Differences Between Bedouin and Jewish Populations in Incidence and Characteristics of Patients Hospitalized with Community-Acquired Pneumonia

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Objective: Southern Israel is inhabited by two ethnic groups: predominantly urban Jews and semi-nomad Bedouin Arabs. We evaluated the incidence of hospitalization and differences in clinical characteristics of community-acquired pneumonia (CAP) between these populations.

Design: A hospital-based prospective observational study at Soroka Medical Center, a 1200-bed tertiary care hospital, the single hospital in the region.

Patients: All patients admitted with CAP to the internal medicine division during a 5-month winter period.

Results: 262 patients were enrolled, of whom 58 (22.1%) were Bedouins. Age-standardized incidence rate for CAP hospitalization among Jews was 68 cases per 100,000 during one winter period, compared to 284 per 100,000 among Bedouins. Bedouin patients were younger than Jewish patients (60.0±20 vs 66±17 years, P=.05). Jews had lower rates of smoking (19.1%, vs 39.7% P=.001), chronic obstructive pulmonary disease (9.3% vs 31.0%, P=.001) and diabetes (25.0% vs 41.4%, P=.01). Bedouin patients had a lower rate of pre-hospitalization antibiotic therapy (12.1% vs 25.5%, P=.03) and influenza vaccination (14.0 vs 26.8, P=.01). Despite these differences, severity of disease, (measured by Pneumonia Outcome Research Team score), length of hospitalization (median 4 days, P=.38) and 30-day mortality rate (3.4% vs 8.8%, P=.18) were similar in both populations.

Conclusions: We found a higher incidence of CAP hospitalizations in Bedouin Arabs compared to the Jews. Higher rates of smoking, chronic obstructive pulmonary disease, and lower rates of influenza vaccination most likely contribute to this difference. Despite socioeconomic and clinical differences between the two ethnic groups, no difference was found in the clinical outcomes. (*Ethn Dis*. 2007;17:441–446)

Key Words: Community-Acquired Pneumonia, Ethnicity, Hospitalization

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Background

In southern Israel, two main ethnic groups can be identified based on religious, national, and social backgrounds: the Jewish population comprising people born in Israel or immigrants from all over the world and an Arabic Bedouin population, whose members are in social transition from being desert nomads to living in settled communities. More than half the Negev's Bedouins no longer maintain the traditional migratory lifestyle of living in tents, but reside in permanent settlements mainly in huts and brick houses. These settlements and townships have been gradually established since the early 1970s and offer social and health services.[1,2] In Israel, both ethnic groups have comprehensive health care, secured by the law of national health, and provided by one of four HMOs according to individual choice. The comparison between Jews and Bedouins living in the same geographic area is possible, as both populations receive their medical care from the same prepaid health insurance, Sick Fund, and are hospitalized in the same, single, regional tertiary care health center. Furthermore, there is no monetary barrier to either emergency room attendance or admission to hospital. Although the level of ambulatory care offered is similar for everyone, preventive interventions like influenza and pneumococcal vaccination depend on a person's health literacy, which determines if he or she will accept such a measure.

Hospitalization rates have been shown to reflect social and economic differences between population groups in various geographic regions and in different healthcare systems. Furthermore, it has been shown that there is a difference in invasive pneumococcal infection among different ethnic groups.[3]

Several studies have compared differences in infectious conditions between Bedouin children and their Jewish peers.[4–6] It was shown that children of Bedouin Arab background had a significantly increased incidence rate of invasive pneumococcal infection 139 /100,000 compared to 45/100,000 among Jewish children.[4] The rate of hospitalizations for infectious conditions was double among Bedouin children as compared to Jewish children (250 vs 121/10,000 child years); the rate of admissions for pneumonia had an odds ratio of 2.9(95% CI: 2.6–3.3).[5]

It is common knowledge that pneumonia is more frequent in the elderly and among patients with chronic conditions such as chronic ischemic heart disease, chronic lung disease and diabetes mellitus. It is recommended for such patients to be vaccinated both with influenza vaccines annually as well as pneumococcal vaccine once in five years; the latter seems particularly useful and beneficial among Black, high-risk patients.[7]

Environmental and inherent differences, which may influence the risk, as well as the course, of community-

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acquired pneumonia (CAP) in different ethnic groups, appear to exist. We describe a prospective study assessing the differences between the Arab Bedouin and Jewish individuals with the diagnosis of community-acquired pneumonia and admitted to the internal medicine department of our medical center.

