

RESEARCH COMMUNICATION

Cancer Incidence in the Middle Eastern Population of California, 1988-2004

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Abstract

International statistics suggest lower cancer incidence in the Middle East and Middle Eastern (ME) immigrants in Europe, Australia, and Canada, but little is known from the United States. This study compares cancer rates in ME population with other race/ethnic groups in California from 1988 through 2004. ME cases in California cancer registry were identified by surname and ME population was estimated from U.S. Census data. Cancer rates for ME countries was obtained from Globocan. The ME incidence rate ratios for all sites combined in male and female were 0.77 and 0.82, respectively and were statistically significant. ME rates were significantly lower for cancers of the colon, lung, skin melanoma, female breast and prostate, and were significantly higher for cancers of the stomach, liver, thyroid, leukemia, and male breast. Cancer incidence in ME population in California was 2.4 times higher than rates in home countries. Incidence trends in ME males remained fairly stable but in females shows a slight decline in recent years. Cancer incidence in ME population is lower than non-Hispanic white and non-Hispanic Black, but is higher than rates for Hispanics and Asians, and ME countries. Improved data quality, chronic infections, acculturation, and access to screening services are some of the factors responsible for the observed patterns.

Key Words: Middle Eastern immigrants - cancer incidence - California - ethnic studies

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Introduction

International data suggest that cancer incidence in the Middle East is noticeably lower from incidence in the West (Parkin et al., 2002; Ferlay et al., 2004; Freedman et al., 2006). This difference is also noted in the first generation immigrants in Australia (McCredie et al., 1994), Sweden (Hemminki et al., 2002), and the Netherlands (Visser and van Leeuwen, 2007), but tend to diminish in next generations and upon acculturation (Herrington et al., 1994; Parkin and Khlat, 1996; Hemminiki and Li, 2002). The ME population is rapidly growing in the US and is estimated to grow to 2.5 million by 2010 (Camarota, 2002), with largest concentration in California that was estimated at a half a million in 2000 (Lopez, 2002). Nevertheless, published reports on patterns of cancer incidence in this population are extremely limited (Schwartz et al., 2004; Darwish-Yassine and Wing, 2005). The main reason is that this highly heterogeneous group of Arabs, North Africans, Afghanis, Armenians, Iranians, Sephardic Jews, and Turks that is held together by common geographical location, genetic backgrounds, common religions, languages, and ways of life, is officially not recognized as a distinct ethnicity (OMB, 1997) and is included with the white race (OMB, 2000).

Direct identification of ME populations in cancer

databases is not possible because their ethnic affiliation is not recorded and data collection on place of birth is generally incomplete (Nasser, 2005). An alternative approach is identification by common ethnic specific surnames. This approach is routinely used for identification of Hispanics (Word and Perkins, 1996; NAACCR, 2005) in the US and South Asians in the United Kingdom (Nanchahal et al., 2001; Cummins et al., 1999). Additionally, surname identification has specifically been used to study cancer incidence in the South Asian population in California (Jain et al., 2005), Arab-American population in Michigan (Schwartz et al., 2004; Darwish-Yassine and Wing, 2005), the Iranian population in Canada (Yavari et al., 2005), and birth outcome in women with Arabic surname in California (Lauderdale, 2006). The objective of this report is to communicate the results of matching a recently developed list of common Middle Eastern surnames with the California cancer registry file and to describe the patterns of cancer incidence in the ME population in California.

Materials and Methods

Cases

California Cancer Registry (CCR) is a population-based, follow-up registry that began statewide data

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collection in 1988 and has previously been fully described (Kwong et al., 2001). It is the largest follow up cancer registry in the US and has collected information on all cancers, except the non-melanoma skin cancers that are diagnosed or treated in California since 1988. Invasive and insitu cancers of the urinary bladder are combined in a single group, and insitu cancers of the uterine cervix have not been registered since 1996. CCR captures detailed data on the type of cancer, demographics of the patients, diagnostic variables, first course of treatment, and follow up information. Race and ethnicity are generally categorized into four mutually exclusive groups of: non-Hispanic White (NHW), non-Hispanic Black (NHB), Hispanic (HSP), and non-Hispanic Asian/Pacific Islanders (API).

