Life Expectancy and Mortality Differences between Populations on Croatian Islands and the Mainland

Sanja Musić Milanović[1], Ana Ivičević Uhernik[1], Sandra Mihel[1], Ivan Pristaš[1], Arsen Stanić[2], Ranko Stevanović[1]

[1]Croatian National Institute of Public Health, Zagreb, Croatia
[2]Orthopedic Clinic, Lovran, Croatia

Aim To examine the differences in life expectancy and mortality between the populations on Croatian islands and the mainland, and among the islands themselves.

Method Data on population size and mortality collected in Croatia in 2001 were analyzed by life table and standardized mortality rates.

Results Life expectancy at birth (95% confidence interval) of the population on Croatian islands was 76.4 yr (75.7-77.1) which was significantly higher than life expectancy at birth of general Croatian population which was 73.8 yr (73.5-73.9) or mainland Croatian population which was 73.7 yr (73.6-73.8). Island population had higher life expectancy until the age of 80 and again in the oldest age group, 95+. More than 10% of inhabited islands in Croatia had life expectancy at birth over 80 years. Two inhabited islands, Ilovik (Kvarner islands) and Lopud (South Dalmatian islands), had one of the highest life expectancy at birth recorded in the literature, with 95.0 and 90.6 years respectively. Mortality rates on islands were significantly lower for age groups 50-64 and 65-79 years, and this difference persisted for all island groups compared with general Croatian population.

Conclusion Residents of Croatian islands had a higher life expectancy than general or mainland Croatian population. Life expectancy at birth on Croatian islands was lower than in other European Mediterranean countries, but it resembles that in the neighboring Slovenia, and it is considerably higher than in central and eastern Europe and Balkan countries.

> **Correspondence to:**

Sanja Musić Milanović
Croatian National Institute of Public Health
Rockefellerova 7
10000 Zagreb, Croatia
sanja.music@hzjz.hr

> **Received:** April 25, 2006
> **Accepted:** July 6, 2006

> **Croat Med J. 2006;47:611-18**

Life expectancy is one of the most important demographic indicators used to compare different population groups. It is defined as the mean number of years a cohort of people might expect to live according to the current age-specific mortality rates. Life expectancy is the main outcome measure of life table analysis. In general, it reflects differences in mortality, but is relatively resistant to differences in age structure and other population characteristics (1,2). It has mostly been applied for comparison of different countries (3,4), regions (5-7), and specific socio-economic groups (8,9) in terms of health and health care. Life expectancy is generally considered to reflect differences in mortality quite well, but also to be insensitive to age structure of the population, changes in birth rates, and other demographic phenomena (10,11).

Low mortality and high life expectancy in European Mediterranean population prompted much interest and has been a focus of research in many studies (12-14). Low intake of saturated fats and high intake of monosaturated fats, as well as high consumption of fruit and vegetables have been proposed as the main factors underlying the low mortality in the Mediterranean (12-17).

This study was the first attempt to investigate the differences in life expectancy and mortality between population on Croatian islands and the mainland, and among the islands themselves, as well as to compare the results on Croatian islands with life expectancy in Mediterranean population of European countries.

Subjects and Methods

Data collection

For life expectancy calculation we used data on population size and mortality statistics. Data on population size were taken from the most recent 2001 Census (18). According to it, there were 4437460 inhabitants in Croatia, and 121486 of them (2.7% of the total Croatian population) were living on the islands. Mortality statistics and indicators were calculated from data collected by the Croatian National Institute of Public Health and Croatian Central Bureau of Statistics. Mortality data for all deceased residents in Croatia in 2001 were taken From Mortality Database at the Croatian Central Bureau of Statistics (19). In year 2001, 1536 deaths were registered on Croatian islands (3.1% of total 49 552 deaths in Croatia). Since these figures are based on compulsory registration, it is considered that the data encompass the entire population.

Description of islands

There are 1185 islands in Croatia, and 67 of them are inhabited. We analyzed 28 inhabited islands for which we had complete and routinely collected data. Croatian islands belong to six maritime counties (Figure 1): Primorsko-goranska, Ličko-senjska, Zadarska, Šibensko-kninska, Splitsko-dalmatinska, and Dubrovačko-neretvanska. Traditionally, there are four distinctive groups of islands: Kvarner islands (islands from Primorsko-goranska County), North Dalmatian islands (islands from Ličko-senjska, Zadarska, and Šibensko-kninska County), Middle Dalmatian islands (islands from Splitsko-dalmatinska County), and South Dalmatian islands (islands from Dubrovačko-neretvanska County).

