A comparison of population-based cancer incidence rates in Israel and Jordan

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Reliable information about comparative cancer incidence in the Middle East has been lacking. The Middle East Cancer Consortium (MECC) has formed a network of population-based registries with standardized basic data. Here the age-adjusted cancer incidences are compared for four populations: Israeli Jews, Israeli non-Jews, Jordanians and the US Surveillance Epidemiology and End Results (SEER) population, for the years 1996–1997 (Israel) and 1996–1998 (other populations). The all-sites rate of cancer is approximately twice as high in Israeli Jews and SEER, compared with Israeli non-Jews and Jordanians. Rates of lung cancer are similar among Israeli Jews and non-Jews and about twice as high as in Jordanians. Childhood leukaemia rates in Jordan are higher than in Israeli Jews, but lower than SEER. Hodgkin lymphoma rates in Israeli non-Jews and Jordanians are similar to SEER, but non-Hodgkin lymphoma rates are lower than SEER. The previous suspicion of higher overall leukaemia and lymphoma rates in Jordan is thus not confirmed.
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Introduction

There is now extensive knowledge about cancer incidence in the Western world and some other parts of the world, and this comes from high-quality population-based registries established in these countries (Parkin *et al.*, 1997). Such knowledge is not currently available in most developing countries (Parkin, 1986) and has been particularly sparse in the Middle East.

The Middle East Cancer Consortium (MECC) (with membership comprising Cyprus, Egypt, Israel, Jordan, and the Palestinian Authority (PA)) was established in 1996. Its first major project has been to establish a network of population-based cancer registries whose basic data are defined and coded in a standardized manner (Freedman *et al.*, 2001). Six such registries comprise the network, one for each of the members of the Consortium, except the Palestinian Authority which has two (one in Gaza and one in the West Bank). Of these registries, the Israel and Jordan registries were both already operational at the time of the formation of the MECC. The Israel registry had been operational from before 1960 and the Jordanian registry became operational at the beginning of 1996.

This report represents the first comparison of cancer incidence rates derived from MECC registries. For reasons related to completeness of reporting, the comparison is restricted to the years 1996–1998 and to the Israel and Jordan registries. Before the comparison was performed there were certain questions and hypotheses. First, Israel's population can be divided into Jews and non-Jews; the non-Jewish population is almost entirely Arab. In analyses of previous years, the Jews had cancer rates comparable to Western populations, whereas the non-Jews had much lower rates (Israel National Cancer Registry, 2000). We were therefore very interested to know whether the rates in Jordan were similar to those of Israeli non-Jews. With regard to specific cancers, it had been apparent from preliminary reports of several MECC registries including Jordan, that leukaemia and lymphoma registrations were relatively common. We were therefore interested to know if the incidence of leukaemia and lymphoma was truly unusually high among Jordanians. Thirdly, also from preliminary reports of MECC registries, cases of early-onset breast cancer appeared relatively common, and we were interested to study and compare the age-specific incidence rates of breast cancer in these populations. To enhance these comparisons we also include in our report, rates from the US Surveillance Epidemiology and End Results (SEER) Program.

Methods

A central tenet of the MECC registry project is the standardization of data items, definitions, coding and

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quality control, so as to enable reliable comparisons to be made. In the first year of the project, the MECC members agreed to a Manual of Standards for Cancer Registration which sets out the data collection and coding methods that all registries use (Roffers, 2002). This includes the definition and codes for 12 basic data items, including age, sex, date of diagnosis, basis of diagnosis, primary site code and histological type/behaviour/grade (ICD-O-2 until the end of 2000 (Percy *et al.*, 1990), ICD-O-3 from 2001 onwards (Fritz *et al.*, 2000)), and summary stage (SEER Summary Staging Guide (Shambaugh and Weiss, 1977) until the end of 2000, SEER Summary Staging Manual 2000 (Young *et al.*, 2000) from 2001 onwards).

