Countries at risk for colorectal cancer noted an increase in right-sided colorectal cancer. We examined this in the Israeli Jewish populations. Israel Cancer Registry data, 1982–2001, were computed by sex, age, ethnic group and colorectal cancer site: 'rectal cancer' included the recto-sigmoid junction, 'right-sided' colorectal cancer included proximal colon up to and including the splenic flexure. In both sexes, colorectal cancer trends increased significantly owing to colonic cancer (P<0.01) whereas rectal cancer decreased (P<0.01). Left and right colorectal cancer trends decreased in Israel born people (P<0.01), but in Asia-Africa born people increases were seen at both sites in the male (P=0.02 and 0.06, respectively) and female (P=0.03 and 0.01, respectively) population. In those ≥65 years old, right colorectal cancer trends increased in all men (P=0.05) and women (P=0.01). On comparing data from 1982–1986 with that from 1997–2001 right colorectal cancer showed an increase in both sexes (P<0.01): to 32.7% of male colorectal cancer and 57.6% of female colorectal cancer. In the period 1997–2001, the total male population ≥65 years had increased relatively by 7.5% (P<0.01), and women by 22.6% (P<0.01) and the proportion of right colorectal cancer in ≥65 years olds increased relatively by 10.9% in the male population, and 18.2% in the female population, with one-third of this increase occurring in Russian immigrants arriving after 1990. In conclusion, there is a trend for right colorectal cancer in Jews aged ≥65 years. The proportion and amount of colorectal cancer increased most significantly in older women, which was partially explained by their increasing numbers and by colorectal cancer occurring in recent immigrants from Russia, who were at high-risk for colorectal cancer. These results should influence colorectal cancer screening and diagnostic methodologies used. European Journal of Cancer Prevention 16:1–9 © 2007 Lippincott Williams & Wilkins.

Keywords: cancer site, colorectal cancer, ethnic groups, Jews

Introduction

In Israel, approximately 3000 new colorectal cancer (CRC) cases are being diagnosed annually, representing 13% of all new cancer cases. CRC ranks second in the total number of cancer cases diagnosed annually both in the Jewish male and female population. It is uncommon in the non-Jewish (Arab) population; however, it is increasing and this is now being analyzed. Historically, Ashkenazi Jews (Jews of European origin) have been noted to be at increased risk for CRC, as compared with non-European Jews and non-Jews. This is attributed to different genetic susceptibility and/or lifestyle and diet (Rozen et al., 1987; Steinitz et al., 1989; Odes et al., 1992; Parkin et al., 1997; Feldman, 2001; Barchana et al., 2004; Kedar-Barnes and Rozen, 2004).

The large intestine is one anatomical organ, but it can be considered as having differing physiological functions in the right colon, left colon and rectum and also differing etiologies and risks for cancer in each segment. Although malignancies in these sites share some etiological causes as well as some diagnostic and treatment modalities, they do differ markedly in morbidity trends (Parkin et al., 2005). For some decades, an age-increasing, and female sex (in some countries), trend for proximal CRC and conversely a decreasing proportion of distal CRC has been noted in countries at high risk for CRC. These countries include European and non-European populations that have undergone a ‘westernization’-industrialization lifestyle (Ottenheimer and Oughterson, 1955; Slater et al., 1982; Jensen, 1984; Vobecky et al., 1984; Schub and Steinheber, 1986; Jass, 1991; Kee et al., 1992; Demers et al., 1997; Ji et al., 1998; Bonithon-Kopp and Benhamiche, 1999; Huang et al., 1999; Troisi et al., 1999; Miller et al., 2000; Cucino et al., 2002; Mitry et al., 2002; Takada et al., 2002; Rabeneck et al., 2003; Thygesen et al., 2004; White et al., 2004; Parkin et al., 2005; Sarli et al., 2005).