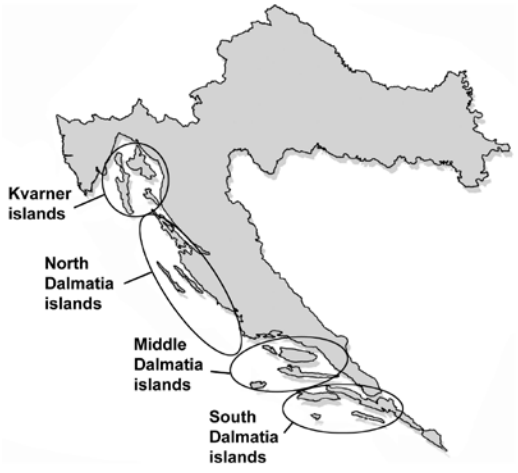

Figure 1. Map of Croatian islands.

Statistical analysis

The data were divided into five-year age categories running from 0-4, 5-9, and so on, up to the age category of 95+. In data nalysis, we applied standard demographic analysis, such as life table analysis and the calculation of standardized mortality rates.

Life table analysis was carried out according to the method described by Chiang (1,2). Life expectancy was calculated for each island, groups of islands from the same county, four traditional groups of islands, and all islands together. It was then compared to the life expectancy in the general and mainland population of Croatia, as well as to the life expectancy of mainland population in the maritime counties.

The differences in mortality between populations of Croatian islands and Croatia as a whole were examined by means of life table analysis, a method which consists of applying the current-age-specific mortality rates to a hypothetical cohort (10,20,21).

In the analysis, we also used the standardized mortality ratio, which is sensitive to differences in age distribution between population on Croatian islands and the mainland (11,20,21).

For the calculation of standardized mortality rates, indirect age standardization was applied, using general Croatian population as the standard: the national Croatian age-specific mortality rates were applied to the age categories of specific groups of islands. Relative risks were calculated for general mortality, as well as for mortality of each age category compared to the general Croatian population.

Results

According to the population census in 2001, 2.7% of the total population in Croatia lived on islands. Their age structure was less favorable than the Croatian average, with a higher share of people older than 65 years than on the Croatian mainland (20.3% vs 15.5%) and a lower share of children younger than 15 years (15.4% vs 17.1%). When the groups of islands are compared, North Dalmatian islands stand out, with 25.0% of people older than 65 and 14.2% of children younger than 15 years (Table 1).

When we compared life expectancies of the mainland and island populations of Croatia, the island population had higher life expectancy until the age of 80. For the age groups above 80 years, island population had slightly lower life expectancy than the mainland population. However, in the oldest age group (95+) the island population again had higher life expectancy than the Croatian mainland (Figure 2).

Life expectancy at birth was significantly higher on the islands (76.4 years) than on the

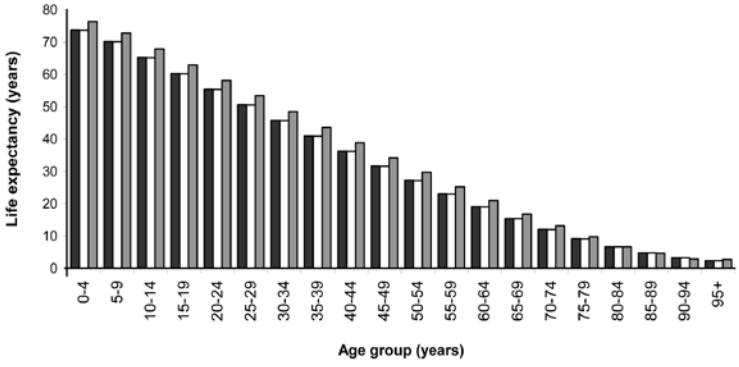

Figure 2. Life expectancy by age on Croatian islands – comparison with mainland and Croatia in whole. Closed bars – Croatia; open bars – mainland; gray bars – islands.