Ethnic identification

Cases with ME origin were identified by matching the newly developed list of common ME surnames with the October 2006 extract of the CCR incidence file that includes over 2,400,000 new primary cases diagnosed from 1988 through 2004. The list of 49,610 ME surnames was directly matched with the last names of cases on the incidence file. To reduce the impact of cross ethnic marriages, the surnames of about 11 % of women were replaced by their maiden names when it was available and different. The deterministic matching of the surname list and cancer registry incidence file resulted in identification of 33,700 cancer cases. After excluding 484 cases of benign brain and borderline malignancies and 499 cases of insitu cervical cancers that were registered prior to 1996, a total of 32,717 cases were selected for final analysis.

Population estimates

Official estimates for the Middle Eastern population in California with the detail required for calculation of age adjusted rates are not available. For the present study, this population was estimated from the Census Public Use Microdata Samples (PUMS) from the 1990 census returns and the ongoing American Community Survey PUMS for 2000 through 2004 (U.S. Census Bureau). The following ancestries were selected to represent the Middle East: Afghan, Algerian, Arabian, Armenian, Assyrian, Chaldean, Egyptian, Iranian, Iraqi, Israeli, Jordanian, Libyan, Middle Eastern, Moroccan, Palestinian, Syrian,

Tunisian, Turkish, and Yemeni. Population estimates for individual years from 1988 through 1999 were calculated by interpolation and assuming a linear increase between 1990 census PUMS and 2000 American Community Survey PUMS. Estimates for 2000 through 2004 were directly extracted from the American Community Survey PUMS. Population estimates for other race/ethnicity groups were provided by CCR.

Middle East cancer rates

Cancer rates for the Middle East were produced from the Globocan 2002 database that is created and maintained by the International Agency for Research on Cancer (IARC) (Ferlay et al., 2004). The accuracy of the data presented in Globocan varies by country. For countries with reliable cancer data systems, the Globocan estimates are based on the actual statistics obtained from the national registries. For countries with less than optimal data, various statistical models are used to arrive at reasonable estimates. For most Middle Eastern countries that lack reliable information, estimates are based on the average of the neighboring countries. The following countries were grouped to provide an overall estimate of incidence rate for the Middle East: Afghanistan, Algeria, Armenia, Azerbaijan, Bahrain, Egypt, Georgia, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi-Arabia, Syria, Tunisia, Turkey, United Arab Emirates, Yemen.

Statistical analysis

Incidence rates were age adjusted to the US 2000 standard population in 18 age categories of 5 years each (0-4, 5-9,...,85+), and expressed per 100,000. For comparison with the Middle Eastern countries, the average 2001-2003 incidence rates for Middle Easterners in California was age adjusted to the World standard population with five age categories (0-14, 15-44, 45-54, 55-64, 65+). Age adjusted rates were directly compared with the confidence limits set at 95 % (Boyle and Parkin, 1991).

Results

Table 1 presents the distribution by race/ethnicity and place of birth for the 33,700 cancer cases that are identified as Middle Easterners in this. Overall, 1.4 % of all cases

Table 1. Distribution of Middle Eastern Cancer Cases* by Place of Birth and Race/Ethnicity, California Cancer Registry 1988-2004

Place of Birth	Middle Eastern					Total	Non-Middle Eastern
	NHW	NHB	HSP	API	OTH		Total
All US outside of California	2,217	97	43	33	15	2,405	757,300
California	1,771	43	98	50	13	1,975	377,416
All Other Countries	2,253	85	233	750	15	3,336	294,099
Middle East	16,469	30	67	460	124	17,150	19,546
Unknown	7,022	111	180	630	891	8,834	952,836
Total	29,732	366	621	1,923	1,058	33,700	2,401,197

