RESEARCH ARTICLE

Sociological Transition and Breast Cancer in the Arab World: the Experience of Lebanon

Najla A Lakkis[1], Salim M Adib[2], Ghassan Hamadeh[1], Rana El Jarrah[1], Mona H Osman[1]*

Abstract

Background: Breast cancer is the leading cause of cancer death among females in Lebanon. This study aimed at analyzing its epidemiology in the country over time. **Methods:** Data were extracted from the Lebanese National Cancer Registry (NCR) for the years 2004 through 2010. Age-standardized and age-specific incidence rates for cancers per 100,000 population were calculated. **Results:** Breast cancer ranked first, accounting for an average of 37.6% of all new female cancer cases in Lebanon during the period of 2004-2010. Breast cancer was found to have been increasing faster than other hormone-related women's cancers (i.e. of the ovaries and corpus uteri). The breast cancer age-standardized incidence rates (world population) (ASRw) increased steadily from 2004 (71.0) to 2010 (105.9), making the burden comparable to that in developed countries, reflecting the influence of sociological and reproductive patterns transitioning from regional norms to global trends. The age-specific incidence rates for breast cancer rose steeply from around age 35-39 years, to reach a first peak in the age group 45-49 years, and then dropped slightly between 50 and 64 years to rise again thereafter and reach a second peak in the 75+ age group. Five-year age-specific rates among Lebanese women between 35 and 49 years were among the highest observed worldwide in 2008. **Conclusion:** Breast cancer is continuously on the rise in Lebanon. The findings of this study support the national screening recommendation of starting breast cancer screening at the age of 40 years. It is mandatory to conduct an in-depth analysis of contributing factors and develop consequently a comprehensive National Breast Cancer Control strategy.

Keywords: Breast neoplasms- Lebanon- developed countries- registries- incidence

Introduction

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females worldwide, accounting respectively for 25.2% of total cancer cases (excluding non-melanoma skin cancers) and 14.7% of cancer deaths in 2012 (Ferlay et al., 2010a; Ferlay et al., 2010b; Ferlay et al., 2015). The highest incidence of breast cancer is in Western and Northern Europe (Age-standardized incidence rates (world population) (ASRw): 89.9 and 84.0 respectively), followed by Australia/New Zealand (ASRw: 85.5), and Northern America (ASRw: 76.7); while the lowest incidence is in Eastern Africa (ASRw: 19.3), Middle Africa (ASRw: 21.3), South-Central Asia (ASRw: 24.0) and Central America (ASRw: 26.0) (Ferlay et al., 2010b). Lebanon is a small developing country in the Middle East with an estimated population of around 5 million in 2013 (World Health Organization, 2015). Lebanon has health indices that are almost comparable to those of more developed countries, with a reported Infant Mortality Rate of 8 per 1000 live births in 2012, Maternal Mortality Ratio

of 16 per 100,000 live births in 2013, and Life Expectancy at Birth of 80 years in 2012 (83.2 for females and 79.6 for males) (World Health Organization, 2015; World Health Organization, 2016a; World Health Organization, 2016b).

The Lebanese National Cancer Registry (NCR) was officially restarted in 2002, and is believed to be an almost absolute count of all incident cases in Lebanon (Adib et al., 2008). The NCR has completed its cancer incidence data for the years 2004 through 2010 and published the data on the official website of the Ministry of Public Health (MoPH). The estimated age-standardized incidence rate per 100,000 (ASRw) for female breast cancer in Lebanon was 71.0 in 2004 (Lakkis et al., 2010). This rate was higher than those estimated for Arab nations but lower than those observed in North America, West Europe and Israeli Jews (Lakkis et al., 2010). The Lebanese NCR showed that the five-year age-specific rates among Lebanese women in 2004 were among the highest observed worldwide for the age groups 35–39, 40–44 and 45–49 years (Lakkis et al., 2010). The MoPH in Lebanon recommends screening for breast cancer yearly starting at the age of 40 years (Adib et al., 2009); whereas most Western countries recommend

[1]*Department of Family Medicine, American University of Beirut Medical Center (AUB-MC),* [2]*Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon. *For Correspondence: mo08@aub.edu.lb*

starting the screening at the age of 50 years (Forouzanfar et al., 2011; Youlden et al., 2012).

The main aim of this study is to analyze the 7-year incidence rates for breast cancer and study the related trends, and to compare it to regional and Western countries. The results of this study would contribute to the national strategy to control breast cancer in Lebanon including current screening recommendations. This study will also discuss different possible contributing factors.

Materials and Methods

The age-standardized incidence rate was computed using the WHO standard world population of 2001 (ASRw) (Hill and Menhamou, 1995). The ASRw and the age-specific incidence rates were obtained from the Lebanese NCR figures for the years 2004 to 2010 (Ministry of Public Health, 2010) and were expressed as per 100,000 population. The age-standardized incidence rate (ASR) is a summary measure of a rate that a population would have if it had a standard age structure. Standardization is necessary when comparing several populations that differ with respect to age structure. The most frequently used standard population is the World Standard Population (Hill and Menhamou, 1995). The age-specific incidence rate is the number of new cancer cases happening during a specific period, in a population of a specific age and sex group, divided by the number of midyear population of that age and sex group (Centers for Disease Control and Prevention, 2014). The NCR does not include data on non-invasive precancerous lesions and in-situ lesions and non-melanoma skin cancer.

