdivisions within the groups, either because the boundaries between them may not be clear (e.g., oral cavity) or because data are only available for the group as a whole.

Several cancers that are common in many areas of the world have been excluded. Skin cancer is extremely common, but because of its (relatively) trivial nature, recording of

[a] Numbers in parentheses denote the rubrics of the Eighth Revision of the International Classification of Diseases (ICD).

Table 1. Population estimates for different areas in the world, 1975[a]

Area	Population (millions)			Age distribution (%)	
	Total	Males	Females	Under 15 years	65 years or more
1. East Africa	115	57	58	45	2.9
2. Middle Africa	47	23	24	43	3.2
3. Northern Africa	94	47	47	44	3.5
4. Southern Africa	29	14	15	42	4.1
5. Western Africa	121	60	61	46	2.5
6. Caribbean	28	14	14	41	5.0
7. Middle America	80	40	40	46	3.4
8. Temperate S. America	38	19	19	30	7.4
9. Tropical S. America	176	88	88	42	3.5
10. Northern America	236	115	121	25	10.3
11. China	928	474	453	37	5.2
12. Japan	112	55	57	24	7.9
13. Other East Asia	57	29	28	38	3.7
14. Eastern South Asia	326	162	164	42	3.1
15. Middle South Asia	845	437	408	43	2.9
16. Western South Asia	85	43	42	43	4.0
17. Eastern Europe	106	51	55	23	11.4
18. Northern Europe	82	40	42	23	13.7
19. Southern Europe	134	65	69	26	10.7
20. Western Europe	152	74	78	23	13.6
21. Australia/New Zealand	17	8	9	28	8.7
22. Melanesia	3	1.5	1.5	43	3.1
23. Micronesia/Polynesia	1.3	0.7	0.6	43	2.8
24. USSR	254	118	136	26	9.0
Total	4066	2038	2028	37	5.7

[a] Source: *Demographic indicators of countries: estimates and projections as assessed in 1980.* New York, United Nations, 1982.

incidence is unlikely to be complete or accurate. Cancers of the pancreas and ovary pose considerable diagnostic problems, and it was considered that for many areas figures would be either unavailable or unreliable. Similar considerations led us to omit cancer of the uterine corpus; for this site there are further difficulties resulting from changes in classification. Some tentative estimates were prepared for laryngeal cancer which is relatively common in males (worldwide it is perhaps as frequent as leukaemia, for example) but rather rare in females, and so is not included in the tabulations. Certain cancers with localized areas of high frequency (e.g., penile cancer) have not been included since the overall world totals are lower than any of the twelve cancers for which figures are presented. Finally, an estimate was made of the incidence of all malignant neoplasms (excluding skin (ICD 173)).

Methods of estimation

The data sources used for each of the 24 geographical areas are detailed below. The procedure employed was to estimate the crude incidence rates for all (or most) of the countries in an area, and then to calculate a weighted average, where the weights are the populations of the individual countries.

Wherever they were available, incidence rates derived from population-based cancer registries have been used, notably those published in the series *Cancer incidence in five continents* (*1–4*). For many registries both the incidence and the mortality rates are available for the same populations, and for 35 centres (in 27 countries) the incidence was plotted against mortality for the tumour sites being studied. Not surprisingly there is a close correlation between the two, and a regression line can be fitted, the slope of which will be related to the lethality of the tumour. When no incidence data were available for a country, the rates have been estimated by using the mortality data (*5*) and these regression lines.

For many countries and some entire areas, where neither incidence rates nor mortality rates were available, data on the relative frequency of different tumour types have been used, a hypothetical crude "all sites" rate being multiplied by the frequency of the site concerned. The "all sites" incidence was calculated from the regression lines of mortality vs incidence, derived as described above, using the estimates of cancer mortality (male and female) by world area, which were prepared by WHO (T. Nakada, personal communication).[b]

As much of the data on cancer incidence or mortality related to the mid-1970s, the estimates of rates and numbers of cancers have been prepared for 1975.

1. East Africa

Population-based data have been available from several centres in the past: Kyadondo (Uganda) (*1*), Bulawayo (Southern Rhodesia, now Zimbabwe) (*2*, *3*), Lourenco Marques (now Maputo, Mozambique) (*1*), and Moshi (United Republic of Tanzania).[c] Some recent relative frequency data from Kenya,[d] Madagascar (*7*) and Lusaka (Zambia)[e] have been used to estimate rates for these countries, using a hypothetical all-sites rate of 90 per 10^5 for males, and 100 per 10^5 for females.

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[b] The methodology involved was essentially that of Preston (*6*), in which information on mortality rates for 12 cause-of-death groupings from many different populations at various stages of development is used to derive a series of linear relationships of the form

$$M_i = a_i + b_i M$$

to estimate the cause-specific death rate (M_i) from the overall crude death rate (M).

[c] LAUREN, K. Unpublished data from Kilimanjaro Cancer Registry (Moshi, United Republic of Tanzania), 1980.

[d] KUNGU, A. Kenya Cancer Registry: unpublished data for 1969–79.

[e] WATTS, T. Unpublished data from Zambia Cancer Registry, 1982.

In all these centres, oesophageal cancer is more frequent than stomach cancer, with particularly high rates in Bulawayo. Liver cancer is very frequent; the rates appear to show a gradient from south to north, being very high in Mozambique and Bulawayo, and considerably lower in Uganda and Kenya (Madagascar, however, has a low relative frequency of liver cancer and high rates for colon cancer). Since the majority of the population inhabits the north of this area, the rates have been weighted accordingly. The frequency of lymphoma in young Africans is reflected by the relatively high crude incidence rate for these tumours. In all centres, cervix cancer appears to be approximately twice as frequent as breast cancer.