Table 1. Population size and number of deaths in Croatia, its mainland, coast, islands, and groups of islands in 2001

Region	Population size	Number of deaths	Share of population younger than 15 y (%)	Share of population older than 65 y (%)
Croatia	4 437 460	49 552	17.0	15.6
Mainland	4 315 974	48 016	17.1	15.5
Coast	1 305 522	13 640	16.9	15.5
Islands:	121 486	1536	15.4	20.3
Kvarner islands	38 687	415	15.8	17.0
North Dalmatian islands	28 865	428	14.2	25.0
Middle Dalmatian islands	34 927	461	15.6	20.2
South Dalmatian islands	19 007	232	16.3	20.2

Table 2. Life expectancy for population of Croatia, its mainland, coast, islands, and groups of islands with highest age group 90+ in 2001

Region	Life expectancy at age (95% CI)*				
	0	15	45	65	90
Croatia	73.8 (73.5-73.9)	60.3 (60.2-60.4)	31.7 (31.6-31.8)	15.5 (15.4-15.6)	3.4 (3.3-3.4)
Mainland	73.7 (73.6-73.8)	60.3 (60.1-60.4)	31.7 (31.6-31.8)	15.4 (15.4-15.5)	3.4 (3.3-3.5)
Coast	75.0 (74.8-75.2)†	61.6 (61.4-61.8)†	33.0 (32.8-33.2)†	16.2 (16.0-16.3)†	3.5 (3.3-3.6)
Islands:	76.4 (75.7-77.1)†	63.0 (62.4-63.6)†	34.2 (33.7-34.8)†	16.9 (16.5-17.3)†	3.0 (2.7-3.3)‡
Kvarner islands	75.9 (74.5-77.3)†	62.8 (61.7-64.0)†	33.9 (32.9-34.9)†	17.0 (16.2-17.8)†	3.5 (2.7-4.2)
North Dalmatia islands	76.7 (75.2-78.2)†	63.2 (61.9-64.5)†	34.7 (33.7-35.6)†	17.1 (16.4-17.8)†	2.8 (2.3-3.2)‡
Middle Dalmatia islands	76.2 (75.0-77.5)†	62.6 (61.5-63.8)†	33.9 (33.0-34.9)†	16.3 (15.6-17.0)†	3.0 (2.5-3.6)
South Dalmatia islands	77.3 (75.5-79.0)†	63.6 (62.0-65.3)†	34.8 (33.4-36.1)†	17.5 (16.5-18.5)†	2.9 (2.3-3.6)

*Confidence interval.
†Significantly above Croatian average.
‡Significantly below Croatian average.

Table 3. Life expectancy for population of Croatia, its mainland, coast, islands, and groups of islands with highest age group 80+ in 2001

Region	Life expectancy at age (95% CI)*				
	0	15	45	65	90
Croatia	73.8 (73.5-73.9)	60.3 (60.2-60.4)	31.7 (31.6-31.8)	15.5 (15.4-15.6)	3.4 (3.3-3.4)
Mainland	73.7 (73.6-73.8)	60.3 (60.1-60.4)	31.7 (31.6-31.8)	15.4 (15.4-15.5)	3.4 (3.3-3.5)
Coast	75.0 (74.8-75.2)†	61.6 (61.4-61.8)†	33.0 (32.8-33.2)†	16.2 (16.0-16.3)†	3.5 (3.3-3.6)
Islands:	76.4 (75.7-77.1)†	63.0 (62.4-63.6)†	34.2 (33.7-34.8)†	16.9 (16.5-17.3)†	3.0 (2.7-3.3) ‡
Kvarner islands	75.9 (74.5-77.3)†	62.8 (61.7-64.0)†	33.9 (32.9-34.9)†	17.0 (16.2-17.8)†	3.5 (2.7-4.2)
North Dalmatia islands	76.7 (75.2-78.2)†	63.2 (61.9-64.5)†	34.7 (33.7-35.6)†	17.1 (16.4-17.8)†	2.8 (2.3-3.2)‡
Middle Dalmatia islands	76.2 (75.0-77.5)†	62.6 (61.5-63.8)†	33.9 (33.0-34.9)†	16.3 (15.6-17.0)†	3.0 (2.5-3.6)
South Dalmatia islands	77.3 (75.5-79.0)†	63.6 (62.0-65.3)†	34.8 (33.4-36.1)†	17.5 (16.5-18.5)†	2.9 (2.3-3.6)

