RESEARCH COMMUNICATION

Global Cancer Incidences are Substantially Under-estimated Due to Under-ascertainment in Elderly Cancer Cases

Mahdi Fallah*, Elham Kharazmi

Abstract

Background: The cancer incidence in developing countries is 7-16% under-estimated due to under-ascertainment of elderly cases in cancer registry data. The global cancer incidence, as a mixture of incidence in all countries, could thus be under-estimated as well. This study was conducted to report corrected global cancer incidence. Methods: The corrected rate in age group 65+ for "All sites excluding skin cancer" was calculated by summing 1/3 of the original age-specific rate and 2/3 of anti-logarithm of "the predicted value of the logarithm of rate in age group 65+" multiplied by a sex-specific coefficient. Cancer data were obtained from GLOBOCAN 2002. Results: The global cancer incidence estimate by the GLOBOCAN 2002 was 8.7% (men 13.3%; women 3.4%) under-estimated due to under-ascertainment in elderly cases, which means, worldwide, new cancer cases in 2002 were 11,810,000 (6,574,000 men; 5,236,000 women), topping the original estimate by 1 million. Conclusions: The global cancer incidence estimate is substantially under-estimated due to under-ascertainment in elderly cases. This correction is performed mathematically; the results, however, emphasize the need for practical strategies to prevent under-ascertainment in the elderly.

Key Words: Neoplasms - incidence rate - under-ascertainment - old age - world data

Asian Pacific J Cancer Prev, **10**, 223-226

Introduction

The cancer incidence in developing countries is 7-16% under-estimated due to the well-known problem of under-ascertainment of elderly cases in cancer registry data (Fallah and Kharazmi 2007). The under-ascertainment, however, is not limited to the developing countries (Fallah and Kharazmi 2008a) and the global cancer incidence, which is a mixture of incidence in developing and developed countries, could thus be under-estimated as well.

The reasons for under-ascertainment in the elderly cancer cases are discussed in details elsewhere (Fallah and Kharazmi 2008c; Parkin et al., 1994). The presence of under-ascertainment in the cancer registry data can be assessed by looking at the age-specific incidence curve, details of which are discussed elsewhere (Fallah 2007; Fallah and Kharazmi 2007; Fallah and Kharazmi 2008c; Parkin et al., 1994). A method to compensate the defect in the age-specific curve show that the original incidence rate for developing countries by GLOBOCAN 2002 is 11% (men 15%; women 7%) under-estimated, so there were 6,462,000 new cancer cases (3,093,000 men; 2,737,000 women) in 2002 topping the original estimate by 632,000 (Fallah and Kharazmi 2008c). This substantial under-estimation in cancer incidence estimates for developing countries due to under-ascertainment in elderly cancer cases raises this question "To what extent the under-ascertainment affects the global cancer incidence then?" The present study using data in the public domain was conducted to provide an answer.

Materials and Methods

The elderly under-registration appears mostly after age 70-75 years (Figure 1), but this is not visible when only age group 65+ is presented (as in GLOBOCAN 2002; Figure 2). However, it may be reflected as a failure to exponentially increase in the age group 65+ compared to younger age groups (Fallah and Kharazmi 2008c).

The correction method has been described in details elsewhere (Fallah and Kharazmi 2008c). In brief, corrected rate in age group 65+ for "All sites cancer" is calculated by summing one third of the original age-specific rate and two thirds of the anti-logarithm of "the predicted value of the logarithm of rate in age group 65+ by a linear regression fitted on the logarithm of rates in age groups 15-44, 45-54 and 55-64" multiplied by a sex-specific correction coefficient (0.893 for female; 1.179 for male).

All the cancer data used in this report were obtained from GLOBOCAN 2002 (Ferlay et al., 2004) and Cancer Incidence in Five Continents Vol. VIII (only Figure 1) (Parkin et al., 2002).