2. Middle Africa

Cancer data from this area are particularly sparse. The figures reproduced are crude estimates based on relative frequency data from Angola,[f] Gabon (*8*), Cameroon (*9*) and the Congo (*10*), using a notional "all-sites" incidence of 90 per 10^5 (males) and 100 per 10^5 (females). Liver cancer is clearly the most commonly occurring tumour, and lymphoma is also frequent.

3. Northern Africa

No population-based incidence data are available. However a comprehensive hospital registration system operates in Cairo (*44*) and good pathological data are available from three centres in Algeria (*11*). In addition, relative frequency data are available from Tunisia[g] and Sudan (*45*). An estimated "all-sites" incidence of 100 per 10^5 (males) and 110 per 10^5 (females) has been used to calculate incidence rates. Published mortality data from Egypt (*5*) seem to confirm the general pattern, but the rates are low.

These sources suggest rather low rates for gastrointestinal tumours (including liver). Rates and frequencies for breast cancer exceed those for cervix in all countries except Algeria. The high estimated rates of bladder cancer reflect the frequency of this tumour in Egypt, and the elevated rates for oral and pharyngeal neoplasms are at least partly explained by cancer of the nasopharynx, which accounts for about half of such tumours in the Sudanese and Algerian data.

4. Southern Africa

In this area, 90% of the population lives in the Republic (before 1961, the Union) of South Africa. Few recent data are available, but population-based rates, by racial group, are available for Johannesburg (1954) (*1*), Cape Province (1956–59) (*2*) and Natal (1964–66) (*2*). These allow approximate rates for this country to be estimated, given the racial composition of the country. In addition, there are some relative frequency data available for Botswana (*12*) and Lesotho (*13*)—estimated all-sites rates, 90 per 10^5 (males) and 100 per 10^5 (females).

5. Western Africa

Data are available from three sources: population registration in Ibadan (Nigeria) (*1–3*) and Dakar (Senegal) (*4*), and the multi-centre hospital registry of Liberia (*14*). The combined rates are heavily weighted by the Nigerian data, since this country has almost 60% of the population in this area. The crude (all sites) rates from this source appear low (33 per 10^5 (males) and 45 per 10^5 (females)) in comparison with the rates based on estimated mortality.

[f] LOPES, C. O cancro en Angola. Que perspectivas? (unpublished).

[g] MOURALI, N. Unpublished data from Salah Azaiz Institute, Tunis, 1976–80.

Cervix cancer shows consistently higher rates in Ibadan than liver cancer (this is supported by relative frequency data from other Nigerian centres and from Liberia); hence the crude rates of liver cancer (the most frequent site in the Sahel countries) are similar to those for cervix cancer for the area as a whole. The high frequency of lymphomas in young persons results in high crude incidence rates.

6. Caribbean

Recent population-based incidence data are available from four centres (Cuba, Puerto Rico, Jamaica, Netherlands Antilles), which together contain over half the population of the area (*4*). A combined rate weighting for the populations of these centres is given.

7. Middle America

There are no population-based incidence data. The national pathology registry of Panama allows estimation of minimum incidence (crude rates for all sites are 58 per 10^5 (males), and 54 per 10^5 (females)) (*15*).

Mortality rates are available for several countries, including Mexico, Costa Rica, Panama, Nicaragua, El Salvador and Honduras (*5*). The rates for the latter three seem particularly low and are likely to be underestimates; but the rates from the former three have been used together with the Panamanian incidence data to estimate rates of incidence for the area.

8. Temperate South America

Incidence data have been published for La Plata (Argentina) for 1980 (*16*) and mortality rates are available for Argentina (1977 only), Chile, and Uruguay (*5*). For liver and bladder cancer, incidence rates in Chile were estimated from registrations in 1959–62 (*1*) and mortality rates in 1980 (*5*).

These different sets of data suggest a fairly uniform picture of tumour incidence in the three countries, the main exception being with regard to female cancers: cervix cancer is more frequent than breast cancer in Chile, the converse of the situation in Argentina and Uruguay.

9. Tropical South America

Population-based incidence data are available from three contrasting areas of Brazil: São Paulo (*4*), Recife (*3*) and Fortaleza (*46*), from Cali (Colombia) (*4*), La Paz (Bolivia) (*17*), Asunción (Paraguay)[h] and Lima (Peru) (*18*). Mortality rates from Ecuador and Venezuela (*5*) were used to estimate the incidence in these countries. With appropriate weightings for the populations represented by these rates, estimates for the area can be produced.

10. North America

Population-based incidence data are available from Canada (*4*) and from the SEER (Surveillance, Epidemiology, and End Results) programme in the USA (*19*), and the respective populations are in the ratio 1:9.3. The resulting weighted rates are as shown in Table 2.

11. China

This is the largest of the 24 areas in this study so that the estimated incidence rates will be important in determining the global frequency of several tumour types. Incidence rates for

[h] ROLON, P. A. Unpublished data from Cancer Registry, Asunción, 1981.

