

Cancer incidence in eastern Libya: The first report from the Benghazi Cancer Registry, 2003

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Cancer registration in Northern Africa is still limited and, until now, there have been no population-based data available for Libya. In this paper, we present the first data collected and analyzed by the Benghazi Cancer Registry. Registration was carried out by active data collection; the registry staff routinely visited all hospitals and pathological laboratories in eastern Libya (1.6 million inhabitants) and collected information from all death registration offices. A huge archive of prevalent cases was established before the 2003 data were collected. A total of 997 cases of primary cancers were registered among residents in 2003. The world age-standardized incidence rate for all sites combined (except non-melanoma skin) was 118 per 100,000 for men and 95 per 100,000 for women. The most frequently diagnosed malignancies in males were lung cancer (19%) and colorectal cancer (10%), followed by cancers of the head and neck (9%) and bladder (9%). Among females, they were breast cancer (26%), cancer of the colon and rectum (9%), uterus (7%) and non-Hodgkin lymphoma (5%). Our study provides data on cancer incidence in eastern Libya, and confirms that cancer incidence is much lower than in western countries. Moreover, observed patterns indicate that the incidence of many cancers, including those of the lung, breast, colon, rectum and bladder is quite different from previous estimates based on the data available from the neighboring countries.

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Key words: Benghazi; cancer; incidence; Libya; population-based registry

Cancer will become an increasingly important health problem in developing countries in the coming decades. Growing and ageing populations, increasing tobacco consumption and exposure to other known risk factors (*e.g.*, industrialization and westernization of diet and lifestyle) will all contribute to dramatically increase the number of new cancer cases, especially in African countries.^{1,2} The establishment of several new cancer registries in Africa in the last 15 years^{3–8} will provide more accurate statistics and help to improve both the monitoring of cancer trends over time and our understanding of this growing epidemic. Although cancer registration activity in Africa is growing rapidly, until now no cancer incidence data have been available for a defined population within Libya.^{7,9–11} In this paper, we report for the first time the statistics on cancer incidence from the population-based Benghazi Cancer Registry (BCR), which was established in 2002 under the auspices of the National Research Center and located in Garyounis University, in eastern Libya.

Material and methods

The BCR covers a wide area of northeastern Libya, on the Mediterranean Sea coast (Fig. 1). The total population, according to 2003 estimates, is 1,632,051 (approximately 28% of the total Libyan population), with a high proportion of children (age 0–14: 35%) and young adults (age 15–29: 32%), while people older than 65 years only account for less than 5% (Fig. 2). The city of Benghazi (660,147 estimated population) is the major center of the region.

Cases were found by active searching in all hospitals in which cancer may be diagnosed. The Department of Pathology of

Garyounis University, located in the city of Benghazi, is the most important source of information because it provides histopathology and cytology services for the whole of eastern Libya. All other public and private pathology laboratories were also periodically visited. Death certificates were actively investigated and followed up to obtain additional information related to the exact date and site of diagnosis.

Data are provided for the latest complete registration year (2003). Registrations included all malignant tumours; non-melanoma skin cancer was excluded from the statistics if not otherwise indicated. Registrations are considered microscopically verified (MV) where diagnosis is based on a malignant histological or cytological reports.

Cases were classified according to the third edition of the International Classification of Diseases for Oncology.¹² The staff of the Modena Cancer Registry (MCR), Italy, contributed to the training of registrars in coding techniques and in software use. Coding practices (including basis and the date of diagnosis) were defined according to the current international guidelines.^{12–14} Age standardization of incidence rates was carried out by the direct method, using the world standard population.¹⁵ The registry used statistical and data entry software developed by the MCR. It includes a variety of methods for checking the validity of the data, based on the IARC/IACR check programs.¹⁶

Results

A total of 997 cases diagnosed in 2003 were registered by the BCR, of which 544 were males (54.6%) and 453 females (45.4%). Excluding nonmelanoma skin cancers, the total number of cases was 978 (529 males and 449 females). The mean age at time of diagnosis was 57 years for males and 49 years for females. The age distribution and the age-specific incidence rates are presented in Figure 3.

