The Global Burden of Cancer

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Estimated Global Cancer Burden
(Numbers of new cases of cancer per annum)
Projected increase in incident cancers to 2030 on the basis of:
(blue) stable age-specific rates, that is, population growth only;
(red) 1% per year increase in incidence rates. Source: WHO
Cancer incidence, rates per 100,000 ages 0-64, world regions: all cancers excl non-mel skin. Globocan.
Cancer incidence, cumulative risk to age 64, world regions: all cancers excl non-mel skin. Globocan.
Cancer mortality, cumulative risk to age 64, world regions: all cancers excl non-mel skin. Globocan.
Mortality

All cancers excluding non-melanoma skin cancer, Male

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GLOBOCAN 2008 (IARC) - 19.7.2012
Cancer death rates to age 60; Australia and WHO LDC

- Liver
- Cervix uteri
- Stomach
- Oesophagus
- Non-Hodgkin lymphoma
- Pancreas
- Melanoma of skin
- Leukaemia
- Ovary
- Brain, nervous system
- Colorectum
- Lung
- Breast
Africa: Hep B 66%, Hep C 42%, both 13%

Aflatoxin B1 (GC-TA transversion in p53 gene)

Iron overload. Smoking, alcohol, oral contraceptives
The Gambia: prevalence of Hep B infection, and chronic carrier state, in 675 vaccinated children and in 823 unvaccinated children, at age 9 years:

From Viviani et al., Vaccine 17: 2946, 1999
Taiwan: incidence of liver cancer in 6-9 yr old children, in birth groups born in 1974-84, before vaccination (82 cases in 15 million, 5.2 per million) and in 1984 to 86, after vaccination introduced (3 cases in 2.2 million, 1.3 per million).

From: Chang et al., NEJM 336: 1855, 2012
Reduction in exposure to carcinogenic aflatoxins by postharvest intervention measures in west Africa: a community-based intervention study

P C Turner, A Sylla, Y Y Gong, M S Diallo, A E Sutcliffe, A J Hall, C P Wild

Lancet 365: 1950, 2005

Subsistence farms in the lower Kindia region of Guinea.

Farms from 20 villages were included, ten of which implemented a package of postharvest measures to restrict aflatoxin contamination of the groundnut crop; ten controls followed usual postharvest practices.

We measured the concentrations of blood aflatoxin–albumin adducts from 600 people immediately after harvest and at 3 months and 5 months postharvest to monitor the effectiveness of the intervention.

Panel: Intervention measures

Hand sorting
Farmers were shown how to identify groundnuts that were visibly mouldy or had damaged shells. Damaged kernels were removed and discarded before storage.

Drying on mats
Groundnuts are commonly spread on the ground for sun drying, making them susceptible to humidity and difficult to gather in the event of unexpected rain. Therefore, locally produced natural-fibre mats for the sun-drying process were provided.

Sun drying
Incomplete sun drying leaves residual humidity in the groundnuts during storage. Farmers were shown how to judge the completeness of sun drying by shaking the kernels to listen for the free movement of the dried nuts.

Storage in natural-fibre bags
Farmers most frequently use plastic or other synthetic bags for storage, which promote humidity. We therefore provided natural-fibre jute bags.

Wooden pallets
In the storage facilities, bags of groundnuts are often stored on the floor or on stones leading to the risk of humidity from the earthen floors. We provided locally made wooden pallets on which to store the bags.

Insecticide
One of the main factors affecting aflatoxin formation is the presence of insects in storage facilities and bags, which produce humidity via metabolic activity and spread fungal spores. We gave about 10 kg of a locally available insecticide (acetelate) to every family to be sprinkled in small quantities on the floor of the storage facility under the wooden pallets at the start of storage and intermittently afterwards.
Reduction in exposure to carcinogenic aflatoxins by postharvest intervention measures in west Africa: a community-based intervention study

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*Lancet* 365: 1950, 2005

Geometric mean and 95% CI of adducts in blood samples from the intervention and control groups at the three main surveys

**Interpretation:** Use of low-technology approaches at the subsistence-farm level in sub-Saharan Africa could substantially reduce the disease burden caused by aflatoxin exposure.
Estimated age-standardised mortality rate per 100,000
Cervix uteri, all ages
Fig. 1. Positive visual inspection with acetic acid test.
Randomised trial of visual cervical screening (VIA) in India:
114 communities randomised; age 30-59;
31,343 screened, 30,958 controls; 7 yrs follow up.