METHODS

We conducted a hospital-based prospective observational study. Soroka University Medical Center is a 1200-bed tertiary care teaching hospital with 258 internal medicine beds and serves as the regional hospital for southern Israel. During a 5-month winter period (from November 2003 to March 2004), we enrolled all patients admitted to the department of medicine with the diagnosis of community-acquired pneumonia.

Demographic data, background disease, influenza and pneumococcal vaccination status, presenting symptoms, laboratory tests results, medication used before and during hospitalization were obtained prospectively from the patient's charts. PORT score (as a severity of disease index) was calculated for all patients during the first 24-hours.[8] Length of hospitalization and 30-day mortality rate were assessed.

The study included the area of Southern Regional Health Authority, Beer-Sheva sub-district with a population of 539,000. Patient addresses were collected to verify residence within the study area. Population statistics were obtained from The Israeli Central Bureau of Statistic's 2004 national census.[9] According to this census, 140,000 (25.9%) of the residents in southern Israel were Bedouin Arabs while the remaining population was Jewish. The adult-area population was used for age standardization.

Statistical analysis

Bivariate hypotheses involving continuous variables were tested with a *t* test for independent groups with normal distribution and Mann-Whitney test for non-normal distribution. Normality of the study data was tested with a 1-sample Kolmogorov-Smirnov test to indicate the appropriateness of parametric testing. For tests of whether the distribution of categorical variables differed across study groups χ^2 test was used. Fisher exact test was applied when appropriate. Linear regression model was used for multivariate analysis of length of hospitalization and logistic regression model was used for analysis of 30-days mortality. Variables included in the models were predefined as: severity of disease, number of specialists agreeing upon the diagnosis of pneumonia, and the final department discharge diagnosis. Incidence rates are presented as cases per million and compared among different patient groups by the χ^2 test. The indirect standardization method was used to avoid the potential confounding influence of age. Continuous variables were expressed as mean ± SD, and categorical variables were expressed as percentages. All reported *P*-values are two-sided and $P<.05$ was considered significant. Statistical analyses were performed with SPSS software (version 12.0.1, SPSS Inc, Chicago, Ill).

RESULTS

During the study period, 262 consecutive patients were recruited. Fifty-eight (22.1%) patients were of Bedouin origin, which is a higher percentage than that found in area where Bedouins represent only 16.6% of the general population. There was an inequality in the age distribution between two ethnic groups in the district: the median age of Bedouin Arabs was 22.3 years compared to 24.3 years among the Jewish patients. For calculating incidence rates, age standardization was undertaken.

The age-standardized incidence rate for hospitalization with CAP among the adult Jewish population was 68 cases per 100,000 during one winter period, compared to 284 per 100,000 in the Bedouin Arab population. Thus, crude relative risk of being hospitalized with CAP among Bedouin Arabs compared to Jews was 5.7 (95% CI: 5.4–5.9, $P<.001$). Figure 1 shows the hospitalization rate according to the ethnicity in the different age groups. For the age group >75 years, the relative risk was 7.4 (95% CI: 4.1–13.3, $P<.001$) and for those <34 years, relative risk was 1.8 (95% CI: 0.8–3.9, $P=.14$).