The most frequently reported malignancies in males were lung cancer (19% of all cases, excluding skin cancers), colorectal cancer (10%), cancer of the head and neck (9%), bladder (9%) and prostate (8%). The most frequently reported malignancies among females were breast cancer (26% of all cases), followed by cancers of the colon and rectum (9%), corpus uteri (7%), non-Hodgkin lymphomas (5%) and cervix uteri (5%) (Table I).

Abbreviations: ASR, age-standardized rate; BCR, Benghazi Cancer Registry; DCO, death certificate only; IACR, International Association of Cancer Registries; IARC, International Agency for Research on Cancer; ICD-O-3, International Classification of Diseases for Oncology, third edition; MCR, Modena Cancer Registry; MV, microscopically verified.

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FIGURE 1 – Area covered by the BCR.

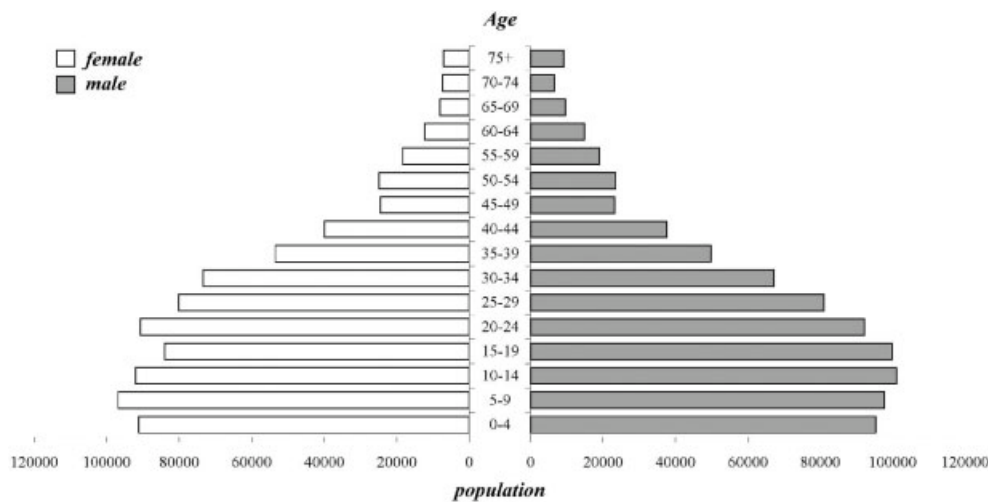


FIGURE 2 – Resident population, 2003, according to sex and age (years).