The staff from each MECC registry have participated in a standardized training course on the principles of cancer registration as laid out in the Manual. Since the start of the project, three such courses have been given to MECC staff. Both the writing of the Manual and the training were carried out by Dr John Young and Steven Roffers of Emory University.

Exercises are conducted to evaluate the comparability of medical records abstracting and coding. The same case records are coded by the staff of each registry and the codes are then compared among different staff at the same registry, and among registries. Since the start of the project, two such exercises have been conducted.

A programme to assess the levels of completeness and accuracy of the data at each registry is planned within the context of the MECC project but has not yet been conducted at the Israel and Jordan registries. However, both registries did undergo such an assessment. The Jordan registry was assessed by Roffers and Young in 1998, whereas the Israel registry has undergone several assessments by its own Ministry of Health, the latest occurring in 1995–1997 on 1990–1991 registration data. These assessments involved external assessors visiting treatment institutions in the region, reviewing all the records of cancer cases at these institutions, abstracting the information required for the basic data items and returning to the registry files to check the proportion already registered, and the level of agreement between the abstracted information and that in the registry file.

The results of these assessments were as follows. Registrations at the Jordan registry were determined to be 88% complete. Such a completeness rate is normally considered excellent for a newly established registry. In the latest assessment of the Israel registry, an overall completeness of 93–94% was found. For solid tumours, completeness was about 95% and for non-solid tumours it ranged from 85% (chronic lymphocytic leukaemia) to 90–92% (acute myeloid or acute lymphocytic leukaemia). For childhood malignancies, a special national registry was established by paediatric haematologists in the early 1990s. The registrations are collected actively from all the paediatric centres in Israel and are then reported to the central registry. Thus, although a designated study assessing completeness in paediatric malignancies has not been made, the Israel registry expects it to be more than 95%. The levels of completeness of registration among Israeli Jews and non-Jews is expected to be similar, since the national health service is the primary deliverer of health care to the population, is available and used by all Israeli citizens, and since notification of cancer cases to the national cancer registry is an established activity conducted by all hospitals in Israel.

The slightly lower completeness rate in Jordan, in comparison to Israel, is of little importance in this paper. Later in the paper we estimate incidence rate ratios between various populations. Assuming that for a given cancer the completeness rates were 88% in Jordan and 95% in Israel, if the incidence rates were equal in the two populations, the data would be expected to show a slightly higher incidence in Israel, with a rate ratio of 1.08 (95/88). The rate ratios we have highlighted in this paper as indicating differences in rates between two populations are much higher than 1.08 (or much lower than 0.93, the inverse of 1.08), and their confidence intervals invariably exclude not only the value 1.0, but also 1.08 and 0.93 (see Results section). Furthermore, the rate ratios highlighted as indicating little difference between two populations have confidence intervals that include not only the value 1.0, but also 1.08 and 0.93. Thus the differences in completeness rates cannot explain the differences or lack of difference seen in the incidence rates of the various populations we have compared.

A second tenet is that in this region it is absolutely imperative that comparisons be age-adjusted. This is because the populations have widely differing age distributions. Table 1 illustrates this, showing the national age–gender distributions of Israel and Jordan in the year 1996, with Israeli Jews and non-Jews presented separately. Inspection of this table shows that the Israeli Jewish population includes a greater proportion of middle-aged and elderly, the proportions of Israeli Jews, Israeli non-Jews and Jordanians who are over the age of 30 years being 49%, 31% and 26% respectively. Age-standardized rates were calculated according to the standard world population age distribution using the method of direct standardization (Breslow and Day, 1987).