* Identified by surname. NHW: Non-Hispanic White, NHB: Non-Hispanic Black, HSP: Hispanic, API: Non-Hispanic Asian/Pacific Islanders, OTH: Other, Unknown

Table 2. Age-Adjusted Incidence Rates and Relative Risks (95%CI) of Invasive Cancer by Sex and Middle Eastern Ethnicity Compared to Non-Hispanic Whites, California 1988-2004

Site	Male					Female				
	Non-Hispanic white		Middle Eastern		RR (95% CI)	Non-Hispanic white		Middle Eastern		RR (95% CI)
	rate	cases	rate	cases		rate	cases	rate	cases	
All Sites	586.7	813,499	451.03	16,871	0.77(0.76-0.78)	444.20	760,530	366.20	14,195	0.82(0.81-0.84)
Brain & CNS	9.24	12,824	7.71	349	0.83(0.75-0.92)	6.31	9,905	6.03	253	0.96(0.84-1.08)
Breast	1.29	1,780	1.80	73	1.40(1.05-1.85)	146.89	243,949	126.16	5,025	0.86(0.84-0.88)
Cervix Uteri	~	~	~	~	~	8.21	12,495	7.22	299	0.88(0.79-0.98)
Colon	44.94	60,819	36.83	1,331	0.82(0.78-0.86)	34.04	63,565	30.33	1,097	0.89(0.84-0.95)
Colon & Rectum	63.81	86,992	51.08	1,878	0.80(0.77-0.84)	45.70	84,468	41.31	1,508	0.90(0.86-0.95)
Corpus Uteri	~	~	~	~	~	25.94	44,223	18.16	720	0.70(0.66-0.75)
Esophagus	7.28	10,141	2.77	95	0.38(0.33-0.43)	2.21	4,042	2.17	77	0.98(0.78-1.24)
Hodgkin Lymphoma	3.53	4,911	3.95	192	1.12(0.95-1.31)	2.80	3,978	3.16	144	1.13(0.94-1.35)
Kaposi Sarcoma	7.32	10,666	2.72	124	0.37(0.33-0.42)	0.13	242	0.60	22	4.62(2.01-10.6)
Kidney & Renal Pelvis	15.38	21,481	11.93	461	0.78(0.71-0.85)	7.21	12,383	6.45	252	0.89(0.79-1.01)
Larynx	7.13	10,106	6.60	256	0.93(0.82-1.05)	1.63	2,771	0.83	35	0.51(0.40-0.65)
Leukemia	17.20	23,170	19.12	727	1.11(1.02-1.21)	9.77	16,760	11.59	450	1.19(1.07-1.32)
Liver & Bile Ducts	5.81	8,067	8.27	310	1.42(1.23-1.64)	2.26	4,054	3.54	135	1.57(1.26-1.95)
Lung & Bronchus	87.54	122,041	54.26	1,942	0.62(0.60-0.64)	59.25	105,236	24.07	898	0.41(0.39-0.42)
Melanoma of the Skin	29.49	41,213	4.89	214	0.17(0.16-0.18)	18.47	28,885	5.87	237	0.32(0.30-0.34)
Mesothelioma	2.37	3,243	1.59	60	0.67(0.54-0.84)	0.42	748	0.52	20	1.24(0.74-2.06)
Multiple Myeloma	6.28	8,607	6.46	239	1.03(0.89-1.18)	3.93	7,145	4.55	171	1.16(0.98-1.37)
Non-Hodgkin's	25.34	35,139	19.50	800	0.77(0.72-0.82)	15.65	27,295	15.24	595	0.97(0.90-1.06)
Oral Cavity & Pharynx	18.61	26,191	7.50	294	0.40(0.37-0.44)	7.78	13,427	4.63	177	0.60(0.53-0.67)
Ovary	~	~	~	~	~	15.87	26,627	13.37	527	0.84(0.78-0.91)
Pancreas	12.80	17,526	11.89	421	0.93(0.84-1.03)	9.76	18,113	8.73	316	0.89(0.80-1.00)
Prostate Gland	166.52	233,089	133.90	4,892	0.80(0.78-0.83)	~	~	~	~	~
Rectum	18.87	26,173	14.26	547	0.76(0.70-0.82)	11.66	20,903	10.98	411	0.94(0.85-1.04)
Stomach	10.37	14,143	16.62	565	1.60(1.43-1.79)	4.30	8,017	10.22	358	2.38(2.02-2.80)
Testis	7.12	10,204	3.84	214	0.54(0.49-0.60)	~	~	~	~	~
Thyroid Gland	3.74	5,336	5.50	254	1.47(1.26-1.72)	9.39	13,846	14.35	615	1.53(1.38-1.69)
Urinary Bladder	42.27	57,452	42.50	1,517	1.01(0.95-1.06)	10.19	18,694	8.75	304	0.86(0.77-0.96)

