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**Changes in clinical status, health behaviour and self-rated health after coronary angiography in Roma and non-Roma Coronary Artery Disease patients**

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Submitted

**Abstract**

**Background:** Roma have a higher mortality after coronary angiography (CAG) and poorer health status at entrance into cardiological care. It is unclear whether poorer treatment effects contribute to this. Therefore, the aim of this study was to assess changes in clinical status, health behaviour and self-rated health (SRH) after CAG in Roma patients with coronary artery disease (CAD) compared with non-Roma patients.

**Methods:** 264 patients (25 Roma) who had undergone CAG were included in the study. SRH and medical data were measured at baseline and follow-up (12-26 months). Linear and logistic regression analyses were performed to assess the effect of ethnicity on the outcome variables over the follow-up period.

**Results:** Triglycerides and diastolic blood pressure increased significantly in Roma when compared with non-Roma during the follow-up (OR with 95% CI: -1.96 (-3.80, -0.11) and 17.55 (3.72, 31.37), respectively). No other significant differences in improvement between Roma and non-Roma were found.

**Conclusion:** The poorer outcomes of Roma CAD patients are for the most part not due to less improvement of their clinical status, health behaviour and SRH after CAG. Outcomes may thus be improved in particular by enhancement of access to health care.

**Keywords**

clinical status; medical risk factors; self-rated health; coronary angiography; coronary artery disease; Roma ethnicity
Introduction
Roma represent one of the largest minorities across Central and Eastern Europe, and their health status is relatively poor. Estimates of their numbers vary from 5 to 10 million according to a European Parliament Resolution from 31 January 2008 (1). In Slovakia Roma account for approximately a 2-7% share of the entire Slovak population, which means 105,000 to 380,000 Roma (2,3). Research published in recent years has shown that Roma ethnicity is associated with a worse risk profile regarding cardiovascular risk factors like smoking, dyslipidaemia, diabetes and obesity(4-13). Moreover, previous studies also found an increased mortality in Roma (14-18). Of particular relevance to the Roma context is their generally low socioeconomic status, which may affect their health outcomes (5,19-22). Roma on average have a very low education level and face high rates of unemployment (23,24).

Roma patients with coronary artery disease (CAD) have been shown to have poorer outcomes after treatment when compared with their non-Roma counterparts. In CAD patients, Roma ethnicity was associated with a worse risk profile, more severe forms of CAD, poorer health-related quality of life and higher all-cause mortality (13,18,25,26). Thus, Roma are considered to be a high-risk population for cardiovascular diseases, which are the leading cause of mortality, morbidity and disability worldwide (27,28).

Ethnic differences regarding the improvement of the health status after the treatment of CAD in the Roma population have not yet been studied. Like the worse risk profile of Roma at entry to health care, such differences in improvement might contribute to the poorer health outcomes of the Roma patients. Therefore, the aim of this study was to assess the changes in clinical status, health behaviour and self-rated health (SRH) after coronary angiography (CAG) in Roma patients with CAD compared with non-Roma patients.

Methods
Patients
A total of 923 consecutive adult Roma and non-Roma patients who underwent routine elective coronary angiography (CAG) at the East Slovakian Institute for Cardiac and Vascular Diseases in Kosice, Slovakia, in the years 2004 - 2012 were asked to participate in our study (Figure 1). The inclusion criteria were being referred for CAG and age under 75 years. We excluded 217 patients based on the exclusion criteria: diagnosis of severe cognitive impairments, psychiatric disorder in the medical history, normal CAG, infectious endocarditis, acute myocardial infarction, severe valve disease, severe atrial or ventricular septal defect. Of the eligible patients, 127 refused to participate, resulting in a response rate 82%. The remaining 579 patients who were invited for follow-up 12-26 months after CAG, 14 patients died during the follow-up period. We also excluded 85 patients who came for follow-up earlier than 12 months or later than 26 months after CAG. Ultimately, 264 patients who came for follow-up (response rate 64%) were included in the study (see Figure 7.1).