The data in this report represent the registrations at the Israel registry for the years 1996–1997 and the registrations at the Jordan registry for the years 1996–1998. Both registries cover their national populations. The extra year (1998) for the Jordan registrations was included partly to

Table 1 Population distribution of Israel and Jordan in 1996

Age groups (years)	Israeli Jews			Israeli non-Jews			Jordanians		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
00–04	210 400	200 100	410 500	87 500	82 500	170 000	354 540	337 213	691 753
05–09	209 600	199 500	409 100	72 900	69 700	142 600	286 565	279 012	565 577
10–14	214 100	202 500	416 600	62 400	59 200	121 600	284 787	265 238	550 025
15–19	201 100	190 200	391 300	60 000	57 400	117 400	287 455	259 907	547 362
20–24	195 300	188 900	384 200	55 400	54 100	109 500	258 574	239 470	498 044
25–29	166 300	164 300	330 600	46 500	46 600	93 100	217 700	197 707	415 407
30–34	152 000	147 500	299 500	41 900	41 400	83 300	153 725	141 285	295 010
35–39	149 200	153 900	303 100	32 000	32 500	64 500	91 078	99 075	190 153
40–44	153 600	159 300	312 900	24 600	25 200	49 800	69 308	70 197	139 505
45–49	145 100	152 300	297 400	18 400	18 600	37 000	62 200	65 310	127 510
50–54	90 800	96 500	187 300	15 400	15 300	30 700	60 422	57 757	118 179
55–59	83 400	93 600	177 000	12 100	12 200	24 300	55 093	52 870	107 963
60–64	76 100	88 700	164 800	8 400	9 500	17 900	37 320	35 987	73 307
65–69	70 000	87 100	157 100	6 100	7 600	13 700	28 435	26 212	54 647
70–74	61 100	83 600	144 700	3 500	5 200	8 700	15 994	14 217	30 211
75–79	40 000	51 900	91 900	2 000	3 200	5 200	8 221	8 880	17 101
80–84	27 700	41 600	69 300	1 800	1 800	3 600	5 040	7 152	12 192
85+	18 900	27 300	46 200	1 600	1 400	3 000	4 065	4 852	8 917
Total	2 264 700	2 328 800	4 593 500	552 500	543 400	1 095 900	2 280 522	2 162 341	4 442 863

Table 2 Numbers of selected cancers by sex in Israeli Jews and Israeli non-Jews (1996–1997) and Jordanians (1996–1998)

	Israel (1996–1997)						Jordan (1996–1998)		
	Jews			Non-Jews			Jordanians		
	All	Male	Female	All	Male	Female	All	Male	Female
All sites	32 106	15 255	16 851	1 814	945	869	8 903	4 584	4 319
Lip	181	124	57	15	10	5	32	28	4
Stomach	1 140	662	478	60	32	28	341	209	132
Colon	3 537	1 743	1 794	115	60	55	455	251	204
Rectum/sigmoid junction	1 151	629	522	39	21	18	258	124	134
Pancreas	744	372	372	34	23	11	82	54	28
Larynx	280	246	34	35	33	2	174	162	12
Lung and bronchus	2 241	1 526	715	223	189	34	625	527	98
Bones and joints	125	71	54	19	11	8	135	80	55
Skin (excl. basal and squamous cell)	1 501	772	729	24	14	10	81	51	30
Breast	5 198	68	5 130	216	5	211	1 297	27	1 270
Cervix	283	0	283	17	0	17	105	0	105
Corpus and uterus	818	1	817	49	0	49	175	0	175
Ovary	616	0	616	29	0	29	167	0	167
Prostate	2 490	2 490	0	68	68	0	294	294	0
Urinary bladder	1 826	1 471	355	89	70	19	510	451	59
Kidney and renal pelvis	1 004	615	389	36	21	15	217	139	78
Brain	517	299	218	55	32	23	391	222	169
Thyroid	710	185	525	69	8	61	284	78	206
Hodgkin lymphoma	316	162	154	43	28	15	295	176	119
Non-Hodgkin lymphoma	1 620	847	773	132	81	51	525	301	224
Leukaemia	918	487	431	121	60	61	635	373	262

increase the numbers (and statistical power) for the comparison, Jordan having considerably smaller numbers of registrations per annum than Israel, and partly because at the time of analysis 1998 registrations at the Jordan registry (but not the Israel registry) were judged to be almost complete. Data from the 11 SEER registry areas for the years 1996–1998, as reported to the US National Cancer Institute (NCI) in August 2000, were used for comparison (Ries *et al.*, 2001).

