The incidence of coronary heart disease among Palestinians and Israelis in Jerusalem

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Background Lifestyle factors relevant to coronary risk factors differ between Palestinians and Israelis. Both have been exposed, albeit differently, to the stressors of the long-term conflict. We determined the incidence of coronary heart disease, previously unreported in Palestinians, in these Mediterranean populations and made international comparisons with the MONICA Programme.

Methods We applied the rigorous World Health Organization MONICA protocol, which enables standardized international population-based comparisons, to determine all acute myocardial infarction events and coronary deaths among Palestinians and Israelis aged 25–74, residents of the Jerusalem district in 1997.

Results We confirmed a total of 265 coronary events among 76,200 Arabs and 698 among 226,500 Jews. Rates among Arabs were substantially higher than in Jews, particularly so in women. Age-adjusted rate ratios (RRs) for coronary events were 1.58 [95% confidence interval (95% CI) 1.34–1.87] among men and 2.37 (95% CI 1.81–3.10) among women. When restricted to coronary deaths, Arab:Jewish RRs were 2.79 (95% CI 2.09–3.73) in men and 2.66 (95% CI 1.77–4.00) in women. Compared with MONICA populations in 20 countries, Arabs ranked first in total coronary event rates and first in non-fatal myocardial infarction rates, exceeded populations in Finland, Scotland, and Northern Ireland, and showed striking differences from the participating Mediterranean centres.

Conclusions Coronary risk appears to be particularly high in Palestinian Arabs. Determinants of these unexpected findings should be sought and prevention programmes initiated.

Keywords Arabs, coronary disease, incidence, Israel, Jews, myocardial infarction, Palestinians, registries, sudden cardiac death

Since 1967 Palestinian Arabs of east Jerusalem have the legal status of permanent residents of Israel. This population, distinguishable from Israeli Arabs who are citizens of the country from 1948, similarly holds Israeli identity cards, is fully covered by Israeli national health insurance, is entitled to social security payments, and has access to the Israeli job market. As such, Palestinians living in east Jerusalem differ from their compatriots in the West Bank and Gaza Strip.

Israeli Arabs and Jews differ in their cardiovascular risk factors. Obesity (and high waist-to-hip ratios), diabetes, and lack of exercise, but not smoking, were more prevalent in Arab women, whereas smoking and diabetes were more frequent in Arab than Jewish men. It is likely that important lifestyle and risk factor differences exist also between Israelis and Palestinians. Both populations have been exposed, albeit differently, to the tensions and stressors accompanying the long-term conflict. Based on Israeli official cause-of-death statistics, east Jerusalem Arabs had over double the coronary heart disease (CHD) mortality of the Jewish population between 1984 and 1997, though both populations experienced a decline during the period.

Within this unusual context, we assessed the incidence of CHD to distinguish whether the higher mortality rate in Palestinians was due to excess incidence, excess case fatality or both, using a population-based heart attack registry in the Jerusalem district. This registry, which adhered to the
WHO-MONICA (World Health Organization Monitoring Trends and Determinants in Cardiovascular Disease) programme protocol \(^6,7\) is comparable with those of 38 centres in 21 countries, \(^7,8\) including populations in the Mediterranean basin. Comparisons with the latter are of special interest because unlike the Israelis, \(^9\) West Bank, \(^10\) and east Jerusalem Arabs (Z Abdeen and M Qleibo, personal communication) are predominantly olive oil consumers.

**Methods**

A MONICA-based myocardial infarction registry of Israelis was conducted in the Jerusalem district in 1995–97 \(^11\) and was extended to include East Jerusalem Arabs in 1997. The registry, authorized by the Ministry of Health, was established by the authors under the auspices of the Israel Center for Disease Control.