Figure 7.1 Flowchart diagram of the study population

The study was approved by the Ethics Committee of the East Slovakian Institute for Cardiac and Vascular Diseases in Kosice in November 2004. All participants were provided with information about the study and signed an informed consent statement prior to the study.
Data collection consisted of two measurements: a baseline measurement (the day preceding the CAG) and a follow-up examination (12-26 months later). During the baseline measurement, a cardiologist extracted data from medical records and performed a physical examination of the patient, including blood pressure and heart rate measurements. An interview was conducted with each participant by a psychologist or trained research assistant. Percutaneous coronary intervention with or without stent implantation (PCI) was performed immediately after CAG, and surgical revascularization followed on average 50±43 days after CAG. For the follow-up examination patients were invited via postal mail. During the follow-up the same type of interview as at the time of enrollment was conducted, as well as a physical examination of the patient, with extraction of data from medical records performed by a cardiologist.

Sociodemographic data included age, gender, education and ethnicity. We categorized education into three categories – low (elementary school or secondary school without school leaving exam), middle (secondary school with school leaving exam) and high (university degree). Ethnicity was measured based on each patient’s declaration and identification by the doctor. In case of conflicting opinions, an independent third person (a head-nurse) was decisive.

Clinical data were retrieved from the medical records. These included disease history, use of drugs and type of treatment after CAG. Disease history concerned previous myocardial infarction, arterial hypertension, diabetes mellitus, dyslipidaemia and the use of acetylsalicylic acid (ASA), clopidogrel, betablockers, statins, nitrates, anxiolytics and non-steroid anti-inflammatory drugs (NSAID). We also asked about smoking status (smoker or non-smoker) and alcohol use (alcohol consumption yes or no). Levels of total, low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol and triglycerides were registered according to laboratory findings. The ejection fraction was measured by ultrasound using either the Simpson or the oculometric method. The type of treatment following the CAG concerned conservative pharmacological treatment, PCI or coronary artery bypass grafting (CABG). This was decided on by cardiologists based on the results of CAG and the patient’s clinical status, independently of participation in this study. The severity of the CAD was evaluated using the Canadian Cardiovascular Society (CCS) and New York Heart Association (NYHA) classifications. CCS identifies the severity of chest pain in 4 grades, while NYHA classifies dyspnea symptoms in 4 grades. In both scales, a higher score represents worse symptomatology. We measured the physical status by taking into our analysis the worst grade from either the NYHA or CCS classification in each patient.

SRH was measured using the first question of the Short Form Health Survey (SF-36) (29). The answer options 1 (excellent), 2 (very good), 3 (good), 4 (fair) and 5 (poor) were transformed into two categories – good (1+2+3) and poor (4+5). The validity and reliability of the SF-36 scale has been proven in patients with coronary artery disease (30).

Statistical analyses
As the first step, we described the background and clinical characteristics of the Roma and non-Roma patients. Differences were statistically tested using the t-test or Mann-Whitney U-test for continuous variables and χ² or Fisher exact tests, when appropriate, for categorical variables. Values of p<0.05 were considered statistically significant. Next, changes over time were tested using paired t-tests or related-samples Wilcoxon signed-rank tests for continuous variables and χ² square tests or McNemar tests for categorical variables, as appropriate. Finally, linear and logistic regression analyses were performed to assess the effect of ethnicity on changes in the outcome variables over the followed period of time.

All statistical analyses were performed using the statistical software program PASW SPSS version 20.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results
Baseline characteristics of the study population are given in Table 7.1. Roma patients were significantly younger, had lower education, were more obese and smoked more frequently when compared with non-Roma. Roma patients more frequently had a positive history of previous myocardial infarction and more frequently used clopidogrel or betablockers. The two groups of patients did not differ significantly in gender, SRH, presence of arterial hypertension, diabetes mellitus, dyslipoproteinemia, use of alcohol, ejection fraction and type of treatment after CAG.

When analyzing changes in the medical risk factors during the follow-up in each group of patients separately, we found that both Roma and non-Roma patients significantly improved in their functional status (see Table 7.2). Non-Roma patients showed a significant increase in their BMI, but on the other hand the levels of total cholesterol and triglycerides were significantly lower at the time of the follow-up. The use of clopidogrel significantly decreased in non-Roma patients, and the proportion of non-Roma patients using statins and betablockers significantly increased. SRH significantly improved only in the non-Roma patients after CAG.

Assessment of the degree to which ethnicity modified improvements in the outcomes by time in linear and logistic regression analyses yielded no significant differences between Roma and non-Roma, except for triglycerides and diastolic blood pressure (Table 7.2). Triglycerides and diastolic blood pressure increased significantly more in Roma patients when compared with non-Roma.
Table 7.1 Baseline characteristics of the study population by ethnicity (N=264). All figures are numbers and proportions except when otherwise indicated.