After confidentiality documents were signed, data without personal identification were submitted electronically by both registries to NCI for statistical analysis. The data were checked for consistency with edit procedures and software programs utilized for data submissions from SEER registries with modifications tailored to use of ICD-9 coding rules rather than ICD-O-2. After clarifications by the registries of the resulting queries, the final analysis was conducted using statistical software developed by the SEER Program for cancer registry data and reporting cancer surveillance information. Security procedures for protecting transmittal and use of confidential data files and reports were applied.

The statements in this paper concerning comparisons of rates in different populations are, unless otherwise stated,

based on large numbers of cases. In such cases, statistical random variation plays a relatively minor role and is therefore safely ignored. In the other cases, where numbers are more limited, we provide estimates of rate ratios with their 95% confidence limits. The confidence limits are based on an assumption that the numbers of registrations have a Poisson distribution, and that the natural logarithm of a rate R based on observed number of cases N is approximately normally distributed with variance $1/N$.

Results

Table 2 presents the numbers and Table 3 the incidence rates adjusted to the world standard, for selected anatomical sites/histological categories for the three populations: Israeli Jews, Israeli non-Jews and Jordanians.

The all-sites rate of cancer is approximately twice as high among Israeli Jews (IJ) compared with Israeli non-Jews (INJ) and Jordanians (J). The all-sites rates among the latter two populations are similar.

Many of the cancer rates of individual sites display a similar pattern to that seen for all sites, being two to three times larger among Israeli Jews than Israeli non-Jews or Jordanians. However, there are some exceptions. Rates of cancer of the larynx and of the bones/joints are similar in all three populations(for larynx, rate ratio and 95% confidence interval IJ:INJ = 0.86 (0.61,1.23), IJ:J = 0.89 (0.74,1.08); for bones/joints rate ratio IJ:INJ = 1.00 (0.62, 1.62), IJ:J = 1.09 (0.86,1.39)). Rates of cancer of the lung/bronchus are similar among Israeli Jews and non-Jews and about twice as high as in Jordanians. Rates of skin cancer (excluding basal and squamous cell carcinomas) are about 10 times higher in Israeli Jews than in Israeli non-Jews and Jordanians (rate ratio: IJ:INJ = 8.4 (5.6, 12.5), IJ:J = 12.2 (9.7,15.2)). Rates of Hodgkin lymphoma are higher in Israeli Jews than Israeli non-Jews (rate ratio IJ:INJ = 1.65 (1.2, 2.3)) or Jordanians (rate ratio IJ:J = 1.32 (1.13, 1.55)). Rates of non-Hodgkin lymphoma are also higher in Israeli Jews, by about 50% compared with Israeli non-Jews (rate ratio IJ:INJ = 1.49 (1.25, 1.78)) but by twofold compared with Jordanians (rate ratio IJ:J = 2.12 (1.92, 2.34)).

Table 3 also shows the incidence rates of the same cancers in the SEER (US) population. The overall picture is one of rates similar to those of the Israeli Jewish population. Noticeable departures from this overall picture are a substantially lower rate of stomach cancer and a much higher rate of prostate cancer than in Israeli Jews. Rates of Hodgkin and non-Hodgkin lymphoma in Israeli Jews are somewhat higher than in SEER. Rates of Hodgkin lymphoma in Israeli non-Jews and Jordanians are similar to SEER rates (rate ratio INJ:US = 0.80 (0.59, 1.08), J:US = 1.0 (0.89, 1.12)), but their rates of non-Hodgkin lymphoma are lower than SEER rates (rate ratio INJ:US = 0.73 (0.62,0.87), J:US = 0.52 (0.47,0.56)).