The calculated ASRw and age-specific rates were subsequently compared with rates from selected regional and Western countries as published online or from Globocan 2008 (Figures 1, 2).

Results

Breast cancer has been the leading cancer among Lebanese females since the 1960s (Abou-Daoud, 1966). Over a seven-year period (2004-2010), breast cancer ranked as the first most common cancer in women and it represented an average of 37.6% of all new female

cancer cases in Lebanon. Other hormonal-related women's cancers were also common, namely ovarian cancer that ranked fifth and corpus uteri cancer that ranked sixth. However, breast cancer has been increasing at a faster rate than both ovarian and corpus uteri cancers (figure 1). Breast cancer ASRw rose steadily from 2004 (71.0) through 2010 (105.9) with an increase of 49.2% in 7 years. An increase in the ASRw of the other female hormone-dependent cancers, which share many similar risk factors (Jemal et al., 2011; Cramer, 2012), was also noted during the same period even though their total caseloads remained much smaller than that of breast cancer. Corpus uteri cancer incidence rose from 6.3 in 2004 to 8.5 in 2010 (an increase of 34.9% in 7 years) and ovarian cancer incidence rose from 8.3 in 2004 to 8.8 in 2010 (an increase of 6.0% in 7 years).

Throughout the years of 2005 to 2010, the age-specific incidence rates for female breast cancer rose steeply at around the age group of 35-39 years, to reach a first peak in the age group 45-49 years, and then drop slightly between 50 and 64 years to rise again thereafter and reach a second maximal peak in the 75+ age group (figure 2 and table 1). The age-specific incidence rates for ovary and corpus uteri cancers in Lebanon for the years 2005-2010 are showed in figure 2 as well.

Around 89% of breast cancers in Lebanon were diagnosed starting the age of 40 years onwards during the period of 2004-2010 (90.0% in 2008), with a significant percentage detected in women younger than 50 years (around 40% in 2008 and in 2004-2010). This percentage was much higher than the ones observed in Western countries for example 19.6% in UK in 2008-2010 and 18.0% in Sweden in 2008 (Cancer Research UK, 2013; Engholm et al., 2013), but lower than those observed in some Arab countries (El-Zaemey et al., 2012; Chouchane et al., 2013).

Breast cancer in Lebanon accounted for 37.9% of all new female cancer cases in 2008 compared to 30.2% in the Middle East and Northern Africa (MENA) region and 22.9% in the world (Ferlay et al., 2010a). This proportion was even higher than in some European nations such as Belgium and Denmark (35.4% and 28.5% respectively in 2008) (Ferlay et al., 2010a; Belgian Cancer Registry, 2011; Engholm et al., 2013; UNECE, 2013).
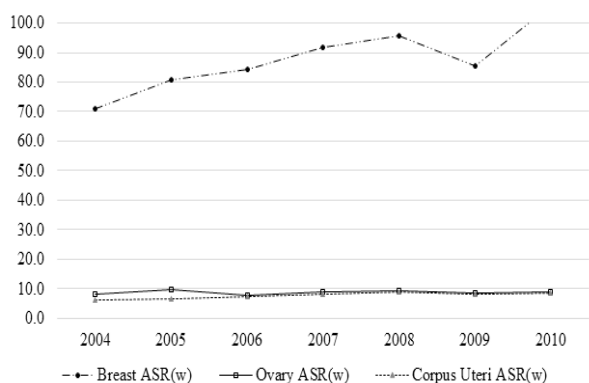

Figure 1. Age-Standardized Incidence Rates (World Population) for Female Breast, Ovary and Corpus Uteri Cancers in Lebanon for the Years 2004-2010
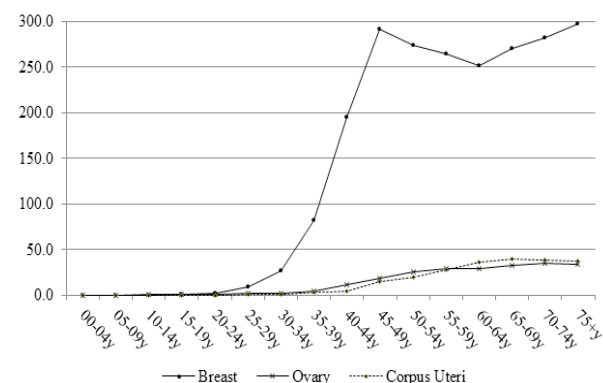

Figure 2. Age-Specific Incidence Rates for Female Breast, Ovary and Corpus Uteri Cancers, Lebanon 2005-2010

Table 1. Breast Cancer Age-Standardized Incidence Rates (World) i.e. ASR(w) and Age-Specific Rates per 100,000 females in Lebanon for the years 2004-2010