The study population (the denominator) comprised Israeli citizens (predominantly Jewish) and non-citizens (predominantly Palestinian Arabs), residents of the Jerusalem district aged 25–74. Average population estimates obtained from the Israel Central Bureau of Statistics (ICBS) for all ages in the Jerusalem district in 1997 (\(n = 696,000\)), were grouped as Jews (\(n = 498,000\)) and others (\(n = 198,000\)). The non-Jews, who comprised 97% Arabs (94% Moslems and 6% Christians), including a small fraction of Israeli Arabs, are subsequently referred to as Arabs or Palestinians. A total of 226,500 Jews and 76,200 Arabs were aged 25–74, and 135,100 Jews and 40,300 Arabs, respectively, were aged 35–64.

Case ascertainment: The rigorous WHO-MONICA protocol was followed for identification and classification of coronary events, \(^6,7,11\) including recurrent events, which were defined as separate episodes if >28 days had elapsed. \(^6\) Jewish residents, according to patients’ identity documents, were included.

Hospital admissions: Patients with suspected acute myocardial infarction were identified by active surveillance \(^6,7\) in 14 relevant clinical wards of the four Israeli Jerusalem hospitals. Computerized searches of discharge diagnoses complemented this process. All Jewish patients and 84% of the Palestinian patients were admitted to Israeli hospitals. Palestinian patients with suspected acute myocardial infarction admitted to the three East Jerusalem Palestinian acute care hospitals were identified solely by searches of discharge diagnoses. Data for all identified suspected infarction patients were extracted from patient charts. Information on symptoms was augmented in the Israeli hospitals by patient interview.

Standardized MONICA classification of events was based on combinations of symptoms, serial electrocardiographs (photocopied and recorded by the Minnesota method), and cardiac enzymes. \(^6,7\) Patients with a MONICA-definite acute myocardial infarction \(^6,7\) were included in the analysis and were classified as non-fatal if they survived >28 days from onset (NF1) and fatal if not (F1). Criteria for definite infarction were (i) MONICA-definite ECG; (ii) MONICA-probable ECG together with typical symptoms (chest pain lasting at least 20 min), atypical symptoms or inadequately described symptoms (i.e. typical chest pain, duration not described), and abnormal enzymes (exceeding twice the upper limit of normal); (iii) MONICA-ischaemic, non-codable or unavailable ECG together with typical symptoms and abnormal enzymes. \(^6,7\)

**Fatal coronary events:** Fatal events, both in and out of hospital, were identified by a periodic review of all death notifications in the Jerusalem District Health Office to which all deaths of district residents are reported. \(^11\) All diagnoses of CHD, sudden death, unknown cause of death, and cardiorespiratory arrest (as the lone cause) were investigated. Furthermore, we scrutinized the national population register for all deaths of Jerusalem residents assigned International Classification of Diseases (ICD-9) codes 410–414 (ischaemic heart disease), 427 (cardiac dysrhythmias), and 798 (sudden death, cause unknown). Next-of-kin of suspected coronary deaths were interviewed in Arabic or Hebrew about the medical history and circumstances of the death, including preceding symptoms. Supporting documentation was collected from hospital records, emergency ambulance records of cardiac arrests, nursing homes, primary care providers, police, and, rarely, forensic authorities. We included in the analysis fatal events classified by MONICA as definite fatal myocardial infarction (F1), possible fatal myocardial infarction (cases with no good evidence for another cause of death and with typical, atypical or inadequately described symptoms, or with a good history of chronic ischaemic heart disease—F2), or unclassifiable (having insufficient data: no history of symptoms, no history of chronic ischaemic heart disease, lack of data on history or symptoms, and no other diagnosis—F9). \(^6,7\) Virtual absence of autopsy may contribute to the relatively high proportion of ‘unclassifiable’ deaths (~30%) in the Jerusalem population. Competing causes of death were assessed. A team of three physicians adjudicated difficult cases.