Because of particular interest in childhood leukaemia, Table 4 presents the age-specific incidence of leukaemia in 10-year age groups. It can be seen that for age under

Table 3 Age-standardized[a] incidence rates by sex for selected cancers in Israeli Jews and Israeli non-Jews (1996–1997), Jordanians (1996–1998) and SEER registry populations (1996–1998)

	Israel (1996–1997)						Jordan (1996–1998)			SEER (1996–1998)		
	Jews			Non-Jews								
	All	Male	Female	All	Male	Female	All	Male	Female	All	Male	Female
All sites	267.6	275.6	265.3	138.4	158.1	123.5	121.3	126.4	117.0	315.6	356.1	287.4
Lip	1.5	2.3	0.8	1.2	1.4	0.9	0.5	0.9	0.1	0.7	1.2	0.2
Stomach	8.7	11.4	6.4	4.8	5.4	4.4	5.2	6.3	4.0	5.5	7.8	3.6
Colon	26.6	29.3	24.7	9.4	10.6	8.4	6.9	7.6	6.2	22.8	26.2	20.1
Rectum/sigmoid junction	9.2	11.2	7.5	3.2	3.6	2.8	3.7	3.6	3.8	9.8	12.5	7.5
Pancreas	5.4	6.3	4.6	3.1	4.7	1.8	1.3	1.7	0.9	6.6	7.6	5.7
Larynx	2.5	4.8	0.5	2.9	5.9	0.4	2.8	5.0	0.4	2.8	4.9	1.1
Lung and bronchus	18.4	28.4	10.2	19.6	36.8	5.2	10.2	17.0	3.2	40.9	51.5	32.7
Bones and joints	1.2	1.5	1.0	1.2	1.3	1.0	1.1	1.2	1.0	0.8	1.0	0.7
Skin (excl. basal and squamous cell)	13.4	14.8	12.3	1.6	2.0	1.3	1.1	1.4	0.9	14.0	17.5	11.2
Breast	47.1	1.2	86.9	16.6	1.0	31.1	17.5	0.8	35.2	51.6	0.8	96.5
Cervix	2.7	0.0	5.2	1.4	0.0	2.6	1.5	0.0	3.0	4.1	0.0	7.9
Corpus and uterus	7.4	0.0	13.7	4.1	0.0	7.7	2.7	0.0	5.5	9.4	0.0	17.6
Ovary	5.8	0.0	10.9	1.9	0.0	3.8	2.2	0.0	4.4	6.4	0.0	12.2
Prostate	18.7	42.6	0.0	6.4	14.3	0.0	5.3	10.6	0.0	47.8	106.5	0.0
Urinary bladder	14.3	26.2	4.7	8.0	14.2	3.1	8.3	14.3	1.9	12.1	20.6	5.4
Kidney and renal pelvis	8.6	11.7	6.0	2.6	3.1	2.1	3.1	4.0	2.1	7.6	10.3	5.3
Brain	5.0	6.2	4.0	3.3	3.9	2.8	3.9	4.2	3.6	4.8	5.7	4.1
Thyroid	6.9	3.7	10.1	3.6	0.9	6.4	3.0	1.7	4.5	5.3	2.7	7.9
Hodgkin lymphoma	3.3	3.4	3.2	2.0	2.3	1.6	2.5	2.9	2.0	2.5	2.7	2.2
Non-Hodgkin lymphoma	14.0	16.3	12.1	9.4	11.6	7.4	6.6	7.1	6.0	12.8	15.8	10.2
Leukaemia	7.7	9.1	6.4	7.4	7.2	7.3	6.3	7.4	5.1	8.5	10.7	6.8

[a]Standardized to world standard population.

Table 4 Age-specific rates of leukaemia by sex in Israeli Jews and Israeli non-Jews (1996–1997), Jordanians (1996–1998) and the SEER population (1996–1998).