*Confidence interval.
†Significantly above Croatian average.
‡Significantly below Croatian average.

mainland (73.7 years), or Croatia as a whole (73.8 years). The difference was almost 3 years and it remained constant at the age of 15 and 45. At age of 65, life expectancy on the islands was still higher, but the difference was about 1.5 years, while at the age of 90, life expectancy was higher on the mainland than on the islands. Among all islands, South Dalmatian islands had the highest life expectancy in all age groups, except at the age of 90 (Table 2). Knowing that life expectancy is highly sensitive to fluctuations in the mortality in the highest age groups, and that the number of deaths on the islands was small, we wanted to determine the sensitivity of the outcomes. In order to do so, we lowered the age of the highest age group to 80+ and found that the results were similar to that of the 95+ age group (Table 3).

Life expectancy at birth was above the Croatian average age of 73.8 years in all groups of Croatian islands. Life expectancy increased toward the south, except for the Middle Dalmatian islands. Only 5 out of 67 inhabited Croatian islands (Iž, Dugi Otok, Vis, Čiovo, and Krapanj) had lower life expectancy at birth than the Croatian mainland or Croatia as a whole, but the rest of them had higher life expectancy at birth than the rest of the country.

More than 10% of inhabited islands in Croatia had life expectancy at birth over 80 years: Cres (83.1 years), Ist (86.9 years), Prvić (81.0 years), Zlarin (81.7 years), Mljet (81.3 years), Šipan (81.0 years), and Koločep (82.0 years). Ilovik (Kvarner islands) and Lopud (South Dalmatian islands) had one of the highest life expectancies at birth recorded in the literature, with 95.0 and 90.6 years, respectively (Figure 3).

Crude mortality rates differed between the islands and the Croatian mainland, as well as between different groups of islands. Generally, islands had higher crude mortality rate than the mainland. However, when we compared the groups of islands, Kvarner and South Dalmatian

islands had lower, while North and Middle Dalmatian islands had higher crude mortality rates than the mainland. After standardization according to the age, mortality rates were compared to those of the Croatian general and mainland population. Standardized mortality rates for islands in general and each of the island groups were significantly lower than those of Croatian population and Croatian mainland population. South Dalmatian islands had the lowest standardized mortality rates compared with Croatian population (0.79) and Croatian mainland population (0.78) (Table 4).

Table 4. Mortality rates and standardized mortality rates for population on Croatian mainland, coast, islands, and groups of islands in 2001*

Region	Number of deaths per 1000 inhabitants	SMR (95% CI) in comparison with Croatia	SMR (95% CI) in comparison with Croatian mainland
Mainland	11.1	1.01 (1.00-1.01)	
Coast	10.4	0.91 (0.90-0.93)	0.91 (0.89-0.92)
Islands:	12.6	0.83 (0.78-0.89)	0.83 (0.79-0.87)
Kvarner islands	10.7	0.81 (0.71-0.92)	0.81 (0.71-0.92)
North Dalmatian islands	14.8	0.83 (0.73-0.94)	0.83 (0.72-0.94)
Middle Dalmatian islands	13.2	0.88 (0.77-0.99)	0.87 (0.77-0.99)
South Dalmatian islands	12.2	0.79 (0.66-0.93)	0.78 (0.66-0.93)

*Abbreviations: SMR – standardized mortality rates; CI – confidence interval.

When we calculated ratios between the mortality rates on islands and in the general Croatian population for fifteen-year age categories, statistically significantly higher mortality rate was found on islands in 5-19 years age group (2.69). However, when we analyzed the groups of islands, higher mortality rate in that age group was present only for Kvarner islands, but it did not reach statistical significance. Mortality rates on the islands were significantly lower in age groups 50-64 and 65-79 years, and this difference persisted for all island groups compared to general Croatian population (Table 5).