**Statistical methods:** We used the coronary event rate, reported by MONICA centers (NF1 + F1 + F2 + F9), which includes first and recurrent events, \(^6,7\) as the main measure of incidence. All event and mortality rates were directly standardized to the World Standard Population. Case-fatality rates, calculated from symptom onset, were age-standardized to the pooled Palestinian–Israeli patient age distribution and, for comparisons with MONICA, to the MONICA age weights of events. \(^6,7\) Rates in MONICA populations were recalculated as the mean of the age-adjusted sex-specific rates of the last 3 years of registration in each population studied, usually between 1991 and 1993, except for Spain. \(^12\) The sexes were given equal weights. For countries with more than one MONICA register, rates were averaged to provide a single estimate. Confidence intervals (CIs) for rate ratios (RRs) and tests for interaction used the standard error of the natural logarithm of the RR. \(^13\)

In statistical testing of rates and proportions in Jerusalem vs MONICA centres in 20 countries that studied both men and women, we applied Holm’s sequentially rejective Bonferroni procedure to conservatively account for multiple comparisons, \(^14\) setting an overall \(\alpha = 0.05\).

**Results**

In 1997 we confirmed a total of 963 events that fulfilled MONICA criteria, 265 in Arab and 698 in Jewish residents. At ages studied by the MONICA project (35–64 years) there were 159 events in Arabs and 407 events in Jews. Compared with Jews, Arab patients were more likely to be female, were less educated, had higher diabetes prevalence, and higher prevalence of smoking (among men) (Table 1). A higher
proportion of Arab than Jewish male patients had fatal events, particularly prehospital deaths. The proportion of sudden death among the prehospital deaths (occurring within 1 h of symptom onset), however, did not differ significantly between the population groups. Typical symptoms, ECG characteristics, and enzyme levels did not differ significantly between the ethnic groups among patients with definite myocardial infarction, except for less typical symptoms in Arab women. Elapsed time from symptom onset to hospital arrival did not appear to differ significantly between Arab and Jewish patients.

**Incidence (Table 2):** Age-adjusted coronary event rates were higher in Arab than in Jewish residents, with RRs of 1.58 (95% CI 1.34–1.87; \( P < 0.0001 \)) in men and 2.37 (95% CI 1.58–3.58; \( P < 0.0001 \)) in women.
In analyses restricted to non-fatal definite myocardial infarction, ethnic differences diminished in men [RR = 1.20 (95% CI 0.97–1.49; P = 0.11)], but persisted in women [RR = 2.16 (95% CI 1.50–3.10; P = 0.0009); P = 0.0066 for the sex-ethnic interaction, i.e. inequality in the RRs].

Restriction of the analysis to first coronary events by exclusion of fatal and non-fatal cases with previous myocardial infarction, had little effect on the Arab–Jewish differences for total incidence [men: RR 1.59 (95% CI 1.30–1.94); women: RR = 2.47 (95% CI 1.82–3.37)] or non-fatal definite infarction [men: RR = 1.18 (95% CI 0.92–1.51); women: RR = 2.18 (95% CI 1.45–3.27)].

Coronary mortality (Table 2): Coronary mortality determined according to the MONICA protocol confirmed the official statistics in showing a substantial disadvantage among Arabs, with age-adjusted rate ratios of 2.79 (95% CI 2.09–3.73) in men and 2.66 (95% CI 1.74–4.00) in women. Rates of out-of-hospital cardiac arrest were much higher in Arabs with Arab/Jewish rate ratios for prehospital plus emergency room mortality of 3.59 (95% CI 2.52–5.10) in men and 2.83 (95% CI 1.69–4.73) for women.

28 Day case fatality: Part of the excess coronary mortality in Arabs is attributable to higher 28 day case fatality (calculated from symptom onset), more evident in men (age-adjusted

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### Table 2: Age-adjusted coronary event rates, non-fatal event rates, coronary heart disease (CHD) mortality rates, prehospital mortality rates (all per 100,000), 28-day case fatality (%) and ethnic rate ratios in Arab and Jewish men and women aged 25–74, residents of Jerusalem, 1997