Age groups (years)	Israel (1996–1997)						Jordan (1996–1998)			SEER (1996–1998)		
	Jews			Non-Jews			Jordanians			Total		
	All	Male	Female	All	Male	Female	All	Male	Female	All	Male	Female
00–09	2.7	2.6	2.8	3.4	3.7	3.2	4.6	5.3	3.8	6.1	6.3	5.9
10–19	2.1	2.6	1.6	3.1	3.2	3.0	2.5	2.5	2.4	2.7	3.0	2.5
20–29	2.8	3.8	1.8	2.6	2.4	2.9	2.2	2.1	2.2	2.4	3.0	2.0
30–39	3.4	3.9	3.0	3.9	3.9	3.9	3.8	4.3	3.3	3.2	4.0	3.0
40–49	6.4	7.5	5.2	7.1	10.0	4.3	6.8	8.2	5.3	5.3	6.0	5.0
50–59	11.0	15.8	6.7	19.1	19.1	19.2	10.8	11.8	9.7	13.1	16.0	11.0
60–69	26.2	29.6	23.4	15.0	19.9	11.0	19.6	22.9	15.9	27.3	36.3	19.5
70–79	47.9	51.8	45.0	43.3	8.1	67.8	23.8	33.3	14.7	48.1	66.1	34.7
80 +	79.1	98.2	66.4	22.6	29.0	15.6	16.0	29.1	5.7	75.0	107.7	58.6

Table 5 Age-specific rates of female breast cancer in Israeli Jews and Israeli non-Jews (1996–1997), Jordanians (1996–1998) and the SEER population (1996–1998)

Age groups (years)	Israel (1996–1997)		Jordan (1996–1998)	SEER (1996–1998)
	Jews	Non-Jews	Jordanians	All
00–19	0.0	0.0	0.0	0.1
20–29	5.0	3.8	2.9	4.7
30–39	51.8	15.6	34.0	41.3
40–49	158.6	62.8	73.8	157.3
50–59	255.9	104.5	113.6	295.2
60–69	331.5	118.1	114.4	383.5
70–79	361.2	73.4	95.9	472.9
80 +	389.8	78.1	48.4	425.3

20 years, the rates of leukaemia in Jordan are higher than in Israeli Jews (rate ratio J:IJ = 1.48 (1.20,1.82)). However, SEER rates are higher than the rates in Jordan (rate ratio US:J = 1.24 (1.11,1.38)) or Israel. For ages over 50 years, the rates in the SEER population and in Israeli Jews are similar (rate ratio I:US = 0.98 (0.91, 1.06)) and higher than in Jordanians (rate ratio US:J = 1.51 (1.30,1.73)).

Table 5 shows the age-specific incidence rates for female breast cancer in 10-year age groups. Rates are considerably lower in Jordanians and Israeli non-Jews, compared with the Israeli Jewish and SEER populations, at both younger (< 50 years rate ratio INJ:IJ = 0.39 (0.31, 0.48), J:IJ = 0.53 (0.48, 0.58)) and older ages (over 50 years rate ratio INJ:IJ = 0.35 (0.29, 0.42), J:IJ = 0.38 (0.35, 0.41)). It should be noted that the rate ratio, compared with Israeli Jews, among Jordanian women under 50 years (0.53) is somewhat higher than that among younger or older non-Israeli Jews (0.35 and 0.38 respectively) and older Jordanians (0.39).

Discussion

This report represents the first definitive comparison of population cancer incidence rates between two countries in the Middle East. This comparison has confirmed certain expectations based on preliminary data, has refuted others, and has highlighted some previously unnoticed trends.

The overall pattern of cancer incidence in Israel and Jordan is much as expected. It has long been known that rates are higher among Israeli Jews than Israeli non-Jews and those rates among Israeli Jews are similar to those of the populations of Western Europe and the United States. This study shows that the rates of the Jordanian population are similar to those among Israeli non-Jews, which might be expected in view of the similarities in their ethnic and cultural lifestyle.