Table 2a. Estimated crude rates of cancer incidence (per 100 000), by sex, site and area

Area	Mouth/ pharynx (140–149)[a]		Oesophagus (150)		Stomach (151)		Colon/ rectum (153, 154)		Liver (155)		Bronchus/ lung (162)	
	M	F	M	F	M	F	M	F	M	F	M	F
1. East Africa	7	6	5	1	4.5	3.5	2.5	2	22	6	2	0.4
2. Middle Africa	5	3	0.9	0.6	3.5	2	4	3	18	6.5	2.5	1
3. Northern Africa	11.5	5.5	2	1.5	4.5	1.5	5.5	3.5	3	2	2.5	0.6
4. Southern Africa	8.5	4	13	3	13	8	4.5	7.5	13	2.5	19	3
5. Western Africa	2	1.5	0.4	0.2	2.5	2	1.5	1.5	9	3	0.9	0.5
6. Caribbean	12	3.5	7.5	3	15.5	7.5	10	11	4.5	3	35	12
7. Middle America	2.5	2	2	1	9	6.5	4.5	6	2	1.5	7.5	3
8. Temperate S. America	18	6.5	11.5	3.5	27	17	23	27	5.5	3.5	39	7
9. Tropical S. America	9	4	4	1	19	11	7	7.5	3	3	11	3
10. North America	16	6.5	5	2	12	7	48	46	3	1.5	68	21
11. China	8	4.5	23	13	29	15	8.5	8	17	6.5	11	5
12. Japan	3.5	2	8	2.5	85	50	17	15	14	7	24	9
13. Other East Asia	7	3.5	3.5	0.8	28	14	8	6	18	4	13	5
14. Eastern South Asia	9	4.5	3.5	1.5	8	4.5	6.5	5.5	15	4	17	6
15. Middle South Asia	18	9.5	6	4.5	4.5	2.5	3.5	2.5	1.5	1	6	1.5
16. Western South Asia	4	2	2.5	2	6	3.5	5	4	2	1	11	2.5
17. Eastern Europe	12	3	3.5	1	41	25	22	22	7	5.5	59	8.5
18. Northern Europe	9	5	7	5	31	21	43	46	2.5	1.5	93	23
19. Southern Europe	14.5	3	8	2.5	44	30	30	30	11	5	62	13
20. Western Europe	20	4	10	1.5	34	22	43	45	4.5	2.5	87	11
21. Australia/New Zealand	15.5	4	5	2.5	16	10	38	39	1.5	0.8	57	12
22. Melanesia	19	14	2	0.3	4	2.5	5	2.5	14	5	4	1
23. Micronesia/ Polynesia	4	1.5	3	0.4	7	3	6.5	5	5	2.5	8	2
24. USSR	13	4	8	5.5	47	36	11	15	7	5.5	43	10

[a] Numbers in parentheses indicate the ICD codes according to the Eighth Revision of the International Classification of Diseases.

Chinese populations are available from population-based cancer registries in Shanghai, Hong Kong and Singapore (*4*). In addition, mortality rates for the whole of China for 1975–78 are presented in the *National Cancer Atlas* (*20*). We have used the rates in this latter volume to calculate crude mortality for 1975, and estimated the incidence from these mortality rates. The rates for nasopharyngeal cancer have been multiplied by 1.5 to approximate the rate of all oropharyngeal cancer. No national mortality data are available for prostatic cancer, and the estimate produced is a weighted average of the incidence observed in the Chinese populations of Shanghai, Hong Kong and Singapore.

Table 2b. Estimated crude rates[a] of cancer incidence (per 100 000), by sex, site and area

Area	Breast (174)	Cervix (180)	Prostate (185)	Bladder (188)		Lymphatic tissue (200–203)		Leukaemia (204–207)		All sites (excl. skin) (140–207, excl. 173)	
	F	F	M	M	F	M	F	M	F	M	F
1. East Africa	9	21	5.5	3.5	1	10	5.5	1.5	1	86	83
2. Middle Africa	12	21	6	3	1.5	12	7.5	1	0.6	90	100
3. Northern Africa	25	19	2	16	6	11	5.5	5	3.5	100	110
4. Southern Africa	20	27	8	3.5	1.5	6	3.5	3.5	2.5	121	116
5. Western Africa	7	11	3	2	1	9	5.5	2	1.5	42	52
6. Caribbean	30	20	19	7.5	2	8	5	5	3.5	146	123
7. Middle America	14	21	7.5	3.5	1	4	3.5	2.5	2.5	73	94
8. Temperate S. America	79	24	22	16	6	6	4.5	7	5	232	256
9. Tropical S. America	27	32	10	5	1	7	4.5	4.5	3.5	104	135
10. North America	87	13	55	22	7.5	16.5	14	11	8	323	315
11. China	12	29	2	2	0.6	3	2.5	4.5	3.5	138	123
12. Japan	20	17	4	4.5	2	5.5	4	4.5	4	199	171
13. Other East Asia	16	26	3	3.5	1	4	2	4	3	128	144
14. Eastern South Asia	14	21	2.5	2	0.6	3.5	2	4.5	3	91	89
15. Middle South Asia	15	24	1.5	1.5	0.4	4.5	2	3	2	72	79
16. Western South Asia	15	4.5	3.5	5	0.9	6.5	4	4	3	82	72
17. Eastern Europe	36	24	17	11	2.5	11	8.5	7.5	5.5	234	216
18. Northern Europe	82	17	37	22	7.5	14	11	9	7.5	334	313
19. Southern Europe	61	13	26	21	3.5	12	9.5	10	6.5	310	253
20. Western Europe	84	23	42	25	5.5	12	9.5	9.5	7.5	365	325
21. Australia/New Zealand	66	13	34	18	5.5	15	12	9	6.5	273	254
22. Melanesia	13	20	1	1	0.3	8	4	4	2	107	114
23. Micronesia/ Polynesia	7	20	12	0.8	0.9	6	2.5	3.5	1.5	80	90
24. USSR	23	23	7	9	3	4	3	5.5	4.5	175	168

[a] Values > 10 rounded to nearest whole number
Values < 10 rounded to nearest 0.5
Values < 1 rounded to nearest 0.1

12. Japan

The numbers of cancer cases for the whole of Japan have been estimated from the data of seven population-based cancer registries (*21*). Figures for cervix cancer are not presented separately in this publication, and for this site incidence rates have been calculated for the four registries in *Cancer incidence in five continents* (*4*) (Fukuoka, Miyagi, Nagasaki, and Osaka) combined.

