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Review

Meeting the global demands of epidemiologic transition – The indispensable role of cancer prevention

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ABSTRACT

The number of new cancer cases each year is projected to rise worldwide by about 70% by 2030 due to demographic changes alone, with the largest increases in the lower-income countries. Wider adoption of specific aspects of westernized lifestyles would translate to still greater increases in certain cancer types. In many countries the burden of cancer and other non-communicable diseases will add to communicable diseases and malnutrition to impose a "double burden" on the poorest. These trends represent major challenges to health, poverty, sustainable development and equality. Prevention is, however, possible based on implementing existing knowledge about risk factors and the natural history of the disease. Both primary and secondary cancer prevention offer therefore many opportunities to combat the projected increases. Tobacco control, reductions in obesity and physical inactivity, reduced consumption of alcohol, vaccination against hepatitis B and human papilloma viruses, safe sex, avoidance of environmental and occupational carcinogens and excessive sun exposure as well as the early detection and screening for breast, cervix and colorectal cancers would all make significant contributions. At the same time, for a number of major cancers (e.g., colon, prostate, kidney, pancreas, brain, lympho-haematological malignancies) research is needed to identify as yet unknown risk factors whilst for existing prevention strategies additional work is needed on their implementation into health services. Finally, there is a remarkable opportunity for advances in understanding the molecular basis of carcinogenesis to provide new tools and insights into aetiology and prevention. It is only by complementing efforts to improve treatment with those aimed at prevention that the impending epidemic of this disease can be addressed.

Abbreviations: COPD, chronic obstructive pulmonary disease; HDI, Human Development Index; HBV, hepatitis B virus; HCV, hepatitis C virus; *H. pylori*, *Helicobacter pylori*; HPV, human papillomavirus; IARC, International Agency for Research on Cancer; KS, Kaposi sarcoma; KSHV, Kaposi sarcoma herpes virus; NCDs, non-communicable diseases; PSA, prostate-specific antigen; UN, United Nations; WHO, World Health Organization.

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1. Introduction

The burden of cancer as well as that of other non-communicable diseases (NCDs) is increasing globally. NCDs (including cancer but also cardiovascular diseases, stroke, diabetes, chronic obstructive pulmonary disease (COPD), etc.) in 2005 were estimated to have caused more than 60% (35 million) of all deaths worldwide (United Nations, 2012). Without prevention and control actions, the figure is expected to increase to 41 million in 2015. This phenomenon is mainly a consequence of the so-called epidemiologic transition, i.e., a shift from infectious to NCDs (Omran, 1971; Maule and Merletti, 2012). One consequence, certainly in the lower-income countries, is the implausibility of treating our way out of the NCD epidemic.

In the present review we will focus on needs, knowledge and opportunities in cancer prevention cognisant of the intimate link between prevention of cancer and prevention of other NCDs. Cancer burden will be put in a global perspective and knowledge on established risk factors summarised. While cancer is a global problem it is not a uniform one. There are distinct patterns of the types of cancer at a regional and national level. These differences reflect heterogeneity in underlying risk factors and hence imply the need for cancer control strategies tailored to specific regional challenges. Any strategy that can prevent NCDs as a whole is, obviously, attractive, but some cancer-specific preventive tools can be extremely effective and potentially cost-effective.

2. The epidemiologic transition

The second part of the twentieth century witnessed enormous progress in improving health and survival around the world. Life expectancy at birth for the world population rose from 48 years in 1950–1955 to 68 years in 2005–2010 (United Nations, 2012). In a number of countries that have transited towards the highest levels of human development (e.g., Australia, Canada, France, Italy, Spain, Norway, Sweden, Switzerland, Israel, Japan and the Republic of Korea), life expectancy at birth exceeded 80 years in 2005–2010. Epidemiologic transition is characterised by initial declines in communicable diseases (Group I) followed by subsequent increases in crude and proportional mortality attributable to NCDs (Group II). Enormous disparities exist across regions in the stage of epidemiologic transition attained, but there are no countries where the present and future challenge posed by NCDs can be ignored.

Figure 1 shows the ranking of world regions in 2008 by the three main Groups of causes of death including, in addition to Group I and II, Group III, i.e., injuries. The non-standardised (or crude) death rate reflects the burden to the population from the number of deaths from a disease or group of diseases. Conversely, age-standardised rates account for the different age structures observed in different populations. Africa's mortality rate for Group I was nearly four-times higher than in Asia and over 20-fold higher than in more developed regions (excluding Eastern Europe). The relationship between regional rates for Group I deaths is not modified by age adjustment indicating that Africa's elevated mortality for Group 1 diseases is not attributable to a very young population but rather to other factors (i.e., very high mortality from malaria and diarrhoea in children and from HIV infection among young adults). If Africa's mortality rates due to communicable diseases were to be reduced to those observed in the longest-lived world populations, the region would achieve a 17-year increase in life expectancy at birth, from 55 to 72 years. Conversely, age-adjustment substantially modifies the ratios between Group II deaths across regions (Figure 1). If the underlying population age structure was equal, Africa, developing Oceania (i.e., Oceania except Australia and New Zealand), and Eastern Europe would have the highest NCD mortality followed by Asia and Latin America. Perhaps contrary to common perception, more developed regions tend to have relatively low age-standardised rates of NCDs. To a lesser extent, deaths from injuries follow a pattern similar to NCDs, with the highest age-standardised mortality rates in Africa and Eastern Europe. It is, therefore, essential to bear in mind that less developed countries experience a "double burden" of infectious diseases and NCDs compared to more developed ones and are potentially extremely vulnerable to additional NCD increases.

The possibility to live a long and healthy life is a fundamental aspect of human development and the epidemiologic transition in more developed countries was associated with improved socioeconomic conditions (that in turn improved hygiene and nutrition) earlier than medical advances (Maule and Merletti, 2012). Medical advances in disease prevention and treatment came at a later stage but they can now, in principle, be made available globally.

3. Global cancer burden: mortality and incidence

This section reviews the current burden of cancer in 2008 and cancer projections for 2030 (GLOBOCAN http://globocan.iarc.fr) (Ferlay et al., 2010). It also provides the latest estimates on the number, and rates of global deaths from cancer. A description of the methods used to produce these estimates is provided in GLOBOCAN. Data are also discussed and presented according to the Human Development Index (HDI) groups (Bray et al., 2012a).

A total of 7.6 million deaths from cancer are estimated to have occurred in 2008 (21% of all NCD deaths). Premature death is a major consideration when evaluating the impact of cancer on a given population. Cancer accounted for 27% of NCD deaths below age 70 (World Health Organization, 2011).

Large variations in both cancer incidence and mortality are observed, overall and in relation to the major forms of cancer, in different regions of the world (Ferlay et al., 2010). Figure 2 presents the most frequent types of cancer diagnosis (based on the number of new cases per year) in each country, for men and women.

The geographical variation in cancer distribution is mirrored on examination of the number of new cases and deaths for the most common cancers in relation to the HDI of countries (Bray et al., 2012a)(Figure 3). It is worth bearing in mind that the population in very high-, high-, medium-, and