<table>
<thead>
<tr>
<th>Sociodemographic data:</th>
<th>Roma (N=25)</th>
<th>Non-Roma (N=239)</th>
<th>Significance of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years, mean ± SD)</td>
<td>52.3 ± 6.0</td>
<td>57.4 ± 7.1</td>
<td>***</td>
</tr>
<tr>
<td>Age range (years)</td>
<td>35-64</td>
<td>32-72</td>
<td></td>
</tr>
<tr>
<td>Gender (male)</td>
<td>20 (80.0%)</td>
<td>185 (77.4%)</td>
<td>ns</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low education</td>
<td>24 (96.0%)</td>
<td>129 (54.0%)</td>
<td></td>
</tr>
<tr>
<td>Middle education</td>
<td>1 (4.0%)</td>
<td>44 (18.4%)</td>
<td></td>
</tr>
<tr>
<td>High education</td>
<td>0 (0%)</td>
<td>66 (27.6%)</td>
<td></td>
</tr>
<tr>
<td>Self-rated health:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>11 (57.9%)</td>
<td>139 (61.0%)</td>
<td>ns</td>
</tr>
<tr>
<td>Good</td>
<td>8 (42.1%)</td>
<td>89 (39.0%)</td>
<td>ns</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.7±4.3</td>
<td>28.8±3.7</td>
<td>*</td>
</tr>
</tbody>
</table>

Table 7.2 Changes in the clinical status, use of drugs and self-rated health during follow-up 12-26 months after CAG with results of linear and logistic regression analysis, model adjusted for ethnicity by time of follow-up period in a sample of Roma and non-Roma: odds ratios (OR) or beta coefficients (B), 95% confidence intervals (CI), significance of difference (N=264)

<table>
<thead>
<tr>
<th>Medical risk factors:</th>
<th>Smoking</th>
<th>BMI (kg/m²)</th>
<th>Functional status (mean±SD)</th>
<th>Systolic BP (mmHg, mean±SD)</th>
<th>Diastolic BP (mmHg, mean±SD)</th>
<th>Heart rate (bpm)</th>
<th>Total cholesterol (mmol/l)</th>
<th>LDL cholesterol (mmol/l)</th>
<th>HDL cholesterol (mmol/l)</th>
<th>Triglycerides (mmol/l)</th>
<th>Use of drugs:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
</tr>
<tr>
<td>Smoking</td>
<td>7 (28.0%)</td>
<td>25 (10.5%)</td>
<td>23 (92.0%)</td>
<td>121 (50.6%)</td>
<td>23 (92.0%)</td>
<td>121 (50.6%)</td>
<td>7 (28.0%)</td>
<td>25 (10.5%)</td>
<td>23 (92.0%)</td>
<td>121 (50.6%)</td>
<td>7 (28.0%)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.7±4.3</td>
<td>31.4±4.1</td>
<td>28.8±3.7</td>
<td>29.1±3.8*</td>
<td></td>
<td></td>
<td>30.7±4.3</td>
<td>31.4±4.1</td>
<td>28.8±3.7</td>
<td>29.1±3.8*</td>
<td>30.7±4.3</td>
</tr>
<tr>
<td>Functional status</td>
<td>2.46±1.3</td>
<td>2.01±0.5</td>
<td>2.01±1.3</td>
<td>2.01±0.5*</td>
<td>2.01±1.4</td>
<td>2.01±0.5*</td>
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<td>2.01±0.5*</td>
<td>2.01±0.5*</td>
<td>2.46±1.3</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>128.6±13.7</td>
<td>136.6±18.7</td>
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<td>136.6±18.7</td>
<td>136.6±18.7</td>
<td>136.6±18.7</td>
<td>128.6±13.7</td>
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<td>136.6±18.7</td>
<td>136.6±18.7</td>
<td>128.6±13.7</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>82.9±9.7</td>
<td>92.6±19.2</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
<td>92.6±19.2</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
<td>82.9±9.7</td>
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<tr>
<td>Heart rate</td>
<td>70±10</td>
<td>69±11</td>
<td>70±10</td>
<td>69±11</td>
<td>70±10</td>
<td>69±11</td>
<td>70±10</td>
<td>69±11</td>
<td>70±10</td>
<td>69±11</td>
<td>70±10</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>2.67±1.11</td>
<td>2.87±0.98</td>
<td>2.67±1.11</td>
<td>2.87±0.98</td>
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<td>2.67±1.11</td>
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<tr>
<td>HDL cholesterol</td>
<td>1.06±0.51</td>
<td>1.28±0.51</td>
<td>1.06±0.51</td>
<td>1.28±0.51</td>
<td>1.06±0.51</td>
<td>1.28±0.51</td>
<td>1.06±0.51</td>
<td>1.28±0.51</td>
<td>1.06±0.51</td>
<td>1.28±0.51</td>
<td>1.06±0.51</td>
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<tr>
<td>Triglycerides</td>
<td>5.6±2.9</td>
<td>6.2±2.9</td>
<td>5.6±2.9</td>
<td>6.2±2.9</td>
<td>5.6±2.9</td>
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<td>5.6±2.9</td>
<td>6.2±2.9</td>
<td>5.6±2.9</td>
</tr>
</tbody>
</table>

