SOUTH ASIA

The estimated and projected cancer incidence and mortality in South Asia for the years 2005,2010 and 2020 is:

Year	2005	2010	2020
Cancer Incidence (in millions)	1.20	1.40	1.80
Cancer Mortality (in millions)	0.82	0.94	1.20

Can the health care facilities in South Asia cope with these kinds of numbers? The region is even now reeling under the onslaught of re-emerging communicable diseases. The necessary infrastructure, trained manpower and financial resources to tackle the current cancer cases are woefully inadequate. How would these countries gear up to meet the challenge?

The UICC Handbook on "Cancer Awareness, Prevention and Control: Strategies for South Asia", focuses on the current cancer scenario in the region and discusses strategies to meet the challenges of the future.

The Handbook examines:

- The cancer burden in South Asia
- The social disparities
- Evaluation of preventive interventions
- Major risk factors like tobacco, occupational exposures, infections and diet
- Successful awareness and screening programmes
- Existing national cancer control programmes in South Asia
- Future directions
- A Model District Cancer Control Programme

MSD

International Union Against Cancer
Union Internationale Contre le Cancer
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Cancer Awareness, Prevention and Control : Strategies for South Asia

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Cancer Awareness, Prevention and Control: Strategies for South Asia

A UICC Handbook for SOUTH ASIA

In collaboration with

TATA MEMORIAL CENTRE
SERVICE RESEARCH EDUCATION

Indian Cancer Society

Cancer Awareness, Prevention and Control: Strategies for South Asia

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Cancer Awareness, Prevention and Control: Strategies for South Asia

SOUTH ASIA

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Foreword

International Union Against Cancer

The title of this handbook encompasses three concepts that are essential in our fight against cancer: cancer awareness, cancer control and prevention. They are more important today, when everybody is forecasting for the near future a possible cancer disaster, mainly in countries with limited resources. We expect 17 million new cases of cancer worldwide by 2020, with three fourths of the cancer related deaths occuring in the developing part of the world. Of course we need everywhere better treatment facilities, however, we all know that this will not be sufficient to tackle the problem, particularly because treatments are becoming more expensive and sophisticated. Therefore, we have to consider the looming disaster and what we can do to avoid it from another point of view. This is the very reason why the Executive Committee of the UICC has declared that the main goal of our organisation is to make sure that within the next 10-15 years, in every country of this world, there will be a cancer control plan. Within these plans, prevention will play a pivotal role, and this is needed most of all in countries where facilities and structures for early detection and treatment are suboptimal.

To succeed we also need increased awareness among the public. I'm convinced that it has just been this kind of awareness among women, which explains to a large extent the decrease in mortality, which we have witnessed in developed countries as regards breast cancer in the last 10 years. This handbook is therefore very timely and I hope that everyone will appreciate it. I'm also proud that it appears when the UICC is starting at the World Cancer Conference in Washington a new phase in its history, reshaping its governance and relaunching its plans for an intensified fight against cancer on a global scale.

Franco Cavalli
President 2006-2008

Foreword

Tata Memorial Centre

In the next 50 years, the world's population is projected to increase to 9.3 billion from the current 6.1 billion, with 88% of the population growth in the less developed countries. Given this population scenario and slower economic growth, there would be serious health consequences in the developing world, still dominated by infectious diseases and compounded by poor living conditions and malnutrition. Nevertheless, cancer has rapidly gained recognition as a serious public health problem with almost half of the cancer cases in the year 2000 being diagnosed in the developing world. In about 20 years the contribution of the developing world to the global burden of new cases would rise to 70%.

Cancer is currently placed between 9th to 6th most common causes of death in South Asia. However, given the current trends, it would not be too long before cancer becomes the 2nd most common cause of death in this region too.

South Asia has the maximum burden of cancers of the head and neck due to the tobacco chewing habit of the native population. Cervix cancer is the commonest cancer among women. Lung cancer in men and breast cancer in women are showing very significant rising trends in the urban setting. Oesophageal and other upper gastrointestinal tract cancers are also on the increase.

Most countries in South Asia have already initiated some cancer control efforts at local and national levels. Intensive research for the development of low cost technological tools for the early detection of oral, cervix and breast cancers has also been conducted in this region over the last decade. It is now very opportune for all the countries in South Asia to bind this information into culturally appropriate and logistically feasible national cancer control programmes.

This UICC Handbook titled "Cancer Awareness, Prevention and Control: Strategies for South Asia" has been designed to provide the necessary evidence and impetus for the development of cancer control programmes of relevance to South Asia. I am sure that country health planners and managers at all levels will find this book very useful as a ready reference in all aspects of their programme activities.

Ketayun Dinshaw
Director

Foreword

Indian Council of Medical Research

With the control of communicable diseases, non-communicable diseases are emerging as a major public health problem. Cancer is on the rise in developing countries including South Asia and is one of the three leading causes of death.

Control of cancer in the setting of a developing country is indeed challenging. It is more so, if this has to be based on research evidence. In order to accomplish this, the Indian Council of Medical Research has built a database on cancer through the National Cancer Registry Programme with a network of population and hospital based cancer registries. Over the years, the population based cancer registries (PBCRs) have identified differing cancer patterns and incidence rates. For example, cancer of the stomach has been noted as a leading site of cancer in males in the Southern registries of Chennai and Bangalore. That is not seen among the leading sites of cancer in the Delhi PBCR. Likewise, cancer of the gall bladder in women is very high in Delhi, but is of little or no importance in the Southern registries. The hospital based cancer registries have shown that a very high percentage of patients first attend for treatment when the disease is clinically advanced leading to poor survival.

More recently, under the auspices of the World Health Organisation a project on 'Development of an Atlas of Cancer in India' was completed using modern advances in Electronic Information Technology. This study covered areas of the country hitherto not covered by the PBCRs. The results of this project confirmed some suspected features of the geography of cancer in India as well as brought to light some new or little known facts. The patterns of cancers of anatomical sites associated with the use of tobacco showed variations according to the type of tobacco habit pursued by the population. An overall high incidence of cancer was seen in the North Eastern State of Mizoram. Other hot spots include the occurrence of gall bladder cancer along the Gangetic belt, thyroid cancer in the South West coast, coincidence of high cervical and penile cancer in some districts in the Southern State of Tamil Nadu and high stomach cancer incidence in the North Eastern States.

The above studies emphasise the need for evolving evidence based and area specific cancer control strategies. It is hoped that this book under the auspices of the International Union Against Cancer will greatly help in such an exercise for the countries in the South Asia region.

Nirmal Kumar Ganguly
Director General

Foreword

Indian Cancer Society

Ten million new cancer cases are diagnosed each year and six million people die from cancer. Forty-three percent of cancer deaths are due to tobacco, diet and infection. More than fifty percent of the new cases are in the developing world. It is estimated that by the year 2020, fifteen million new cases will be diagnosed per year with sixty percent of the cancer burden from the developing world.

The countries with limited resources face an uphill task of a rising burden of cancer cases in addition to the existing burden of infectious diseases and this problem is compounded further because of low educational and economic status and unequal distribution of available resources. The initial step in the fight against cancer is to build capacity; that is, human resources and facilities and to detect a larger number of cancer patients at an early stage through prevention and early detection.

The countries with limited resources do not have adequate resources to carry out screening programmes; however, it is possible to identify a subset of the population that is at high risk through a campaign of cancer awareness and an evidence based strategy of prevention and early detection.

This book is directed towards government agenices as well as non-government organizations, as it will help them to plan appropriate strategies.

This handbook is a classic example of the International Union Against Cancer bringing the International Community together to form a global alliance for cancer control.

Arun Kurkure
Honorary Secretary and Managing Trustee

Preface

Home to a quarter of the world's population, South Asia (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka) presents a complex sociodemographic scenario that is medieval in places, transitional in others and most modern in some. The health problems and the available health care infrastructure in the region is a direct reflection of this situation. While the urban conurbations boast of the most modern and sophisticated levels of health care, rural areas lack even basic facilities. While communicable diseases control programmes are still the main thrust of the public health care systems in South Asia, most countries have taken the first steps towards initiating plans for noncommunicable diseases control programmes.

Cancer is currently placed 6th to 9th in the common causes of mortality in the region. Using available information it is estimated that the annual cancer incidence in the region that was 1.12 million in the year 2002 increased to 1.21 million in 2005. If the current sociodemographic trends continue (which in all probability is inevitable) then we can expect these numbers to increase exponentially in the not too distant future.

The most common cancers in South Asia are the cancers of the head and neck, which can be directly attributed to the widely prevalent tobacco chewing habit in the region. Cervix cancer is the commonest cancer among women while the incidence of breast cancer is rising rapidly, particularly in the urban areas. Lung, esophageal and other upper gastrointestinal tract cancers are also showing significantly increasing trends, particularly in men.

Most countries in the region currently have some form of national cancer control programmes. Community based studies for the development of technically, financially and culturally appropriate screening tests for the early detection of oral, cervix and breast cancers have been conducted in this region over the last decade. Of particular interest have been the cervix cancer screening tests:

- Visual inspection after application of acetic acid (VIA)
- Visual inspection after application of Lugol's Iodine (VILI)

These tests have been shown to have a sensitivity as good as (and sometimes better) than conventional cytology. Sequential combination of these tests with cytology or HPV DNA tests are seen to provide acceptable levels of sensitivity and specificity at a fraction of the cost of standalone cytology or HPV tests.

This book collates and examines available information from the countries in South Asia listed above (except Maldives) on the following subjects:

- Cancer Burden
- Social issues in cancer
- Evaluation of cancer prevention interventions
- Causative factors including tobacco, infections, occupations and diet
- Screening interventions
- Existing National Cancer Control Programmes
- Model for a District Cancer Control Programme

This book is the labour of a very distinguished panel of cancer control experts from South Asia. The book was first discussed and conceived at a UICC meeting held at the Tata Memorial Hospital in Mumbai, India, in September 2004. The meeting included experts from South Asia, South East Asia and the Asia Pacific regions. The Asian continent being very large and diverse in several ways including health care, it was decided that separate books are required for the sub-regions. This book as mentioned earlier concentrates on South Asia. This book is aimed at country health planners and cancer control programme managers from the government and non-governmental sectors. The authors bring their rich experience and practical knowledge of handling cancer control interventions in South Asia to this book.

The UICC and authors of this book would be very happy to receive comments (particularly the critiques) and suggestions on the usefulness of this book at preventionhandbook@uicc.org

D

Abbreviations

ADHUNIK	Amra Dhumpan Nibaron Kori
AFTC	Advocacy Forum for Tobacco Control
ASCUS	Atypical Squamous Cells of Undetermined Significance
ASR	Age Standardized Rate
BAT	British American Tobacco
BATA	Bangladesh Anti-Tobacco Alliance
BMI	Body Mass Index
BSMMU	Bangabandhu Shiekh Mujib Medical University
BTC	Bangladesh Tobacco Company
CBE	Clinical Breast Examination
CCC	Comprehensive Cancer Centre
CI	Confidence Interval
CIR	Crude Incidence Rate
CIRH	Cancer Institute and Research Hospital
CMCH	Chittagong Medical College Hospital
CPAA	Cancer Patients Aid Association
CVD	Cardio Vascular Diseases
EBV	Epstein-Barr Virus
FAO	Food and Agricultural Organisation
FCTC	Framework Convention on Tobacco Control
GAVI	Global Alliance for Vaccines and Immunisation
GCIM	Government Cancer Institute Maharagama
GSK	Glaxo Smith Kline
GSPS	Global School Personnel Surveys
GTS	Green Tobacco Sickness
GYTS	Global Youth Tobacco Surveys
HBsAg	Hepatitis B virus Surface antigen
HBV	Hepatitis B Virus
HC2	Hybrid Capture-2
HCC	Hepato Cellular Carcinoma
HCV	Hepatitis C Virus
HHV-8	Human Herpes Virus type 8
HIV	Human Immunodeficiency Virus
HPV	Human Papilloma Virus
HR-HPVs	High Risk Human Papilloma Viruses
HTLV	Human T Cell Lymphotropic Virus

Abbreviations

IARC	International Agency for Research on Cancer
ICD-10	International Classification of Disease-10
ICD-O	International Classification of Disease for Oncology
ICMR	Indian Council Of Medical Research
IFA	Integrated Framework for Action
IFN	Interferon
INCTR	International Network for Cancer Research and Treatment
ISRO	Indian Space Research Organisation
IT	Information Technology
KCR	Karachi Cancer Registry
MCWC	Maternal and Child Welfare Centre
NCCP	National Cancer Control Programme
NCD	Non Communicable Disease
NCI	National Cancer Institute
NCRP	National Cancer Registry Programme
NGO	Non-Government Organisation
NIH	National Institute of Health
NRA	National Regulatory Authority
NRT	Nicotine Replacement Therapy
ODPC Act	Occupational Diseases Prevention and Control Act
OELs	Occupational Exposure Limits
OSHA	Occupation Safely and Health Administration
PATC	Pakistan Anti Tobacco Coalition
PBCR	Population Based Cancer Registry
PTI	Press Trust of India
RCR	Regional Cancer Centre
RCT	Randomised Controlled Trials
SAARC	South Asian Regional Cooperation
SMRs	Standardised Mortality Rates
TMCROP	Tata Memorial Centre Rural Outreach Programme
UH&FWC	Urban Health & Family Welfare Centre
VIA	Visual Inspection with Acetic Acid
VIAM	Visual Inspection with Magnification
VILI	Visual Inspection with Lugols Iodine
WHA	World Health Assembly
WHO	World Health Organisation

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Tata Memorial Centre

Service-Education-Research

The Tata Memorial Hospital was commissioned by the Sir Dorabji Tata Trust on 28 February 1941. The Indian Cancer Research Centre established in 1952, as a pioneer research institute for basic research, later called the Cancer Research Institute (CRI), is now part of the Advanced Centre for Training Research and Education in Cancer (ACTREC). The Tata Memorial Hospital and the ACTREC together constitute the Tata Memorial Centre. The Tata Memorial Centre functions under the administrative control of the Department of Atomic Energy since 1962.

Every year nearly 30,000 new patients visit the Tata Memorial Hospital from all over India and neighbouring South Asian countries. Nearly 70% are treated almost free of cost. Over 8500 major operations are performed annually and 5000 patients are treated with Radiotherapy and Chemotherapy annually. Apart from the patient care and service, clinical research programmes and randomized trials contribute increasingly to improved delivery of care and highest standards of work ethics.

The strategies for early diagnosis, treatment management, rehabilitation, pain relief and terminal care have been established at the Tata Memorial Hospital in a comprehensive and multidisciplinary approach for total cancer care.

The Tata Memorial Centre (TMC) is a classic example of private philanthropy augmented by Government support with a mandate for Service, Education & Research in Cancer.

For details please visit us at www.tatamemorialcentre.com or contact:

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Indian Council of Medical Research

As early as in 1911, the Government of India set up the Indian Research Fund Association (IRFA) with the specific objective of sponsoring and coordinating medical research in the country. It was redesignated in 1949 as the Indian Council of Medical Research (ICMR). The ICMR is funded by the Government of India through the Ministry of Health & Family Welfare. The Council's research priorities include control and management of communicable diseases, fertility control, maternal and child health, control of nutritional disorders, developing alternative strategies for health care delivery, containment within safety limits of environmental and occupational health problems; research on major non-communicable diseases like cancer, cardiovascular diseases, blindness, diabetes and other metabolic and haematological disorders; mental health research and drug research (including traditional remedies). All these efforts are undertaken with a view to reduce the total burden of disease and to promote health and well-being of the population.

The Council promotes biomedical research in the country through its 21 permanent research institutes and six regional medical research centres. Extramural research is promoted by ICMR through 'Centres for Advanced Research' in Medical Colleges and through Task force studies. Scientists from non-ICMR research institutes, medical colleges and universities are encouraged with funding support. The ICMR encourages human resource development in biomedical research through research fellowships, visiting fellowships, research studentships and through training programmes and workshops. The ICMR also encourages research on traditional systems of medicine and efforts have been made to strengthen and streamline medical informatics and communication to meet the growing demands and needs of the biomedical community.

For details and contact please visit www.icmr.nic.in

Indian Cancer Society

Indian Cancer Society

Established in 1951 the Indian Cancer Society (ICS) now has six branches and eighteen affiliates in various parts of the country. It is a founding member of the Asian Federation of Cancer; has representation on the International Union Against Cancer and World Health Organisation's International Expert Committee on Cancer.

The ICS established the first Cytology Laboratory in India in 1955, followed in 1956 by the establishment of the first Chemotherapy Department in India. The first Indian Population Based Cancer Registry was established in Mumbai in 1963 followed by six Satellite Registries. The ICS publishes the 'Indian Journal of Cancer' since 1963. The Society has published a Hand Book for doctors on the Diagnosis and Management of Cancer. In 1977 the Society established the first professional Society of Indian Cancer Specialists, the Indian Association of Oncologists.

The ICS established a Rehabilitation Research Centre including the first Vocational Training Workshop for cancer patients in India in 1962. Cancer patients are provided free meals, clothing, household essentials, medicines and transport. They are given post-operative support in the way of free appliances, breast prostheses and other medical devices. Financial assistance is provided through various trusts and individual donors; and counselling services and guidance are given to mastectomy patients. Patients are taught marketable skills so that they can become self-supporting. The Rehabilitation Centre conducts projects for children and young cancer patients to provide medical assistance and nutritional support to patients and their families. Recreational and entertainment activities are also provided. In 1985 the ICS introduced a Cancer Risk Insurance Scheme whereby a member of the Society can obtain cancer insurance coverage to cover the cost of diagnosis and treatment if at any time they are affected by cancer. Cancer Education and Detection Centres including Mobile Units are run by the Society for people in remote areas.

For detailed information please visit www.indiancancersociety.org

International Union Against Cancer

The International Union Against Cancer (UICC) is devoted exclusively to all aspects of the worldwide fight against cancer. Its objectives are to advance scientific and medical knowledge in research, diagnosis, treatment and prevention of cancer, and to promote all other aspects of the campaign against cancer throughout the world. Particular emphasis is placed on professional and public education.

Founded in 1933, UICC is a non-governmental, independent association of more than 270 member organizations in over 80 countries. Members are voluntary cancer leagues and societies, cancer research and treatment centres and, in some countries, ministries of health. UICC is non-profit, non-political and non-sectarian. It creates and carries out programmes around the world in collaboration with hundreds of volunteer experts. It works in four strategic directions: prevention and early detection, tobacco control, knowledge transfer, and capacity building.

UICC is governed by its members through a General Assembly, which meets every two years. Responsibility for programme structure and implementation rests with an elected Board of Directors. UICC organizes a World Cancer Congress every two years, as well as annual symposia, workshops and training courses. It publishes the International Journal of Cancer (30 issues per year), UICC eNews (every second month), bloom, the newsletter of Reach to Recovery International (twice yearly), a Calendar of International Cancer Conferences (twice yearly), and technical reports, textbooks, and manuals.

Its headquarters are in Geneva, Switzerland.

For detailed information please visit www.uicc.org or contact us at

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Most countries in South Asia have a decentralized public health care system that provides basic preventive health care services e.g. reproductive health services and communicable diseases control programmes. Preventive services for non-communicable diseases include Iodine deficiency disorders, Blindness control Cancer control etc. However, Cancer control programmes seem to lack a decisive thrust. This is possibly due to absence of adequate health infrastructure and trained manpower necessary for the programme.

This section of the book describes a Model District Cancer Control Programme that is currently being implemented in two backward rural districts in India.

Model District Cancer Control Programme

Programme Goals

District Selection

Planning of Logistics

Training of Health Care Staff

Collecting Demographic and Cancer Data

Community Informatiom and Education Programme

Planning of Effective Cancer Screening Services for Oral, Breast and Cervical Cancers

Diagnostic and Treatment Services

Quality Assurance, Monitoring and Evaluation

Cost of Screening and Treatment

Model District Cancer Control Programme

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The Tata Memorial Centre, a recognized comprehensive cancer care centre since 1941, commissioned a Model Rural Cancer Control Programme on 17th August 2003 as part of the Xth five year plan projects of the Government of India. This programme titled the " Tata Memorial Centre Rural Outreach Programme" (TMCROP) is located in the Ratnagiri and Sindhudurg districts of the Maharashtra State in Western India.

The BKL Walawalkar Hospital located at Dervan, Chiplun was selected as the base hospital within the region, for implementing the TMCROP project. Walawalkar hospital is a 100 bed charitable hospital and is completely dedicated to charitable health care work in the region. It is the only hospital in the entire district with well developed departments of Community Medicine, Gynecology, Surgery, Dental, ENT, Pathology and Radiology, which are crucial for the implementation of the project.

Programme Goals

The TMCROP has specific goals namely;

1. Creating health awareness about oral, breast & cervical cancers.
2. Screening for precursors/early stages of cervix, breast and oral cancer among women and oral cancer among men.
3. Treatment of detected cases.
4. Establishing a dynamic linkage of the service program with that of the Health Information System.

District Selection

Two districts, namely, Ratnagiri and Sindhudurg in Maharashtra state were selected for cancer control activities under TMCROP based on:

(i) The districts that have a high prevalence of common cancers.

(ii) The districts are within a reasonable distance from the Tata Memorial Hospital, Mumbai for programme monitoring and supervision.

(iii) The districts are backward region with poor access to health care services.

The total population of Ratnagiri and Sindudurg districts as per 2001 census is 1,696,482 and 861,672 respectively. The two districts covers 2268 villages and 13 towns from 16 tehsils.

Planning of Logistics

Pre programme logistics planning is probably the toughest exercise in

such a programme. It should take into consideration the approximate target population, capital costs, recurring expenditure, topography of the region, availability of the transport and existing health care facility.

A vertical program design was planned for the project. The focus of the programme was on primary screening by trained health care workers followed by examination of the screen positive cases by the Medical Officer for diagnostic confirmation. The various categories of manpower required to carry out different tasks within the programme was identified.

A Mobile Education cum Screening Unit (MESU) was planned as the primary unit which would have one custom-fitted transport-cum-examination vehicle with a staff component of 6 trained Female Health care worker/Auxiliary Nurse Midwives (ANMs), 2 trained Male Health Workers (MHW), 2 trained Medical Social Workers (MSW), 3 helpers and 2 Drivers. Four such teams were planned in the field for implementation of various components of the programme. Women/men found positive by the screening tests were to be sent to the first-referral level unit (FRLU). The FRLU was planned for one Medical Officer, one trained health care worker, one support staff and a driver.

Thus logistics were planned taking into account the capital cost which will be incurred for screening equipments, diagnostic equipments such as colposcope, transport cum screening vehicles, basic furniture, computers, data storage and office communication equipment and material required for Information & Education activities. The recurrent costs involved the staff salaries, treatment supplies, vehicular maintenance and travel, other recurrent costs and overall contingencies. Separate budget provisions were made under each category.

Training of Health Care Staff

Project staff comprising Programme co-ordinator, Medical Officers, Medical Social Workers, Male Health Workers, Female Health Workers, Technicians, Computer data entry operators, drivers and support staff were appointed with requisite qualifications.

Training was carried out in phases to orient the health care personnel on all aspects of the organization and implementation of the various components of the cancer control programme. Pilot camps were conducted to test the protocol and the various components of the programme.

Training for screening of cervical pre-cancers by Visual Inspection Methods was done using modules designed by IARC (International Agency for Research on Cancer). Training for oral & breast cancer screening was conducted with help of modules specially developed by the project. Different modules and training methods were adopted for different categories of workers for handling different tasks as given in the table below.

TMCROP Staff Training

Staff Category	Type of Training	Period
Medical Officers	Visual Inspection Techniques VIA (Visual Inspection with 5% Acetic Acid) and VILI (Visual inspection of the cervix after application of Lugol's iodine), Colposcopy & Diagnostic confirmation techniques.	6 weeks
Primary Health Care Workers (Females)	Visual Inspection Techniques (VIA/VILI) Clinical Breast Examination (CBE) Visual Oral Inspection Tobacco Cessation and counseling	4 weeks
Primary Health Care Workers (Males)	Visual Oral Inspection for oral cancer screening. Tobacco Cessation and counseling, Conducting Community Surveys	4 weeks
Medical Social Workers	Coordinating community surveys Organisation & Planning of cancer awareness and screening programmes Community Follow ups Tobacco Cessation and counseling	4 weeks
Computer Data Entry Operators	Effective usage of adopted data software for data entry, processing, retrieval and data linkages	3 weeks
Cancer Registry Personnel	Activities of rural registry and responsibilities of Social Investigator Different sources of data collection for death & relevant records Sampling Methods Maintenance of data bases	3 weeks
Laboratory Technicians	Cytology and Histopathology techniques	4 weeks

Demographic and Cancer Data

(1) Developing Population Based Cancer Registry

Base line information on cancer prevalence in the area was collected prior to the commencement of the screening activities in the region. For this, listing of village clusters was carried out with the help of the latest census data along with mapping of villages for enumerating target populations within these clusters. Epidemiological data on the occurrence of all forms of cancer and the site of occurrence in the last five years is collected by carrying out house to house surveys which gives a comprehensive assessment of cancer burden in the region.

Determination of burden of disease and evaluation of cancer control activities on long term basis, require reliable system for measuring incidence and mortality of cancer in the regions where cancer control activities are ongoing. Population based cancer registry is therefore set up in these two rural districts. In rural districts identification of cancer cases is different than that of urban setting. The setting and working of rural cancer registry is as follows:

(2) Identification of sources of registration

The base source hospital for registry is Walvalkar hospital in Devran village of Ratnagiri district as this is the largest hospital in this area. This hospital is also linked with Tata Memorial Hospital, Mumbai to get support for detecting and treating cancer patients. The list of other sources of registration includes all private clinics, general practitioners, laboratories, public health centers and death registration. Group meetings with Aanganwadi workers and village Panchayat is done to identify cancer patients in village. House to house survey by systematic sampling will also be done to identify and enquire about the cancer case from members of the household. The registry is linked with Tata memorial Centre Rural Outreach Programme (TMCROP) and will be able to get all the cases obtained during cancer awareness and screening activities of this project. The flow chart of case finding by registry is given in Figure 1.

(3) Method of data collection

The method of data collection is active. The active reporting involves registry personnel (Social Investigator) actually visiting the sources of data and abstracting the required information on to a special questionnaire. It contains demographic and identifying information, details on tumor, the most valid basis of diagnosis, clinical stage and treatment. The demographic information is sufficient to avoid the registration of same cases twice, and to be able to be distinguish between resident of the registry area and those who have come from outside. The baseline information on tobacco habits is also obtained. The tumor is classified and coded according to the International Classification of Diseases-Oncology -3.

(4) Training

Training of the registry staff at all levels is an important aspect of cancer registry operation. The staff of Chiplun registry is trained in the field at Barshi rural cancer registry. The staff was also trained by staff of Tata Memorial Hospital, Mumbai for data abstraction from medical records and coding of neoplasm. Staff of Hospital Based Cancer Registry at Tata Memorial Hospital goes periodically to Chiplun registry to ensure quality of registry and to resolve any problems faced by the registry staff.

(5) Equipment, office space and funds

The basic requirement for the registry i.e. office space, storage space and facilities for

the case documents has been provided by the base hospital. Computer and software for data entry will be provided by Tata Memorial hospital. Motorbikes for field visits will also be provided. The estimated annual cost for registry operation is US$ 31909 which includes cost of US$ 18820 for recurring expenditure (staff and miscellaneous) and cost of US$ 13089 for capital expenditure (Computer, office furniture, motor-bikes).

(6) **Confidentiality**

The data collected by registry are safeguarded and kept confidential. The aims of confidentiality measures are (a) the preservation of anonymity for individuals reported to the registry (b) cancer registry data are of the best quality possible and (c) the best possible use of cancer registry data is made for the benefit of the cancer patient, for cancer control and medical research.

This rural cancer registry set up at Chiplun will be extremely helpful in patient care, monitoring and in providing information on population based survival. The information on number of cancer cases in a population, provided by the registry will be useful for planning and establishing cancer treatment and cancer care facilities directed towards various types of cancers. It will also help in the management of cancer patient care programmes by ensuring that all patients with a given cancer are given state-of-the art diagnosis and treatment. The most important contribution of the registry will be to monitor population based survival rates and mortality rates over the period of time so as to evaluate the effectiveness of cancer control programmes in a rural population. In an early phase of cancer control programme by screening, cancer registry will serve to monitor changes in stage distribution.

Community Informatiom and Education Programme

No screening programme is possible without adequate awareness about preventable cancers both to encourage and support men and women to participate in screening services in order to ensure the programme reaches its screening coverage target. Awareness programmes precedes screening programmes in all the communities. Awareness programs are conducted at the local village level using posters, flipcharts, videocassettes and oral group presentations through Mobile Education-cum-Screening Units (MESUs).

Awareness programme strategies involved reaching men and women with the same health awareness messages about the importance of oral, breast and cervical cancer prevention, to make them understand their role as motivators of women in the family and support their partners to be screened and treated where necessary. Fears, embarrassment and myths about screening and cancers in general are dealt with to gain and establish mutual trust between the community and the project team.

Planning of Effective Cancer Screening Services for Oral, Breast and Cervical Cancers

Evidence based low cost effective cancer screening techniques are adopted which are administered by trained health care workers in community screening settings.

The evidence base is gathered from studies conducted and published by groups of investigators from Tata Memorial Centre, Barshi, Trivandrum etc. that provides evidence regarding the efficacy of oral cancer screening by oral visual inspection, cervical cancer screening by VIA(Visual Inspection with 5% Acetic Acid) and VILI (Visual inspection of the cervix after application of Lugol's iodine) and further a current trail for breast cancer screening by Clinical Breast Examination (CBE) is showing promising results in the interim analysis (personal communication).

The community based programme undertakes the screening of common cancers (tobacco related cancers of the oral cavity, cervix and breast cancers). All tobacco users (men and women) and women in the age group of 35-60 years is the target eligible population for this screening program.

Individual and group counseling is done, before and after the screening tests by trained medical social workers. Each participant is registered under the programme with the allocation of a unique Identification No. Participant case history with reproductive and demographic details are documented in pre designed formats.

Screening for Women

- Screening for precursors/early stages of cervix cancer is done by Visual Inspection Techniques i.e VIA(Visual Inspection with 5% Acetic Acid) and VILI method (aided visual inspection of the cervix after application of Lugol's iodine), by trained health care workers among women in the 35-60 years age group. The VIA and VILI tests are used as parallel screening tests for primary screening with either of the test being positive test taken to constitute an overall positive result.

- Screening for early stages of breast cancer is done by Clinical Breast Examination (CBE), by trained health care workers, among women in the 35-60 years age group.

- Screening for oral cancers is done by clinical examination of the oral cavity (Oral Inspection), by trained health care workers, among all women tobacco users in any form (smoked/smokeless) with counseling/tobacco-cessation advice.

Screening for Men

- Screening for oral cancers is done by clinical examination (Oral Inspection)of the oral cavity, by trained Male Health Workers, among all men tobacco users. They are provided counseling/tobacco-cessation advice and treated as the need be.

First-referral level

Women/men found positive by any of the referral criteria set by the screening tests are referred to the first-referral level unit (FRLU). The FRLU consists of one Medical Officer, one trained health care worker, one support staff and a driver. The FRLU provides clinical diagnostic confirmation for screen positive women referred by MESUs. The FRLU travels with the MESUs to the selected primary screening location for this work.

Women/men found negative on the screening test are informed of their test result with counseling and advise on tobacco cessation.

Women/men with diagnostically confirmed precancer/ cancerous lesions are informed of their test result by house visits by the medical social workers, counseled and motivated for the need for referral to the local base hospital for treatment.

Diagnostic and Treatment Services

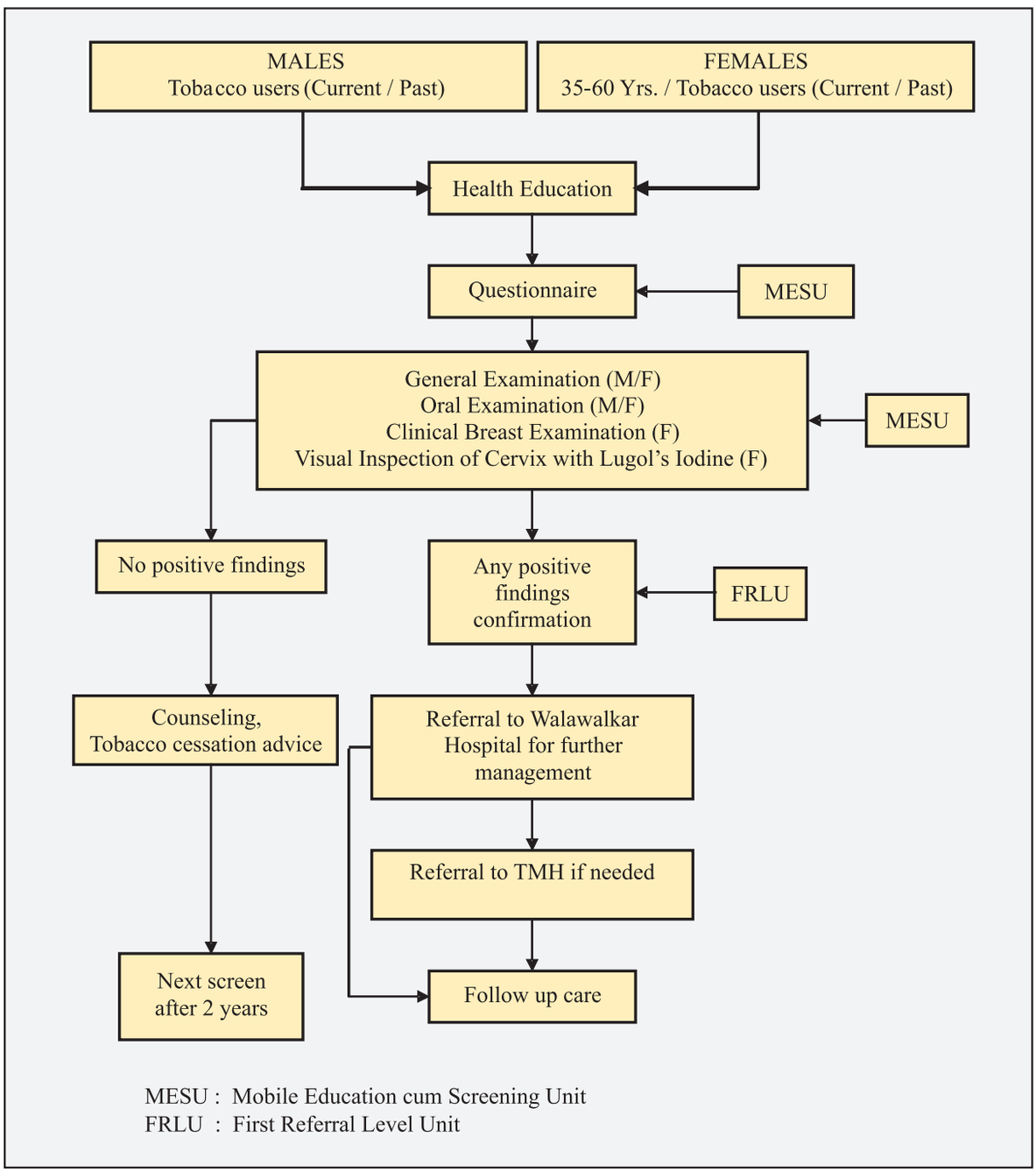
For a successful implementation of a cancer control programme it is important to provide comprehensive cancer care services under one roof in order to get maximum compliance for referral and treatment. Diagnosed cases from the screening camps are unlikely to follow up for treatment if the diagnostic and treatment facilities are not located in the reasonable commutable distance from their localities.

Hence it was important to identify an intermediate care facility (Base Hospital) with in the region to provide for comprehensive cancer care services for referral and management of diagnosed cases. The TMCROP project identified BKL Walawalkar Hospital, run by a nonprofit charitable organisation (equivalent to District Level Hospital), located at Dervan, Ratnagiri District as its base hospital.

Diagnostic confirmation and treatment facilities at the base hospital are suitably upgraded for the cancer patient treatment and management, except for radiation therapy facilities which could not be provided under the budget.

The existing physicians and surgeons at the hospital have been trained at Tata Memorial Hospital for suitable periods to enable them to undertake cancer treatment and management. Oncology consultants from the tertiary care hospital i.e TMH visits the base hospital on a

TMCROP Screening Protocol



periodic basis. Management guidelines are set to give optimum treatment to the patient depending on the curability of the disease. Due to the lack of radiation therapy facilities at the base hospital, patients requiring radiation treatment are referred to Tata Memorial Hospital or the identified radiation therapy centers. In the 5 year plan of the Government of India (April 2007 to March 2012) it is proposed to set up full fledged Radiation Therapy Center at the base hospital

Telemedicine services have also been set up between the base hospital at the project site and the Tata Memorial Hospital, to aid efficient patient treatment and follow up management.

Quality Assurance, Monitoring and Evaluation

A quality control for adequacy and correct interpretation of the screening test procedure, and other aspects of program implementation is undertaken at regular intervals by the programme managers.

Tracking system for follow up of persons with screen positive test result and further treatment completion have been developed with action initiated in a desired timeframe, documenting reasons for noncompliance to follow up.

An adequate Data Collection System is in place for maintaining screening and treatment data base, with the help of appropriate computer software programmes with linkage of the personal records with cancer registry.

An evaluation of process measures like participation rates, screen positivity rates, compliance to diagnostic confirmation, compliance to treatment completion and case detection rates is carried out at regular intervals.

Under the TMCROP project till date 60,000 men/women have participated in the screening programme with an overall participation rate of 44%. The screen positivity rate for Oral, Breast and Cervical cancers was 2.2%, 1% and 3.8% respectively 293 malignant cases of Oral (n=192), Breast (n=54) and Cervical cancers (n=42) have been diagnosed and treated under the programme. The detection rate for Oral, Breast and Cervical cancers being 0.12%, 0.06% and 0.12% respectively. Compliance for diagnostic confirmation of the test positive result was around 70% with an overall compliance for treatment completion being 65%.

Lessons Learnt

- Community awareness programmes underwent a lot of changes and transition in the context of providing correct and essential information related to prevention, screening and management of common cancers. Reaching men within the community in a conservative culture, with the same health awareness messages about the importance of breast and cervical cancer prevention was a daunting task, but did make a good impact in motivating their partners to be screened and treated where necessary.
- Organizing community cancer screening services was an uphill task in a conservative community with illiteracy, ignorance, prevalent caste culture, local politics and suspicious attitudes towards screening services being offered. It was possible to overcome these hurdles by selecting the project team from the local community itself & equipping and training them in managerial and communication skills, good community networking with key local leaders/ women groups, thus enabling them to get consistently good community participation for screening activity.
- Inspite of selection of a base hospital (BKL Walawalkar Hospital) which is centrally located within the region with diagnostic facilities for cancer detection and treatment, compliance for referrals and treatment is a key concern. It

was observed that individuals are not ready to seek health facility if required to travel a distance beyond 100 kilometers and were not willing to complete the treatment if referred beyond the local facility for radiation treatment due to non availability of the same at the base hospital in the present project.

After following up the patients with incomplete treatment it was found that the distance, the cost incurred for traveling, the requirement of accommodation facilities at the referred place and the daily wages lost due to accompanying person were some of the reasons quoted for non compliance with treatment. This gives an insight into the aspect of developing "Comprehensive cancer care facilities" including Palliative care facilities under one roof.

Acknolwdgements

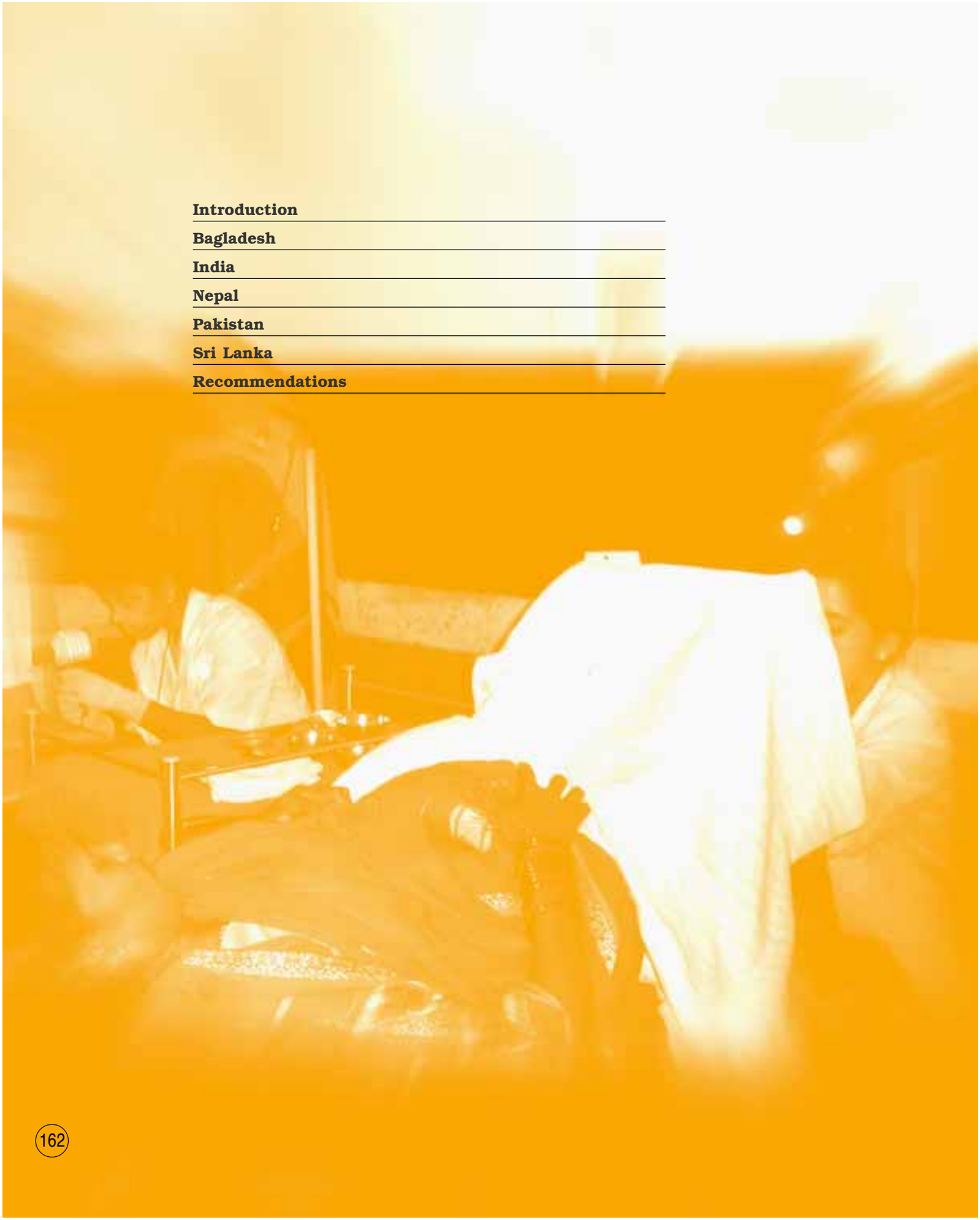
The authors would like to acknowledge the entire staff and management of TMCROP and BKL Walawalkar Hospital for their outstanding efforts in the conduct of the project.

Dr. K. A. Dinshaw is the Project Director, Dr. S. S. Shastri is the Officer-in-Charge, Dr. S. Banavali and Dr. Suvarna Patil are the Project Coordinators. Dr. S. Pimple is the Associate Project Coordinator of the TMCROP.

The burden of cancer in the developing regions of the world is rapidly increasing. Control of communicable diseases, increased life expectancy and overall growth of the population have all contributed to such an increase. Improvements in diagnostic techniques, accessibility to such services, general awareness about cancer with better literacy have also added to the increase in detection of cancer. Control of cancer in the setting of a developing country is challenging. More so, if the programmes have to be based on research evidence and the results sustained over a period of time.

Five countries in the region have provided a summary of the cancer control activities in their respective countries. These countries include Bangladesh, India, Nepal, Pakistan and Sri Lanka. Most of the scenario on cancer and especially its control in all these countries is similar. However, based on the availability of resources, each country has progressed in different directions towards designing and implementation of cancer control programmes. Subsequent to the summary by each of these countries a common matrix and schema for cancer control in the region is given.

National Cancer Control Programmes in South Asia



National Cancer Control Programmes in South Asia

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Introduction

Screening for the cancer of the cervix has rightfully received the priority for control of cancer in Bangladesh. This includes visual inspection of cervix with acetic acid followed by colposcopy, pathological examination and diagnosis. The screening activities for cancer cervix are being implemented as a pilot programme in 16 districts. Gradual expansion of this programme is being considered after evaluation of the results of the pilot study. Tobacco chewing is common in Bangladesh as in the rest of the subcontinent. Consequently cancers due to the use of tobacco constitute a major portion of all cancers. In 2005, the parliament of Bangladesh has passed a law to ban production, use, buy-sale and advertising of smoking and tobacco products. Bangladesh has also signed in the framework of convention on tobacco control by WHO in 2003.

India is a vast country and a National Cancer Control Programme (NCCP) has been under operation since 1975. The main goals have been the primary prevention of cancers through health education especially on hazards of tobacco consumption and the necessity of genital hygiene for prevention of cervical cancer. The goals also include early detection and diagnosis of common cancers like that of cancer of the cervix and breast. The third goal was to strengthen existing cancer treatment facilities and finally to provide palliative care for patients with terminal cancer.

Over the years, the NCCP has helped in commencing oncology wings in several medical colleges, recognition of 25 Regional Cancer Centres in different parts of the country and conduct of specific District Cancer Control Programmes in selected districts. Non Government Organisations(NGOs) were also provided support for conduct of health education and early detection camps. Some of the new initiatives under this NCCP programme include - supply of morphine to pain and palliative care units, commencing of telemedicine schemes and training of cyto-pathologists & cyto-technicians.

