

Prevention of cancer through lifestyle change and screening

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Educational aims

- To provide evidence base for prevention
- To describe the lifestyle factors affecting cancer
- To describe effectiveness of screening

Key words

cancer, prevention, lifestyle, screening programmes, effectiveness

Cancer is the leading cause of death worldwide. Evidence shows that about 40% of all cancers are preventable. This article looks at the evidence base for primary prevention measures focusing on lifestyle risk factors of tobacco exposure, overweight and obesity, dietary factors, alcohol and physical activity. Some basic principles of screening and screening programmes are discussed with emphasis on the importance of doing more benefits than harms, at a reasonable cost. We look at the evidence for effectiveness of cancer screening programmes, including randomized controlled trials and touch briefly on the ongoing debates for and against the effectiveness of organized screening programmes. Sufficient evidence exists to demonstrate the effectiveness of screening for breast, colorectal and cervical cancer. Ongoing studies in prostate screening will provide valuable evidence in due course.

Introduction

Cancer is a leading cause of death worldwide and accounted for 7.6 million deaths (around 13% of all deaths) in 2008. The number of global cancer deaths is projected to increase by 45% from 2007 to 2030 (from 7.9 million to 11.5 million deaths), influenced in part by an increasing and aging global population. The estimated rise takes into account expected slight declines in death rates for some cancers in high resource countries. New cases of cancer in the same period are estimated to jump from 11.3 million in 2007 to 15.5 million in 2030.¹

The incidence rate of new cases of cancer in Malta is on the increase however the number of deaths from cancer are on a down going trend (Figure 1) especially for some forms of cancer including breast cancer.² This reflects improvements in early detection and treatment.

A recent study has estimated that the number of cancer-related deaths in EU member states for 2011 will be nearly 1.3 million. Using a new mathematical model, the predictions show that cancer mortality rates should fall around 7% for men and 6% for

women compared with 2007.³ Prostate cancer is the most common cancer in males, followed by lung and colorectal. For women breast cancer is the most common followed by lung and colorectal. Lung cancer is the number one cancer killer for both men and women.

There is much evidence which shows that about 40% of all cancer cases are preventable (Table 1). In fact prevention offers the most cost-effective long-term strategy for the control of cancer. Lifestyle factors continue to be causally related to certain cancers including tobacco use, unhealthy diet, alcohol overuse and inadequate physical activity.⁴

Secondary prevention measures include screening. Screening for cancer involves the application of a simple test in a healthy asymptomatic population to identify early disease. The main objective of cancer screening (and subsequent treatment) is to shift the stage at which disease presents thus extending life and reducing cancer mortality. Other important considerations include the economic cost and the potential effects on quality of life, which may be beneficial or harmful. Screening may induce adverse effects, such as over-diagnosis and over-treatment and generation of undue anxiety. Screen detected cases may include indolent lesions, some of which would not progress even if untreated.^{5,6}

Table 1: Preventable Cancers

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|--|
| 67% of mouth, pharynx and larynx cancers |
| 75% of cancers of the oesophagus |
| 33% of lung cancers |
| 45% of stomach cancers |
| 41% of pancreatic cancer |
| 16% of gallbladder cancer |
| 43% of bowel cancer |
| 17% of liver cancer |
| 42% of breast cancer |
| 56% of endometrial cancer |
| 20% of prostate cancer |
| 19% of kidney cancer |
| 39% of these 12 cancers combined and |
| 26% of all cancers |

Effectiveness of screening is measured in terms of mortality reduction – this is what motivates public health policy makers to implement, manage and evaluate cancer screening programmes.⁷

Primary Prevention Measures

Tobacco

Tobacco is the single largest cause of preventable cancer in the world.⁸ It is responsible for 1.8 million cancer deaths per year and causes 80-90% of all lung cancer deaths, and also causes a number of deaths from cancer of the oral cavity, larynx, oesophagus and stomach.⁹ Tobacco smoke contains about 4000 different chemicals, of which at least 80 of these could cause cancer.¹⁰