When mortality rates between islands and the general Croatian population were compared by five-year age groups, statistically significantly lower mortality rates were present on the islands

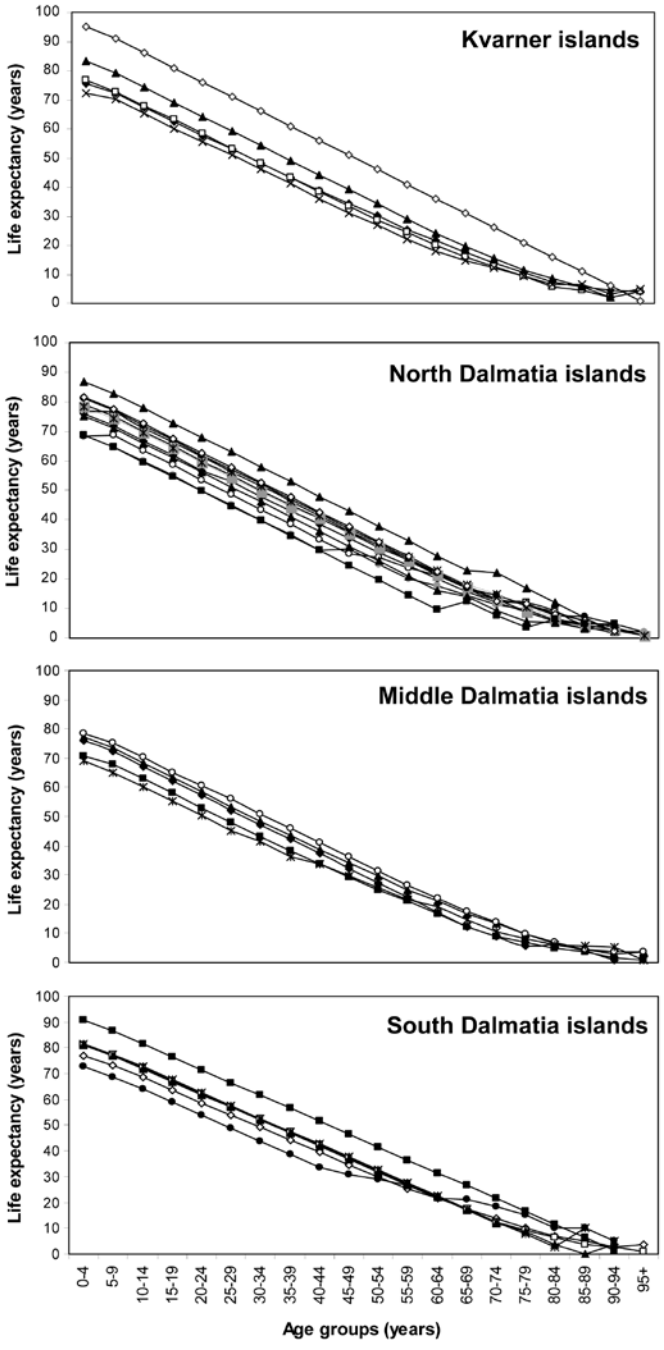

Figure 3. Life expectancy by age for each island in four Croatian groups of islands. Kvarner islands: closed rhombuses – Krk; open squares – Rab; closed triangles – Cres; asterisks – Lošinj; open rhombus – Ilovik. North Dalmatia islands: closed rhombuses – Pag; open squares – Vir; closed triangles – Ist; gray triangles – Ugljan; asterisks – Iž; closed circles – Dugi Otok; gray squares – Pašman; gray circles – Murter; open circles – Prvić; open rhombuses – Zlarin; closed squares – Krapanj; open triangles – Kaprije. Middle Dalmatia islands: closed rhombuses – Drvenik Veli; closed squares – Čiovo; closed triangles – Brač; open circles – Hvar; asterisks – Vis. South Dalmatian islands: open rhombuses – Korčula; open squares – Mljet; closed triangles – Šipan; closed squares – Lopud; asterisks – Koločep.

Table 5. Relative probability of population on Croatian mainland, coast, islands and groups of islands dying at a particular age, with regard to the rest of the Croatian population, by age group in 2001.