	2004	2005	2006	2007	2008	2009	2010	Medican 2004-2010
20-24y	1.4	0.6	1.6	1.6	2.6	1.5	1.5	1.5
25-29y	7.8	9.4	9.2	4.5	9.9	10.8	11.6	9.0
30-34y	17.7	27.8	20.2	28.0	19.3	29.5	33.9	25.2
35-39y	67.7	79.0	86.5	76.4	78.7	87.7	82.0	79.7
40-44y	163.7	208.6	179.1	209	203.6	167.9	200.5	190.3
45-49y	209.3	213.0	268.2	286.2	338	280.2	366.6	280.2
50-54y	241.6	270.6	233.2	288.7	276.5	237.1	338.6	269.5
55-59y	239.7	206.0	255.1	270.2	271.1	239.2	344.3	260.8
60-64y	171.3	231.9	235.1	246.5	259.2	240.2	295.7	240.0
65-69y	202.4	220.6	237.2	227.1	320.5	290.9	324.4	260.4
70-74y	197.0	246.2	254.6	330.4	303.2	261.5	299.3	270.3
75+y	200.2	277.9	332.5	343.1	267	283.8	282.7	283.9
ASR(w)	71.0	80.7	84.4	91.8	95.7	85.6	105.9	87.9
Total n. of cases	1274	1,451.0	1617	1747	1717	1603	1993	1,629.0

Reference: 2004 to 2010 (Ministry of Public Health, 2010)

The breast cancer ASRw in Lebanon (95.7 in 2008) was lower than the ASRw reported in Western countries such as Belgium (106.0 in 2008) and Denmark (99.9 in 2008), but higher than the ASRw in the United Kingdom (UK) (91.9 in 2008-2010) and the United States (US) SEER (89.4 in 2006-2010) (United States Census Bureau, 2008; Ferlay et al., 2010a; Belgian Cancer Registry, 2011; Cancer Research UK, 2013; Engholm et al., 2013; Howlader et al., 2013; UNECE, 2013) (table 2). This rate was almost comparable to that of the Israeli Jewish women (ASRw: 94.3) (Ministry of Health, 2008). However, it remained higher compared to other MENA region (32.7) (Ferlay et al., 2010a; Ferlay et al., 2010b) countries (table 3) (Chouchane et al., 2013).

Ovarian ASRw in Lebanon (9.3 in 2008) was higher than the one estimated for the world (6.3 in 2008) and for MENA region (4.8 in 2008) (Ferlay et al., 2010a). It was comparable to the one estimated in developed countries (9.4 in 2008) (Jemal et al., 2011) and Israeli Jewish (8.9 in 2008)(Ministry of Health, 2008).

Corpus uteri ASRw in Lebanon (8.8 in 2008) was almost similar to the one estimated for the world (8.2 in 2008) and higher than the one estimated for MENA region (3.9 in 2008) (Ferlay et al., 2010a). But, it was lower than the one estimated in developed countries (12.9 in 2008) (Jemal et al., 2011), and Israeli Jewish (14.7 in 2008) (Ministry of Health, 2008).

Table 2. Breast Cancer Age-Standardized Incidence Rates (World Population) and Age-Specific Rates per 100,000 Females in Lebanon Compared to Non-MENA* Countries

Breast	Lebanon	Iran	Malaysia	Japan	USA	England	Denmark	Finland	Sweden	Belgium
	2008	2005-2006	2007	2007	2006-2010	2009	2008	2008	2008	2008
ASR(w)§	95.7	23.2	29.1	52.0	89.4	90.3	99.9	85.5	79.6	106.0
20-24y	2.6	0.8	1.6	1.6	1.6	2.0	-	0.6	0.7	3.5
25-29y	9.9	5.9	5.7	5.6	8.6	10.1	8.3	4.3	8.1	8.8
30-34y	19.3	14.7	16.0	22.6	26.2	27.2	31.4	20.0	27.4	35.0
35-39y	78.7	33.1	29.6	55.4	59.1	61.2	56.6	45.6	51.6	75.4
40-44y	203.6	47.9	54.9	113.0	122.2	122.1	115.5	100.8	103.6	165.5
45-49y	338	74.0	95.1	171.4	187.7	202.2	175.3	183.0	175.5	265.9
50-54y	276.5	74.3	90.6	155.5	222.8	274.2	258.1	274.0	219.2	304.1
55-59y	271.1	69.3	100.4	155.1	268.3	273.3	353.3	301.4	245.7	347.5
60-64y	259.2	69.1	85.5	157.6	346.2	358.4	450.0	391.5	321.8	394.3
65-69y	320.5	48.6	82.2	144.0	413.2	391.8	528.6	369.0	374.1	402.2
70-74y	303.2	43.7	63.1	141.0	424.6	302.8	408.6	287.5	337.7	360.1
75+y	267.0	47.2	53.7	110.0	405.7	388.6	371.3	295.0	291.0	365.2