The Indian parliament passed the "Cigarette and Other Tobacco Products Bill 2003" in April 2003. This bill became an act in May 2003. Rules were formulated and are being enforced from 1st May 2004. India also has a network of cancer registries under the National Cancer Registry Programme (NCRP) of the Indian Council of Medial Research (ICMR). This programme has helped to lay a strong foundation for evidence based focussed cancer control

programmes. The details of this activity are given in chapter 1.

In 1991, the Government of Nepal established a national level cancer centre, with the major tasks of setting up of a cancer registry programme, cancer education and awareness campaign, cancer screening and prevention activity and provide cancer directed treatment. In 1999, Nepal has also commenced a cervical cancer screening programme for women. Mass screening by visual inspection of the cervix has been organised since 2002.

The Government of Pakistan along with its Ministry of Health and the World Health Organisation(WHO) and an NGO signed a public private partnership in 2004 with the aim of developing and implementing a long term plan for control of non communicable diseases including cancer. The framework of action includes, establishment of cancer registries, programmes for the early detection of cancers, evolving cost effective strategies for prevention of cancers, capacity building and plans for pain relief and palliative care. The priority sites of cancer for population screening include oral and cervical cancers and to some extent cancer of the breast in women. However, they found the cost of mammography testing to be prohibitive.

Sri Lanka established a National Cancer Control Programme (NCCP) in the year 1980 following a recommendation by WHO team that made a detailed survey in cancer morbidity and mortality in Sri Lanka in 1979. Some of the current activities under this programme include, maintenance of a cancer surveillance system including the pathology based cancer surveillance activity, pap smear examination in well women clinics, training of public health care workers and educational programme for school children. The future plans include development of a population based cancer registry in Colombo district and development of a national centre for cancer screening.

The foregoing gives an indication of the status of cancer control activity in the region. Needless to say much can be done with additional resources to improve the cancer control programmes especially if it has to be evidence based. These have to be done at different levels depending on the facilities that are available within the existing infrastructure and with additional inputs wherever required. Accordingly, a matrix or schema has been drawn and is given at the end of this chapter in the form of a table. This matrix is for planning and implementing cancer control with itemised application in the context of developing countries in general and South Asia in particular. Accordingly, the matrix is broadly divided into -

A. Organisational Set-Up

B. Information Collation and Primary and Secondary Prevention Activities

C. Clinical Management

D. Specific Cancer Control Activities

Under each of these broad types, 13 different types of institutions / organisations have been identified. Each of these institutions would have different kinds of infrastructure. Besides the usual diagnostic and clinical departments, a Comprehensive Cancer Centre (CCC) would be expected to have the departments of cancer registration, cancer epidemiology, preventive oncology, pain relief unit and should also function as a source of training of human resources at different levels (even up to post graduate degree in surgical or medical oncology). Accordingly, such a centre would need to have both population based and hospital based cancer registries expected to undertake survey of selected populations, conduct opportunistic as well as population based screening and have permanent cancer detection clinics in their institutions. They should also participate in information dissemination and have all facilities for cancer diagnosis, treatment, follow up etc.

At the bottom of such categorisation, we have the general practitioners, dentists and others who would have a major role to play especially in facilitating specific cancer control activities.

The tables are only a framework and one needs to elaborate on each cell based on the kind of infrastructure, resources and population set up.

BANGLADESH

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Introduction

Data from hospital statistics indicate that cervical cancer is a major health problem among the Bangladeshi women. It was the leading site in that sex constituting about 22-29% of all cancers in females followed by cancer of the breast (17.7%). Studies also show that the leading site of cancer among males was cancer of the lung accounting for 22% of all sites of cancer in males . [1-5]

Because of the huge load of cancer patients barely a proportion of cervical cancers actually go through the process of clinical management – in terms of diagnosis, treatment and follow-up. This is done at few institutes and tertiary level hospitals. Surgical facilities are available in some institutes such as Cancer Institute and Research Hospital (CIRH), Bangabandhu Sheikh Mujib Medical University (BSMMU) and government medical college hospitals. Facilities for teletherapy are available in about six institutes. Brachytherapy is available only in Dhaka (Cancer Institute, BSMMU and Delta Medical Center). The high number of cervical cancer patients and inadequate treatment facilities demand the need of screening for this cancer and its prevention in Bangladesh.

Situation of cervical cancer screening in Bangladesh

Although cervical cancer is a major health problem among the women of Bangladesh, an organised screening programme has not been developed at the national level. Screening is practised from time to time in some institutes, tertiary level hospitals and private practitioners.

Absence of such organised screening is partly due to minimal facilities for cyto-pathological examination, which are available essentially in only major hospitals. Routine cervical smear testing has been practiced for the last 10 years in the gynaecological out patient department of BSMMU and 5% of smears showed dyskariosis.[6] BSMMU also has a well organised cytopathology department and a colposcope clinic that receives and treat many women with CIN. Several private laboratories have developed cytopathology facilities and screening is also done once in a while by some of the gynaecologists and private practitioners. CIRH also practices opportunistic screening for some of the women at their OPD by performing pap smear testing. Chittagong Medical College Hospital (CMCH) has a colposcopy clinic.

Thus screening for cancer and mainly cervical cancer screening is

Table-1 : Ten common Cancers in order of frequency at the Radiotherapy Department of DMCH (1990-1992) (N=10,095).

Male (N=6,620)				Female (N=3,475)		
Sl.	**Site**	**No.**	**%**	**Site**	**No.**	**%**
1.	Lung	1384	20.91	Cervix uteri	845	24.32
2.	Larynx	793	11.98	Breast	614	17.67
3.	Unknown Primary	438	6.62	Oral cavity	270	7.77
4.	Lymphoma	437	6.60	Ovary	206	5.93
5.	Oropharynx	419	6.33	Unknown primary	132	3.80
6.	Oral Cavity	388	5.86	Oropharynx	130	3.74
7.	Oesophagus	342	5.17	Oesophagus	128	3.68
8.	Stomach	221	3.34	Lymphoma	115	3.31
9.	Bone	218	3.29	Lung	108	3.11
10.	Skin	178	2.62	Bone	95	2.73

Table-2 : Districts involved in Pilot Programme for Cervical Cancer screening based on VIA Method

Sl. No.	Name of District	Sl. No.	Name of District
1	Manikganj	9	Faridpur
2	Comilla	10	Narayanganj
3	Tangail	11	Cox's Bazar
4	B. Baria	12	Joypurhat
5	Khagrachari	13	Rangpur
6	Rangamati	14	Barisal
7	Bogra	15	Chandpur
8	Hobiganj	16	Munshiganj

mainly undertaken at premier institutions in Dhaka (BSMMU, CIRH and DMCH). In the rest of the country facilities for cervical cancer screening is almost non-existent. Therefore the Government of Bangladesh (GOB) is initiating a major plan for large scale screening of the population for cancer.

Steps taken by the Government for cervical cancer screening

An orientation meeting on cervical cancer screening was arranged by GOB on 16th October 2003 at Dhaka in which different methods of cervical cancer screening were discussed. In that meeting, visual inspection of the cervix with Acetic Acid (VIA) was considered as a feasible method of screening of cervical cancer. This activity, was planned to be undertaken by field health workers and a pilot programme has been developed to assess the feasibility of implementation through the existing government infrastructure. Emphasis was given to community involvement and motivation by creating awareness. With technical support of UNFPA, the Department of Obstetrics and Gynaecology of BSMMU helped the Government for successful completion of this pilot programme of cervical cancer screening based on VIA method in 16 out of 64 districts by December 2005. Facility for colposcopic examination for this study were provided by BSMMU, DMCH and Chittagong Medical College Hospital (CMCH). Additional facilities for colposcopy will be developed gradually at other Medical Colleges and Institutes. Training of more gynaecologists on colposcopy and other aspects of cervical cancer screening will be arranged. Linkages are being developed between field level and referral organizations at higher levels (institutes/ medical colleges) for back-up services. Treatment of high grade dysplasia (CIN II/III) and long-term follow-up after treatment of CIN is being arranged.

Government health infrastructures involved in this pilot programme

Bangladesh has a comprehensive health infrastructure suitable for introducing screening programmes. Furthermore, the highly successful family planning program and the effort of NGOs has developed social awareness of women's health issues, which should aid the introduction of this potentially sensitive procedure for cervical cancer screening.

The highest level of government health infrastructure is the Ministry of Health and Family Welfare of Bangladesh and it performs its activities through two directorates - the Directorate of Health Services and the Directorate of Family Planning. Bangladesh has 64 districts. It has District (Sadar) Hospitals in each of these districts managed by the Directorate of Health Services. District Hospitals are large 300 – 500 bedded general hospitals with several departments including both outpatient and indoor facilities for obstetrical and gynecological patients. Each of the District Hospitals usually has an Obstetrics and Gynecology Consultant and several Medical Officers supported by nurses providing services round the clock.

The Maternal and Child Welfare Center (MCWC) provides family planning services at the district level. The MCWCs are Reproductive Health (RH) care centers which provide all categories of basic RH services. Two Medical Officers and four Family Welfare Visitors (FWVs) provide basic health services to the population and are responsible for providing MCH and FP care to all the women of reproductive age living within that district. Among the 64 Districts, 58 districts have MCWCs under the Directorate of Family Planning.

The lowest level health facility in rural Bangladesh is the Union Health and Family Welfare Center (UH&FWC) at each Union. At the UH&FWC basic health services are provided by a FWV and a Medical Assistant titled as SACMO. These two paramedics are generally responsible for providing MCH and FP care to all women of reproductive health living within that Union.

Completion of the Pilot Programme and present status

The pilot activity on cervical cancer screening based on VIA method was performed in 16 districts and for this pilot programme the department of Obstetrics and

Gynaecology of BSMMU conducted the training of health workers and doctors of MCWC and the District Hospitals. The target groups for cervical cancer screening are all ever-married women aged 30 years and above. These women were encouraged to attend their local MCWC (N=16) or the District hospital (N=16) or selected UH & FWCs (N=12).

The Medical Officers and FWVs from the MCWCs and Doctors/ Nurses from District Hospitals (DHs) received extensive training on the VIA method along with counseling, referral, follow up and management after screening. This pilot activity was an attempt to train manpower on the VIA method and to establish a system of screening of cervical cancer as well as providing treatment and referral linkages wherever possible. Gradual expansion of this programme will be considered after evaluation of the results of the pilot programme.

Breast Cancer Screening

Like cervical cancer screening, in Bangladesh breast cancer screening is also practised infrequently, by gynaecologist and surgical specialist. In majority of the cases clinical breast examination (CBE) is practiced with or without mammography. Among the national level institutes, BSMMU has a breast clinic and equipment for mammogram.

No system of breast cancer screening has been developed at national level. But a consensus has been taken to incorporate breast cancer screening along with cervical cancer screening programme.

Tobacco Control in Bangladesh

Bangladesh is a small, poor, densely populated country of roughly 130 million people, about 80 percent of who live in rural areas.[7] Due to different health and environmental problems, tobacco control has not gained much priority in this country. However tobacco use is widespread and increasing rapidly, and knowledge about the harm it causes to health is slight. Although other causes of death still dominate, tobacco use contributes a considerable amount to the overall burden of disease and death.

Smoking rates were higher among men (70.3% at 35-49 years) than women (6.6% at 35-49 years).[8] Tobacco chewing is common in Bangladesh, particularly among women and the rate for use of all forms of tobacco, smokeless and smoked, by women is around 50%.[9]

In Bangladesh, 70 percent of the tobacco produced is used for cigarettes and *bidis* (small cigarettes hand rolled in paper), 20 percent is consumed as chewing tobacco, and the remainder is used in cigars, snuff, and pipe tobacco. Only a small fraction of cigarettes have filtters.[10] Since the mid-1980s, Bangladesh has had a growing negative trade balance in tobacco and tobacco products as leaf imports have increased tremondously.[11]

During 1980s and most of the 1990s, tobacco control programme was limited to few groups as Amra Dhumpan Nibaron Kori (ADHUNIK), which, means, "We prevent tobacco", the Bangladesh Cancer Society, Madok O Nesha Nirodh Shansthya (MANAS—the Association for the Prevention of Drug Abuse) and the National Non-Smokers' Forum. These groups achieved partial success and tobacco control activity was mostly limited to publicity on World No-Tobacco Day that falls on 31 May of each year.

Though, tobacco is available in different forms in Bangladesh, only cigarette packages carry a warning. This is printed (in Bengali), in small type, "Government warning: smoking is deleterious to health." The same warning is used on BAT billboards and on television advertisements but not on advertisements for cigarettes produced by other companies or for bidi.[12] The written warnings can be read by only about half the population. Better statistics are needed to track tobacco use among the population and to monitor changes when tobacco controls laws and interventions come into effect.

More than 93 percent of male smokers and more than 84 percent of female smokers know that smoking is generally bad for health, few are aware of specific effects such as cancer, respiratory diseases, stroke, and heart disease. In general, nonsmokers have slightly higher awareness of the diseases caused by smoking than do smokers.[13]

The Bangladesh Tobacco Company (BTC) controlled tobacco related business for many years until late

1990s. BAT was doing business in Bangladesh since 1954 but in the late 1990s BAT purchased controlling shares in the BTC.

Satellite Bangla channel casts advertisements for different brands of bidis and cigarettes and many of them say that smoking makes one strong, healthy, and irresistible to women.[14]

Though cigarettes production requires very little labor, bidi production employ a large number of women and children who are underpaid after working in an unhealthy setting.[15] There is opportunity of shifting from tobacco product use and manufacturing to other products.[16]

Initially, the dominance of doctors in tobacco control organizations kept the focus mainly on health, with little consideration to the non-health dimensions such as the direct and indirect costs of health care and lost earnings.

But in 1999 tobacco control activity gained momentum due to the aggressive activities of British American Tobacco (BAT) company. BAT's Voyage of Discovery campaign in the summer of 1999 included sailing a yacht carrying the John Player Gold Leaf brand logo to 17 countries in 177 days and Chittagong as the final destination attracted attention of people of Bangladesh. Despite a law prohibiting BTV from carrying tobacco advertisements, BTV repeatedly broadcasted advertisements for the Voyage. All these activities created a concern about tobacco control and gradually the activities improved and a number of organizations coordinated their activities and BATA (Bangladesh Anti-Tobacco Alliance) was born. BATA organized press conferences, seminars and a range of organizations and personalities included lawyers involved for tobacco control activities. They obtained High Court victory to tobacco control and by late 2002, strong new legislation had been submitted for consideration by Parliament.

Parliament passed a law to ban production, use, buy-sale and advertising of smoking and tobacco products on 15th March 2005. The law banned smoking in public places and public transport and advertises of Tobacco products and Ban of establishment of automatic vending machine. Bangladesh also signed in Framework Convention on Tobacco Control by WHO in 2003.

The balance of tobacco import and export was a net loss of over US$14.4 million in year 1997-98.[17] Bangladesh Cancer Society estimated that half of the annual deaths from cancer in Bangladesh (75,000 people) result from tobacco use. Research and publicity is necessary to reveal the negative economic impact and health hazards of tobacco use in Bangladesh, to convince policymakers to succeed in obtaining strong tobacco control laws and policies.

Conclusions

Screening of cervical cancer is in a preliminary stage of development. Government completed a pilot programme on cervical cancer screening based on VIA method and planning to bring all women of 30 years and above under an organized screening programme in near future. Development of organized population based screening needs lot of effort from government and a good system of follow-up needs to be created for successful implementation of the programme.

Screening using VIA method will be initiated at the primary health care level and within the existing infrastructure. Adequate colposcopy centres will be developed in the institutes and medical colleges throughout the country for management of VIA +ve and CIN cases. A follow-up mechanism will be developed to ensure management and follow-up of all positive cases.

Though government has taken some steps for tobacco control, the policy cannot be successfully formulated or implemented unless a broad base combined effort by government and NGOs around the country actively supports it.

Still other steps need to be taken including, ban production of tobacco leaf in phases, and help tobacco workers find other jobs, restrict permission and licenses for establishing tobacco factories, restrict the harvesting of tobacco to produce bidis. A heavy import tax on tobacco productions related materials will help further in tobacco control.

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INDIA

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The article gives an overview on the control of cancer in India, the strategies and initiatives taken under the National Cancer Control Programme, its goals and objectives, operative mechanisms with emphasis on health education, awareness generation, early detection and prevention of cancer. It also gives an idea about the availability of cancer treatment facilities in India.

Cancer has become one of the ten leading causes of death in India. It is estimated that there are nearly 2 – 2.5 million cancer cases at any given point of time. Based on the data from the National Cancer Registry Programme (NCRP) of the Indian Council of Medical research (ICMR). An estimated 0.7 – 0.9 million new cases of cancer occur annually with about 0.4 million deaths due to cancer. Population-based Cancer Registries under the NCRP indicate that the leading sites of cancer in men are oral cavity, lungs, oesophagus and stomach and in women cervix, breast and oral cavity. Cancers of oral cavity and lungs in males, and cervix and breast in females account for over 50% of all cancer deaths in India. WHO has estimated that 91 per cent of oral cancers in South-East Asia are directly attributable to the use of tobacco and this is the leading cause of cancer of oral cavity and lung in India.

National Cancer Control Programme in India was started in 1975-76.

The Goals & Objectives of the programme were

1. Primary prevention of cancers by health education which includes hazards of tobacco consumption and necessity of genital hygiene for prevention of cervical cancer.
2. Secondary prevention i.e. early detection and diagnosis of common cancers e.g. cancer of cervix, breast cancer and oro-pharyngeal cancer by screening methods and patients' education on self examination methods.
3. Strengthening of the existing cancer treatment facilities, which were inadequate.
4. Palliative care in terminal stages of cancer.

Evaluation of earlier National Cancer Control Programme (NCCP)

Based on an evaluation study of the NCCP by National Institute of Health & Family Welfare, New Delhi in 2002, National Cancer Control Programme was revised with renewed thrust for community based strategies in the prevention and control of cancer.

Existing Schemes under National Cancer Control Programme

1. **Oncology Wing Scheme** – This scheme had been initiated to fill up the geographical gaps in the availability of cancer treatment facilities in the country. Central assistance is provided for procurement of equipments, which include radiotherapy equipments beside other equipments of related specialities. The human resources are to be provided by the concerned State Government/ Institution. The civil work for installation of equipments is now permitted under the scheme. In view of the recommendations of the evaluation report of NCCP as well the working group for 10th plan strategies, the financial assistance under this scheme is now enhanced from Rs. 2.00 crores (Rs. 20 million) to Rs. 3.00 crores (Rs. 30 million). There are several district hospitals which are comparable to Medical Colleges in terms of facilities and need enhanced financial assistance, which are now taken care of by this scheme.

2. **Regional Cancer Center Scheme**–There are 25 Regional Cancer Centres (RCC) recognised by Government of India. The list of Regional Cancer Centres is annexed. Assistance to RCCs is provided not exceeding Rs. 3 crores (Rs. 30 million) for existing RCCs and Rs. 5.0 Crores to new RCCs based on action plan for developing infrastructure of the institution including equipments for cancer treatment to bring them to the desired level. The grant which was provided annually is now enhanced and made as one time grant. These centres are in different stages of development. Six of these are charitable Non Governmental Organisations (NGOs). These centres are envisaged to be self sustainable with user charges and other resource generation mechanisms.

3. **District Cancer Control Programme** – It is known that a large number of cancer cases can be prevented with suitable health education and early case detection. Accordingly the scheme for district projects regarding health education, early detection, prevention and pain relief measures was started in 1990-91. Under this scheme one time financial assistance of Rs.22.00 lakh is provided to the concerned State Government for each district project selected under the scheme with a provision of Rs.17.00 lakh every year for the remaining four years of the project period. The project is linked with a Regional Cancer Centre or an institution having adequate facilities for treatment of cancer patients. The patients are provided treatment at the concerned Regional Cancer Centre or the nodal institution. The scheme is now revised with more focus on prevention, early detection etc. The financial assistance is now proposed to be released to the nodal agency (RCC/well developed Oncology Wings in Medical Colleges) instead, to the State Govt. as in earlier scheme.

4. **NGO Scheme** – Earlier NGO scheme for cancer awareness, prevention etc. was operated centrally. Now this scheme is decentralized and entrusted to the RCC/Govt. medical Colleges as nodal agencies. Under the scheme financial assistance of Rs. 8000 per camp is provided to the registered voluntary organisations recommended by the nodal agency and state government for undertaking health education and early detection activities in cancer.

5. **New Components** – New components of IEC and Research are made for the first time now. This would be operated at central level.

Achievements

There are 210 institutions having more than 345 teletherapy facilities across the country. There are 25 RCCs providing comprehensive Cancer treatment facilities, besides carrying out research. There are efforts now to reduce the geographical gaps in the cancer treatment facilities in the country.

New Initiatives

There are some activities, which were carried out under the National Cancer Control Programme out of WHO funding under the biennium pattern. In WHO biennium 1998-1999, 16 workshop/ training programmes were conducted throughout India. The Pap Smear Kits and Can scan software were supplied to 12 RCCs. Morphine tablets were also supplied to them. In the WHO biennium

2000-2001 following were carried out: -

- Outreach activities by medical colleges for early detection and awareness of cancer.
- Training of appropriate personnel in early detection and awareness of cancer.
- Supply of Morphine
- Telemedicine and supply of computer hardware and software.
- IEC activities.
- Modified District Cancer Control Programme
- National Cancer Awareness Day
- Training of cytopathologists and cytotechnicians in the quality assurance in Pap Smear technology
- Participation in Health Melas and distribution of health education material
- Postage stamp depicting a woman carrying out 'self breast examination' was brought out by Deptt. of Posts on National Cancer Awareness Day
- Broadcast of health education audio material developed by CNCI, Kolkatta, through FM Radio channels.

In the WHO biennium 2002-03 the activities continued in similar way. A book on '50 Years of Cancer Control in India' was compiled and published with WHO biennium assistance.[1]

Modified District Cancer Control Programme

Modified District Cancer Control Programme was carried out in year 2001 & 2002 in four states of Uttar Pradesh, Bihar, Tamil Nadu & West Bengal. Sixty Blocks were taken and 1200 Non Communicable Disease (NCD) workers, 30 supervisor doctors, and consultants were appointed. This was a Survey cum health education drive in which about 12 lakh women in the age group 20-65 years were contacted. Health education about general ailments, cancer prevention and early detection besides 'Self Breast Examination' was imparted. The data collected is under analyses.

National Cancer Awareness Day

National Cancer Awareness day was observed for the first time on 7-11-2001. A commemorative stamp on Cancer and first day cover portraying Madame Curie was released at Vigyan Bhawan, New Delhi on the same day. A newspaper advertisement on National Cancer Awareness Day was also released in prominent dailies across the country. The National Cancer Awareness Day is being observed throughout the country since then. Media kit containing audio visual spots and posters is also being made which would be utilised for the general public awareness about cancer.

Eleventh Plan strategies for National Cancer Control Program

The funding made available for NCCP in 9th five year plan (1997-2002) was Rs. 1850 million which is increased to Rs. 2850 million in the 10th five year plan. In the financial year 2005-06 the allocation for NCCP is Rs. 690 million and the provisional budget allocation for financial year 2006-07 is Rs. 820 million. Task force for 11th five year plan (2007-2012) strategies for National Cancer Control Programme has been constituted. The task force consists of senior experts and stake holders from different specialities related to cancer. The task force is likely to submit report by May 2006. The budget allocation is likely to be enhanced for cancer control in 11th five year plan.

Research

The research in cancer is being carried out by several agencies including RCCs. Indian Council of Medical Research (ICMR) is the apex agency for co-ordinating and collaborating with national and international agencies in the field of cancer. Several national and international conferences and workshops have been held by ICMR. India will be first in the developing countries to join International Agency for Research in Cancer, Lyon, France. This step is likely to give boost to cancer research in the region. ICMR has also decided to carry out research in cancer vaccine along with a leading company.

Human Resource in Cancer Control

Several categories of experts, healthcare workers and para medical personnel are required. There is an acute shortage of some categories specially radiation physicists and cyto-technicians. Efforts would be made to bridge the shortage by enhanced training facilities at various RCCs. Training manuals have been published for the purpose of training of various personnel at RCCs and Medical Colleges under National cancer Control Program.

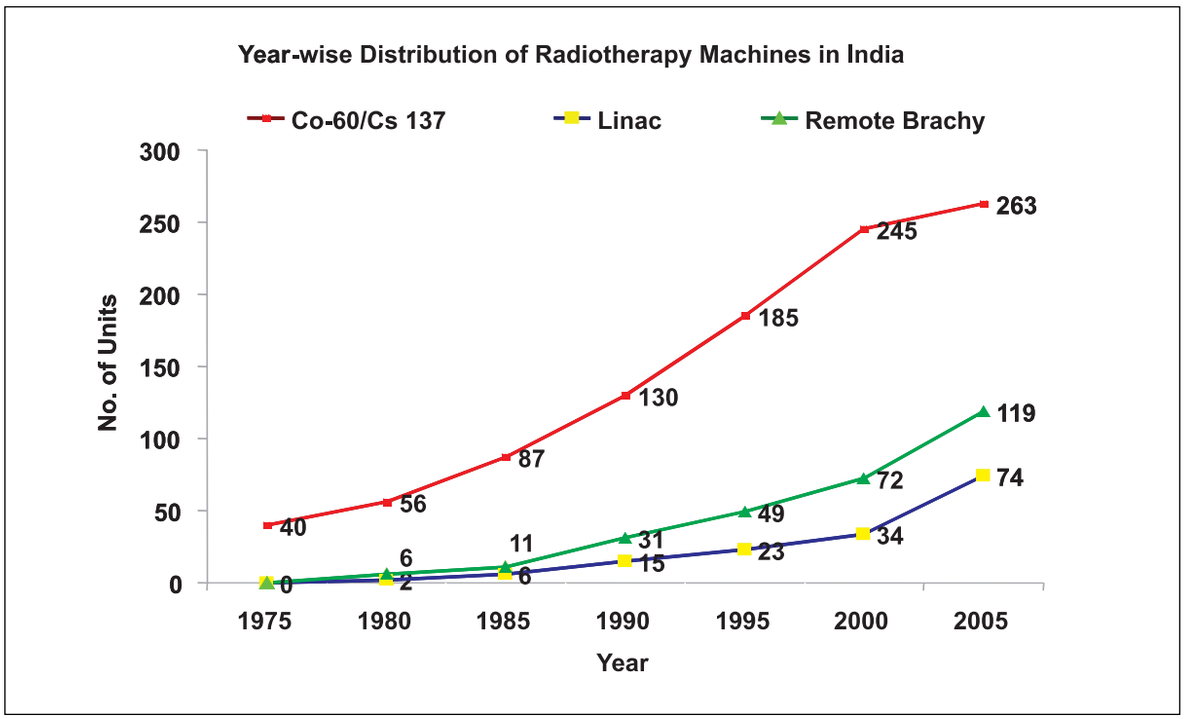
Tobacco Control

There are estimated 18.4 crore Tobacco users (15 crore men, 3.4 crore women). Tobacco Cell is now functional since year 2000 and several activities in the area of tobacco control have been carried out. Indian Parliament passed the Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Bill, 2003 in April 2003. This Bill became an Act on 18 May 2003. Rules were formulated and enforced from 1 May 2004. Thirteen Tobacco cessation clinics are now functional and it is likely that all RCCs would have one such clinic in due course of time. 'Tobacco Control in India' book has been published under Indo-US collaboration. The document is available on the internet for reference by researchers and stakeholders in tobacco control.[2]

Thus it is seen, that since 1975, in the last 3 decades, major initiatives and strategies have been taken up to address the problem of cancer. From a curative strategy, efforts are on in awareness generation and health promotion through health education so that early detection of cancer is made possible & effective.

State-wise Distribution of Radiotherapy Installations as on September, 2005[3]

	Teletherapy				Brachytherapy				
State	No. of Centres	Teletherapy Units			Remote Brachytherapy		Manual Brachytherapy		No. of Centres
		Co-60	Cs-137	Linac	LDR	HDR	Intra-cavitary	Intersti-tial (Ir)	
Andhra Pradesh	26	22	0	5	2	11	12	5	19
Assam	6	8	0	1	2	1	0	0	2
Bihar	5	6	0	0	1	2	0	0	3
Delhi	13	17	0	10	2	6	2	2	7
Goa	2	2	0	0	0	0	1	0	1
Gujarat	8	10	1	6	1	5	2	2	5
Haryana	4	8	0	4	1	3	2	1	2
Himachal Pradesh	1	2	0	0	1	0	1	0	1
Jammu & Kashmir	3	5	0	1	1	0	0	0	1
Karanataka	16	26	1	5	1	4	10	6	12
Kerala	10	16	1	6	2	5	4	1	6
Madhya Pradesh	12	17	0	0	2	5	1	1	7
Maharashtra	29	34	0	10	7	13	14	2	26
Mizoram	1	1	0	0	0	1	0	0	0
Orissa	5	7	0	1	1	1	1	0	3
Pondicherry	1	2	0	0	0	1	1	0	1
Punjab	7	6	0	2	1	3	1	1	5
Rajasthan	7	10	0	1	1	3	2	1	5
Tamil Nadu	28	28	0	15	5	8	16	5	22
Uttar Pradesh	14	21	0	3	5	6	3	0	6
West Bengal	12	15	5	4	1	4	3	1	5
Total	**210**	**263**	**8**	**74**	**37**	**82**	**76**	**28**	**139**



LIST OF REGIONAL CANCER CENTRES

1. Kidwai Memorial Institute of Oncology, Bangalore (Karnataka)
2. Gujarat Cancer & Research Institute, Ahmedabad (Gujarat)
3. Cancer Hospital Research Institute, Gwalior (Madhya Pradesh)
4. Cancer Institute, Chennai (Tamil Nadu)
5. Regional Cancer Centre, Thiruvananthapuram (Kerala)
6. Regional Centre for Cancer Research and Treatment Society, Cuttack (Orissa)
7. Dr. B. B. Cancer Institute, Guwahati (Assam)
8. Chittaranjan National Cancer Institute, Kolkatta (West Bengal)
9. Dr. B. R. A. Institute Rotary Cancer Hospital (AIIMS), New Delhi
10. Tata Memorial Hospital, Mumbai (Maharashtra)
11. Kamala Nehru Memorial Hospital, Allahabad (Uttar Pradesh)
12. M.N.J. Institute of Oncology, Hyderabad (Andhra Pradesh)
13. R. S. T. Cancer Hospital, Nagpur (Maharashtra)

14. Indira Gandhi Institute of Medical Sciences, Patna (Bihar)
15. Acharya Harihar Tulsi Das Regional Cancer Centre, Bikaner (Rajasthan)
16. Indira Gandhi Medical College, Shimla (Himachal Pradesh)
17. Post Graduate Institute of Medical Sciences, Rohtak (Haryana)
18. Pt. J.N.M. Medical College, Raipur (Chattisgarh)
19. Pondicherry Regional Cancer Society, JIPMER, Pondicherry
20. Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh
21. Civil Hospital, Aizawl (Mizoram)
22. Sher-i-Kashmir Institute of Medical Sciences, Srinagar (Jammu & Kashmir)
23. Sanjay Gandhi Post-graduate Institute of Medical Sciences, Lucknow (Uttar Pradesh)
24. Regional Institute of Medical Sciences, Imphal (Manipur)
25. Government Arignar Anna Memorial Cancer Research Institute and Hospital, Kancheepuram (Tamil Nadu)

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NEPAL

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Country Profile

Nepal is one of the developing countries in Asia, predominantly a mountainous and landlocked country, China to the North and India on the east, south and west. The area is 147,181 sq. km and a population of 24 million with male 11,587,547 and female 11,627,134, sex ratio 0.997. 14% live in urban area. Regarding the health status, population per doctor is 18,439, population per hospital bed is 2349, and population per health care provider (Doctor, Nurses/ANM, and AHW) is 2071.[11]

Magnitude of the problem of cancer in Nepal

A population based cancer registry has not been established as yet in Nepal. Thus exact figures on incidence and prevalence of cancer cannot be stated. Inadequate reporting of mortality and morbidity adds to the problem of estimating the figures. But in the last decade there have been some developments in cancer control in Nepal.

Establishment of a National level Cancer centre -1991

Establishment of a national level hospital to undertake all the cancer related activities. The major tasks that this centre will undertake are [1,2]

- Establishment of a cancer registry programme,
- To conduct cancer education and awareness
- Undertake cancer screening and prevention programme,
- To undertake all the aspects of cancer treatment such as Surgery, Radiotherapy and Chemotherapy.
- And finally to undertake cancer research activities.

Cancer statistics in Nepal: A Hospital Based study, 1994

For the first time in Nepal, with the objective of assessing the burden of cancer in the country, a cancer prevalence survey was carried out by BPKMCH, in 6 major tertiary level referral hospitals. This included the cancer cases reported to these tertiary National level hospitals for a period of 5 years [April 1987-March 1992}.

The ratio of cancer in females was higher (55%) as compared to 45% in males. The ten major cancers from this study are shown in the table below.

Table 1.
Cancer Prevalence Survey 1994

Type	Frequency	Percentage
GI. System	1661	32.63
Female Genital	1066	20.94
Respiratory System	473	9.29
Breast	365	7.17
Skin	274	5.38
Lymphoma	267	5.25
Leukemia	243	4.77
Urinary System	214	4.20
Male Genital	155	3.05
Skeletal System	155	3.05
Others	217	4.27
Total	5090	100

Table 2.
Health indicators and targets for the 10th five years plan
(2002/2003 -2006/2007)[1]

Indicators	Statistic of 2002/03	Target for 2006/07
Cancer incidence rate (per 100000)	33.58	30.1
Infant Mortality rate (per 1000)	64	45
Child Mortality Rate		
((<5yrs) Per 1000)	91	72
Crude Death Rate (per 1000)	9.6	7
Life Expectancy	58.6	65
Total Health Expenditure as %	5.20	6.5

Incidence and prevalence of cancer in Nepal - an estimate

Assessment of cancer burden including most prevalent form of cancer and dynamics of the situation is essential in order to plan the National cancer prevention and control program. In any region it is essential to have incidence, prevalence and mortality data on cancer for an overall situation analysis. Usually the number of new cases of cancer occurring in a defined geographical region is expressed per 100,000 population per year. A population based cancer registry covering reasonable proportion of population will provide the information on occurrence of new cases. But in the country like ours, where mortality data and information on cancer incidence are underreported, estimate on probable total cancer incidence is made by considering the size of the countries population, age and sex distribution and utilizing the available data in Table 2. In Nepal, patients usually present in late stages and survival rate is also low even after the treatment. In such situations it is therefore assumed that prevalence {point} is estimated to be 1.5 times the overall expected incidence and will indicate the current probable burden. Based on these assumptions the prevalence of cancer in our country can be estimated to be around 35,000-40,000 at any point of time. Crude incidence rate of Cancer in Males is 106.6/100000 (New cases 12327) Crude incidence rate of Cancer in Females is 112/100000 (New cases 12978)

Cervical cancer screening program

Cervical cancer screening in women in Maternity Hospital; 1999-2000

As per the available data in the country, it was a first study of its kind regarding the cervical cancer screening that was undertaken in the Maternity Hospital for a one year period with collaboration with WHO. As a screening, assessment of pre neoplastic and neoplastic lesions in women attending ANC clinic in Maternity

Table 3. Assessment of Pre-neoplastic and Neoplastic Lesions in Women attending ANC Clinic at Maternity Hospital 1999-2000

Cytological Finding	Frequency	Percentage
Normal Cytology	232	11.6
Cervical Infection	1635	81.8
Abnormal Cytology	133	6.6
Total	**2000**	**100**

Table 4. Cytological Abnormalities

Screening Abnormalities	Number	% of total number
CIN I	118	5.9
CIN II	6	0.3
CIN III	3	0.15
Invasive Cancer	6	0.3
Total	**133**	**6.65**

Hospital was done in the year 1999-2000, in 2000 women by PAP smear (Table 3). It was found that 6.6% (133/2000) were abnormal cytology which showed CIN I 5.9% (118/133), CIN II 0.3% (6/133), CIN III O.15% (3/133) and invasive cancer 0.3% (6/133) (Table 4). PAP smear is practiced in Nepal as a method of cervical cancer screening at all government and private hospitals and as opportunistic screening in mass community, in health camps.

Organized Mass screening by VIA: 2002

In developing countries like Nepal, cervical cancer forms a bulk of tumor burden in women.[9,6] It is well known that an effective control programme brings down the incidence and mortality, but as in general, there are no sufficient screening programs due to lack of awareness, resources, facilities and expertise to conduct the screening at the national level and have large population coverage[5,7,8]. In this context many International organizations and experts have played a major role as a catalyst to establish, and to run the program.

In the year 2002, IARC/WHO and the International Network for Cancer Research and Treatment (INCTR) Belgium, have helped to establish a mass cervical cancer screening program from 3 centers in Nepal with the technique of VIA. with initial target of screening 15,000 women at a time. The primary aim of this program was to introduce the mass cervical cancer screening program in Nepal and to build up the infrastructure and expertise needed. The program is having a catalytic effect and was presented in the national level meeting to discuss with the policy makers as to how it can be incorporated into the National Health system. As a result, the government has evolved a policy to incorporate cervical cancer screening as a procedure at the basic health care level. Human resources will be trained and facilities for successfully executing the same will be provided.[1] The task will be undertaken by the Non Communicable Disease –NCD under the HMG Ministry of Health with collaboration of the Division of Epidemiology and preventive oncology at BP Memorial cancer Hospital [BPKMCH]. A process would also be evolved for Networking and collaborating with any NGO and the INGO those are working in the field of cancer in the country.

Summary: Cancer Control Programme in Nepal,

Focal Point for Non Communicable Diseases in the country under The Ministry of Health is formed which will co-ordinate all the cancer related activities in the country.

A National level referral Hospital was established in 1991. The Department of Epidemiology and Preventive oncology will work in cancer awareness, education and screening.

The government, under the umbrella of NCD-Focal point will co-ordinate with all NGOs and INGO,s that are working in the country in the field of cancer, both in the curative as well as preventive aspects.

A cancer registry programme has been started with the help of HMG/ WHO, in 2002,

BPKMCH has established the network with all the major hospitals in the country for data collection. It has been training the manpower as the medical recorders from all the centers to strengthen the cancer registry program.

Population based cancer registry has been started from one district now out of 75 districts in the country. A cancer estimate done by the epidemiologists shows that the prevalence of cancer in the country is around 35,000-40,000 cases at any point of time.

The hospital based data has listed cancers of the lung, cervix, GI, Breast, Head and Neck as the commonest cancers among others.

There are 4 cancer treatment centers in the country which provide all the facilities of Radiation, Medical and Surgical Treatments. Except for few

treatment modalities like Bone Marrow transplantation and Immunohistochemistry most of the cancers can be treated in the country itself.

Cancer research as in other developing countries is just in the initial stages but is on the start now.

It is expected that more and more data will be available in the coming years. An effort to control the cancer and effective National Cancer Control Program will be developed in the country with the help of WHO and various other NGOs and INGOs working in the country.

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PAKISTAN

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Karachi Cancer Registry, Pakistan

Introduction

Pakistan is an Islamic Republic in Southern Asia, bordering the Arabian Sea (30 00 N, 70 00 E). It is situated between India on the east, Iran and Afghanistan on the west and China in the north. The total area of Pakistan is 803,940 sq km, 778,720 sq km of land and 25,220 sq km of water. The administrative divisions of the country are 4 provinces (Sindh, Punjab, Baluchistan and North-West Frontier Province), a territory (Federally Administered Tribal Area), 1 capital territory (Islamabad), and the Pakistani-administered portion of the disputed Jammu and Kashmir region (Azad Kashmir and the Northern Areas).[1]

The estimated population of Pakistan is 162,419,946, with an annual population growth rate of 2.03% (July 2005). The population is young, the median age being 19.44 years in males and 19.74 years in females. The age structure is a typical developing country pyramid with the 0-14 years constituting 39.6% of the population (male 33,104,311/ female 31,244,297); the 15-64 years group forming the bulk i.e. 56.3% (male 46,759,333/female 44,685,828) and the 65+ years comprising 4.1% (male 3,189,122/ female 3,437,055) of the population. The major ethnic groups in the country are Punjabi, Sindhi, Pashtun (Pathan), Baloch, Muhajir (immigrants from India at the time of partition and their descendants). Muslims comprise 97% of the population with the Christians, Hindus, and other religions comprising 3% of the population.[1]

Pakistan is a developing country, which falls into the low to medium resource category by WHO classification. Since 2001, it has had a bolstered economy. The world health report 2005[2] on Pakistan indicates a GDP per capita (2002) of $1,920. The total health expenditure per capita (HE/GDP) in 2002 was $62, which is 3.2% of GDP and less then the 2001 HE/ GDP which was $85. Life expectancy at birth for males and females is 62.0 years and adult mortality male/female (per 1000) is 225/199.[1,2]

The Federal Government of Pakistan in Islamabad and the Provincial Health Governments share the responsibilities of health coverage, with a rapidly increasing private health sector. Health insurance coverage and employer benefits are negligible. Free cancer screening, old age benefits and health care, concept of Medicare and Medicaid-like programs, and subsidized pharmaceutical drug programs have not been implemented. The majority of population (approximately 70%) is responsible for their own and their extended families' health expenditures. In this background the

National Cancer Control Program (NCCP) evolved as part of the National Action Plan using evidence-based strategies for prevention, early detection, treatment, and palliation as advised by WHO.[3-7] The magnitude of cancer burden was assessed with the help of the sample data of Karachi South (1995-1997), as published in Cancer Incidence in the Five Continents (CIV) volume VIII, and cancer estimates for Pakistan in Globocan.[8-11] Time trends in cancer were measured in 2 periods, 1995-1997 and 1998-2002. Geographical variations analyzed on the basis of the joint Karachi Cancer Registry (KCR) and Aga Khan University Cancer Surveillance for Pakistan (ACSP), data.

'ACTION PLAN: In 2004, a tripartite public-private partnership between the Ministry of Health, Government of Pakistan, the World Health Organization, Pakistan office, and the NGO Heartfile was developed with the aim of developing and implementing a carefully planned long-term national strategy for prevention and risk factor control of non-communicable diseases (NCDs) in Pakistan. The result was the formulation of the National Action Plan for Prevention and Control of NCDs and Health Promotion in Pakistan (Action Plan). This pioneer attempt has within the legal framework of Pakistan, incorporated core public health principles into the health program planning based on precise evidence-based strategies, through an Integrated Framework for Action (IFA). "This initiative is one of the few initial partnership-based, concerted national responses to the global challenge of NCDs from within the developing countries. The active role of WHO as an international public health agency with the global mandate of promoting best practices through its linkages with governments in respective countries, broadens the scope of this initiative". The Action Plan is a locally suited, concerted and integrated approach – one that incorporates both policies and actions. It has prepared and is implementing the 'Framework for Action' (table 1)"[4]

Table 1 Framework for Action
• Provide sustainable institutional support for mature cancer registries as a priority to facilitate continuous monitoring of cancers; extrapolate to comparable populations.
• Establish cancer registries in areas that centre on representative population.
• Preventions of cancers and early detection should feature prominently on the comprehensive NCD behavioral communication strategy.
• Establish a National Cancer Control Council which should be given the mandate of upholding ethics and principles and guidelines on technical matters.
• Conduct studies to bridge gaps in evidence relating to appropriate and cost-effective strategies for preventing common cancers.
• Institute proactive measures to contain potential risks to cancers in industrial settings.
• Ensure transparent enforcement of National Environmental Quality Standards in industrial settings.
• Identify causal associations of risk factors with cancers in the native Pakistani worksite setting to enable the delineation of precise targets for preventive interventions.
• Invest in educating healthcare providers in worksites to observe safety standards.
• Build capacity of health systems in support of cancer prevention and control. Integrate public health programme monitoring and evaluation with NCD surveillance.
• Prioritize pain relief and palliative care alongside prevention and control efforts.
• Integrate guidance on preventing cancers and early detection into health services as part of a comprehensive and sustainable, scientifically valid, culturally appropriate and resource sensitive initiative.
• CME program for all categories of healthcare providers.
• Build a coalition or network of organizations at the national, provincial and local levels facilitated by federal and provincial health services to add momentum to cancer prevention and control as part of a comprehensive effort for the prevention of NCDs.

Cancer control measures advocated for the next two decades

A cost-effective NCCP can be effectively implemented in developing countries if planning takes into critical consideration the limitations in the political, social, economic and organizational factors of the country on an individual basis. Though collectively all developing countries have similar problems, the realistic assessment of the limitations will prevent overenthusiastic siphoning of finances into poor risk ventures.

The primary recommended strategy for 'National Cancer Control Programme' (NCCP), Pakistan based on the assessment of eight common cancers in Karachi and the WHO estimates would remain identical. 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 demographic data, risk factor data, data on other diseases and capacity assessment; these have been provided by KCR. This data is substantiated by the data of the ACSP which provides the geographical variation. KCR data along with WHO estimates form the initial framework of NCCP in Pakistan, the lack of a national cancer registration should not deter initiatives. It is recommended that with this backbone data available for planning, assessment and evaluation, NCCP Pakistan can be implemented and monitored.

Intervention if associated with careful planning can stretch restricted resources available for cancer control to be used efficiently. Benefits of an immediate, prompt and targeted implementation established today will be realized after 20–30 years, however the earliest benefits to the population can be realized within the first 2 years in the form of down staging of malignancies. The following strategies will/should be followed for success of NCCP Pakistan with stringent annual evaluation.

1. **Legislation**

   Implementation of anti-tobacco legislation in the form of taxation, ban on public smoking or chewing, ban on advertising and enforcement. A curb on the epidemic levels of tobacco and areca nut use would reduce 43.7% of the malignancies in males and 17.8% in females. Tobacco control is an independent component of NCD control of Pakistan.