Rate: Age Adjusted Incidence Rate per 100,000. RR: Middle East/non-Hispanic White Rate Ratio. Male breast cancer includes the insitu cases. ~ Not Applicable

registered during the study period were identified as ME, and 88 % of all those born in the Middle East were positively identified by the surname list. Although the percentage of cases with unknown place of birth is 40% for all cases, it is only 26% for ME cases. This observation suggests that information on the place of birth is more frequently collected for this ethnic population. Of the 24,866 ME cases with known place of birth 69 % were first generation immigrants born in the Middle East, 18% were born in the US and 13 % were born in other countries. When dichotomized into Arab/non-Arab categories, 70% of the first generation immigrants were from the non-Arab countries. Slightly over 90 % of the identified cases are classified as non-Hispanic White. The highest concentration of ME cases was found in Los Angeles County (54.5%), followed by Orange County (8.5%), San Diego (5.3%), Santa Clara (4.5%), Fresno (3.3%), and Alameda (3.2%).

Table 2 presents the age adjusted incidence rates of

invasive cancers in California residents by sex and ethnicity. The comparison is between the ME and the NHW population and is limited to invasive cases, except for breast cancer in men that include the insitu cases.

Examination of this table reveals that the overall incidence of cancer in ME population is significantly lower than that of the NHW. The ME population, however, have higher rates for few sites such as stomach, liver and bile ducts, thyroid, leukemia, and female Kaposi sarcoma, and lower rates for cancers of the lung and bronchus, colorectal, and melanoma of the skin. Incidence of breast cancer in ME men is significantly higher than the NHW while in women it is in the opposite direction and is significantly lower.

Table 3 presents the incidence rates of the insitu cancers in the ME population and show that with the exception of colorectal cancers in men, the insitu diagnosis for all other cancers are significantly lower in ME men and women.

Table 3. Age-Adjusted Incidence Rates of the *In situ* Cancers by Sex and Middle Eastern Ethnicity, California 1988-2004

Site	Male					Female				
	Middle Eastern		Non-Hispanic white		RR (95% CI)	Middle Eastern		Non-Hispanic white		RR (95% CI)
	rate	cases	rate	cases		rate	cases	rate	cases	
All Sites Combined	10.02	384	24.40	34,040	0.41 (0.38-0.44)	31.40	1,267	44.86	72,187	0.70 (0.67-0.73)
Breast	~	~	~	~	~	22.76	915	26.00	41,662	0.88 (0.82-0.93)
Colon and Rectum	4.56	171	5.31	7,423	0.86 (0.74-1.00)	2.35	91	2.93	5,231	0.80 (0.66-0.98)
Melanoma of the Skin	2.52	104	15.36	21,400	0.16 (0.15-0.18)	3.18	133	9.28	14,907	0.34 (0.31-0.38)

Rate: Age Adjusted Incidence Rate per 100,000. RR: Middle East/non-Hispanic White Rate Ratio. ~ Not applicable.