The symbol "-" = 0-2 cases; *MENA, Middle East and North Africa region; §Age-standardized incidence rate world population; References, Lebanon (Ministry of Public Health, 2010); Iran (World Health Organization, 2008); Malaysia(Malaysia Ministry of Health, 2011); Japan (Matsuda et al., 2013); US-SEER (United States Census Bureau, 2008; Howlader et al., 2013); England (Office of National Statistics, 2009; Office of National Statistics, 2010); Denmark (Engholm et al., 2013); Finland (Engholm et al., 2013); Sweden (Official Statistics of Sweden, 2009); Belgium (Belgian Cancer Registry, 2011; UNECE, 2013)

Table 3. Breast Cancer Age-Standardized Incidence Rates (World Population) and Age-Specific Rates per 100,000 Females in Lebanon Compared to MENA* Countries

Breast	Lebanon	Cyprus	Jordan	Saudi-Arabia	Oman	Egypt (Aswan)	Egypt (Damietta)	Egypt (Minia)	Algeria (Algeria)	Morocco (Rabat)	Morocco (Casablanca)	Israeli Jewish	Israeli Arabs
	2008	2008	2008	2009	2008	2008	2009	2009	2007	2005	2005-2007	2008	2008
ASR(w)§	**95.7**	**76.6**	**50.4**	**22.7**	**21.6**	**63.9**	**41.4**	**35.7**	**65.1**	**35.8**	**36.4**	**94.3**	**56.2**
20-24y	2.6	6.1	0.3	1.1	-	4.2	1.7	4.2	1.2	-	0.5	4.3	-
25-29y	9.9	3.0	7.3	5.6	4.6	13.7	5.7	14.0	12.9	3.3	6.8	6.9	5.5
30-34y	19.3	29.9	17.3	14.0	11.0	28.9	29.5	28.3	38.5	27.6	18.1	36.9	26.3
35-39y	78.7	53.1	44.4	24.2	24.0	57.8	49.6	42.5	66.7	25.9	52.8	81.5	45.7
40-44y	203.6	111.3	93.0	47.8	50.0	140	78.2	56.0	163.6	100.0	96.8	131.3	82.7
45-49y	338	180.8	139.6	69.1	48.0	99.1	116.7	83.1	184.1	107.2	106.1	205.5	145.1
50-54y	276.5	224.7	154.1	62.1	71.0	220.7	107.8	109.7	181.9	88.3	108.2	237.4	199.2
55-59y	271.1	236	139.8	58.3	60.0	220.6	142.3	112.2	197.2	143.7	108.5	263	150.3
60-64y	259.2	316.4	193.3	74.8	35.0	184.4	127.1	145.9	238.1	85	103.2	365.1	228.6
65-69y	320.5	269.3	139.9	75.1	82.0	181.7	151.7	85.9	154.4	128.8	86.5	434.9	225.5
70-74y	303.2	324.7	198.3	62.7	58.0	215.1	93.5	81.6	162.5	67.4	85.9	459.4	126.6
75+y	267.0	271.4	147.1	43.8	111.0	296.9	89.9	83.5	116.2	55.4	53.2	343.5	170.2

The symbol '-' means "<3 cases; MENA, Middle East and North Africa region; §Age-standardized incidence rate world population; References: Lebanon (Ministry of Public Health, 2010); Cyprus (Pavlou et al., 2011); Jordan (Tarawneh et al., 2008); Saudi Arabia (Al-Eid et al., 2012); Oman (Sultanate Oman Ministry of Health, 2008); Egypt (Egypt National Cancer Registry, 2009); Algeria (Ministere de la Sante et de la Population, 2007); Morocco (Registre des cancers de Rabat, 2005; Association Lalla Salma, 2012); Israel (Ministry of Health, 2008)

Discussion

Breast cancer remains by far the leading cancer among women in Lebanon. ASRw remains higher compared to the other MENA countries but still lower than non-MENA countries reflecting possibly the influence of sociological and reproductive patterns transitioning from regional norms to global trends. Another particularity is the presence of relatively high age specific incidence rates at age groups younger than 50 years in Lebanon, which supports the current national recommendation of starting screening at the age of 40 years.

Several factors have been reported in the literature to be associated with the international variation in breast cancer incidence rates; these include: differences in reproductive, hormonal and lifestyle factors; differences in population size and age structure; and availability of early detection services (Jemal et al., 2011; Youlden et al., 2012). The rise of female breast cancer incidence rates in Lebanon between 1998 and 2010, in general and across all broad age groups (Table 1 and Figure 1), might be attributed to the following factors:

Improved breast cancer screening rates and improved technology in Lebanon

The awareness campaigns held annually by the Lebanese MoPH since 2002, recommending yearly screening starting at the age of 40 years, led to higher rates of mammography screening and improved awareness of early signs of breast cancer among Lebanese women (Adib et al., 2009).