*Tampere University Hospital, Tampere, Finland *For Correspondence: Mahd.Fallah@gmail.com*

Table 1. Change in Number of New Cancer Cases, Crude Incidence Rate and Age-standardized Rate, Worldwide, for "All cancer sites excluding skin" by Sex, 2002

	Before correction			After correction			Increase (%)		
	Cases (n)	Rate/10^5a	ASR/10^5b	Cases (n)	Rate/10^5a	ASR/10^5b	65+c	Cases or rate[a]	ASR/10^5b
Men	5,802,531	185.7	209.6	6,574,002	210.4	238.0	27.4	13.3	13.6
Women	5,061,968	164.4	161.5	5,235,738	170.0	166.4	8.3	3.4	3.0

[a]Crude incidence rate; [b]Age-standardized rate (World Standard Population); [c]Percentage of increase in number of new cases or rate in the elderly age groups (65 or more)

Results

The age-specific incidence curves of cancers in both sexes in the world demonstrated the presence of under-ascertainment in the oldest age groups (Figure 2). The corrected rate for age group 65+ in men was 27.4% higher than the original estimate while in women it topped the original rate by 8.3% (Table 1). Without correction, the crude rate (and consequently number of new cases) for "All sites but skin" was 8.7% (men 13.3%; women 3.4%) under-estimated. This means that, worldwide, new cancer cases in 2002 were 11,810,000 (6.6 million men; 5.2 million women), topping the original estimate by 1 million (Parkin et al., 2005). This estimate is 1.8 million more than that for the year 2000 (5.3 million men; 4.7 million women) (Parkin et al., 2001). The magnitude of increase was similar for the age-standardized rate (ASR).

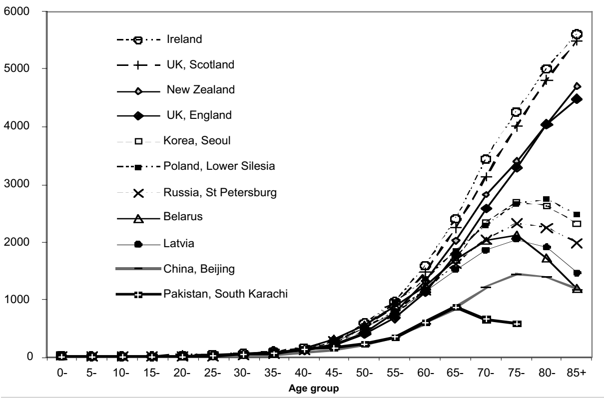

Figure 1. Male Age-specific Incidence Curves of "All sites excluding skin" Cancers in Selected Registries. Note some with and some without fall-off in the oldest age groups, 1993-97 (from Cancer in Five Continents, Vol. VIII). Data are rates /100,000

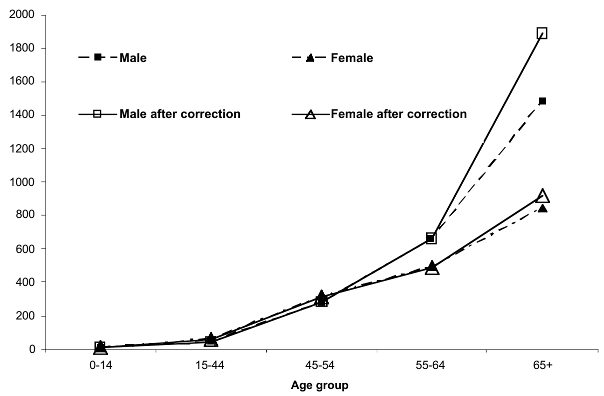

Figure 2. Global Cancer Incidence for "All sites cancer excluding skin" Before and After Correction for Elderly Under-ascertainment

Discussion

Applying our method on the world cancer data showed that the global cancer occurrence measures, such as ASR, crude rate, and annual number of new cases, were obviously under-estimated and that the magnitude of this under-estimation varied by sex. The incidence rates were less under-estimated in women than in men, perhaps due to different health-seeking behavior in women (de Nooijer et al., 2002; Rutten et al., 2006), which leads to more frequent cancer diagnosis in women in the health care facilities as the main source of cancer registry data.

Elderly people aged 65 or more constituted 7.1% of the world population in 2002, but, according to the prediction by the United Nations (2006 revision), this proportion will increase to 16.2% in 2050. Assuming no change in the other risk factors of cancer than age, and no population growth, the number of new cancer cases will be more under-estimated when the future burden of cancer is calculated based on current under-estimated rates by taking only the change in the population age structure into account. The significance of this correction increases when under-estimated information on cancer burden leads to inadequate resource allocation for cancer control.

