# Frequency of Risk Factors in Patients with Acute Myocardial Infarction

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## ABSTRACT

**Introduction:** Various risk factors contribute to the occurrence of acute myocardial infarction as the most serious type of ischemic heart disease and the leading cause of sudden death worldwide.

**Aim of the Study:** The aim of this study was to assess the frequency of changeable and unchangeable risk factors in patients with acute myocardial infarction in the Republic of Srpska.

**Patients and Methods:** This cross-sectional study included patients treated for acute myocardial infarction at the University Clinical Center of Banja Luka, in the period from January 1st to December 31st, 2011. The patients were from the municipalities of Banja Luka and Laktaši. We analyzed the following risk factors: hypertension, total cholesterol values, diabetes, increased body weight and obesity, smoking, family history and physical inactivity.

**Results:** Out of 273 patients, the majority were male (64%), and there was a statistically significant difference between age and sex (p <0.01) of the respondents. The most common risk factor for both genders was hypertension (70.1%), while the least frequent risk factor was diabetes mellitus (25.6%). Smokers and ex-smokers accounted for 58.1%, with a statistical significance between men and women (p <0.01). The average BMI in both genders was in the overweight category (27.69 kg / m2). A positive family history was found in almost half of the respondents (49.4%), with a statistically significant difference between age groups and family history (p = 0.036).

**Conclusion:** Acute myocardial infarction mainly affects men in their sixties, while women are averagely affected nine years later than men. The number one risk factor for both genders is hypertension. Given the large impact of risk factors on the occurrence of acute myocardial infarction, priority must be given to the prevention and control of the aforementioned, especially in the primary health care.

**Key words:** acute myocardial infarction, risk factors, patient

## Introduction

Risk factors, as predictors of risk for morbidity and mortality in cardiovascular disease (CVD), have been in use since the late 19th century.[1,2]

The first large international study focused on the correlation between risk factors and CVD was the Framingham Heart Study in which, during the period between 1948 and 1951, approximately 5,208 healthy respondents between the ages 30 and 60 were enrolled. A working hypothesis of this study was that heart and blood vessel diseases do not have one risk factor, such as in the case of infectious diseases; it is rather caused by multiple factors that steadily make changes on the subject. Four years after the beginning of the study, with 34 cases of heart attack, investigators identified high cholesterol, arterial hypertension (AH), obesity and ECG abnormalities as the most important factors in the development of CVD. After 1961, Kannel introduced the term "risk factors".[3]

The risk factors can be changeable and unchangeable. Unchangeable risk factors are age and gender (men age>55; women after menopause and age>65 years), while changeable risk factors can be modified (hypercholesterolemia, arterial hypertension, tobacco smoking, diabetes mellitus, overweight and obesity, stress and physical inactivity).

According to the study from west Sweden, acute myocardial infarction (AMI) among women is commonly affected by multiple risk factors. Hence, women more commonly have diabetes and arterial hypertension, while cigarette smoking is the only factor of lower frequency.[4] On the other side, men have 3-6 times higher risk of developing disease compared to women, since women develop disease approximately ten years later. The risk of developing diseases is increased with aging.

Smoking 1-5 cigarettes daily increases the risk for developing AMI by 38.4%,[6] contributing to the fact that the risk for CVD is proportional to the number of cigarettes consumed. Both men and women are equally affected by the harmful effect of smoking (either active or passive); although the effect is probably stronger in women since it affects their natural hormonal protection at a younger age.[7]

Smoking has a synergistic effect with other risk factors and it also impacts an increase in CVD when combined with hypertension and diabetes. Studies have shown that, among randomly chosen patients with ACS, smokers, when compared to non-smokers, are twice as likely to have STEMI, indicating a protombotic effect of smoking.[8]