The aims of this study were to follow Israeli Jewish long-term incidence trends of CRC by anatomic site and their associations with sex, age and group ethnicity. The goal was to evaluate the clinical implications of the findings.
Materials and methods
Cancer patients and data
The data included all CRCs that were diagnosed in Jewish citizens residing in the State of Israel from 1982 to 2001. The data source is the Israel National Cancer Registry (INCR) and the following description of the INCR and the Jewish population has been published in full (Barchana et al., 2004). In summary, the INCR is a population-based central tumor registry established in 1960 (Israel National Cancer Registry, 2005). Since 1982, reporting to the registry is mandatory for all medical facilities and pathology laboratories, both public and private, that are diagnosing or treating cancer patients. The INCR also collects data on cancer deaths from District Health Authorities and the Central Population Registry.

In Israel, everyone receives at birth, or immigrants upon getting citizenship, a personal identification number. This personal identification number serves to identify an individual in all his/her contacts with all organizations in the country, including the universal and compulsory health system available to all citizens. All demographic data, including place of birth and immigration date, as well as residential and other personal data (including religion) are stored in the Central Population Registry. The INCR is linked to this Registry and each cancer patient’s personal data are then retrieved and validated.

In the INCR, in addition to demographic data, all data available on the CRC are registered, including detailed tumor location, using the International Classification of Diseases for Oncology version-3 codes (SEER Program, 1999). The last audit of data completeness concluded that registration was above 95% (Fishler et al., 2003).

Israeli Jewish population
The State of Israel was established in 1948 and at that time the Jewish population comprised about 650,000 people. This was followed by massive waves of immigration of Jews surviving Europe, and refugees from Arab and other Muslim countries in the Maghreb (North Africa), and later from Asia. In 2001, the Israeli population was 6.5 million people and 5 million were Jews, comprising 62% who were Israel-born and 38% born abroad (Anon, 2001).

Within the Jewish population, the major ethnic groups are usually defined by their place of birth, in four categories: those born in Europe or America, Asia, Africa and those born in Israel (Anon, 2001). This geographic subdivision corresponds only approximately to ethnic groups usually defined as ‘Ashkenazim’ (those who were born in Europe or America) and ‘Sephardim’ (those who were born in Asia or Africa). In 2001, of those born outside Israel, 72% were born in Europe or America, 16% in African countries and 12% in Asia (Anon, 2001). As a result of their relatively small numbers, the statistics of the latter two groups are usually combined to compare them with the ‘Ashkenazi’ majority. Historically, there was always geographic intermingling and intermarriage of Jewish ethnic groups, so Israel-born Jews frequently represent the results of interethnic as well as intraethnic marriages (Kedar-Barnes and Rozen, 2004). From the Israeli demographic statistics, 22–40% of male immigrants to Israel married outside their ethnic (continent of birth) group, whereas 60% of Israel-born men married non-Israel-born women (Anon, 2001).

Statistical analyses
Age-standardized rates were computed per 100,000 population, standardized to the ‘World Standard Population’. Rates were computed for each large bowel site and subsite and ‘ethnic’ group (country/continent of birth). The Israeli population data, by age group and sex, were retrieved from the Central Bureau of Statistics (Anon, 2001). Trend analysis was computed by linear regression. Tests of significance used confidence intervals of 95% and a result was considered significant when P < 0.05.

Evaluations for all Jews were made by sex, CRC site, age groups and ethnic groups. For site we used International Classification of Diseases for Oncology version-3 codes to evaluate rectal cancers (but excluded anal cancer) and colon cancers (but excluded appendiceal cancer). We also included from C18.0 (cecum) to C18.5 (splenic flexure) for ‘right’ colon, and the remainder of the large bowel sites from colon, C18.6 to C20.9a including rectum as ‘left’-colon. To study the effects of the increasingly aged population, we grouped the CRC cases as 45–64 years old or ≥ 65 years old. The relative proportions of right vs. left CRC were compared for 5-year periods from 1982 to 2001; age-adjustment was performed when comparing rate ratios. Evaluations were made for all Jews and also when grouped by continent of birth, namely Israel-born, Europe-America-born or Asia-Africa-born. The contribution of immigration from the former Soviet Union (FSU), 1996–2000, to the incidence of CRC, was evaluated.