Reduction in incidence: 25% (95% CI 5 to 41%)
Reduction in mortality: 35% (11 to 53%)
Countries with high incidence and mortality from oral cancer.

From Warnakulasuriya, Oral Oncology 45: 309, 2009
Risk factors – oral and pharyngeal cancers

- Smoking – cigarettes, cigars, pipes, bidi, reverse smoking; marijuana?, passive smoking
- Chewing – tobacco, snuff, betel / pan (areca nut + tobacco + etc), khaini, toombak, nass, narwar
- Alcohol
- Low fruit / veg intake
- Mouthwash? Poor oral hygiene, dentition?
- Fanconi anaemia, psoriasis
- Human Papilloma Virus HPV
Effect of screening on oral cancer mortality in Kerala, India: a cluster-randomised controlled trial

Rengaswamy Sankaranarayanan, Kunnambath Ramadas, Gigi Thomas, Richard Muwonge, Somanathan Thara, Babu Mathew, Balakrishnan Rajan, for the Trivandrum Oral Cancer Screening Study Group

Summary
Background Oral cancer is common in men from developing countries, and is increased by tobacco and alcohol use. We aimed to assess the effect of visual screening on oral cancer mortality in a cluster-randomised controlled trial in 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 to a control group during 1996–2004, in Trivandrum district, Kerala, India.
<table>
<thead>
<tr>
<th></th>
<th>Screen</th>
<th>Control</th>
<th>% reduction; 95% limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco or alcohol users (47%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>incidence per 100,000</td>
<td>81</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>mortality per 100,000</td>
<td>30</td>
<td>45</td>
<td>34 (5 to 55)</td>
</tr>
<tr>
<td>no of deaths</td>
<td>70</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Whole population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>incidence per 100,000</td>
<td>43</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>mortality per 100,000</td>
<td>16</td>
<td>21</td>
<td>21 (-22 to 49)</td>
</tr>
<tr>
<td>no of deaths</td>
<td>70</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>
Kerala trial: Stage distribution of randomised screening and control groups

![Bar chart showing stage distribution for screened and control groups.]

Legend:
- Stage 1
- Stage 2
- Stage 3
- Stage 4

Stepping forward

BC GUIDELINES 2008
- Step-by-step process of oral cancer detection
- Referral pathways
- Published in JCDA for international dissemination

M William, M Elwood, G Hislop, C MacAulay, C Poh, L Zhang, M Moores, D Laronde, H MacKay, P Lobb, M Rosin
This simple handheld device uses a blue/violet light (400-460 nm) to illuminate oral tissue. A selective filter in the eyepiece allows the viewer to directly visualize the pale green autofluorescence that is given off by normal tissue. Abnormal or suspicious tissue shows decreased levels of normal autofluorescence and appears as a dark brown to black region in comparison with the brighter, green surrounding healthy tissue.
Fluorescent Visualization (FV)

This simple handheld device uses a blue/violet light (400-460 nm) to illuminate oral tissue. A selective filter in the eyepiece allows the viewer to directly visualize the pale green autofluorescence that is given off by normal tissue. Abnormal or suspicious tissue shows decreased levels of normal autofluorescence and appears as a dark brown to black region in comparison with the brighter, green surrounding healthy tissue.
FVL associated with high risk histology

192 lesions from 170 patients in Oral Cancer Prediction Longitudinal Study
Pilot Study: FV-guided Margins & Tumor Recurrence

Fluorescence Visualization detects high-risk, clinically not apparent field alterations

White light  Fluorescence Visualization (FV)

NIH Longitudinal study – Reduction of disease recurrence from 25% to 5% when use FV-guided surgery

Sept 2010: Launch of Phase III pan-Canadian clinical trial (funded by Terry Fox Research Institute)

Clin Can Res, 12(22), 6716-22, 2006

Pan-Canadian Network for Oral Cancer Control  A Terry Fox Research Model
COOLS (Canadian Optically-Guided Approach for Oral Lesions) Surgical Trial