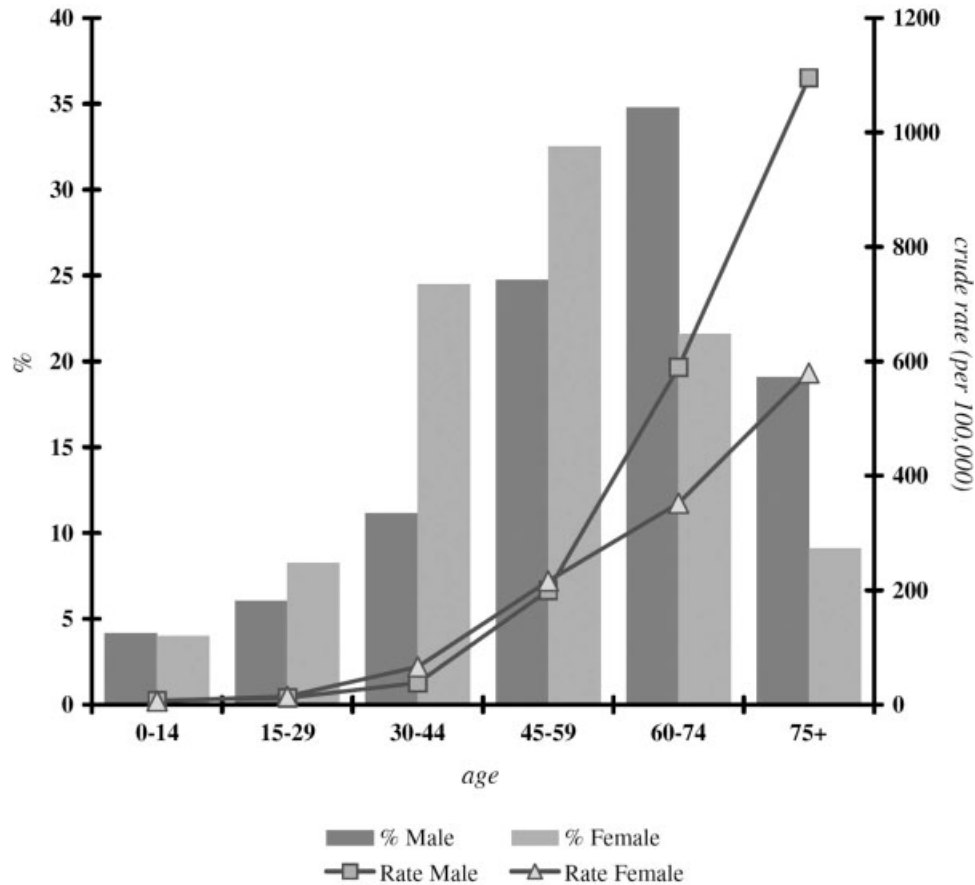


FIGURE 3 – Age distribution (%) and age-specific incidence rates for all cancers combined.

According to morphology, ductal infiltrating carcinoma was the most common histological type (54%) of all female breast malignancies, while lobular carcinomas accounted for 11%.

Adenocarcinoma was the most common type of lung cancer, accounting for 34% of all MV lung neoplasms, followed by squamous cell carcinoma (29%), small-cell carcinoma (14%) and large-cell carcinoma (9%).

Transitional cell carcinoma represented 72% of all bladder cancers, followed by adenocarcinoma of unspecified type (17%). Only 4% of bladder cancers were of the squamous cell type.

The most valid basis of diagnosis at each cancer site, sorted by gender, is reported in Table II: 79% of all cancers were verified by microscopy, and 9.9% were documented only by a death certificate. A comparison of age-standardized rates (ASR) in Benghazi with those of other African areas^{7,8} and with the estimated cancer incidence for Libya provided by the Globocan 2002 database is presented in Table III.¹⁷

Discussion

The results presented here are the first from a population-based cancer registry in Libya, although several clinical and hospital-based series have been published in the past.⁹⁻¹¹

As expected, the overall cancer incidence rate in Benghazi is lower than that in more developed countries, but it is higher than the rate estimated for Libya, according to the Globocan 2002 database. The main differences are the higher incidence in Benghazi of lung and prostate cancer in males, and of colon-rectal

cancer in both sexes, while bladder and uterine cervical cancer incidence seems to be much lower than expected by Globocan 2002 estimations.

The high rate of lung cancer is similar to the average of rates reported in North African cancer registries,⁷ mainly because of the well-established smoking habit within the Libyan population. According to the latest statistics for Libya, the annual per capita consumption of cigarettes in Libya in 1980 was extremely high (3,950) when compared, for example, with that in Algeria (1,499) and Tunisia (1,543), but also with Italy (2,351), the United States (3,544) and Japan (3,450).¹⁸ Because of the long latency of the disease and to the lack of effective smoking control programs, it is reasonable to expect an increase in lung cancer incidence in the Benghazi area. The proportion of adenocarcinoma (34%) in Benghazi is slightly higher than Garbiah, Egypt (30%), Jordan (28%) and lower than United States (37%).⁸ The monitoring of these results as well as the analysis of time trend will probably explain the real significance of these differences.