Tobacco smoke was first shown to cause lung cancer in 1950 by Doll and Hill.¹¹ Decades of research have consistently established the strong association between tobacco use and cancers of many sites. Specifically, cigarette smoking has been established as a cause of cancers of the lung.⁸ Studies have shown that lung cancer risk is greatest amongst those who smoke the most cigarettes over the longest period of time.¹² Starting smoking at an early age increases the cancer even more than starting later in life.¹³ Tobacco is a major risk factor for several other types of cancer including oral cavity, oesophagus, bladder, kidney, pancreas, stomach, cervix, and acute myelogenous leukemia.^{14,15,16,17} Second-hand

smoke, also known as environmental tobacco smoke, has been proven to cause lung cancer in nonsmoking adults.¹⁸

Smoking avoidance and smoking cessation result in decreased incidence and mortality from cancer. Stopping smoking at 50 years of age would half the excess risk of overall cancer, whilst stopping at 30 years of age would avoid the majority of cancer.¹⁹ The effects of quitting smoking depend on the type of cancer.^{20,21}

Overweight and obesity

Cancer of the colon,²² breast (postmenopausal),²³ endometrium,²⁴ kidney,²⁵ oesophagus,²⁶ are associated with obesity. Some studies have also reported associations of obesity with cancer of the gallbladder, ovaries and the pancreas.²⁷ The risk of postmenopausal breast cancer in obese women is 1.5 times the risk of women of healthy weight.^{28,29} This led to a number of studies related to the risk reduction in persons who were overweight or obese by intentional weight loss. A recent study found that women who experienced intentional weight loss of 20 or more pounds and were not currently overweight, had cancer rates at the level of non overweight women who never lost weight.³⁰ These findings suggest that intentional weight loss might reduce risk of obesity-related cancers. Therefore this adds on the importance that overweight and obese people will gain health benefits by losing weight.