Phase 3
400 Patient Randomized Trial

Vancouver
- University of British Columbia
- Vancouver General Hospital
- BC Cancer Agency
- Surrey Memorial Hospital
- University of British Columbia Hospital

Calgary
- University of Calgary Health Sciences Centre

Winnipeg
- University of Manitoba
- Health Sciences Centre

Toronto
- University of Toronto

Montreal
- McGill University
- Montreal General Hospital

London
- Schulich School of Medicine and Dentistry, University of Western Ontario

Ottawa
- University of Ottawa

Halifax
- Dalhousie University Medical School
- Queen Elizabeth II Health Sciences Centre
Approx survival ratio, (1 - Mort / Incid) ages to 64, world regions: all cancers excl non-mel skin. Globocan.
The wide variation in cancer survival between regions emphasises the need for urgent investments in improving awareness, population-based cancer registration, early detection programmes, health-services infrastructure, and human resources.
5-year cancer survival (%) in Kampala, Uganda; Harare, Zimbabwe, and US African-Americans; patients diagnosed between 1993 and 1997

From: Sitas et al., Lancet Oncol 9: 786, 2008
Radiation therapy machines per million population, 2006; some African countries

Data from: Sitas et al., Lancet Oncol 9: 786, 2008
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Cancer incidence lower in developing countries, but cancer mortality similar; in fact, higher to age 60.

Cancers commoner in developing countries: e.g. liver, oesophagus, oral cavity

Cancers also common in developed countries, e.g. breast, colorectal

Avoidable but increasing: e.g. lung cancer

Much lower patient survival

Much lower quality of life: limited palliative care

The challenges
The Global Burden of Cancer

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Estimated age-standardised mortality rate per 100,000
Oesophagus: both sexes, all ages

Iran, Golestan: up to 166 m / 195 f
China, Linxian: 109 both
UK: 8 m, 4 f
## Risk factors for oesophageal cancer

### Table 3 – Strength\(^a\) of evidence for the association between select factors and risk of OSCC in Western countries and in high-risk areas of China and Iran

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Western countries</th>
<th>Linxian, China</th>
<th>Golestan, Iran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco smoking</td>
<td>Strong</td>
<td>Probable</td>
<td>Probable</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>Strong</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Opium consumption</td>
<td>Possible</td>
<td>Possible</td>
<td>Probable</td>
</tr>
<tr>
<td>Hot drinks</td>
<td>Possible</td>
<td>Possible</td>
<td>Probable</td>
</tr>
<tr>
<td>Nutritional deficiencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low fruit and vegetable intake</td>
<td>Strong</td>
<td>Strong</td>
<td>Probable</td>
</tr>
<tr>
<td>Zinc deficiency</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Selenium Deficiency</td>
<td>Possible</td>
<td>Probable</td>
<td>None</td>
</tr>
<tr>
<td>Water supply</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>PAHs</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>N-nitroso compounds</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Silica fibres</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Mycotoxins</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>HPV infection</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Possible</td>
</tr>
<tr>
<td>Oral Hygiene</td>
<td>Possible</td>
<td>Probable</td>
<td>Probable</td>
</tr>
<tr>
<td>Gastric atrophy</td>
<td>Probable</td>
<td>Probable</td>
<td>Probable</td>
</tr>
<tr>
<td>Low socioeconomic status</td>
<td>Strong</td>
<td>Strong</td>
<td>Strong</td>
</tr>
<tr>
<td>Genetic background</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Abbreviations: PAHs, polycyclic aromatic hydrocarbons; HPV, human papillomavirus.

\(^a\) None: present evidence shows no association; Possible: not enough data but there are some indications of an association; Probable: current evidence favours an association; Strong: there is strong evidence for an association; Unclear: large numbers of studies show conflicting results.
Figure 1: Tobacco advertising in Malawi 2002
Caption at top reads “Tobacco may be harmful to your health”, and caption at bottom reads “Your heart is contented”.

From: Sitas et al., Lancet Oncol 9: 786, 2008
Effective legislative action more easily taken before or after high smoking rates: ACT NOW

From: Magrath I, in Elwood and Sutcliffe (Eds) Cancer Control, OUP 2010