COMMENTARY

Karachi Cancer Registry Data – Implications for the National Cancer Control Program of Pakistan

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Abstract

Cancer registries play a major role in providing the data to justify establishment, implementation and monitoring of cancer control programs, therefore stability in cancer registration is of pivotal importance. An erroneous assessment of the cancer burden can have long-term negative implications for the limited health resources of a country. Thus, registries starting simultaneously with cancer control programs clearly cannot be adequate for the purpose. The Karachi Cancer Registry (KCR) is the first population-based registry of Pakistan, with 9 years proven data stability (1995-2003) for Karachi South (KS), a location with a population distribution similar to that for the country in general as regards age, gender, and religion. It also has the distinction of being the only district in the country with representation of all ethnic and socio-economic groups of the country. The primary recommended strategy for the 'National Cancer Control Program' (NCCP), Pakistan based on the assessment of eight common cancers in Karachi and the WHO estimates would be identical. A curb on the epidemic levels of tobacco and areca nut use would reduce malignancies in males by 43.7% and in females by 17.8% . WHO estimates put these figures at 45% and 18.5% for males and females respectively. Primary prevention in the form of diet control, checks on preservatives, dyes, and pesticides; protection from occupational hazards, control of biological agents and solar UV protection would help control of another half of the malignancies.

Resource restrictions put high technology methods beyond the scope of Pakistan today. Early detection of cancers of accessible sites, though not an urgent requirement, would be warranted for oral, cervical and breast cancer, after sufficient capacity building, initially in the high-risk groups. In females, this could help target 47.6% (approximately half) of the malignancies and in men 13% of the total. Establishment of equitable pain control and a palliative care network throughout the country is an urgent and essential measure as more than 70% of cancer patients report with very advanced stages of malignancy. The estimated annual incident cancer cases for Pakistan, year 2000 on the basis of KCR data were 138,343 for males and 135,054 for females; approximately twice the number cited by WHO for the same year. The argument that higher KCR estimates reflect an urban catchment population may be justified, the urban: rural ratio being 2:1 in Pakistan. Evidence-based strategies, however ,support the counter argument, that the rising incidence of cancer in Pakistan is primarily attributable to risk factors equally prevalent in the rural and urban areas viz. increasing tobacco use, low socio-economic conditions, dietary deficiencies and prevalence of oncogenic viruses.

Pakistan has a significant cancer burden and rising trends of risk factors - it is a country in dire need of a Cancer Control Program. KCR data along with WHO estimates can form the initial framework of a NCCP in Pakistan; the lack of a national cancer registration should not deter initiatives. Benefits of an immediate, prompt and targeted implementation established today will be realized after 20–30 years. Otherwise the country should be prepared to face epidemic proportions of the disease in the next decade or two. Prerequisite 'qualification criteria' or 'sincerity of intent test' for NCCP funding by international donors should be legislation against tobacco and areca nuts in Pakistan and stringent evaluative criteria.

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Introduction

Worldwide, there are over 10 million new cases of cancer annually (4.7 million in developed countries; 5.5 million in less developed countries) and more than 6 million cancer deaths. It is estimated that there will be 15 million new cancer cases every year by 2020, and 10 million cancer deaths. To reduce this prediction of doom "National Cancer Control Programs (NCCP) are recommended in countries with a significant cancer burden and rising trends of risk factors. Such public health programs should be designed to reduce the incidence and mortality of cancer and improve the quality of life of cancer patients in a particular country or state. They require systematic, equitable implementation of evidence-based strategies for prevention, early detection, treatment, and palliation, making best use of available

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resources. Epidemiological data on the occurrence of cancer, knowledge of causative factors and how to avoid these factors provide a basis for determining where emphasis of cancer control efforts should be placed". (NCCP, 2002)