Colorectal cancer is relatively frequent in Benghazi. This is in contrast with the Globocan 2002 estimates. Moreover, the incidence of colorectal cancer in Benghazi is closer to that reported in other North African cancer registries. The higher incidence rates are probably due to dietary factors, variations in economic status and the diffusion of endoscopic procedures, especially in urban areas of eastern Libya.

As expected, breast cancer was the most common malignancy in women, accounting for more than 25% of all cancer in females, and the ductal subtype was the most frequent morphology among the microscopically confirmed cases. The young age structure of

TABLE 1 – NUMBER OF NEW CASES BY AGE (YEARS), SEX AND SITE

Site	0-14		15-24		25-34		35-44		45-54		55-64		65+		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip	0	0	0	0	0	0	0	0	0	0	1	0	1	1	2	1
Tongue	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1
Mouth	0	0	0	0	0	0	0	0	0	0	1	2	3	0	4	2
Salivary gland	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1
Oropharynx	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Nasopharynx	2	0	0	0	0	1	4	1	2	1	2	1	1	0	11	4
Hypopharynx	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0
Esophagus	0	0	0	0	0	0	1	0	0	0	2	0	3	0	6	0
Stomach	0	0	0	0	2	1	4	3	6	5	3	2	6	3	21	14
Colon	0	0	3	1	0	2	2	6	1	8	11	5	11	9	28	31
Rectum	0	0	0	0	2	1	4	2	5	5	7	2	6	0	24	10
Liver	0	0	0	0	0	0	0	0	2	0	1	7	10	5	13	12
Gallbladder, etc.	0	0	0	0	0	0	1	2	0	2	3	4	3	6	7	14
Pancreas	0	0	0	0	0	0	2	2	4	0	3	3	8	2	17	7
Larynx	0	0	0	0	1	0	1	0	4	0	6	1	14	0	26	1
Lung	0	0	0	0	0	0	7	0	16	3	29	2	49	2	101	7
Bone	2	2	1	1	0	1	0	2	0	1	0	0	0	1	3	8
Skin melanoma	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Other skin	0	0	0	0	1	0	3	1	1	0	2	0	8	3	15	4
Mesothelioma	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0
Kaposi sarcoma	0	0	0	0	1	0	0	0	0	0	0	0	2	0	3	0
Soft tissue	2	3	0	1	5	2	1	0	3	3	1	0	5	2	17	11
Breast	0	0	0	0	0	19	0	34	0	33	1	19	1	11	2	116
Prostate	0	-	0	-	0	-	2	-	0	-	10	-	33	-	45	-
Testis	0	-	1	-	0	-	0	-	1	-	0	-	0	-	2	-
Cervix uteri	-	0	-	0	-	0	-	4	-	11	-	6	-	2	-	23
Uterus	-	0	-	0	-	0	-	1	-	7	-	17	-	5	-	30
Ovary	-	1	-	3	-	4	-	6	-	3	-	2	-	4	-	23
Kidney, etc.	3	1	0	0	0	1	0	2	2	3	4	2	8	3	17	12
Bladder	0	0	0	0	1	0	2	2	8	0	11	1	27	3	49	6
Brain and CNS	1	6	5	1	3	2	1	3	4	0	9	0	5	2	28	14
Thyroid	1	0	0	1	1	5	0	1	0	6	0	1	0	3	2	17
Hodgkin disease	1	0	6	3	1	4	2	1	1	1	0	0	0	0	11	9
Non-Hodgkin lymphoma	4	3	1	4	5	1	3	0	4	6	5	4	6	7	28	25
Myeloma	0	0	0	0	0	0	0	1	1	0	3	0	2	3	6	4
Acute lymphoid leukemia	2	2	3	1	1	0	0	0	0	0	0	0	2	0	8	3
Chronic lymphoid leukemia	0	0	0	0	0	0	1	1	0	1	0	0	1	2	2	4
Acute myeloid leukemia	1	0	3	4	0	1	1	0	0	1	5	0	1	1	11	7
Chronic myeloid leukemia	0	0	0	0	0	2	0	1	0	0	0	2	0	1	0	6
Other and unspecified	3	0	1	0	1	2	4	3	4	4	6	3	9	13	28	25
Total (including skin)	22	18	24	20	25	49	46	79	71	105	128	87	228	95	544	453
Total (excluding skin)	22	18	24	20	24	49	43	78	70	105	126	87	220	92	529	449