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Average population size</th>
<th>CHD events</th>
<th>Non-fatal events</th>
<th>CHD mortality</th>
<th>Prehospital mortality</th>
<th>28 Day case fatality</th>
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<td></td>
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<tr>
<td>Number (25–74)</td>
<td>37 900</td>
<td>186</td>
<td>113</td>
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<tr>
<td>Age adjusted rates (25–74)</td>
<td>(95% CI)</td>
<td>796 (680–912)</td>
<td>460 (373–548)</td>
<td>336 (258–413)</td>
<td>248 (182–315)</td>
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<td>(95% CI)</td>
<td>799 (654–944)</td>
<td>567 (446–689)</td>
<td>232 (152–311)</td>
<td>172 (104–240)</td>
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<td>Age adjusted rates (25–74)</td>
<td>(95% CI)</td>
<td>503 (460–546)</td>
<td>383 (345–420)</td>
<td>120 (99–141)</td>
<td>69 (53–85)</td>
<td>25 (22–29)</td>
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<td>(95% CI)</td>
<td>557 (498–616)</td>
<td>444 (391–497)</td>
<td>113 (86–140)</td>
<td>74 (53–96)</td>
<td>21 (16–25)</td>
</tr>
<tr>
<td>Arab:Jewish comparisons</td>
<td>Rate ratio (25–74)</td>
<td>1.58 (1.34–1.87)</td>
<td>1.20 (0.97–1.49)</td>
<td>2.79 (2.09–3.73)</td>
<td>3.59 (2.52–5.10)</td>
<td>1.69 (1.37–2.10)</td>
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<tr>
<td>Rate ratio (35–64)</td>
<td>(95% CI)</td>
<td>1.43 (1.16–1.77)</td>
<td>1.28 (1.00–1.63)</td>
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<tr>
<td>Number (25–74)</td>
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<td>(95% CI)</td>
<td>295 (230–360)</td>
<td>158 (110–206)</td>
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<td>88 (52–123)</td>
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<td>(95% CI)</td>
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<td>128 (72–184)</td>
<td>105 (54–156)</td>
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<td>66/164</td>
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<td>Age adjusted rates (25–74)</td>
<td>(95% CI)</td>
<td>125 (105–144)</td>
<td>73 (59–88)</td>
<td>51 (39–64)</td>
<td>31 (21–41)</td>
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<td>(95% CI)</td>
<td>98 (75–122)</td>
<td>55 (38–73)</td>
<td>43 (27–59)</td>
<td>27 (14–39)</td>
<td>42 (30–54)</td>
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<td>2.37 (1.81–3.10)</td>
<td>2.16 (1.50–3.10)</td>
<td>2.66 (1.77–4.00)</td>
<td>2.83 (1.69–4.73)</td>
<td>1.20 (0.88–1.63)</td>
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<td>P-value</td>
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<tr>
<td>Rate ratio (35–64)</td>
<td>(95% CI)</td>
<td>2.37 (1.58–3.53)</td>
<td>2.31 (1.34–3.98)</td>
<td>2.45 (1.34–4.48)</td>
<td>2.71 (1.29–5.68)</td>
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<td>P-value</td>
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<td>0.016</td>
<td>0.022</td>
<td>0.041</td>
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</tbody>
</table>

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a Includes emergency room deaths.

b Rates were adjusted to the world standard population using the following weights: ages 25–34: 0.28, and for the subsequent 5 year age bands: 0.12, 0.12, 0.10, 0.08, 0.08, 0.06, and 0.04. Case fatality was adjusted in 10 year age bands to the age distribution of all Jewish and Arab cases with weights of 1, 4, 14, 19, and 24.

c Rates were adjusted as in MONICA6,7 using world standard population weights for 5 year age bands: 35–39 6/31, 40–44 6/31, 45–49 6/31, 50–54 5/31, 55–59 4/31, and 60–64 4/31. Case fatality rates were adjusted with MONICA weights of 1, 3 and 7 for ages 35–44, 45–54, and 55–64, respectively.
Arab:Jewish risk ratio = 1.69, 95% CI 1.37–2.10) than women (RR = 1.20; 95% CI 0.88–1.63) (Table 2). When we restricted the analysis to patients admitted with definite acute myocardial infarction, excess 28 day case fatality in Arabs persisted [RR = 1.90 (95% CI 0.84–4.32) in men and 1.45 (95% CI 0.68–3.06) in women]. Nevertheless, evidence-based in-hospital acute care in the Israeli hospitals was generally equally good in Arab and Jewish patients (although invasive coronary procedures were undertaken less frequently in Arab patients) (Table 1). Time from symptom onset to admission appeared to be similar, but the large proportion of missing observations should temper this inference (Table 1).