Hypertension is an equally important risk factor in both genders and its frequency increases with age. The likelihood of developing changes on the CV system depends on the blood pressure values and the length of hypertension. The blood pressure values greater then 110/75 mmHg increase the risk for development of CVD in any age group.[9] The threshold for lower blood pressure level that does not increase the risk for CVD development has not been determined yet.[10-13] According to the CINDI research study, conducted in Republic of Srpska in 2002, hypertension prevalence was 47%.[14,15]

In contrast to hypertension and diabetes, hypercholesterolemia is asymptomatic and is discovered accidentally during routine laboratory analysis. Cardiovascular risk is accompanied with hyperlipidemia and smoking, especially among young people (<55 years in men and <65 years in women), when compared to older generations.[6] A 10% reduction in total cholesterol decreases the frequency of coronary artery disease approximately by 25% five years after, while lowering LDL by 1 mmol/l reduces the frequency of ACS by 20%.[16]

Diabetes mellitus and CVD are distinctly connected and are studied together. In the EURODIAB IDDM Complication study, which included 3250 respondents with diabetes mellitus type 1 from 16 European countries, the CVD prevalence was 9% in men and 10% in women; it also increased with age and the length of diabetes (6% in age group 15-29; up to 25% in age group 45-59).[10] Coronary disease risk is increased 2-3 times in men and 3-5 times in women with diabetes.[10,11]

Epidemics of increased body weight and obesity have strong negative influence on quality of life and is one of the most important current health problems. During the last two decades, the prevalence of overweight people in european countries have tripled. Weight that is higher than what is considered as healthy is present in almost 50% of adults, and one third of the European population is obese.16 According to our studies in 2002, the prevalance of overweight was 39.8% and obesity 17.7% (greater in women) among people.[14,15]

Physical activity is used to estimate the quality of health, while physical inactivity is considered to be an important risk factor for the development of disease. Studies have shown that weight greater than what is considered as healthy (BMI≥25) and physical inactivty (<3,5 h of excercise per week) in combination, could be responsible for 59% of premature deaths due to CVD.[17]According to the European guide for CVD prevention, healthy people should have 2,5-5 hours per week of physical activity or moderate intensity aerobic training.[18]

Some studies, such as the PROKAM study, confirmed the importance of positive family history as an independant risk factor in first generation relatives among men younger than 55 years of age and women younger than 65.[19,20] However, it is not yet determined to which extent a positive

family history is an independant risk factor and to which is dependent on other risk factors, such as hypertension, diabetes and hyperlipidemia.[21,22]

## Aim of the Study

The aim of this study was to investigate the frequency of preventable and nonpreventable risk factors in patients with AMI in the Republic of Srpska.

## Patients and Methods

A cross-sectional study included patients treated for acute myocardial infarction at the University Clinical Centre in Banja Luka, in the period from January 1st to December 31st, 2011. The first inclusion criterion was that the patients were residents of Banja Luka and Laktaši; the second was the written consent for participation in the research, which was obtained from patients.

Patients who had had positive laboratory markers for myocardial necrosis (e.g., Troponin T), along with supportive evidence in the form of typical symptoms, suggestive electrocardiographic (ECG) changes, or imaging evidence of new loss of viable myocardium or new regional wall motion abnormality, were diagnosed as having AMI at the University Clinical Centre of Banja Luka. The list of patients with AMI was obtained from the administrative office of the University Clinical Centre of Banja Luka.

Research instruments

Data were extracted from the patients' medical history and discharge letters, as well as from their electronic and paper records. The protocols at the Primary Care Centres were analysed, followed by telephone interviews carried out by the researchers. Furthermore, a special form that was related to each respondent was filled in.

The data on arterial hypertension, the value of total cholesterol, diabetes, increased body weight and obesity, smoking, positive family history, and physical inactivity were included in the retrospective analysis of the cardiovascular risk factors.

Arterial hypertension is high blood pressure with diastolic blood pressure measurements $\geq$ 90 mmHg and systolic $\geq$ 140 mmHg. Blood pressure values and therapy was recorded for each patient individually.