Organized screening programs in developed countries are associated with improved diagnosis of breast cancers (Paci et al., 2004; Svendsen et al., 2006; Youlden et al., 2012). The incidence rates from several Western countries increased sharply in the late 1980s and 1990s (Jemal et al., 2011) mainly due to the introduction of population screening (Jørgensen and Gøtzsche, 2009; Jemal et al., 2011; Youlden et al., 2012) and to changes in reproductive factors such as the increased use of postmenopausal hormone replacement therapy (HRT) (Jemal et al., 2011). Since the beginning of the millennium, the overall incidence rates remained significantly higher than expected worldwide, despite a decrease in several developed countries, partly due to lower use of combined postmenopausal HRT (mainly in age group 50-59), a plateau in participation rates for mammographic screening and a decline in the pool of cases diagnosed by screening prior to becoming symptomatic (Jørgensen and Gøtzsche, 2009; Forouzanfar et al., 2011; Jemal et al., 2011; Youlden et al., 2012; Hou and Huo, 2013). In Lebanon, breast cancer incidence rates did not reach a plateau yet and the rates of participation in breast cancer screening are still increasing particularly in the age group 50-59 compared with the age group 40-49 or ≥ 60 (Haddad et al., 2015). Moreover, and in view of the limited use of postmenopausal HRT in Lebanon (Obermeyer et al., 1999), its effect on the sharp rise in incidence rates was not obvious between 1998 and 2006, even among women in the age group 50-59, contrary to what happened in Western countries such as US, UK, France and Australia

(Center et al., 2011).

Furthermore, the introduction of advanced breast cancer screening methods such as digital mammography, to the Lebanese market improved cancer detection rates, hence contributing to the rise in incidence rates. Digital mammography is significantly more accurate than regular film mammography in detecting cancer in women under the age of 50 years, women with dense breasts, and premenopausal or perimenopausal women (Pisano et al., 2005; Pisano et al., 2008; Hou and Huo, 2013).

In Lebanon, the trends by age group show clearly that the steeper increase in breast cancer incidence between 2004 and 2010 was largely confined to women above the age of 40 corresponding to the target population of the national awareness campaign. The aforementioned factors contributed to the high incidence rates for the age group 40-49 years. Moreover, the elevated ASRw in the age group 35-39 years may be attributed to an improved awareness of breast cancer early signs since the initiation of the annual national breast cancer awareness campaigns in 2002, particularly among those who have a family history of breast cancer.

The low rates in Arab countries might be due to limited screening and incomplete reporting (El Saghir et al., 2007; Forouzanfar et al., 2011; Youlden et al., 2012; Chouchane et al., 2013).

Lebanese women demographics

The overall worldwide number of new breast cancer cases in 2008 were almost similar in more developed and less developed countries, but the different population size and age structure resulted in a lower ASRw in the latter (71.7/100,000 and 29.3/100,000 respectively) (Ferlay et al., 2010a; Ferlay et al., 2010b). The proportion of women younger than 50 years in Lebanon (77.6% in 2007) is higher than the ones reported in Western countries such as the USA (67.7% in 2008) (United States Census Bureau, 2008), UK (64% in 2009) (Cancer Research UK, 2013), Australia (69% in 2009) (Center et al., 2011) and Denmark (62.7% in 2008) (Engholm et al., 2013). This may partly explain the highest age specific rates among women below 50 years in Lebanon.

Moreover, the changes in the Lebanese women demographics since 1998 may contribute to the high rate of breast cancer in elderly women. These demographic changes were mainly related to a steady increase in life expectancy at birth for both sexes (80.0 years in Lebanon compared to 68.0 years in the WHO Eastern Mediterranean region in 2012) (Central Administration of Statistics, 2007; World Health Organization, 2015).

Changes in reproductive, hormonal and lifestyle factors

Breast cancer risk factors that are more prevalent in more developed countries than less developed ones including having children (if any) at an older age, inappropriate breastfeeding, use of oral contraceptives and postmenopausal HRT, obesity (body fatness), poor physical activity, and excessive alcohol consumption (Jemal et al., 2011; American Cancer Society, 2014) are also prevalent in Lebanon, with the exception of alcohol consumption (Sibai et al., 2009), use of oral contraceptives

(Sikimic, 2010) and postmenopausal HRT (Obermeyer et al., 1999).

Female reproductive factors in Lebanon are different than the regional Arab countries and are more similar to Western developed countries: The total fertility rate per woman in Lebanon (year 2011) was 1.5 compared to a regional average of 3.2 and a global average of 2.4 (World Health Organization, 2015); the median age of marriage among females was reported to be 28.9 years; the number of single nulliparous women in Lebanon is relatively high (Central Administration of Statistics, 2007; World Health Organization, 2015), and the age at natural menopause in Lebanon is comparable to median ages reported for women in industrialized countries (49.3-51.4) (Reynolds and Obermeyer, 2001). Although different contraceptive methods are easily accessible at low prices and without a prescription, Lebanon's 58% contraceptive-use rate is relatively low compared to some Arab countries (e.g. Morocco: 63%) regional countries (e.g. Iran: 73.8%) and to Western countries (e.g. France: 81.8% and US: 72.8%) (World Health Organization, 2014), with only around 15% of Lebanese women using oral contraceptives (Sikimic, 2010).

Physical activity: In their national representative sample of household survey, Sibai et al found that a good percentage of adult female respondents had sedentary lifestyle, with the percentage increasing with age from 25.4% for the age group 18-39 years to 31.8% and 47.3% for the age groups 40-59 and 60+ years respectively (Sibai et al., 2009).