Success requires assessment of the magnitude of cancer problem, a sound knowledge of carcinogenesis and factors that influence the course of the disease. An understanding of the political, social, economic and organizational factors that govern how that knowledge can be put to effective use within different countries is essential. These factors vary in different countries and within countries in different political and time periods. Without careful planning, restricted resources available for cancer control are used inefficiently, and benefits to the population not realized. A cost-effective NCCP can be organized independently or a cancer surveillance program can be built around a stable population-based cancer registry. (NCCP, 2002)

The main objective of 'Population-based Cancer Registries' is to provide demographic data and identify risk factors, essential for the assessment of the magnitude of the cancer problem as well for monitoring the progress of NCCP. Age, gender, and characteristics of malignancies show a geographical variation linked to racial, genetic and environmental pathogenic factors. Cancer rates of one population cannot be used to develop a cancer control program of another population, yet overenthusiastic stress and allocation of limited funds on cancer registration at the cost of the goal of cancer control should be essentially avoided. The registry data also forms the basis of 'projection of the future cancer burden' and 'time trends' in cancer.

Projection of the future cancer burden involves the assumption that past trends in rates of incidence or mortality will be maintained, and will apply to projected changes in the population. Intervention in the form of primary and secondary cancer prevention changes the natural trends of the disease. "Projections nevertheless provide a useful benchmark against which the impact of all future changes, including the interventions of the national cancer control program, can be evaluated". (NCCP, 2002)

The cancer pattern of populations changes over long periods. Time trends in cancer are therefore measured in terms of decades not months or couple of years. Dramatic changes are not observed in short periods. The factors, which influence time trends maybe indirect viz. environmental factors especially tobacco use 20–30 years earlier or changes in the age structure of the population or direct intervention via the cancer, control program. Environmental factors play an important role in oncogenesis, these are the factors more readily controlled then the genetic and racial factors. The emerging age structure of populations, improvement of living standards, control of communicable diseases and population control has improved life expectancy and associated cancer susceptibility.

Pakistan has been historically unsuccessful in sustaining the numerous population-based registries established in the past. In the last 5 decades published data of a few sporadic institution-based registries, provided the country with its only cancer database. The data have limited value as the demographic details of the patients are partially recorded; there is associated selection bias of different hospitals and lack of continuity. Relative frequency data cannot be used as a replacement for population-based data, or as a guideline for cancer control.

Karachi Cancer Registry (KCR) is the first population-based registry of Pakistan, and has acquired 9 years stability (1995-2003) for the data of Karachi South (KS), a sample population of Pakistan (Table 1). (Bhurgri et al 2000; 2002a and b) The city of Karachi is divided into 5 districts, South, Central, West, East and Malir. KS has a population of 1,724,915 (929,394 males and 795,521 females) annual growth rate 1.94, as calculated by the Federal Census Bureau. (Census 1998). The population distribution is similar to the population distribution of Pakistan as regards age, gender, and religion. KS has the distinction of being the only district in the country with a representation of all ethnic and socio-economic groups of the country. It can thus be taken as a sample population of the country in the absence of other data sources. KCR has also calculated the incidence of Karachi Division (1998-2002), population of 9,802,134; 5,261,712 males and 4,540,422 females, annual growth rate 3.52 and Quetta (1998-1999) population of 759,245; 425,474 males (56%) and 333,771 females (44%); (Census 1998;Bhurgri et al, 2002 a & b).

Methodology

Epidemiological data of all malignancies, diagnosed clinically or microscopically and registered at the Karachi Cancer Registry for Karachi South during 1st January 1995 to 31st December 2002 were analysed. People residing in the specified geographical regions for more than six months were considered residents. Variables recorded were the hospital patient-number, date of incidence, name, age, sex, address, ethnicity, topography, morphology, grading and staging.

The data were classified using ICD-O2 (International Classification of Diseases-Oncology, 2nd edition) and computerized using a customized version of CANREG-3 software. (WHO, 1990) Manual and computerized validity checks for the cancer data were performed as per recommendations of International Agency for Research on Cancer (IARC) and International Association of Cancer Registries (IACR). This involved factors influencing comparability i.e. classification and coding. (Parkin et al 1994; 1997; 2002; Skeet, 1991).