Table 1 describes different characteristics of the patient population stratified according to the ethnicity. No difference existed between Bedouin Arabs and Jews in terms of severity of illness as assessed by PORT score. However, Bedouins suffered less from atherosclerotic diseases (ischemic heart disease and cerebrovascular disease) and had lower number of cardiovascular risk factors such as diabetes and hypertension. Bedouin patients smoked at a rate twice as high as Jewish patients. This difference was higher in males (56.3% vs 26.5%, $P=0.002$) than in females (16.0% vs 9.6%, $P=.29$). In patients <55 years, no difference was found in smoking rates between Bedouins and Jews (33.3% vs 27.0%, $P=0.41$). In the cohort of patients >55 years, smoking rates were higher among the Bedouins compared to the Jews (43.2% and 17.4%, respectively. $P=.002$). Appropriately, Bedouin patients had higher values of hemoglobin (−13.2±2.4 g/dL

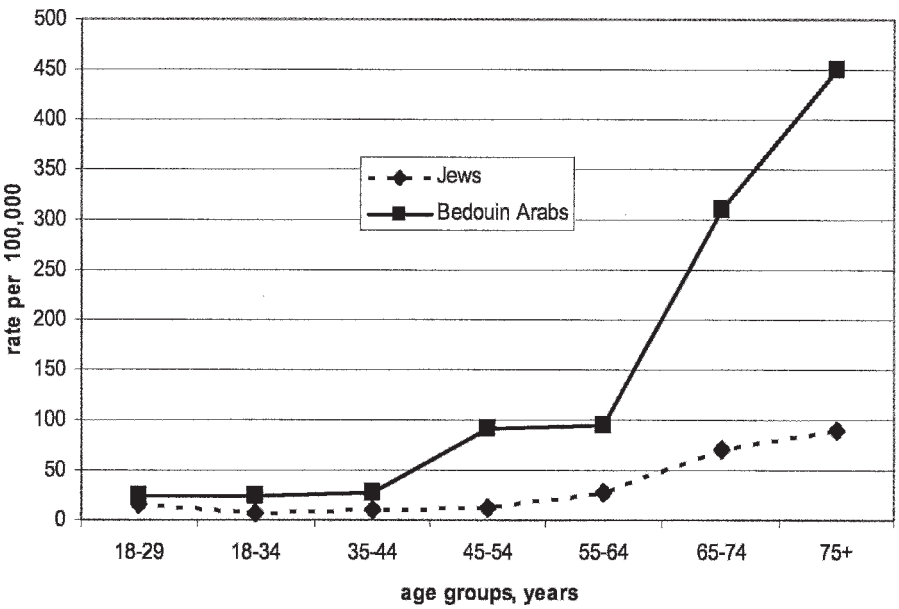

Fig 1. Winter incidence of the hospitalization due to community acquired pneumonia stratified by the ethnicity and age

vs 12.4±2.0 g/dL, P=.03 and pCO_2–47±17 mm Hg vs 41±10 mm Hg, P=.01) upon an admission (data not shown).

Table 2 shows that there was a difference in utilization of the primary medical service by the two ethnic groups. Bedouin patients were less likely to be vaccinated against influenza than Jewish patients and they tended to have a lower rate of anti-pneumoccocus vaccination within the preceding five years. The difference in influenza vaccination rates was especially noticeable in patients >65 years: 31.9% for Jewish patients; 9.9% for Bedouin patients, P<.001. Similarly, the rate of anti-pneumoccocus vaccination within the preceding five years was higher in Jewish patients >65, compared to Bedouins in the same age group (10.2 vs 2.2, P=.02) (data not shown).

Overall, of the 262 patients, 23 (8.8%) needed ventilatory support: 14 with a noninvasive device and nine patients were intubated and mechanically ventilated. There was No differences were found between the ethnic groups for the rates of either invasive or non-invasive ventilatory support.

The median length of hospitalization was four days (range 3–6 days) and did not differ between groups, P=0.38. Overall 30-day mortality rate in our cohort was 20/262 (7.6%). No significant differences were found in mortality between Bedouin and Jewish patients (3.4% vs 8.8%, P=.18).

Table 3 depicts differences in clinical characteristics and outcomes between patients with history of chronic obstructive pulmonary disease (COPD) and the rest of the cohort. As expected, patients with COPD were older, had higher rates of current smoking, use of home oxygen and chronic steroid therapy. COPD patients had higher rates of diabetes, 28.1% vs 9.1%, P<.001 and congestive heart failure, 18.9% vs 8.0%, P=.04, compared to patients without COPD. Multivariate linear regression analysis shows that only PORT score and not ethnicity was a significant predictor for both outcomes.