the Libyan population and the rather smooth age-incidence curve mean that the average age at diagnosis, as reported in many clinical series for other African countries,⁷ is lower than in European populations. Based on these data, it is unclear whether mass-screening programs would be feasible in a country with such relatively low incidence. We think that more studies, such as research on the role of genetic factors among African women, should be done for a better understanding of the best way to fight breast cancer in Libya.

The incidence of bladder cancer in Benghazi is lower than expected. The remarkable difference from the predicted cancer incidence for Libya reported by the Globocan 2002 database, especially among males, is probably due to the fact that the Globocan 2002 calculation is based on the average of neighboring countries, including Egypt, where the estimated¹⁷ incidence rate in males is the highest in the world (ASR: 37 per 100,000), although both the Algerian and Tunisian cancer registries reported much lower incidence rates among males (Algiers: 11 per 100,000; Tunis: 12 per 100,000). Apart from smoking attitude, no other risk factor has been identified within the Benghazi area. The relatively limited occurrence of schistosomiasis was confirmed by the low incidence of squamous cell tumors (4% of all MV bladder cancers) when compared with that observed in the area covered by the Garbiah Cancer Registry (25%), in Egypt.⁸

Our data confirm that this region's demographic variables, such as marital status, ethnicity, religion and social status, differ strongly from those of southern Africa. Consequently, fewer risk factors may be related to cancers such as Kaposi sarcoma and cancer of the cervix uteri.

The level of MV cases (79%) is much higher than in other African cancer registries,⁷ but lower than the averages of Algeria (88%) and Tunisia (90%), while little difference was found between Benghazi and Garbiah (82%).⁸ Unfortunately, a large proportion of cancer cases are still reported by death certificate only (DCO) (10%) and 11% of cases had only clinic-based confirmation. Although these rates demonstrate that the degree of dependence upon histopathology for BCR is very limited, we believe that the quality of the BCR data may be enhanced in the near future. However, the percentages of both MV and DCO cases are comparable with many other cancer registries located in Africa, Asia, and South America.¹⁵

Cancer registration has proved to be difficult in Benghazi. Some problems are common to most African cancer registries. These include uncertainty regarding population sizes, difficulty in defining the place of residence and the poor quality of death certificate notifications, and may limit the accuracy of reports from these areas. It has been noticed¹³ that another factor that may affect initial reports from population-based

TABLE II – PERCENTAGE OF CASES WITH MICROSCOPICAL VERIFICATION (MV) AND DEATH CERTIFICATE ONLY (DCO) REGISTRATIONS

Site	MV	DCO
Oral cavity	100	0
Nasopharynx	93.33	7.26
Hypopharynx	100	0
Esophagus	66.67	33.33
Stomach	80	11.43
Colon	81.36	10.17
Rectum	94.12	2.94
Liver	20.38	28
Gallbladder, etc.	52.38	4.76
Pancreas	33.33	20.84
Larynx	77.77	18.52
Lung	52.77	18.52
Bone	100	0
Skin melanoma	100	0
Other skin	100	0
Mesothelioma	100	0
Kaposi sarcoma	100	0
Soft tissue	96.43	3.57
Breast	94.32	2.54
Prostate	84.44	6.67
Testis	100	0
Cervix uteri	86.96	13.4
Uterus	93.33	6.67
Ovary	86.96	0
Kidney, etc.	82.76	6.89
Bladder	94.55	5.45
Brain and CNS	59.52	26.19
Thyroid	94.74	0
Hodgkin disease	100	0
Non-Hodgkin lymphoma	94.35	3.77
Myeloma	70	20
Leukemias	97.56	2.44
Other and unspecified	54.7	22.6
Total (including skin)	79.33	9.73
Total (excluding skin)	79.04	9.92