Cholesterol values, recorded during check-ups in the family medicine office before AMI had been developed, were obtained from patients' medical records. Cholesterol greater than 5 mmol/l was considered as an increased value.

Patients' medical records and discharge letters were used

as a source of information on type of diabetes mellitus (I or II) and hyperglycemia. Two types of glucose values in blood were recorded: first, obtained during check-up if the patient did not have diabetes, or an average glucose value if the patient had diabetes; second, the glucose value when patient got accepted in coronary unit.

Patients' medical records (when information was available), discharge letters and direct interviews with the patient were used to obtain information about body mass index (BMI), smoking, and family history. Normal BMI was 18-24,9 kg/ m2; overweight was 25-29,9 kg/m2; and obesity was determined at  BMI 30 kg/m2(obesity I, II, and III grade).

During conversation with the patients, the smoking history was obtained, whether or not the patient was a current, ex-smoker, or non-smoker. Positive family history included the presence of CVD in parents (father before 55 years of age and/or mother before 65 years of age).

Physically active patients were considered to have had moderate physical activity of 30 min on most days in a week (i.e. walking, gardening, house work) before hospitalisation.

Statical analysis

Data extracted from the secondary sources were entered in patient's study record and afterwards, in electronic form using Microsoft Excel 2010.

The data were analysed and presented using descriptive statistics (absolute and relative numbers, measures of central tendency, standard deviation) and appropriate statistical tests ($\chi$2/test, Mann-Whitney U test, Fisher test) using SPSS analytical software. A probability level or p value less than 0.05 (P<0.05) was considered statistically significant.

## Results

The study included 273 patients with AMI. The average age of the participants was  65,43±11,677 years. Using the Mann-Whitney U test (U = 5841,500; p = 0,000), the statistically significant difference was found between female (Md = 72,00; n = 97) and male gender (Md = 63,00; n = 176). Women with AMI in the study were approximately older than men.

The frequency of cardiovascular risk factors in patients with AMI is presented in Figure 1. Hypertension was the most common risk factor (70,1%). Diabetes mellitus, mainly type 2 (23%) was the least presented risk factor (25,6%). 58.1% of the respondents were current and ex-smokers. Positive family history was found in approximately 50% of the respondents.

**FIGURE 1.** Representation of risk factors among patients with AMI
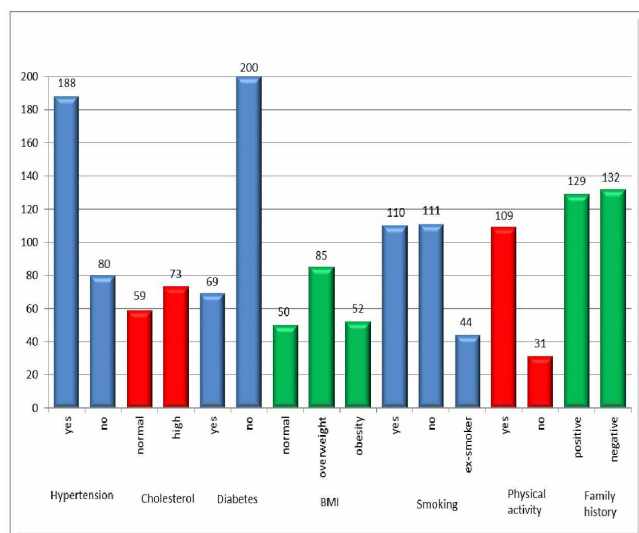


The risk factors were evaluated according to sex and age. Using χ2 test, the statistically significant difference was found between the genders in smoking status (χ2=31.442;p=0,000) and the level of arterial blood pressure (χ2 = 7,151; p = 0,007) (Table 1). Compared to females, more frequently, men were smokers and had hypertension.

Systolic and diastolic blood pressure values were recorded during the first medical contact; the mean value was 146/90 mmHg.