Table 1. Patient characteristics according to the department discharge diagnosis

	Entire patients population N=262	Jews n=204	Bedouin Arabs n=58	P-value
Age, years (mean ±SD)	64.5±17.8	65.6±17.1	60.4±14.7	0.05
Male sex, %	58.0	58.5	56.1	0.75
PORT score, points	90.0±40.0	91.0±40.0	87.0±36.0	0.43
Bed–bound, %	40 (15.3)	33 (16.2)	7 (12.1)	0.44
Nursing home resident, %	27 (10.3)	26 (12.7)	1 (1.7)	0.01
Ischemic heart disease, %	63 (24.0)	58 (28.4)	5 (8.6)	0.002
Congestive heart failure, %	25 (9.5)	20 (9.8)	5 (8.6)	0.78
History of cerebrovascular accident, %	33 (12.6)	30 (14.7)	3 (5.2)	0.05
Chronic renal failure, %	31 (11.8)	6 (12.7)	5 (8.6)	0.39
Hypertension, %	106 (40.5)	92 (45.1)	14 (24.1)	0.01
Diabetes, %	75 (28.6)	51 (25.0)	24 (41.4)	0.02
Smoking, %	62 (23.7)	39 (19.1)	23 (39.7)	0.001
COPD, %	37 (14.1)	19 (9.3)	18 (31.0)	<0.001
History of asthma, %	17 (6.5)	12 (5.9)	5 (8.6)	0.45
Chronic steroid therapy, %	18 (6.9)	13 (6.4)	5 (8.6)	0.55
Home oxygen, %	16 (6.1)	9 (4.4)	7 (12.1)	0.05
Malignancy, %	19 (7.3)	17 (8.3)	3 (3.4)	0.21

COPD=chronic obstructive pulmonary disease; PORT=pneumonia outcomes research team.

DISCUSSION

Two distinct population groups inhabit the northern Negev desert of Israel, Jews and Bedouin Arabs. The two groups differ greatly in their socioeconomic status, culture and way of living. The Bedouins, compared to their Jewish neighbors, have higher indicators of socioeconomic disadvantage.[10] Poor socioeconomic status is an independent risk factor for many chron-

Table 2. Factors associated with exposure to continuous medical care and preventive medicine

	Entire patients population $N = 262$	Jews $n=204$	Bedouin Arabs $n=58$	*P*-value
Influenza vaccination in current season, %	23.9	26.8	14.0	0.01
Pneumoccocus vaccination within 5 years, %	7.3	8.4	3.4	0.16
Home antibiotic treatment prior to hospitalization, %	22.5	25.5	12.1	0.03

ic diseases; yet, marked differences in disease incidence among neighboring populations need further consideration.

Although Jews and Bedouins reside in the same geographic area and are exposed to similar environmental conditions, our study found marked differences in CAP hospitalization rates and characteristics of the patients among the two populations. The reasons accounting for these differences are likely attributed to many factors and reflect a combination of environmental and culture-bound etiologies.

In our study, Bedouins were found to have a higher prevalence of smoking and COPD. Our data is in line with previously published reports showing higher rates of smoking in Arab populations compared to Jews.[11] Current smoking and COPD, traditional risk factors associated with higher risk of CAP acquisition,[12–14] can partially account for the higher incidence of CAP in Bedouins. In addition, higher level of ambient air pollutants derived from traditional Bedouin open fire cooking has been shown to increase the susceptibility for respiratory illness.[15,16]

Pre-hospital antibiotic use and vaccination rates against influenza and pneumococcus are both surrogates of primary health service utilization. Our data showed a low influenza vaccination rate among patients hospitalized with CAP: 23.9%, as compared, for example, to 48% of patients hospitalized with pneumonia and influenza in the US population.[17] This may reflect the fact that population at risk (eg, >65), both Jews and Arab Bedouins, have a lower rate of influenza vaccination than reported by other countries and recommended by WHO.[18,19] We found