Excess body weight: Is associated with an increased risk of breast cancer among postmenopausal women (Lahmann et al., 2004; Ligibel, 2011; American Cancer Society, 2014), and a poor prognosis in obese women diagnosed with early-stage breast cancer (Ligibel, 2011). A national population-based study in Lebanon in 2009 showed high prevalence rates of excess weight in women aged 40 to 59 years (76.9%; overweight: 40.3%, obesity: 36.6%) and ≥ 60 years (84.4%; overweight: 35.1%, obesity:49.3%), with the rates approaching those observed in developed countries such as the US (Nasreddine et al., 2012).

Smoking, active or passive: Suspected to increase breast cancer risk (California Environmental Protection Agency, 2005; Luo et al., 2011; Xue et al., 2011; Gaudet et al., 2013), is on the rise among Lebanese females of different age groups (Sibai et al., 2009; Nakkash et al., 2010; World Health Organization, 2013). Lebanon has one of the weakest tobacco control regulatory environments in the Middle East region, and smoking is socially accepted even among teen girls unlike other Arab countries. The average rate of tobacco use in females aged ≥ 15 years in Lebanon is 30.0% compared to 4% in the region (World Health Organization, 2013).

Environmental factors

Environmental factors such as petrochemical air pollution, although not yet investigated in humans, were reported to cause mammary gland tumors in animals (Brody et al., 2007; Rudel et al., 2007). Lebanon is not an industrial country but air pollution, mostly of petrochemical origin, is high in all its residency areas secondary to the diesel fueled electric generators present in most streets or buildings, and to the high traffic in overpopulated cities namely Beirut (Office of Communications, 2011).

Genetic factors

Genetic factors may also account for a small part of the worldwide variation in the incidence of breast cancer (Parkin and Fernández, 2006; American Cancer Society, 2014). About 5% to 10% of breast cancer cases in the US are thought to be due to inherited gene mutations mostly the BRCA1 and BRCA2 genes (American Cancer Society, 2014). The prevalence of BRCA1 and BRCA2 mutations in Lebanese women with breast cancer and at high risk of carrying inherited gene mutations (young age at presentation and/or positive family history of breast and/or ovarian cancer) and recruited at the American University of Beirut-Medical Center between 2009 and 2012 (n=250) turned out to be 5.6% (El Saghir et al., 2015). Further population-based study is recommended to evaluate different breast cancer genetic mutations.

Conclusion and Recommendations

Breast Cancer among Lebanese women is in continuous rise across all age groups especially in younger age compared to Western countries. Lifestyle modernization, reproductive changes, environmental and genetic factors should be further evaluated and addressed in an effort to control and halt this increase in breast cancer incidence. Establishing a comprehensive National Breast Cancer Control strategy can be of great help in this respect. The results of this study support the current national screening recommendation of starting breast cancer screening at the age of 40 years; yet, a cost-effectiveness study of this screening recommendation is still needed. Moreover, the Lebanese NCR which has had an excellent case counting since 2003-2004, needs further improvements to encompass a more comprehensive and full database including in-situ cases, cancer location in the breasts; staging TNM; hormonal receptors; provided therapy; mortality/survival at 1, 2, and 5 years.

References

Abou-Daoud KT (1966). Morbidity from cancer in Lebanon. *Cancer*, **19**, 1293-300.

Adib S, Daniel J, Issa G (2008). Cancer in Lebanon 2004 with an update of cancer 2003 [Online]. Beirut, Lebanon: Ministry of Public Health, National Cancer Registry. Available: http://www.moph.gov.lb/Prevention/Surveillance/Pages/Cancer.aspx [Accessed 7 2014].

Adib S, El Saghir N, Ammar W (2009). Guidelines for breast cancer screening in Lebanon public health communication. *J Med Liban*, **57**, 72-4.

Al-Eid HS, Garcia AD, Bazarbashi S, et al (2012). Cancer incidence report Saudi Arabia 2009. Kingdom of Saudi Arabia: Ministry of health.

American Cancer Society (2014). Breast Cancer. What are the risk factors for breast cancer? [Online]. Available:

http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-risk-factors [Accessed 8 2014].

Association Lalla Salma (2012). Registre des cancers de la région du Grand Casablanca: Années 2005-2007.

Belgian Cancer Registry (2011). Cancer incidence in Belgium 2008. Brussels: Belgian cancer registry.

Brody JG, Moysich KB, Humblet O, et al (2007). Environmental pollutants and breast cancer. *Cancer*, **109**, 2667-711.

California Environmental Protection Agency (2005). Proposed identification of environmental Tobacco smoke as a toxic air contaminant. USA.

Cancer Research UK (2013). Breast cancer statistics [Online]. London. Available: http://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer [Accessed 5 2013].

Center M, Siegel R, Jemal A (2011). Global cancer facts and figures. Atlanta. *ACS*, **6**, 1-52.

Centers for disease control and prevention (2014). United States Cancer Statistics (USCS) [Online]. USA. Available: https://www.cdc.gov/cancer/npcr/uscs/technical_notes/stat_methods/rates.htm [Accessed 9 2016].

Central administration of statistics (2007). Population characteristics in 2007 living conditions survey 2007. Lebanon.