Results
Populations studied
Out of 34,282 CRC patients who were entered into the analysis, there were 17,716 men and 16,566 women; 23,044 with left CRC and 11,238 with right CRC; and 10% were born in Israel, 70% in Europe-America, and 20% in Asia-Africa. During 1982–2001, the proportion of CRC in Israel born increased from 6 to 14%, Africa-Asia born from 17 to 18.5% and conversely, the proportion of CRC in Europe-America born decreased from 77 to 67.5% (P < 0.01 for all). The proportion of each ethnic group, at each CRC pathology stage, however, remained constant (Israel National Cancer Registry, 2005).
Incidence trends 1982–2001, and rates for colorectal, colonic and rectal cancers for the entire population, and by sex and ethnic groups

From 1982 to 2001, the overall incidence trends of all CRC were on a sharp and steady increase until the early 1990s and have been at a plateau since then ($P < 0.01$) (Fig. 1). The CRC rates increased significantly by 18% in the male and 17% in the female population ($P < 0.01$ for both). The increase was mainly of colon cancer (55 and 54%, respectively; $P < 0.01$ for both). Rectal cancer trends showed a rise in rates until the mid-1980s, with an increase of 15% in men and 8% in women. Then there was a decrease in rectal cancer incidence in both sexes till the mid-1990s, 27% in men and 38% in women ($P < 0.01$ for both), with little variation since then (Fig. 2).

The incidence trends for CRC by ethnic groups and sex are shown in Fig. 3a and b. The trends were for increasing CRC in Europe-America born ($P < 0.01$) and Asia-Africa born people ($P < 0.01$), but for decreasing CRC in Israel born ($P < 0.01$). Overall, the CRC trends for Europe-America born men and women are at a plateau level, and those of Asia-Africa and Israel born have converged at a lower level. Rectal cancer trends decreased in all three ethnic groups ($P < 0.01$ for all).

In 2001, in men, the highest CRC incidence rates were in those born in Europe or America ($48.3/10^5$), followed by those born in Asia or Africa ($35.5/10^5$) and those born in Israel ($32.7/10^5$), giving the Europe-America born a relative risk of 1.36, $P = 0.03$. In women, the highest rate of $35/10^5$ was in those born in Europe-America, and both the Asia-Africa and the Israel born had rates of $26/10^5$ (relative risk, 1.35, $P < 0.01$).

In 2001, incidence rates for rectal cancer in men were $13/10^5$ in those born in Europe-America, whereas those born in Israel or Asia-Africa had rates of $10/10^5$. In women, the rectal cancer incidence of all ethnic groups converged and the rate in those born in Europe-America was $9/10^5$, while those of the Africa-Asia and Israel born were $8/10^5$.

Incidence trends 1982–2001 for left and right colorectal cancer site by sex, for the total population and by ethnic group

During 1982–2001, in the total male and female populations there was no significant left or right CRC site trend by sex. In men, in the Europe-America born and Israel born there were stable trends for left and right CRC; however, the Asia-Africa born had increasing trends for both left ($P = 0.02$) and right CRC ($P = 0.06$). In women, the Europe-America born had stable trends, whereas the Israel born had a nonsignificant decrease in both left and right CRC and the Asia-Africa born had a significantly increased trend for both left ($P = 0.03$) and right CRC ($P = 0.01$). Overall, the site trends for the Israel born and Africa-Asia born converged.

Incidence trends 1982–2001 for left and right colorectal cancer site by age group, sex and ethnic group

Age group 45–64 years

The incidence trends are summarized in Table 1. None reached statistical significance but there was increasing left and right CRC in the Asia-Africa born. The trends in Israel-born women were for decreasing left CRC.

Age group $\geq 65$ years

The incidence trends are summarized in Table 1. Both men and women had significant trends for increasing...
right CRC ($P = 0.05$ and 0.01, respectively). In the Israel-born men there were decreasing trends for right and left CRC, whereas the trends for women were stable. In the Europe-America born, in both sexes, there was a significant trend for increasing right CRC, whereas the Asia-Africa born showed increasing trends for both sites, reaching significance for left CRC in women and right CRC in men (Fig. 4a and b).