Increased cholesterol levels were found in 73 examinees. There was no statistically significant difference between men and women in cholesterol level (χ2= 0.020; p = 0,887), as well as in BMI (U = 3846.000; z=-0. 083; p = 0.934; r = 0.006; p=0,131) (Table 1).

Men had diabetes more frequently (χ2=4.340;p=0,037) and were also more physically active than women (χ2=20.060; p=0,000). A statistically significant difference, regarding the positive family history between genders, was not found (Table 1).

**Table 1.** Distribution of risk factors according to gender

| Risk factors | | Gender | | | |
|---|---|---|---|---|---|
| | | M | F | Total | p |
| Smoking, n (%) | Yes | 84 (31,7) | 26 (10) | 110 (41,5) | **0,000** |
| | No | 51 (19,2) | 60 (22,7) | 111 (41,9) | |
| | Ex-smoker | 37 (14) | 7 (2,6) | 44 (16,6) | |
| Hypertension, n (%) | Yes | 112 (41,8) | 76 (28,4) | 188 (70,1) | **0,007** |
| | No | 62 (23,1) | 18 (6,7) | 80 (29,9) | |
| Total cholesterol,  n (%) | Nomal | 38 (28,8) | 21 (16) | 59 (44,7) | 0,887 |
| | Increased | 49 (37,1) | 24 (18,2) | 73 (55,3) | |
| Body weight,  n (%) | Nomal | 29 (15,5) | 21 (11,2) | 50 (26,7) | 0,131 |
| | Overweight | 63 (33,7) | 22 (11,8) | 85 (45,5) | |
| | Obesity | 33 (17,6) | 19 (10,2) | 52 (27,9) | |
| BMI  (mean, SD) | | 27,52(5,2) | 27,93(3,9) | 27,69(4,3) | 0,934 |
| Diabetes,  n (%) | Yes | 37 (13,8) | 32 (11,9) | 69 (25,7) | **0,037** |
| | No | 137 (51) | 63 (23,4) | 200 (74,3) | |
| Physical activity,  n (%) | Yes | 89(63,6) | 20(14,3) | 109(77,9) | **0,000** |
| | No | 12(8,6) | 19(13,6) | 31(22,1) | |
| Family history,  n (%) | Yes | 84(32,2) | 45(17,2) | 129(49,4) | 1,000 |
| | No | 86(33) | 46(17,6) | 132(50,6) | |

*p<0,01  is significant and bolded*

The mean value of glucose in blood before AMI was 6,45±2,15 mmol/l, while during the first medical contact, it was 12,68±6,87 mmol/l.

The respondents were classified into 4 age groups. The greatest number of the respondents (28,6%) was in the age group 65-74 years.

A statistically significant difference was found in presence of hypertension between different age groups ($\chi2= 31,721$; p = 0,000). Increased blood pressure was most frequently found in the age group 65-74 years. Positive family history was most frequently found in the age group <64 years ($\chi2= 8.570$, p = 0.036) (Table 2).

**Table 2.** Distribution of risk factors according to age

| Risk factors | | Age group | | | | |
|---|---|---|---|---|---|---|
| | | <= 54 | 55 - 64 | 65 - 74 | >= 75 | P |
| Smoking, n(%) | Yes | 40(15,1) | 36(13,6) | 23(8,7) | 11(4,2) | - |
| | No | 7(2,6) | 22(8,3) | 38(14,3) | 44(16,6) | |
| | Ex-smoker | 3(1,1) | 14(5,3) | 15(5,7) | 12(4,5) | |
| Hypertension, n(%) | Yes | 20(7,5) | 49(18,3) | 61(22,8) | 58(21,6) | **0,000** |
| | No | 30(11,2) | 23(8,6) | 17(6,3) | 80(29,9) | |
| Total cholesterol, n(%) | Nomal | 13(9,8) | 18(13,6) | 16(12,1) | 12(9,1) | 0,546 |
| | Increased | 15(11,4) | 15(11,4) | 25(18,9) | 18(13,6) | |
| Diabetes, n(%) | Yes | 3(1,1) | 19(7,1) | 22(8,2) | 25(9,3) | - |
| | No | 48(17,8) | 53(19,7) | 56(20,8) | 43(16) | |
| Physical activity, n(%) | Yes | 30(27,5) | 36(33) | 22(20,2) | 21(19,3) | - |
| | No | 4(3,7) | 5(4,6) | 9(8,3) | 13(11,9) | |
| Family history, n(%) | Yes | 33 (12,6) | 38(14,6) | 31(11,9) | 27(10,3) | 0,036 |
| | No | 18(6,9) | 33(12,6) | 42(16,1) | 39(14,9) | |