2. **Establishment of equitable pain control and a palliative care network**

   This is an urgent and essential necessity as more than 70% of cancer patients report in very advanced stages of malignancy and have little chance of being cured.

3. **Public Helth Education**

   Cancer trends are interplay of prevalent risk factors, the level of prevalence, preventive education and intervention. A cost effective and efficient cancer control program focused around the target populations would be beneficial for Pakistan with assistance of audio-visual media, in view of the literacy status. Public health education, especially of schoolchildren, adolescents, and healthcare providers by mass education and media influence is imperative for:

   - Health Promotion
   - Primary prevention of cancer.
   - Awareness of early signs and symptoms.

3.1 Health Promotion

Promotion of a healthy life-style in asymptomatic healthy persons.

3.2 Primary prevention

In the form of tobacco and arecanut control, 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.

3.3 Awareness of early signs and symptoms

In symptomatic patients, early diagnosis of cancer improves survival.

4. Population screening of asymptomatic and apparently healthy individuals

Resource restrictions put high technology methods beyond the scope of Pakistan today. Early detection of cancers of accessible sites is 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.

Oral cancer and cancer cervix

A cost effective and reliable community-based screening programme could be successfully implemented. Self-examination of the oral cavity, and cytology-based screening for high-risk cervical cancer populations should be established. Screening will reduce the incidence of oral cancer, but requires careful planning, and extensive financial resources therefore mobilization of general practitioners, health visitors, volunteer organizations and medical students for early detection of oral cancer is the essential need of today.

Breast cancer

There is an intense need for a well-directed cancer control program focusing on population screening and control of breast cancer. The justification would be a target of a third (35.5%) of the cancers in females. The primary recommended strategy for breast cancer screening in Pakistan, based on the assessment of the disease in Karachi would be regular breast examinations of all females including the reproductive age group by trained healthcare workers. This associated with health education for the population and training of health providers is essential for early diagnosis. Healthcare planning should focus on capacity building over the next 2 decades for a more aggressive breast screening.

Pitfalls

Two thirds of the breast cancers are reproductive age malignancies. Thus mammography, which benefits women aged 50-69 years, would have limited effectiveness in these patients diagnosed before 50 years of age. The cost effectiveness at a national level would be questionable, as the cost of a reliable mammography in the country is $50-100. The annual cost for breast cancer screening is the high-risk population of Pakistan, in the first year of screening would run into approximately $400,000,000. The minimal annual increase in the number of females which would require screening 3,039,179 cases (2001 estimate). The maintenance cost each year subsequently would be approximately $200,000,000. These estimates have not included the cost of capacity building, structural or human.

Capacity building

Is required by the Government to increase the availability of professionals, technical help and technology, and equipment.

Counselling

Is essential to provide the best possible management, cost effectively and efficiently. In developing countries 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. Precious time is lost whilst the patient shops for a cure.

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

Tumor*	ASR	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				

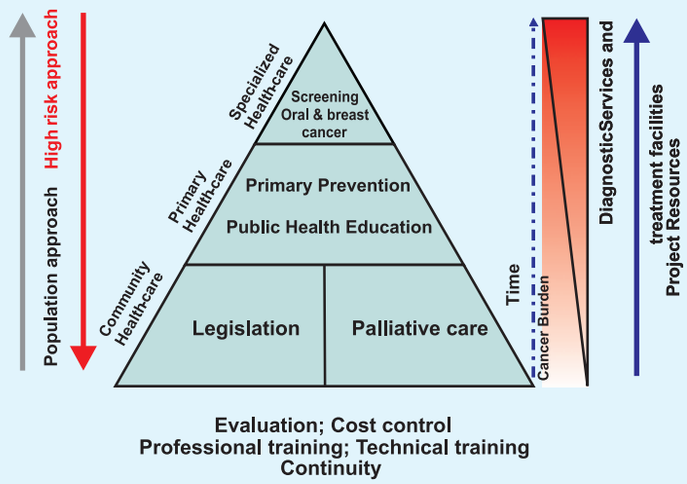
*Listed in the order of the eight most common tumors globally**Curative for the majority of cases providing they are found early+ + (effective); + (partly effective); - (not effective) ASR: Age Standardised Rates per 100000.

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) ASIRs: Age Standardised Incidence Rates per 100000.

Figure 1: NCCP Pakistan 'Public Health Approach'



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SRI LANKA

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Location

National Cancer Control Programme (NCCP) which is the National Programme for prevention & control of malignant illnesses in the country, is situated as a part of the Government Cancer Institute Maharagama (GCIM), in the city of Maharagama , 15km from the commercial capital, Colombo.

History

National Cancer Control Programme was established in 1980 following recommendation of a WHO team that went in to a detailed survey on cancer morbidity and mortality in Sri Lanka in 1979. NCCP was originally located at the present Ministry of Health premises, and the first Director was Dr. S. Sivayogham. Following his departure in 1983 Dr. Markus Fernando became the Acting. Director until 1985 . Dr. B. D . P. Gunawardana. assumed duties as the Director NCCP in late 1985 . He remained as the Director until 1988 . In 1986 NCCP was shifted to its present location at the Government Cancer Institute , Maharagama . Main activities during this period were limited to collection of data and statistics. Cancer statistics. were published as a supplementary in the Weekly Epidemiology Report . Dr. Bernard Randeniya assumed duties as the Director NCCP in 1988 , and remained as the Director until his demise in 1999. It is during his period that NCCP became popular among the public of this country and various preventive programmes were started through out the country . Publication of Cancer Registry was started during this period by publishing the Cancer Registry of 1985 .In 1989 a survey was carried out to identify the prevalence of the habit of smoking for which Dr. Randeniya was awarded the TOBACCO AND HEALTH gold medal in 1992.

Dr. M.AY. Ariyaratna, MD, has been the Director, NCCP since late 1999. At present NCCP staff consists of, the Director, Two Medical officers, One Registered Medical officer, One Public Health Inspector, One Public Health Nursing Sister. and thirteen subordinate staff members.

National advisory committee on tobacco & anti-smoking & the National advisory committee on cancer control activities are the main statutory bodies of policy making with regard to cancer

control & anti - tobacco activities in Sri Lanka.

World Health Organisation & the United Nations Fund for Population Activities play an important role in cancer control activities in Sri Lanka by providing financial assistance & by making available the necessary advice & directions. International Agency for Research on Cancer (IARC) & International Association for Cancer Registry (IACR) also contribute to the cancer control & surveillance effects carried out by NCCP. Rotary Club of Sri Lanka also assists in the cancer screening activities of NCCP while the Ministry of Education conducts collaborative programmes on tobacco control / Health Education with the NCCP.

Objectives of the National Cancer Control Programme

The aim of cancer control is to reduce the incidence of cancer and its morbidity and mortality ,that could be accomplished with due attention to the relevant knowledge about cancer , to socio-economic factors and by introduction of legislative measures. National Cancer Control Programme comprises of six main approaches.

1. Primary prevention of cancer.
2. Secondary prevention of cancer.
3. Tertiary cancer care.
4. Palliative care.
5. Cancer registry and Epidemiology.
6. Cancer research.

(I) Current Activities Of National Cancer Control Programme

1. NCCP is responsible for the maintenance of cancer surveillance system of Sri Lanka. In this regard NCCP carries out methodology development, collection and analysis of data and publication of hospital based cancer registry report.
2. NCCP with the collaboration of College of Pathologists of Sri Lanka has developed & maintains a pathological based cancer surveillance system based on returns from pathological laboratories around the country.
3. National Cancer Control Programme plays an important role in the National Advisory Committee for cancer control activities in Sri Lanka and the National Advisory Committee on tobacco control measures in Sri Lanka where the Director of the National Cancer Control Programme acts as the secretary to these committees which advises the Minister of Health on these matters.
4. National Cancer Control Programme provides the technical support in training of Public Health Nursing Sisters, Divisional Directors of Health Services & Medical Officers of Health in Well Women Clinics & Pap smear examination for the establishment of 300 well women clinics throughout the country.
5. The National Cancer Control Programme has established a cancer early detection clinic in Colombo with the assistance of Rotary Club of Sri Lanka & conducts screening activities.
6. Conduction of a one day training programme for primary health care workers on Well Women Clinics with special emphasis on improving the coverage of well women clinics.
7. NCCP has developed and is conducting a population household cancer survey in a selected MOH area to assess the cancer prevalence rates in Sri Lanka.
8. Conduction of a review Well Women Clinic programme to follow up previously screened population in several selected estates. The initial screening of the population of these selected estates was done previously as a pilot project.
9. Conduction of mobile well women clinics and mass screening clinics in selected

population groups such as working females.

10. Educational programme for school children - NCCP with the collaboration of Educational Ministry of Sri Lanka conducts educational / awareness programmes for school children on hazards of tobacco.
11. Conduction of a one day training programme for trainee teachers and school teachers of colleges of education and teacher training schools on hazards of tobacco and highlighting various aspects in prevention of cancer.
12. National Cancer Control Programme is entrusted with the duty of purchasing of expendable equipment for the smooth functioning of the Well Women Clinics. The equipment purchased is distributed to the Well Women clinics by the Family Health Bureau.
13. National Cancer Control Programme has printed leaflets on breast cancer and breast self examination, cervical cancer and Pap test, flash cards on breast self examination, booklet on cervical cancer, manual for cyto-screeners for Pap smear examination, triplicate books for Pap smear reporting and a poster on Well Women Clinics. These were distributed to the primary health care workers and to the cyto-screeners.

Future plans of National Cancer Control Programme

1. National Cancer Control Programme plans to upgrade its Cancer Surveillance system by upgrading its cancer surveillance software. CANREG: a software specific to cancer registries will be installed & the computers of NCCP will also be upgraded. NCCP also plans to link the present separately maintained hospital based cancer registry with the Pathology based cancer registry and to develop a common cancer database.
2. NCCP will develop a Population Based Cancer Registry in Colombo District from the year 2004. This population based cancer registry will be carried out concurrently with the linked hospital based & pathological based cancer registries.
3. NCCP with the collaboration of the Family Health Bureau plans to develop IEC materials with regard to well women clinics.
4. Training of registrars of death and improving the quality of death registration to incorporate mortality data in to the population based cancer registry.
5. Development of a National Centre for Cancer Screening with screening laboratory facilities that will coordinate the mobile and out reach screening clinics and well women clinics.

Cancer Treatment Centres with Radiotherapy Facilities

1. Government Cancer Institute, Maharagama.
2. Cancer Unit, Teaching Hospital, Kandy
3. Cancer Unit, Teaching Hospital, Karapitiya
4. Cancer Unit, General Hospital, Anuradhapura
5. Cancer Unit, General Hospital, Badulla
6. Cancer Unit, General Hospital, Jaffna

Recommendations for Implementation of Cancer Control in South Asia

A. Organizational Set-up

	Nature of Activity	Dept/Unit Cancer Registration	Dept/Unit Cancer Epidem.	Dept/Unit Preventive Oncology	Dept/Unit Pain Relief/ Training Palliation	HRD
	Type of Institution					
1.	***CCC***	Yes	Yes	Yes	Yes	Yes
2.	***RCCs***	Yes	Yes/No	Yes	Yes	Yes
3.	***Private Cancer Centres***	Yes	No	Yes thru PSM	Yes thru Anae	No
4.	***Medical Colleges* with Radiotherapy***	Yes thru Path	No	Yes thru PSM	Yes/No thru Anaes	Yes
5.	***Medical Colleges* without Radiotherapy***	Yes thru Path	No	No thru PSM	Yes/No thru Anaes	No
6.	***Non Government Organisations***	Yes/No	Yes/No	Yes/No	Yes/No	No
7.	***Government Hospitals***	No	No	Yes/No	Yes/No thru Anaes	No
8.	***Private Hospitals in urban centres***	Yes thru Path	No	Yes/No	Yes/No thru Anaes	No
9.	***District Hospitals***	Yes/No	No	Yes/No	Yes/No	No
10.	***Taluk Hospitals/ PHCs / Units***	No	No	No	Yes/No	No
11.	***Private Hospitals in rural settings***	Yes/No	No	No	Yes/No	No
12.	***Pathological Labs / Imaging Centres***	Yes	No	No	No	No
13.	***General Practitioners/ Dentists/Others***	No	No	No	No	No

Yes/No: Indicates that the institution/individuals will facilitate either by coordination or participating in specific cancer control activities in the region. They may or may not participate in routine activity.
* Government or Private

B. Information Collation and Primary and Secondary Prevention Activities

	Nature of Activity	Cancer Information	Other Opp Scr	CDCs/ Screening	Population Information	Information Dissemination
	Type of Institution					
1.	***CCC***	PBCRs HBCRs	One time Survey of Selected Pop.	Yes	Yes	Yes
2.	***RCCs***	HBCRs	No	Yes	No	Yes
3.	***Private Cancer Centres***	Ca Atlas thru Path	No	Yes	No/Yes	Yes
4.	***Medical Colleges* with Radiotherapy***	Ca Atlas thru Path	Yes/No thru PSM	Yes	Yes/No thru PSM	Yes thru PSM
5.	***Medical Colleges* without Radiotherapy***	Ca Atlas thru Path	Yes/No thru PSM	No	Yes/No thru PSM	Yes thru PSM
6.	***Government Hospitals***	Ca Atlas	No	Yes/No	No	Yes
7.	***Non Government Organisations***	Yes/No	Yes/No	Yes/No	Yes/No	Yes
8.	***Private Hospitals in urban centres***	Ca Atlas	No	Yes/No	No	Yes
9.	***District Hospitals***	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
10.	***Taluk Hospitals/PHCs/ Units***	Yes/No thru ANMs	Yes/No thru ANMs	No	Yes/No thru ANMs	Yes/No thru ANMs
11.	***Private Hospitals in rural settings***	Yes/No	No	No	No	Yes/No
12.	***Pathological Labs / Imaging Centres***	Ca Atlas	No	Yes	No	Yes/No
13.	***General Practitioners / Dentists/Others***	Yes/No	No	Yes/No	Yes/No	Yes/No

Yes/No: Indicates that the institution/individuals will facilitate either by coordination or participating in specific cancer control activities in the region. They may or may not participate in routine activity.

* Government or Private

C. Clinical Management

Nature of Activity / Type of Institution	Imaging/ Pathology Diagnosis	Social Counselling	Cancer Directed Treatment	Active Follow-up	Referral System
1. CCC	Yes	Yes	Yes	Yes	Yes
2. RCCs	Yes	Yes	Yes	Yes	Yes
3. Private Cancer Centres	Yes	Yes	Yes	Yes	Yes
4. Medical Colleges with Radiotherapy*	Yes	Yes thru PSM	Yes	Yes thru PSM	Yes thru PSM
5. Medical Colleges without Radiotherapy*	Yes	Yes thru PSM	Yes/No	Yes thru PSM	Yes thru PSM
6. Government Hospitals	Yes/No	Yes/No	No	Facilitate	Facilitate
7. Non Government Organisations	Yes/No	Yes/No	Yes/No	Yes/No	No
8. Private Hospitals in urban centres	Yes	Yes	Yes/No	Yes/No	Yes/No
9. District Hospitals	Yes/No	Yes/No	No	Facilitate	Facilitate
10. Taluk Hospitals/ PHCs/ Units	No	No	No	Facilitate	Facilitate
11. Private Hospitals in rural settings	Yes/No	No	No	Facilitate	Facilitate
12. Pathological Labs/ Imaging Centres	Yes	No	No	No	No
13. General Practitioners / Dentists/Others	No	No	No	Facilitate	Facilitate

Yes/No: Indicates that the institution/individuals will facilitate either by coordination or participating in specific cancer control activities in the region. They may or may not participate in routine activity.

* Government or Private

D. Specific Cancer Control Activities

	Nature of Activity	Education/ Primary Prevention	Early Det Cancer Cervix	Early Det Cancer Oral Cav	Early Det. Cancer Breast	Early Det Other Cancers
	Type of Institution					
1.	***CCC***	Yes	Yes Cl, Path	Yes Cl, Path	Yes Cl, Rad, Path	Yes
2.	***RCCs***	Yes	Yes Cl, Path	Yes Cl, Path	Yes Cl, Rad, Path	Yes
3.	***Private Cancer Centres***	Yes	Yes Cl, Path	Yes Cl, Path	Yes Cl, Rad, Path	Yes
4.	***Medical Colleges* with Radiotherapy***	Yes	Yes Cl, Path	Yes Cl, Path	Yes Cl, Rad, Path	Yes
5.	***Medical Colleges* without Radiotherapy***	Yes	Yes Cl, Path	Yes/No Cl, Path	Yes Cl, Rad, Path	Yes
6.	***Government Hospitals***	Yes	Yes/No	Yes/No	Yes/No	Yes/No
7.	***Non Government Organisations***	Yes/No	Yes/No	Yes/No	Yes/No	No
8.	***Private Hospitals in urban centres***	Yes	Yes Cl, Path	Yes/No Cl, Path	Yes/No Cl, Rad, Path	Yes/No
9.	***District Hospitals***	Yes	Yes/No	Yes/No	No	No
10.	***Taluk Hospitals/PHCs Units***	Facilitate	Facilitate	Facilitate	Facilitate	No
11.	***Private Hospitals in rural settings***	Yes	Yes/No	Yes/No	Facilitate	No
12.	***Pathological Labs/ Imaging Centres***	No	Facilitate	Facilitate	Facilitate	No
13.	***General Practitioners/ Dentists/Others***	Yes	Facilitate	Facilitate	Facilitate	No

Yes/No: Indicates that the institution/individuals will facilitate either by coordination or participating in specific cancer control activities in the region. They may or may not participate in routine activity.

* Government or Private

Footnote for the tables

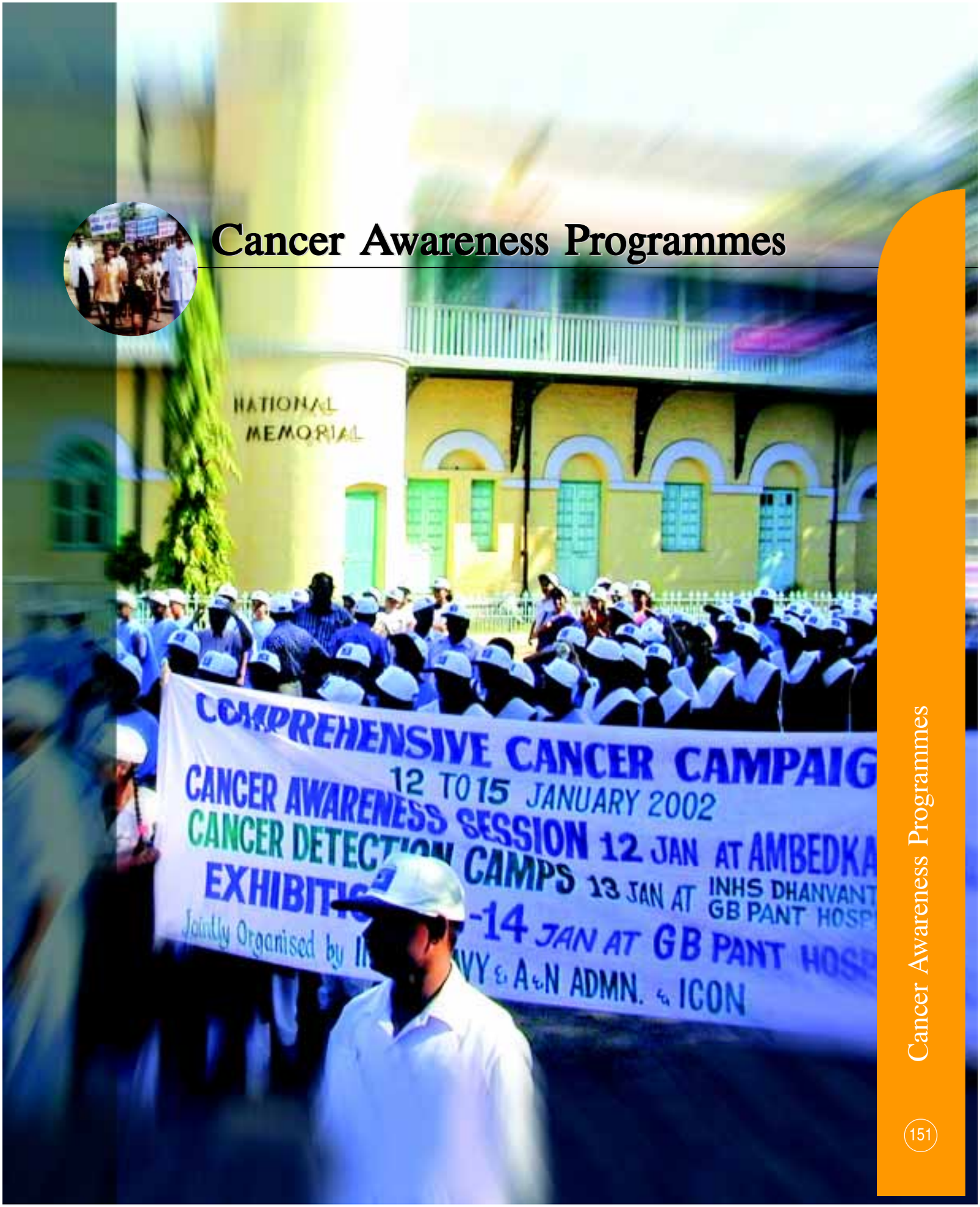
Anaes = Anaesthesia
Ca = Cancer Atlas
CCC = Comprehensive Cancer Centre
Cl = Clinical
Det = Detection
HBCRs = Hosptial Based Cancer Registries
Opp = Opportunistic
PBCRs = Population Based Cancer Registries
Pop = population
Rad = Radiological
Scr = Screening

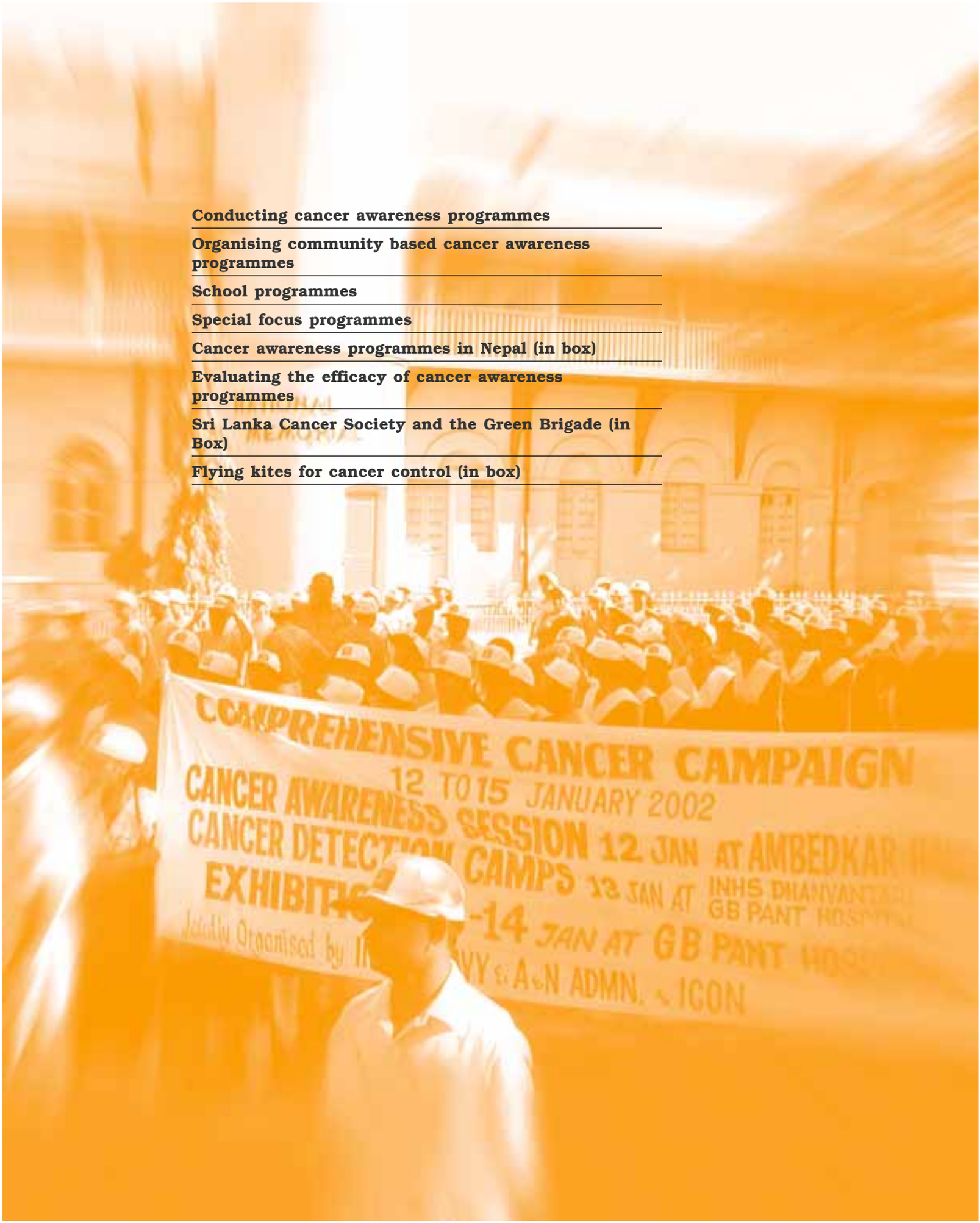
ANM = Auxiliary Nurse Midwife
Cav = Cavity
CDCs = Cancer Detection Clinics
Dept = Department
Epidem = Epidemiology
HRD = Human Resource Department
Path = Pathology
PHCs = Primary Health Centres
PSM = Preventive and Social Medicine
RCCs = Regional Cancer Centres
thru = through

C

In most parts of South Asia, the word 'Cancer' instils fear of pain, death and financial depletion in the average individual. This fear is partly due to ignorance and partly due to the real experiences narrated by the affected individuals. Added to this are the different levels of literacy and hence comprehension among various sections of the population. The awareness programmes, methodologies and messages have to be tailored to suit the addressed group. Making the task further complex is a myriad of languages, socio-cultural diversities, economic disparities and religious preferences of the various population subgroups. All these factors together make the organisation of cancer awareness programmes a very daunting task. The authors have compiled the lessons from successful programmes to propose feasible templates for cancer awareness programmes in South Asia.

Cancer Awareness Programmes





Cancer Awareness Programmes

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Conducting cancer awareness programmes

Adult learning follows certain principles. If trainers follow these guidelines, they will greatly enhance the learning experience for participants.[1]

It is said that adult learners retain: [2]

20 percent of what they hear

30 percent of what they see

50 percent of what they see and hear

70 percent of what they see, hear, and say (e.g. discuss, explain to others)

90 percent of what they see, hear, say, and do.

Cancer awareness and education programmes should be conducted employing a holistic approach that helps people to make healthy decisions and participate in healthy activities by increasing knowledge and motivation, by changing attitudes and by increasing the skills needed to maintain good health. Cancer awareness initiatives should include a suitable mix of educational strategies. One of the most widely used strategies in cancer awareness programmes in South Asia is the dissemination of information through media channels (television, newspapers, periodicals). *Mass media communication* plays a vital role in creating awareness about policies and programmes of the government. It also helps in motivating people to become active partners in the process. A sensible mix of traditional and modern audio-visual media including satellite communication would produce the best results. The 'Information and Broadcasting' ministries can play a very significant role in this direction.

A number of cancer control agencies in South Asia conduct small and large group awareness sessions in specifically targeted populations using audiovisual aids like slideshows, films, posters and flipcharts. Poster exhibitions and distribution of informative pamphlets and booklets is another useful strategy. A number of educational initiatives have the potential to reduce the incidence of cancer and mortality from the disease. Examples would include:

1. Training all health professionals including primary health care workers to provide counselling on tobacco cessation and avoiding exposure to passive smoking.
2. Promoting awareness about the risks of common cancers, and their curability if detected early.
3. Promoting healthy food habits.
4. Educating the public about environmental health risks and the measures that can be

adopted by individuals, governing agencies and citizens groups, to deal with them.

5. Educating employees about hazardous substances in their workplaces and protection from exposure to them.

Organising Community-Based Cancer Awareness Programmes

Organising community-based cancer awareness programmes requires a considerable amount of planning and deviation from the routine health services settings. Firstly, being a health promotive activity, people (the target audiences) would get interested only if the activities are organised during the time when they are relatively free from their routine daily activities. This *timing* can differ from afternoons in the case of urban homemakers to late evenings in the case of rural men and women. The *educational methods* will also have to be varied according to the tastes of the target audiences (e.g. urban audiences are seen to prefer interactive lecture sessions while rural audiences seem to like the messages interwoven in popular stage plays). In South Asia one has to keep in mind the *difficulty in accessing rural areas* during odd hours of the day due to the absence of public transport systems at these times. Rural terrains are also difficult to access during the rains. *Frequent electric power outages* will have to be considered while adopting specific audiovisual technologies. Graphic posters that can be hung on walls coupled with trained educators are probably the most feasible technique both in urban and rural areas.

The *contents of the educational messages* have to be tailored to suit the literacy levels and comprehensibility of the audiences. Giving an accurate account of the risk factors of breast cancer (e.g. obesity, lack of physical activity, absence of breast-feeding) makes the average rural and urban middle class women in South Asia automatically put herself in the low risk category. Similarly, information that cervix cancer is caused due to human papilloma virus infection that is transmitted through sexual promiscuity would again make the naive women put themselves in low risk categories or make over zealous husbands want to protect their wives from exposure to what they might consider as unnecessary information. The best approach to convince the women about the necessity of screening would be by informing them about the increasing numbers of cancer cases, the benefits of early detection and the cost and complications associated with detection and treatment in late or advanced stages. The tricky issues related to the risk factors can be discussed on a one-to-one basis, when the women come for screening.

In community based educational programmes in South Asia, particularly in rural and urban low socio-economic areas, Maslow's theory of hierarchy of needs,[3] goes for a toss. Here we cannot wait for the basic needs to be met before we introduce the concept of primary prevention and health promotion. Time and again cancer control programme managers get diverted from their principal objectives by the beneficiaries who insist that they have other more pressing requirements. This can turn into a vicious cycle and has to be handled very tactfully.

Local political and religious leaders and local government officials are the gateway to community rapport building. They can be useful if cultivated and a hindrance if ignored. Since the effective literacy levels are very low in most rural areas of South Asia (except probably in Sri Lanka), the local leaders and government officials invariably call the shots. Some communities are still very feudalistic (particularly in Central and Northern India and in Pakistan). *In a feudal system the landlord would be the most important person to deal with*. In such societies the local leaders or the landlords usually give *blanket consent* and the *subjects* (as they are known) rarely have any say in their own affairs, including health affairs. While government programmes are considered mandatory, especially if government employees themselves conduct them, *NGOs have to work very hard to get themselves accepted*.

Rural women listening intently to a primary health worker

A young child learns about cancer at an awareness programme in Mumbai, India

School Programmes

School cancer education programmes are relatively easier to organise. One has to however have an *accurate idea about the academically busy and lean periods* at the school. *School teachers are very good allies* once they are convinced about the benefits of the programme. A separate programme has to be therefore arranged for the school teachers and *school's managing committee* before one can reach the school children. The content has to be suitably modified for school programmes. The school children are very interested in the basic biology of cells and the process leading to their change to cancer cells (a *set of seven booklets produced by the UICC COPES programme*, a decade ago, are still very useful for cancer education in schools). After providing information on the risks and prevention/early detection of the most common cancers in the region, *school cancer education should essentially revolve around tobacco control programmes*. School children are always interested in *participatory and interactive* programmes. School programmes should therefore have a *competitive element* associated with them. *School children have a high media impact and can become great champions for the cause of tobacco control in their regions*.

The *Global Youth Tobacco Surveys* (GYTS) and the *Global School Personnel Surveys* (GSPS) have been completed in most countries in South Asia and the surveys have brought out very pertinent information on the tobacco use,

Cancer awareness programmes the Nepal experience[4]

Nepal Network for Cancer Treatment and Research (NNCTR) the Nepal branch of International Network for Cancer Treatment and Research (INCTR) works primarily for the development of suitable educational materials and programmes for creating cancer awareness and developing manpower for cancer control in Nepal. The NNCTR awareness programmes are aimed at community health workers and school children from grades 7-10. The programme has already covered 32 schools in the Kabhre and neighboring districts of Nepal involving over 7,000 students. The NNCTR has also trained 40 community health workers for creating cancer awareness in the villages that they are working in. Training-of-trainers workshops have been conducted in 11 districts by the NNCTR in collaboration with several medical schools and hospitals in Nepal including the Bhaktapur and Bharatpur Cancer hospitals.

Sri Lanka Cancer Society and the Green Brigade[6]

The Sri Lanka Cancer Society in collaboration with another organisation called the Green Brigade organises cancer awareness parades comprising of school children carrying placards and distributing leaflets to the general public in Kandy, Sri Lanka. They mainly target unhealthy eating habits, chemical fertilizer based foods, and artificial/genetically modified foods. These programmes draw huge crowds and succeed in generating a lot of media attention towards the cause of cancer control.

knowledge and attitudes of school children in the 13-15 age group. School cancer education planners should make use of this information that is available, country wise, on the CDC website.

Special Focus Programmes

Special occasions and events like the "World No-Tobacco Day" – May 31, "International Women's Day" – March 8, "World Cancer Day" – February 4, "Breast Cancer Day" – October 9, and several other local/regional events can become good cancer education opportunities. Cancer survivor's day is another important event since the *survivor's testimonials are probably the most potent educational tool for cancer education*. Programmes can be planned in conjunction with the other activities and functions that are usually arranged by several motivated groups on these occasions.

Evaluating the efficacy of cancer awareness and education programmes

Building an evaluation component in educational programmes is very important. Although a number of agencies take up the job (sometimes duplicating, even triplicating the efforts), the utility of the programmes and their impact is rarely evaluated. Tons of educational aids are produced and expended meaninglessly by several agencies, year after year.

Short-term evaluation measures would include pre and post interventional Knowledge-Attitude-Practices (KAP) studies. Effective changes in public policies and legislation for cancer control programmes would qualify as intermediate evaluation measures. Long-term evaluation measures would include the monitoring of trends for incidence and mortality due to the cancers.

In the first Rural Cancer Registry programme in South Asia at Barshi in India, that started registering cancer cases since 1988-91. The 3-year survival was significantly higher in cases registered in 1990-91 (40.0%), than in those registered in the earlier years (26.6%). This improvement was attributed to the cancer education activities undertaken alongside the registry.[5]

Flying kites for cancer awareness

The "Annual Kite Flying Festival" is a major event that takes place in both urban and rural areas of Gujarat, India and in several states of Pakistan.

In Gujarat, on 14th January each year, marking the transit of the Sun into the phase of Uttarayan, people of all ages, both sexes and all religions participate enthusiastically in the kite flying competitions organised in large maidans (fair grounds) on this occasion. The Gujarat Cancer Research Institute (GCRI) uses this opportunity to create cancer awareness. Kites carrying cancer educational messages are distributed and prizes are given to winners of the competition. This event has been growing in popularity year after year with celebrities from all walks of life adding glamour to the event.

Cancer Awareness in Rural India

Cancer Awareness in Urban Slums, Mumbai, India

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Early detection of cancer can be achieved by screening and early clinical diagnosis. The objective of cancer screening is to reduce the burden of disease, at affordable costs, by detecting and treating early pre-clinical lesions when treatment is more effective than for advanced disease. Early clinical diagnosis, a concept different from screening, refers to the detection of early clinical stages of disease in symptomatic or high-risk subjects. The burden of cervical, breast and oral cancer in South Asia is particularly high, with poor survival outcome, warranting for introduction of screening and early clinical diagnosis using suitable early detection tests. A large number of research studies in this region have given valuable leads and evidence basis for organising suitable early detection programmes in India, Pakistan, Bangladesh, Sri Lanka, Nepal, Maldives and Bhutan. There are currently no organized cancer early detection programmes in any of these countries. To begin with, small regions must be encouraged to introduce both oral and cervical cancer screening and geographical coverage may be gradually increased in a phased manner, learning from initial phases of introduction. Training a large number of health care professionals including nurses, health workers and doctors and improving health care infrastructure should be commenced now to prepare for mass screening. For breast cancer control, much could be achieved by increasing the awareness of the population on breast cancer symptoms and signs and by providing readily accessible diagnostic and treatment services. The cancer establishments and non-governmental organizations in the region can catalyze such developments

Screening

Screening

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Introduction

This chapter deals with the principles and practice of early detection of cancer and the scope for cancer screening in cancer control in South Asia. Screening refers to the presumptive identification of unrecognised disease by the application of tests or examinations that can be applied rapidly on a large scale. Those screened positive are subsequently investigated with reference diagnostic investigations to confirm or rule out disease; those with confirmed disease are offered appropriate treatment and follow-up.

The objective of screening is to reduce incidence of and/or death from disease, at affordable costs, by detecting and treating early pre-clinical disease when treatment is more effective than for advanced disease.[1] The ethical imperatives in cancer screening are to ensure that those detected with early disease are appropriately treated and the benefits of early detection outweigh potential harms. The link between screening, diagnosis and treatment is vital to ensure the benefits of screening. The framework for implementing a screening programme is given in Table 1.Reduction in death rate from the disease is the final outcome measure for evaluating the effectiveness of screening.

Suitable screening test

A screening test is applied to a large number of apparently healthy people to identify those with a high probability of having clinically unrecognized precancerous lesions or cancer or those who may develop it in future. The test results require confirmation through diagnostic investigations like endoscopy, imaging and biopsy. A suitable screening test is accurate and reliable in identifying people with a high probability of disease.[1] Reliability refers to the extent the test gives the same results on repeat examinations of subjects by the same or different test providers. Due to the large scale application, a screening test must be simple, easy to perform, safe, acceptable, preferably non-invasive, painless, and low in cost.[1]

Sensitivity and specificity are measures of accuracy and refer to the ability of the test to identify diseased and non-diseased persons correctly. Sensitivity is the likelihood that the test will detect the disease when it is present and is expressed as the proportion of positive tests among persons with disease. It is an indicator of yield of cases and a test with poor sensitivity will miss cases resulting in a large number of false negative cases thereby delaying diagnosis and treatment. Specificity is the likelihood that the test is negative

when the disease is absent and indicates the proportion of negative tests among persons with no disease. A test with low specificity will result in a high number of false-positive test results leading to unnecessary diagnostic investigations in healthy persons and high costs. It is impossible to have a screening test with 100% sensitivity and specificity! In general, the sensitivity and specificity of a test must be traded off against one another. Most suitable screening tests have sensitivity in the range of 50-70% and specificity in the range of 90-95% (e.g., cervical cytology). Test sensitivities of 70% or more and specificities of 95% or more are desirable in programmatic settings. If there are fewer opportunities for repeated screening (as in developing countries), a high sensitivity is desirable.

The positive predictive value (PPV) is the likelihood that a positive test has detected the disease of interest and is expressed as the proportion of persons with the disease among those tested positive. A high prevalence of disease and high sensitivity lead to high PPV. The negative predictive value (NPV) is the likelihood that the persons tested negative actually do not have the disease and is expressed as the proportion of persons without disease among those tested negative. NPV of cancer screening tests is generally high, since most asymptomatic persons have no cancer.

Suitable disease for screening

Cancer as a disease suitable for screening should satisfy the following characteristics[1]: It should be a major public health problem; its natural history known and is fatal if untreated. A long preclinical (premalignant or asymptomatic early invasive) phase provides the opportunity to detect cancer early enough by the screening test at a time when treatment can prevent death from the disease. There should be effective treatment for the early disease, the outcome of which should be more effective than that of treatment applied to the advanced disease. It is unreasonable to screen for an untreatable disease.

Table 1 explains the concept of the preclinical disease. The total preclinical phase (TPCP) begins when a disease starts and ends when medical attention is sought due to symptoms. The detectable preclinical phase (DPCP), a component of the TPCP, starts when the disease can be detected by a screening test before symptoms occur. A test, which can detect a very early cancer, results in a DPCP longer than the one following a test that detects only more advanced stages of cancer. A long and high prevalence of DPCP favours screening, as the early detection of cancer in DPCP is likely to result in reduced mortality from the disease.

If the natural history of the disease demonstrates a detectable premalignant phase (precancerous lesions/conditions), the development of invasive cancer can be prevented. Knowledge on the natural history of disease will facilitate decisions on the appropriate ages to initiate and stop screening and on the optimal frequency of re-screening in those who test negative.

Cancer screening programmes

Cancer screening may be offered to a population as an organized programme or opportunistically, or as some combination of the two.[2,3] In organized programme, screening is initiated by invitations extended from a central target population register, while screening is initiated by the individual or a health care provider in the opportunistic screening.

Organized cancer screening programmes:

Organized screening programmes refer to planned and concerted public health application of early detection and treatment in defined populations, operating under precise protocols and guidelines. The protocol specifies the target population, policies and actions to ensure high coverage of the target population, invitation procedures, test and frequency of screening, delivery of test results, referral, diagnostic, treatment and follow-up methods, staff training, quality assurance procedures, monitoring and evaluation of input and outcome measures and mid-course corrections. The essential features of an organized programme are given in Table 2.

Table 1: The classical framework for implementing screening programmes
• The disease is an important health problem
• Natural history of disease is known
• There is a detectable pre-clinical phase for the disease
• A suitable screening test is available
• Effective treatment exists for the disease
• Facilities for diagnosis and treatment are available and accessible in the local health services
• The cost of screening is economically balanced in relation to per capita health expenditure
• Screening is a continuing dynamic process and not an one-time affair

Table 2: The essential features of an organised screening programme
• Clear definition of target population
• A central register with names and addresses of eligible individuals available
• Personal invitation from the central register
• Adequate facilities for testing and conveying results
• Availability of a referral system for management of screen positive subjects
• Adequate facilities for diagnosis, treatment of persons with confirmed disease and follow-up of treated persons· Availability of quality assurance system
• A monitoring system for evaluation

Table 3: Per capita expenditure on health in South Asia, 2002[38]

Country	Per capita Total Expenditure on Health (in US$)	Per capita Public Expenditure on Health (in US$)
Bangladesh	**11**	**3**
Bhutan	12	11
Maldives	120	105
Nepal	12	3
Pakistan	13	5
Sri Lanka	32	16

Organized screening requires adequate financial and human resources as well as an adequately developed health infrastructure to satisfy the demands of diagnostic and therapeutic interventions, and hence should be backed by political will. Organized programs have greater ability to cost-effectively reduce cancer incidence and mortality, because of higher levels of population coverage and centralized commitment to quality and monitoring; and offer greater protection against the harmful effects associated with screening. Any deviation from the protocol, poor coverage of the target population for screening, diagnosis, treatment and follow-up reduces the expected benefits and increases the costs.

Opportunistic screening

Opportunistic screening denotes spontaneous screening operating under imprecise guidelines for tests, frequencies, diagnostic, treatment and follow-up procedures. Screening is initiated either by the individual or health care provider during routine health-care encounters. It is often associated with low coverage of people at high-risk and excessive repetition of procedures at frequent intervals, high-costs and a small benefit at the population-level.

Compliance and coverage

The success and cost-effectiveness of a screening programme depends on the coverage of the target population for screening, diagnosis and treatment and high-quality of the interventions used.[4] If the coverage for screening is less than 60% and the coverage of screen positive persons for diagnosis and treatment is less than 70%, the benefit expected may be rather small. Educational efforts to ensure participation of the vulnerable sections of the target population, and identification and elimination of barriers are important to ensure high coverage.

Quality assurance

The quality assurance procedures relate to training of staff, testing, test positivity threshold, disease detection rates, equipment, laboratory procedures and archiving results and referral practices. Implementation of quality control measures are mandatory and help to detect, reduce and correct deficiencies in testing, diagnosis and treatment and in improving provider competencies.

Potential harms of screening

The acceptability of screening to a large extent depends on the balance between expected benefits and possible harms. While false-negative results may give a false sense of security, false positive tests lead to anxiety, other psychological effects such as depression, unnecessary investigations, over-treatment and high costs as well as loss of faith in health services. Even among the true positives, screening might result in treatmentrelated morbidity and unnecessary treatment of subjects with slow indolent cancers that may never surface in the absence of screening leading to over-diagnosis and over treatment. Documenting the harmful effects is important in the overall evaluation of screening.

Evaluation of screening programmes

A monitoring system helps in evaluating the impact of screening and should be an integral part of the programme. Population-based cancer registries and death registration systems complement evaluation of screening. The principles of evaluation are similar for both population-based screening and for evaluating new screening tests before they are introduced in mass screening.

The following measures are considered for evaluation: Process measures are related to the administrative, organisational and quality assurance aspects of the programme such as participation of the target population for screening, diagnosis and treatment; proportion of inadequate tests, repeat testing; number of tests per person screened; and test characteristics.

Outcome measures are the most conclusive way to evaluate the efficacy of screening as they are related to the objectives of the programme. Since screening detects early disease and improves prognosis, one would like to evaluate intermediate outcome measures in terms of stage of disease at diagnosis, survival rates

Table 4: Estimated cancer burden in South Asian countries around 2002

Cancer	New cases			Cancer deaths		
	World total	South Asia	%	World total	South Asia	%
Cervix	**493,243**	**151,904**	**30.8**	**273,505**	**84,358**	**30.8**
Breast	1,151,298	120,590	10.5	410,712	61,186	14.9
Oral cavity	274,289	114,941	41.9	127,459	63,680	50.0
Colon and rectum	1,023,152	40,487	4.0	528,978	27,591	5.2
Prostate	**679,023**	**19,822**	**2.9**	**221,002**	**12,754**	**5.8**

Table 5: Five-year relative survival (%) from selected cancers in population based cancer registries in India and Pakistan

Country/Population	Period	Cancer sites				
		Breast	Cervix	Oral cavity	Colon	Rectum
INDIA						
Barshi	1993-2000	55.3	35.1	23.6	NA	13.0
Bhopal	1991-1995	32.8	35.4	33.6	7.0	8.5
Chennai	1990-1999	48.6	59.4	35.7	NA	NA
Karunagappally	1991-1997	51.2	56.3	41.2	NA	33.4
Mumbai	1992-1999	51.4	46.1	37.0	32.3	33.6
PAKISTAN						
South Karachi	1995-1999	NA	NA	38.2	NA	NA

NA: Not available

Table 6: Test characteristics of cytology, HPV testing and inspection with acetic acid (VIA) in detecting CIN 2 –3 lesions in multi-centre studies in India[18-20]

Test	Total number of women	Sensitivity % (95% confidence interval)	Specificity % (95% confidence interval)
Cytology	22 663	61(56-66)	95 (94-95)
HPV testing	18 085	68 (61-74)	94(93-94)
VIA	56,981*	79(77-81)	86(85-86)

- includes participants from 5 African centers.