Table 4. Age-Adjusted Incidence Rates and Relative Risks (95%CI) for Invasive Cancer in the Middle East and Middle Eastern Immigrants in California

Site	Male					Female				
	California		Middle Eastern		RR (95% CI)	California		Middle Eastern		RR (95% CI)
rate	cases	rate	cases	rate		cases	rate	cases		
All Sites Combined	297.70	3,943	126.50	187,514	2.35 (2.14-2.59)	257.70	3,306	107.20	175,985	2.40 (2.15-2.69)
Brain & Nervous	6.41	79	3.60	6,437	1.78 (0.93-3.41)	4.60	52	2.70	4,840	1.71 (0.78-3.74)
Breast	1.10	14	~	~	~	99.06	1,214	27.50	46,033	3.60 (2.94-4.41)
Cervix Uteri	~	~	~	~	~	3.68	44	3.80	5,686	0.97 (0.54-1.73)
Colorectal	35.85	480	8.40	12,407	4.27 (3.06-5.96)	25.55	358	7.30	11,334	3.50 (2.43-5.03)
Corpus Uteri	~	~	~	~	~	14.78	185	3.90	6,448	3.79 (2.24-6.40)
Esophagus	1.63	23	4.90	6,814	0.33 (0.23-0.48)	1.26	19	3.70	5,501	0.34 (0.24-0.49)
Hodgkin Disease	4.04	45	1.90	3,928	2.12 (0.94-4.79)	2.41	26	1.20	2,272	2.01 (0.70-5.74)
Kidney	9.73	130	2.40	3,677	4.06 (2.13-7.72)	3.90	52	1.60	2,632	2.44 (0.97-6.15)
Larynx	3.45	45	5.60	7,885	0.62 (0.41-0.94)	0.27	4	0.90	1,380	0.30 (0.14-0.64)
Leukemia	14.07	172	5.30	9,690	2.65 (1.57-4.49)	8.41	103	3.90	7,195	2.16 (1.13-4.11)
Liver	6.97	93	3.80	5,289	1.83 (1.05-3.21)	2.88	39	2.10	3,254	1.37 (0.69-2.73)
Lung & Bronchus	34.15	459	22.20	30,496	1.54 (1.26-1.88)	15.55	224	3.80	5,860	4.09 (2.52-6.64)
Melanoma of the Skin	3.52	45	1.00	1,450	3.52 (1.26-9.85)	4.25	53	0.90	1,517	4.73 (1.62-13.7)
Multiple Myeloma	3.63	49	1.00	1,381	3.63 (1.46-9.05)	2.63	35	0.70	1,093	3.76 (1.20-11.8)
Nasopharynx	1.09	14	1.80	3,135	0.60 (0.27-1.33)	0.18	2	0.80	1,419	0.23 (0.10-0.53)
Non-Hodgkin's	14.62	191	5.20	8,922	2.81 (1.72-4.60)	9.66	129	3.70	6,405	2.61 (1.51-4.53)
Oral Cavity	4.23	54	3.20	4,703	1.32 (0.73-2.39)	2.62	35	2.00	3,077	1.31 (0.61-2.81)
Ovary	~	~	~	~	~	8.85	111	7.50	12,345	1.18 (0.76-1.83)
Other Pharynx	1.07	13	0.80	1,198	1.34 (0.34-5.24)	0.27	3	0.30	548	0.89 (0.20-3.97)
Pancreas	7.29	99	2.30	3,073	3.17 (1.71-5.88)	5.40	77	1.50	2,167	3.60 (1.68-7.71)
Prostate Gland	85.52	1,155	8.00	10,182	10.7 (8.28-13.8)	~	~	~	~	~
Stomach	10.31	140	11.50	15,994	0.90 (0.67-1.20)	6.50	93	5.80	8,845	1.12 (0.73-1.72)
Testis	3.37	40	0.90	2,014	3.74 (1.81-7.75)	~	~	~	~	~
Thyroid Gland	6.30	78	1.10	1,977	5.73 (2.12-15.5)	15.04	171	3.40	6,212	4.42 (2.55-7.67)
Urinary Bladder	26.10	352	15.40	21,778	1.70 (1.31-2.20)	5.56	78	3.00	4,655	1.85 (1.02-3.36)