Region	Relative mortality rates per age group (95% CI*)						
	0-4	5-19	20-34	35-49	50-64	65-79	80+
Mainland	1.00 (0.83-0.87)	1.00 (0.83-1.19)	1.01 (0.91-1.12)	1.00 (0.95-1.06)	1.01 (0.98-1.04)	1.01 (0.99-1.03)	1.00 (0.97-1.02)
Coast	1.06 (0.86-1.31)	0.90 (0.69-1.19)	1.14 (0.98-1.32)	0.85 (0.78-0,92)‡	0.80 (0.77-0.85)‡	0.85 (0.83-0.88)‡	1.08 (1.05-1.12)†
Islands:	0.95 (0.47-1.91)	2.69 (1.27-5.71)†	0.73 (0.41-1.29)	0.84 (0.65-1.09)	0.61 (0.51-0.71)‡	0.75 (0.68-0.81)‡	1.07 (0.99-1.16)
Kvarner islands	1.11 (0.35-3.45)	2.35 (0.97-5.71)	0.54 (0.17 -1.68)	0.84 (0.54-1.30)	0.73 (0.55-0.96)‡	0.75 (0.64-0.88)‡	0.99 (0.84-1.16)
North Dalmatia islands	1.08 (0.27-4.33)	/	1.41 (0.59-3.41)	0.89 (0.52-1.54)	0.52 (0.37-0.74)‡	0.69 (0.59-0.81)‡	1.13 (0.98-1.30)
Middle Dalmatia islands	0.82 (0.20-3.28)	0.54 (0.08-3.82)	0.42 (0.11-1.69)	0.96 (0.60-1.52)	0.53 (0.39-0.74)‡	0.84 (0.73-0.98)‡	1.12 (0.97-1.29)
South Dalmatia islands	0.70 (0.10-4.98)	0.96 (0.14-6.88)	0.75 (0.19-2.99)	0.57 (0.26-1.28)	0.64 (0.42-0.97)‡	0.66 (0.52-0.82)‡	1.05 (0.86-1.27)

*Confidence interval.
†Significantly above Croatian average.
‡Significantly below Croatian average.

only in the following age groups: 50-54, 55-59, 60-64, 65-69, 70-74, and 75-79 years (Figure 4).

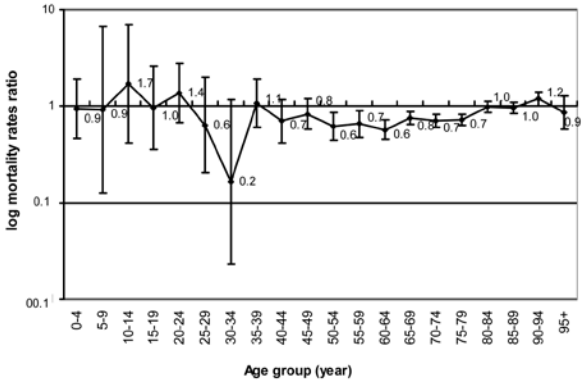

Figure 4. Relative probability of population on Croatian islands dying at a particular age, in regard to the rest of Croatian population, by age group in 2001.

Discussion

Population of Croatian islands had a significantly higher mean age and lower mortality rates than the general Croatian population. This was an evident and consistent finding of our study.

As a whole, Croatian islands population had significantly higher life expectancy from birth until the age of 80 and again in the oldest age group, 95+, than the general or mainland Croatian population. This difference remains persistent for all four distinctive groups of Croatian islands in comparison with general or mainland Croatian population. If life expectancy for each island in four distinctive groups of Croatian island is compared, it becomes apparent that life expectancy is above the Croatian average age in 85% of analyzed inhabited islands.

Mortality rates on Croatian islands were significantly lower in age groups 50+. There was a north-south cline in our results, with increased life expectancy and decreased mortality rates toward the south. In comparison with the population of the Croatian mainland; the differences for age 0, 15, 45, and 65 years were 2.7, 2.7, 2.5, and 1.4 years, respectively.

A possible explanation for these consistent findings could be Mediterranean lifestyle, especially the diet (22-27), although it is not possible to rule out the genetic factors in some specific cases (28-30). It is possible that in some isolated islands the combination of population genetic phenomena, such as founder effect and subsequent genetic drift, can bring rare longevity-enhancing genetic variants of large effect to unusually high frequency, which is then reflected in the increased life expectancy in the whole population (eg, Ilovik island).