Chouchane L, Boussen H, Sastry KS (2013). Breast cancer in Arab populations: molecular characteristics and disease management implications. *Lancet Oncol*, **14**, 417-24.

Cramer DW (2012). The epidemiology of endometrial and ovarian cancer. *Hematol Oncol Clin North Am*, **26**, 1-12.

Egypt national cancer registry (2009). Reports and statistics: Aswan 2008, Damietta, 2009, El Minia 2009.

El-Zaemey S, Nagi N, Fritschi L, et al (2012). Breast cancer among Yemeni women using the national oncology centre registry 2004–2010. *Cancer Epidemiol*, **36**, 249-53.

El Saghir NS, Khalil MK, Eid T, et al (2007). Trends in epidemiology and management of breast cancer in developing Arab countries: a literature and registry analysis. *Int J Surg*, **5**, 225-33.

El Saghir NS, Zgheib NK, Assi HA, et al (2015). BRCA1 and BRCA2 mutations in ethnic Lebanese Arab women with high hereditary risk breast cancer. *Oncologist*, **20**, 357-64.

Engholm G, Ferlay J, Christensen N, et al (2013). NORDCAN: cancer incidence, mortality, prevalence and survival in the nordic countries, version 5.3 (25.04. 2013). Association of the Nordic Cancer Registries. Danish Cancer Society. Danish Cancer Society. http://www. ancr. nu (accessed 11/05/2013).

Ferlay J, Shin H, Bray F, et al (2010a). GLOBOCAN 2008: Cancer incidence and mortality worldwide: IARC CancerBase No. 10 [Internet] [Online]. Lyon, France: International Agency for Research on Cancer. Available: http://globocan.iarc.fr [Accessed 5 2013].

Ferlay J, Shin HR, Bray F, et al (2010b). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*, **127**, 2893-917.

Ferlay J, Soerjomataram I, Dikshit R, et al (2015). Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer*, **136**, 359-86.

Forouzanfar MH, Foreman KJ, Delossantos AM, et al (2011). Breast and cervical cancer in 187 countries between 1980 and 2010: a systematic analysis. *The lancet*, **378**, 1461-84.

Gaudet MM, Gapstur SM, Sun J, et al (2013). Active smoking and breast cancer risk: original cohort data and meta-analysis. *J Natl Cancer Inst*, djt023.

Haddad FG, Kourie HR, Adib SM (2015). Trends in mammography utilization for breast cancer screening in a Middle-Eastern country: Lebanon 2005–2013. *Cancer Epidemiol*, **39**, 819-24.

Hill C, Menhamou E (1995). Age-standardization in epidemiological data. *Int J Epidemiol*, **24**, 241-2.

Hou N, Huo D (2013). A trend analysis of breast cancer incidence rates in the United States from 2000 to 2009 shows a recent increase. *Breast Cancer Res Treat*, **138**, 633-41.

Howlader N, Noone A, Krapcho M, et al (2013). SEER cancer statistics review, 1975-2010 [Online]. Bethesda, MD: National Cancer Institute. Available: https://seer.cancer.gov/archive/csr/1975_2010/ [Accessed 5 2013].

Jemal A, Bray F, Center MM, et al (2011). Global cancer statistics. *CA Cancer J Clin*, **61**, 69-90.

Jørgensen KJ, Gøtzsche PC (2009). Overdiagnosis in publicly organised mammography screening programmes: systematic review of incidence trends. *BMJ*, **339**, b2587.

Lahmann PH, Hoffmann K, Allen N, et al (2004). Body size and breast cancer risk: Findings from the European prospective investigation into cancer and nutrition (EPIC). *Int J Cancer*, **111**, 762-71.

Lakkis NA, Adib SM, Osman MH, et al (2010). Breast cancer in Lebanon: incidence and comparison to regional and Western countries. *Cancer Epidemiol*, **34**, 221-5.

Ligibel J (2011). Obesity and breast cancer. *Oncology (Williston Park)*, **25**, 994-1000.

Luo J, Margolis KL, Wactawski-Wende J, et al (2011). Association of active and passive smoking with risk of breast cancer among postmenopausal women: a prospective cohort study. *BMJ*, **342**, d1016.

Malaysia ministry of health (2011). Malaysia national cancer registry Report 2007. Kuala Lampur, Malaysia: National cancer registry.

Matsuda A, Matsuda T, Shibata A, et al (2013). Cancer incidence and incidence rates in Japan in 2007: a study of 21 population-based cancer registries for the Monitoring of Cancer Incidence in Japan (MCIJ) project. *Jpn J Clin Oncol*, **43**, 328-36.

Ministere de la Sante et de la Population (2007). Registre des Tumeurs d'Alger: Année 2007.

Ministry of health (2008). Cancer incidence table [Online]. Available: http://www.health.gov.il/UnitsOffice/HD/ICDC/ICR/CancerIncidence/Pages/about.aspx [Accessed 8 2016].

Ministry of public health (2010). National cancer registry [Online]. Lebanon. Available: http://www.moph.gov.lb/en/Pages/2/7164/national-cancer-registry [Accessed 8 2016].