Rate: Age Adjusted Incidence Rate per 100,000. RR: Middle East/non-Hispanic White Rate Ratio., California Immigrants: CCR 2001-2003, Middle East: Globocan 2002 ~ Not Applicable

Table 4 compares the incidence rates of invasive cancers in ME population in California with the rates for the Middle East. This table reveals that the overall incidence of cancer in California is significantly higher than similar rates in the Middle East, except for the larynx and esophagus that have significantly lower rates in both men and women. There is an eleven fold increase for prostate cancer, and six fold increase in thyroid cancer in ME men in California. In ME women, there is a five fold increase in melanoma of the skin and cancer of the thyroid gland.

Figures 1 and 2 present the general time trend of incidence rates in ME men and women in comparison with other major race/ethnicities in California. As noted

in these figures, incidence rates in men and women are uniformly lower than rates for the non-Hispanic White and non-Hispanic Black, and are uniformly higher than rates for the Hispanics and Asian/Pacific Islanders.

Discussion

The analysis presented in this report includes a 17 year period from 1988 through 2004 that ensures sufficient numbers for calculating stable rates for most sites. The overall incidence of all cancer sites combined is lower in the ME population and since 69 % of these cases are known to be the first generation immigrants, acculturation has probably not played a significant role in shaping these

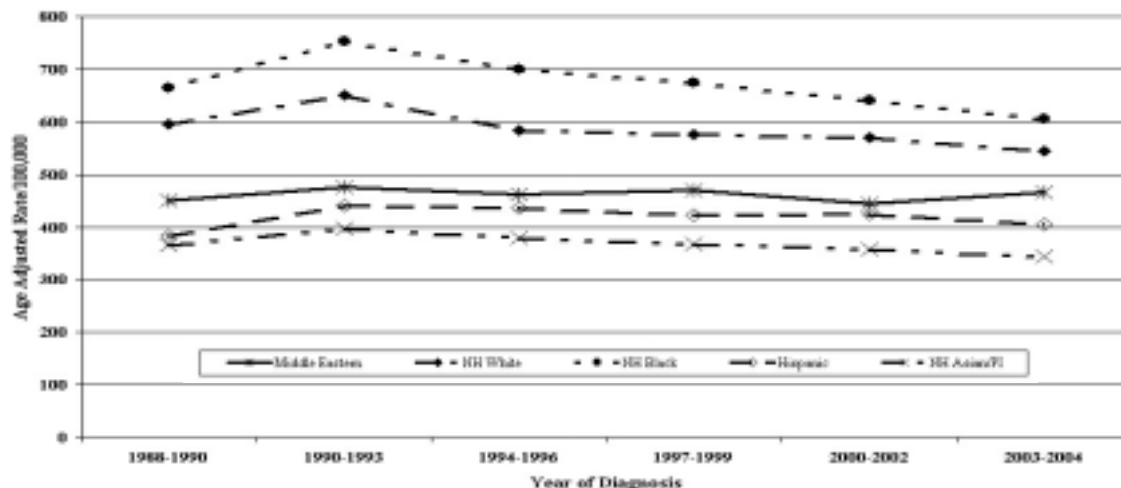


Figure 1. Incidence of Invasive Cancers in Men by Race/Ethnicity, 1988-2004

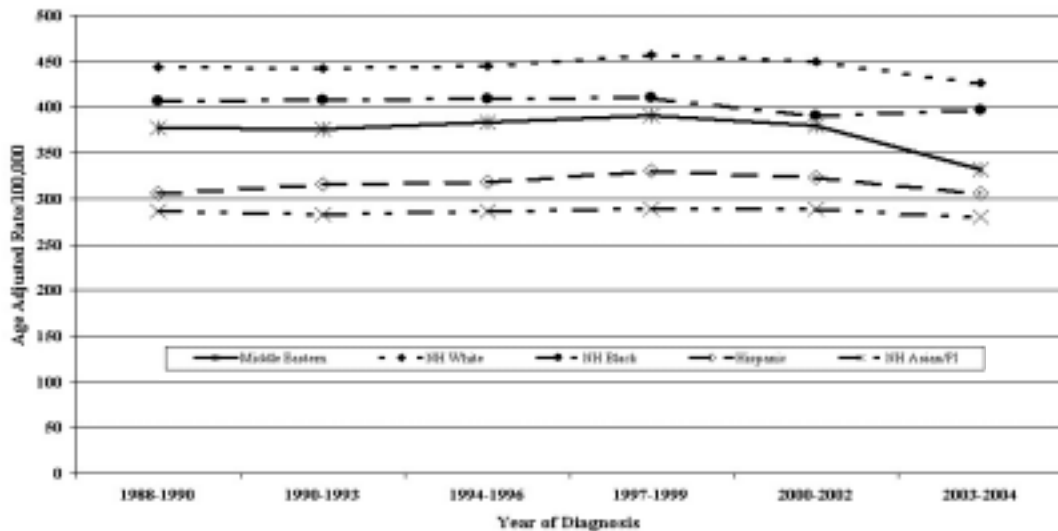


Figure 2. Incidence of Invasive Cancers in Women by Race/Ethnicity, 1988-2004