Quantifying the shift to right-sided colorectal cancer

The quantity of right CRC in 2001 was determined by the changing size of the total population by natural increase and immigration, the changing proportions of the sex, the changing proportions of the Jewish ethnic groups and the overall aging of the population.

During the years 1982–2001, the rate ratios between relative incidence risk rates for right vs. left CRC, when comparing 1982–1986 to 1997–2001, for the entire Jewish population and by sex and ethnic groups are summarized in Table 2. In all men, there was a nonsignificant increased risk for right CRC. The right CRC risk was significantly less in the Israel ($P < 0.01$) and the Asia-Africa born ($P = 0.03$), but was significantly increased in the Europe-America born ($P < 0.01$). In all women, the rate ratio for right-sided CRC increased significantly ($P < 0.01$). This was also increased in women of Asia-Africa ($P < 0.01$) and Europe-America origin (NS), whereas the Israel born had a significantly reduced risk for right CRC ($P < 0.01$).

In the time period 1982–1986, there were 6624 CRC cases of all ages reported to the ICR; of these 3451 were in men and 3173 in women. Right CRC was present in 31.4%, 30.5% in men and 32.4% in women. In the period 1997–2001, there were 11 181 CRC cases; of these 5636 were in men and 5541 in women. The proportion of right CRC increased to 34.3%, 32.7% of all the CRC in men ($P < 0.01$), but to 57.6% of CRC in women ($P < 0.01$).

From 1982–1986, as compared with 1997–2001, in the age group $\geq 65$ years, there was a significant quantitative increase in the number of both left and right CRC ($P < 0.01$). The number of left CRC increased in parallel in the two sexes, there was more left CRC in men and the number of right CRC also increased; but recently, there was more right CRC in women than in men (Fig. 5). The proportion of right CRC, as a percentage of all CRC in the $\geq 65$-year-olds, increased significantly by 3.3% in men ($P < 0.01$) and by 6.2% in women ($P < 0.01$). These represent a relative increase of 10.9 and 18.2%, respectively (Table 3 and Fig. 6).
During 1982–2001, the total Israeli Jewish population increased by natural growth, but also because of a large immigration since 1990, mainly from the FSU, the peak immigration period being 1989–2001. They were mostly Jews of European origin, many of whom were adults and their CRC rates, both in men and women, were higher than those of the long-term Israeli residents of similar European origin. In 1996, the rate in new immigrants exceeded 55/10^5 in men and 43/10^5 in women. Considering the latency period of CRC, this trend can be explained by both a health-immigration effect and better accessibility to the healthcare system in Israel than in their native land. In the year 2001, however, the higher differences in rate between the new immigrants from the FSU and the entire population originating from Europe-America and having emigrated to Israel in past years was still 7.5/10^5 for men and 4/10^5 for women (Table 4, Fig. 7a and b) (Vadlamani et al., 2001; Barchana et al., 2004).

Contributory causes for the increased amount of right colorectal cancer
During 1982–2001, the total Israeli Jewish population increased by natural growth, but also because of a large immigration since 1990, mainly from the FSU, the peak immigration period being 1989–2001. They were mostly Jews of European origin, many of whom were adults and their CRC rates, both in men and women, were higher than those of the long-term Israeli residents of similar European origin. In 1996, the rate in new immigrants exceeded 55/10^5 in men and 43/10^5 in women. Considering the latency period of CRC, this trend can be explained by both a health-immigration effect and better accessibility to the healthcare system in Israel than in their native land. In the year 2001, however, the higher differences in rate between the new immigrants from the FSU and the entire population originating from Europe-America and having emigrated to Israel in past years was still 7.5/10^5 for men and 4/10^5 for women (Table 4, Fig. 7a and b) (Vadlamani et al., 2001; Barchana et al., 2004).
Whereas the total numbers of Jewish men and women were approximately equal in 1982–1986, the total number of women was greater than men in 1997–2001, but more so of women ≥ 65 years of age. During that period of time, the total male population ≥ 65 years of age increased from 9.3 to 10.0% of the male population (P < 0.01), whereas women of this age increased from 10.6 to 13.0% of the female population (P < 0.01), an increase of 7.5 and 22.6%, respectively. During 1996–2001, about one-third of right-sided CRC occurring in women ≥ 65 years of age could be attributed to the recent immigrants from the FSU (Tables 4 and 5, Figs 5–7).