This method has up to 2.1% error, thus all the corrected estimates for the world should be considered within the interval of estimate multiplied by 0.979 and 1.021; e.g. the corrected global ASR in men is 238 (233-243) per 105, which is 13.6% (11.5-15.7%) more than original one. This method has been successfully validated by data of five cancer registries without fall-off at age-specific incidence curve in logarithmic scale (Fallah and Kharazmi 2008c). This is, however, a method to mathematically account for the under-ascertainment in the elderly and the ultimate correction for under-ascertainment relies on number of actions such as expediting the access of elderly people to health care system, referring all the clinically diagnosed cancer patients in outpatient clinics to hospitals or at least providing an easy system for reporting patients with cancer diagnosis in the outpatient clinics to cancer registry, increasing access of cancer registries to day care or general practitioners archives, correct notification of cause of death for cancer patients considering underlying cause of death rather than immediate one (e.g. not every cardiac arrest in cancer patients should be coded as death due to cardiovascular diseases), inclusion of diagnosis of cancer on death certificate in the cancer registry, inclusion of higher age groups in the cancer screening programs with increasing life expectancy, and strategies to zero the number of cancer cases with unknown age as most of these cases can be elderly people (Fallah and Kharazmi 2008b).

The underlying assumption in this study is that any age-specific incidence curve should increase continuously. In cross-sectional data this is not necessarily the case, since there may be important cohort effects that can make incidence lower in the older age-groups. Thus, to suppose that this is necessarily a sign of under-ascertainment is arbitrary. However, when we use this method on all cancer sites together, the possibility that cohort effect affects the incidence curve of all sites is substantially lower than that for each site individually. Moreover, using one third of original data for older age groups partially cancels out this bias if any.

GLOBOCAN database as the source of data in this study is based on data from cancer registries, some of which are less efficient at case-ascertainment at older ages than at younger ages. Any argument about data quality must, therefore, be directed at data source, and this can be accessed at Cancer Incidence in Five Continents Vol. VIII (Parkin et al., 2002), available electronically. This implies the caution about using GLOBOCAN for the oldest age-group without correction.

In conclusion, the global cancer incidence estimate is substantially under-estimated due to under-ascertainment in elderly cases, especially in men. This correction is performed mathematically; the results, however, emphasize the need for practical strategies to prevent the under-ascertainment in the elderly ages.

References

de Nooijer J, Lechner L, de Vries H (2002). Early detection of cancer: knowledge and behavior among Dutch adults. *Cancer Detect Prevent*, **26**, 362-9.

Fallah M (2007). Cancer Incidence in Five Provinces of Iran: Ardebil, Gilan, Mazandaran, Golestan and Kerman, 1996-2000. University of Tampere.

Fallah M, Kharazmi E (2007). Iran cancer incidence should be corrected for under-ascertainment in cancer cases in the elderly (Aged 65+). *Asian Pac J Cancer Prev*, **8**, 348-52.

Fallah M, Kharazmi E (2008a). Correction for under-ascertainment in cancer cases in the very elderly (aged 75+): external reference method. *Cancer Causes Control*, **19**, 739-49.

Fallah M, Kharazmi E (2008b). New methods of handling cases of unknown age in cancer registry data. *Asian Pac J Cancer Prev*, **9**, 259-262.

Fallah M, Kharazmi E (2008c). Substantial under-estimation in cancer incidence estimates for developing countries due to under-ascertainment in elderly cancer cases. *Cancer Letters*, **264**, 250-5.

Ferlay J, Bray F, Pisani P (2004). GLOBOCAN 2002. Cancer Incidence, Mortality and Prevalence Worldwide. [2.0]. Lyon, IARC Press. IARC CancerBase No. 5.

Parkin DM, Bray F, Ferlay J, Pisani P (2005). Global cancer statistics, 2002. *CA Cancer J Clin*, **55**, 74-108.

Parkin DM, Bray FI, Devesa SS (2001). Cancer burden in the year 2000. The global picture. *Eur J Cancer*, **37, Suppl-6**6.

Parkin DM, Chen VW, Ferlay J, Galceran J, Whelan SL (1994), Comparability and Quality Control in Cancer Registration, IARC Press, Lyon p 38.

Parkin DM, Whelan SL, Ferlay J, Teppo L, Thomas DB (2002), Cancer Incidence in Five Continents, IARC Press, Lyon.

Rutten LJ, Squiers L, Hesse B (2006). Cancer-related information seeking: hints from the 2003 Health Information National Trends Survey (HINTS). *J Hlth Commun*, **11**, **Suppl-56**.