*p was not calculated for risk factors where n<5*

## Discussion

In this study, it has been shown that the most frequent risk factors among patients with AMI are hypertension and smoking.

According to the WHO, Bosnia and Herzegovina, along with Serbia, belonged to the group of countries with the highest prevalence of tobacco smoking in Europe. Presently, Bosnia and Herzegovina is on the bottom of that ladder (below 20%), in contrast to Serbia where there has not been changes.[23] The highest prevalence of smoking among men in Europe is in Ukraine (62%) and among women in Serbia (27%).[24] In this study, we found that 58.1% of patients with AMI consumed or is still consuming tobacco. It was also found that smoking has a tendency to decline with age.

According to Braunwald[24], the four major changeable risk factors for CVD - smoking, obesity, increased blood pressure and high cholesterol, are more commonly found in Europe and Central Asia compared to other parts of the world. The above mentioned risk factors are also recognized in our country as important factors that greatly influence the development of CVD either individually or together. Besides these risk factors, family history, diabetes and physical inactivity are also important. In our study, the majority of respondents were male. It was found that women with AMI were, on average, nine years older than men, which was in agreement with other studies

that showed that AMI was more frequently found among men than women, with the ratio 7:1 in the fourth and fifth decade; in the sixth one 1,5:1; in the seventh 1,5:1; while in the eighth decade, it was equally present among both sexes.[25] The CVD has been perceived as a man's disease and this stance dates from 2600 years B.C. in Eber's papyrus where is written: „If you found a man with cardiac discomfort, with pain in his arms, at the side of his heart, death is near."[26] With further advance in medicine, the perception about CVD has been changing toward a more favorable outcome. Presently, women are more likely to develop disease and die from not well known causes that are in connection with poor life standard, chronic stress and unchangeable hereditary factors. However, the studies have shown that women averagely develop their first AMI nine years later then men, which indicates high levels of risk factors in men at a younger age.[27]

Khot et all. showed that the prevalence of conventional risk factors, except for smoking, was higher among women than men (it has also been confirmed in the recent studies),[28] which is in contrast with our results.

The results of our study showed that men had hypertension more often as an individual risk factor; they were also smokers more frequently than women (three times more frequently smokers and five times more frequently ex-smokers), which is in accordance with the previously

mentioned study.

According to the recent data, hypertension is most frequently found among men in Croatia (50%), while among women in Bosnia and Herzegovina (45%).[24] In this study, it was determined that hypertension, as the most common risk factor, was present among 70.1% of patients with AMI, with the statistically significant difference between genders and different age groups.

In the studies ROSCOPS I, II and III, where patients with CHD were followed, the frequency of hypertension in Republic of Srpska was 74 %,81 % and 77 %.[12,29] However, CHD was the major cause of death in patients with hypertension. According to the INTERHART study results, hyperlipidemia represents a 49% of attributable risk for development of the first stroke, while diabetes represents a 10% of attributable risk.[6]

In this study, the mean value of cholesterol, recorded earlier in patients, was 5,5 mmol/l. The mean age of the patients with normal cholesterol levels was 64 years, while in patients with increased cholesterol, it was 65 years. Compared to men, women were twice less likely to had had increased cholesterol levels.