Table 7: Test characteristics of FIVE cervical screening tests in detecting histologically proved CIN 2 –3 lesions in Mumbai, India: concurrent evaluation in a cross-sectional study[14]

Test	Total number of women	Sensitivity % (95% confidence interval)	Specificity % (95% confidence interval)
VIA	4009	59.7 (45.8-72.4)	88.4 (87.4-89.4)
VIAM	4009	64.9 (51.1-77.1)	86.3 (85.2-87.4)
VILI	4009	75.4 (62.2-85.9)	84.3 (83.1-85.4)
Cytology	3749	57.4 (43.2-70.8)	98.6 (98.2-99.0)
HPV testing	3546	62.0 (47.2-75.4)	93.5 (92.6-94.3)

and case fatality which are available at early years of a programme. Absence of a favourable shift in these parameters may mean that the screening is not successful. For example, in a successful screening programme, earlier stages, higher survival and fewer deaths are observed for screen-detected cases than for symptom-detected cases. While absence of a change in these parameters may mean that screening is not successful, they do not themselves provide an adequate measure of evaluation as they suffer from lead time bias, length bias, overdiagnosis and self-selection bias.

Health care infrastructure and resources

Adequate, affordable and accessible facilities in the health services in terms of trained human resources, diagnostic and treatment facilities and information systems are essential before a screening programme is introduced in a given region or country. If diagnosis and treatment cannot be offered for screen positive individuals, the goals cannot be achieved and reputation of early detection will be compromised. Adequate funding (through cost recovery from participants as well as government sources) for start up costs and to cover recurring costs for tests, diagnosis, and treatment as well as for organization, training, data collection, communication, quality assurance, monitoring and evaluation should be ensured. Cost recovery from participants is the most efficient way of running screening services. Introducing screening programmes in the absence of adequate health care infrastructure and funds would result in waste of resources.

Cost-benefit of screening

Given the very limited health care resources available in developing countries, data on cost-effectiveness are vital to assess if the cost of screening can be balanced in relation to the total health care resources.[5] The costs of medical procedures vary by country and are heavily influenced by costs of consumables, staff salaries and infrastructure costs and the source of services (governmental, voluntary or private sector). If cost of screening is as high as or higher than the average annual per capita health care expenditure, there is little possibility to introduce screening. The average per capita health expenditure around 2002 in South Asia is given in Table 3. Except in Bhutan and Maldives, the per capita private expenditure on health exceeds 50% of total health expenditure.[6]

The effectiveness of screening may vary from country to country due to the varying efficiency of health services and depending on the quality of the overall screening process - including monitoring, quality control, proactive recruitment and follow-up strategies. Cancer screening should attain demanding levels of cost-effectiveness before it can be prioritised in many countries.[5]

Early clinical diagnosis

Early clinical diagnosis, a concept different from screening, refers to the detection of early clinical stages of disease in symptomatic or high-risk subjects.[7] Increasing awareness of the population on early symptoms and warning signs of the disease and empowering them to seek early clinical attention, and orienting health personnel towards early diagnosis of common forms of curable cancers as well as improving health care infrastructure and accessibility contribute to early clinical diagnosis.[7] Early clinical diagnosis is relevant for all countries. If the stage specific survival in a given population is similar to other populations but the overall survival is lower, early clinical diagnosis is highly relevant. On the other hand, lower stage-specific survival rates indicate the need for improving treatment services, in addition to early diagnosis.

Cancer screening in South Asia

This review covers the cancer screening scenario in South Asia namely in India, Pakistan, Bangladesh, Nepal, Sri Lanka, Maldives and Bhutan. The burden of selected cancer sites in this region is given in Table 4.[8] There are no organized cancer screening programmes in any of these countries.[9] The current 5-year survival for selected cancer sites in selected populations in this region are given in Table 5.[10] Other than very negligible level of opportunistic cytology screening and even more negligible mammography carried out in urban areas, practically no worthwhile screening occurs in routine health care settings in South Asia. On the other hand, there have been a number of research efforts in defining suitable early detection approaches for cervical, oral and breast cancers in the region, particularly in India. These are described briefly. The burden of other cancer sites such as large bowel and prostate are low and as such do not warrant screening in this region.

Cervical cancer:

South Asia accounts for a third of global burden of cervical cancer[8] (Table 4), yet less than a million cervical smears are taken annually, mostly in urban centres, accounting for less than 0.5% of women at risk. A population-based survey involving 200,000 women in Osmanabad and Dindigul districts in India in 1999-2000 revealed that only 0.02% of women ever had a cervical smear.[11,12] Although the incidence rates were slowly declining in the region over the last two decades due to socio-economic and demographic changes[9,13], further substantial declines are unlikely in the future, without screening or a vaccination initiative. More than three-fourths of cases present in locally advanced stages and 5-year survival rates do not exceed 50% in many regions[10] (Table 5). Recognizing the challenges in introducing organized cytology screening programmes, alternate screening methods such as visual inspection with acetic acid (VIA), visual inspection with acetic acid using low-level magnification (VIAM), visual inspection with Lugol's iodine (VILI) and HPV testing for accuracy in detecting high-grade cervical intraepithelial neoplasia (CIN 2 and CIN 3) have been widely evaluated in South Asia.[11,12, 14- 25] The results from large multi-centre studies in India and Africa indicate that VIA had similar or higher sensitivity than cytology but lower specificity[14,15,19,20] (Table 6 AND 7). Low-level magnification did not improve the test qualities of naked eye VIA.[14,16] The sensitivity of VIA and HPV testing were similar in these studies (Tables 6 and 7).[14,18] VILI was found to have a higher sensitivity(92%) than VIA (77%) but similar specificity (85%).[19] Studies also indicate some gain in sensitivity when combining both VIA and VILI.[14] The results from the studies in South Asia have been instrumental in standardizing visual testing and reporting results and training methods.[26] Efforts are also underway to develop affordable, rapid and simple HPV tests. Three large cluster randomised trials are on-going in India to evaluate the efficacy and cost-effectiveness of once a life-time screening with cervical cytology or VIA or HPV testing in reducing cervical cancer incidence and mortality.[11,12, 27] Interim results suggest similar CIN 2-3 detection rates associated with the above screening tests.[12] Final results in terms of reduction in incidence and mortality are

expected from these studies around 2007. Cure rates exceed 80% for CIN 2-3 lesions treated by cryotherapy or loop excision procedures in field conditions in India.

Costing in the context of the randomised trial in Osmanabad district, India suggest that VIA costs 4.5 USD, cytology 7.3 USD and HPV testing 12.7 USD.[5,12] With VIA the cost of detecting a case of CIN2/3 compared to no screening was $775; the incremental cost effectiveness ratio of cytology compared to VIA was $1,135.[5] A recent study on the cost-effectiveness of a variety of cervical-cancer screening strategies in India, Kenya, Peru, South Africa, and Thailand reported that screening women once in their lifetime, at the age of 35 years, with a one-visit or two-visit screening strategy involving VIA reduced the lifetime risk of cancer by approximately 25 to 36 percent and cost less than 500 dollars per year of life saved.[28] Relative cancer risk declined by an additional 40 percent with two screenings at 35 and 40 years of age, resulting in a cost per year of life saved that was less than each country's per capita gross domestic product, a very cost-effective result, according to the Commission on Macroeconomics and Health.

The know-how and programmatic strategies for establishing cervical screening programmes in low-resource settings including in South Asia have been well established.[4] Currently large scale cervical screening programmes based on visual screening are being organised in selected districts in India, Nepal and Bangladesh, which are expected to catalyse further expansion in due course. The high-burden of disease in South Asia is a major justification to evaluate HPV vaccination introduction strategies in the region, given the promising developments in this domain.[29]

Breast Cancer

Breast cancer is the second most common cancer and incidence rates are slowly increasing in all countries in the region.[30] It is the most common cancer among women in Pakistan and in urban areas in other countries in South Asia . Screening programmes based on mammography are not feasible and affordable in South Asian countries given the current levels of per capita health expenditure (Table 3). A conservative estimate might be that less than 100,000 women are subjected to screening mammography annually, mostly through private health services, in the region. The potential for breast self examination (BSE) and/or clinical breast examination (CBE) in early detection or screening, either as an adjunct to mammography, or in medium/low income countries, as a replacement, remains inconclusive and controversial.[31] Currently a cluster randomized trial is evaluating the efficacy and cost-effectiveness of CBE in early detection and reducing breast cancer deaths in Mumbai, India.

Since the incidence of breast cancer is still low in South Asia[13], the detection rate will inevitably be lower, so that the cost benefit of an organized breast cancer screening programme will be much less favourable than in western countries. Since stage of disease at diagnosis is the most important prognostic variable, clinical early diagnosis linked with appropriate treatment is an important option to be considered for control of breast cancer in this region, given the poor survival[10] (<55% 5-year survival) due to late presentation of cases (Table 5). A cluster randomized controlled trial to evaluate the effectiveness of a package of interventions consisting of increasing awareness of breast cancer and its excellent prognosis when detected and treated in its early stages, and providing ready access to an affordable and effective diagnostic and treatment service in reducing breast cancer mortality has just commenced in Kerala, India. It should be noted that such a programme would be unlikely to make such a difference to breast cancer outcome in the developed countries, where already large numbers of tumours are detected in stage I. It may, however, confer a substantial benefit in South Asia where the majority of breast cancer cases clinically present in stages III and IV.

Oral cancer

South Asia accounts for half of the global burden of oral cancer[8] (Table 4). Most cases present in locally advanced stages and the 5-

year survival of less than 40% indicate the considerable possibility of improving outcome by early detection.[10] The test qualities of oral visual inspection as a suitable test for oral cancer screening has been well established in studies in the region.[32-35] The results from a recently concluded randomised oral cancer screening trial involving 196,000 subjects in Kerala, India indicates that oral visual screening and treatment can result in a 34% reduction in oral cancer mortality among users of tobacco or alcohol or both.[36] These results extrapolated to the South Asia would indicate that about 20,000 premature deaths from oral cancer can be prevented annually by oral cancer screening, providing the evidence-base for implementation of screening for oral cancer among users of tobacco or alcohol or both in South Asia.[36,37]

Conclusions and recommendations

The high burden of cervical cancer in South Asia and the substantial number of women dying of it justify the introduction of cervical screening with visual tests for women aged 30-49 years, with the objective of covering them at least with a single testing in life time, in view of the recent evidence on the accuracy and costs of these tests in detecting CIN 2-3 lesions and the efficacy of cryotherapy and loop excision procedures in curing these lesions. The development of cheap, rapid, easy to perform yet accurate HPV tests is a promising possibility. The conclusive demonstration of mortality reduction associated with oral visual screening among high-risk individuals and the high burden justify introduction of oral cancer screening in the region. To begin with, small regions must be encouraged to introduce both oral and cervical cancer screening and geographical coverage may be gradually increased in a phased manner, learning from initial phases of introduction. Training a large number of health care professionals including nurses, health workers and doctors and improving infrastructure for colposcopy, biopsy, histopathology reporting and treatment should be commenced now to prepare for mass screening. For breast cancer control, much could be achieved by increasing the awareness of the population on breast cancer symptoms and signs and by providing readily accessible diagnostic and treatment services.

The cancer establishments and non-governmental organizations in the region can act in the following areas to ensure a substantial proportion of the 209,000 deaths from cervix, breast and oral cancer are avoided:

- Raise public awareness and increase demand for oral and cervical screening and breast cancer early diagnosis as part of general early detection campaigns.
- Advocating for and catalyzing investments in training human resources and improving infrastructure and quality assurance.
- Support programmatic and translational research to help introducing programmes in these regions.

Successful control of cervical, oral and breast cancers by screening or early clinical diagnosis is feasible in South Asia, and, if implemented with earnest commitment, can lead to substantial reduction in worldwide burden of cancers.

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Over 15% of all cancers worldwide can be attributed to viral or bacterial infections. Cancers of the uterine cervix, liver, nasopharynx, stomach, some sarcomas and lymphomas are caused by infections.

Since the causal association is well established in these cancers, prevention or appropriate treatment of the infections would be effective strategies for the control of these cancers.

Control of cervical cancer by regular cytological screening has been amply demonstrated. Further, procedures like visual inspection with acetic acid (VIA), or with Lugol's iodine (VILI) have been tested and shown to be feasible alternatives for South Asia. Primary liver cancer, caused by hepatitis B and C virus infections, is also preventable by observing universal safety precautions, blood safety measures, good sanitation, safe sexual practices and immunization. Food hygiene can prevent Helicobacter pylori infections that cause stomach cancer. HIV associated cancers can be prevented by adopting HIV prevention measures and appropriate treatment of the cases.

Infections

Infections

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Introduction

People in South Asia are at a greater risk of developing infectious diseases and subsequent mortality which is attributed to associated problems of unhygienic living conditions, malnutrition, illiteracy, and poor access to clean food and water, poor sanitation, warm tropical climate and lack of quality health care.[1] Many of these infections persist for a long time ultimately lead to development of cancer. At least 15% of all cancers worldwide can be attributed to infections with viruses, or bacteria. The largest infection-related cancer burden in the region is primarily of cervical cancer, liver cancer, nasopharyngeal cancer, sarcomas, lymphomas and stomach cancer. These cancers are best controlled by preventive strategies as their causative agents are known.

Control of morbidity and mortality from cervical cancer can be achieved by regular cytological screening of Pap smear. However, this practice is not feasible due to lack of sufficient trained manpower, awareness and resources along with the disadvantage of having large population in the region. The procedures like visual inspection with acetic acid (VIA), or with Lugol's iodine (VILI) or VIA with magnification (VIAM) are being promoted as cheaper and more practical alternatives. The recognition that cervical cancer is caused by certain specific types of high risk human papillomaviruses (HR-HPVs) has led to the possibilities of employing HPV DNA testing as an adjunct, if not alternative, to cytological Pap test for effective screening and management of cervical cancer or precancer lesions particularly those with negative Pap smear or ASC-US (atypical squamous cells of undetermined significance). There are at least two vaccines against most prevalent oncogenic HPV type 16 and 18 have successfully undergone the Phase III clinical evaluation and are ready to be introduced in the South Asia. This will have a great impact on prevention of cervical cancer, the most prevalent cancer of the region.

Like cervical cancer, the primary cancer of the liver is also quite prevalent in the region and is a preventable cancer which is caused by infection of hepatitis B and C viruses (HBV & HCV). The incidence of liver cancer has been radically reduced by immunization of children against hepatitis B virus which is now a part of national vaccination program of most of countries of the region, and by prevention of hepatitis C virus through improved awareness and sanitation.

AIDS –associated cancers/sarcomas can be avoided by preventing and treating infection with human immunodeficiency virus (HIV). Appropriate awareness programmes

for hygienic and sexual activities and blood transfusions are actively being pursued in absence of effective therapeutic modalities/vaccines to cure or prevent HIV infection.

Nasopharyngeal carcinoma, Burkitt's and non-Hodgkin's lymphomas have been related with Epstein-Barr virus (EBV) infection which is primarily asymptomatic. EBV induced-cancer development is associated with immunosuppressed state of host. EBV also acts as a co-factor in HIV-induced opportunistic malignancies.

Prevention of stomach cancers caused by Helicobacter pylori is different from that of the other cancers, as the incidence can be controlled effectively by improving hygiene and dietary habits of the individual.

The evidence for association of these infectious agents as human carcinogens have been evaluated by international experts and published as monographs series by International Agency for Research on Cancer (IARC), Lyon.[2-6] In this chapter, we focus mainly on the extent of the disease and various strategies that can be employed for awareness, prevention and control of infection-associated cancers in the region.

Human papillomavirus and cancer

Invasive cancer of the uterine cervix is the most common cancer in the women in South Asia, especially India which harbours more than one fifth of the global burden of the disease. In contrast, Pakistan and Maldives show low cervical cancer incidence 7. For over a century it was believed that cervical cancer is associated with 'sexual behaviour' indicating involvement of a sexually transmissible infectious agent. In the early 1980s, the involvement of HPV was demonstrated by cloning of several HPV genomes, including the most prevalent oncogenic HPV16 from cervical carcinomas.[8-10] However, it took more than a decade before the causal role of specific types of HPVs in the development of cancer of the cervix and their precursor lesions was accepted.[11-13] Of more than 100 HPV types described so far, more than 20 types are associated with anogenital cancers. These are broadly classified into High Risk (HR) and Low Risk (LR) groups. Large scale clinico-epidemiological, molecular biological and experimental studies have provided convincing evidence that high-risk HPV are the main risk factors for development of cervical cancer.[14] HPV is also found to be associated with other human cancers such as oral, oesophageal, lungs, laryngeal and skin cancer.[15,16] Mainly, the most prevalent high risk HPV types 16 and 18 and another less frequent twelve HPV types (31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, and 73) were defined as the causative agents for cervical cancer.[4,11,17] Apart from HPV infection, various epidemiological risk factors such as, sexual promiscuity, exposure to sexual intercourse at an early age, number of pregnancies, long term use of oral contraceptives and smoking have been shown to contribute to the development of cervical cancer. Studies on biological behavior and natural history of HPV infection and cervical cancer indicate a long interval between infection and development of cancer. Persistence of HPV infection in terms of years is essential for manifestation of its carcinogenic activity.[18,19] This makes primary prevention of cervical cancer feasible. HPV infection is common in South Asia and is primarily symptom-less, transient and thus it is most suitable to use prophylactic approach for its intervention.

Methods and characteristics of effective intervention

1. Cytological screening has made little impact on incidence and mortality from cervical cancer in South Asia due to lack of trained manpower and financial and technical constraints. Once in a life-time or selective cytology screening of high risk patients has been proposed but these are also not feasible in resource-poor, rural set-up with lack of awareness in target population. Increasing the awareness among clinicians and primary health care providers can play a major role in successful intervention.

2. Regular cervical cancer screening should be done in different regions within the countries and between the countries through organized cancer awareness and early detection camps and development of cancer control programmes at national and regional levels.

3. Before embarking on organized screening programmes there

should be training and development of cyto-screeners and cyto-pathologists. There is an urgent need for quality control of the diagnostic laboratories both for cytology and for HPV testing, to enforce early detection effectively.

4. Instead of mass cytology, visual screening such as VIA, VILI and VIAM should be introduced for detection of precancerous and cancerous lesions. Also, use of hand-held, battery-operated magnavisualizers could be promoted. VIA-based screening programmes are feasible, safe and easily acceptable to population in rural settings.

5. There has been substantial improvement in the methods used for reliable detection of HPV DNA. Different assays such as hybrid capture 2 (HC2), consensus and type-specific PCRs and several other assays are available that can offer detection of HPV DNA, quantification of viral DNA in clinical samples, identification of high risk genital HPV types, localization of the viral DNA and analysis of viral transcripts. These tests can be optimally utilized for screening of at least high-risk population, if not for all.

6. Based on resources, region can be subdivided into three categories, the most resource poor region should enforce the visual screening, and cytology screening can be utilized by the developing parts and both cytology and HPV-DNA typing by the middle and high income countries.

7. Intervention protocols should target early age of marriage or sexual exposure, sexual promiscuity, number of pregnancies, genital hygiene, use of oral contraceptives and smoking to prevent the persistence of HPV infection and cervical cancer.

8. HPV vaccines, which should be economically viable and attempts to develop indigenous vaccine should be encouraged. For identification of the target population for the vaccine programme, mass scale molecular epidemiological screening program should be taken up to create baseline data for HPV infection in the region.

9. Till date no therapeutic is available for treatment of HPV infection therefore, efforts may be made to develop anticancer microbicides such as curcumin and others that are safe to administer and economically viable for developing countries.

Advances in HPV research and vaccine program

There are at least two successful HPV VLP vaccines have been developed and are in Phase III clinical trials. The vaccine developed by Merck, called 'Gardasil' is a recombinant quadrivalent L1 VLP vaccine which contains HPV 6, 11, 16 & 18 and is made in yeast, and the other one is called 'Cervarix' developed by GlaxoSmithKline, is a recombinant bivalent L1 VLP vaccine made in bacculovirus against HPV 16 & 18 [20,21]. Both the vaccines have showed 100% efficacy in variety of short term (up to 4.5 years follow up) clinical trials in 13-25 year age group women. But nobody knows how long they will provide protection. Since Indian initiatives to develop HPV vaccines are in infancy, India is going to initiate clinical trial of these vaccines shortly. A memorandum of understanding (MOU) has been signed between Merck and Indian Council of Medical Research (ICMR), New Delhi for clinical trial of Gardasil in India for which a protocol is being developed. But before the trial is initiated in the region several issues need to be resolved for effective implementation of HPV program.

- Creating baseline epidemiology data – To identify most prevalent HPV types, use of cost effective tools such as Paper Smear Method should be introduced in resource poor countries.[22] This is easy to administer, store and transport samples from the field to the laboratories.

- Target Population - What is the age group of females to be vaccinated, whether males also to be vaccinated?

- Will HPV vaccine prevent the development of cervical cancer? It needs long-term monitoring of vaccinated women till they reach 35-45 years when rate of HPV

infection and cervical cancer is higher.

- Would the vaccine provide life long immunity or how long antibody will persist to protect infection or boosters will be required, if so, then at what interval?

- Will the HPV16 and 18 prototype vaccine have any protection against the cancers caused by other high-risk HPV infections?

- Do the geographical HPV variants affect efficiency of the prototype vaccine? There are geographical variations in the sequence of HPV types which leads to proteins with altered biological functions resulting in different clinical outcome of the disease. Therefore, it may be required to develop region-related-variant-specific HPV vaccine for effective anti-HPV immunity.

- Consideration of ethical and social issues for administration and monitoring of vaccines is most essential. Because of ethical and social stigma associated with unmarried girls in Asian region, non-invasive methods such as self sampling of urine for HPV DNA testing can be employed effectively for vaccine monitoring.

- Both for screening and monitoring of HPV vaccine program there is a need for development of regional reference laboratory with Region-specific HPV diagnostics at par with international standards. In this regard, WHO is making efforts to establish a Regional HPV Laboratory for southeast Asian region. The laboratory will be involved in development of International standards of HPV DNA reagents for reliable HPV diagnosis and vaccine monitoring.

- Is HPV serology reliable as antibody titre following spontaneous HPV infection is very low or undetectable? Good antibody responses occur if vaccine is given in young adolescents (9-10 years olds) but it remains to be seen whether they get protected when they reach sexual maturity and activity. It is also not known if adults can have high antibody titre following vaccination?

- Will the vaccines produced by Merck and GSK be affordable to resource poor countries? Furthermore, these protein-based VLP vaccines are heat-labile, need cold chain for storage and distribution and are not effective in already infected women. To address, these issues, there is a need for developing a second generation vaccine which should be easy to produce, cost-effective and can also take care of already HPV infected women. Major efforts, therefore, be directed towards developing HPV DNA-based vaccine which will be highly immunogenic, cost-effective and both prophylactic and therapeutic in nature.

The hepatitis viruses and cancer

Hepatocellular carcinoma (HCC), the major type of primary liver cancer, is one of the commonest cancers contributing nearly 4% of all the malignancies and a leading cause of death in many countries, mainly in Asia and Africa.[23] The heterogeneous geographical distribution of HCC has been instrumental in identification of major risk factors, including chronic infections with hepatitis B virus (HBV), hepatitis C virus (HCV). Although, exposure to hepatocarcinogen aflatoxin B1, alcohol, hemochromatosis, alpha 1-antitrypsin deficiency, tyrosenimia, glycogen storage disease also contribute to the development of HCC, in 70-85% of HCC cases, there is an underlying HBV or HCV infection.[23] HBV infection causes mainly chronic liver disease and as high as 400 million people are chronically infected with HBV and 70 to 80% of these cases occur in Africa and Asia.[24] In several cohort studies, the relative risk of developing HCC increases from 5.3 to 148 fold in chronic HBV surface antigen (HBsAg) positive subjects [2,25].

The clinical course of acute HCV infection is mostly asymptomatic, but acute infection leads to chronic liver disease. Advanced liver disease and its complications may be the first clinical evidence of chronic HCV infection. It is estimated that about 170 million people are chronically infected with HCV worldwide.[26] The rate is around 1% in North America and Western Europe, while it is up to 10-20% in some African and Asian countries. The number of HCV

infected people is lower than in case of HBV infection, the chronicity, however, is much higher in every age group, reaching up to 85%.[26]

In a study from India, 74 consecutive cases of HCC were studied and evidence of HBV infection was recorded in 71% patients. Infection of HCV alone was detected in 4% and dual HBV and HCV infection in 8% patients [27]. Thus, HBV infection is the predominant factor for the development of HCC which is generally related to mutant forms of the virus. In majority of HCC in India, overt cirrhosis of the liver has been shown.

It is reported that the incidence of HCC is increasing in many countries in parallel to an increase in chronic HCV infection. The death rate due to HCC has been increasing over the last two decades. Recent studies have shown that one of the main causes of this increase is associated with increased infection with HCV.[28]

Methods and Characteristics of effective intervention

Transmission of infection in areas of high prevalence is predominantly occurs in children. However, the modes of transmission in children are unclear. Mother-to-child (perinatal) transmission plays a particularly important role in South Asia. In adults, sexual transmission is a major mode, although intravenous use of drugs and lack of stringent quality control measures during blood transfusion play an important role in some regions.

Vaccination against HBV is the most effective means for preventing transmission of HBV. Recombinant vaccines are highly immunogenic and confer long-lasting protection against acute hepatitis and chronic infection. When administered properly, the vaccine induces protection in 95% of recipients where child and adult infection predominates and greater than 70% in regions where perinatal infection is higher. Evidence that mass immunization is followed by decrease in the incidence of liver cancer has been reported in Taiwan [29], and the Republic of Korea.[30] The efficacy of vaccination in preventing perinatal infection is improved by the addition of hepatitis B immunoglobulin administration soon after birth. Efforts made by the Global Alliance for Vaccines and Immunisation (GAVI) has resulted in inclusion of hepatitis B vaccination in national immunization programme of India and most of South Asia. Due to expiry of intellectual property rights on HBV vaccine and development of its own manufacturing units, the economics of implementing nationwide immunization against hepatitis B has become affordable for the region.

An effective vaccine has been available for prevention of new infection with HBV. However, vaccine against HCV infection is not available as yet. Interferon (IFN) has potent antiviral activity against hepatitis C virus. Previous studies have shown that IFN can reduce the incidence of hepatocellular carcinoma in patients with HCV infection.[31-33] After complete eradication of HCV by IFN therapy, HCC rarely occurs.[34] The risk of HCC might increase in patients with chronic hepatitis who have complete responses to IFN therapy. New regimens combining IFN with antiviral drugs can improve the rate of HCV clearance.[35]

Interferon is effective in patients with HBV-related chronic hepatitis and is known to reduce serum HBV DNA concentration, improve biochemical data, and consequently suppress disease progression to cirrhosis. Previous studies reported that IFN therapy successfully reduced hepatocellular carcinogenesis in patients with HBV-related cirrhosis and induced tumor regression with inoperable HCC.[36] On the other hand, in terms of HCV-related HCC, it is reported that long-term IFN therapy suppresses tumor recurrence after radical operation for HCC.[37]

How to prevent HBV and HCV infection

Apart from vaccination, various other prophylactic approaches such as avoiding transmission of the infection by blood contacts such as during medical and dental interventions, blood products, tissue/organ transplants, disposable syringes and awareness among adolescents and adults of the need for hygienic sexual practices are the effective approaches to control hepatitis virus infections. In addition, community programmes for control of contamination of food and water with aflatoxins and reduction in alcohol consumption could also reduce the risk for development of liver cancer. Provide counseling and educational programmes through audio-visual and print media for avoiding any type of body piercing activities including tattooing which is very common in Asia, occupational

exposure, cross-contamination during intravenous drug injections, screening all blood and other human products, and screening of pregnant women for HBV/HCV infections.

Human immunodeficiency viruses, AIDS and cancer

The human immunodeficiency viruses (HIV-1 and HIV-2), the etiological agents of the acquired immune deficiency syndrome (AIDS) belongs to lentivirus family of the Retroviridae family. South Asia especially India has the second largest population with HIV infection and AIDS following Africa.[5,38] Prevalence rates are lower in other parts of South Asia but rising slowly, particularly in Pakistan and Nepal. The prevalence of HIV in India is heterogeneous; it is concentrated in some southern and western states while most of India has low prevalence. Diagnosis of infection with HIV relies on the identification of specific antibodies to viral proteins, or direct detection of viruses or viral proteins. HIV infection is marked by the decrease in CD4+ lymphocytes and CD4+:CD8+ cell ratio.[39] The development of AIDS is defined by the occurrence of one or more specific opportunistic infections especially tuberculosis, malignancies such as non-Hodgkin's lymphoma, Kaposi's sarcoma and related diseases occurring in patients with HIV infection. In South Asia, the prevalence of kaposis's sarcoma is quite low as compared with reports from Africa, USA and United Kingdom.[40,41] However, the data from India and Pakistan indicate that patients with AIDS have an increased risk of developing non-Hodgkin lymphoma.[42,43]

Scientific evidence for disease etiology

Epidemiological evidence indicates that the incidence of Kaposi's sarcoma is greatly increased in persons infected with HIV-1 with a relative risk of 1000 fold with progression of immunosuppression.[5] Human herpesvirus type 8 (HHV-8) is the leading candidate as a cofactor for the development of this cancer. HHV-8 seroprevalence was found to be low in South Asia in both the healthy and the HIV-infected populations.[44] This correlates with the fact that hardly any AIDS-related Kaposi's sarcoma has been reported in these countries. Non-Hodgkin's lymphoma incidence is greatly increased in persons with HIV-1 infection. Co-infection with specific viruses like Epstein-Barr virus (EBV) is associated with primary lymphoma of the brain and body-cavity lymphomas and multicentric Castleman's disease are associated with HHV-8. Studies of women infected with HIV show increase in development of cervical carcinoma and HPV infection.[45] Since HIV-1 tat protein may also enhance the development of HPV-related precancerous and anogenital lesions, it is considered that the immunosuppressive effect of HIV-1 infection is the main cause of development of malignancies in AIDS.

Methods and characteristics of effective intervention

More than 40 preventive vaccines for HIV/AIDS are being tested around the world. Aventis, Merck, Chiron and GlaxoSmithKline (GSK) are some of the companies in the forefront of research. But two phase – III trials carried out in Thailand and the USA have not demonstrated any significant level of efficacy. Efforts have also been made to combine two different type of vaccines i.e. VaxGen's AIDSVAX with Aventis Pasteur's ALVAC-HIV but it also did not work.[46]

In the absence of an effective treatment or vaccine, control and prevention of HIV infection continues to rely on behavioral interventions. The main routs of HIV-1 transmission are sexual intercourse, blood-blood contact and from mother to infant, including breast-feeding.[5] The risk of transmission through all routes is associated with viral load in the infected person. Other factors like presence of other sexually transmitted diseases, especially genital ulcerative disease also increase the sexual transmission.[47] Use of appropriate physical barriers such as condoms during intercourse is the most recommended. However, in some African countries abstinence has been promoted though it is less acceptable. In preventing sexual transmission, reducing the number and modifying the types of sexual contacts and consistent and correct use of condoms are essential. In addition, strong genital hygiene is to be promoted. Transmission from mother to child is associated with vaginal delivery and with breast feeding. Appropriate counseling of HIV positive mothers should be promoted to avoid vaginal delivery and breast feeding of their infants. Drug-dependence treatment programmes and improving the availability of sterile needles are possible effective measures to control

the HIV epidemics among intravenous drug users. Apart from these, stringent screening of blood from donors should be performed to prevent passive infection entry.

New approaches to the treatment of HIV infected people include combination therapy and use of anti-retroviral drugs and protease inhibitors and are the only alternative in the absence of effective and economical preventive vaccine for HIV which still faces many obstacles.

Human T cell lymphotropic virus and cancer

Human T cell lymphotropic virus (HTLV-I and HTLV-II) are complex retroviruses and play an important role in the pathogenesis of HTLV associated adult T cell leukemia/ lymphoma (ATLL). Evidence of HTLV-I infection was originally found in at least 90% of patients with ATLL in endemic regions. In ATLL, the virus is clonally integrated into the tumor cells. ATLL develops in 2-5% of HTLV-I infected individuals. Infection early in life appears to be important for the development of ATLL. No environmental co-factors promoting the progression to ATLL have so far been identified. A recent study revealed a strong disease association of HTLV-I with haematological malignancies and provided evidence for both horizontal and vertical transmission of the infection in the Indian population.[48] HTLV-I infection appears to be common among family members of individuals with HTLV-I associated haematological malignancies.

Methods and characteristics of effective intervention

There is no preventive vaccine available for HTLV infection in humans. Therefore, control and prevention of HTLV infection primarily depends on reduced transmission. HTLV-I infection is caused by transmission of live lymphocytes via three routes : perinatal, sexual and parenteral (from mother to child, from males to females, and by transfusion). Familial occurrence of ATL is frequently seen.[49] Perinatal transmission can be greatly reduced by avoidance of prolonged breast-feeding. A number of countries have introduced universal screening of blood donors to prevent transmission of HTLV.

Helicobacter pylori and cancer

H. pilori, a spiral, flagellated gram-negative bacterium that colonizes the human gastric mucosa was first isolated in 1982. The infection is ubiquitous but the strains are genetically heterogeneous, and this attribute is useful to study its transmission.[3, 50] In most cases, it is acquired early in life through oral contamination and persists with no or mild symptoms. H. pylori causes a chronic infection which rarely resolves spontaneously. Its transmission is favoured by overcrowding and low economic status and is most prevalent in developing countries.[51] H. pylori can be detected in gastric biopsy specimen and indirectly by serology and analysis of breath after ingestion of labeled urea (as it possesses a strong urease activity). Standard histological and bacteriological techniques and PCR are highly sensitive diagnostic tests. Epidemiologial studies currently involve use of serological tests and mainly commercially available ELISA kits. The actual distribution of Helicobacter pylori infection and its related diseases in South Asia is controversial. There is a large inter-country variation in incidence of gastric cancer and H. pylori seroprevalencein South Asia. There is a strong link between H. pylori infection and gastric cancer in many countries, such as Japan. By contrast, the prevalence of H. pylori infection is high in some countries, including India and Bangladesh, but low gastric cancer rates have been reported from these regions.[52]

Scientific evidence for disease etiology

The common gastric disorders that develop in infected persons include chronic gastritis, duodenal ulcer and, in a small number of individuals, gastric cancer or B cell mucosa-associated lymphoid tissue lymphoma. Marshall and co-workers provided the first evidence that H. pylori causes gastric inflammation for this discovery he was awarded the Nobel prize in Physiology or Medicine in 2005. The bacterium has been shown to increase cell replication in the gastric mucosa and induce inflammation through expression of IL-8[53,54] which results in increased cell replication in the gastric mucosa. The association between prior seropositivity for H. pylori and subsequent gastric cancer has been

evaluated by IACR experts.[3] Significant positive associations were observed with cumulative relative risk of 3.8. The relative risk increased with the increase in the length of follow-up.

Methods and characteristics of effective intervention

The transmission of H. pylori occurs from one person to another; both oral-oral and oral-faecal routes. Epidemiologic studies of atrophic gastritis which is essential to the development of gastric cancer have also shown an association with dietary factors, especially excessive salt and nitrate intake and inadequate consumption of fresh fruits and vegetables.[3]

H. pylori can be cultured and is sensitive to most antibiotics. Therefore, an early detection can lead to bacterial eradication by antibiotic treatment. In two studies of treatment, 75 to 85 % gastric cancer patients showed tumor regression after therapy to eradicate H. pylori.[55] However, the option appears to be less feasible in view of prophylactic treatment of a large population at all ages.

Epstein-Barr virus and Cancer

Epstein-Barr virus (EBV) is a gamma-1 herpesvirus found throughout all human populations, with a prevalence of over 90% in adults.[6] Primary infection usually occurs in the early childhood and is asymptomatic, whereas delayed primary infection may cause a self-limiting lyphoproliferative disease, infectious mononucleosis. B lymphocytes are a normal reservoir for latent infection. Only a small fraction of latently infected B lymphocytes spontaneously enters the productive cycle. EBV infection has been primarily related with development of nasopharyngeal carcinomas, Burkitt's lymphoma, non-Hodgkin's lymphomas, Hodgkin's disease and related weakly with lymphoepithelial and adenocarcinomas. Nasopharyngeal carcinoma is a rare malignancy in most populations, although very high rates are seen in populations from southern China and more moderate rates in other parts of South East Asia. Nasopharyngeal carcinoma show higher prevalence rates in some southern states and northeast frontiers of India.[56-58] However, this carcinoma is quite infrequent tumor in Pakistan and only a small portion of them show presence of EBV.[59]

Scientific evidence for disease etiology

Monoclonal EBV DNA and viral products are consistantly detected in malignant nasopharyngeal carcinoma cells but not in normal nasopharyngeal epithelium which strongly implicate EBV as a causative factor in the etiology of the disease.

The viral DNA present in Burkitt's lymphoma cells is also in monoclonal form. However the frequency of this association varies geographically. The importance of EBV in the causation of Burkitt's lymphoma appears to be greatest when infection occurs in the early years of life.[60] As seen in African populations, malaria acts as an important cofactor in the development of Burkitt's lymphoma.

EBV has particular importance in non-Hodgkin's lymphomas occurring in immunosuppressed individuals, who are at increased risk.[61] Non-Hodgkin's lymphomas in transplant recipients and in patients with congenital immunodeficiencies are nearly always EBV-positive.

The consistency of the finding of clonal EBV and the expression of LMP-1 in about half of Hodgkin's disease cases in many patient populations throughout the world argues strongly against a passenger role for the virus in these cases.[62]

Methods and characteristics of effective intervention

One cause of nasopharyngeal carcinoma in high risk populations is Chinese-style salted fish, a known carcinogen. Other preserved foods and cigarette smoking have also been implicated in its carcinogenesis. Saliva is the usual vehicle of transmission of EBV.

Few drugs are available that prevent viral replication without significant toxicity. Acyclovir and a number of related compounds have been used successfully to reduce viral replication but with no significant effect on persistent infection. Prophylactic, post-infection and therapeutic EBV vaccination strategies are currently being developed with recombinant subunit viral proteins and live recombinant virus vectors. The success of this endeavour will depend on a better understanding of the EBV life cycle and the immune response generated by natural infection in humans.

Conclusions and Recommendations

Evidence-based decision making in human health and disease requires the availability of sound data, but good quality information on the occurrence of premature mortality and loss of healthy life years due to infection related malignancies is unavailable from most of South Asia. Therefore, there is an urgent need to develop a database in this respect to prioritize and to focus the intervention efforts.

Considering the heterogeneity in the prevalent infections and diverse disease patterns, locally relevant intervention programmes are needed to be formulated than a one specific approach for all. As a first step behavioural surveillance programmes have to be initiated to improve the understanding of transmission patterns.

In resource-poor regions, information about the infectious agents, and their role in development of various cancers should be disseminated through audio-visual and print media, awareness camps and community programmes.

Organization of frequent early cancer detection camps for effective cancer control and improving care-seeking behavior of the patients.

Immunization with vaccines at an early age should be promoted whereever the vaccines are available such as in case of HBV and HPV.

Programs may be undertaken to educate masses about cancer-promoting agents including tobacco, and their occupational or otherwise exposure.

Promote personal and community hygiene in food and drug usage.

Training of primary health-care professional for visual inspection of cervix should be imparted which has been demonstrated to be a very effective strategy for control of cervical cancer in resource-poor set-up.

Surveillance systems for infectious diseases are lacking in most of South Asia, which is essentially required for detecting and monitoring the occurrence of infectious diseases important to public health and for measuring the effectiveness of targeted intervention. There should be involvement of staff in the government and private sector, sentinel laboratory surveillance, simple reporting procedures and regular feedback to the data providers.

Monitory support should be provided for creation of epidemiological baseline data on infection-associated cancer in the region.

Support should also be provided for development of low cost vaccines and already developed vaccines should be made available at affordable cost.

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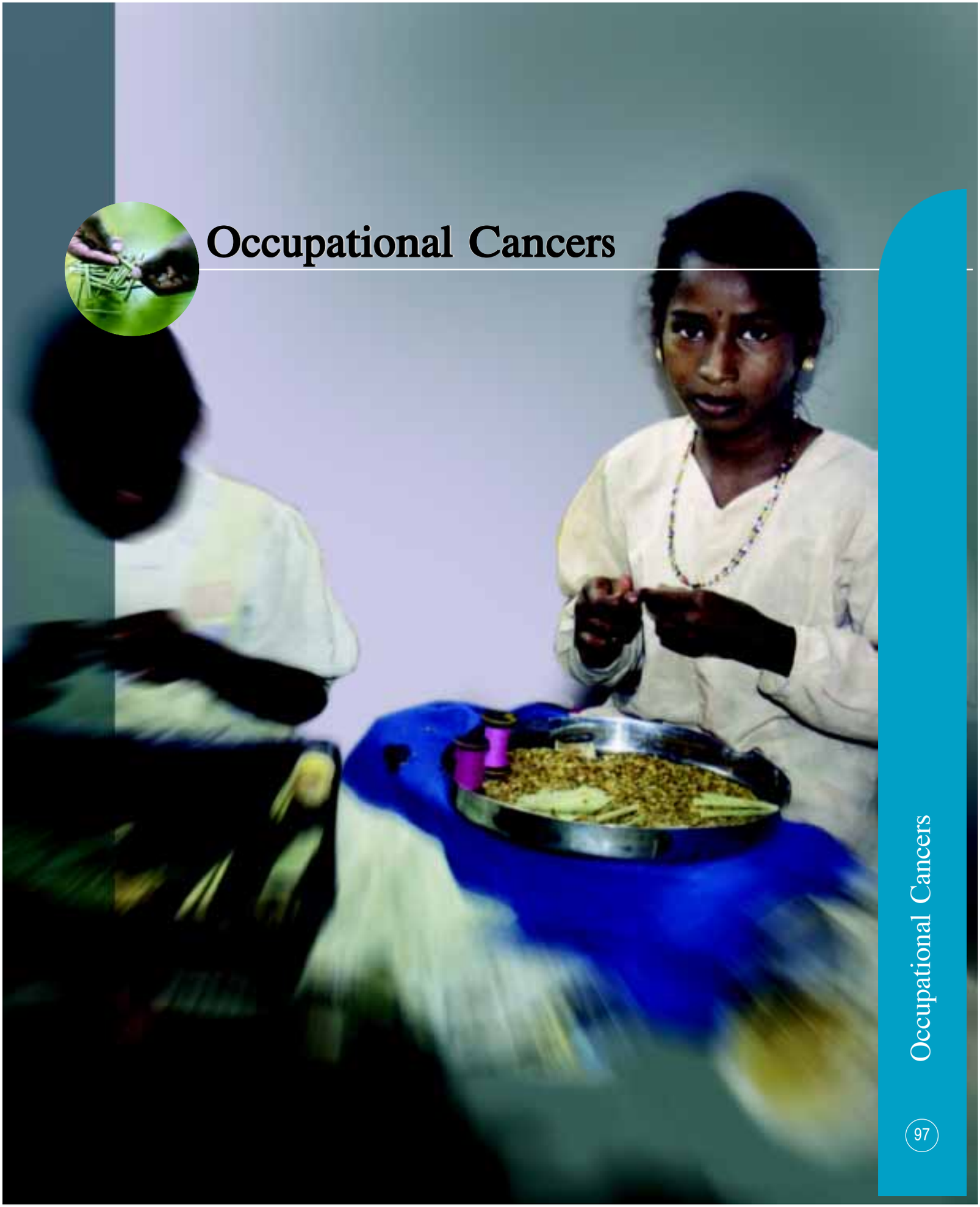
A high incidence of scrotal cancer was reported in 1775, among chimneysweeps. Perhaps this was one of the earliest reports indicating an association of occupational exposure and cancer. This observation led to adopt protective regulations and legislations to reduce workplace exposure. The present article focuses mainly on those occupational agents, which are reported to be carcinogenic to humans. Tables 1 and 2 summarize the agents or groups of agents and mixtures reported to be carcinogens to humans and exposure circumstances associated with increased risk of cancer respectively, and table-3 deals with the life style factors relevant to the countries in South Asia that have significant role in causation of cancer development and are known human carcinogens.[1] Table- 4 depicts some known or possibly carcinogenic agents to humans, occupational situations and associated cancer types.

During occupational situations, workers are exposed with higher doses of toxicants as compared to environmental exposure. Industrial workers may be exposed to various chemicals, radiation, toxic fumes, toxic solvent,intense heats, etc. without the knowledge of the exposed individual and effect of this low-level exposure can only be assessed when the clinical manifestation of diseases occurs. However, risk associated with work place carcinogens could be reduced drastically by reducing and eliminating the carcinogens in the work place environment. Most countries in South Asia are in different stages of development and some times it is difficult for them to adopt best available methods for the reduction of work place exposure due to one or other reasons. Occupational cancers have a very long latent period i.e. up to 20-30 years or more. Research is needed on better applications of existing knowledge for primary prevention. Thus focus should be on those chemical agents, fibers, and particulates, along with ionizing radiation, which are considered, to be the primary causes of occupational cancers.