Comparisons with MONICA. Jerusalem Arabs exceeded all 20 countries with MONICA registers both in coronary event rates and non-fatal infarction rates. Jewish residents ranked high, third and second, respectively, but significantly below Jerusalem Arabs (Figure 1). We repeated the comparison with all individual MONICA populations. Glasgow, Scotland reported the highest age-adjusted sex-averaged event rate in a MONICA population (510 per 100,000), similar to that in East Jerusalem Arabs (516 per 100,000). The east Jerusalem Arab rate exceeded that of North Karelia, Finland, the next-highest ranking MONICA population (386 per 100,000), by 34% and was more than double the average event rate of all MONICA
populations that registered events between 1991 and 1993 (240 per 100,000). The east Jerusalem non-fatal infarction rate (348 per 100,000) exceeded the two highest-ranking MONICA populations, Glasgow (291 per 100,000) and Belfast, Northern Ireland (218 per 100,000), by 19 and 59%, respectively. Compared with the 20 countries, Arabs ranked high for all coronary mortality (fifth) and prehospital mortality (seventh), significantly above Jerusalem Jews who ranked 17th and 18th from the top, respectively (Figure 2). Arabs ranked fourth lowest in case fatality, above the Jewish population (second lowest) (not shown in figures). However, this low ranking belies high case fatality among 65- to 74-year-old Arab men, an age group not studied in MONICA. After exclusion of past myocardial infarction, the top Arab ranking for coronary event and non-fatal infarction rates persisted (not shown). Overall, Jerusalem Arabs differed diametrically from populations in the Mediterranean countries—Spain, Italy, and France, characterized by low incidence and low coronary mortality, whereas the Jewish population exhibited Mediterranean-like low prehospital mortality and overall coronary mortality, but discrepantly high total and non-fatal event rates.

Figure 2 Age-adjusted and sex-adjusted coronary death rates (upper panel) and early (predominantly prehospital) mortality rates (lower panel) per 100,000 in Arab and Jewish residents of Jerusalem (1997) compared with centres in 20 countries in the MONICA programme (circa 1991–93), ages 35–64. The bars represent standard errors and the asterisks represent statistically significant differences for each population compared with Palestinians (P < 0.05, Holmes’ sequentially rejective Bonferroni procedure). \(^*\) (Prehospital mortality, emergency room deaths and deaths occurring within 24 h of symptom onset were grouped as early mortality to permit comparison with accessible MONICA data).
Sensitivity analysis

Electrocardiographic criteria

The average proportion of Minnesota-coded definite electrocardiograms among non-fatal myocardial infarction patients across MONICA centres in 1993–95 was 50% vs 41.0% in Jewish patients and 43.5% in Arab patients, suggesting the possibility of relative overascertainment of less severe infarctions in Jerusalem (although these fulfilled MONICA criteria). Jewish and Arab non-fatal rates were adjusted to the MONICA average of 50% definite electrocardiograms by multiplying by factors of 0.82 and 0.87, respectively. The high rankings compared with MONICA persisted for coronary event rates in Arabs (first) and for non-fatal infarction in Arabs and Jews (first and second, respectively); Jews declined to ninth place for all coronary events.

Cardiac enzymes

Enzyme levels are crucial in MONICA definitions of definite infarction when the ECG is non-definite. In 98% of such cases in Jerusalem abnormal levels of creatinine phosphokinase (CPK) or CPK-MB were recorded. In three of the Israeli hospitals normal values of CPK were defined as below 110 and in the fourth as below 150 units. In a second analysis, we arbitrarily reset the cut-off point to 150 units in all four Israeli hospitals. Sex-averaged coronary event rates for ages 35–64 declined by 5.1% in Arabs and 4.4% in Jews, and non-fatal infarction rates by 7.6% in Arabs and 5.4% in Jews. The first place MONICA ranking of Jerusalem Arab Arabs persisted strongly for both incidence measures, and Jews ranked fourth and second, respectively.