Living conditions on Croatian islands had many other specific and mainly favorable characteristics as opposed to the mainland: pleasant microclimate, less pollution, and slower pace of life (28-30). The strong sense of family and community might also have positive influence on general health and life expectancy. However, their geographic isolation and less accessible health services might act in opposite direction, especially among the older age groups. This is possibly reflected in the finding that the residents of Croa-

tian islands have a higher life expectancy in all age groups, except the oldest. The longer life expectancy seen on Croatian islands could be due to the Mediterranean lifestyle. Higher life expectancy among people from Mediterranean has often been observed (22,23). The Mediterranean diet is characterized by a high intake of vegetables, legumes, fruits, and cereals; a moderate to high intake of fish; a low intake of saturated fats, but high intake of unsaturated fats, particularly olive oil; a low intake of dairy products and meat; and a modest intake of alcohol, mostly wine. Current evidence suggests that such a diet may be beneficial to health (22-27). The strongest association is in the southern parts of Croatian islands, probably because people follow a genuinely Mediterranean diet, which is consistent with the results reported for Greece and Spain (24).

With a life expectancy of 76.4 years at birth, Croatian islands population is closer to the life expectancy at birth of EU members (78.2 years) than population on the Croatian mainland (73.7 years). Life expectancy at birth on Croatian islands was lower than in other European Mediterranean countries (Greece, Albania, Italy, Spain, Portugal). The difference ranges from 0.65 years higher life expectancy in Portugal to 3.85 years higher life expectancy in Italy. Life expectancy at birth on Croatian islands is as high as in neighboring Slovenia, and considerably higher than in Balkan countries, such as Romania with 71.27 years, Bulgaria with 71.91 years, or Serbia and Montenegro with 72.9 years. Hungary, Poland, and other countries of Central and Eastern Europe have higher life expectancy at birth than the Balkan countries, but lower than Croatian islands or Mediterranean Europe (31).

Mortality rates on islands were significantly lower for age groups 50-64 and 65-79 years, and that difference persisted in all island groups compared with general Croatian population. Mortality differed substantially between older (50+ years) population on islands and the mainland Croatia.

Dietary patterns and lifestyle factors are associated with mortality from all causes, coronary heart disease, cardiovascular diseases, and cancer (12-17). Among individuals aged 70 to 90 years, adherence to a Mediterranean diet and healthy lifestyle is associated with a more than 50% lower rate of all-causes and cause-specific mortality (25).

The "Albanian paradox" of high adult life expectancy in a low-income country can be most plausibly explained by diet, ie, low consumption of total energy, meat, and milk products but high consumption of fruit, vegetables, and carbohydrates (26). Low level of adult mortality is remarkably consistent with other Mediterranean countries, and is in sharp contrast to all other central and eastern European countries (27).

Further studies will be necessary to explain what proportion of the observed differences can be attributed to differences in the prevalence of diseases, cultural and socio-economic differences, and genetic factors in the isolated population.

References

1 Chiang CL. The life table and its construction. In: Chiang CL, editor. Introduction to stochastic processes in biostatistics. New York: Wiley; 1968. p. 189-214.

2 Chiang CL. Lifetable and its application. New York: Robert E. Krieger; 1984.

3 Mathers CD, Sadana R, Salomon JA, Murray CJ, Lopez AD. Healthy life expectancy in 191 countries, 1999. Lancet. 2001;357:1685-91. Medline:11425392

4 Nakaji S, MacAuley D, O'Neill S, McNally O, Baxter D, Sugawara K. Life expectancies in the United Kingdom and Japan. J Public Health Med. 2003;25:120-4. Medline:12848400

5 Groenewegen PP, Westert GP, Boshuizen HC. Regional differences in healthy life expectancy in The Netherlands. Public Health. 2003;117:424-9. Medline:14522158

6 Woods LM, Rachet B, Riga M, Stone N, Shah A, Coleman MP. Geographical variation in life expectancy at birth in England and Wales is largely explained by deprivation. J Epidemiol Community Health. 2005;59:115-20. Medline:15650142

7 Dzurova D. Mortality differentials in the Czech Republic during the post-1989 socio-political transformation. Health Place. 2000;6:351-62. Medline:11027960

8 Uitenbroek DG, Verhoeff AP. Life expectancy and mortality differences between migrant groups living in Amsterdam, The Netherlands. Soc Sci Med. 2002;54:1379-88. Medline:12058854

9 Leinsalu M, Vagero D, Kunst AE. Increasing ethnic differences in mortality in Estonia after the collapse of the Soviet Union. J Epidemiol Community Health.