13. Other East Asia

This area includes Hong Kong where incidence rates are available (*4*) and the Republic of Korea, where multi-centre hospital registration provides information on relative frequency from which incidence rates have been estimated[i] (crude all-sites rates: 120 per 10^5 (males) and 140 per 10^5 (females)). These data suggest a rate of cervix cancer almost double that of breast cancer, and the frequency of liver cancer may well approach that seen in Hong Kong Chinese. Stomach cancer appears to be some 10 times more frequent than oesophageal cancer.

14. Eastern South Asia

This large area has a population-based registry in Singapore which publishes the incidence rates for Chinese and Malay populations separately (*4*), hence some idea of incidence rates in neighbouring countries (Malaysia, Indonesia, Vietnam) can be obtained. Incidence rates are also produced by cancer registries located in Rangoon (Burma),[j] and Manila (Philippines) (*47*). There is a multi-hospital registry in operation in Thailand (*48*), and relative frequency figures have been published from Indonesia (*22*, *23*) and Malaysia (*24*). Approximate rates can be estimated for these countries based on hypothetical all-sites rates of 80 per 10^5 (males) and 105 per 10^5 (females), and very tentative estimates produced for the area as a whole.

Relatively high rates of respiratory cancer and liver cancer are present in all of the above countries, and liver cancer is uniformly more frequent than stomach cancer (except for Singapore Chinese).

15. Middle South Asia

Population-based incidence rates are available for the Indian centres of Bombay (*4*), Pune (*4*), Ahmedabad,[k] Madras, (*49*) and Bangalore (*50*). These together with the extensive relative frequency data from Indian cities published by Jussawala et al. (*25*) allow fair estimates of the probable order of rates for India as a whole.

Relative frequency data are available from a multi-centre study in Pakistan (*51*), from hospital registries in Bangladesh (*26*) and Sri Lanka (*27*), and from pathology series in Iran (*28*) and Afghanistan (*29*). Crude all-sites rates of 100 per 10^5 (males) and 100 per 10^5 (females) have been assumed in the estimation of site-specific rates.

Oral cancer is very common in all these countries, and the overall estimated rates suggest that oesophageal cancer incidence exceeds that of stomach cancer.

16. Western South Asia

This area includes the Arab countries of Asia plus Turkey and Israel. Rates for Arab populations are available from the Kuwait cancer registry (*30*) and Israel cancer registry (*4*), and relative frequency data are available from Saudi Arabia (*31*). For Turkey, mortality data collected by Firat (*52*) suggest all-sites rates of 88 per 10^5 (males) and 72 per 10^5 (females). These mortality rates and relative frequency from a national pathology series (*32*) have been used to estimate rates for Turkey. Weightings for the populations are Arabs 42: Turks 40: Jews 3. The estimated rates for "all sites" from these data appear to be low; in particular, cervix cancer seems to be extremely rare in these populations, whilst lymphoma and lung cancer appear to be relatively frequent.

[i] WOO, Z. H. ET AL. Unpublished interim report, Cancer Register Programme in the Republic of Korea. Seoul, National Medical Centre, 1982.

[j] Annual report, Rangoon Cancer Registry, 1978-80.

[k] PATEL, T. B. Unpublished data from Ahmedabad Cancer Registry, 1978-81.

17. Eastern Europe

Data from six cancer registries in Poland, and two others in Hungary and Romania appear in *Cancer incidence in five continents* (*4*). National incidence rates have been published for the German Democratic Republic (*4*), Czechoslovakia (*33*) and Bulgaria (*34*). The rates for the area as a whole are appropriately weighted averages.

18. Northern Europe

The whole of the population of this area (except for Ireland) is subject to national cancer registration (*3*, *4*, *35*), so the figures for this area are likely to be the most accurate of those presented in Table 2.

19. Southern Europe

Cancer registry data for centres in Spain, Italy, and Yugoslavia permit estimation of the rates in these countries (*4*). These can be checked against estimates derived from mortality rates (*5*) to ensure that rates from single centres are reasonably representative. For Portugal and Greece, incidence rates have been estimated from the mortality data alone.

20. Western Europe

There are several cancer registries in France, Switzerland, and the Federal Republic of Germany (*4*) and mortality rates are available for these countries as well as for Austria, Belgium, Luxembourg, and the Netherlands (*5*). Reasonable estimates of incidence rates can be made.

21. Australia/New Zealand

Cancer registries for the states of New South Wales and South Australia (*4*) provide data for half the population of Australia, and there is a National Registry in New Zealand (*4*). Incidence estimates should be fairly accurate for the area as a whole.

22. Melanesia

Incidence rates are available for New Caledonia,[1] and these have been used together with estimates of incidence for Papua New Guinea based on recent relative frequency data (*36*) and all-sites rates of 100 per 10^5 (males) and 110 per 10^5 (females). As the area is small, any crudity of estimated rates will have little effect on global estimates.