Discussion

We provide the first standardized population-based data on CHD incidence in Palestinians. The coronary event rate in Palestinians surpassed that of Jewish residents of Jerusalem. In comparison with MONICA populations studied on average across MONICA centres in 1993–95 was 50% vs 41.0% in Jewish patients and 43.5% in Arab patients, suggesting the possibility of relative overascertainment of less severe infarctions in Jerusalem (although these fulfilled MONICA criteria). Jewish and Arab non-fatal rates were adjusted to the MONICA average of 50% definite electrocardiograms by multiplying by factors of 0.82 and 0.87, respectively. The high rankings compared with MONICA persisted for coronary event rates in Arabs (first) and for non-fatal infarction in Arabs and Jews (first and second, respectively); Jews declined to ninth place for all coronary events.

Possible artefacts in the Jewish–Arab and MONICA comparisons

Estimates of population size (the denominator)

The population estimates for Arabs and Jews of the Jerusalem district in 1997 were obtained from the ICBS. These estimates, based on the population census of 1995 updated by population movements to 1997, represent residents living in the district for >1 year regardless of their status or nationality and Israeli citizens or permanent residents of the district absent for <1 year. Studies by the ICBS indicate that a further 11% of Palestinian Arabs who were enumerated in the 1995 census did not live in Jerusalem at that time and were excluded by the ICBS from the population denominator. Part of this group may have resided near enough to Jerusalem to access Israeli hospitals, and their deaths were likely to have been reported. These hospitalized events and coronary deaths are included in the numerator if the Palestinian patients had the status of permanent residency in Jerusalem irrespective of actual residency. On the other hand, Palestinians who were not formally permanent residents of Jerusalem, but lived in the city for over 1 year, are included in the denominator but not the numerator. We conclude that the effective maximal underestimation of the Arab population denominator is likely to be <10%. This inference is supported by the Palestinian Central Bureau of Statistics estimate of December 1997 that the east Jerusalem population numbered 9% more than the corresponding ICBS figure, albeit using different residency criteria. Census estimates of the Jewish population are considered to be sound.

Overestimation of coronary deaths among Arabs?

Arabs had a higher proportion of out-of-hospital deaths than Jews. However, the mechanism of screening and verification of cause of death was uniform in both populations. Next-of-kin were interviewed in a similar proportion of Arab and Jewish prehospital deaths (86% vs 80%, respectively). The proportion of ‘unclassifiable’ deaths with insufficient information (MONICA F9) among the coronary deaths was similar in Arabs (33%) and Jews (30%). None of these considerations suggest overascertainment of Arab vs Jewish coronary mortality.
As noted above, deaths of Palestinians with the status of permanent residents of Jerusalem, but not residing in the city at the time and, therefore, not included in the population denominator, are likely to have been reported by their families to the Jerusalem District Health Office and are included in the numerator. We infer that mortality rates in Palestinians may be inflated by a maximum of 11%.

Overestimation of non-fatal myocardial infarction?
As stated above, Arabs with permanent residency status, but living at the time outside Jerusalem, and who sought acute care in Jerusalem hospitals may have been included in the numerator but not the denominator. The maximal inflation of the Palestinian rate (11%) is too small to account for the large differences with Israeli residents, or differences of 34 and 59%, respectively, in event rates and non-fatal infarction rates between east Jerusalem Arabs and high ranking North Karelia, but would place east Jerusalem Palestinians in second place after Glasgow for event rates, though still above Glasgow for non-fatal infarction.

Based on the electrocardiographic findings (definite and probable ECG and ST elevation) and cardiac enzyme levels it appears quite unlikely that definite myocardial infarction was overdiagnosed in Arabs relative to Jews. The lower proportion of definite ECG in Jerusalem in 1997 than in MONICA is consistent with the decline in this proportion in MONICA centres from ≥61% in 1980–84 to 49% in 1995. The sensitivity analyses in this regard did not diminish the top Palestinian ranking among MONICA populations. Further, it seems most improbable that the less educated Palestinian population would have a greater awareness of CHD and used tertiary facilities more than the Israelis.