TABLE III – WORLD ASR IN BENGHAZI COMPARED TO OTHER AFRICAN COUNTRIES AND TO THOSE EXPECTED FOR LIBYA ACCORDING TO GLOBOCAN 2002 ESTIMATES

Site	Benghazi CR (2003)		Libya (est.), Globocan (2002) ¹⁷		Algiers, Algeria (1993–1997) ⁷		Tunis, Tunisia (1994) ⁷		Garbiah, Egypt (1999–2001) ⁸	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Nasopharynx	1.9	0.8	2.2	0.9	2.7	1.2	3.7	1.8	1.4	0.5
Esophagus	1.5	0	2.4	1	0.9	0.5	1.2	1	1.7	1
Stomach	4.4	3.4	4.1	1.5	5.6	3.7	6.1	3.5	3.6	2.2
Colon and rectum	11.6	8.8	4.9	2.5	7.1	6.1	6.2	7	6.9	5.1
Liver	3.3	3.1	4.8	1.6	0.9	0.9	2.9	1.8	20.1	5.2
Gallbladder, etc.	1.6	3.6	n.a.	n.a.	1.5	5.3	1.7	4.4	1.2	0.8
Pancreas	4.4	1.6	1.5	0.5	1.2	0.9	2.4	1.7	3.7	2.5
Larynx	6.1	0.3	3.7	0.5	4.3	0.3	6.3	0.3	4.2	0.3
Lung	24.8	2	10.4	1.5	17.2	1.9	26.6	2.3	11.9	3.7
Breast	–	22.9	–	17.4	–	21.2	–	24.1	–	49.6
Prostate	11.4	–	5.6	–	5.4	–	7.9	–	7.5	–
Cervix uteri	–	5.3	–	8.2	–	12.6	–	6.1	–	2.7
Uterus	–	8	–	1.6	–	3.2	–	2.4	–	3.5
Ovary	–	4	–	1.9	–	1	–	2.9	–	5.4
Kidney, etc.	3.9	2.8	1.8	0.9	1.4	1.5	1.7	1.3	3.2	1.7
Bladder	11.7	1.3	22.4	2.7	10.8	2.3	12.3	1	27.5	6.3
Brain and CNS	5.3	2.1	2.1	1.1	2.7	1.4	2.6	1.3	3.8	3.5
Hodgkin disease	1.2	1	1.3	0.4	0.5	0.5	1.6	0.9	2.9	1.4
Non-Hodgkin lymphoma	5.3	5.4	4.2	1.8	3.6	2.4	5.4	3.5	17.1	11.3
Myeloma	1.6	1.9	0.7	0.4	0.7	0.6	1.8	1.6	1.4	0.6
Leukemias	4.8	3.6	4	2.2	2.4	1.5	4.3	4.4	6.7	5.3
Total (excluding skin)	117.6	95	99.3	84.7	86	85.9	113.9	89.1	152.6	135

cancer registries is overestimation due to the misclassification of prevalent cases. At the time this paper was published, our archives contained a significant number of prevalent cases, mostly diagnosed in 1999–2002. In conclusion, although this report includes only 1 year of data, we believe that the figures presented here provide a reasonably accurate description of cancer incidence in the Benghazi area and can contribute to a

better understanding of cancer incidence patterns along the southern coast of the Mediterranean Sea.