results. This assumption is further supported by lower rates of tobacco related cancers such as the lung and bronchus, and oral cavity; lower incidence of female breast cancer that is strongly associated with cultural preferences including pregnancy at earlier age; and higher incidence of cancers of the stomach and liver that are associated with chronic bacterial and viral infections that are more common in the Middle East. Of particular interest is the observation of significantly higher incidence of breast cancer in men, Kaposi sarcoma in women, and thyroid cancer in men and women with ME ethnicity. Possible reasons for these observations may include genetic predisposition for male breast cancer, higher incidence of classic Kaposi in the Middle East (Iscovich et al., 1998), and widespread use of radiation therapy for fungal diseases of the scalp early last century in the Middle East that is shown to be associated with thyroid cancer in later life (Schafer et al., 2001; Schneider and Sarne, 2005). Lower incidence of melanoma of the skin may be due to a combination of less leisure exposure to sunshine and higher resistance due to higher skin pigmentation in the ME population. Differences in cancer incidence among various ethnic groups can have significant impacts on the overall rates in multiethnic populations. The generally lower incidence rates in the Hispanic population has made it necessary for California to produce separate rates for the Hispanic and the non-Hispanic populations (Kwong et al., 2001), and a national study has shown that higher death from cervical cancer in the immigrant population has slightly increased the overall mortality rates for cervical cancer in the US (Seef and McKenna, 2003).

In the present study, lower incidence of all invasive cancers in ME population has only slightly modified the incidence rate for all cancers combined in the NHW population, but has actually reduced the incidence rate for invasive melanoma of the skin in NHW men by almost 3%.

Lower incidence of *insitu* cancers, Table 3, that is generally identified through screening and early detection suggests lack of proper access to these services. This

situation may arise from lack of financial support for obtaining health insurance, or lack of knowledge, attitude, or practice in this ethnic population, and is worth further research.