2004;58:583-9. Medline:15194720

10 Shryock HS, Siegel JS. Mortality. In: Shryock HS, Siegel JS, editors. The methods and materials of demography. Washington: US Department of Commerce, Bureau of the Census; 1973. p. 389-428.

11 Shryock HS, Siegel JS. The life tables. In: Shryock HS, Siegel JS, editors. The methods and materials of demography. Washington: US Department of Commerce, Bureau of the Census; 1973. p. 429-60.

12 Mariotti S, Capocaccia R, Farchi G, Menotti A, Verdecchia A, Keys A. Differences in the incidence rate of coronary heart disease between north and south European cohorts of the Seven Countries Study as partially explained by risk factors. Eur Heart J. 1982;3:481-7. Medline:7173232

13 Renaud S, de Lorgeril M. Wine, alcohol, platelets, and the French paradox for coronary heart disease. Lancet. 1992;339:1523-6. Medline:1351198

14 Helsing E. Traditional diets and disease patterns of the Mediterranean, circa 1960. Am J Clin Nutr. 1995;61 6 Suppl:1329S-37S. Medline:7754984

15 Criqui MH, Ringel BL. Does diet or alcohol explain the French paradox? Lancet. 1994;344:1719-23. Medline:7996999

16 Kushi LH, Lenart EB, Willett WC. Health implications of Mediterranean diets in light of contemporary knowledge: 1. Plant foods and dairy products. Am J Clin Nutr. 1995;61 6 Suppl:1407S-15S. Medline:7754996

17 Kushi LH, Lenart EB, Willett WC. Health implications of Mediterranean diets in light of contemporary knowledge: 2. Meat, wine, fats, and oils. Am J Clin Nutr. 1995;61 6 Suppl:1416S-27S. Medline:7754997

18 Central Bureau of Statistics of Republic of Croatia. Census 2001 [in Croatian]. 2nd ed. Zagreb: Central Bureau of Statistics; 2003.

19 Central Bureau of Statistics of Republic of Croatia. Statistical yearbook 2001 [in Croatian]. Zagreb: Central Bureau of Statistics; 2002.

20 McMahon B, Trichopoulos D. Epidemiology: principles and methods. 2nd ed. Boston: Little Brown and Co; 1996.

21 Mausner JS, Kramer S. Epidemiology – an introductory text. 2nd ed. Philadelphia: W.B. Saunders Co; 1985.

22 Razum O, Zeeb H, Akgun HS, Yilmaz S. Low overall mortality of Turkish residents in Germany persists and extends into a second generation: merely a healthy migrant effect? Trop Med Int Health. 1998;3:297-303. Medline:9623931

23 Seppa N. Mediterranean diet proves value again. Sci News. 1999;155:119.

24 Trichopoulou A, Orfanos P, Norat T, Bueno-de-Mesquita B, Ocke MC, Peeters PH, et al. Modified Mediterranean diet and survival: EPIC-elderly prospective cohort study. BMJ. 2005;330:991. Medline:15820966

25 Knoops KT, de Groot LC, Kromhout D, Perrin AE, Moreiras-Varela O, Menotti A, et al. Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. JAMA. 2004;292:1433-9. Medline:15383513

26 Gjonca A, Bobak M. Albanian paradox, another example of protective effect of Mediterranean lifestyle? Lancet. 1997;350:1815-7. Medline:9428253

27 Bobak M, Marmot M. East-West mortality divide and its potential explanations: proposed research agenda. BMJ. 1996;312:421-5. Medline:8601115

28 Rudan I, Campbell H, Rudan P. Genetic epidemiological studies of eastern Adriatic island isolates, Croatia: objective and strategies. Coll Antropol. 1999;23:531-46. Medline:10646227

29 Rudan I, Rudan D, Campbell H, Biloglav Z, Urek R, Padovan M, et al. Inbreeding and learning disability in Croatian island isolates. Coll Antropol. 2002;26:421-8. Medline:12528265

30 Rudan I, Smolej-Narancic N, Campbell H, Carothers A, Wright A, Janicijevic B, et al. Inbreeding and the genetic complexity of human hypertension. Genetics. 2003;163:1011-21. Medline:12663539

31 World Health Organization; Regional Office for Europe. European health for all database. Copenhagen: WHO; 2005.