**Discussion**

The present long-term national analysis of CRC in the Israeli Jewish population demonstrated a higher CRC incidence in the Europe-America born, and an increasing trend in the lowest-risk Asia-Africa born to merge with the decreasing incidence in Israel born. It also demonstrated a recent significant increase in the amount of right-sided CRC, more so in women ≥ 65 years of age. This was true for those of Europe-America origin, but also of Asia-Africa origin. This was due in part to the increased number of European immigrants at high risk for CRC and the increased number of older women.

Jewish immigrants, especially men, from Europe or the Americas are at high risk for colon cancer as compared with other immigrant populations (Steinitz et al., 1989; Parkin et al., 1997; Feldman, 2001; Barchana et al., 2004). The markedly rising CRC incidence in Israeli Jews born in Asia or Africa, initially rectal and then left and right-sided CRC, is consistent with the effects of long-term diet and lifestyle, namely ‘westernization’ and the associated affluence of a Mediterranean and Middle Eastern people. This effect has been consistently seen in other immigrants moving from low risk for CRC countries, such as southern Italy or Greece, to high risk

**Table 3 Changing proportion of right colorectal cancer (CRC) in the two sexes, aged ≥ 65 years old, 1982–1986 vs. 1997–2001**

<table>
<thead>
<tr>
<th>Period</th>
<th>All Jews</th>
<th>Israel born</th>
<th>Europe-America born</th>
<th>Asia-Africa born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right %</td>
<td></td>
<td>Right %</td>
<td></td>
</tr>
<tr>
<td>1982–1986</td>
<td>2445</td>
<td>2415</td>
<td>2563</td>
<td>2987</td>
</tr>
<tr>
<td>1992–1996</td>
<td>11.17</td>
<td>12.04</td>
<td>11.95</td>
<td>12.23</td>
</tr>
<tr>
<td>1997–2001</td>
<td>11.78</td>
<td>12.13</td>
<td>12.15</td>
<td>12.32</td>
</tr>
</tbody>
</table>

**Table 2 Right and left colorectal cancer (CRC) age-standardized incidence rates/10^5 (ASR), for 5-year periods, 1982–2001, for all Jews, by sex and ethnic groups and the changing rate ratio (RR) of right CRC site vs. left with time**

<table>
<thead>
<tr>
<th>Period</th>
<th>All Jews</th>
<th>Israel born</th>
<th>Europe-America born</th>
<th>Asia-Africa born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right ASR</td>
<td>Left ASR</td>
<td>RR</td>
<td>Right ASR</td>
</tr>
<tr>
<td>1982–1986</td>
<td>2445</td>
<td>2415</td>
<td>1.43</td>
<td>2563</td>
</tr>
<tr>
<td>1987–1991</td>
<td>10.94</td>
<td>11.79</td>
<td>0.95</td>
<td>11.59</td>
</tr>
<tr>
<td>1992–1996</td>
<td>11.17</td>
<td>12.04</td>
<td>0.92</td>
<td>11.95</td>
</tr>
<tr>
<td>1997–2001</td>
<td>11.78</td>
<td>12.13</td>
<td>0.93</td>
<td>12.15</td>
</tr>
</tbody>
</table>

**Fig. 5**

The increasing numbers of left and right colorectal cancer (CRC) in both sexes aged ≥ 65 years, 1980–2001 (P < 0.01 for both). The number of right CRC increased more in women than in men.

Whereas the total numbers of Jewish men and women were approximately equal in 1982–1986, the total number of women was greater than men in 1997–2001, but more...
for CRC countries, such as the United States or Australia (Parkin et al., 1997, 2005). As found in these other populations, the increased cancer risk in the Israeli Jewish population was recently most marked in the colon whereas rectal cancer had decreased and reached a plateau level. Israel-born CRC patients have the lowest and a decreasing incidence of all ethnic populations (Barchana et al., 2004). As indicated before, Israel-born Jews are increasingly the descendants of interethnic marriages and have a merging of diet–lifestyle and genetic pool of those ethnic groups. They now have a CRC incidence similar to those of the Asia-Africa born who have the lowest risk for CRC.