Occupational Cancers



Occupational Cancers

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Occupational Exposure and Cancer

Most countries in South Asia have poor occupational safety and health legislation and also resources and infrastructure. Pakistan has also poor occupational safety and health legislation and infrastructure to promote occupational health and safety.[2] Occupational exposure limits (OELs) are well established in many countries, which serve occupational professionals as benchmarks of industrial hygiene practice at workplaces worldwide. In China, the strategy of the World Health Organization's "Two-step Procedure" is applied to convert health-based recommendations to law-based operational occupational exposure limits, with considerations for national technological and socioeconomic conditions and priorities. As a result Occupational Diseases Prevention and Control Act of the People's Republic of China (ODPC Act), an official document on occupational exposure limits for hazardous agents in the work place has now become one of the most essential regulations affiliated with the ODPC Act in China.[3] In the Republic of Korea, industrial safety and health act was completely restructured in Year 2003 to be more systematic to meet the particular needs of the country.[4] The concept of environmental auditing in industrial units in India was formally introduced in 1992 with the overall objective of minimizing consumption of resources and promoting use of clean technologies in industrial production to minimize generation of wastes.[5] Women and children are especially vulnerable as they usually work informally, with no basic occupational health and safety protection. A very large number of illiterate workers are employed informally in unorganized sectors like agriculture, construction, mining and small-scale industries. Occupational cancer, caused by emission of pollutants at the work place, poses an increasingly serious health problem. Workers are exposed to a wide variety of chemical or physical agents. Hundreds of newly developed chemicals are introduced into work places each year. Many of these chemicals have not been adequately tested for carcinogenecity. A substantial number of cancer deaths are associated to occupational exposure. At least 4% of deaths from cancer each year is thought to be the result of exposures at the workplace.[6] Estimations of the number of cancer cases related to occupational exposures are based on cancer sites such as lung and bladder, which are recognized as having a substantial occupational component. A total of 10 to 20% of lung cancers [7] and 21 to 27% of bladder cancers [8,9] estimated to be related to occupational exposure. However, evaluation of number of

high-risk population is very difficult with regards to the known carcinogens. There are various teething problems in estimation of high-risk population due to inadequate information with regards to the number of workers engaged in occupations related with exposure to these carcinogens, lack of proper exposure history, degree and duration of exposure and affect data, no systematic record keeping or reporting of occupational mortality and morbidity, etc. Further, there are several occupations for which an elevated risk of cancer has been documented, but the causative agents has not been definitely identified, including painters, rubber workers, dry cleaners, printing processes and welding [10] and substantial number of workers are engaged in these occupations in South Asia.

Epidemiological methods especially retrospective cohort studies have been very successful in documenting cancer risks associated with single agent.[11] Generally recognition of single agent associated with work-related cancer is assessed by retrospective cohort studies. A study indicative of an exposure-response relationship among the rubber hydrochloride workers, exposed to benzene between 1940 and 1965 indicated a pattern of higher risk for standardized mortality rates (SMRs) to leukemia was associated with higher cumulative exposure to benzene.[12,13] Workers as well as general public are exposed to benzene as a result of a various activities. Major contributors to benzene emissions into air include: gasoline production, storage, transport, vending and combustion; production of other chemicals from benzene; and indirect production of benzene (e.g., in coke ovens). Chronic human exposure to benzene results in leucopenia, thrombocytopenia, anemia or combinations of these. Many studies have described the association of leukemia with exposure to benzene, either alone or in combination with other chemicals.[14] Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood forming organs.

A large number of epidemiological studies and case reports have substantiated the causal association between vinyl chloride and angiosarcoma of the liver. Several studies also confirm that exposure to vinyl chloride causes other forms of cancer, i.e. hepatocellular carcinoma, brain tumours, lung tumours and malignancies of the lymphatic and haematopoietic system.[15] Strong associations with liver cancer were reported for workers exposed to vinyl chloride. They died due to liver cancer at the rate seven times than expected, and most of the deaths were reported due to angiosarcoma of the liver.[16] A high incidence of predominantly oat-cell carcinoma in a small population of laboratory workers exposed to bischloromethyl ether (BCME) strongly suggests that exposure to this compound constitutes a serious human lung cancer hazard. Epidemiological evidence also suggest that exposure to BCME may constitute a lung cancer risk amongst workers exposed to it as a contaminant in the manufacture of the related chloromethyl methyl ether (CMME).[17]

A very large workforce is employed in the construction and mining industry, in which substantial number of workers is exposed to asbestos. Asbestos causes cancer of the lining of the lungs and abdominal organs known as mesotheliomas. However, asbestos is an important occupational lung carcinogen, first documented following inhalation of asbestos fibres in the 1950s.[18] All different forms of asbestos – chrysotile and amphiboles, including crocidolite, amosite and tremolite – are carcinogenic to humans, causing mesothelioma and lung cancer, although the potency of chrysotile might be lower than that of other types, with respect to mesothelioma risk.[19] In India, chrysotile form of asbestos is used almost exclusively. Asbestos is used in roofing, drainage and drinking water pipes, textile products, brake lining etc. An investigation into the deaths among housewives from asbestos related diseases such as asbestosis and mesotheliomas, indicated that during the second world war they had worked in a gas masked factory putting asbestos filters into mask.[20] Recently Chaturvedi and Chaturvedi, mentioned that inspite of hard epidemiological and clinical evidence associating asbestos fibres with asbestosis and cancer, the

Table-1 List of chemical and physical agents, groups of agents and mixtures encountered in various occupations for which there is sufficient evidence for carcinogenicity (Group 1 carcinogens to humans)*

Agents and groups of agents	
Aflatoxins (naturally occurring)	Nickel compounds
4-Aminobiphenyl	Phosphorus 32
Arsenic and arsenic compounds [NB. This evaluation applies to the group of compounds as a whole]	Plutonium-239 and its decay products
Asbestos	Radioiodines, short-lived isotopes, including iodine-131, from atomic reactor accidents and nuclear weapons detonation (exposure during childhood)
Benzene	Radionuclides, á-particle-emitting, internally deposited
Benzidine	Radionuclides, b-particle-emitting, internally deposited
Beryllium	Radium-224 and its decay products
Bis (chloromethyl)ether	Radium-226 and its decay products
1,4-Butanediol dimethanesulfonate	Radium-228 and its decay products
Cadmium and cadmium compounds	Radon-222 [10043-92-2] and its decay products
Chlorambucil	Silica [14808-60-7], crystalline
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)	
-1-nitrosourea (Methyl-CCNU; Semustine)	Solar radiation
Chromium [VI] compounds	Talc containing asbestiform fibres
Ciclosporin	Tamoxifen
Cyclophosphamide	2,3,7,8-Tetrachlorodibenzo-*para*-dioxin
Diethylstilboestrol	Thiotepa
Ethylene oxide	Treosulfan
Etoposide	Vinyl chloride
Formaldehyde	Mixtures
Hepatitis B virus	Coal-tar pitches
Hepatitis C virus	Coal-tars
Human immunodeficiency virus type 1	Mineral oils, untreated and mildly treated
Melphalan	Shale-oils
8-Methoxypsoralen (Methoxsalen) plus ultraviolet A radiation	Soots
MOPP and other combined chemotherapy including alkylating agents	Tobacco products, smokeless
Mustard gas	Wood dust
2-Naphthylamine	
Neutrons	

* Based on overall evaluations of carcinogenicity to humans, IARC monographs volumes 1-88.

issue is complicated. In developing countries, extensive and aggressive marketing continues by chrysotile producers from developed countries. It is extremely dangerous and scientifically unsound to say that chrysotile asbestos can be used without risk.[21]

The available data suggest that it is possible to develop evidence for a causal relationship between specific agent and the cancer excess, single-agent carcinogens can be effectively controlled. Ward (1995) reported that 23 of the 24 carcinogens regulated by OSHA (Occupational Safety and Health Administration, USA), including benzene, asbestos, BCME and vinyl chloride are single-agent association with the occupational cancer.[11] However, association between single agent exposure and excess cancers risk is reported with some of the chemicals but practically humans are exposed to a number of other chemicals as well as physical factors during occupations that may also be contributing for this excess.

Occupational Cancer associated with Agriculture and Forestry

The countries in South Asia are in different stages of industrial development while the agriculture is the major source of employment. A large number of people are engaged in agriculture and related activities in South Asia. They are exposed to certain farm chemicals and physical factors and some of these have the potential causes of cancer. Elevated frequency of brain, cervix, gall bladder, liver, ovary, stomach cancer and leukemia, lymphoma, multiple myloma, was reported among the agriculture workers.[22] The data on farm chemicals and occupational cancer are limited from South Asia. However, situation may be more severe in this region as a large number of workers are engaged in agriculture and are not adopting hygienic practices, taking precautions while mixing and spraying of farm chemicals and tropical condition of this region also warrants them using protecting clothing during occupation with respect to the developed countries. A case control study of lung cancer carried out among sugar cane farmers in India indicated an increased risk of lung cancer for workers employed on a sugar cane farm (OR = 1.92, 95% CI 1.08 - 3.27). The authors concluded that exposure to fibres of biogenic amorphous silica (BAS) formed from silica absorbed from the soil and deposited in the leaves of the sugar cane crop or crystalline silica formed as a result of conversion of BAS to cristobalite at high temperatures may account for the increased risks of lung cancer among sugar cane farmers.[23] Another study carried out in India indicated a significantly higher risk of skin cancer seen among agricultural labourers (OR = 1.4, 95% CI 1.36 - 4.23).[24] Tobacco harvesters are occupationally exposed to nicotine during cultivation. There are about 1.2 million (0.7 million growers and 0.5 million curers) tobacco harvesters in India. The tobacco harvesters develop a group of symptoms, which is called "Green Tobacco Sickness (GTS)". This sickness from India reported in 1979 and it was described as "green symptoms".[25] The prevalence of GTS among Indian tobacco harvesters was found fairly high in the harvesters of both varieties i.e. non-Virginia (86.20%) and Virginia (60.09%).[26] GTS is an acute form of toxicity resulting from absorption of nicotine through skin. Further, a study on tobacco farmers carried out in Malaysia also indicated the dermal absorption of nicotine from tobacco leaves by measuring urinary cotinine as a marker of nicotine absorption.[27] Nicotine has not shown direct carcinogenic effects but it may promote tumour growth.[28] Threonine kinase activation by nicotine and tobacco specific carcinogen 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) could contribute to tobacco - related carcinogenesis by regulating two processes critical for tumorigenesis, cell growth and apoptosis.[29] The use of hand gloves significantly decreased the urinary level of nicotine ($p < 0.01$) and cotinine ($p < 0.0005$) among the tobacco harvesters.[30] This suggests that simple preventive measure could reduce the nicotine exposure significantly among tobacco harvesters.

Dye Manufacturing workers and applicators

A large number of workers are engaged in the dyestuff industry in South Asia especially in India, Pakistan, Sri Lanka and Bangladesh. Exposure in the dyestuff industry causes cancer of

the urinary tract, usually the bladder as a result of inhalation or absorption of chemicals like benzidine and beta-napthylamine by the skin. Few epidemiological studies have examined the cancer risk associated with exposure to benzidine. A surveillance study of 179 active and 65 retired workers in a dyestuff manufacture plant in Japan revealed nine cases of bladder cancer; all of the cases had been engaged in benzidine production.[31] High incidences of cancer of the bladder and urinary tract after concomitant exposure to benzidine and 2-naphthylamine were also reported.[32,33] Exposure to these two compounds was also associated with an increase in the occurrence of second primary cancers at sites other than the bladder, including the liver.[34] Study carried out in India among workers of a small-scale industry manufacturing benzidine-based dye i.e. Direct Black 38 (C.I. 30235), benzidine was detected in the urine of 16 of 18 workers. Mono and diacetyl benzidine were found in all the samples.[35] Further, study conducted on the workers exposed to Direct Black 38 dyes indicated the presence of deoxyguanosine – (8 monoacetyl benzidine) adduct in the exfoliated urothelial cells of the workers.[36] These studies highlighted the potential risks of bladder cancer in such units of developing countries.

Crystalline Silica exposure

The earth's crust contains about 12% free silica mostly quartz. The sand stone industry, stone quarrying and dressing, granite industry, grinding of metals, sand blasting, iron and steel foundries, silica milling, flint crushing and manufacture of abrasive soaps are some of the occupations related to silica exposure. A sizable number of workers are working in various industries where silica exposure is there in South Asia. In India alone, there are about 3 million workers employed in various types of mining and quarries (1.7 million), manufacture of non-metallic products i.e., refractory products, structural clay, glass, mica etc. (0.6 million) and manufacture of basic metals & alloys industries i.e. iron & steel, copper, ferro alloys, aluminium etc. (0.67 million) are at potential risk of silica exposure. In addition many of the 5.4 million construction workers are also at the risk of silica exposure.[37] Slate pencil industry, agate-grinding industry etc., are the occupations peculiar to India and very important from silicosis point of view. Epidemiological studies indicate high prevalence of silicosis in many occupational groups like slate pencil workers,[38] agate workers,[39] pottery workers [40] etc. Non-occupational silicosis has also been reported in certain villages in Ladakh region of India.[41] This indicates the significant exposure to crystalline silica in this group of workers through occupational and non-occupational environment. Since crystalline silica is established human carcinogen these groups are at a high risk of cancer. Special epidemiological studies are needed to find out incidence of lung cancer in these high-risk groups. An increased rate of lung cancer has been reported in cohorts of silicotic patients.[42,43]

Ionizing radiations

Workers are exposed to higher doses of ionizing radiation accidentally as well as during their occupation or sometimes industrial workers have to do repair work after the accidental spillage of radioactive material, which leads to exposure to high doses of unwanted radiation. Exposure to X- and gamma-radiation causes leukemia and solid tumors in human.[44] Iron ore mining causes lung cancer due to high radioactivity in the air in mines. The excess number of cases of lung cancer in miners exposed to radon appears to be between 0.1-1.0/year, per rem per million.[45] Further, underground miners exposed to radioactive radon and its decay products reported to be at increased risks for lung cancer.[46]

Painters and Dry cleaners

Employment in the furniture-making industry has been associated with nasal adenocarcinoma; an increased risk for other nasal cancers. Case reports and epidemiological studies have clearly corroborated an increased risk of nasal adenocarcinoma among workers in the furniture and cabinet-making industry.[47] IARC concluded that there is sufficient evidence for the carcinogenicity of occupational exposure as a painter. Thousands of chemical compounds are used in paint products as pigments, extenders, binders, solvents, and additives; some of them are recognized to be potential

human carcinogens. Painters have been shown to have increase risks of lung cancer and cancers of the oesophagus, stomach and bladder in many studies.[48] Study carried out in India also indicated a significant increased risk of lymphatic and haematopoietic cancer among painters (OR = 7.3, 95% CI 1.42-37.28).[24]

Workers in the dry-cleaning industry are also known to have elevated cancer risks. There is no or scanty data from South Asia. Ward reviewed the data on the dry–cleaning industry and cancer, and reported that elevated rates for urinary tract, bladder, oesophageal, pancreatic, colon and lymphatic cancers among dry –cleaning workers.[11] However, in most of the studies it could not be established that to which solvent or solvents workers were exposed. Ruder et al have identified excess of oesophageal cancer among a small cohort (n=625) of dry – cleaning workers exposed only to perchloroethylene.[49]

Electrical workers

Concern in recent years created with the potential for increased risk of cancer among electrical workers resulting from electromagnetic radiation. Milham documented increased leukemia mortality among electrical workers. Later several studies pointed risk of leukemia and brain cancer in relation to electrical occupations.[50] Studies of leukemia in electrical workers show a moderate consistency, with elevated risk ratios of 1.2 to 2.0 commonly observed. Brain tumors are similarly elevated with some consistency, and few studies have suggested increased risk of male breast cancer.[51]

Rubber industry

The link between urinary bladder cancers and occupational exposure to certain aromatic amines such as 1-naphthylamine, 2-naphthylamine, benzidine and 4 aminodiphenyl has been suggested. Such exposure occurs in various industries especially rubber and cables, dyestuffs and chemicals, etc..[45] Rubber industries cause bladder cancers due to the chemicals used in the processing and hardening of rubber. A number of studies have been conducted on the rubber industries in different countries. Workers employed in the industry before 1950 have a high risk of bladder cancer, probably associated with exposure to aromatic amines. Leukemias have been associated with exposure to solvents and with employment in back processing, tyre curing, synthetic rubber production and vulcanization.[52] Excess mortality from lymphomas has been noted among workers exposed to solvents in such departments as footwear and in tyre plants.[53] Failure to eliminate completely worker's exposure to carcinogenic aromatic amines explained the persistent observation of an increased risk of bladder cancer in the rubber industry worldwide.[54]

Arsenic exposure

Arsenic contamination of ground water is the major problem in some parts of South Asia especially Bangladesh and Eastern India. Occupational exposure to inorganic arsenic, especially in mining and copper smelting, has quite consistently been associated with an increased risk of cancer.[55] An almost ten-fold increase in the incidence of lung cancer was found in workers most heavily exposed to arsenic, and relatively clear dose-response relationships have been obtained with regard to cumulative exposure.[56] An association between environmental exposure to arsenic through drinking water and skin cancer has been reported.[55,57,58] A multiplicative effect of arsenic exposure and smoking was also observed among Swedish smelter workers. A slightly increased risk was also indicated for exposure to sulphur dioxide in this study.[59]

Occupations associated with exposure to mixture of chemicals

The workers are exposed to complex mixture of pollutants both physical and chemicals in a number of occupations. Coke oven workers particularly those on the oven top, have been reported to suffer from lung cancer, due to the presence of polycyclic aromatic hydrocarbons in the air in the vicinity of the oven.[45] Diesel exhaust is a complex mixture and has been reported carcinogenic in animals and is considered a probable human carcinogen by IARC. A study conducted among the cohort of service station workers in Nordic countries exposed to gasoline vapors with benzene levels

Table-2 Work place Exposure circumstances for which there is sufficient evidence of carcinogenicity (Group 1 carcinogens)*

Sr No.	Exposure circumstances
1	Aluminium production
2	Arsenic in drinking-water**
3	Auramine, manufacture of
4	Boot and shoe manufacture and repair
5	Coal gasification
6	Coke production
7	Furniture and cabinet making
8	Haematite mining (underground) with exposure to radon
9	Iron and steel founding
10	Isopropanol manufacture (strong acid process)
11	Magenta, manufacture of
12	Painter (occupational exposure as a)
13	Rubber industry
14	Strong-inorganic-acid mists containing sulfuric acid (occupational exposure to)

*Based on Overall evaluations of carcinogenicity to humans, IARC monographs volumes 1-88.

**Arsenic is quite high in the drinking water of certain areas of South Asia especially W. Bengal in India and Bangladesh.

Table-3 Life style agents or mixtures for which there is significant evidence of carcinogenicity (Gr. 1 Carcinogens) and are relevant to South Asian countries.

Sr No.	Mixtures (Gr. 1 Carcinogens to humans)
1	Alcoholic beverages
2	Analgesic mixtures containing phenacetin
3	Areca nut**
4	Betel quid with tobacco**
5	Betel quid without tobacco**
6	Salted fish (Chinese style)**
7	Tobacco products, smokeless**

*Based on Overall evaluations of carcinogenicity to humans, IARC monographs volumes 1-88.

** Use is very common

Table-4 Known and probable carcinogens, occupations associated with elevated higher cancer type

Agent	Cancer type	Occupations with Proven excess cancer
Asbestos	Lung, Mesothelioma	Construction, asbestos mining and milling, and cement
Arsenic	Skin, Lung, Liver	Metal mining and smelting
Benzene	Leukemia	Chemical and rubber manufacturing, petroleum refining
Benzidine, derived dyes	Urinary bladder	Dye and textile production
Beryllium	Lung	Beryllium processing, aircraft manufacturing, electronics, secondary smelting
Bischloromethyl ether (BCME)	Lung	Chemical plant workers
Cadmium	Lung	Smelting, battery making, welding
Chromium and chromates	Nasal sinus, Lung	Tanning, pigment making chrome ore mining and chromium industry
Chlorophenoxy herbicides	Non Hodgkin's Lymphoma	Farmers
Ethylene oxide	Leukemia	Hospitals, production of hospital supplies
Ionizing radiation	Skin, Thyroid, Lung	Nuclear, health care
Nickel	Nasal sinus, Lung	Nickel refining
Polycyclic aromatic hydrocarbons (from coke, coal, tar, shale, mineral oils and creosote)	Skin, Scrotum, Lung	Steel making, roofing, chimney cleaning
Radon	Lung	Uranium and hematite mining
Silica	Lung	Casting, mining
Vinyl chloride Monomer	Liver	Chemical manufacturing
Wood dust	Nasal sinuses	Carpentry
Some pesticides, Sun light and fuels	Brain, cervix, gallbladder, leukemia, liver, lymphoma multiple myeloma, ovary, stomach	Agricultural workers
Exposure to paint related chemicals	Lung, esophagus, stomach and bladder	Exposure in paint manufacturing and painting
Some of the solvents used in dry-cleaning	Cancer of Urinary tract, bladder, oesophagus, and pancreatic	Drycleaners

estimated to be 0.1-1.0 mg/m^3 showed no excess risk of leukemia or acute myeloid leukemia, a 30 % elevated risk of kidney cancer, and a risk of nasal cancer was reported.[60,61] In 1988, reviewing of the carcinogenecity data of diesel exhaust it was concluded that the epidemiological evidence was limited by the difficulty in defining and quantifying exposure, the relatively short time between initial exposures and analysis of risk in some studies, and suggested the need to control for cigarette smoking.[62] However, in later studies, smoking data have been collected and an attempt has been made to measure diesel exposure currently and then extrapolate back to historical levels. Steenland et al. conducted such nested case-control study of lung cancer deaths within the Teamsters Union. Interviews with next of kin were conducted to determine smoking history; both Teamster Union records and next-of-kin interviews were used to determine work history. Odds ratios for jobs with diesel exposure were compared with those without such exposure. Long-term (>35 years) truck drivers of primarily diesel trucks had an odds ratio of 1.89 (95% CI 1.04-3.42); individuals whose main job was truck mechanic had an odds ratio of 1.69 (95% CI 0.92-3.09), which was not related to length of exposure.[63] A case control study was conducted in India to note the risk factors for lung and bladder cancer. The study suggested a significantly elevated risk (adjusted for smoking) for textile workers (OR = 1.99, 95% CI 1.3-3.6) and cooks (OR = 4.88, 95 % CI 1.2-16.5). High risks were also observed among ship and dockyard workers (OR = 2.87, 95% CI 0.8-10.1) and wood workers (OR = 2.88, 95% CI 0.9-9.6). For bladder cancers, significantly elevated risk was observed only for chemicals/pharmaceutical plant workers (OR = 4.48, 95% CI 1.2-16.5).[64]

Children and Occupational Cancer

The foetus is particularly vulnerable even to the minutest concentrations of chemicals. Some of the carcinogenic chemicals are passed from mother to offspring, through the womb and breast milk, which may affect the offspring's growth and development and might induce cancer. Exposure to very small amounts of a chemical at an important period of development of the foetus or infant can be more harmful than greater exposures at other times or to adults. In South Asia a large number of children are working in various industries such as carpet making, garages, match box making, gem stone polishing, metal industries, shoeshine, garbage collecting and chemical sectors, etc. even though legislation to employ them in the hazardous industry is in enforce. These children are exposed to various known carcinogenic agents such as crystalline silica, benzene, dyes, organic solvent, etc. However, data on occupational cancer among children from this region is scanty as latency for cancer development is very long and these young workers shift from one to another industry frequently. Further, exposure during pregnancy may also have role in causation of childhood cancer. Several reports have been published on the relationship between parental occupational exposures and the risk of childhood cancer in offspring from other parts of the world.[65-67] However more research is needed on this aspect. Recently, Ward et al. mentioned that current epidemiological evidence is insufficient to determine the causal relationship, if any between parental occupation and risk of cancer in offspring.[68] Studies done in the USA, several European countries, Brazil and China show that children where parents are exposed to pesticides in and around the home, are more likely to get leukemia, brain cancer, Non-Hodgkin's lymphoma and soft tissue sarcoma.[69] However, available findings suggesting potential role of parental exposure and childhood cancer and occupational exposure in early life might also have some role in causation of cancer among children in this part of the world.

Role of life style factors and Occupational cancers

Life style factor does not have direct relationship with occupational cancer but might have some impact on the elevation of risks for causation of disease. Complex interactions may occur between occupation and life style factors such as diet, alcohol

consumption and smoking, which contribute; to differential cancer risks by occupation. The combination of cigarette smoking and exposure to occupational carcinogens increases risk of cancer. The same may be applicable with the chewing areca nut and tobacco, which is very common in this region. Both areca nut and smokeless tobacco products have been included as Group 1 carcinogen to humans by IARC (Table-3). The habit of areca nut and tobacco chewing is very common and it is estimated that about 200-400 million people, mainly Indo-Asian and Chinese use areca nut as a masticatory substance [70] and quite a large number of them are in South Asia. Higher prevalence of oral cancer in South Asia as compared to other parts of the world is believed to be associated with the chewing of areca nut and tobacco prevalent commonly in the region. Peculiar dietary habits such as consumption of Chinese-style salted fish and smoke dried meat has been reported to be associated with nasopharyngeal carcinoma. Several case-control studies consistently demonstrate that consumption of Chinese-style salted fish is strongly related to risk for nasopharyngeal carcinoma.[71] Recently a study conducted in Taiwan to find out risk factors for nasopharyngeal cancer in high risk nasopharyngeal carcinomas families and observed that risk associated with cumulative wood exposure and salted fish consumption before age ten was stronger in families with early NPC age-onset [OR (wood) = 5.10, 95% CI 1.50-17.34; OR (fish) = 3.94, 95% CI 1.47-10.55].[72] Studies carried out in North Eastern Region of India indicated higher risk for nasopharyngeal carcinoma with the consumption of smoke dried meat.[73] Thus these life style factors especially peculiar dietary habits might also have some impact on elevation of occupational cancer in this region.

Intervention Studies

It is an established fact that reduction of exposure to carcinogenic agents during occupation, lead to the reduction in the incidence of work related cancer. A number of case reports and follow-up studies of workers in many countries have demonstrated that occupational exposure to benzidine is causally associated with an increased risk of bladder cancer. Earlier data suggesting that the incidence of this cancer in workers decreased after a reduction in industrial exposure.[74] This have been supported by a study of a cohort of workers at a US benzidine-manufacturing facility, in which major preventive measures were instituted in 1950 to minimize worker's exposure. The study period covered 1945-1979, and overall, there was a clearly significant excess of bladder cancer incidence, which, however, declined in those first employed after 1950.[75]

A decrease in lung cancer risk after cessation of exposure to arsenic has been observed in some studies, possibly indicating a late-stage effect of arsenic.[76,77] Further, in designing strategies for occupational cancer prevention, attention should be focused on non chemical risk factor such as white collar and clerical workers have a 1.7 –fold excess risk of colon cancer related to their sedentary work, a risk factor that may be amenable to intervention strategies.[78] Fine postulated that prevention of occupational cancer depends upon dissemination of research findings, resulting in changes in work processes and reduction of occupational exposure to carcinogens. Examples of successes and failures of information dissemination are found in the results of research on silicosis. Better effectiveness of information dissemination is needed along with greater understanding of the barriers to implementation of the information by workers and management and improved hazard surveillance.[79] Further, prevention research methods should emphasize the overall reduction of cancer risks through modification of both occupational and non-occupational risk factors.[68] High prevalence and incidence of silicosis and asbestosis in silica and asbestos based industries has been reported. National Institute of Occupational Health, India carried out intervention studies to reduce the silica dust and asbestos fibres at the workplace by developing /using engineering control techniques such as enclosure of the source of hazardous material, use of local or general ventilation system, wet

methods, etc. in various small and medium size industries like agate, quartz crushing, stone quarry and asbestos mining and milling. These methods cut down occupational exposure to carcinogens and thereby might be reducing the risk of cancer to the workers.

Gaps and Research need

Data is needed to estimate the actual number of workers potentially exposed to specific chemicals or mixture, along with information of workplace environment with statistics on employment, job categorization, and manufacturing process as the information on these aspects are scanty from the South Asia. Detection of work related carcinogens are very important in public health terms because of the potential for prevention through regulation and improvements in industrial hygiene practices.[80] More emphasis should be given for the development of more suitable engineering and personnel protective devices in order to reduce the occupational exposure. Studies in occupational groups provide an unique opportunity to understand gene-environment interaction and other aspects of the mechanisms by which environmental exposures causes human cancer and may also provide an opportunity to investigate the relationship between endocrine disruptors and cancers of the reproductive organs.[68] More attention should be given on the carcinogenicity of substances classified by the International Agency for Research on Cancer (IARC) in Groups 2A and 2B (probably and possibly carcinogenic to humans), certain mixed-exposure circumstances and particulates. Additional studies are needed to address the individual and interactive roles of other physical agents, as well as biological agents and psychological factors related to work and also malnutrition and poor hygienic status prevailing in South Asia.

Current scientific knowledge indicates two primary approaches to the prevention of carcinogens or reduction of exposure to them. The combination of life style factors and occupational carcinogens increases the risk of cancer. Thus attention is needed to develop strategies for prevention of smoking and tobacco chewing. Further there is a need for improving the methods used in occupational cancer research i.e. identification of occupational carcinogens, design of well planned epidemiological studies, risk assessment, primary and secondary prevention and also to adopt new biotechnology tools to identify workplace carcinogens. This could be achieved to include the estimation of internal dose through biological monitoring of chemicals or their metabolites; estimation of the amount of carcinogen that has interacted with cellular macromolecules including DNA and protein adducts; the detection of early biological effects such as sister chromatid exchange, DNA hyperploidy, or oncogene activation; and identification of genetic factors of susceptibility.[81]

Role of Employer, NGOs, and Policy maker in intervention of Occupational cancer

It is paramount duty of the employer to provide safe and healthy work environment. They should consider the following for the improvement of working environment.

- Substitute less hazardous agents if available for cancer-causing agents.
- Adopt appropriate technology to reduce worker's exposure to an absolute minimum to carcinogenic agents.
- Employers should completely enclose the hazardous processes and use local exhaust ventilation to capture contaminants.
- Provide personal protective equipment for workers.
- Imparting the knowledge about the toxicity of workplace chemicals and physical agents
- Material Safety Data Sheets should be pasted in workplaces. Known carcinogens should be identified on these sheets preferably in local languages.

Extensive research provides information that certain chemicals in workplace causes cancer, but unfortunately workers are ignorant of the danger. There is a significant role of NGOs in pressing the genuine demand of workers to the management to adopt the proper safety measures

and making public awareness about the carcinogenic chemicals in the work environment.

The number of workers in industries entailing a carcinogenic risk is increasing in developing countries, partly as a transfer of hazardous industry from industrialized countries. Policy makers should be aware about the same. Such transfers should not happen by making stringent rule and regulation. A major concern in recent years has been the problem of the transfer of hazardous industries to the developing world.[82] Such transfers have occurred in part due to the stringent regulation of carcinogens and increasing labour costs in the industrialized world, and in part from low wages, unemployment and push for industrialization in the developing world. For example a number of asbestos –based industries have been transferred to the developing countries such as Brazil, India, Pakistan, Indonesia and South Korea from the developed countries.[82] A similar pattern also reported for tyre industry in developing countries.[83] Banned chemicals are used clandestinely by small-scale industries in the region. Further, policy makers should impose ban on the use of known carcinogens or restrict the use of such chemicals if no substitute is available.

Conclusions and recommendations

Occupational cancer research can be strengthened by the integration of human, animal, and other biological data in planning research and conducting risk assessments using interdisciplinary approaches. Less expensive ways of screening of new substances for potential carcinogenicity must be developed and applied before or early in their commercial use. Further, priority should be given to study those agents which are already classified as Groups 2A and 2B by IARC for which wide-spread human exposure are there by conducting appropriate occupational cohorts studies. The difficulty in finding populations with suitable exposure history for inclusion in epidemiological studies requires refinement in exposure assessment and consideration of study designs that use intermediate biomarkers to examine mode of action in humans, as well to estimate dose of exposure and detect early symptoms. In occupational cancer, past exposures are more relevant than current exposures as potential causes of cancer occurring in workers today. There is a need to adopt new biotechnology to identify work place carcinogens. Studies of occupational cancer risks among female and child workers are especially needed to examine risks of hormonally related cancer.

The process, which leads to the reduction of occupational exposure to carcinogens, involves both the development of new policies and independent use of the scientific knowledge by the labour and management. The greatest progress in the prevention of occupational cancer in South Asia is most likely has to come from the policy makers, and economic changes in the region along with the positive attitude of employer and NGOs towards the cause of worker's health and also improving the methods used in occupational cancer research. i.e. identification of occupational carcinogens, design of epidemiological studies, risk assessment, and primary and secondary prevention.

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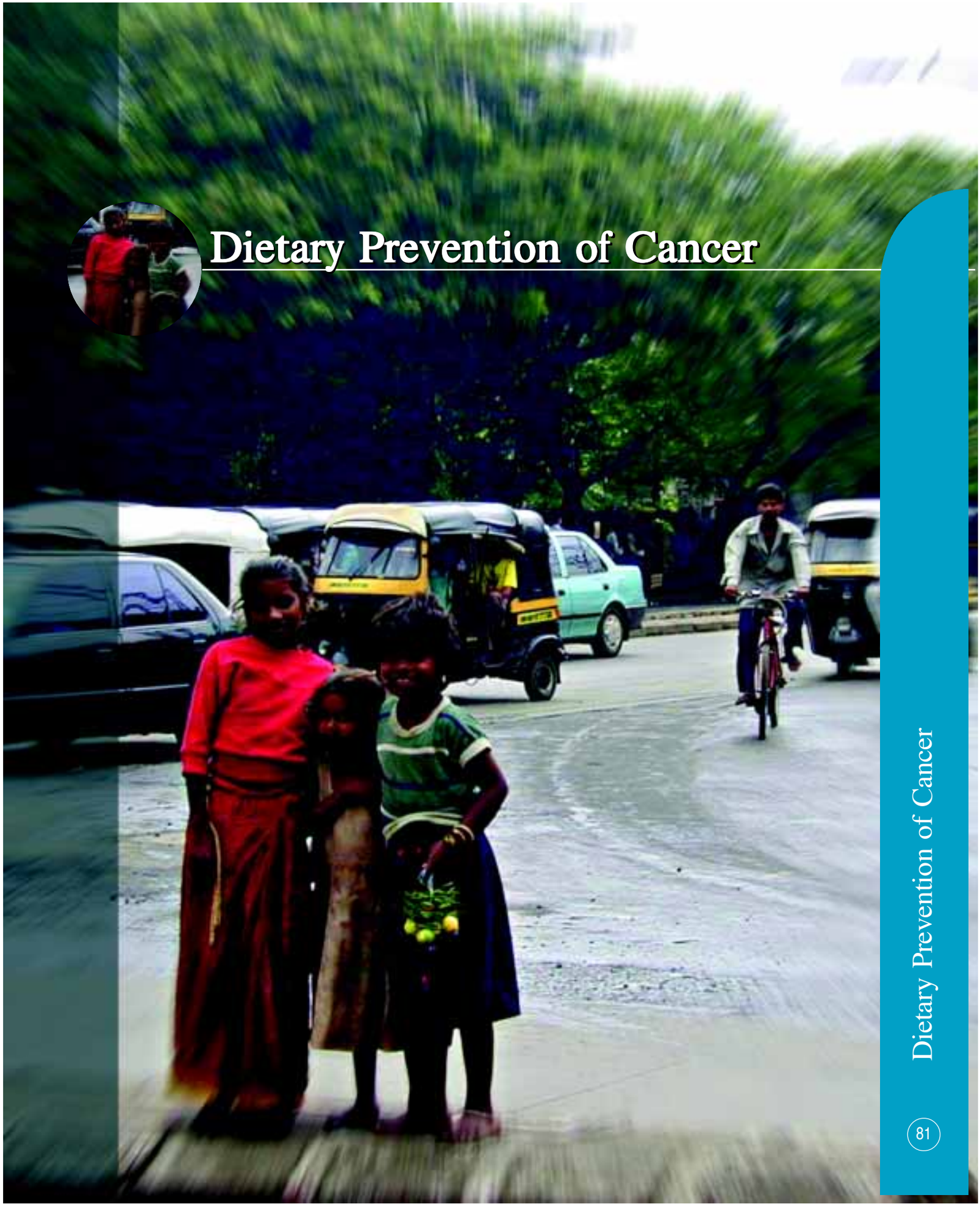
Excess body fat and deficiency of protective nutrients play an important role in the development of up to thirty percent of cancers. Randomized trials, which intervened by reducing fats, increasing fruits and vegetables or adding supplements for 5 to 10 years in adult life didn't have a major impact on common cancers. These studies teach us that short term dietary interventions in adult life can't help and there are no shortcuts to cancer prevention using dietary supplements.

Growing prosperity is changing the diet and lifestyles in South Asia. Increasing intake of calories, consumption of calorie dense snacks between meals, decreased intake of vegetables and reduced physical activity has increased the risk of lifestyle related diseases in middle age. This is reflected in increasing body mass index of the young and middle aged the in urban South Asia and big increase in diabetes, cardiovascular disease and an increasing trend in life style related cancers. Dietary recommendations are broad for reducing premature death from several life style diseases that include cardiovascular disease, stroke and cancer.

Based on large population based observational studies the broad dietary guidelines for prevention of cancer are as follows. Maintain ideal body mass index (20.0 to 24.0 Kg/ M^2), consume five serving of vegetables and fruits per day and undertake regular physical activities. Traditional diets in South Asia are rich in protective nutrients and quite close to the recommendations. It is important that these dietary habits are acquired in early childhood and retained through out adult life. Given the social-economic and cultural-religious diversity, no single intervention will suit every one in South Asia. A combination of programmes at individual, household, community, state and country levels are needed to achieve the goals. Governments in South Asia have started to promote local food processing industries and removed the barriers for the import and marketing of processed foods and beverages. Any attempts to change the dietary behavior of the populations will confront the big budget promotions by the food and beverage industry. Population explosion and urban migration has depleted parks, playgrounds and open recreational space that is necessary to maintain daily physical activity. These facilities need protection by governmental legislation. All governmental policies and non-governmental efforts during the last 60 years were to prevent or manage undernutrition and specific nutritional deficiencies. Undernutrition and micronutrient deficiency affect over 800 million people in the subcontinent. Extra efforts will be needed to tackle the dual problems of deprivation related nutritional deficiency and affluence related nutritional excess.

Dietary Prevention of Cancer



Role Of Diet In The Development Of Cancer

Dietary Patterns Of Individuals And Populations

Preventing Obesity And Related Diseases

Community Approach To Dietary Change

What Can Be Done In South Asia

Do's And Don't

Future Research Needs

Dietary Prevention of Cancer

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"One swears by whole meal bread, one by sour milk; vegetarianism is the only road to salvation of some, others insist not only on vegetables alone, but on eating those raw. At one time the only thing that matters is calories; at another time they are crazy about vitamins and roughage. The scientific truth may be put quite briefly; eat moderately, have an ordinary mixed diet and don't worry".

Sir Robert Hutchinson, in Newcastle Medical Journal 1932

Background

Three decades of war on cancer with advances in screening, diagnosis, and treatment has slightly reduced deaths from cancers.[1] In the absence of population based screening, vast majority of common cancers in South Asia are diagnosed in an advanced stage.[2-4] Primary prevention will offer most cost-effective approch in South Asian countries, given the limited resources and competing health care demands.[5] Chronic infections and tobacco abuse are the leading causes of cancer in South Asia.[6] Diet has smaller role in the development of cancer and a big role in the causation of heart disease and strokes in South Asia. The principles for dietary prevention of most non-communicable diseases are similar. Therefore, any dietary prevention strategy offers global benefits in reducing premature mortality from non-communicable diseases.[7-9] The traditional foods, dietary habits and life styles of South Asia are not very different from the current recommendations for developed countries. The growing prosperity, adequate food supplies and epidemiological transition has resulted in a lifestyle paradox. "Affluent people in South Asia eat and live like economically disadvantaged people in developed countries" .[10] They consume too many calories and undertake little physical work resulting in increasing Body Mass Index (BMI). The public health burden is associated with both, the extremes of thinness and overweight.[11,12] The group at risk for thinness is illiterate, less educated and old while the college educated middle age groups are at-risk of overweight.[11]

Since ancient times, the balancing dietary excess and dietary deficiencies have been used health promotion and disease prevention. Little has changed since the days of Sir Robert Hutchinson whose book on clinical medicine instructs every medical student in South Asia. Dietary risk factors contribute towards 10% to 30% of cancer deaths worldwide. In recent times increased body fat (overweight and

obesity) has been implicated as a cause of death from several non-communicable diseases including cardiovascular disease, diabetes, hypertension, kidney failure, degenerative osteoarthritis and cancer.[13-15] Dietary modification programmes for weight control has met with variable success in developed countries.[16] Implementing similar programmes in South Asia is a big challenge. The strategies for tobacco control won't help controlling the obesity epidemic. Bipolar situation of undernutrition and micronutrient deficiencies (affecting 70% of population mostly rural regions) and increasing body fat (affecting 5-10% mostly urban populations) create practical problems at all levels of preventive intervention.

Not all the risk for cancer is by excess fats and calories. A substantial burden is from the deficiency of fiber and nutrients like calcium, antioxidant nutrients, selenium, etc.[6] Therefore, the nutritional guidelines are for everyone. Meeting ideal dietary guidelines in South Asia is relatively expensive. Consuming 400 gm/person/day of different vegetables and fruits will cost over one US dollar per day for a family with four-members. Dealing with this challenge would require prolonged commitment, multidisciplinary approach and much more research on different aspects of human nutrition.

Table 1. Some examples of protective nutrients in traditional foods of South Asia

Principal food	Protective nutrients	Destruction of protective foods
Cereals and pulses	Rich in complex carbohydrates having low calorie density and low glycemic index. Rich in soluble and insoluble fiber.	Excess cooking destroys vitamins and the fiber. Refining of the flour results in loss of vitamins, fiber, and increase calorie density.
Milk and milk products	Rich in calcium and vitamins those are beneficial in protecting against colon cancer.	Pesticide residues are seen in milk due to contamination of water and grazing lands. Excess use of high fat (e.g. Buffalo) milk, butter and rectified butter predisposes to obesity and metabolic syndrome.
Fresh vegetables and fruits	Rich in vitamins, fiber and antioxidants Reduces calorie intake	Destruction of the nutrients due to prolonged cooking or frying. Pesticide residues due to uncontrolled spraying.
Spices like turmeric	Rich in antioxidants like curcumin which is protective against colorectal cancer	Adulteration of spices using artificial colours is a big problem in India.
Allium vegetables	Onion is poor mans staple food in north India. It is protective against stomach cancer.	Contamination with the aspergillum fungi is common.

Scientific articles and non-scientific tips on diet and cancer are freely available but usually misleading and very confusing. There are few population based controlled interventional studies on dietary prevention of cancer from South Asia. Most reports, guidelines and statements from experts in South Asia are based on case-control studies and animal experiments or by extrapolation of Western studies. In the absence of randomized trials, such reports would be prone for selection bias and confounding. Carcinogens can be present in natural foods in small quantities and some carcinogens are generated during the preservation, storage and cooking of the foods. Some dietary toxins function as co-

carcinogens that interact with other carcinogens. For example, the progression of Helicobacter pylori gastritis to metaplasia and adenocarcinoma is potentated by nitrate salts in diet. Liver cancer in chronic hepatitis B virus infection is potentated by the aflatoxins produced by moulds growing on oil seeds. Unlike radiation, the risk for cancer from diet does not come by short exposures to one or two carcinogens in the foods. Exposure to dietary risk factors and absence of protective factors is akin to passive smoking. They work silently in steady manner for decades. The change from a traditional diet (rich in protective foods rich in fruits, vegetables and fibers) to a diet rich in energy and fats, and low in protective nutrients is gradual and happen over several decades. Dietary recommendations need to follow these principles. The best and current scientific evidence is presented below with special reference to the South Asia.

Table 2. Examples of carcinogenic substances in food

Agent	Foods and mechanisms
Polycylic aromatic hydrocarbons	Several food items due to smoking, charring and grilling
Aflatoxins	Nuts, tubers and oils made from contaminated nuts
Nitroso compounds	Nitrite salts used for pickling or preserving meat and vegetables
Acetaldelyde	Present in alcoholic drinks or produced in the body after drinking.
Acrylamide	Fried and baked carbohydrate-rich foods.
Dyes and colours	Artificial colouring of foods and drinks with unsafe chemical and by adulteration.
Pesticides and toxin residues in food	Due to uncontrolled use of these in agriculture.

Role Of Diet In The Development Of Cancer

Of all the environmental exposures, diet is a universal exposure, comprising a complex mixture of different compounds that varies over time, space and according to a number of historical, ethnic, religious, agricultural, socioeconomic and psychological factors, at the individual and population levels.[17] Dietary factors account for up to one third of different cancers among non-smokers in Western countries.[6] Traditional diets in South Asia and foods may be responsible for the lower incidence [the frequency with which different cancer occurs in a community] of many cancers. The traditional diet is not calorie dense and is rich in protective foods like fruits and vegetables. Unfortunately, as a price of development, the dietary habits of South Asia began to change in the post green revolution era, and gained momentum in the last decade. For these reasons there is a steady rise in the incidence of lifestyle related cancers in these countries. After infections and tobacco, the dietary factors constitute the third most common cause of cancer in South Asia. The role of foods in causing and preventing cancer vary widely with cancer sites. Some cancers common in Western countries (e.g. breast, colon, prostate, etc.) are associated with excess energy and fat intakes and other cancers common in South Asia (e.g. head and neck, esophagus, stomach, etc.), are associated with deficiency of protective nutrients. Temporal changes in dietary habits are influenced by changes in processing, cooking and storing practices. Interactions between foods, diets, processing, storing, cooking and consumption are complex.[20] This results in marked

variation in the research findings of the association of dietary factors and cancer in different parts of the world.