23. Micronesia/Polynesia

This is a very small area. Rates have been estimated using relative frequency data in Fiji (*37*) and for the Polynesian population of Hawaii (*4*), with estimated all-sites rates of 80 per 10^5 (males) and 90 per 10^5 (females).

24. USSR

Incidence rates for the USSR are available for a restricted series of sites (*38*) including the entire group of lymphatic and haematopoietic neoplasms (ICD 200–209). The incidence rates of prostatic and bladder cancer have been estimated from mortality rates, as have the relative proportions of lymphomas and leukaemias (*39*). There are no data on the probable level of liver cancer, and the rates estimated for Eastern Europe have been used.

[1] THEVENOT, H. Unpublished data from Cancer Registry of Nouvelle Calédonie, 1982.

RESULTS AND DISCUSSION

The estimated annual numbers of new cases of the twelve selected cancers in each of the 24 areas are shown in Table 3. The accuracy of these figures will depend on the validity of the estimates of incidence rates and on the population size. Thus inaccurate estimates of incidence in small areas such as Melanesia or Micronesia will be of little consequence, compared with errors in data from China or Middle South Asia, for example. The effect of some variation in the estimated incidence rates for these latter areas on the world totals for individual tumours can readily be tested; in most instances, the relative ranking of the cancer sites in question is unaffected.

The results incidate that globally the most common neoplasm is almost certainly cancer of the *stomach*, incidence rates of which are high in Europe, East Asia and South America. However, it is interesting to note that the annual number of cases of *lung* cancer is not far behind, and this appears to be the most common tumour among males. The results presented refer to a single point in time. However, the incidence rates for stomach cancer are declining throughout the world, whilst with a few exceptions those for lung cancer are rising rapidly—the USSR registered a 55% increase in lung cancer cases between 1970 and 1980, for example (*40*). Thus, the relative position of these two cancers is likely to change in the near future. Indeed, as a result of the energetic expansion of sales of high tar and high nicotine cigarettes in developing countries, very large numbers of lung cancers are now inevitable. For females, lung cancer is now in fifth rank and, given the present trends in female smoking, is likely to move up.

Colo-rectal cancer is frequent in Western populations. As these cancers show a steep increase in incidence in relation to age, the crude rates will be especially high where there are many elderly. For all areas, the incidence rates in males and females are very similar. This site probably ranks third or fourth in the world total.

Liver cancer seems to give rise to less than half as many tumour cases as lung cancer despite the fact that it is more common in Africa and Eastern Asia (except Japan). Since liver cancer is one of the more difficult tumours to diagnose clinically, its incidence is probably underestimated, although many series will include liver metastases of other cancers along with true liver cancers; so it is questionable whether its incidence has been significantly more underestimated than that of, say, lung cancer. Liver cancer is primarily a disease of developing countries with very young populations so that, although the age-specific rates may be very high, the crude rates (Table 2) are not. China accounts for over 40% of the global total; Africa, where liver cancer is almost certainly the most common tumour, accounts for only 13%.

The total numbers of cases of cancer of the *oral cavity and pharynx* disguise very large differences in the individual sites throughout the world. In Chinese populations, most such tumours are nasopharyngeal, whereas in the Indian subcontinent the great majority are cancers of the oral cavity and related to the chewing of tobacco and/or betel nut. Lip cancer is very frequent in some western populations, and where laryngeal cancer is common, there is also an apparently high rate of cancers classified as "hypopharynx".

Perhaps the most striking feature of the results is the frequency, among females, of *breast* cancer and *cervix* cancer which, taking account of the fact that these are restricted to a single sex, now present the biggest challenge in the field of cancer prevention. It is only very approximately true that cervix cancer occurs more frequently in developing countries. Breast cancer would appear to be the more frequent cancer overall; it occurs in older age groups compared with cervix cancer, and is more frequent in "Western" populations; thus one half (50%) of the estimated cases are from North America and Europe (excluding USSR) where there are only about 18% of the female population of the world.

Table 3a. Estimated number of new cases of cancer in 1975 in the different areas of the world

Area	Sex	Estimated number of cancer cases (in thousands)					
		Mouth/ pharynx	Oesophagus	Stomach	Colon/ rectum	Liver	Bronchus/ lung
1. East Africa	m	4.0	2.9	2.6	1.4	12.5	1.1
	f	3.5	0.6	2.0	1.2	3.5	0.2
	m+f	7.5	3.5	4.6	2.6	16.0	1.3
2. Middle Africa	m	1.2	0.2	0.8	0.9	4.1	0.6
	f	0.7	0.1	0.5	0.7	1.6	0.2
	m+f	1.9	0.3	1.3	1.6	5.7	0.8
3. Northern Africa	m	5.4	0.9	2.1	2.6	1.4	1.2
	f	2.6	0.7	0.7	1.6	0.9	0.3
	m+f	8.0	1.6	2.8	4.2	2.3	1.5
4. Southern Africa	m	1.2	1.8	1.8	0.6	1.8	2.7
	f	0.6	0.5	1.2	1.1	0.4	0.5
	m+f	1.8	2.3	3.0	1.7	2.2	3.2
5. Western Africa	m	1.2	0.2	1.5	0.9	5.4	0.5
	f	0.9	0.1	1.2	0.9	1.8	0.3
	m+f	2.1	0.3	2.7	1.8	7.2	0.8
6. Caribbean	m	1.7	1.1	2.2	1.4	0.6	4.9
	f	0.5	0.4	1.1	1.5	0.4	1.7
	m+f	2.2	1.5	3.3	2.9	1.0	6.6
7. Middle America	m	1.0	0.8	3.6	1.8	0.8	3.0
	f	0.8	0.4	2.6	2.4	0.6	1.2
	m+f	1.8	1.2	6.2	4.2	1.4	4.2
8. Temperate S. America	m	3.4	2.2	5.1	4.4	1.0	7.4
	f	1.2	0.7	3.2	5.1	0.7	1.3
	m+f	4.6	2.9	8.3	9.5	1.7	8.7
9. Tropical S. America	m	7.9	3.5	16.7	6.2	2.6	9.7
	f	3.5	0.9	9.7	6.6	2.6	2.6
	m+f	11.4	4.4	26.4	12.8	5.2	12.3
10. North America	m	18.4	5.8	13.8	55.2	3.5	78.2
	f	7.9	2.4	8.5	55.7	1.8	25.4
	m+f	26.3	8.2	22.3	110.9	5.3	103.6
11. China	m	37.9	109.1	137.5	40.3	80.7	52.2
	f	20.4	58.9	68.0	36.3	29.5	22.7
	m+f	58.3	168.0	205.5	76.6	110.2	74.9
12. Japan	m	1.9	4.5	46.6	9.4	7.4	13.1
	f	1.0	1.4	28.5	8.8	3.9	5.2
	m+f	2.9	5.9	75.1	18.2	11.3	18.3