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References

1. Parkin DM, Bray F, Devesa SS. Cancer burden in the year 2000. The global picture. *Eur J Cancer* 2001;37(Suppl 8):S4–S66.
2. Parkin DM. Global cancer statistics in the year 2000. *Lancet Oncol* 2001;2:533–43.
3. Koulibaly M, Kabba IS, Cisse A, Diallo SB, Diallo MB, Keita N, Camara ND, Diallo MS, Sylla BS, Parkin DM. Cancer incidence in Conakry, Guinea: first results from the cancer registry 1992–1995. *Int J Cancer* 1997;70:39–45.
4. Echimane AK, Ahnou AA, Adoubi I, Hien S, M' Bra K, D'Horpock A, Diomande M, Anongba D, Mensah-Adoh I, Parkin DM. Cancer incidence in Abidjan, Ivory Coast: first results from the cancer registry, 1995–1997. *Cancer* 2000;89:653–63.
5. Freedman LS, Al-Kayed S, Qasem MB, Barchana M, Boyiadzis M, El-Najjar K, Ibrahim AS, Salhab AR, Young JL, Roffers S, Kahan E, Harford J, et al. Cancer registration in the Middle East. *Epidemiology* 2001;12:131–3.
6. Okobia MN. Cancer Care in sub-Saharan Africa—urgent need for population-based cancer registries. *Ethiop J Health Dev* 2003;17:89–98.
7. Parkin DM, Ferlay J, Hamdi-Chérif M, Sitas F, Thomas JO, Wabinga H, Whelan SL, eds. *Cancer in Africa. Epidemiology and prevention*. Lyon: IARC Press, 2003. 414 p. IARC Scientific Publication No. 153.
8. Freedman LS, Edwards BK, Ries LAG, Young JL, eds. *Cancer incidence in four member countries (Cyprus, Egypt, Israel and Jordan) of the middle east cancer consortium (MECC) compared with US SEER*. Bethesda: National Cancer Institute, 2006. 150p. NIH Publication No. 06-5873.
9. Akhtar SS, Abu Bakr MA, Dawi SA, Huq IU. Cancer in Libya—a retrospective study 1981–1985. *Afr J Med Med Sci* 1993;22:17–24.
10. Sara NH, Rajesh K, Gahukamble LD, Fituri OM, Mangal DK. Gall bladder cancer in north eastern Libya. *East Afr Med J* 1998;75:417–21.
11. Singh R, Al-Sudani OE. Cancer mortality in Benghazi, Libyan Arab Jamahiriya, 1991–1996. *East Mediterr Health J* 2001;7:255–73.
12. Fritz A, Percy C, Jack A, Shanmugaratnam K, Sabin L, Parkin DM, Whelan S. *International classification of diseases for oncology*, 3rd edn. Geneva: World Health Organization, 2000. 240 p.
13. Jensen OM, Parkin DM, MacLennan R, Muir CS, Skeet R, eds. *Cancer registration: principles and methods*. IARC Technical Report, 1992. Lyon: IARC Press, 2003. 304 p. IARC Scientific Publication No. 95.
14. Tyczynski JE, Démaret E, Parkin DM, eds. *Standards and guidelines for cancer registration in Europe: the ENCR recommendations*, vol. I. Lyon: IARC Press, 2003. 97 p. IARC Technical Publication No. 40.
15. Parkin DM, Whelan SL, Ferlay J, Teppo L, Thomas DB, eds. *Cancer incidence in five continents*, vol. VIII. Lyon: IARC Press, 2002. 781 p. IARC Scientific Publication No. 155.
16. Ferlay J, Burkhard C, Whelan S, Parkin DM, eds. *Check and conversion programs for cancer registries (IARC/IACR tools for cancer registries)*. Lyon: IARC Press, 2005. 46p. IARC Technical Report No. 42.
17. Ferlay J, Bray F, Pisani P, Parkin DM, eds. *GLOBOCAN 2002: Cancer incidence, mortality and prevalence worldwide*. IARC cancer base No. 5, version 2.0. Lyon: IARC Press, 2004.
18. Shafey O, Dolwick S, Guindon GE, eds. *Tobacco control country profiles*, 2nd edn. Atlanta: American Cancer Society, 2005. 503 p.