The role of diet in the causation and prevention of cancer has been studied extensively in developed countries.[20] Several individuals, institutions and organizations such as the World Cancer Research Fund, the Department of Health in the United Kingdom, the Center for Disease Control and National Institutes of Health in USA, and the European Union have published their recommendations.[20-27] Most recent evidence is summarized by the World Health Organization (WHO) and Food and Agricultural Organization (FAO) of the United Nations.[20-27]The evidence that hold diet guilty of causing cancer comes from a variety of studies including inter-country comparisons, study of immigrants, case-control studies, prospective observational studies and Randomized Controlled Trials (RCT). The RCTs provide the most reliable evidence. Nutritional RCTs are expensive and labor intensive and rarely undertaken in developing countries. Randomized dietary interventions are not foolproof because of the complex interaction of diet and cancers over long periods of life.[28-34] Furthermore, any extrapolation of results from one population to another is difficult. For example, there is very good evidence that beta-carotene pills can't reduce deaths from cancer and cardiovascular disease in the US.[35]Will the results be the same in South Asia where large proportions of the population is deficient in this nutrient?

The strength of the evidence linking different dietary factors with cancers varies widely. Colo-rectal cancer is positively associated with being overweight and high alcohol intakes and inversely associated with intake of fruit, vegetables, folates and calcium.[36,37] However, RCTs for dietary prevention of colorectal adenoma and carcinoma did not reveal a protective effect.[29, 33, 38] This raises an important question about the role of diet in different stages of a disease.[39, 40] Are specific (or general) dietary constituents that are important, and at which stage of life the dietary intervention have the greatest impact for preventing cancer? Studies on seventh day Adventists suggest that early start is important.[40] Dietary carcinogenesis is a life long process and randomized trials with dietary modifications for short periods do not reproduce the situation. Therefore, we need to consider the prospective trials that are inferior to RCT. There is plenty of evidence that weight gain in adult life with or without little physical activity is associated with excess incidence many cancers in men and women.[8] Observational studies suggest that increasing energy expenditure, limiting alcohol intake and consuming adequate quantities of fruits and vegetables will reduce the incidence of several cancers. The currently recommended diet is similar to traditional diet eaten in the Mediterranean region.[7]This diet is rich in protective nutrients (vitamins A and C) and antioxidants derived from fruit, vegetables, olive oil, and have fewer calories per meal. The scientific evidence for a role of cooking habits such as high intakes of red meat, salted food, poorly stored perishable foods, additives, pesticides and high-temperature cooking increasing the risk for cancer is epidemiological suggestive but not compelling.[20]

Table 3 . General Guidelines for Cancer Prevention for South Asia

Broad guidelines	Basic principles	Specific recommendation
High intake of plant foods including cereals, vegetables and fruits.	Diet rich in variety of plant foods helps to reduce calories and increase anti-oxidants.	At least five to seven portions of fruit and vegetables per day
Maintain the body mass index in normal range.	Avoid excess weight gain after 18 years.	BMI* of 20.0 to 24.0 Kg/M^2
Increase physical activity of all kinds throughout life.	Moderate physical activity for 30 min for 5 days a week for adults and 60 min for 5 days of the week for adolescents.	Undertake physical activities to burn 3500 calories per week.
Avoid alcohol	Alcohol increases the risk of several cancers	No specific recommendation
Don't replace the dietary modifications with food supplements.	Randomized trials using supplements have failed to reduce cancer mortality.	Dietary supplements are costly and won't help.

* Body Mass Index

Because of the trials and tribulations of modern day living, people have been tempted to use dietary supplements as an easier means to meet the dietary recommendations. More than a dozen large RCT using nutritional supplements have been undertaken in North America, Europe and China.[7] They evaluated the role of supplemental fiber or micronutrients singly or in combination. Majority of these RCT failed to reduce the cancer rates.[31-35] On the contrary some increased mortality was noted in smokers who took beta carotene. Few promising preventive strategies that emerge from these trials include alpha-tocopherol and selenium for prostate cancer, the combination of beta-carotene plus alpha-tocopherol plus selenium for stomach cancer, retinol plus zinc for gastric non-cardia cancer.[7]Overall, preventive experts agree that dietary supplements are unhelpful in reducing the cancer risk, as they do not provide a wide range of bioactive components present in fruits and vegetables.[8] Because of these reasons, the American Cancer Society proposes a broad goal-centered diet for prevention of cancer.[18] In the absence of good interventional trials from South Asia, similar recommendations may be followed with some modifications. The recommended upper limit of BMI for Asians is 24.0 kg/M^2 due to higher body fat content in South Asians.[12]

Dietary Patterns Of Individuals And Populations

Unlike stopping tobacco that saves money, following the nutritional guidelines will increase the household expenditure. Several interventions are needed to change the dietary habits of populations. This includes governmental policy changes and efforts at national, community, household and individual levels. A well-planned programme sustained for decades can change the dietary practices of communities. For example, with widespread availability of affordable refrigeration at home, community markets and during transport, the incidence of stomach cancer has dropped in many developed countries. This is probably attributed to reduced use of salt as a preservative. This type of change is heavily dependent on the social and economic reforms and progress-taking place in the developing countries. Food is a major ingredient of cultural identity in South Asia. All interventions or policy changes need to consider the pleasures associated with food (e.g. celebration, satisfaction of appetite, etc.) and its role in shaping the

daily lives, rituals and routines of a community.[19]

Dietary prevention of cancer requires the improvement of diet of both undernourished and overnourished people both of who are at increased risk for developing cancer.[6] Preventing obesity while eliminating the macro and micro nutritional deficiencies presents a formidable challenge to South Asia. Successful dietary interventions should be pragmatic and must reach the population at risk. We can't take for granted that the access and availability of foods is adequate, while raising the awareness about preventive diets. Until recently, obesity was not considered an important public health problem by the government and policy makers. South Asia's nutrition policies have continued to focus on undernutrition, because of which research and expertise in dealing with problems of weight gain and obesity is restricted to few interested individuals.

Preventing Obesity And Related Diseases

Numerous interventions have looked at individual dietary behavior as their primary outcome. Most have had a modest effect on life style.[28, 41] Interventions are generally more successful at changing dietary behavior in populations at risk of or with disease than in healthy populations. Most intervention studies have short-term results, which indicate that effective change is possible, but the effects on long-term behavior are not always or not yet clear. Chronic energy deficiency, maternal and child malnutrition and micronutrient deficiencies are rampant in South Asia for centuries. Governmental and non-governmental programmes have aimed at reducing malnutrition by increasing the intake of food and supplements. Dietary intervention for obesity control is quite the opposite and a lot more difficult. Unlike interventions for malnutrition, which may be achieved by food subsidy and similar programmes, long-term sustained maintenance of the dietary intervention is necessary to bring about a reduction in body fat. Dietary intervention programs do not address this long-term maintenance component and governmental policies tend to change with time. Allocation of funds and resources in a situation where half the population suffers from under nutrition and another 5% to 10% over nutrition is a challenge. Cardiovascular diseases (CVD) are several folds more common in South Asia than cancer. Fortunately, the diet advocated for preventing CVD is low in saturated fat, high in complex carbohydrates, fruit and vegetables, and very similar to the diet recommended for cancer prevention. Universal availability of cable and satellite television and internet with 24 hours access is another reason for the increasing obesity.[42]

Preventing obesity and related chronic diseases should be a priority of central and state governments, as well as of international, bilateral, and national organizations while efforts to eliminate nutritional deficiencies should continue. Overweight and obesity will keep increasing as the per capita income in South Asia increases. People in South Asia are highly prone for metabolic syndrome and have more body fat than Chinese and Caucasian counterparts.[43-45] With the implementation of a web enabled administration, we need to develop information systems to collect data about chronic diseases to define national policies and help support advocacy activities. These efforts must target secondary school children, elderly women, and men and not merely the women of reproductive age and young children. The role of voluntary calorie restriction through religious fasting (a common practice in South Asia) has not been studied and is worthy of future research.

Information on nutrition and healthy lifestyles should be increased in the school curriculum, and physical activity should be promoted in schools, colleges and among laity. For example, the "Trim and Fit Scheme"- a comprehensive 10-year programme that began in 1992 in Singapore featured teacher education and training, assessment of students, a program to reduce sugar in children's beverages, and more physical activity during school hours.[46] A recent review of this programme showed a marked improvement in fitness and some evidence of reduction in obesity. Similar efforts will be useful, albeit in the schools with resources

(where childhood obesity is a major health problem). Knowledge, beliefs and attitudes of Asians for cancer prevention are suboptimal.[47-48] An educational program akin to the family planning and AIDS control programme need to be launched for cancer prevention in South Asia. City and suburban planning must ensure facilities to encourage a physically active living environment to reduce television watching and other sedentary behavior.[42] Measures like increased physical activities, sports, protection of open spaces and parks for recreation and pedestrian-friendly streets need to be considered.

Agricultural research should evaluate the energy, fat and micronutrient composition of their food supply. Vegetarian diets in South Asia are rich in protective phyto-chemicals[49-50], and these can be increased through agricultural research. In the developed countries, consumers have choice of foods with various nutritive and caloric values that are displayed by food labels. Sugar free foods low fat milk and meat are widely available at affordable costs. In South Asia, the health foods are scarce and more expensive. Agriculture and food industry's role in developing healthy food products and in promoting public health nutrition should be recognized and encouraged. Effective public education as commercial advertisements and campaigns in promoting healthy diets and lifestyles could help. Nutrition labeling should go beyond mere vegetarian and non-vegetarian labels. Nutritional value labels should be mandated by law and enforced by food inspectors for all prepared or processed foods to help consumers select food. The film and entertainment industry in South Asia or involved in major advertising campaigns by the snack food and beverage industry and their support must be sought for public education campaigns.

Current dietary recommendations are directed towards whole populations, rather than 'at-risk' groups. The communities in South Asia vary widely in their economic, cultural, linguistic and religious background and practices. The dietary and food habits are reinforced by these factors and the local availability of the foods that vary from season to season. Different strategies are needed to target these diverse population groups or individuals. Theoretically, there are five important levels for health care behavior. These are intrapersonal (individual), interpersonal, institutional or organizational, community and public policy. Population interventions need to take into account individual psychological determinants and environmental perspectives (e.g. life circumstances) provide an appropriate framework for action.

Community Approach To Dietary Change

Community interventions are targeted on a particular region, village or rural area, and are implemented in different settings like schools, work places, retail outlets or whole sale markets and places of worship. This involves collaboration and partnership between the private, public and voluntary sectors in the community. These national initiatives facilitate individual access to healthy, acceptable food at affordable prices. Evidence for effective dietary change from comprehensive, community-based studies has been sparse, and the results community-based programmes in developed countries have been mixed. It is difficult to conclude that the changes in behavior and health outcomes were due solely to the effect of an intervention program. Secular trends (e.g., economic and social changes) take place, which would have facilitated the impact of the intervention, and these cannot be replicated elsewhere. Community-based programmes for simpler problems like anemia has not been successful in all parts of South Asia. For example in India, several populous north Indians states have high prevalence of anemia along with dismal human development indices. Further work is needed in the design and evaluation of the community projects.

What Can Be Done In South Asia

In the absence of studies in South Asia, any evidence-based recommendation is borrowed. Readers must be cautious of extrapolating Western studies to South Asia. This is fallacy is typified in the finding that while vegetables and fruits were not

protective against breast cancer in North America and Europe[30, 51], and life long vegetarian was found to reduce the risk among South Asian immigrants.[49] The preventive approaches described in this chapter are broad based and cover common causes of death including cardiovascular disease, strokes, diabetes and cancer. The collective benefits are important in South Asia, because only 5-10% of all deaths are from cancer, while three out of four deaths are due to cardiovascular disease. Based on the western experience, interventions at three levels are suggested. The intensity of intervention will vary depending on the socio-political-cultural considerations. The first is national planning, policy and legislation. The second level is community programmes in schools, health services and local authorities that involve private, public and voluntary bodies and address issues as wide-ranging as health promotion and local pricing policies. Third level interventions are for changing the behavior of individuals. Aims of the interventions are as follows.

1. Control calorie intake and obesity

Overweight individuals carry the highest risk for becoming obese in later years. There are two phases in life when an individual is at the greatest risk of becoming overweight. During weaning from breast milk (when calorie dense processed foods are given to the child) and in the fourth decade (when the basal metabolism and physical activity starts to reduce). Promotion of breast feeding and proper weaning is important, particularly among urban population of South Asia. In a region where malnutrition and famines flourished for centuries, there is a popular notion among laity that a "chubby child is a healthy child". Calorie dense processed foods have replaced the traditional whole grain and cereal based weaning foods in this region due to convenience and effective marketing. Overweight children are likely to become obese in later life. The Indian academy of pediatrics has published pragmatic guidelines that can be followed in South Asia.[52]Subsidizing food at workplace is another reason for weight gain among the middle aged South Asia. In South Asia the food is not served in portions or courses and eaten in social groups (family or friends). This creates an opportunity for small increase of calories at each meal and cumulative excess over decades.

In South Asia like world over, a large "Weight loss" industry exists and alternate medicine like Ayurveda, Yoga, Unani, Homeopathy, Naturopathy, Tibetan Medicine, etc. are a part of this industry. Review of randomized controlled trials reveal strong and consistent evidence that weight loss amounting to 8% of initial body weight can be obtained within 3-12 months on a low-calorie diet. Considerable effort has to be made to increase the public awareness and interests on health issues associated with obesity, its causes and management. Despite the wide media coverage, obesity rates are rising throughout Europe indicating failure of the obesity prevention programmes. Schools are the good setting for such an intervention, but there is little evidence (except Singapore) for the efficacy of school approaches. Overall, the review of evidence concludes that there is a little high quality of data on the effectiveness of obesity management programmes. There is a need for well-designed studies that examine a range of interventions. Obesity prevention studies must be started in South Asia that includes alternative system of Medicine and this should be funded by governmental and non-governmental agencies.

2. Maintain the high fruit and vegetable intake

The National Institutes of Health and the National Cancer Institute (USA) reported that behavioral and food service interventions in elementary schools had a positive effect on the pupils vegetable and fruit consumption.[23-26] An analysis by the Agency for Healthcare Research and Quality suggests that the interventions are more successful in increasing fruit intake among children and vegetable intake among adults. Interventions in populations at higher risk for disease have significantly higher increase in fruit and vegetable intakes than studies in the general population.[25] Studies carried out in schools, work places and primary care settings showed a reduction in blood cholesterol of

2-10% while community-based interventions showed no effect on blood cholesterol. The greatest reductions in fat intake (10-16% of energy intake) and blood cholesterol (7-10%) were in highly motivated individuals in intensive programmes.

The consumption of vegetables in South Asia is relatively higher than in other parts of the world. Three out of four persons in South Asia directly or indirectly depend on agriculture for livelihood. The same may not be true for fruits, which are relatively more expensive (except banana) and eaten seasonally in smaller amounts. Cooking the vegetables before eating, a common practice in South Asia could lower the protective value of vegetables by destroying fiber, micronutrients and antioxidants and need to be researched. Recommendations for increasing the fruits and vegetables in South Asia without strengthening all links of the supply chain from agricultural production transport, storage, and purchase by consumers will be useless. The household expenditure on food is an important determinant of dietary habits and healthy foods are relatively more expensive. According to the World Bank, 1128 million (84.8%) of people in South Asia live with less than two US dollar a day in 1999. Guidelines are unlikely to affect the eating habits of these people until the per capita income increases.

3. Increase physical activity

To handle the challenges of obesity and overweight, the planners and developers must provide for an active living environment in cities, suburbs and villages. Simple measures like increased physical education in schools, protection of open spaces and parks for recreation and pedestrian-friendly streets need to be considered. Unfortunately, the development activities in almost all cities, towns and even villages in India continue to ignore this. In the absence of proper space, activities like walking, cycling, jogging, swimming and playing will remain a mere theoretical process. Present urban and rural planning and development processes are contradict these recommendations and will contribute greatly in increasing burden of non-communicable diseases in South Asia in the coming decades.

Do's and Don't

DO

Regular physical activities 5 or more times a week.

Eat meals rich in whole grain cereals, pulses, vegetables, and fruits.

Develop the concept of portion size. Avoid large portion size.

Reduce the intake of saturated fats, cut down fried snacks and foods,

Record your weight at least once a year.

Start in early childhood and continue life long.

DON'T

Eat calorie dense snacks and beverages between meals.

Eat plenty of sweets and sugar rich snacks, puddings and beverages.

Eat large portions or unlimited amounts of food with each meal.

Put on weight after 20 years of age.

Feel shy to discuss your eating and weight problems.

Try shortcuts. They don't help in the long term.

Future Research Needs

What are the best diets for cancer prevention and what are the best means to achieve those diets remains elusive. There is paucity of credible information on dietary and physical activity patterns that are practical and have the potential to reverse the increasing obesity, and reduce the risk of common cancers and other life style related worldwide. Creating such information is a challenging task, and there is considerable diversity of opinion concerning research designs and priorities. Good studies on the preventive role of dietary factors are lacking from South Asia. High quality population based research is urgently needed in this region.

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B

This chapter concentrates on the tobacco situation in South Asia. Some neighbouring countries that have a direct or indirect effect on this region are also mentioned.

The chapter begins with a summary of the amount of tobacco produced in Asia and the Region and then a brief description of the tobacco products used. The presence of cigarette multinationals is noted, with a list of companies represented in each country. Estimates of tobacco use prevalence are given by country, based on national survey reports.

The health consequences of tobacco use in the Region are mentioned, giving available mortality estimates followed by information on tobacco related cancers.

The elements of tobacco control are outlined along with their relevance to the Region, with examples and suggestions for their implementation. Research and documentation are considered to be essential to support all tobacco control strategies. The six globally recognised most effective strategies are listed, followed by others that may also be important for the Region.

The Framework Convention on Tobacco Control, developed by the World Health Assembly, is instrumental in promoting tobacco control policies in member countries. Government support and involvement are necessary for implementing the policies and related strategies. Effective ways to advocate for enhancing tobacco control policies are described. Issues of policy enforcement, the importance of evaluation, and strategies for resource mobilisation are also briefly dealt with.

Tobacco Control

Tobacco Control

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Tobacco Production

Asia, with 60.5% of the world's population produces well over 60% of the world's tobacco (63% in the 1990s). Out of Asia's 49 countries, 36 of them produce tobacco.[1]

India, Pakistan and Bangladesh are among the top twenty tobacco producers in the world.[2] (Table 1). The only non-producer of tobacco in South Asia is the Maldives.[3,4] Tobacco leaf and tobacco products are items of trade within the Region as well as outside it.

Table 1. Asian countries ranked according to world production among the top 20 world producers.[2]

World Rank	Countries	2004 Tobacco Leaves Production (Mt)	World%
1	China	2,409,500	37.10
3	India	598,000	9.21
6	Turkey	160,000	2.46
7	Indonesia	141,000	2.17
11	Pakistan	83,700	1.29
12	Thailand	80,000	1.23
14	DPR Korea	64,000	0.99
16	Philippines	47,800	0.74
17	Japan	52,659	0.81
18	Myanmar	49,000	0.75
20	Bangladesh	40,000	0.61
Total	World	6,496,368	100.00

Products used in the Region

Cigarettes are industrially produced in most countries of South Asia. They are made from flue cured Virginia tobacco grown mainly within the countries where the cigarettes are made (or in Asia).[5]

Cigarettes are no longer entirely a luxury product due to the addition of smaller sized, low priced and lower taxed cigarettes along side the other categories of cigarettes with a range of prices and levels of taxation. Roll your own cigarettes are also used in the Region.[6]

The *bidi* is a smoking stick hand made with 0.15-2.5 g of sun-dried, blended tobacco flakes, rolled in a *tendu* or *temburni* leaf (*Diospyros melanoxylon*) and tied with a cotton thread. It requires frequent puffing to remain lit, thus increasing delivery of nicotine, tar and carbon monoxide. India is the largest producer and consumer of *bidis*.[7] Bidis are also made in Bangladesh (rolled in cigarette paper due to unavailability of tendu leaves) and Pakistan (with tendu leaves imported from India)[8,9] and are popular also in Nepal, Sri Lanka, and in other Asian countries outside the Region.[6,10]

Smokeless tobacco is used in South Asia in a variety of ways, and a wide range of products available, especially in India. Products available in India include plain chewing tobacco, dry snuff (*tapkeer*) tobacco mixed with molasses in dry or paste form (e.g. *gudhaku,* used as a dentifrice), dry snuff-like products used for application on teeth and gums (*mishri, bajjar*), tobacco toothpaste ('creamy snuff'); tobacco-lime mixtures often containing menthol (e.g. *khaini, nass, nasswar*), scented and spiced tobacco chewing mixtures (either dried or also boiled), e.g. *zarda, qiwam, gundi, kadappan*. Other tobacco mixtures, such as *mawa* and *gutka*, contain areca nut along with slaked lime, flavourings and scents, e.g. saffron, sandalwood and menthol. Some mixtures of areca nut without tobacco (*pan masala, supari mix*) contain similar flavouring and scent as *gutka* and scented *zarda,* and have identical brands and packaging.[7]

Presence of Trans-National Cigarette Companies

Most cigarettes sold in South Asia are manufactured by trans-national or multinational companies having their main headquarters outside the Region. It is important to know about the presence and strategies of cigarette trans-nationals in South Asia, even where cigarettes are not widely smoked, because these companies bring with them their financial might, management capability, technical expertise, and marketing strategies, all of which have the potential to change the tobacco use scenario.

Each of the world's three largest multinational cigarette companies, Philip Morris (PM), the largest, British American Tobacco (BAT), the second largest and Japan Tobacco International, the third largest after its purchase in 1999 of RJ Reynolds (RJR), currently own or lease plants in at least 50 countries spanning all corners of the globe.[5,11] They all operate in what they call the Asia-Pacific Region, which comprises South and South-East Asia, the Far East, Australasia and the Pacific Islands.

The market shares of multinational and domestic cigarette companies in South Asia are shown in Table 2.[3,12-17] Of the three majors, BAT has the largest presence with a factory, subsidiary or affiliate in nearly every country in South Asia. BAT has its Asia-Pacific Regional headquarters in Malaysia and makes brands, like Wills and Gold Flake, John Players, Dunhill, and Peter Stuyvesant. In India, BAT owns about one third of the Indian Tobacco Company (formerly Imperial Tobacco Company).[15]

Philip Morris International (now known as Altria), owner of the Marlboro brand, has a regional headquarters in Melbourne, Australia from where it supports its operations in South Asia.[13,14,16,17] In South Asia, Philip Morris has the second largest presence, where it recently introduced the Marlboro brand into India (Table 2), and in India it operates through Godfrey Philips.[13,14]

Japan Tobacco does not at the present time have a palpable presence in South Asia.[18]

In order to devise adequate strategies to curb or prevent increases in cigarette smoking prevalence in each country of South Asia, it is useful to know the behaviour and strategies of the cigarette trans-nationals. The trans-national cigarette manufacturers have been in expanding their business more and more from the developed countries into the developing countries. International pressures of various kinds, including economic, diplomatic and lobbying, has helped them open markets in Asia.[19] They have

been increasing their exports into Asia, building up their distribution and sales networks and they continue to target youth to expand their consumer base.[20]

Table 2. Market Share by Cigarette Manufacturer in South Asia.[3,12-17]

Countries	Year	Company	(%) Market
Bangladesh	1999	BAT Bangladesh Other domestic Imports	60.0 32.0 8.0
India	2000	Indian Tobacco Company (BAT) Godfrey Phillips (PM) Vazir Sultan Tobacco Industries (BAT) Golden Tobacco Cigaratte Industries	66.9 12.3 12.0 7.8
Nepal	1999	Surya Tobacco Company (BAT, ITC) Janakpur Tobacco Company Nepal Tobacco Co. Perfect Blends Nepal	56.0 30.4 12.0 0.6
Pakistan (WHO EMRO)	2000	Lakson Tobacco Company (PM) Pakistan Tobacco Company (BAT) Others	55.0 43.0 2.0
Sri Lanka	2000	Ceylon Tobacco Company (BAT) Imports	99.8 0.2

BAT= British American Tobacco; PM= Phillip Morris;

Prevalence of Tobacco Use

Tobacco use is highly prevalent in South Asia, in many different forms (Table 3).[25-28]

Table 3 shows that smoking is more prevalent among men than among women in all the countries of South Asia. In some countries, like India, women tend not to smoke, but many use smokeless tobacco. Only in Nepal, a substantive proportion of women smoke.

Socioeconomic factors associated with tobacco use include age, education, income and occupation. Industrially manufactured cigarettes and smokeless tobaccos, being more expensive, tend to be used more by urban populations and those with higher incomes. After adjusting for age and occupation, cigarette smoking also shows strong inverse correlation with education, just like other forms of tobacco use.[29]

Table 3. SMOKING AND OTHER TOBACCO USE PREVALENCE – (current daily use)[21]

Countries	Smoking Prevalence %		Total Tobacco Use %		Age (yrs)
	M	F	M	F	
Bangladesh[22]	NR	NR	48	21	≥ 10
Bhutan[23]	NR	NR	NR	NR	-
India[24]	29	2	47	14	≥ 15
Maldives[25]	41	NR	57	29	≥ 15
Nepal[26]	47	29	NR	NR	≥ 15
Pakistan[27]	36	5	54	20	> 15
Sri Lanka[28]	26	2	NR	NR	≥ 15

NR : Not reported M: Male F: Female

Areca Nut Production and Use

Areca nut, commonly chewed in some countries of South Asia, is most often wrapped in a betel leaf and accompanied by tobacco. Therefore the subject of smokeless tobacco use is not complete without mentioning areca nut use.

The use of areca nut predates tobacco use by at least 1.5 thousand years in South Asia. Areca nut has a mildly addictive quality and there is now sufficient evidence that by itself it is carcinogenic. Used with tobacco, the mixture becomes even more addictive and carcinogenic.[30]

Areca nuts are grown in large quantities in India and Bangladesh, as well as in South Asia. Producing countries within these regions both consume and export areca nut. Pakistan imports it. To a smaller extent, betel leaves, are economically important within these regions.

Areca nut use is increasing in India, Nepal and Pakistan in packaged processed forms. From a simple agricultural commodity, the areca nut has become a big industry in some parts of South Asia. In India, industrially packaged chewable mixtures like *pan masala* and *supari* mix, as well as others containing tobacco, especially *mawa* and *gutka* have become very popular and these are also sold in ethnic shops in areas of immigration of Asians, such as the U.K. and Australia.[31,32,33,34] Country-wise areca nut usage prevalence figures are not available.

Tobacco Related Mortality

Reports from countries in South Asia emphasise the importance of tobacco-related diseases, e.g. chronic obstructive lung disease, heart ailments, and cancer, causing a very large number of deaths. The patterns of tobacco related diseases in different countries reflect the ways tobacco is used in these countries.

Conservative estimates of tobacco related mortality has been made for India at 800,000 per year (700, 000 for smoking alone),[35] for Pakistan 100,000 deaths per year.[36] Tobacco use imposes costs to the quality as well as length of life, often burdening individuals with years of disability (Box 1).

Box 1

"Every single one of those four million people who died last year (of tobacco-related illnesses) could have lived longer — five years longer, 10 years longer, 20 years longer," World Health Organization Director-General Gro Harlem Brundtland told delegates from 190 nations." It is these lives and lost years which provide us the answers to those who will speak to you of profits and marketing gains, of special concessions and "reasonable" campaigns. There is nothing reasonable about tobacco deaths," the U.N. health chief said.[37]

Tobacco Related Cancers

Cancers caused by tobacco smoking include lung, urinary bladder, oral cavity (mouth and tongue), sino-nasal cavity, nasopharynx, oropharynx and hypopharynx, larynx, pancreas, esophagus, stomach, liver, uterine cervix, and myeloid leukaemia.[38]

Cancers known to be caused by smokeless tobacco use include cancers of the oral cavity, oropharynx, and esophagus.[30,39] Results from a case-control study on cervical cancer were suggestive of an association with betel quid chewing with or without tobacco.[40]

The cause of most head and neck cancers in South Asia is the use of tobacco, areca nut and alcohol. These countries have some of the highest rates in the world for cancer of the oral cavity for men and women and very high burden of tobacco related cancers.[41] High incidence rates of oral and other upper aerodigestive tract cancers in South Asia have declined over the decades, but are still very high from a global perspective.[42-45]

Although India has seen slow decreases in incidence of oral cancer over the decades, it is notable that in some areas an increase has been seen among men in younger age groups, attributed to increasing popularity of chewable mixtures of tobacco and areca nut.[46]

Thailand has demonstrated the potential to prevent cancers related to chewing and tobacco. Steady and substantial decreases in cancers of the oral cavity and esophagus have been documented in Thailand and the decrease has been attributed to educational campaigns against betel quid use.[45,47,49]

Research and Documentation

Research has helped to identify and quantify the magnitude of the tobacco problem and health hazards arising from tobacco in South Asia, generating evidence for advocacy for tobacco control legislation.[49]

Recently, the Global Youth Tobacco Surveys (GYTS), supported by the World Health Organization and the Centres for Disease Control, USA, have studied the various aspects of tobacco use among students in grades 8 to 10, roughly corresponding to the age group 13-15 years. In the first GYTS India (2000-2004) the prevalence of smokeless tobacco use was as high as 55.6% in Bihar and that of smoking as high as 34.5% in Mizoram.[50]

Tobacco use prevalence surveys conducted in localised areas have helped to pinpoint areas and age-groups of high tobacco or areca nut use. For example, a local school survey among 160 children attending primary school in Karachi, Pakistan, showed 74% areca nut use in some form including betel quid and pan masala.[51] School surveys in India found 16% of 95 boys in 8th and 9th grades using *gutka* in a small town private school in Anand District of Gujarat and forty-six percent of 476 high school students in grades 10-12 in Patna (urban and rural schools) were using khaini or pan masala.[52] As high as 66% of 100 village students were using *gutka* in Mullanpur District in Punjab.[53]

NGOs can also use research methods, like before-and-after comparisons and controlled trials, to evaluate strategies of mass awareness programmes, tobacco use cessation counselling, taxation or any other tobacco control strategy and are extremely valuable for determining effectiveness. Dissemination of research findings to governments and among members of the tobacco control community and to the public can motivate people to act. Sometimes findings are successfully used in litigation to ban the most harmful products or to kick-start the process of policy formation for smoke-free

Box 2

India: Smoking out the tobacco habit; a 'Super Army' on a mission – New Kerala, January 5, 2004[63]

Mumbai: They are people with a difference, they target the young and vulnerable, shoot with scientific truths, grapple the killer menace with bare facts and are out on a mission to liberate the nation from a mercilesskiller, the tobacco.

Calling themselves the 'Super Army', nearly 2023 children of six municipal schools across the city, have plunged into the battle against tobacco through a project, launched by the 'Salaam Bombay Foundation', an NGO working with children.

The project 'Super Army' attempts at developing 'refusal skills' in children through interactive and informative sessions weaved with scientific facts and some home truths.

Giving details of the project, Padmini Somani, director of the foundation said, "Our survey of municipal school children revealed that more than 50 per cent of them consume tobacco, mostly in the form of gutkha. There were instances of children consuming 16 packets of gutkha in a day".

The number of girls consuming tobacco was close to those consumed by male students. Those found to consuming tobacco were mainly in the 12-15 years but even some eight-year-olds were found to be into the tobacco habit, she said.

The prevalent chewing tobacco habit back home, the habit of brushing teeth with tobacco powder and lack of information had led to misconception about tobacco. "Many did not perceive anything wrong in consuming tobacco, some even thought it was something like an 'after lunch mint," Somani said.

"Some turned to tobacco out of experimentation, some to portray the macho image, some out of influence of adults and others tried to ape the advertisements", she added. PTI

public places or tobacco advertising, as has been tried in India and Bangladesh.[54-56] Investigating and publicizing the extent of donations by the tobacco industry to political parties and to individual politicians can help to discover the reasons for delays in adoption of tobacco control measures, as has been tried in California.[57]

Tobacco Control

Controlling tobacco is a complex task. Economists have identified **six key elements of effective tobacco control policy**: five major demand side strategies and one supply side strategy.[49,58] The effective demand influencing strategies are:

- Health education
- Regularly increasing taxation of tobacco products
- Clean air policies (ban on smoking in public and work places)
- Comprehensive advertising bans
- Brief tobacco cessation counselling by general practitioners.

The supply side strategy considered most effective in the Western world is:

- Control of illegal trade

Table 4 lists these and other strategies along with the major outcomes expected from them.

Most of these strategies require government intervention, with legislation and enforcement. NGOs therefore need to advocate for those policies. Examples of strategies implemented by NGOs in South Asia are available.[59]

Demand Side Strategies

Health education

Only an informed public can be motivated to control tobacco in their own lives and in society. The public in South Asia is not yet well informed about the hazards of tobacco, especially in rural areas, where 70 per cent or more of the populations live. Youth, with their impressionable minds, are the key to changing social norms. With 40% of the population in South Asia under the age of 15,[60] it is important to influence these young people about the dangers of initiating tobacco use and prevent them from taking it up in any form. Tobacco companies routinely target youth through advertising and marketing strategies. NGOs can reach youth through school and non-school programmes to change beliefs, customs, and concepts of appropriate behaviours, i.e., social norms. Informed youth can refuse tobacco use and can interact with the community and with policy makers to change attitudes and perceptions. [61,62]

Table 4. Factors relating to tobacco use and strategies to counter them.[49,58]		
Factors influencing Tobacco Use	**Strategies of Tobacco Control**	**Main Policy Goal**
	DEMAND SIDE	
Product pricing and socioeconomic status of users; public finance.	**Regularly increased taxation**, use of some proceeds for tobacco control activities.	Improve health, protect children & youth, reduce health inequalities
Incorrect beliefs, i.e., that tobacco benefits the user; Knowledge of health hazards of tobacco use	**Health Education** through the mass media, school curricula for school children and health professionals, warning labels; reading materials in clinics.	Protect children & youth, inform adults
Advertising and marketing; attitudes towards tobacco use.	**Comprehensive bans on advertising**; counter marketing campaigns.	Protect children & youth
Social norms on smoking in public. Involuntary smoking – environmental smoke.	**Clean air policies** (bans on public smoking), **spitting bans**; bans in schools and colleges; bans in films.	Protect nonsmokers, protect children and youth.
User experience of tobacco; addiction, desire to quit.	**Cessation counselling** by health professionals, self-help literature; medication.	Improve health, prevent deaths.
Health care systems	Addressing tobacco use through primary care, ante-natal care, clinic based and community-based: health visitors; doctors of the Government system; general practice, dental care.	Improve health, reduce health inequalities
Different types and strengths of tobacco products and nicotine replacement treatment (NRT) products.	Test and regulate product contents.	Harm reduction; reduce addiction
	SUPPLY SIDE	
Product availability, accessibility; range of products.	Restrictions to minors and in certain locations.	Protect children & youth
Cheaper prices due to tax evasion, the lure of foreign brands.	**Control of illegal trade.**	Protect the public, encourage quitting.
Production (Supply side): Primary (agriculture; government promotional bodies), and Secondary (manufacture, labour); Trade and Smuggling.	Crop substitution, dismantling of government promotional bodies, facilitation of alternative occupations, regulation of imports and control of smuggling.	Protect farmers, protect children & youth, improve health

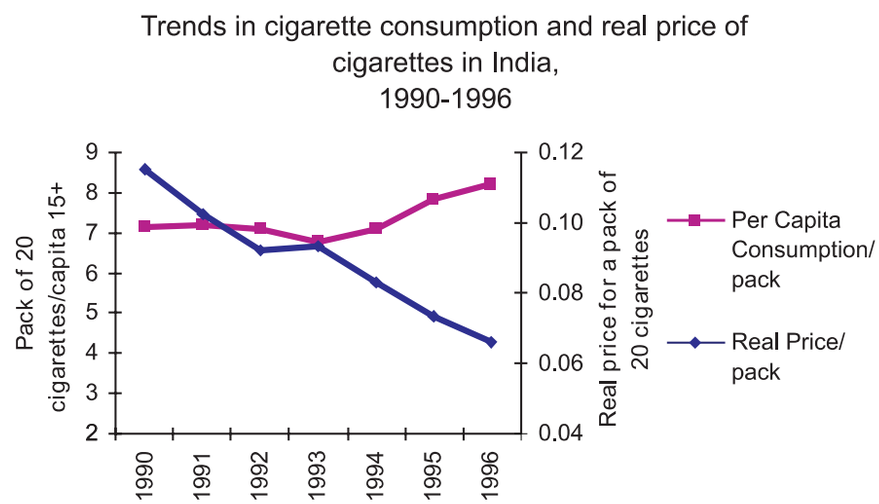
Strategies in **bold** have been judged to be the six most effective types.

Taxation

Cigarettes are taxed at relatively high rates in countries of South Asia. Other tobacco products have not attracted much tax and remain rather inexpensive. The belief prevails that high excise tax on these tobacco products will be politically unacceptable. However, recently available findings in India on knowledge and attitudes show that tobacco users have basic knowledge of the harmfulness of tobacco and that they support price increases. The Sentinel Survey conducted in India revealed that 75% of tobacco users support price increases, 77% of the lowest income group in Karnataka, 69% in Uttar Pradesh.[64] In the Global School Personnel Survey conducted in various states of India, the majority of school personnel, even if they used tobacco, supported price increases on tobacco products.[65-67]

Figure 1 shows that cigarette consumption is very sensitive to changes in price: during 1990-1996, while the price of cigarettes (white sticks) decreased by 43%, consumption per pack increased by 14.5%.[68]

Figure 1.



Ban on Smoking in Public Places (Clean Air Policies)

NGOs have participated in successfully advocating for public smoking bans in the countries of South Asia and of enforcing bodies. Figure 3 shows the complimentary roles of NGOs and Government in the control of tobacco.[69] Some basic support exists for public smoking bans among tobacco users in India, as found in the Sentinel Survey. The percentages of tobacco users supporting a ban on smoking in public places and in transport in Karnataka was 79.9% and in Uttar Pradesh was 74.5%.[64] In a society where public smoking is banned and prices are increased due to taxation, it is easier for users to give up using tobacco. Bhutan has not only banned smoking in public places but also the sale of tobacco products.[70-72] This and other examples of smoking bans[73-75] are also given in Box 3.

Box 3. Tobacco Free Zones

In the Kingdom of Bhutan, a national ban on the sale of tobacco products came into effect in December, 2004. Smoking in public has been banned from March 1, 2005.[70] The father of the antismoking drive, Pem Dorji, was governor of the eastern district of Bumthang when he enacted Bhutan's first modern ban on tobacco sales in 1992. He was a pack-a-day smoker then. Anyone caught selling cigarettes or chewing tobacco was fined and forced to watch officials burn the inventory. Mr. Dorji's efforts were soon copied by most district administrations[71] King Jigme Singye Wangchuck is trying to reduce his consumption of cigarettes. Smoking is recognised as a growing problem in the country.[72]

In the Maldives, youth groups, island development committees, and health workers worked together, leading to the declaration of two islands (Madifushi and Haa Alif Berinmadhoo) as 'no smoking' islands.[73]

When a villager, a chain smoker, died of cancer, fellow villagers in Koolimadu, Kerala (India), launched an antismoking movement. People were convinced that smoking reduces lifespan and could be persuaded to quit smoking. In view of these developments, the district administration imposed a total ban on using and selling tobacco in the area and declared it a tobacco free zone. Groups of youths monitored the ban. The penalty for violators was to be excluded from village life for a day. Before this item went to press, the penalty was not to be imposed.[74]

After the death of a woman due to mouth cancer in a village of 5000 people in Indore District, Uttar Pradesh (India), the panchayat completely banned the buying and selling of all tobacco items. This was followed by a programme on freedom from addiction in which local government functionaries and a professor from the Dental College, Dr. B. M. Shrivastava, participated. School children have taken out rallies in support of the decision and the local government and NGOs in the village are supporting the ban in various ways. [75]

Figure 3. Tobacco control legislation situation in South Asia, listed by FCTC articles.

Country& Years of TC Acts	Taxation & Price	Non price measures	Public smoking	Content Regulation	Disclosure	Warning labels	Health Education	Advertising	Cessation	Illegal Trade	Sale to Minors	Alternative econ activity
FCTC:	Art. 6	Art. 7	Art. 8	Art. 9	Art. 10	Art. 11	Art. 12	Art. 13	Art.14	Art. 15	Art. 16	Art. 17
Bangladesh 2005	Gov't agreed	–	A	On imports only	–	A	Activities	A	Activities	A	–	A
India 1975 2003	Partial	A NYN	A	A NYN	A NYN	A NYN	Activities	A	Activities	A	A	–
Maldives 1993, 1994, 1995, 1998	Import duties	A	A	–	–	A	Activities	A	Plans	A	A	–
Nepal 1992 1998	Yearly review	C	A	A NYN	A NYN	A Cigs.	NP	A		A NYN	A NYN	–
Pakistan* 1979 1990 1997 2002	–	–	A	–	–	A	–	A	–	–	A	–

A = Act in place (dark shaded cells); NYN= Not Yet Notified; NP=National Plan; B = Bill pending or draft law (light shaded cells); C = Campaign for legislation; – = no action taken; Activities – cells shaded lightly. Information is indicative only and may not be complete. Cigs. = cigarettes only.

*Ordinance of 2002 extends only to Islamabad, the capital city. The table is based on the compiler's understanding of the sources indicated.

Advertising bans

Tobacco advertisements typically target youth by associating aspirations of economic and social success and fun with tobacco use. Like studies in the western world, small studies in India have shown that youth even in rural areas have been influenced to use tobacco through advertisements: on television, magazines and advertisements painted on public buses[53] as well as through sponsorship of sports, cultural events or fashion.[76] Surrogate advertisements are a way for tobacco companies to get around advertising bans. This includes advertising pan masala of the same brand and similar packaging as gutka, where advertising of tobacco is prohibited. It also includes marketing of clothes with brand names of cigarettes, such as the Wills Lifestyle and John Players clothing lines in India. These types of activities need to be monitored and restricted.

Cessation programmes and activities

Chronic users of tobacco, mostly in older youth and middle age, need to receive brief tobacco use cessation messages from their health care providers to prevent early deaths. Some initial results suggest that reducing tobacco use with the aid of medical treatment could result in dramatic decreases in mortality from smoking-related causes, even within a few years.[77] However, given the high cost of medical treatment, tobacco cessation advice without medication is the most realistic method for South Asia. Research in this area is lacking in the Region. The current knowledge needs to be taught to health practitioners through evaluated programmes.[78] In India a nicotine gum has recently become available, and it has been approved by the Drug Controller as an over the counter product. There is a fear among the health community that it will be targeted towards non-users of tobacco, especially youth. It is contraindicated for heart patients unless they are unsuccessful quitting smoking without it and uncontrolled use can lead to use of other tobacco products.

One community intervention trial in India showed higher rates of tobacco use cessation after five years of follow-up in two out of three areas: 9%, 17% and 13% during behavioural intervention compared to areas without intervention (3%, 5%%, 9%). The proportions of those who had reduced their intake in the intervention cohort were 28%, 49% and 20%.[79] Such a community approach might be the more effective in most of South Asia as compared to the individual approach, since access to health care is more difficult relative to the developed world. NGOs and health care providers could join hands to implement these programmes in some areas and the health system of the Government could implement them in others. Where the public has been informed about the hazards of tobacco use, people are more motivated to quit.

Product testing

Another possible demand side intervention is product testing and regulation. The purpose of testing and regulation is to progressively reduce the levels of harmful constituents, eliminate toxic non-tobacco additives, and alter their physical characteristics influencing the delivery of toxic chemicals. This would hopefully lead to reduced harm, reduced uptake/demand and facilitate quitting. There is a trend to ban the use of descriptors such as 'light', 'mild' and 'ultra' as a part of cigarette brand names, which imply a degree of safety. It is now well established that low tar, low nicotine cigarettes introduced during the 1970's did not decrease the rise of lung cancer.

Product regulation requires facilities for testing contents and emissions, imposing regulatory limits on these and disclosure of contents on packages to inform the consumer. A strong National Regulatory Authority (NRA) with affiliated laboratories has been recommended to successfully implement such regulations. An NRA would need access to all relevant information from tobacco product manufacturers. Tobacco product testing requires considerable investment and expertise.[80]

Supply Side Strategies

Control of illegal trade

Tobacco and areca nut and their products are traded and sometimes smuggled across borders within and from outside South Asia.

Smuggling of cigarettes into the Region from China and Myanmar is known. Much of this trade is in counterfeit goods, to the chagrin of the multinationals.[81] Smuggling can sometimes, however, be a weapon in the competition between multinationals. Smuggling avoids payments of taxes, compliance with health warnings, and other labelling requirements. Some smuggling takes place over the internet, which bypasses age bars.[82]

Trade barriers for tobacco products and control of smuggling can be negotiated bilaterally and in international forums like South Asian Association for Regional Cooperation. The WHO has sent representatives to these meetings to talk about tobacco control issues.[83] Licensing of all parties in the tobacco trade has also been suggested to help to control illegal trade. Enforcement against illegal selling, often through street sellers, would also be an important measure. The hands of the customs authorities also need to be strengthened.