13. Other East Asia	m	2.0	1.0	8.1	2.3	5.2	3.8
	f	1.0	0.2	3.9	1.7	1.1	1.4
	m+f	3.0	1.2	12.0	4.0	6.3	5.2
14. Eastern South Asia	m	14.6	5.7	13.0	10.5	24.3	27.5
	f	7.4	2.5	7.4	9.0	6.6	9.8
	m+f	22.0	8.2	20.4	19.5	30.9	37.3
15. Middle South Asia	m	78.7	26.2	19.7	15.3	6.6	26.2
	f	38.8	18.4	10.2	10.2	4.1	6.1
	m+f	117.5	44.6	29.9	25.5	10.7	32.3
16. Western South Asia	m	1.7	1.1	2.6	2.2	0.9	4.7
	f	0.8	0.8	1.5	1.7	0.4	1.1
	m+f	2.5	1.9	4.1	3.9	1.3	5.8
17. Eastern Europe	m	6.1	1.8	20.9	11.2	3.6	30.1
	f	1.7	0.6	13.8	12.1	3.0	4.7
	m+f	7.8	2.4	34.7	23.3	6.6	34.8
18. Northern Europe	m	3.6	2.8	12.4	17.2	1.0	37.2
	f	2.1	2.1	8.8	19.3	0.6	9.7
	m+f	5.7	4.9	21.2	36.5	1.6	46.9
19. Southern Europe	m	9.4	5.2	28.6	19.5	7.2	40.3
	f	2.1	1.7	20.7	20.7	3.5	9.0
	m+f	11.5	6.9	49.3	40.2	10.7	49.3
20. Western Europe	m	14.8	7.4	25.2	31.8	3.3	64.4
	f	3.1	1.2	17.2	35.1	2.0	8.6
	m+f	17.9	8.6	42.4	66.9	5.3	73.0
21. Australia/New Zealand	m	1.2	0.4	1.3	3.0	0.1	4.6
	f	0.4	0.2	0.9	3.5	0.1	1.1
	m+f	1.6	0.6	2.2	6.5	0.2	5.7
22. Melanesia	m	0.3	–	0.1	0.1	0.2	0.1
	f	0.2	–	–	–	0.1	–
	m+f	0.5	–	0.1	0.1	0.3	0.1
23. Micronesia/ Polynesia	m	–	–	–	–	–	0.1
	f	–	–	–	–	–	–
	m+f	–	–	0.1	0.1	–	0.1
24. USSR	m	15.3	9.4	55.5	13.0	8.3	50.7
	f	5.4	7.5	49.0	20.4	7.5	13.6
	m+f	20.7	16.9	104.5	33.4	15.8	64.3
World	Male (rank)	232.9 (4)	194.0 (6)	421.7 (2)	251.2 (3)	182.5 (7)	464.3 (1)
	Female (rank)	106.6 (6)	102.3 (7)	260.6 (3)	255.6 (4)	76.7 (9)	126.7 (5)
Total (rank)		339.5 (6)	296.3 (7)	682.4 (1)	506.9 (4)	259.2 (8)	591.0 (2)

Table 3b. Estimated number of new cases of cancer in 1975 in the different areas of the world