* p<0.05; ** p<0.01; *** p<0.001; ns – not significant; SD – standard deviation; BMI – body mass index; ASA – acetylsalicylic acid; NSAID – non-steroid anti-inflammatory drugs; HDL – high-density lipoprotein; LDL – low-density lipoprotein; PCI – percutaneous coronary intervention; CABG – coronary artery bypass grafting.
Discussion
The aim of this longitudinal study was to assess whether Roma and non-Roma differ regarding improvement in clinical status, health behaviours and SRH after CAG. We found that changes over time were mostly similar, with Roma patients showing significantly less improvement only in the levels of triglycerides and diastolic blood pressure when compared with non-Roma. We found no significant changes in other risk factors, such as smoking, BMI, systolic blood pressure, total, LDL and HDL cholesterol, as well as use of drugs and SRH during the follow-up.
As described in previous studies, the health status of Roma patients entering the health care system is rather poor when compared with the majority population (4,5,11,13). Their higher mortality after treatment was mostly explained by their worse health status after treatment and low SES (14,15,31,32), but no data were available on the effects of the treatment on these ethnic differences. The finding of no significant difference in improvement between Roma and non-Roma CAD patients after CAG indicates that the origin of these differences is already present at entrance into the health care system – the process of further care does not seem to be affected by ethnic differences.
Roma and non-Roma patients in our study did not differ in the use of drugs during the follow-up period, so their different outcomes are unlikely to be caused by a lack of adequate drug treatment after confirmation of the CAD by CAG. Despite facing barriers in accessing health care (21,33), especially in the group of Roma people living in segregated settlements, we can assume that their medical treatment afterwards is similar to that of the majority population. However, previously described differences in the risk profile of Roma CAD patients undergoing CAG and more severe forms of CAD (13) might lead to the conclusion that other factors, like late referral for diagnostics and treatment of CAD, are factors influencing this health care consumption pattern. The care process does not seem to be able to counteract the worse initial condition of Roma patients.
To summarize, the results of the present study suggest that the lack of ethnic differences in changes of clinical status, health behaviour and SRH after CAG between Roma and non-Roma CAD patients may exclude these factors as being responsible for the worse outcomes of the Roma CAD patients. Other factors at entry to care, i.e. before undergoing CAG, must therefore be considered.

Strengths and limitations
To our knowledge, this is the first single major center longitudinal study focusing on a specific Roma population with diagnosed CAD and the changes in clinical status, health behaviour and SRH. However, one of the limitations of our study is the relatively small number of Roma patients, which might be responsible for some non-significant results. Next, we did not adjust the regression analysis of changes for possible confounding factors like age or education because we had already adjusted for them at baseline.

Implications
The present finding of almost no significant changes in the clinical status, health behaviour and SRH between Roma and non-Roma CAD patients implies for health researchers and health policy makers that they should direct their future research efforts on identifying the underlying causes. Health care practitioners and cardiologists should consider Roma patients for earlier referral for CAG to diagnose CAD at earlier stage of the disease. In this way, their later unfavorable outcomes might be improved. Special attention should be paid on treatment of hypertriglyceridemia by non-pharmacologic measures, such as lifestyle changes in Roma CAD patients. Future research should look to determine what causes the delay at entry into care of Roma CAD patients.

References
(3) Vano B. Demographic characteristics of the Roma population in the SR. 2001.