Table 3. Clinical characteristics of the patient population, stratified by the background diagnosis of chronic obstructive pulmonary disease (COPD)

	COPD $n=37$	No COPD $n=225$	*P*-value
Age, years	70.5±12.3	63.5±18.4	.03
Bedouin Arabs, %	18 (48.6)	40 (17.8)	<.001
Current smoking, %	22 (59.5)	40 (17.8)	<.001
Chronic steroid therapy, %	8 (21.6)	10 (4.4)	.001
Home oxygen, %	10 (27.0)	6 (2.7)	<.001
Influenza vaccination during current season, %	8 (21.6)	52 (24.0)	.95
Pneumoccocus vaccination within last 5 years, %	3 (8.1)	15 (7.1)	.79
Home antibiotic treatment prior to the hospitalization, %	6 (16.2)	52 (23.5)	.32
PORT score, points*	101.0±27.0	89±41	.07
Ventilation, invasive and non-invasive, %	13 (35.1)	10 (4.4)	<.001
Length of the hospitalization, days: median (interquartile range)	5 (3–9)	4 (3–6)	.07**
30-day mortality rate, %	2 (5.4)	18 (8.0)	.75

* PORT denotes pneumonia outcomes research team.
** Mann-Whitney test.

…our study found marked differences in CAP hospitalization rates and characteristics of the patients among the two populations

Bedouin patients were less likely to use any of these treatment and preventive measures. As previously mentioned, Jews and Bedouins in the Negev share a common health care system; yet, poor accessibility and lower level of education could have contributed to the underutilization of primary health care services among Bedouins, as seen in our study. Similar ethnic discrepancy of vaccination rates, eg, lower rates in socioeconomically disadvantaged populations, was reported previously in the United States.[20] The diagnosis of pneumonia in this study was not verified by microbiological techniques; nevertheless, it is reasonable to assume that the lower level of vaccination among elderly Bedouin patients exposes them to a higher risk of CAP contraction by those specific pathogens. This factor might also have an indirect impact on their higher rates of hospitalization.

Furthermore, studies comparing the effectiveness of the 23-polyvalent polysaccharide pneumococcus vaccine among different ethnic groups have shown wide variations. One study conducted among the Navajo Indians demonstrated an effectiveness of only 26% in preventing invasive pneumococcal infection; and, among Navajo patients with diabetes, the effectiveness was 15% and for Navajo patients with alcoholism, the effectiveness was reported to be as low as zero.[21] Those figures can be compared to another study where the rate of vaccine effectiveness was 56% in a population with lower rates of diabetes and alcoholism.[22] Among our Bedouin patients, there was