Area	Sex	Estimated number of cancer cases (in thousands)						
		Breast	Cervix	Prostate	Bladder	Lymphatic tissue	Leukaemia	All sites (excl. skin)
1. East Africa	m			3.1	2.0	5.7	0.9	49.0
	f	5.2	12.2		0.6	3.2	0.6	48.1
	m+f				2.6	8.9	1.5	97.1
2. Middle Africa	m			1.4	0.7	2.8	0.2	20.7
	f	2.9	5.0		0.4	1.8	0.1	24.0
	m+f				1.1	4.6	0.3	44.7
3. Northern Africa	m			0.9	7.5	5.2	2.4	47.0
	f	11.8	8.9		2.8	2.6	1.6	51.7
	m+f				10.3	7.8	4.0	98.7
4. Southern Africa	m			1.1	0.5	0.8	0.5	16.9
	f	3.0	4.1		0.2	0.5	0.4	17.4
	m+f				0.7	1.3	0.9	34.3
5. Western Africa	m			1.8	1.2	5.4	1.2	25.2
	f	4.3	6.7		0.6	3.4	0.9	31.7
	m+f				1.8	8.8	2.1	56.9
6. Caribbean	m			2.7	1.0	1.1	0.7	20.4
	f	4.2	2.8		0.3	0.7	0.5	17.2
	m+f				1.3	1.8	1.2	37.6
7. Middle America	m			3.0	1.4	1.6	1.0	29.2
	f	5.6	8.4		0.4	1.4	1.0	37.6
	m+f				1.8	3.0	2.0	66.8
8. Temperate S. America	m			4.2	3.0	1.1	1.3	44.1
	f	15.0	4.6		1.1	0.9	1.0	48.6
	m+f				4.1	2.0	2.3	92.7
9. Tropical S. America	m			8.8	4.4	6.2	4.0	91.5
	f	23.8	28.2		0.9	4.0	3.1	118.8
	m+f				5.3	10.2	7.1	210.3
10. North America	m			63.3	25.3	19.0	12.7	371.5
	f	105.3	15.7		9.1	16.9	9.7	381.2
	m+f				34.4	35.9	22.4	752.7
11. China	m			9.5	9.5	14.2	21.3	654.1
	f	54.4	131.5		2.7	11.3	15.9	557.2
	m+f				12.2	25.5	37.2	1211.3
12. Japan	m			2.3	2.6	3.1	2.6	109.5
	f	11.5	9.7		1.1	2.2	2.1	97.5
	m+f				3.7	5.3	4.7	207.0
13. Other East Asia	m			0.9	1.0	1.2	1.2	37.1
	f	4.5	7.3		0.3	0.6	0.8	40.3
	m+f				1.3	1.8	2.0	77.4

14. Eastern South Asia	m			4.1	3.2	5.7	7.3	147.4
	f	23.0	34.4		1.0	3.3	4.9	146.0
	m+f				4.2	9.0	12.2	293.4
15. Middle South Asia	m			6.6	6.6	19.7	13.1	314.6
	f	61.2	97.9		1.6	8.2	8.2	322.3
	m+f				8.2	27.9	21.3	636.9
16. Western South Asia	m			1.5	2.2	2.8	1.7	35.3
	f	6.3	1.9		0.4	1.7	1.3	30.2
	m+f				2.6	4.5	3.0	65.5
17. Eastern Europe	m			8.7	5.6	5.6	3.8	119.3
	f	19.8	13.2		1.4	4.7	3.0	118.8
	m+f				7.0	10.3	6.8	238.1
18. Northern Europe	m			14.8	8.8	5.6	3.6	133.6
	f	34.4	7.1		3.2	4.6	3.2	131.5
	m+f				12.0	10.2	6.8	265.1
19. Southern Europe	m			16.9	13.7	7.8	6.5	201.5
	f	42.1	9.0		2.4	6.6	4.5	174.6
	m+f				16.1	14.4	11.0	376.1
20. Western Europe	m			31.1	18.5	8.9	7.0	270.1
	f	65.5	17.9		4.3	7.4	5.9	253.5
	m+f				22.8	16.3	12.9	523.6
21. Australia/New Zealand	m			2.7	1.4	1.2	0.7	21.8
	f	5.9	1.2		0.5	1.1	0.6	22.9
	m+f				1.9	2.3	1.3	44.7
22. Melanesia	m			–	–	0.1	0.1	1.6
	f	0.2	0.3		–	0.1	–	1.7
	m+f				–	0.2	0.1	3.3
23. Micronesia/ Polynesia	m			–	–	–	–	0.6
	f	–	0.1		–	–	–	0.5
	m+f				–	0.1	–	1.1
24. USSR	m			8.3	10.6	4.7	6.5	206.5
	f	31.3	31.3		4.1	4.1	6.1	228.5
	m+f				14.7	8.8	12.6	435.0
World	Male (rank)			197.7 (5)	130.7 (8)	129.5 (9)	100.3 (10)	2968.5
	Female (rank)	541.2 (1)	459.4 (2)		39.4 (11)	91.3 (8)	75.4 (10)	2901.8
Total (rank)		541.2 (3)	459.4 (5)	197.7 (10)	170.1 (12)	220.9 (9)	175.7 (11)	5870.3

The figures for cancer of the *prostate* are probably the least reliable of the twelve sites considered. It is a tumour of elderly males, and is often asymptomatic and found on autopsy; the incidence rates will thus depend on the level of diagnostic services available. It is the most common tumour of males in Jamaica (*4*) and ranks second in the Black population of the USA (*19*). Given their young populations, the figures from some African centres (e.g., Liberia (*14*)) suggest that it is by no means uncommon in that continent also.

Bladder cancer is predominantly a tumour of males (ratio 3:1 overall), and is more frequent in the developed countries of Europe and North America than elsewhere, with the exception of those areas where schistosomiasis is endemic, especially Egypt.

Incidence rates for tumours of *lymphatic tissue* and for *leukaemias* show relatively small variations between the different areas. Lymphomas are particularly common in African populations where these tumours are only slightly less frequent than cancers of the liver and cervix.

The technique used in this analysis is patently crude, and the results for several large portions of the globe are only informed estimates. Very large contributions to the world totals are made by the populous areas of China and South Asia for most of the tumour sites. By considering large areas of the world, half of which have populations in excess of a hundred million (Table 1), it is evident that localized areas of high risk for a given cancer (e.g., of the oesophagus—in Brittany and Normandy in France or around Lake Victoria in Central Africa) will have little influence on the figures in Tables 2 and 3. Such areas are, however, of great interest for the population concerned as well as for the analytical epidemiologist seeking determinants.