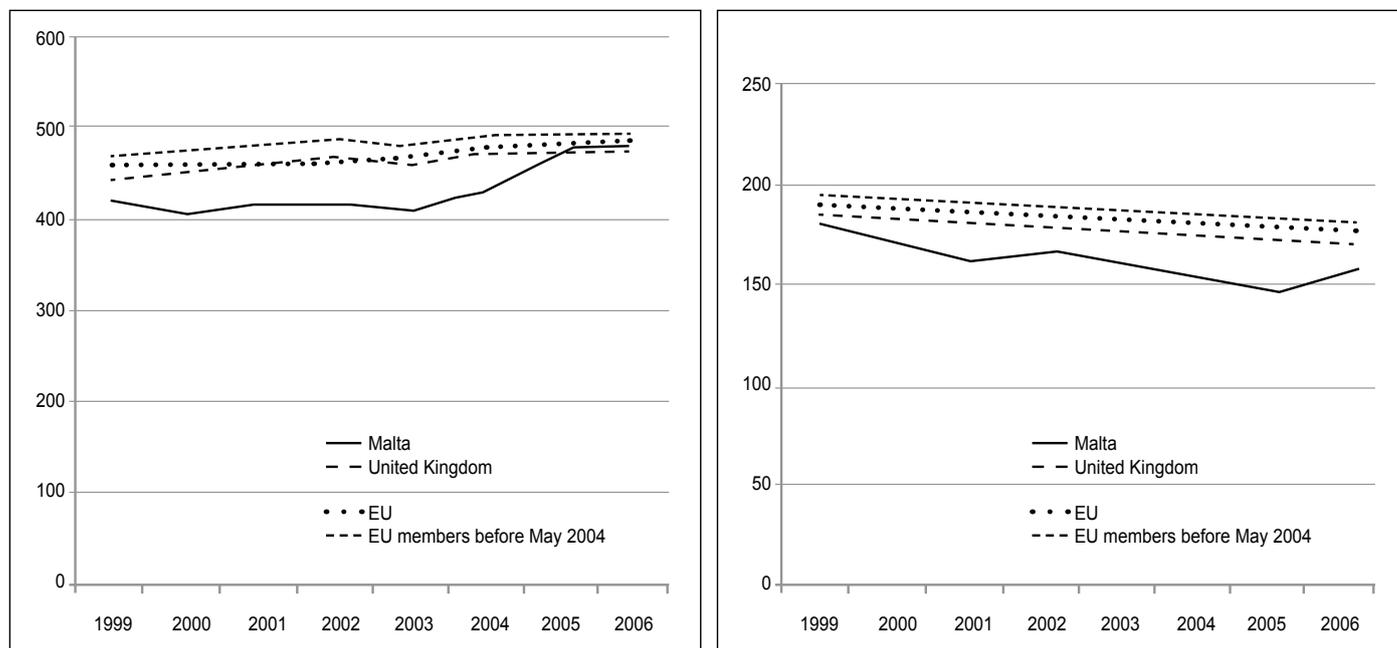
Diet

Apart from the link between overweight and obesity, which is related to diet, there is also some evidence that diet has an effect on cancer. Estimates concerning the potential contribution of diet to the population burden of cancer have varied widely. The exact association between diet and cancer development has not been firmly established. In contrast to the epidemiologic evidence on cigarette smoking and cancer, evidence for the influence of dietary factors and cancer is uncertain. An assessment of the potential role of diet entails measuring the net contribution of diets, comprising factors that may protect against cancer and other factors that may increase cancer risk.

Various reviews,³¹ have shown that the greatest consistency was seen for fruits and non-starchy vegetables. They were associated with “probable decreased risk” for cancers of the mouth, esophagus, and stomach. Fruits, but not non-starchy vegetables, were also found to be associated with “probable decreased risk” of lung and bladder cancer.^{32,33} Vegetables may also have a protective effect against ovarian cancer.³⁴

Literature suggests that eating a variety of foods containing high fiber has a protective effect against colon cancer. Evidence also indicates that a high fiber-containing diet may be protective against breast, ovary, endometrial, and gastrointestinal cancer. However, it is difficult to assess if the protection is clearly

Figure 1: Incidence (left) and mortality rates (right) of Cancer in Malta compared to UK and EU average



from fiber or some other dietary component, such as low fat.³⁵ A randomized controlled trial of supplemental wheat bran fiber did not reduce the risk of subsequent adenomatous polyps in individuals with previously resected polyps. Hence for cancer prevention, the emphasis for dietary recommendation should be on a dietary pattern rather than on an isolated dietary fiber supplement.³⁶

Ecologic, cohort, and case-control studies found an association between fat and red meat intake and colon cancer risk,³⁷ but a randomized controlled trial of a low-fat diet in postmenopausal women showed no reduction in colon cancer.³⁸

Alcohol

Alcohol use is a risk factor for many cancer types including cancer of the oral cavity, pharynx, larynx, oesophagus, liver, colorectum and breast. In fact WHO have estimated that harmful alcohol use is responsible for 351 000 cancer deaths per year globally. Risk of cancer increases with the amount of alcohol consumed.³⁹ The risk from heavy drinking for several cancer types (e.g. oral cavity, pharynx, larynx and oesophagus) substantially increases if the person is also a heavy smoker. Attributable fractions vary between men and women for certain types of alcohol-related cancer, mainly because of differences in average levels of consumption. For example, 22% of mouth and oropharynx cancers in men are attributable to alcohol whereas in women the attributable burden drops to 9%. A similar gender difference exists for oesophageal and liver cancers.⁴⁰

Physical activity

A growing body of epidemiologic evidence suggests that people who are more physically active have a lower risk of certain malignancies than those who are more sedentary.⁴¹ It has been established that there is a "probable" association of physical activity with lower risk of postmenopausal breast cancer,⁴² and colon cancer.⁴³ Some evidence also shows a link with lower risk of endometrial⁴⁴ and prostate cancer⁴⁵. As with the dietary factors described above, physical activity seems to play a more prominent role in selected malignancies.