Karachi South (KS), the southern-most district of Karachi has a population of 1,724,915 with 929,394 (54%) males and 795,521 (46%) females. (Census 1998) Person-years of population at risk by sex and 5-year age groups were estimated, based on the 1998 census, assuming an annual growth rate of 1.74%, as calculated by the Federal Bureau of Statistics. "Standardized incidence rate was calculated with an external reference population, the 'world' population. (Segi, 1960) The rates given are the annual incidence per

100,000 population, averaged over the number of years for which data are presented". (Parkin et al, 1997) The projection of cancer cases for the years 2003-2027 is based on an assumed annual population growth rate of 1.94% for Karachi, and change in incidence rates for 1995-1997 and 1998-2002.

Karachi South includes all ethnicities of the country, namely Sindhis, Punjabis, Pathans, Baluchs and Mohajirs with a fair representation of all socio-economic categories. In the absence of a national cancer registration system, it qualifies as a sample population of the country. A profound affect of westernization is seen in parts of this district, in stark contrast to an extreme cultural conservativeness in some parts and moderation in other parts of the same district. The population of Pakistan used for projections was 130,579,571; 67,840,137 males; 62,739,434 females annual growth rate 2.61. (census, 1998)

Results

The first 8-cancer sites in Karachi South (males) are cancer of the lung (ICD-10 C33-C34) (11.7%; ASR 25.5), oral cavity (ICD-10 C00-C06) (13.1; ASR 22.5), larynx (ICD-10 C32) (6.1%; ASR 11.8), urinary bladder (ICD-10 C67) (4.8%; ASR 9.9), prostate (ICD-10 C61) (4.1%; ASR 9.8), lymphoma (ICD-10 C81-85;96) (7.0%; ASR 9.6), pharynx (ICD-10 C09-14) (4.3%; ASR 8.2), and colo-rectum (ICD-10 C18-21) (4.4%; ASR 7.8).

In females these are cancer breast (ICD-10 C50) (34.6%; ASR 69.1), oral cavity (ICD-10 C00-C06) (8.9%; ASR 8.9), cervix (ICD-10 C53) (4.1; ASR 8.6), esophagus (ICD-10 C15)(3.7%, ASR 8.6), ovary (ICD-10 C56) (4.2%; ASR 7.8), lymphoma (ICD-10 C81-85;96) (3.5%; ASR 7.2), gall bladder (ICD-10 C23-C24) (2.6%; ASR 5.8), and skin (ICD-10 C43-44) (2.6%; ASR 5.6).

The tobacco-associated cancers were responsible for 43.7% of the tumours in males and 17.8% in females. Breast cancer, the commonest female cancer in the world, is very high in Karachi, the highest in Asia. Cervical cancer is showing a gradual but significant rise, so is prostate cancer. With implementation of early detection through screening, this may be higher.

Discussion

The word "control" in context to cancer does not imply disease eradication, but rather control over its causes and consequences. This requires extensive resources. "In order to make the best use of resources, it is important to identify both effective strategies and strategies that are largely ineffective". The cost of various cancer control strategies differs in different countries, because of different levels of existing infrastructure and differences in local strategy implementation. In general, prevention and palliative care require less national resources commitment than early detection (screening) and treatment". (NCCP, 2002)

The cost of primary prevention is negligible when compared with the psychosocial and economic impacts of the disease once it commences. The economic burden of cancer is measurable in terms of direct health care costs but immeasurable and immense when the indirect costs are considered. In developing countries like Pakistan, the biggest financial and psychological drain is the element of false hope, futile frantic searches for miracle treatments, and collaborative faith healing by quacks and physicians alike. 'Large amounts of money paid by the family for treatments that cannot prolong the life of the family member with advanced cancer' and "loss of productivity because of illness and premature death of those affected" makes the picture more dismal. (NCCP, 2002)

"Since cancer control depends on the application of existing knowledge, no activity should be introduced unless its effectiveness is strongly supported by evidence-based strategies". Assessing the magnitude of the cancer problem is an initial step, in the development of NCCP. The categories of information needed for the initial analysis are cancer demographic data, risk factor data, data on other diseases and capacity assessment. This information is provided by ' Cancer Registries'