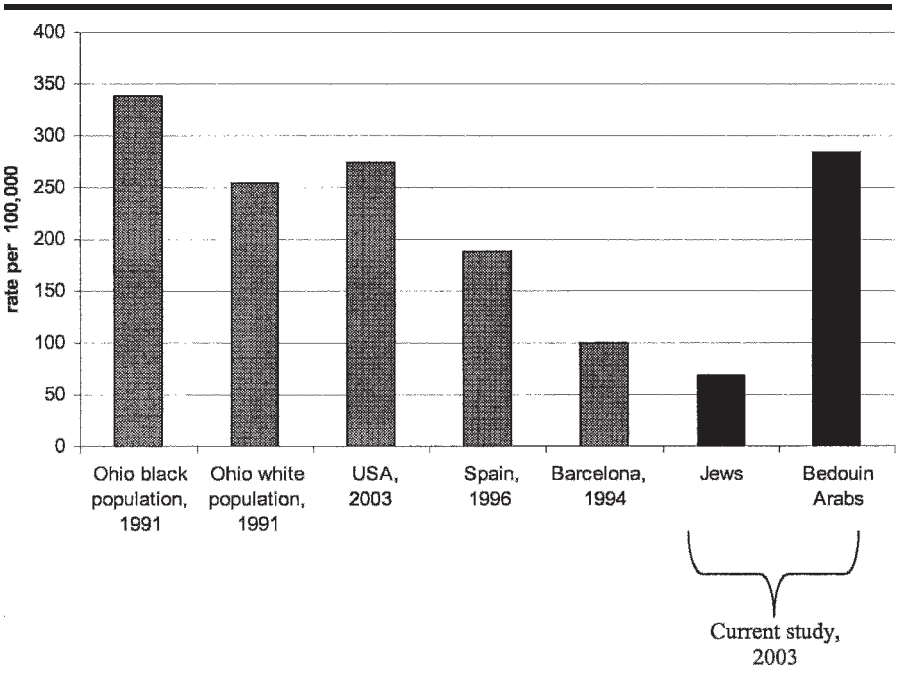

Fig 2. Annual incidence rate of hospitalization due to community acquired pneumonia per 100,000 residents in different geographical areas[24–27]

a higher incidence of diabetes mellitus than among the Jewish patients, a factor that might have contributed to the lower efficacy of pneumococcal protection in Bedouins.

The Bedouins, as with other tribal cultures, have extended family members residing under the same roof. In addition, the Bedouin population is characterized by a higher birth rate and number of children per family compared to the Jewish population.[9] These two factors increase the level of crowdedness and tend to bring elderly family members into proximity with the younger ones. Bedouin children have been shown to have higher rates of pneumococcal carriage and infection as compared to their Jewish peers in the Negev region.[4] Both of these factors might contribute to a higher level of hospitalization among elderly Bedouins and to a unique pathogenic milieu causing CAP in this population.

This study found a low incidence of pneumonia in the Jewish population compared to incidence rates found in pneumonia registries from other countries. It can be argued that comparative analysis cannot be truly made due to different methods of incidence calculations among studies. While studies from other countries calculate incidence on an annual basis, the data presented in our study is derived from the winter and spring months only. Still, past studies have shown that these months carry the heaviest burden of disease, so that the true incidence is probably not higher by far.[23] Further investigations of pneumonia incidence in different ethnic groups populating our region are warranted in order to determine if this finding is of true significance.

Although our findings regarding higher rates of CAP among Bedouins are preliminary, they suggest that different population groups in Israel need to be targeted in a culturally sensitive manner to achieve better preventive, state-of-the-art medical care. From our acquaintance with Bedouin society and culture, we believe a multilevel approach should be implemented in order to achieve the goal of reducing CAP contraction rate in this population. At the educational level, there is often a culture gap that needs to be bridged between the Bedouin patient speaking Arabic and the healthcare professional speaking Hebrew. A considerate number of Bedouin women are illiterate, making written education material, even in Arabic, unusable. Therefore, efforts should be made to empower local Arabic-speaking medical staff and leaders by enhancing educational programs addressing issues of prevention, early detection and treatment and immunization of subpopulations at risk. Special emphasis should be placed on the linkage between cigarette smoking and the higher rates of respiratory infections and complications. Accessibility to medical care can be improved by establishing mobile medical units reaching areas lacking permanent medical infrastructure and conducting a mass immunization campaigns held at gathering areas. Finally, financial incentives in the form of free-of-charge vaccination and antibiotics are expected to improve immunization rates and compliance to medical treatment and would probably prove cost effective in the long term.

In conclusion, while hospitalization rates are not a totally accurate measure of risk of disease in the community, we believe that the data presented support our conclusion that Bedouin Arabs are at higher risk for contracting CAP requiring hospitalization as compared to Jews living in the same geographic area. Further investigations of genetic, microbiological and epidemiological correlates are needed to elucidate these findings.

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AUTHOR CONTRIBUTIONS

Design concept of study: Novack, Avnon, Riesenberg, Elbaz
Acquisition of data: Novack, Schlaeffer
Data analysis and interpretation: Novack, Avnon, Etzion
Manuscript draft: Novack, Avnon, Etzion, Riesenberg, Elbaz, Schlaeffer
Statistical expertise: Novack
Administrative, technical, or material assistance: Novack, Elbaz, Schlaeffer
Supervision: Novack