The pattern of CRC site incidence in industrialized and ‘westernized’ countries is that of a decreasing incidence of rectal cancer and an increasing incidence in proximal colon cancer (Parkin et al., 2005). This has been noted worldwide in diverse populations and this proximal increase in CRC has often been noted to be more prominent in women (Ottenheimer and Oughterson, 1955; Slater et al., 1982; Jensen, 1984; Vobecky et al., 1984; Schub and Steinheber, 1986; West et al., 1989; Whittmore, 1989; Ponz De Leon et al., 1990; Jass, 1991; Kee et al., 1992; Demers et al., 1997; Ji et al., 1998; Bonithon-Kopp and Benhamiche, 1999; Troisi et al., 1999; Miller et al., 2000; Cucino et al., 2002; Mitry et al., 2002; Takada et al., 2002; Rabeneck et al., 2003; Thygesen et al., 2004; White et al., 2004; Sarli et al., 2005). It has also been seen in the United States, which is unique in that the total CRC incidence, and mainly distal CRC, is now decreasing while right-sided CRC incidence is constant (Rabeneck et al., 2003). Norway and Denmark are exceptional as there, distal CRC is more prominent than proximal cancer (Svensson et al., 2002; Thygesen et al., 2004).

### Table 4 Comparison of colorectal cancer (CRC) rates in the Jewish ethnic groups and those of recent European immigrants, 1996–2001

<table>
<thead>
<tr>
<th>Year</th>
<th>Israel born</th>
<th>Europe-America born</th>
<th>European immigrants arriving ≥ 1990a</th>
<th>Asia-Africa born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>ASR</td>
<td>Cases</td>
<td>ASR</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>112</td>
<td>27.08</td>
<td>841</td>
<td>50.92</td>
</tr>
<tr>
<td>1997</td>
<td>126</td>
<td>27.48</td>
<td>871</td>
<td>53.13</td>
</tr>
<tr>
<td>1998</td>
<td>131</td>
<td>30.68</td>
<td>888</td>
<td>49.76</td>
</tr>
<tr>
<td>1999</td>
<td>157</td>
<td>34.07</td>
<td>905</td>
<td>48.33</td>
</tr>
<tr>
<td>2000</td>
<td>155</td>
<td>29.48</td>
<td>869</td>
<td>47.14</td>
</tr>
<tr>
<td>2001</td>
<td>187</td>
<td>31.70</td>
<td>917</td>
<td>48.95</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>127</td>
<td>26.72</td>
<td>815</td>
<td>37.66</td>
</tr>
<tr>
<td>1997</td>
<td>111</td>
<td>21.04</td>
<td>832</td>
<td>36.21</td>
</tr>
<tr>
<td>1998</td>
<td>124</td>
<td>22.10</td>
<td>913</td>
<td>38.78</td>
</tr>
<tr>
<td>1999</td>
<td>155</td>
<td>25.37</td>
<td>920</td>
<td>37.21</td>
</tr>
<tr>
<td>2000</td>
<td>162</td>
<td>27.23</td>
<td>932</td>
<td>37.60</td>
</tr>
<tr>
<td>2001</td>
<td>175</td>
<td>26.24</td>
<td>891</td>
<td>35.51</td>
</tr>
</tbody>
</table>

ASR/105, age-standardized rate.

aThese immigrants are also included in the group Europe-America born.