Risk factor differences that might explain the high incidence in Palestinians
Our study design does not permit direct assessment of risk factor exposures and their association with coronary event rates. Little is known about conventional cardiovascular risk factors in Palestinians. In a global myocardial infarction case–control study (INTERHEART), Middle Easterners (mostly Arabs from the Gulf States and Egypt) ranked first among 10 regions in the population fraction attributable to smoking, second for dyslipidaemia and psychosocial factors, and third for diabetes.

Smoking, although far more prevalent in Arab than Jewish men, cannot serve as an explanation for the high event rates in Arab women, who smoke less than Jewish women. Obesity, glucose intolerance, and diabetes are highly prevalent in both urban and rural Palestinians, more so in women, and may be important determinants of their excess risk. In our study, diabetes was more frequent in Arab than Jewish patients, particularly in women. Low HDL-cholesterol, but not high LDL-cholesterol, was reported in urban Palestinians, and HDL-cholesterol and apolipoprotein A-1 concentrations are low in Israelis, consistent with excess coronary risk in both populations.

There are unusual attributes relating to dietary and alcohol intake. Alcohol consumption in the Jewish population is exceedingly low (which may contribute to their relatively high coronary event rate), and we presume an even lower intake in Jerusalem Muslim Arabs. The Israeli diet includes prodigious intakes of polyunsaturated fatty acids, mainly linoleic acid from vegetable oils, whereas there is evidence for a substantial intake of monounsaturated fatty acid by olive oil in Palestinians. An interview-based survey conducted by Al Quds University in 1998–99 showed that olive oil was the main oil used by east Jerusalem Arabs (Z. Abdeen and M. Qleibo, personal communication). If olive oil, an important component of the Mediterranean diet, is protective, its effect is presumably overwhelmed by other risk factors in Jerusalem Palestinians.

Both Israelis and Palestinians are likely to have been affected by stressors related to the long-term conflict. These stressors probably differ in nature between the population groups. The presumed chronic stress of disempowerment associated with the special status of Jerusalem Palestinians may contribute to excess risk and would seem a fertile area for study. Furthermore, the substantially lower socioeconomic status of Palestinians as reflected in our study by the low educational level of patients may also play an important role.

Part of the high prehospital mortality of Jerusalem Arabs might relate to later or less call for help and inequalities in emergency ambulance care. However, it may also suggest an increased vulnerability to lethal arrhythmias compared with Jews. An important determinant may be nutritional. The polyunsaturated fatty acid-rich diet of the Jewish Israeli population, abundant in both n-6 linoleic acid and n-3 α-linolenic acid, derived mostly from soybean oil, may protect against lethal arrhythmias, a benefit that might not be conferred by the monounsaturated fatty acid-rich diet of Palestinians.

In conclusion, we provide evidence that suggests that Arabs residing in Jerusalem had an exceptionally high risk of CHD. Elevated incidence explains much of the excess CHD mortality in Jerusalem Arabs vs Jews, although part is attributable to higher case fatality. These findings, which require confirmation, point to directions for future work to gain a better understanding of the determinants of this susceptibility to CHD, as well as to the need for prevention programmes directed at recognized risk factors.

Acknowledgements
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KEY MESSAGES

- Coronary heart disease (CHD) mortality among Arabs living in Jerusalem has been previously shown to be double that of Jews, who have relatively low coronary mortality.
- The incidence of CHD and case fatality among Palestinians was unknown.
- The coronary event rate and non-fatal myocardial infarction rate were found to be higher among Palestinian residents of Jerusalem than Jewish residents and higher than any of the WHO-MONICA populations in 20 countries, whereas 28 day case fatality in both Arabs and Jews ranked low relative to MONICA.
- These high rates should provoke efforts in search of causes and stimulate preventive action in the Palestinian population.

References