When compared with cancer rates in the Middle East, rates in the ME population of California is significantly higher. This is not unusual and has previously been reported in other migrant studies (Darwish-Yassine and Wing, 2005; Yavari et al., 2006). Probable reasons for such observations include:

a) Higher quality of data in the host country. Since most ME countries do not have accurate population based cancer registries, the estimates provided by Globocan are often based on rates in neighboring countries. A recent report suggests that these estimates may be far from an accurate representation of actual rates (El Mistiri et al., 2007). Even with established cancer registries, the quality of healthcare services and health records in the Middle East are generally not comparable to those available to the host countries such as the US. This suggestion is supported by increased incidence of malignancies that are difficult to correctly diagnose as primary or are easily missed. Examples include primary cancers of the liver, pancreas, prostate, and colorectal, all of which have higher incidence in ME population who are living outside of the Middle East.

b) The immigrant population is generally not a true representative of the general population of the home countries and has rates that are substantially different. For example, Iran, Turkey, and Afghanistan are three countries where over 90% of the populations are Muslim (Goring, 1994), and yet among cases from these three countries for whom information on religion was available, 37% were Christian, 24% were Jews, and only 15% were Muslims (data not shown).

c) Acculturation to the way of life in the host country, particularly in those who are born in the host country or have immigrated at young age. This is suggested by increase in cancers of the lung and bronchus, female breast, and reduction in esophageal cancer that is one of

the major cancers reported from the Middle East. These observations are in general agreement with other studies.

A study of Iranian immigrants in Canada has shown that the overall cancer rates in the immigrant group are lower than the rates for Canadians, while rates for some cancers such as female breast, prostate, stomach, and esophagus are halfway between the rates in Iran and Canada (Yavari et al., 2006). Studies of Arab-Americans in Michigan have also shown lower incidence for cancers of the lung and bronchus and melanoma of the skin and higher incidence for cancers of the urinary bladder and kidney (Schwartz et al., 2004; Darwish-Yassine and Wing, 2005). Similar differentials have also been noticed for female breast and prostate cancers in the South Asian immigrants in California in comparison to Indians in India (Jain et al., 2005).

This is the first report of cancer incidence in a population with ME origin in California or anywhere else in the US. It includes cases with non-Arab heritage and is different from a few studies that have included only the Arab-Americans. The reported analysis is based on age-adjusted rates using the best available estimates of cases and population. In the absence of official identifiers for ME ethnicity, case identification for this study was achieved by direct matching of last names with a list of common ME surnames. The accuracy of the case identification in this study may be inferred from Table 1 that shows a high proportion of cases with known place of birth in the Middle East were positively identified.

Evaluation of the distribution by race shows that about ten percent of cases are identified with a race other than NHW. This is not unusual. Some of the people from North Africa have dark complexions and can easily be mistaken for blacks. Also, data on self identified race/ethnicity is generally not verified by the staff at the healthcare facility during patient registration, and is not edited by central cancer registries. Although the overall agreement of the registered and self reported race/ethnicity is high (Clegg et al., 2007), a particular finding of this study that 16 percent of cases born in Afghanistan, 8 percent of those born in various countries of the Arabian peninsula, and three percent of cases born in Iran have identified their race as Asian, suggests that self identification may be influenced by other factors, including lack of knowledge of the exact definition of Asian race on the part of the patients. Another issue in using names for identification of ME ethnicity is mixing of the Arabs and non-Arabs into one group. This situation arises from the fact that many of the ME surnames extensively overlap across geographical areas, religions, and ethnic sub-populations. Names based on Islamic traditions are common among Pakistanis, Indians, Indonesians, and parts of the Philippines, all of which are classified as Asian. Similarly, Armenian names are common among the diaspora of Orthodox Christians around the world and structurally overlap with some of the non-Christian Iranian surnames. Thus some geographical and minor ethnic overlaps are inevitable, although the overall commonality of being identified as Middle Easterner overrides these minor differences. In this context, the ME surname list is similar to the list of common Hispanic names that does not

differentiate the national origin of cases, but is widely used to identify Hispanic ethnicity. Further research can help with refinement of the procedures and solving some of these issues.

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