### Table 5 Colorectal cancer occurring in Jewish female ethnic groups and recent European immigrants, aged ≥ 65 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Israel born</th>
<th>Europe-America born</th>
<th>European immigrants arriving ≥ 1990a</th>
<th>Asia-Africa born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>ASR</td>
<td>Cases</td>
<td>ASR</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>11</td>
<td>54.73</td>
<td>190</td>
<td>81.84</td>
</tr>
<tr>
<td>1997</td>
<td>7</td>
<td>31.16</td>
<td>209</td>
<td>82.15</td>
</tr>
<tr>
<td>1998</td>
<td>8</td>
<td>33.59</td>
<td>238</td>
<td>97.84</td>
</tr>
<tr>
<td>1999</td>
<td>9</td>
<td>37.05</td>
<td>270</td>
<td>107.44</td>
</tr>
<tr>
<td>2000</td>
<td>27</td>
<td>94.23</td>
<td>263</td>
<td>106.75</td>
</tr>
<tr>
<td>2001</td>
<td>25</td>
<td>79.93</td>
<td>262</td>
<td>105.03</td>
</tr>
</tbody>
</table>

ASR/105, age-standardized rate.

aThese immigrants are included in the group Europe-America born.

The proportion of right colorectal cancer in men and women aged ≥ 65 years old increased from 1982–1986 to 1997–2001 (P<0.01), but mostly in women. Note the sharp increase of CRC in women during the last time period.
In our population, over the last three decades we have observed a pattern of initial increase in rectal cancer in the lowest-risk population (non-European Jewish immigrants), followed by a decreasing rectal cancer incidence in the high-risk population (European Jewish immigrants) and now a merged plateau level of all ethnic groups. The CRC rates are highest in male Europe-America-born immigrants, whereas the Asia-Africa and Israel born have similar rates because of increasing trends in the former and deceasing trends in the latter. As a result of the increased prevalence in women over 65 years of age, both of Europe-America and Asia-Africa origin, and the recent arrival of high-risk European immigrants, however, the total amount of right CRC has increased markedly.

The reasons for the changing epidemiology of CRC, incidence and site, are assumed to be related to the changing diet and lifestyle associated with industrialization (West et al., 1989). Worldwide, industrialization is associated with an increasing life expectancy, especially of women, and their proportion has increased in the ≥ 65 years of age population (Okamoto et al., 2002; Rabeneck et al., 2003). The reason for female predilection for proximal cancer is unclear.

The quantity of right-sided CRC has become a major medical issue that needs to be addressed by adapting our screening methodology (Saltzstein et al., 1998). Our medical services provide CRC screening to all average-risk citizens by fecal occult blood testing, and colonoscopy for persons at high-risk for CRC. We do not have evidence that the decreased left CRC in our population is due to the screening program. Today, the most adequate answer for the aging population is total colonoscopy (Imperiale et al., 2000; Lieberman et al., 2000; Gupta et al., 2005; Schoenfeld et al., 2005).

This requires a high quality and complete examination, especially as a proportion of right CRC appear as flat lesions, and not necessarily as the polypoid neoplasia usually identified in the left colon (Okamoto et al., 2005). False-negative colonoscopic identification of right-sided CRC has been estimated as 4–6% of all CRC (Hosokawa et al., 2003; Bressler et al., 2004). The reasons have been an incomplete colonoscopic examination, an inadequately cleaned bowel and observer errors (Cotton et al., 2003; Dafnis et al., 2005; Minoli, 2005). Quality control of completeness of colonoscopy requires identifying and photographing landmarks such as the cecum and ileo-cecal valve. A poorly cleaned bowel requires repeat examinations or at least a high-quality computed tomography-colonography examination. Observer errors occur with inadequately trained endoscopists, and too rapid an examination precludes identifying, biopsying or removing polyps. For these reasons, the use of a chromo or magnifying endoscopy or of a fecal biomarker between colonoscopy examinations has been suggested. The latter include fecal DNA or a sensitive occult blood test (Bampton et al., 2005). The latter test, based on immunochemical detection and quantification of human fecal hemoglobin, seems a cheap and promising methodology for quality control between colonoscopic screening examinations (Bampton et al., 2005; Vilkin et al., 2005).

In conclusion, there has been a change in incidence and prevalence of right-sided CRC in Israeli Jews aged older than 65 years of age, for all ethnic groups. As a result of the increasingly aging population, especially women, and influx of high-risk immigrants, the proportion of right-sided CRC in the population has increased significantly. Screening and diagnostic methodologies in this age group must address this clinical problem by providing complete examination of the colon.
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References