Crop substitution

Economists in South Asia believe that helping farmers diversify to other crops and assisting tobacco workers to shift to other livelihoods can achieve supply reduction. The demands of social justice also require that governments offer guidance and assistance to tobacco farmers and workers dependent on tobacco to change over to other activities.[84,85]

Tobacco control policies and human rights

Since health is the right of every citizen, tobacco has been identified as affecting human rights. Policies designed to control tobacco use are in support of human rights in society, although users may complain such policies infringe on personal the freedom to use tobacco (Box 4).[86]

Box 4. Tobacco – Identified as a Human Rights Issue in India[11]

In 2001, the National Human Rights Commission of India identified certain rights of the individual that are violated due to tobacco use in India: the right to clean air, rights of children to health, the right to information and education, the right to redressal and the right to tobacco cessation programmes. The rights of the smoker may be violated by regulatory mechanisms intended to control tobacco, however, these need to be superseded in the interest of public health and the human rights of the larger community. The most vulnerable groups affected by tobacco include those less knowledgeable and unable to make informed choices about tobacco use: children, the less educated, pregnant women and unborn children. The problem is not only the health hazard, but also the fact that money spent on tobacco can lead to insufficient amounts spent on food and consequent malnourishment, as well as under-spending on education of children. Thus tobacco control policies aim to protect vulnerable groups and NGOs could take up tobacco issues as human rights issues at local, national and international levels.[86]

The Framework Convention on Tobacco Control (FCTC)

World Health Organization for the first time initiated the development of an international treaty to impact health, Framework Convention for Tobacco Control (FCTC) in 1996. A large number of NGOs from around the world formed a Framework Convention Alliance to discuss common issues relevant to the convention.

The FCTC was designed to incorporate strategies to counter all possible elements supporting tobacco use. The strategies are spelled out in Articles 6 through 22 (Box 5).[87] These strategies include the six key elements as well as other measures. Countries that ratify the treaty are required to implement the measures.

On 21st May 2003 the World Health Assembly (WHA) adopted the FCTC and called upon countries to sign and later ratify it. All countries in South Asia have signed the FCTC and, except for Nepal, all others have ratified it. With 57 countries having ratified the treaty, the FCTC entered into force on 27 February, 2005.[88,89]

Box 5. Framework Convention on Tobacco Control (FCTC)[87] Articles relevant to legislation and international cooperation

Part I: Introduction

Article 1:	**Use of terms**
Article 2:	**Relationship between this Convention and other agreements and legal instruments**

Part II: Objective, guiding principles and general obligations

Article 3:	**Objective**
Article 4:	**Guiding principles**
Article 5:	**General obligations**

Part III: Measures relating to the reduction of demand for tobacco

Article 6:	**Price and tax measures to reduce the demand for tobacco**
Article 7:	**Non-price measures to reduce the demand for tobacco**
Article 8:	**Protection from exposure to tobacco smoke**
Article 9:	**Regulation of the contents of tobacco products**
Article 10:	**Regulation of tobacco product disclosures**
Article 11:	**Packaging and labeling of tobacco products**
Article 12:	**Education, communication, training and public awareness**
Article 13:	**Tobacco advertising, promotion and sponsorship**
Article 14:	**Demand reduction measures concerning tobacco dependence and cessation**

Part IV: Measures relating to the reduction of the supply of tobacco

Article 15:	**Illicit trade in tobacco products**
Article 16:	**Sales to and by minors**
Article 17:	**Provision of support for economically viable alternative activities**

Part V: Protection of the environment

Article 18:	**Protection of the environment and the health of persons**

Part VI: Questions related to liability

Article 19:	**Liability**

Part VII: Scientific and technical cooperation and communication of information

Article 20:	**Research, surveillance and exchange of information**
Article 21:	**Reporting and exchange of information**
Article 22:	**Cooperation in the scientific, technical, and legal fields and provision of related expertise.**

Mechanisms of tobacco control adopted

Much new tobacco control legislation has been adopted in countries of South Asia since the FCTC was adopted by the WHA. This shows a level of political commitment. The current situation in countries who provided this information for the WHO Tobacco Free Initiative website is shown in Table 5. Information shown is from those countries that provided information only (Bangladesh, India, Maldives, Nepal and Pakistan).[90-94]

The Role of Civil Society and Non Governmental Organizations

Enthusiastic response and active participation by the civil society are essential for tobacco control laws to succeed. The "bottom-up" community mobilization approach needs to complement the "top-down" regulatory approach of the government. Constant, concerted action by both the government and the community can ensure successful enactment and implementation of tobacco control legislation, like requirements for smoke-free public places. Figure 2 illustrates this point.[69] Unfortunately, this collaboration between civil society and the government can break down when the tobacco industry tries to influence politicians. NGOs have to be alert for this.

Government inclusion of NGOs in National Tobacco Control Committees is seen in the Maldives.[92]

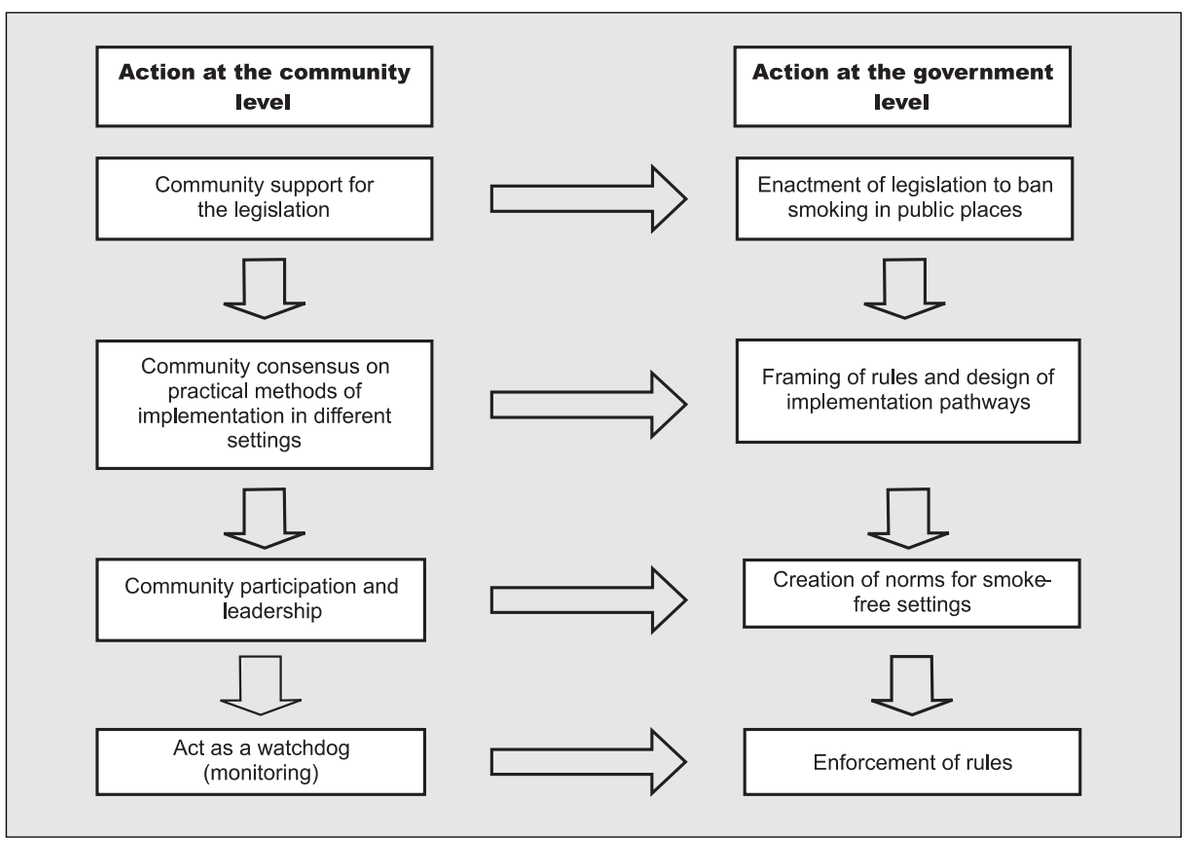


Figure 2. Complementary roles of the government and community in making public places smoke free.[69]

Civil society, often through various voluntary organizations, has been playing an important role in advocacy toward governments at local, state and national levels, to persuade them to adopt and enforce tobacco control policies. NGOs have also been playing a role at international level in influencing the tobacco control climate in regionally and globally.

Making good ideas work

It is helpful to read success stories from countries besides ones own and even outside one's region to understand what worked.

The effectiveness of NGO coalitions in advocacy for policy adoption has also been seen in countries of South Asia, in the adoption of tobacco control legislation: e.g., in Bangladesh, the Bangladesh Anti-tobacco Control Alliance, in India, the Advocacy Forum for Tobacco Control (AFTC), and in Pakistan, the Pakistan Anti-Tobacco Coalition (PATC).

Thailand is pursuing a path to reduce advertising to zero through the use of national coalitions. In the national anti-tobacco coalition, doctors, parents and students are working together using bold strategies to bring about drastic changes in marketing of tobacco products. As tobacco advertisements are banned in all media, the tobacco companies use product displays in stores to appeal to customers. Youth are especially attracted to displays in convenience stores. A new law prohibits the display of tobacco products in stores and NGOs in the anti-tobacco coalition are monitoring compliance. In addition, signatures of students have been collected in support of this new law.[95]

Canada has achieved a drastic reduction in smoking prevalence. It found that public education was not sufficient, but that advertising had to be curbed.[96]

People in the process

Leadership is crucial in achieving the goals of tobacco control because of the power of the tobacco lobby (Box 6). Two essential types of leaders that work best in synergy are the "outside sparkplugs" and the "inside advocates". "Outside sparkplugs" (or outside advocates) tell truth to power, hold governments and established organizations up to their own commitments, keep the public informed and mobilize communities in to action. "Inside advocates" influence key policymakers with their negotiating skills and advantageous position.[97]

A combination of diverse types of people is needed to make coalitions effective: visionaries, strategists, statespersons, experts, strategic communicators and movement builders. In order to remain complementary, all these must remain grounded in reality and truth, strive to work as a team, foster trust and goodwill, and avoid being blinded by ego. The required range of skills includes communication and organising, as well as expertise in health and law. Creativity, insight, foresight, flexibility and determination are all important qualities. The ability to recognise and seize appropriate opportunities for action within an existing strategic framework is crucial.[97]

Box 6. Tobacco Control – War Actually

In Thailand, the tobacco industry has been able to delay progress in tobacco control through four strategies: gaining many allies among politicians, circumventing or flagrantly violating advertising laws, and influencing the nature and extent of research on tobacco and corporate sponsorship and philanthropy. These strategies were revealed in tobacco industry documents from court actions.[98]"

Perhaps the most important lesson many of us have learned – painfully – over the nearly half-century of the tobacco war is simply that tobacco control, unlike most public health struggles, is a war with an opposing enemy, the tobacco industry. This very fact has disabled or neutralised our most common public heath strategies…"

Indeed we have had science, truth, and public health firmly on our side. But none of these suffices in the face of the economic and political power of the tobacco lobby…

"**So we have had to learn to fight, not only fiercely, but skilfully**. **We have had to learn the lobbyist's trade … and … to approach the mass media**" Mike Pertschuk. Anti-tobacco advocate, American Cancer Society, USA.[97]

Enforcement issues

Putting legislation in place is an achievement in itself, but enforcing it, is more difficult. Civil society has to be involved. If informed of the issues, the laws and the enforcement mechanisms, it can be motivated and mobilised to act. Social pressure on the government at different levels, the tobacco companies, other stakeholders (like hotels and restaurants, the world of cinema, sports associations) and tobacco users could prove more effective than the laws themselves. A clear chain of command has to be created in the official enforcement machinery, with specific authorities with assigned responsibility for implementation and monitoring tobacco control laws at state, district and block levels. This type of structure also needs to be formulated in national coalitions of NGOs, too, for better responses to violations of the laws. There is a need for a nodal agency for tobacco control in each country that can coordinate state, central and international efforts. Targets can be set to help monitor for reductions in tobacco use prevalence. NGOs can carry out community interventions to help further government tobacco control goals. Enforcement agencies need to be sensitised and trained to carry out their new duties under tobacco control.[99]

Funding Strategies and Mobilisation of Human Resources

Tobacco control interventions need funding. Some of the funding can come from Government allocations. Government funding can come in part from increased excise taxes on tobacco products, and penalties for violations of tobacco control laws. Private sources of funding include foundations, and corporations. In addition, a large number of NGOs are capable of mobilising substantial finances. International funding sources include the World Bank, through its intergovernmental development assistance programmes. The FCTC includes a provision for the creation of a global fund for tobacco control. The WHO sponsors World No Tobacco Day activities and the creation of health education materials.[100]

Human resources can be mobilised through awareness generation, motivation and training in the health sector, including health care providers and researchers, the education system, the rural development sector, civil society groups, and among professionals like lawyers, economists and social scientists.[101] Celebrities sympathetic to the cause often agree to donate their time, which helps get press coverage and viewers. Advertising agencies sometimes produce anti-tobacco advertisements with minimal charges knowing that these advertisement will fetch awards. These TV advertisements can also be used as educational aids in schools. The Cancer Patients Aid Association (CPAA) in India produced three such advertisement using cinema celebrities and the technical charges were supplemented by the WHO.[100]

Conclusion

The tobacco problem is vast and has broad consequences. It requires to be tackled with a sense of urgency and a well-planned and coordinated strategy. A beginning has been made, but many more efforts and resources are required to achieve substantive progress in most countries of the Region.

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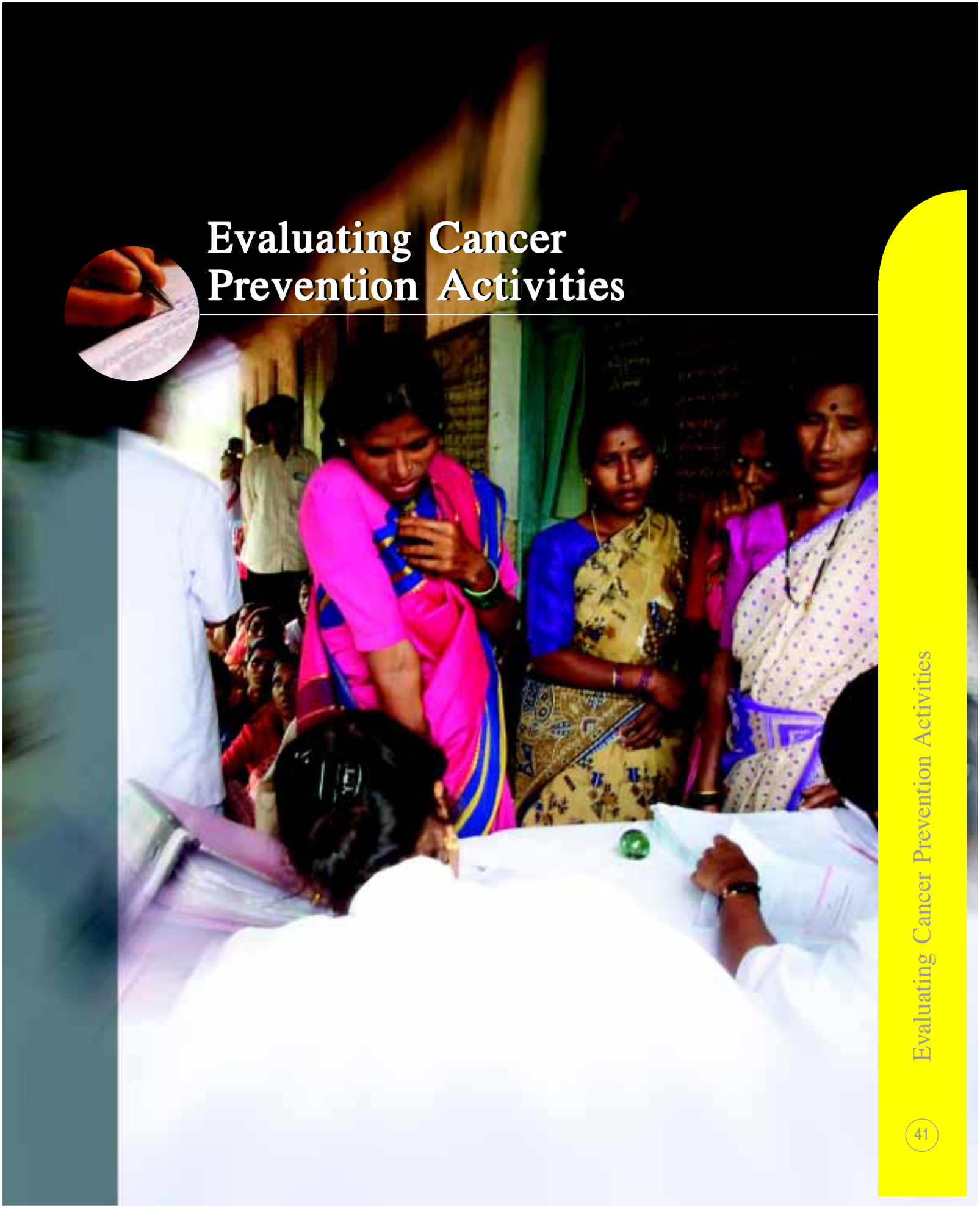
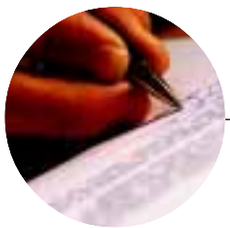
102. w3.whosea.org/en/section1174/Section1462/TFIMain.asp?pg=legistative emro.who.int/tfi/Legislation-PAK.pdf(90-94) [homepage on the internet]

This section describes evaluation strategies for cancer prevention activities in South Asia that NGOs and Government health services should find useful. While writing this section the author has constantly paid attention to the fact that urban areas in South Asia are in a sociodevelopmental transition phase, while the rural areas are still mostly very backward in terms of social, economic and health care indicators.

Evaluating Cancer Prevention Activities





Evaluating Cancer Prevention Activities

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Relevance of Evaluation

The double blind, randomised controlled trial is considered the most robust evaluation tool in health research methodology.[1]

A big drawback with the double blind, randomised controlled trial is that we presume that the subjects recruited in these studies are educated and empowered to take their own health care decisions. This is not necessarily true all over the world and particularly so in South Asia. Uneducated populations in several parts of South Asia, who are deprived of even basic health care services, present serious challenges to the conduct of preventive trials and the implementation of community-based health promotion and screening programs. Truly randomised controlled studies may be very expensive and time consuming or even impossible in several situations (although there are a few excellent examples of such studies in the region). Logistics are usually very difficult to organise. Given this level of difficulty in adopting the so-called 'Gold Standard' of clinical trials, preventive trials and cancer control programmes in most parts of South Asia would have to largely depend on the available evidence from well-conducted case-control and observational studies. The constant sociodemographic transition, taking place in Urban South Asia, further complicates the situation by introducing several confounders, making it difficult to show a clear association between an intervention and the effect. Service delivery evaluation will also need to set indicators based on ground realities rather than ideal-but-unachievable targets and goals.

Programme Evaluation

Programme evaluation is "the systematic assessment of the operation and outcomes of a programme or policy compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the programme or policy". [2] Evaluation activities are part of a continuum of actions that support the decision-making process in all stages of programming, viz. planning, implementation and outcome evaluation. Evaluation is thus useful to all programme activities and provides a wide scope for evidence-based decisions within a national cancer control programme.[3] Programme monitoring is intended to assess whether the implementation is performing as was devised, and whether or not the programme is reaching the target population and meeting the needs of people.

The essential prerequisites for overall evaluation of a national

level cancer control programme are:

1. Political endorsement through written policy and a commitment to long-term financial support, as well as, the existence of dedicated national and state level programme administrators.
2. A well written plan with long and short term measurable goals and objectives for cancer prevention, early diagnosis, treatment and palliative care.

The evaluation plan should have realistic *structural*, *process* and *outcome* measures.

Structural measures evaluate the human, physical and financial resources that are needed to provide medical care. For health care providers, structural variables include demographics and professional characteristics such as specialty and board certification. For institutions, structural variables include the number, size and geographic distribution of health care providers and hospitals as well as their access to health care equipment and technologies. The way in which health care is financed and how providers are reimbursed are also structural components of health care. *Structural measures* evaluate resources available in the programme.

Process measures evaluate the working of, and interactions between, the various components of a programme. Process measures are related to the administrative, organisational and quality assurance aspects of the programme e.g. screening participation rates, compliance for diagnosis and treatment; proportion of inadequate tests, repeat testing, number of tests per person screened and test characteristics.

Outcome measures evaluate the effects of a programme on the population that are expected to have short, medium or long-term consequences, depending on the nature of the interventions involved. Outcome measures are the most conclusive tools for the evaluating the efficacy of prevention and screening programmes. *Intermediate outcome measures* e.g. stage of disease at diagnosis, survival rates and case fatality are usually available early in the programme and are as important as the *final outcome measures* e.g. reduction in incidence and mortality.

The effectiveness of screening may vary from country to country due to the varying efficiency of health services and depending on the quality of the overall screening process, including monitoring, quality control, proactive recruitment and follow-up strategies. Cancer screening should attain demanding levels of cost-effectiveness before it can be prioritised in many countries.[4]

The type of measure selected, will depend on the purpose of assessment. Structural characteristics, for example, can be used to infer that the context in which care is delivered is conducive to good care, but are generally inadequate to determine whether care is good or bad. For example, there can be wide variation in the quality of care delivered at the same hospital depending on diagnosis, procedure, or attending physician.[5] Structural measures are unable to reflect these differences. The principal value of process measures is that the link between health care and outcomes highlight what can be changed in the delivery of care to improve health outcomes. Nevertheless, our ability to use process measures is limited by the strengths and weaknesses of clinical science. Outcome measures are appealing because they appear to be the most direct assessment of quality. Other factors outside the control of the health care system, such as patient behavior and environment, also affect outcomes. For a health outcome to be a valid quality measure, it must be possible to differentiate between the influences of the health care system from the effects of other factors. Outcome measurement is also problematic because the time between the delivery of health care services and the outcome of interest can be quite long. As a rule, quality measurement activities with components of structure, process, and outcome allow the strengths of each approach to compensate for the weaknesses of the others.

Another important measure is that of programme efficiency, which relies on analysis of cost–benefit, cost–effectiveness, and cost–utility. An efficient programme is one that achieves the best possible results using the available resources. A programme

that seems likely to have a significant impact on a country's cancer problems is of little value if the resources required to sustain it exceed those that can be made available.

Evaluation of Prevention Interventions

Evaluation of prevention interventions can often take 15-20 years. Cancer prevention evaluation is done by *analysing time trends in the incidence* of cancers to look for the desired reduction in incidence over time. For cancers with a poor, or unchanging survival, mortality rates may be used for the same purpose. Examples are a) Monitoring of the incidence of tobacco-related cancer in response to tobacco control programmes, b) Monitoring the incidence of liver cancer following hepatitis vaccination.

In South Asia, with limited health resources, the implementation may be confined to certain areas. In such cases comparisons of the changes in the 'intervention' areas with that in 'control' areas may be possible.

Examples of Prevention Interventions and their Evaluation

Cervical Cancer Education Study - India[8]

Madha and Karmala are two Tehsils (Sub-districts) of the Solapur district of Maharashtra State in Western India. The literacy rate among women in these areas is less than 20%. Cervical cancer education was provided in small group meetings to 97,000 women in Madha Tehsil, while 76,000 women from the Karmala Tehsil served as controls. This programme was initiated in 1995 and the preliminary evaluation in 2000 (shown in the table below) indicated that, a substantially higher proportion of women from the intervention area presented with cervical cancer in earlier stages, and had a significantly reduced case fatality when compared with women from the control area.

Cervical Cancer Education Study: Madha and Karmala Tehsils, Solapur District, Maharashtra, India

	Intervention (Madha)	**Control (Karmala)**
Total number of women	96,908	76,084
No. of women–years	352,628	380,805
No. of incident cervical cancers	80	64
Stage I and II cancers (%)	65.1	32.8
Age-standardized incidence (per 100000)a	26.3	18.7
No. of deaths from cervical cancer	17	30
Age-standardized mortality rate (per 100000) b	5.6	8.6

a Incidence rate ratio: 1.41 (95% CI: 1.00–1.98).

b Mortality rate ratio: 0.65 (95% CI: 0.36–1.18).

Theatre Against Tobacco

The *Salaam Bombay Foundation*[9], a non-profit anti-tobacco group works for the prevention and reduction of tobacco (particularly a variety of flavoured chewing tobacco generically called Gutkha that children in India and other countries in South Asia have taken fancy to over the last one decade). The *Theatre Against Tobacco Project* was conceived by the foundation in 1995. It consists of a 30-minute skit by theatre professionals that aims to create awareness in the 12-15 years age group. Extensive use of child psychology, medical facts interwoven with topical themes and film (Bollywood) songs drive home the messages to the audience. Following the skit a brief discussion and a competition are held for small groups of children to reinforce the message in an interactive manner. The first evaluation was done after 4 years. Over 600 shows of the play had reached out to 147,000 children from over 250 schools and institutions. A high recall rate of the messages was observed and attributed to the non-preaching nature of the intervention.

Evaluation of Screening Intervention

Outcome evaluation of cancer screening programmes depends upon measuring whether their ultimate objective has been achieved. Depending on the natural history of the cancer and the efficacy of the screening tool the objective may be to bring about a reduction in the incidence of invasive cancer, or to reduce the mortality, or both. Screening programmes for oral and cervical cancers aim to reduce the incidence of invasive cancer. Screening programmes for prostate and breast cancers aim to detect invasive cancers early, thereby providing the benefit of better treatment and control facilities, leading to a reduction in the mortality. When programmes for prostate and breast cancer screening are initiated the incidence may increase initially since the screening programme would detect a number of undiagnosed but pre-existing cancers.

When we link screening programme data with a population-based cancer registry, we can compare the cancer risk among the screened and unscreened population groups. It is also possible to estimate the cancer incidence at different intervals (within 1 year, 1–2 years, and so on) in the screening negative sub-group, as a fraction of the "expected" incidence in unscreened populations. This rate of "interval cancers" is a very useful indicator and is called the *programme sensitivity*.[5]

Case-control studies have also been widely used to evaluate early detection programmes. This can be done by studying the screening history in cases of cancer and comparing this with appropriate controls.[6] Cervical cancer screening programmes have been audited in this manner in the past.[7]

Both cohort and case-control studies of screening programmes will always have an inherent selection bias since they would be able to measure the effect of the screening programme only among those who choose to be screened and not the entire population at risk. It is usually seen that people who chose to be screened are often at lower risk of the disease. Further, though earlier detection, as shown by 'intermediate endpoints' (e.g. size and stage of cancers detected), is essential if a screening programme is to be successful in reducing mortality, it is no guarantee that it will do so. Intermediate endpoints may appear to improve, even though mortality does not. The final outcomes will depend very much on the availability of effective diagnostic and treatment facilities to back up the screening programme (something that is woefully missing in most of the rural areas in South Asia).

Some useful intermediate end points for evaluating screening programmes are:

1. Incidence of interval cancers
2. Size and stage distribution of cancers detected by screening

(compared to the expected distribution in unscreened populations).

3. Incidence rate of advanced cancers, compared with the prescreening period (or an unscreened comparison group).

Changes in the stage at which the cancers of cervix, breast and mouth are diagnosed can be evaluated at the existing cancer treatment centres in South Asia. Evaluation of population coverage in screening programmes should concentrate particularly on coverage of target age groups, rural areas and low socioeconomic groups. The proportion of people with abnormalities revealed in screening tests who subsequently obtain appropriate diagnosis and treatment should be determined, as should the proportion of all cases of particular cancers that were diagnosed by screening. The technical quality of screening tests (test characteristics) and of the facilities that undertake them should also be carefully monitored. With a view to future expansion of the screening programme by coverage of a wider age range or increase in the frequency of screening, the staff development and training processes are essential.

New screening tests can be evaluated in randomised controlled trials using the above end points before they are introduced in mass screening. Once the screening becomes wide-spread, observational studies at the population level can be used for geographical comparisons and trends in mortality. At individual level cohort and case-control studies may be used for further evaluation of effectiveness and for optimising screening intervals, age-groups to be screened and other programmatic aspects.

Biases

One should keep in mind the following biases that are encountered universally in screening programmes:

(a) Lead time bias: Lead time is the interval between the time of detection by screening and the time at which the disease would have been diagnosed, so that the improved survival or

Examples of Screening Interventions and their Evaluation

Trivandrum Oral Cancer Screening Study[10]

A cluster-randomised controlled trial aimed to assess the effect of visual screening on oral cancer mortality was conducted in Trivandrum, Kerala, India. Of the 13 clusters chosen for the study, seven were randomised to three rounds of oral visual inspection by trained health workers at 3-year intervals and six were randomised to a control group during 1996-2004. Healthy participants aged 35 years and older were eligible for the study. Screen-positive people were referred to experts for clinical examination, biopsy and treatment. Outcome measures were survival, case fatality and oral cancer mortality. Oral cancer mortality in the study groups was analysed and compared by use of cluster analysis. Analysis was by intention to treat. Of the 96,517 eligible participants in the intervention group, 87,655 (91%) were screened at least once, 53,312 (55%) twice, and 29,102 (30%) three times. Of the 5145 individuals who screened positive, 3218 (63%) complied with referral. 95,356 eligible participants in the control group received standard care. 205 oral cancer cases and 77 oral cancer deaths were recorded in the intervention group compared with 158 cases and 87 deaths in the control group (mortality rate ratio 0.79 [95% CI 0.51-1.22]). 70 oral cancer deaths took place in users of tobacco or alcohol, or both, in the intervention group, compared with 85 in controls (mortality rate ratio 0.66 [95% CI 0.45-0.95]). The mortality rate ratio was 0.57 (95% CI 0.35-0.93) in male tobacco or alcohol users and 0.78 (95% CI 0.43-1.42) in female users. On the basis of these findings the investigators concluded that 'Oral Visual Screening' by trained primary healthcare workers can reduce mortality in high-risk individuals.

early stage at diagnosis is due to the advancement of the time of diagnosis.

(b) Length bias: It is likely that when screening tests are applied at intervals (say once in 2-5 years), cases with a long preclinical phase are predominantly diagnosed rather than those faster growing aggressive tumours. Hence cases detected by screening may be a biased sample of all cases, containing those lesions with a more favourable outcome.

(c) Overdiagnosis: It is possible that some screen-detected lesions would never have led to invasive cancer and death. The true benefit of identifying pre-clinical lesions through screening may be smaller than is perceived.

(d) Self-selection bias: People undergoing screening are likely to be healthconscious individuals and may have a better prognosis than those who did not accept screening.

Using the Results of Evaluation

Valuable resources spent on evaluation would be completely wasted if the results are not disseminated among the key stakeholders and used in the future decision-making processes.

1. Evaluation results and recommendations should appropriately project the information requirements of different sections of the stakeholders e.g. policy makers, administrators, health care providers, health care funding agencies, health insurance agencies and the beneficiaries.

2. Evaluation results and recommendations must be available when needed to those who require them.

3. Implementation and monitoring of the accepted recommendations is the final and most essential requirement of an evaluation process.

As newer cancer screening programmes using appropriate technological tools are preparing to take-off in South Asia, the programme managers should ensure that the evaluation components are strongly embedded and well understood by all stakeholders and programme staff, before they actually embark on the exercise.

Dedication

I would like to dedicate my entire efforts in compiling this handbook to my mother Mrs. Kamal Srinivas Shastri who had devoted her entire life towards the cause of emancipation of women and was the strength and support to several individuals and families whom she opened the doors of her heart to.

Surendra S. Shastri

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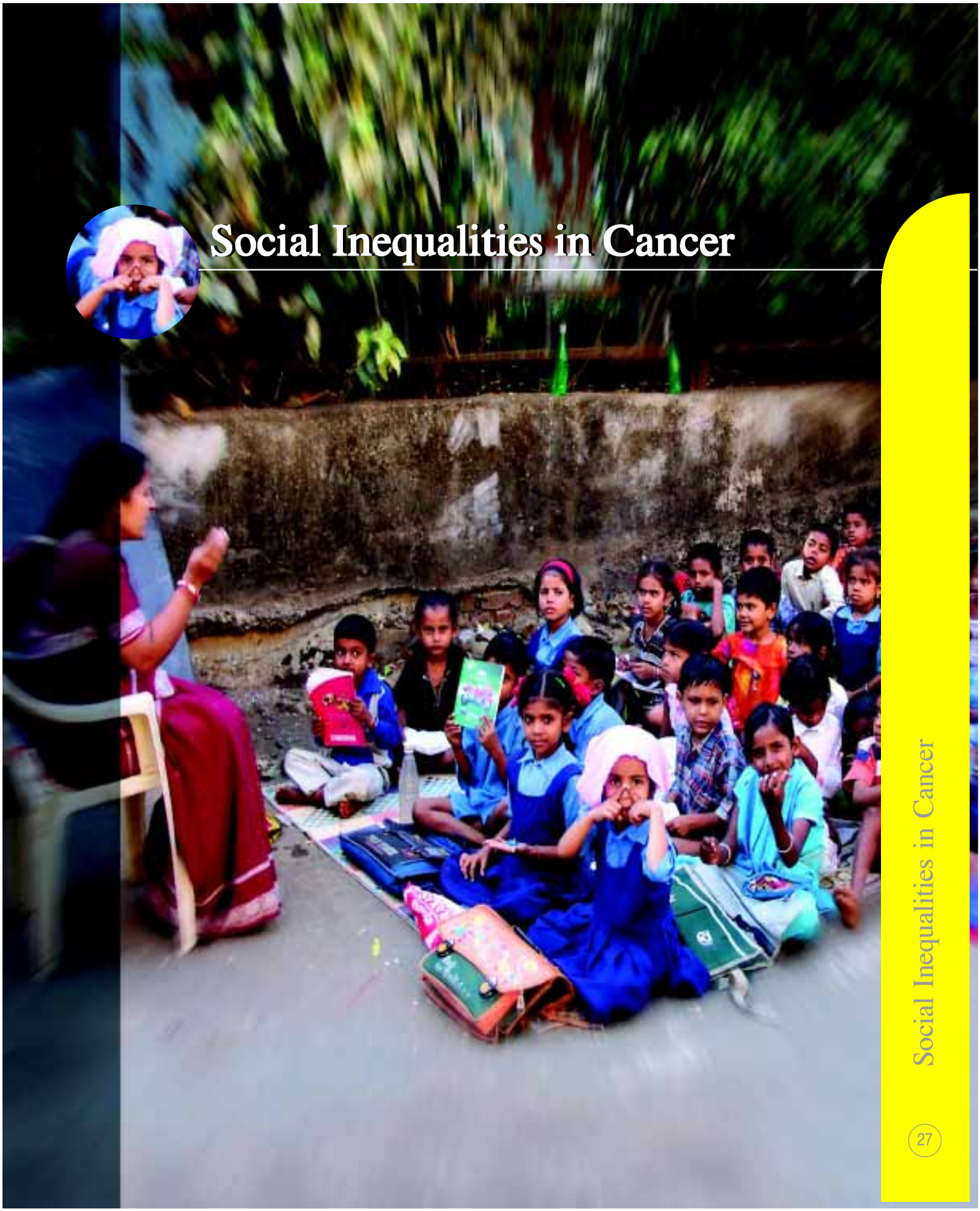
Social inequalities are highly prevalent in South Asia. It has been well documented in literature from the developed countries that cancer incidence, and cancer related treatment and mortality outcomes are unequally distributed in the population. The population based cancer registries in Mumbai (Bombay) and Chennai (Madras) have analysed data on the clinical extent of the disease and the survival of common cancers in women and its relation to the socio economic parameters like educational level, marital status and place of residence (urban or rural).

There is a lack of reliable data on economic status, however the educational level of the individual can be extrapolated to one's economic status. The socio economic status of the society has always been an issue of political agenda, however inferior survival as a result of social inequality has never received its due attention.

The purpose of this chapter is to present key data on socio economic differences in cancer incidence and mortality in South Asia. The adequate infrastructure for the registration of cancer in India is available as a result of the National Cancer Registry Program, whereas there is inadequate data from other countries in South Asia.

Social Inequalities in Cancer



Historical Perspective

Current Cancer Incidence Patterns in Mumbai, India, and Trends over the Last 20 Years.

Preventable Cancers

Factors Contributing to Social Inequalities

Lack of empowerment

Socio-economic Issues

Breaking the Barriers of Social Inequalities

Social Inequalities in Cancer

Kurkure AP

Yeole BB

Indian Cancer Society
Mumbai, India

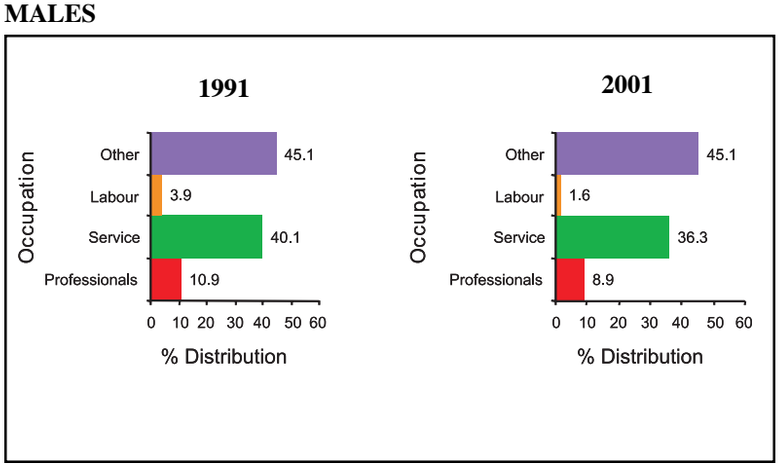
Historical Perspective

Socio-economic differences in the frequency of cancer may be attributable to differences in life circumstances from different sections of society. Societies are not homogenous, and variations between people of different social classes and their multiple aspects of lifestyle, culture, religion and behavior have clear repercussions on health. In most studies of socio-economic differences, in cancer incidence, measures have been used that are constructed on the basis of occupation, education, income and wealth or area of residence.[1] Classifications involving such measures have been criticized as they provide imprecise definitions and have an uncertain relation to sociological concepts. They persist in epidemiological research because data on morbidity and mortality and on health behavior reveal clear social divisions.

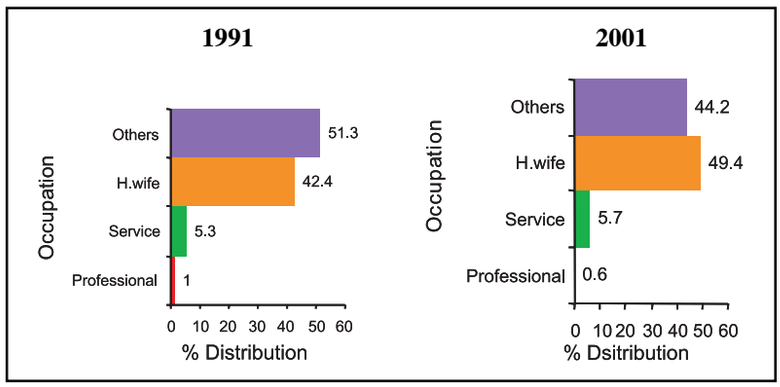
Figure 1 shows the cancer mortality rates for men and women according to class in the years 1991 and 2001. Class 1 represented professionals like doctors, lawyers, and businessmen, whereas Class 2 represented white collar jobs, Class 3 included unskilled workers, whereas Class 4 included groups of people where no information was available. There was a clear gradient in overall cancer mortality in both 1991 and 2001. The lowest mortality rates were seen in Class 1. The highest mortality rates were seen in Class 3 & Class 4.[2]

Figure 1: Cancer Mortality by Class/Professional Status, in Greater Mumbai

MALES



FEMALES



The percentage distribution of cancer cases for cancer of the breast, cervix and mouth by educational level amongst the Greater Mumbai female population for the period 1991 and 2001 is presented in Figure 2 and Figure 3 respectively. The educational levels have been categorized in four groups i.e. Illiterates (no schooling at all), Primary (up to 6 yrs of schooling), Secondary (up to 7-10 yrs of schooling), and College (11-15 yrs of schooling).In 1991 there was no significant difference in breast cancer incidence for different educational levels, but in 2001, there was an increasing trend in incidence with increasing educational levels. In contrast, incidence of cervix and mouth cancers was inversely related to educational levels in 1991 as well as in 2001.The higher the educational level ,the lower the incidence.

Figure 2: Percentage Distribution of Cancer Cases for Selected Sites by Educational Level, Females, 1991

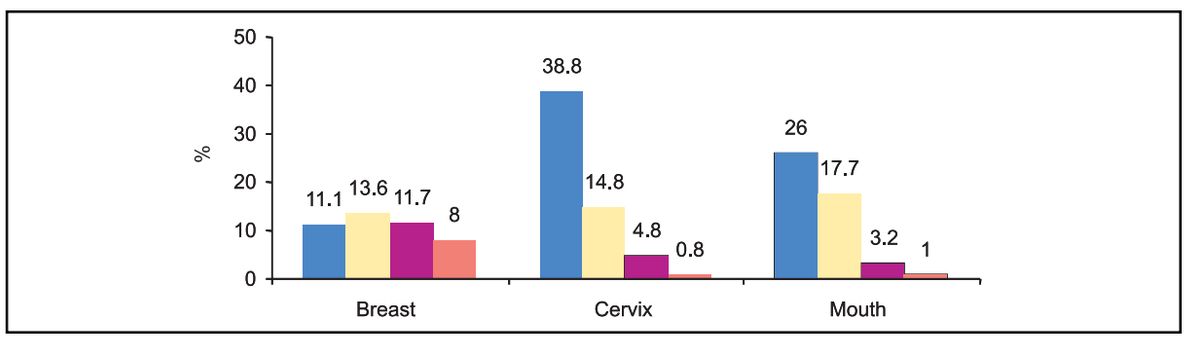
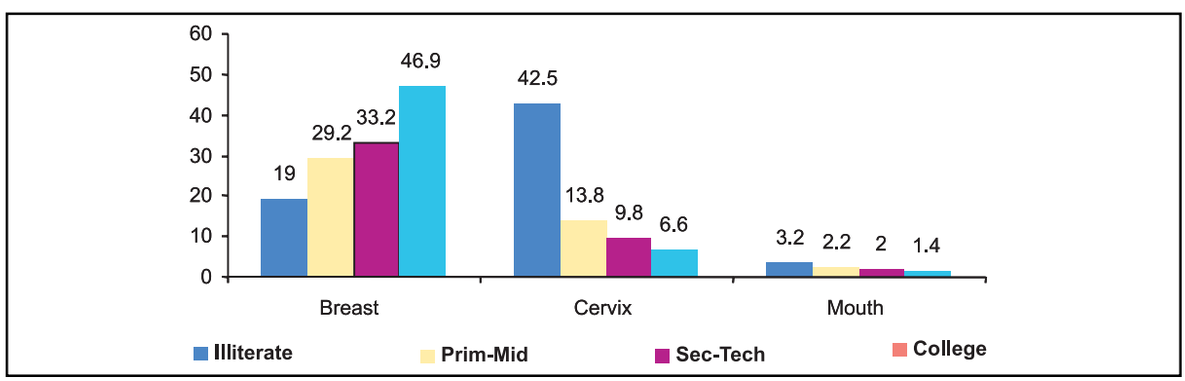


Figure 3: Percentage Distribution of Cancer Cases for Selected Sites by Educational Level, Females 2001



This data sends three key messages

1. There are certain cancers that are more common in lower socio economic classes.
2. The treatment outcome, like survival, is related to the social class, as patients belonging to the higher classes have better survival rates probably due to better access to the healthcare facilities and their ability to complete the treatment
3. The inequality between social classes can increase or decrease over time depending upon the dynamic changes in the society.

The Current Cancer Incidence Patterns in Mumbai, India, and Trends over the Last Twenty Years.

Trends

The information relating to cancer incidence trends, forms the scientific basis for the planning and organization of prevention, diagnosis and treatment of cancer, in a community. The trends may contribute towards a hypotheses generation concerning the etiology and biology of cancer that can be extrapolated and tested in clinical and experimental oncology. A trend however, always represents changes that have occurred within different groups of people, living under divergent conditions.

An attempt has been made to study the trends in age-adjusted incidence rates, for cancers at prominent sites in Greater Mumbai patients for the period 1982 to 2001. A model that fits this data is the logarithm $Y=AB^x$ which represents a linear regression model, where Y is the estimated incidence rate per 100,000 of the population and x is the calendar year minus the initial year (1982) for the current data. 'A' therefore represents the estimated rate of the initial year and (A-1)*100 gives the average annual percentage change in the incidence rate, during the period. In Table 1, the estimates of the average annual percentage change in incidence rates, of various cancers by sex are given for the major sites, during the period 1982 to 2001[3].

Figures 4 to 11 show the results of the model fit, diagrammatically.

For the period 1982 to 2001, there is a decrease of 0.72% per year in males and an increase of 0.37% per year in females (Figure 11). The increase in females is found to be not statistically significant. Increasing trends in incidence (statistically significant), are seen in males for cancers involving the liver, gallbladder, prostate, urinary bladder, kidney, brain, lymphomas and leukemias and in females for cancers involving the gallbladder, breast, uterus, ovary, urinary bladder, kidney, brain, lymphomas and leukemias (Figure 6 & 7). A decreasing trend in incidence (statistically significant), was found for the oropharynx, hypopharynx, oesophagus, stomach, larynx, lung, testis and penis in males and for the oropharynx, hypopharynx, oesophagus, stomach and cervix in females (Figures 4 & 5).

The incidence was found to be more stable for cancers involving the tongue, mouth, colon, rectum and thyroid in males and tongue, mouth, oropharynx, colon, rectum, liver, pancreas, lung and thyroid in females (Figures 7 & 8).