The precise incidence, mortality rates, number of new cancer cases and number of deaths annually for Pakistan is not known. WHO estimates put the figures at 61624 incident cases and 42684 cancer deaths annually in males and 75095 incident cases and 43188 deaths annually in females. (Ferley et al 2000) Estimates on the basis of KCR data put the figures at 138343 incident cancer cases for males and 135054 for females, approximately twice the number cited by WHO. " Estimates of the numbers of cancer cases and deaths due to cancer may be higher than the numbers known to the health services. In countries where awareness of cancer is low and access to health care is limited, only a small proportion of actual cases are known to the health services". (NCCP, 2002) In Pakistan, the rising incidence of cancer can primarily be attributed to increasing tobacco use, low socio-economic conditions with associated diet deficiencies and prevalence of oncogenic viruses. Higher life expectancy, with more people surviving to old age, when cancer is more likely to occur, changes in diet, decreasing physical activity and increasing obesity are additional risk factors.

The primary recommended strategy for NCCP, Pakistan based on the assessment of eight common cancers in Karachi (Tables 1-3) and the WHO estimates is 'a curb on the epidemic levels of all forms of tobacco use, areca nut and paan chewing'. Primary prevention in the form of tobacco and areca nut control could reduce 43.7% of the malignancies in males and 17.8% in females. WHO estimates put these figures at 45% and 18.54% for males and females respectively. This can be achieved by public health education, especially of schoolchildren, adolescents, healthcare providers and by mass education and media influence. Legislation in the form of taxation, ban on public smoking or chewing, ban on advertising and enforcement of non-tobacco industry. Regulation of tobacco exports and encouragement of alternative crops in tobacco areas will

Table 1. Cancer Incidence in Karachi South (1998-2002)

Topography	Karachi South; 1998-2002				
	Males		Females		
	Rel.* Freq.%	ASR World	Rel.* Freq. %	ASR World	ICD (10^{th})
Oral Cavity	13.1	22.5[2]	8.9	20.4[2]	C00-08
Pharynx	4.3	8.2[7]	1.5	3.1	C09-14
Oesophagus	3.7	6.3[9]	3.7	8.6[3]	C15
Stomach	3.2	6.0	1.9	4.0	C16
S.Intestine	0.2	0.4	0.1	0.2	C17
Colo-rectum	4.4	7.8[8]	2.4	5.2[9]	C18-21
Liver	2.5	5.3[10]	1.6	4.0	C22
Gall bladder	0.7	1.4	2.6	5.8[7]	C23-24
Pancreas	0.7	1.1	0.2	0.5	C25
Nose, sinuses etc.	0.3	0.5	0.3	0.7	C30-31
Larynx	6.1	11.8[3]	0.8	1.7	C32
Bronchus, lung	11.7	25.5[1]	1.6	4.2	C33-38
Bone	1.4	1.5	0.1	1.8	C40-41
C. tissue	1.9	2.8	1.3	2.3	C47;49
Mesothelioma	0.1	0.1	0.0	0.0	C45
Melanoma skin	0.4	0.6	0.1	0.1	C43
Other Skin	2.8	4.8	2.5	5.5[8]	C44
Breast	0.5	1.0	34.6	69.1[1]	C50
Uterus	-	-	2.3	5.0[10]	C54-55
Cervix	-	-	4.1	8.6[3]	C53
Placenta	-	-	0.3	0.3	C58
Ovary	-	-	4.2	7.8[5]	C56
Female genital, oth	-	-	0.2	0.5	C51-52;57
Prostate	4.1	9.8[5]	-	-	C61
Testis	1.0	1.1	-	-	C62
Penis	0.1	0.1	-	-	C60
Other male genital	0.0	0.0	-	-	C63
Bladder	4.8	9.9[4]	1.3	2.8	C67
Kidney	1.1	1.8	0.8	1.4	C64-66;68
Eye	0.4	0.4	0.4	0.4	C69
Brain, N. system	2.2	3.0	1.9	2.2	C70-72
Thyroid	0.8	1.0	1.8	3.3	C73
Other endocrine	0.4	0.5	0.2	0.2	C74-75
Lymphoma	7.0	9.6[6]	3.5	7.2[6]	C81-85;96
Multiple myeloma	1.0	1.8	0.7	1.8	C88;90
Leukemia	4.3	4.8	3.0	4.7	C91-95
Unspecified	14.9	27.6	9.9	21.1	
All sites	100	179.0	100	204.1	
Tobacco-Associated Ts.	43.7%		17.8%		