The rank order of the twelve selected cancers discussed above is given in Table 3 and summarized in Table 4.

The consolidated totals at the foot of Table 3 and the rankings given in Table 4 conceal substantial differences between the 24 areas. Five of these areas are considered in Table 5. For females, despite large differences in the crude incidence rates in different areas, breast or cervix cancers are always in first place, the other often being in second or third rank. For males there is somewhat more variety and preventive measures will therefore be different in each region.

The figures presented are cross-sectional and are poor prognosticators in that they take into account neither the evolution of population structure nor the increases and decreases of certain cancers, trends that are to some extent inevitable owing to the exposures already experienced by existing birth cohorts (*41*).

Mention was made above of time-trends in stomach and lung cancer. The evolution of several other sites can also be forecast. Rising trends in breast cancer in certain populations, e.g., in China and Japan where this cancer has hitherto been very rare, and a fall in uterine cervix cancer in many populations are likely to strengthen the first position occupied by breast cancer.

Table 4. Rank order by frequency of occurrence of the twelve selected cancers in males, females, and both sexes

Rank	Males	Females	Both sexes
1	Lung	Breast	Stomach
2	Stomach	Cervix	Lung
3	Colon/ rectum	Stomach	Breast
4	Mouth/ pharynx	Colon/ rectum	Colon/ rectum
5	Prostate	Lung	Cervix
6	Oesophagus	Mouth/ pharynx	Mouth/ pharynx
7	Liver	Oesophagus	Oesophagus
8	Bladder	Lymphatic	Liver
9	Lymphatic	Liver	Lymphatic
10	Leukaemia	Leukaemia	Prostate
11	–	Bladder	Bladder
12	–	–	Leukaemia

Table 5. Rank order, by sex, of the most frequently encountered cancers, among the 12 considered, in selected areas of the world

Rank	Western Africa (5)[a]		North America (10)		China (11)		Middle South Asia (15)		Eastern Europe (17)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	Liver	Cervix	Lung	Breast	Stomach	Cervix	Mouth/ pharynx	Cervix	Lung	Breast
2	Lymphatic	Breast	Prostate	Colon/ rectum	Oesophagus	Stomach	Lung	Breast	Stomach	Stomach
3	Prostate	Lymphatic	Colon/ rectum	Lung	Liver	Oesophagus	Oesophagus	Mouth/ pharynx	Colon/ rectum	Cervix
4	Stomach	Liver	Bladder	Lymphatic	Lung	Breast	Stomach	Oesophagus	Prostate	Colon/ rectum
5	Mouth/ pharynx	Stomach	Lymphatic	Cervix	Colon/ rectum	Colon/ rectum	Lymphatic	Stomach	Mouth/ pharynx	Lung

[a] The numbers in parentheses refer to the area number in the map of the world (Fig. 1).

In the USA and Northern Europe, cancers of the ovary and corpus uteri are now more frequent than carcinoma of the cervix. With improvements in diagnosis, the number of cancers of the prostate and pancreas will probably assume more importance in global terms. Cancer of the prostate has a high and increasing incidence in the Black populations of North America and the Caribbean and, when looked for, is fairly frequent in Africa. The rapid rise in prostate cancer in the low-risk populations of China and Japan bodes ill.

Yet, it is worth emphasizing that many of these cancers are preventable today. Lung cancer and much oropharyngeal, oesophageal and bladder cancer are determined by tobacco smoking and to a lesser extent alcohol consumption. Interventions to control these determinants can yield results within a decade. On the basis of the figures in Table 3, over 1 million cancers which at present occur each year could be avoided by this single step (*42*). It may be that with improved personal hygiene and a rise in the age of marriage, cancers of the cervix uteri will show the same decline in developing countries as already experienced in most of Europe and North America.

Cancers of the breast in women and of the large bowel in both sexes deserve the closest attention. Current etiological hypotheses suggest that these (and prostate cancer) are linked with a high fat diet and low intake of dietary fibre. Yet in many areas of the world there is a trend towards the consumption of such diets. Cancer of the stomach occurs most frequently in persons with a low intake of fresh food and vegetables and it is probable that in those areas where this cancer is still common, increased availability of these commodities would accelerate the fall in incidence.

In the case of primary liver cancer, the long-term goal of prevention by means of immunization to reduce chronic carriage of hepatitis B virus presents an exciting prospect (*43*); in the meantime, the reduction of aflatoxin intake may be rewarding.

While the causes of malignant lymphoma and leukaemia remain unknown, it is difficult to forecast their evolution.

There is no doubt that many developing countries have been complacent about the cancer problem because their priorities lay in the fields of infectious, parasitic and nutritional disease. Elimination of certain infectious diseases is now technically feasible even if the control of several parasitic diseases and of protein-energy malnutrition often calls for large investments. None the less, the demographic changes following reduction of infant mortality are resulting in increasing numbers of persons in the middle and older age groups, many of whom are being encouraged to smoke large quantities of the most dangerous types of cigarettes. The consequences of this one habit are going to require an investment in diagnostic and treatment facilities for cancer as well as heart and lung diseases that may far outweigh the revenue to be obtained from the taxation of tobacco. The adoption of a high fat and low fibre diet, which seems to be conducive to cancers in the large bowel, breast, and prostate, needs critical assessment. For several numerically important cancers, particularly in males, it is still not too late to implement the appropriate preventive measures. By the year 2000 the battle may be lost.

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