Secondary prevention by screening

"All screening programmes do harm; some also do good. The responsibility of the policy-maker is to decide which programmes do more good than harm at reasonable cost

Key Practice Points

- Many aspects of general health can be improved, and many cancer deaths prevented, if people adopt healthier lifestyles (adopted from European Cancer Code 2003).
- Tobacco should be avoided completely. Assistance is available to help people quit in the form of counselling and group sessions.
- Obesity is a risk factor and needs to be controlled. Physical activity on a daily basis helps prevent weight gain and is directly related to cancer prevention. A healthy diet with vegetables and fruits and decreased consumption of foods containing fats from animal sources are proven beneficial to prevent cancer. Alcohol can only be consumed in moderation.
- Exposure to sun and cancer causing substances should be avoided.
- Public health programmes that could prevent cancers developing or increase the probability that a cancer may be cured include breast, cervical and colorectal screening.
- Vaccination programmes against hepatitis B virus infection can prevent cancers of the liver.

and then introduce them, once they are confident that the screening programme can and will reach the standard of quality required for success."⁴⁶

Appraising the evidence - the effectiveness of screening

A screening programme should have high sensitivity and specificity. Sensitivity is the capacity to detect cases in the pre-clinical detectable phase amongst those screened. Specificity is the ability to correctly identify subjects without the disease. Other measures of performance include screening attendance, reproducibility of screening test, diagnostic procedures used to confirm positive screens and interval between successive screening tests.⁴⁷

A randomized controlled trial (RCT), with mortality as its end-point, is still considered as the optimal and often the only valid means of evaluating the effectiveness of a screening programme. Cohort and case-control studies are often used, and most evidence comes from comparisons of time trends and geographical differences between populations that were subjected to screening of variable intensity. Non-experimental studies do not provide a solid basis for decision making.⁴⁸

The criteria developed by Wilson and Jungner,⁴⁹ have stood the test of time well and are still useful today. There have since been broad debates stimulated by the evidence-based decision making movement and the Cochrane collaboration. In a hierarchy of evidence, a systematic review of randomized controlled trials is usually placed at the top. However, disputes remained unresolved, because value judgments are involved in the selection or rejection of trials

to be included in the systematic review. This was most fiercely argued in the debate about breast cancer screening when a review in *The Lancet* suggested that the evidence for screening was biased by the inclusion of trials of low quality.⁵⁰ An extensive exchange of letters took place until the issue was reviewed by IARC, the International Agency for Research on Cancer, which published a report concluding that: "...trials have provided sufficient evidence for the efficacy of mammography screening of women between 50 and 69 years. The reduction in mortality from breast cancer among women who chose to participate was estimated to be about 35%..."⁵¹

The effectiveness of screening for breast (mammography), colorectal (FOBT) and cervical cancer (Pap smear) have now been firmly established.⁶ Although limitations in the existing evidence base include insufficient evidence about harm and the need to address opportunity costs.⁷

Introduction of the HPV vaccine may reduce the demand for cervical cancer screening by decreasing the risk of disease, but this will take a considerable amount of time to be seen. Screening for prostate cancer has not been fully evaluated but ongoing RCTs should provide important evidence in due course.⁵² Evidence of effectiveness of screening for other cancers remains insufficient or unclear.

Conclusion

Prevention is the key to reducing the burden that cancers have on our health care systems. Regular physical activity and the maintenance of a healthy body weight, along with a healthy diet, and avoidance of tobacco will considerably reduce cancer risk.

Screening is a programme, not a test. Screening programmes mandate a fine and dynamic balance between benefits and harms. Establishing the benefits of screening requires evidence of mortality reduction from large randomized trials, as for breast, and colorectal cancer. In spite of the lack of RCT evidence, screening for cervical cancer with cytological smears has been shown to be effective. Screening tests are available for other cancer types but their efficacy has not been demonstrated effectively. Based on this evidence, Malta launched the National Breast Screening Programme in 2009. The National Cancer Plan 2011-15 announced in February 2011 outlines firm plans for colorectal and cervical screening programmes in the near future. This is complemented by the Non Communicable Disease Strategy launched in April 2010, which outlines the basis upon which programmes are implemented to raise awareness and reduce exposure to cancer risk factors, and to ensure that people are provided with the information and support they need to adopt healthy lifestyles.

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