have the most dramatic effects on the trends of cancer. "The benefits of a cancer prevention program will only be realized 20–30 years after effective implementation".

Primary prevention in the form of diet control (colon, breast, gastric cancers), checks on preservatives, dyes, and pesticides; protection from occupational hazards (lung, pleural, peritoneum, skin, eye, scrotum, liver, lymphatic, haematopoietic malignancies), control of biological agents (hepatitis B vaccination - liver cancer, H.pylori treatment - gastric cancer and MALTOMA, avoidance of aspergillus contamination – oral cavity and liver) and solar UV protection (eye and skin cancers) will help in the control of half the malignancies.

Early detection of cancers of accessible sites though not an urgent requirement would be warranted for oral, cervical and breast cancer, after sufficient capacity building, initially in the high-risk groups. In females, this could help target 47.6% (approximately half) of the malignancies and in men 13% of the total. Establishment of equitable pain control and a palliative care network throughout the country is an urgent and essential necessity as more than 70% of cancer patients report in very advanced stages of malignancy.

Pakistan falls into the low to medium resource countries by WHO classification. (Table 4) Resource restriction put high technology methods beyond the scope of Pakistan today. Cancer control activities should focus primarily on education to improve awareness. Self-examination of the oral cavity, and breast, physician breast examination and cytology-based

Table 2. Priorities and Strategies for the Eight most Common Cancers in Karachi – Males

Tumor *	ASIRs	Frequency %	Primary prevention	Early diagnosis	Curative therapy	Pain relief / palliative care
Mouth/pharynx	30.7	17.4	++	+	++	++
Lung	25.5	11.7	++	-	-	++
Larynx	11.8	6.1	++	+	++	++
U.Bladder	9.9	4.8	++	+	++	++
Prostate	9.8	4.1	+	+	++	++
Lymphoma	9.6	7.0	+	+	++	++
Colon/rectum	7.8	4.4	+	-	+	++
Esophagus	6.3	3.7	+	-	-	++
Total		59.2				

*Listed in the order of the eight most common tumors globally **Curative for the majority of cases providing they are found early
+ + = effective; + = partly effective; - = not effective.

Table 3. Priorities and Strategies for the Eight most Common Cancers in Karachi – Females

Tumor *	ASIRs	Frequency %	Primary prevention	Early diagnosis	Curative therapy	Pain relief / palliative care
Breast	69.1	34.6	+	+ +	++	++
Mouth/pharynx	23.5	17.4	+ +	+	++	++
Cervix	8.6	4.1	+	++	++	++
Esophagus	8.6	3.7	+	-	-	++
Ovary	7.8	4.2	+	-	-	++
Lymphoma	7.2	3.5	+	+	++	++
Gall Bladder	5.8	2.6	++	++	++	++
Skin	5.6	2.6	++	++	++	++
Total		72.7				

*Listed in the order of the eight most common tumors globally **Curative for the majority of cases providing they are found early
+ + = effective; + = partly effective; - = not effective.

screening for high-risk cervical cancer populations should be established. These initiatives along with model community programs were successfully organised in Kerala (initiated in 1988 as a 10-year action plan) and Trivandarum in India and need to be closely examined and reproduced in Pakistan as resource allocation, social-economic and cultural similarities suggest potential for success. A hospital cancer registry, started in 1982, was a major source of information for planning these programs. (NCCP, 2002)