However, the reasons for the large difference between cancer rates in Israeli Jews and Israeli non-Jews/Jordanians are not completely clear. Surprisingly, the pattern is reversed for cardiovascular and cerebrovascular disease (Green, 1998). For example, Kark *et al.* (2000) found an increased rate of coronary heart disease mortality among Arab residents of Jerusalem, compared with Jewish residents and suggested that this could be due to a higher prevalence of diabetes, obesity and smoking in the Arab residents. In as much as obesity is associated with cancers such as colorectal cancer, one might therefore have expected rates of colon cancer to be at least as high as among Israeli non-Jews as Israeli Jews, whereas our data show that the non-Jews' rates are approximately one-third the rates of the Jews. Data on nutritional intakes of Israeli Jews and non-Jews will soon be available from the first Israeli national health and nutrition survey (Kaluski *et al.*, 2000), and may help to clarify the reasons for these patterns.

There are some cancers that do not fit in with the general pattern of 'high incidence in Israeli Jews/SEER, low incidence in Israeli non-Jews/Jordanians'. Most notable are the rates of lung cancer, which although lower in Jordanians, are approximately equal in Israeli Jews and non-Jews. Actually, further inspection of Table 3 indicates that the rates in Israeli non-Jewish men are somewhat higher than in Israeli Jewish men, whereas the rates in

non-Jewish women are about half those in Jewish women. This is supported by evidence that Israeli non-Jewish men smoke more than Israeli Jewish men, whereas Israeli non-Jewish women smoke less than Israeli Jewish women (Kivity *et al.*, 2001). The data indicate a need for a smoking cessation programme. While the rates of lung cancer in Jordan are still relatively low, reports on the prevalence of smoking indicate currently high rates of smoking (Hawamdeh and Spencer, 2001) and explain the recent initiation of a smoking cessation programme in that country (Kandela, 2000).

The data did not confirm the early impression that overall leukaemia rates are particularly high among Jordanians or Israeli non-Jews. Overall leukaemia rates in these populations are slightly lower than SEER rates and those of Israeli Jews. However, further analysis by age showed that childhood leukaemia rates are higher in Jordan than in Israeli Jews, although they do not reach the level of the SEER rates. Reasons for the differences in the childhood leukaemia rates of Jordan, Israel and the US are unclear and is a topic that needs further study.

Non-Hodgkin lymphoma rates in Jordanians are considerably lower than in Israel and the US, and rates among Israeli Jews appear higher than in the US. Hodgkin lymphoma rates appear similar among Jordanians and Israeli non-Jews and comparable to the SEER rates, but Israeli Jewish rates are again somewhat higher. Again, it would be interesting to study reasons for the apparently increased rates of lymphoma in Israel.

Finally, the data did not confirm clearly an increased rate of breast cancer in young Jordanian women. The rate ratio for Jordanian women under 50 compared with Israeli Jews is somewhat higher (about 0.5) than the equivalent rate ratios in Israeli non-Jews and older Jordanians (about 0.35). Further monitoring of the breast cancer rates in younger women in Jordan is therefore warranted to check whether these are the first signs of a trend towards rates found in Western populations, but generally the Jordanian rates are still commensurate with a population at lower risk of breast cancer than Western populations. Previous observations that the median age of diagnosis of breast cancer among Jordanian women is far below that among Israeli Jewish women appear due mainly to the large difference in age distribution of the two populations.

This comparison is the first of a planned series of MECC cancer incidence studies. In future comparisons we plan to include data from other MECC registries, as they achieve the necessary levels of completeness and accuracy that are required for reliable conclusions to be drawn.

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Appendix: MECC Organization

MECC Board of Governors

Cyprus: Dr Charatini Komodiki
Egypt: Professor Amal Ibrahim
Israel: Professor Rami Rahamimoff
Jordan: Dr Samir Al-Kayed
Palestinian Authority: Dr Khamis Najjar
USA: Dr Andrew von Eschenbach

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Professor Michael Silbermann, MECC
Professor John L Young, Emory University, Atlanta, USA

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