Nakkash R, Chaaya M, Afifi R, et al (2010). Smoke-free policies in Lebanon: Lessons learned from existing experiences and recommendations for the future a research study supported by IDRC-RITC Canada. Beirut, Lebanon: American University of Beirut.

Nasreddine L, Naja F, Chamieh MC, et al (2012). Trends in overweight and obesity in Lebanon: evidence from two national cross-sectional surveys (1997 and 2009). *BMC Public Health*, **12**, 798.

Obermeyer CM, Ghorayeb F, Reynolds R (1999). Symptom reporting around the menopause in Beirut, Lebanon. *Maturitas*, **33**, 249-58.

Office of communications (2011). Beirut shrouded in polluted air [Online]. American University of Beirut News. Available: http://www.aub.edu.lb/news/Pages/115861.aspx [Accessed April 17 2013].

Office of national statistics (2009). Cancer statistics registrations England series MB1 No. 40. September 7 ed. England.

Office of national statistics (2010). Population estimates for UK, England and Wales, Scotland and Northern Ireland, Mid 2009 - (SUPERSEDED). June 24, 2010 ed. England.

Official statistics of Sweden 2009. Cancer incidence in Sweden 2008 Sweden.

Paci E, Warwick J, Falini P, et al (2004). Overdiagnosis in screening: is the increase in breast cancer incidence rates a cause for concern?. *J Med Screen*, **11**, 23-7.

Parkin DM, Fernández LM (2006). Use of statistics to assess the global burden of breast cancer. *Breast J*, **12**, 70-80.

Pavlou P, Demetriou A, Soteriou C (2011). Cyprus cancer registry - Progress report for 2011 (Data 2006-2008). Cyprus: Ministry of health.

Pisano ED, Gatsonis C, Hendrick E, et al (2005). Diagnostic performance of digital versus film mammography for breast-cancer screening. *N Engl J Med*, **353**, 1773-83.

Pisano ED, Hendrick RE, Yaffe MJ, et al (2008). Diagnostic accuracy of digital versus film mammography: exploratory analysis of selected population subgroups in DMIST 1. *Radiology*, **24**6, 376-83.

Registre des cancers de Rabat (2005). Incidence des cancers a Rabat: Année 2005.

Reynolds R, Obermeyer C (2001). Age at natural menopause in Beirut, Lebanon: the role of reproductive and lifestyle factors. *Ann Hum Biol*, **28**, 21-9.

Rudel RA, Attfield KR, Schifano JN, et al (2007). Chemicals causing mammary gland tumors in animals signal new directions for epidemiology, chemicals testing, and risk assessment for breast cancer prevention. *Cancer*, **109**, 2635-66.

Sibai A, Tohme RA, Mahfoud Z, et al (2009). Non-communicable diseases and behavioral risk factor survey comparison of estimates based on cell phone interviews with face to face interviews. Lebanon: American University of Beirut.

Sikimic S (2010). Fifty years on, birth control pill fails to make major impact in Lebanon. The daily star. Lebanon.

Sultanate Oman ministry of health (2008). Oman cancer registry 2008. Sultanate Oman.

Svendsen AL, Olsen AH, Lynge E (2006). Breast cancer incidence after the introduction of mammography screening. *Cancer*, **106**, 1883-90.

Tarawneh M, Nimri O, Arqoub K, et al (2008). Non-communicable diseases directorate Jordan cancer registry cancer incidence in Jordan 2008. Jordan: Ministry of health.

UNECE. 2013. Belgium population, 5-year age groups, by Sex, [Online]. UNECE statistical database. Available: http://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__30-GE__01-Pop/001_en_GEPOAGESEX_REG_r.px/table/tableViewLayout1/?rxid=6392094e-664a-4dc8-ba83-2cc30b302cbe [Accessed 5 2013].

United States Census Bureau (2008). Age and sex composition in the United states: 2008 [Online]. Available: http://www.census.gov/population/age/data/2008comp.html [Accessed 9 2016].

World health organization (2008). National cancer registry in Iran, 2005–2006.

World health organization (2013). WHO report on the global Tobacco epidemic. Lebanon.

World health organization (2014). Lebanon: statistics summary (2002 - present) [Online]. Available: http://apps.who.int/gho/data/node.country.country-LBN [Accessed 5 2014].

World health organization (2015). Lebanon country profile- general health statistical profile.

World health organization. (2016a). Life expectancy and mortality: Infant mortality rate per 1000 live births by country [Online]. Available: https://rho.emro.who.int/rhodata/node.main.A55?lang=en [Accessed 10 2016].

World health organization. (2016b). Life expectancy and mortality: Life expectancy at birth by country [Online]. Available: https://rho.emro.who.int/rhodata/node.main.A50?lang=en [Accessed 10 2013].

Xue F, Willett WC, Rosner BA, et al (2011). Cigarette smoking and the incidence of breast cancer. *Arch Intern Med*, **171**, 125-33.

Youlden DR, Cramb SM, Dunn NA, et al (2012). The descriptive epidemiology of female breast cancer: an international comparison of screening, incidence, survival and mortality. *Cancer Epidemiol*, **36**, 237-48.