Pathology-based cancer data can be utilized as a reflection of the patterns of cancer in the population it represents, provided the microscopic verification of malignancies is high and demographic data well recorded. Incomplete information gives either an over-registration of non-resident cases or a duplication of cases. The risk of associated selection bias of different hospitals and over-representation of more easily accessible sites also remains. Despite these drawbacks, if interpretations are made in the light of information on selective factors, invaluable scientific information may be derived from this data as approximately 70-90% (urban, rural variation) of the malignancies in Pakistan can be traced to pathology departments. The Aga Khan University pathology-based cancer registry is a good example. (Bhurgri et al, 2002) Oncology-based registries emphasize on clinical-care of cancer patients and submit the data to the central, population-based registries. Approximately 30-50% (urban, rural variation) of the malignancies in Pakistan can be traced to treatment centres. These are cases with early diagnosis and socio-economic security. Cancer cases at extreme ends of life may not enter the health sector, especially oncology units. National population-based registries though ideal are not practicable due to restrictions of finances and a lack of technical expertise. There is likelihood of wastage of allocated resources, as desired completion rates cannot be achieved.

Unfortunately the vast majority of hospital-based and pathology based data in the country is recorded without establishing the residency status of the patient or without recording a retraceable address or telephone number or even the correct name. This invaluable data is wasted as no conclusions can be derived if the population from which the cases are drawn is not known. Duplication of data also cannot be avoided. In such circumstances, incidence rates cannot be calculated; the data when presented as proportions or relative frequencies is also not representative of the population. Ironically, this deficiency of incidence data

Table 4. WHO Report – Low, Medium and High Resource Countries.

	Low resource countries		Low to medium resources		High resource countries	
	Rawanda	Afghanistan	India	Pakistan	UK	Japan
Total population (100,000)	7,948,000	22,473,000	1,025,095,000	144,971,000	59,541,000	127,334,000
GDP per capita (Intl $):	774	820	1,461	1,834	24,462	25,901
Life expectancy at birth m/f (years):	38.9/42.8	41.1/43.7	60.0/61.7	61.0/61.5	75.1/79.9	77.9/84.7
Healthy life expect. at birth m/f (years):	31.7/36.0	31.1/35.7	51.5/51.3	50.4/51.5	68.4/70.9	71.4/75.8
Child mortality m/f (per 1000):	197/179	252/249	89/98	105/115	7/6	5/4
Adult mortality m/f (per 1000):	688/575	527/418	291/222	229/203	109/69	97/47
Total health expend./capita (Intl $):	40	9	71	76	1,774	2,009
Total health expend. % of GDP:	5.2	1	4.9	4.1	7.3	7.8

hinders the development of a well-organized cancer control program. Comprehensive assessment of the cancer burden also requires assessment of 'survival, and mortality data for all forms of cancer combined, and other indicators of burden", such as prevalence, (PYLL), (DALY)'. These data are not available for any geographical region in Pakistan. Awareness of the phenomenon, that NCCP implementation will increase public awareness, and demands for care maybe the biggest drawback for the implementation of NCCP. Health sectors with limited funds, lack of ability and associated mismanagements may prefer to avoid this responsibility.

Conclusion

Pakistan has a significant cancer burden and rising trends of risk factors, it is a country in dire need of a Cancer Control Program. KCR data along with WHO estimates can form the initial framework of NCCP in Pakistan; the lack of a national cancer registration should not deter initiatives. Benefits of an immediate, prompt and targeted implementation established today will be realized after 20–30 years' else the country should be prepared to face epidemic proportions of the disease in the next decade or two. Yet prerequisite 'qualification criteria' or 'sincerity of intent test' for NCCP funding by international donors should be legislation against tobacco and areca nut in Pakistan and stringent evaluative criteria.

Cancer registration is a public health profession and requires professionalism for success. It is not a hobby for the selected few, dependent on the availability of funds in particular time periods. Registries starting simultaneously with the national cancer control program cannot adequately be used for the planning, establishment and monitoring of the program.

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