For males, the greatest change in incidence over the eighteen year period was for the penis which decreased by 4.65% per year followed by the gall bladder (an increase of 4.23% per year) and lymphomas (an increase of 3.96% per year). In females, the greatest change in incidence during the same time period was observed for the brain (an increase of 4.60% per year) followed by the gallbladder (an increase of 4.42% per year) followed by lymphomas (an increase of 4.24% per year) (Table 1).

Amongst females, cancers of the breast, cervix and ovary contribute about 50% of the total incidence. A statistically significant increasing trend was observed for breast and ovarian cancers, while a statistically significant decreasing trend, was observed for cancer of the cervix. (Fig.9)

Preventable Cancers

The goal of primary prevention is to avoid the development of cancer by reducing or eliminating exposure to cancer causing factors. These include environmental carcinogens as well as life style factors. In South Asia, the proportion of tobacco related cancers is very high i.e. more than 50% in males and more than 20% in females.

Tobacco-induced death and disease are preventable: Stopping current smoking rates would avoid 20-30 million deaths worldwide before 2025 and 150 million by 2050. Smoking cessation is very effective in reducing the risk of lung cancer in later life. The greatest saving of life would result if rates of smoking

by children and adolescents were decreased. Comprehensive tobacco control, including implementation of regulatory majors and encouraging personal commitments requires coordinated involvement of government, community and nongovernmental organizations, health care professionals and planners. The hazard posed by environmental tobacco smoke is significant. This justifies the demand for a tobacco-free environment, particularly at work and in public places.

The burden of cancer due to infections (hepatitis B & C), helicobacter pylori and human papilloma virus (HPV) has been identified in the range of 15-40% depending upon the socio economic status of the country. These cancers can be prevented by use of vaccines.

The prevention of cancer attributable to occupational environmental exposures is primarily achieved by regulatory action. Relevant measures include the replacement of carcinogens with alternative chemicals or processes, improved ventilation, and re-engineered manufacturing processes. A significant reduction in occupational cancer attributable to implementation of preventive measures has been demonstrated in many instances.

Table 1 : Estimates of average Annual Percentage change in Age adjusted incidence Rate by Site and Sex from Regression Analysis for the 20 Year Period, 1982 to 2001, Greater Mumbai

ICD10	Site		Average Annual Percentage Change (APC)
		MALE	FEMALE
C01-C02	Tongue	-2.42***	-0.78^{ns}
C04-C06	Mouth	+0.36^{ns}	-0.02 ^{ns}
C09-C10	Oropharynx	-2.91***	-1.84^{ns}
C12-C13	Hypopharynx	-3.96***	-3.44**
C15	Oesophagus	-2.83***	-2.67***
C16	Stomach	-2.20***	-2.82***
C18	Colon	+0.86 ^{ns}	+0.68^{ns}
C19-C21	Rectum	-0.57^{ns}	-0.13^{ns}
C22	Liver	+1.76***	+1.26^{ns}
C23-C24	Gallbladder	+4.22***	+3.89***
C25	Pancreas	+1.01^{ns}	+1.65*
C32	Larynx	-1.11*	-2.78**
C33-C34	Lung	-1.63***	+1.21^{ns}
C50	Breast	-	+1.65***
C53	Cervix	-	-1.04**
C54-55	Uterus	-	+2.65***
C56	Ovary	-	+1.73***
C61	Prostate	+1.27*	-
C62	Testis	-1.33*	-
C60	Penis	-4.69***	-
C66-C68	U Bladder	+1.61*	+1.99*
C64-C65	Kidney	+3.40***	+4.02***
C70-C72	Brain	+3.79***	+4.45***
C73	Thyroid	+0.13^{ns}	+0.88^{ns}
C81-C85	Lymphomas	+3.68***	+4.02***
C91-C95	Leukamias	+1.57*	+1.38***
C00-C95	All Site	-0.72^{ns}	0.37^{ns}

ns: not significant * p=0.05 ** p=0.01 *** p=0.001

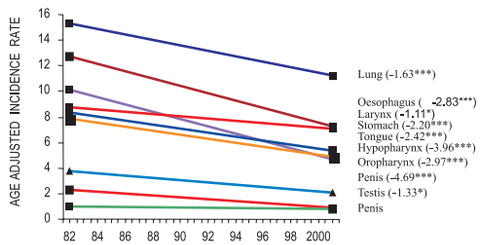


Figure 4

Sites Showing Decreasing Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Male

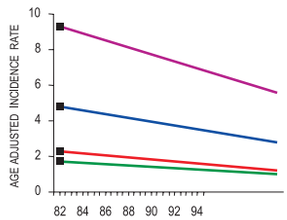


Figure 5

Sites Showing Decreasing Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Female

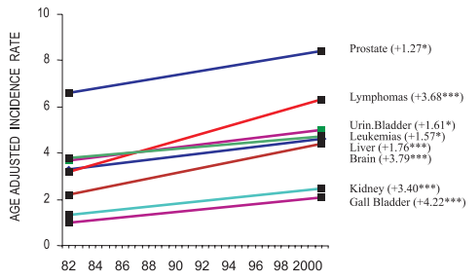


Figure 6

Sites Showing Increasing Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Male

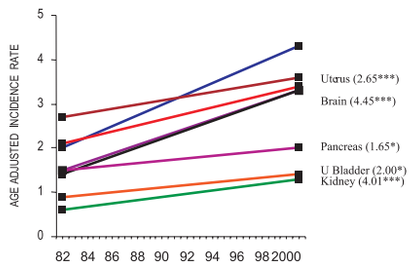


Figure 7

Sites Showing Increasing Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Female

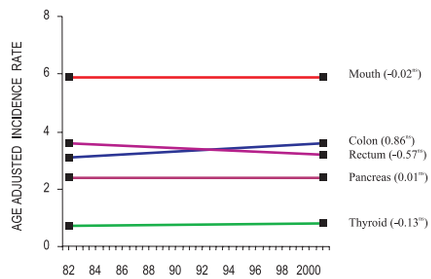


Figure 8

Sites Showing no Significant Changes in Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Male

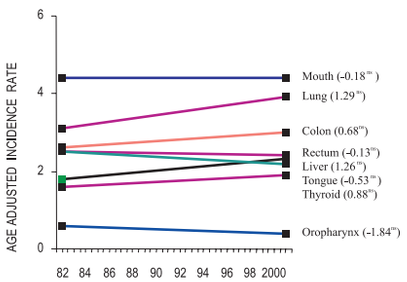


Figure 9

Sites Showing no Significant Changes in Trends in Age-adjusted Incidence Rates with Corresponding APCs, Greater Mumbai, 1982-2001, Female

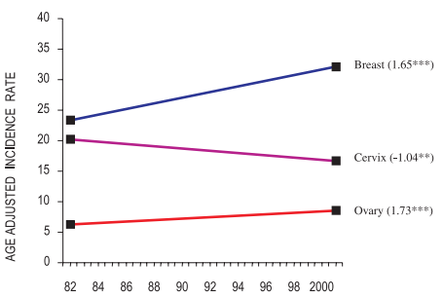


Figure 10

Trends in Age-adjusted Incidence Rates for Breast , Cervix and Ovary with Corresponding APCs, Greater Mumbai, 1982-2001

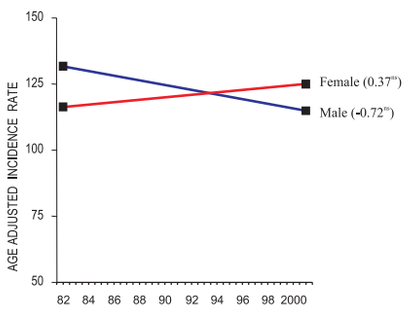


Figure 11

Trends in Age-adjusted Incidence Rates for All Cancers with Corresponding APCs, Greater Mumbai, 1982-2001

Factors Contributing to Social Inequalities-

Lack of empowerment

Empowerment is defined as a multidimensional social process that helps people to gain control over their own lives. Poverty (Table 3) and lack of education (Table 2) together lead to lack of empowerment forming a vicious cycle which leads to delay in diagnosis, inability to access the health care facility, to complete the treatment and to have adequate follow up. (Figure 12)

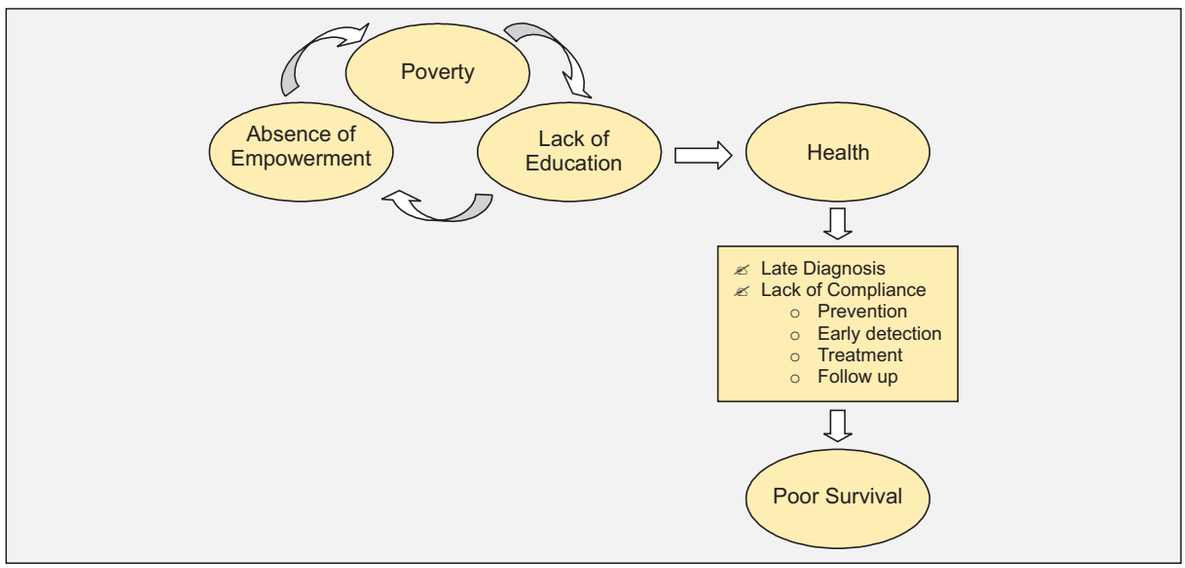


Figure 12 : The Vicious Cycle depicting relationship between Empowerment and Outcome

Table 2 : Literacy Rates (%): 2001-02, South Asia.

Country	Male	Female
Bangladesh	53.9	31.8
India	68.0	44.0
Nepal	65.1	42.5
Pakistan	54.8	32.0
Sri Lanka	94.8	90.0

Source: Government reports of respective countries

Table 3 : Income 2002, South Asia.

Country	Income: 2002	
	Below 1US $ / day	Below 2 US $ / day
India	44.2%	86.2%
Bangladesh	29.1%	77.*%
Pakistan	31.0%	84.7%

Besides Indian studies, there are very few studies from other countries in South Asia, which have studied the link between poverty, education and cancer risk and survival.

Socio-economic Issues

The role of socio-economic status and reproductive factors in breast cancer in India was studied[4]. In this study three parameters educational level, economic or income level, and area of living were considered under socio-economic status. According to existing status in the country the educational levels have been categorized into four groups i.e. Illiterates (no schooling at all), Primary (up to 6 yrs of schooling), Secondary (7-10 yrs of schooling), and College (11-15 yrs of schooling). Income level has been categorized into three levels. Lower Income (below Rs1,500/- p.m.), Middle Income (Rs.1501-4500/- p.m.) and higher Income (Rs.4500/- p.m.). Area of living has been classified into two groups namely Urban and Rural as per census definitions.

The odd ratios of breast cancer by socio economic status as judged by educational level, economic status and area of living are given in Table 4 and shown in Figures 13,14,15. The univariate analysis revealed that the risk of breast cancer increased over fourfold with the increase in educational level, particularly for women with educational levels of secondary and college level compared to that of illiterate women. Similarly, women with a higher income had about three-fold risk of developing breast cancers compared to women with a lower income. Women residing in urban areas were found to be at a two-fold higher risk of breast cancer compared to women residing in rural areas

Table 4: Odd ratios (ORs) and 95% Confidence Intervals (95% CI) of Breast Cancer by Socioeconomic Status (Standard of Living).

Factor	Case	Control	OR	95% CI
Education Level				
Illiterate	153	215	1.00*	-
Primary	57	71	1.24	0.82-1.87
Secondary	119	58	4.09	2.56-6.53
College	31	16	4.15	1.99
Economic Level				
Lower	143	177	1.00*	-
Middle	106	129	1.07	0.76-1.51
Higher	111	54	3.06	1.95-4.82
Area of Living				
Rural	208	250	1.00*	-
Urban	152	110	2.05	1.41-2.99

CI: Confidence Interval * Reference category

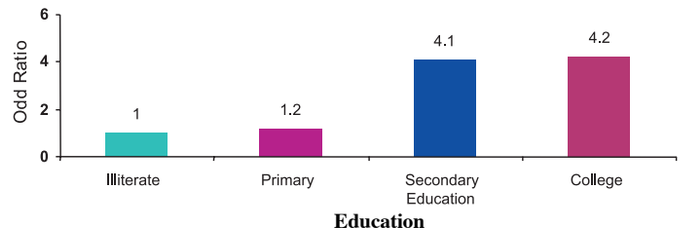


Figure 13: Odd Ratios (Risk) of Breast Cancer by Educational Level

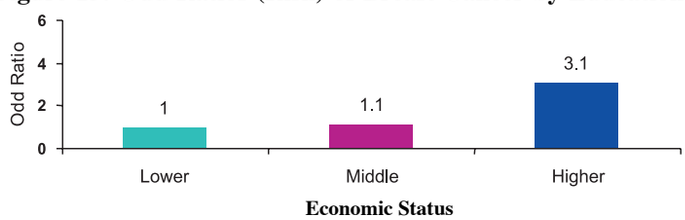


Figure 14: Odd Ratios (Risk) of Breast Cancer by Income Level

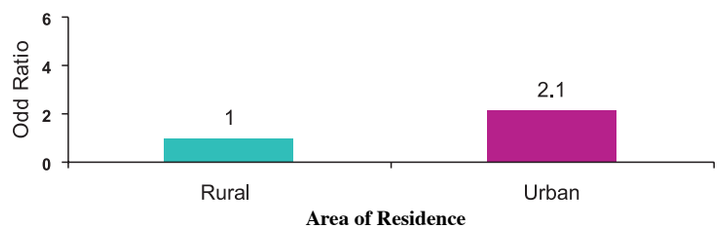


Figure 15: Odd Ratios (Risk) of Breast Cancer by Area

The five-year survival rate for breast cancer was 41.8% for the Mumbai population during 1992-94[5]. Age, education, marital status and extent of the disease emerged as independent predictors of survival in breast cancers. Educated women who attended college had a 40% less risk of death as compared to illiterate women (Figure 16).

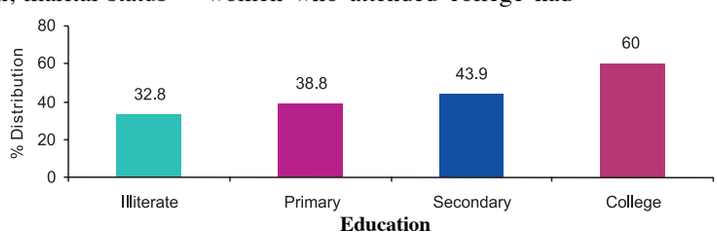


Figure 16 : Survival Proportions of Breast Cancer by Education Level, Greater Mumbai, 1992-94

Similar data was reported from Chennai Metropolitan Tumor Registry[6]. The survival rate at 5 years was 69.5% for women who had more than 12 years of education as compared to 46.8% for the illiterate women. The women who had education less than 12 years had survival rates similar to the illiterate women. In this study the age at diagnosis, clinical extent of the disease, marital status and educational level emerged as prognostic factors for survival. Education status emerged as one of the independent factors for survival in breast cancer in the Bangalore population-based study. [7]

A study from the Allama Iqbal Medical College in Lahore, Pakistan published the correlation between the socio economic status and the outcome of Breast Cancer in ESMO newsletter .[8]

Table 5 : Relationship between Socioeconomic Status and Outcome of Breast Cancer Patients, Pakistan

Status	Breast cancer			
	Diagnosis		Treatment Outcome	
	Early Stage	Late Stage	Adequate Treatment	10 yr Survival
Low Socio economic	50%	50%	44%	22%
High Socio economic	75%	25%	89%	73%

There was no difference in the stages for diagnosis in the low socio-economic group patient, whereas in the high socio-economic group, 75% of breast cancer patients have been diagnosed in the early stage. As far as treatment outcome is concerned 89% of breast cancer patients have received adequate treatment in the high socio-economic group compared to only 44% in the low socio-economic group. Patients belonging to the high socio-economic groups have more than a three times better 10 year survival rate as compared to the patients belonging to the low socio-economic group (Table 5)

The link between oral cancer and low-income levels, poor oral hygiene and habits like the use of alcohol, tobacco and pan has been clearly demonstrated.[9]

Breaking the Barriers of Social Inequalities

The health education and awareness programs can empower the individuals in society to avail of health care system appropriately and there by reduce the mortality. These programs require minimal resources and can educate large populations in a short period of time. Such well-prepared programs can increase awareness of the signs and symptoms of cancer and provide information about benefits of available health care system. These programs empower people to take decisions and approach existing health care systems for treatment and they also increase their compliance for the completion of treatment and encourage adequate follow up. (Figure 17)

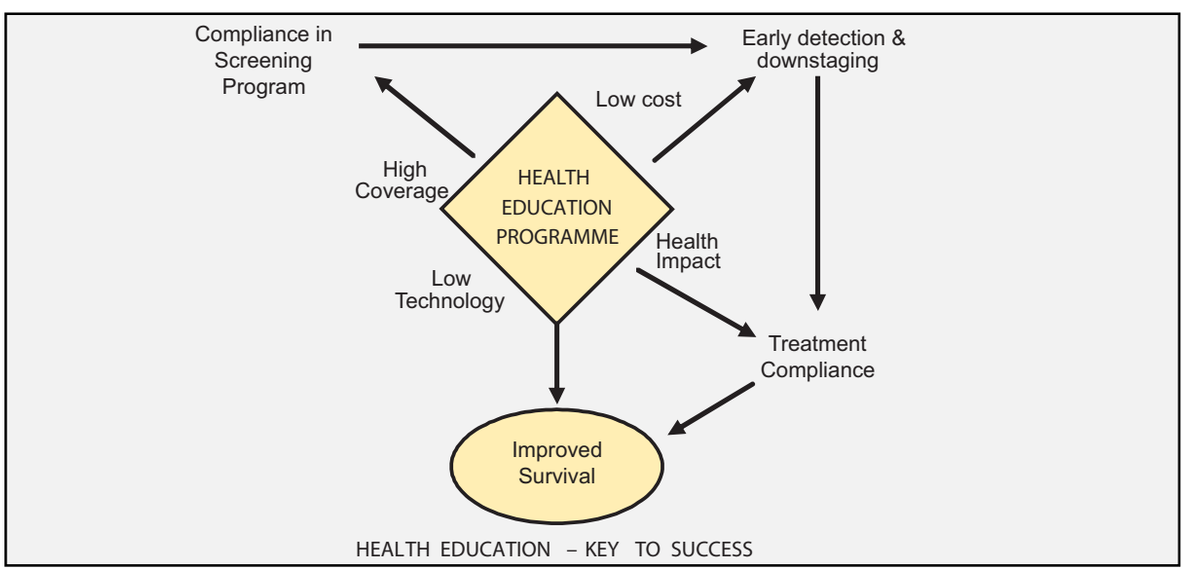


Figure 17 : Health Education Key

The strategy adopted by the Tata Memorial Centre Rural Cancer Project at Barshi in India is to educate the population and motivate people to undergo medical investigations. The women with suspicious lesions were navigated and tracked to a rural cancer centre by referral card. A significant change in down staging of cervical cancer was achieved. 51% patients were diagnosed at stage 1 & 2 in the period 1990-92 as compared to 38% of patients in the period of 1988-89. The shift in down staging and completion of treatment resulted in a significantly higher 5 year survival (33.1%) in the period 1990-92 Vs 24.4% 5 year survivalin the period 1988-89. The health education also improved the compliance with the treatment as 60% patients completed the treatment as compared to 42% in the earlier period.[10] (Refer to Table No.6).

The programmes of prevention and early detection will yield desirable results only if they are integrated with a programmes directed towards elimination of poverty, illiteracy and restoring social equality.

These programmes should be such designed that they reach and engage all irrespective of cultural and ethnic background, and make efficient use of existing human and fiscal resources. A modified and structured approach to effective utilizations of the existing framework is imperative for the elimination of factors which contribute towards social inequalities.

Table 6 – Stage and Distribution of Cancer Cervix by Registration Period, Barshi Registry, India

Stage (FIGO)	1988-89 (%)	1990-92 (%)
I	12 (15.4)	35 (20.7)
II	13 (16.7)	31 (18.3)
III	39 (50.0)	74 (43.8)
IV	3 (3.8)	2 (1.2)
Unknown	11 (14.1)	27 (16.0)

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A

One of the first objectives in understanding disease and its control is to know its burden, and who is affected and where. Measuring accurate estimates of the burden of any disease in a developing country is challenging. There are several reasons for this. Some of them have to do with the documentation of medical records and discharge summaries, methods of referral and follow-up and the system of registration and certification of cause of death. Specific disease registers are perhaps the answer.

The Indian Council of Medical Research (ICMR) initiated a network of cancer registries across the country under the National Cancer Registry Programme (NCRP) in December 1981. The programme was commenced with the objectives of generating reliable data on the magnitude and patterns of cancer; to undertake epidemiological research; provide a basis for developing appropriate strategies to aid National Cancer Control Programmes and develop human resource in cancer registration and epidemiology. Since their commencement, the registries have accumulated a wealth of data, several research studies undertaken and scientific publications made in international journals. Since 1981 newer registries (especially population based (PBCR)) have been added into the NCRP network and some more PBCRS have commenced under the auspices of other agencies. Attempts are being made by ICMR to include all of the PBCRs under one umbrella.

Of the other countries in the region that comprise Pakistan, Sri Lanka, Nepal, Bhutan and Bangladesh, the PBCR that has been included in the recent publication of Cancer Incidence in Five Continents is the one in Karachi, Pakistan. Data for Bhutan and Maldives, which are also part of South Asia, was not available.

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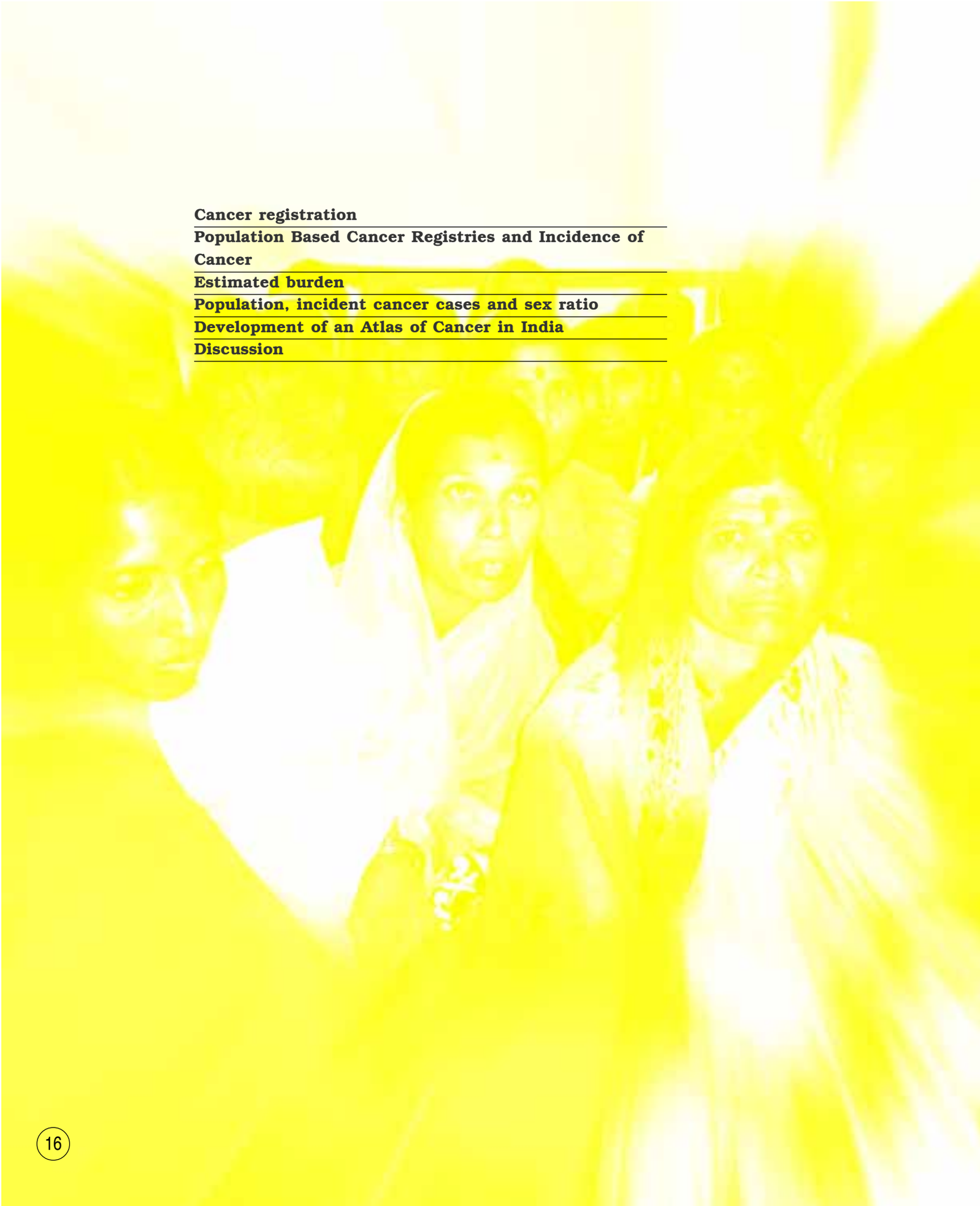

Burden of cancer

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Cancer registration

Cancer registration involves a process of systematic, continuous collection of core information on cancer cases occurring in a particular geographic area or an institution. Cancer registries collect and classify information on cancer so as to provide reliable data to study the magnitude and pattern of cancer.

Cancer registration is a means to a purpose and not a purpose in itself. It is the forerunner of studies in descriptive epidemiology of cancer, which in turn generate specific scientific hypotheses. Studying the magnitude and patterns of cancer would be the first step in determining clues to the cause of cancer and having a baseline to plan and assess control measures. Epidemiologic studies based on these help in knowing what is happening and what can be done about it. Cancer registries provide the needed information to undertake such investigations.[1]

The quinquennial publications on cancer incidence by the International Agency for Research on Cancer (IARC), the series of eight volumes of "Cancer incidence in five continents", till date, have remained a single reliable source of information on cancer incidence of assured quality globally.[2]

The earliest data among these countries to be published in these volumes from the population based cancer registry (PBCR) has been from Mumbai (formerly Bombay), India, in 1965 and that from South Karachi, Pakistan in 1998.[3,4] For the other south Asian countries, reliance has to be placed on the data on cancer frequency from the major hospital cancer registries or special studies or simply the incidence rate prevailing in the neighbouring countries/area. This article aims to provide the cancer scenario in south Asian countries.

It has been estimated that there would be 10 million new cases, 6.2 million deaths and 22.4 million prevalent cases of cancer in the world in the year 2000. Of these, 5.4 million new cases (53.5%), 3.6 million deaths (57.4%) and 10 million prevalent cases (44.6%) of cancer were expected to be from the less developed countries.[5,6]

Currently, coding for topography and morphology is done using International Classification of Disease for Oncology (ICD-O),[7] and reporting of results using ICD-10.[8] Only invasive cancers are reported.

Cancer is not as yet a notified disease in any of the South Asian countries under reference. Hence, cancer registration in these countries is active in that trained staff of registries periodically visit medical institutions and pathology

laboratories where a diagnosis of cancer is made and collect the required core information. Registry staff also visit the corporation death units to collect information on cases where cancer is mentioned on the death certificate.

In order to ensure the complete coverage of cancer cases in these areas staff of registries visit hospitals on routine basis and scrutinise the records in various departments that include pathology, radiology, radiotherapy, in-patient wards and out-patient clinics to elicit the desired information on reported cancer cases. The hospitals include the main cancer hospitals, other general hospitals in both the government and private sector. Besides pathology laboratories that routinely report cancer cases are also visited. Death certificates are also scrutinised from the municipal corporation units. Every attempt is made by registries to register all cancer patients in the registration area who are resident (at least one year) in the area in all hospitals and copy all death certificates in which cancer is mentioned.

Population Based Cancer Registries and Incidence of Cancer

Population based cancer registries (PBCRs) provide incidence rates of cancer in a defined population or community. Cancer incidence rate is generally expressed as age adjusted or age standardized (according to world standard population) incidence rate per 100,000 persons. In providing incidence rates and patterns of cancer the PBCRs present a base for studies in cancer aetiology and control. Though the geographic area and the population covered by the registries is small, compared to the vastness of the country and its huge population, the data does give a fair idea of the cancer problem in the country.

The estimates of cancer incidence rates and summary data on cancer incidence individually for these countries as well as together are computed using the worldwide available data on incidence, mortality, survival and relative frequency.[5] In this, the estimates of cancer incidence for India are derived from the data on different population based cancer registries established to cover representative parts of the country under the National Cancer Registry Programme spanning more than two decades.[9] Currently, there are 21 PBCRs in India with 13 of them being in the network of the NCRP and nine outside the network. The estimate for Pakistan is based on the incidence rates observed in the Karachi region.[4] The estimates for Bangladesh and Sri Lanka are based on inputs from local agencies responsible for cancer control in those countries and standard statistical norms. The estimate of the average annual crude incidence rate (CIR) for the South Asian countries together is computed by averaging the CIRs of individual countries.

Estimated burden: Population, incident cancer cases and sex ratio

The descriptive statistics on the population at risk and incident cancer cases in the South Asian countries are given in Table 1.

Table 1: Sex Ratio Among the Population and Incident Cancer Cases - South Asia, Year 2000

Countries	Population(in millions)		Sex ratio	Cancer cases		
	Male	Female		Male	Female	Sex ratio
India	523.2	490.5	1:0.938	3,86,854	4,26,741	1:1.103
Pakistan	80.7	75.8	1:0.939	61,624	75,095	1:1.219
Bangladesh	66.1	63.0	1:0.953	39,984	44,090	1:1.103
Sri Lanka	9.3	9.5	1:1.022	8,365	9,777	1:1.169
South Asia	**679.3**	**638.8**	**1:0.940**	**4,96,827**	**5,55,703**	**1:1.120**

The composition of the population at risk that gives rise to the cancer than one billion people, 50 times more than Sri Lanka. A male preponderance is forthcoming in Bangladesh, India and Pakistan while it is reversed in Sri Lanka. Some variation is also observed in the age distribution of the population between these countries. The highest proportion of geriatric subjects (>=65 years of age) is forthcoming in Sri Lanka (6.7%) followed by India (5%). The least proportion is observed in Pakistan and Bangladesh (3.2%). On the contrary, the youngest population cases is of paramount importance in understanding the cancer pattern(<=14 years of age) is more prevalent in Pakistan (42%) followed by Bangladesh (35%), India (33%) and Sri Lanka (26%).

The burden of incident cancer cases in the whole of South Asia by the year 2000 is estimated to be more than a million with the male-female ratio of 1:1.120. Unlike in population, a uniform female preponderance in incident cancer cases is observed in all the countries.

Burden of Cancer In India

prevailing in the region. India tops in the population figures with more The data of the registries that has accrued over the years is essentially that of selected urban centers and only one rural registry that covers part of a district. Therefore it would be difficult to provide valid estimates of the burden of cancer of the entire country with over 70% of the population of India residing in the rural areas. Nonetheless, scientists in the NCRP have carried out, limited exercises, and these figures vary from 700-900,000 new cancer cases in India every year.[10]

Table 2: Average Annual Cancer Incidence Rates - South Asia, Year 2000

Countries	Cancer incidence rates					
	Male (M)		Female (F)		M+F	
	CIR	ASR	CIR	ASR	CIR	ASR
India	73.9	99.0	87.0	104.4	80.5	101.7
Pakistan	76.3	129.6	99.1	154.3	87.7	141.9
Bangladesh	60.5	99.0	70.0	104.4	65.3	101.7
Sri Lanka	89.8	99.0	102.8	104.4	96.3	101.7
South Asia	**75.1**	**106.7**	**89.7**	**116.9**	**82.5**	**111.8**

CIR: Crude incidence rate per 100,000; ASR: Age standardized rate per 100,000

Cancer incidence by gender

The average annual incidence rates for all cancers together (ICD-10:C00-C96) in each of the South Asian countries as well as together is given in Table 2. The CIR of all cancers among both sexes when all South Asian countries are taken together is 82.5 per 100,000 with a corresponding ASR of 111.8 per 100,000. In terms of CIR, which is the direct measure of the burden of cancer in a region, the rank order of countries in the descending order of occurrence of cancer is Sri Lanka, Pakistan, India and Bangladesh, among both sexes. However, the highest ASR is observed in Pakistan among both sexes while the ASRs of others were identical. The range of ASR was 99 to 130 per 100,000 among males and 104 to 154 per 100,000 among females.

Cancer patterns among males

The ASRs of top ten cancers among males in different countries in south Asia are given in Table 3. Two striking patterns seem to emerge. India and Sri Lanka have cancers of the oral cavity as the commonest but with a wide difference in the incidence rates. It is 2-3 times higher in Sri Lanka compared to all other countries. It is the cancer of the lung that is the commonest in Bangladesh and Pakistan with not much of a difference in the incidence rates between themselves but double the times higher than India and ten times more than Sri Lanka. The other common cancers ranked at the top in India and Sri Lanka are pharynx, oesophagus and larynx. Lung does not emerge within the top five in Sri Lanka while leukemia is ranked ninth in India and fourth in Sri Lanka. Oral cavity and larynx are interchangeably placed in the rank order of cancers for the second and third places in Bangladesh and Pakistan respectively.

Table 3: Top Ten Cancers in South Asia, Males, Year 2000

India		Pakistan		Bangladesh		Sri Lanka	
Site	ASR	Site	ASR	Site	ASR	Site	ASR
Oral cavity*	12.8	Lung	20.1	Lung	22.4	Oral cavity*	36.1
Other Pharynx@	9.6	Oral cavity*	14.7	Larynx	15.4	Oesophagus	8.2
Lung	9.0	Larynx	8.5	Oral cavity*	13.4	Other Pharynx@	6.1
Oesophagus	7.6	Bladder	8.8	Other Pharynx@	12.5	Leukemia	5.5
Larynx	6.2	NHL	5.1	Oesophagus	6.9	Larynx	4.5
Stomach	5.7	Other Pharynx@	6.7	NHL	2.8	Lung	1.9
Colon/Rectum	4.7	Oesophagus	6.3	Stomach	1.6	Bladder	1.9
Prostate	4.6	Colon/Rectum	5.0	Testis	0.9	Colon/Rectum	1.8
Leukemia	3.1	Liver	5.6	Liver	1.3	Thyroid	1.3
NHL	3.2	Leukemia	3.4	Leukemia	0.9	Stomach	1.2

* - includes Lip, Tongue, Salivary gland, Gum, Floor of mouth and other parts of the mouth
@ - includes Oropharynx and Hypopharynx
ASR: Age standardized rate per 100,000

Cancer pattern among females

The ASRs of top ten cancers among females in different countries in South Asia are given in Table 4. Two distinct patterns of common cancers are observed. Cancer of the cervix is the commonest among all the countries excepting Pakistan in South Asia wherein breast is the leading site of cancer. While there is not much of a difference in the incidence of cervix cancer in Bangladesh, India and Sri Lanka, it is 3-4 times lower in Pakistan. The incidence of breast cancer in Pakistan is more than two times than that observed in the rest. Cancer of the oral cavity is the third most common cancer in Bangladesh, India and Sri Lanka and is ranked second in Pakistan. Ovary and oesophagus figure in the top six cancers in all the countries.

Table 4: Top Ten Cancers in South Asia, Females, Year 2000

India		Pakistan		Bangladesh		Sri Lanka	
Site	ASR	Site	ASR	Site	ASR	Site	ASR
Cervix	30.7	Breast	50.1	Cervix	27.6	Cervix	28.8
Breast	19.1	Oral cavity*	14.7	Breast	16.6	Breast	19.3
Oral cavity*	7.5	Ovary	9.8	Oral cavity*	16.8	Oral cavity*	12.0
Ovary	4.9	Cervix	6.5	Oesophagus	5.7	Oesophagus	11.5
Oesophagus	5.1	Oesophagus	6.3	OtherPharynx@	4.8	Ovary	5.1
Colon/Rectum	3.2	Corpus uteri	5.8	Ovary	3.4	Leukemia	3.4
Stomach	2.8	Leukemia	3.8	Lung	3.5	Other Pharynx@	2.5
Leukemia	2.1	Colon/Rectum	5.1	Larynx	3.3	Thyroid	2.4
Thyroid	1.9	Thyroid	3.9	Thyroid	2.0	Colon/Rectum	1.9
Lung	1.9	NHL	3.5	NHL	1.3	Lung	1.1

* - includes Lip, Tongue, Salivary gland, Gum, Floor of mouth and other parts of the mouth
@ - includes Oropharynx and Hypopharynx
ASR: Age standardized rate per 100,000

Development of an Atlas of Cancer in India[11]

The cancer registries have provided an idea of the magnitude and pattern of cancer in selected urban centres and in a couple of rural pockets. Geographic differences in patterns of cancer have already been observed among the different registries. However, large areas of the population, particularly the rural areas remain largely uncovered and therefore the patterns of cancer in several urban centres and rural areas remain largely unknown.

Therefore, under this project, on 'Development of an Atlas of Cancer in India' a cost-effective design and plan using advances in modern electronic information technology, was conceived, to collate and process relevant data on cancer so as to fulfill the objectives of obtaining an overview of patterns of cancer in different parts of the country; and, calculating estimates of cancer incidence wherever feasible.

The data of the NCRP shows that 80-85% of registered cases of cancer have microscopy as the basis of diagnosis. Making a microscopic diagnosis of cancer is the domain of the pathologist. Accordingly, the basic principle of working was to have the department of pathology (in medical colleges and hospitals) as the focal point of capture of information on cancer cases.

Data collection took place mainly via the Internet through the web-site canceratlasindia.org. Internet as a device for data collection on disease related information was a unique concept being tried for the first time. Collaborating centers were given an individual login-ID and password. Care was taken to code/encrypt the data. This ensured confidentiality of patient information and security of data

transmitted. The data that was periodically downloaded at the Coordinating Unit of the NCRP at Bangalore was scrutinized and checked so as to meet international standards.

Collaboration in the project was voluntary and depended on the feasibility of a given center to provide the essential identifying and diagnostic information and the keenness of the concerned staff. Intense training workshops and visits to several centers were the key to the success of the project. A total of 105 collaborating centers provided information on 217,174 microscopically diagnosed cancers during the two-year period January 2001 to December 2002.

Cancer incidence rate refers to the number of new cases of cancer seen in the population of a defined geographic area over a definite period of time. Usually the rate is calculated per 100,000 population by sex. In this study, the district was taken as a unit for calculation of incidence rates. All cases were microscopically confirmed and all institutions in the district were not covered. Consequently the incidence rates provided are the minimum. Such incidence rates by sex and site were calculated for each of the 593 districts in the country and compared with those from established population based cancer registries (PBCRs).

There were 82 districts that had incidence rates for 'all cancer sites' above that (36.2/100,000 in males) at the rural PBCR of Barshi. The results confirmed some known features of the patterns of cancer in our country and brought to light several new ones. Many districts (with Aizawl leading) in Mizoram state in both males and females had incidence rates of cancer (for all sites) far greater than that reported to-date anywhere else in India. Some of the anatomical sites of cancer responsible for the high incidence of cancer in this state are tongue, hypopharynx, oesophagus, stomach and lung.

The incidence rates of cancer of the tongue (in males) were particularly high in districts in Gujarat state. Wardha district in Maharashtra state recorded the highest incidence of cancer of the mouth in males. Besides Mizoram, many districts in Assam had a high incidence of mouth cancer. Cancer of the oesophagus (in males) was high in districts in Mizoram, Assam and Karnataka. Several districts in the North Eastern states of Mizoram, Nagaland, Manipur and Sikkim had incidence rates of stomach cancer (in males) equivalent to that of high incidence regions of the world. Aizawl women had almost ten times that in Mumbai. Imphal West and East in Mizoram state and South Goa had much higher incidence rates of lung cancer (in females) than that seen in Mumbai.

The north-eastern districts of Tamil Nadu state showed the highest incidence of cervix cancer in women and penile cancer in men. Such a coincidence of high incidence of these two cancers has been reported and appears logical with the common risk factor – human papilloma virus (HPV). These districts have also reported a high prevalence of human immunodeficiency virus (HIV). There appears to be a belt of high incidence of thyroid cancer from the southern tip of the country (Kanyakumari) in Tamil Nadu state along the coast of the states of Kerala and Karnataka extending on to South Goa.

Very high incidence rates of nasopharynx cancer were found in the northeastern states (Nagaland, Manipur). The area of high risk for gallbladder cancer seems larger than previously suspected, involving a wide band of northern India.

The results presented throw a whole new set of cancer incidence and patterns, demonstrating the immense potential of the system and the numerous possibilities for cancer research and control. It has identified hot spots of high incidence, recognized belts of geographic areas with specific types of cancer and discerned likely zones for establishing PBCRs. The study was remarkably cost-effective (Rs 24 per case). The concept of using web-based design and approach with on-line transmission of cancer data has worked – a major advance for using Information Technology in Medicine – Measuring Disease Burden and Medical/Health Informatics. Developments in Information Technology (IT) should be quickly harnessed and a timely start made in this new field.

There is a need for special efforts to create and develop through this IT model, a system of specific disease registers – whether for research, administration or disease control. The methodology could pave the way for broad usage and opening the field of health informatics in the setting of a developing country.

Discussion

Statistics on the risk of developing cancer remains as the fundamental elements in research into causation. Descriptive statistics on cancer occurrence are traditionally used to formulate hypotheses, which might explain the observed differences (geographically, over time, in population subgroups) and which can be tested by further study. Such statistics are also essential components in the planning and evaluation of cancer control programmes.

Notwithstanding the distinct variation in the age structure of the population in the individual countries in South Asian region, the levels of cancer registration prevailing in these countries are even more perturbing. No national level PBCR is existent in any of the countries. India, among the South Asian countries, has the longest history of having laid a solid basis for rational reporting of cancer occurrence based on population based cancer registration in 1981. Under the auspices of the Indian Council of Medical Research (ICMR) there is a national level programme known as the National Cancer Registry Programme (NCRP) with a Coordinating Centre at Bangalore. In Pakistan, apart from the sporadic reports based on institutional cancer registries, the first ever PBCR was established in South Karachi, in 1995.[12] Subsequently, the Aga Khan University Cancer Surveillance for Pakistan (ACSP) was established in 2000 to cover a large geographical area and population of Pakistan, through 64 centers.[13] In Sri Lanka, the first official cancer registry/survey based on hospital case series was undertaken in 1990. But a full fledged PBCR has not come into reckoning until now. In the case of Bangladesh, all estimates of cancer occurrence have relied on frequencies from hospital statistics. It is general understanding that cancer pattern observed in hospital cancer registries can obscure the reality prevailing in that area. In this scenario of cancer registration, with varying problems of completeness there are limitations in the observed cancer incidence pattern and therefore have to be interpreted with caution.

Descriptive statistics of the crude incidence rate of all cancers together leaves Sri Lanka at the top among the different South Asian countries in both sexes. However, with the demographic transition in operation in all the developing country populations, the Age Standardized Rate (ASR) is the best measure to compare different populations as it seems to approximate the scenario that is expected to prevail should the population structure resemble that of the world standard population. Given the younger population than in the standard one, it can be observed that the ASR is higher than the CIR in all the south Asian countries unlike in more developed regions wherein it is the reverse. The difference between the ASR and CIR is the maximum for Pakistan which has the youngest population of the lot and minimal for Sri Lanka which has the oldest population among other south Asian countries.

Some similarities in cancer pattern between individual countries in south Asia are observed. Cancer of the oral cavity with buccal mucosa predominates as the most common cancer in India and Sri Lanka in men and within the top three cancers among both sexes in other countries. This reiterates the abuse of smokeless tobacco apart from smoking in all these countries. The variation in the incidence of cervix and breast cancers by religious groups is well documented. This is reflected in the cancer pattern in females in Pakistan wherein breast cancer is most common but not in Bangladesh wherein cervix is the leading cancer site, both countries with a predominantly Muslim population. There are reports linking such high incidence of cervix cancer in Muslim countries to a correspondingly high incidence of penile cancer in these countries.[14,15] In India, though cervix is still the leading cancer site on the whole and having a decreasing incidence in most registries, the transition of breast emerging ahead of cervix as the

leading cancer site has already happened in most urban areas of the country in the middle of 1990s.[16]

It may be pertinent to comment on cancer patterns in other regions of South Asia where there are no PBCRs. The important cancers that come within this ambit are those of oesophagus and stomach. Studies from Kashmir[17] report, stomach cancer as the top ranking one among males and females. Oesophagus cancer is the commonest malignancy among both sexes in the Baluchistan plateau of Pakistan[18] forming part of the oesophageal belt.

All these are pointers to augment the cancer registration activities in South Asian countries like India and Pakistan where they are already in operation to widen the coverage to accommodate areas that can depict the subtle geographic variations within a country. The agencies responsible for cancer surveillance in Bangladesh and Sri Lanka have to be urged to embark on population based cancer registration activity covering a mixture of urban and rural areas wherever feasible. That will enable one to derive valid estimates of cancer burden and pattern in these countries.

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