One Belgian study in the public health institution showed that the prevalence of obesity was higher among women, while cigarette smoking was twice less frequent among obese and overweight patients with CHD, compared to patients with diabetes and CHD.[30]

Although obesity is a disease itself, and may, same as hypertension, influence the development and progression of many diseases, including CHD. According to some authors, the risk for CHD increases with an increase in BMI; respectively, high BMI is a strong predictor of fatal CHD.[31]

According to the body weight groups (WHO, 1997), patients in this study, either male or female, were mainly overweight. The median BMI value for women was 27.09 kg/m2, while for men, it was 26,85 kg/m2. Based on the fact that more than 50% of the respondents were overweight, it could be concluded that the increased body weight, together with obesity, was and still is an important risk factor for the development of CHD.

Almost 20% of patients with MI have diabetes, and it is expected that this number will continue to increase.[32] Diabetes mellitus in this study was found among 25.6% of patients with AMI, while 23% were patients with type 2 diabetes, which was equalised with CHD. While analysing this risk factor, it was found that almost the same number of men and women had diabetes (men insignificantly more); while twice more women and three and a half times more men did not have this risk factor. Two large clinical studies, Framingham and MRIFT, have showed that men with diabetes are twice more likely to develop CHD, while in women diabetes increases the risk for development of CHD three times more.[33;34]

In our study, data on physical activity showed that the respondents were physically active. Physical activity might be useful for secondary prevention of coronary disease, since continuous physical activity decreases mortality after MI.[35] The majority of patients had a positive family history and were younger than 65 years of age, while the patients older than 65 usually had a negative family history (it was taken with caution since older patients were not always aware of their family history).

Since risk factor control is very important for the prevention of CVD, the importance of prevention as the main concept of family medicine has to be emphasized among family medicine doctors in our country.

## Conclusion

In this study, we have found that the majority of people developing AMI are older men across all institutions where the first medical help was first administered. Women with AMI are on average nine years older than men. The most frequent risk factors in the development of AMI in men are hypertension and smoking, while in women, it s only hypertension. Another important risk factor for the development of AMI is the increased body weight, regardless of sex. Out of four conventional risk factors for the development of AMI, on the group of respondents in this study, diabetes is present least commonly. Since risk factors have great influence on the development of AMI, prevention must be emphasized, especially on the primary health care level.

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# Učestalost faktora rizika kod bolesnika sa akutnim infarktom miokarda

**SAŽETAK**

**Uvod:** Djelovanjem različitih faktora rizika dolazi do nastanka akutnog infarkta miokarda kao najozbiljnijeg oblika ishemijske bolesti srca i glavnog uzroka iznenadne smrti širom svijeta.

**Cilj rada:** Cilj ove studije je bio procjena učestalosti promjenjivih i nepromjenjivih faktora rizika kod pacijenata sa akutnim infarktom miokarda u Republici Srpskoj.

**Ispitanici i metode:** Studija presjeka je uključivala pacijente sa područja opština Banja Luka i Laktaši, oboljele od akutnog infarkta miokarda, koji su liječeni na Klinici za kardivaskularne bolesti Univerzitetskog Kliničkog Centra Banja Luka u periodu od 1.1.2011. do 31.12.2011.godine. Analizirani su sljedeći faktori rizika: arterijska hipertenzija, vrijednost ukupnog holesterola, dijabetes melitus, prekomjerna tjelesna težina i gojaznost, pušenje, pozitivna porodična anamneza i fizička neaktivnost.

**Rezultati:** Od ukupno 273 pacijenta, većinu su činili muškarci(64%), a utvrđena je statistički značajna razlika između dobi ispitanika muškog i ženskog pola(p<0,01). Najzastupljeniji faktor rizika kod oba pola je hipertenzija(70,1%), a najmanje prisutan faktor rizika je dijabetes melitus (25,6%). Pušači i bivši pušači su činili 58,1%, sa statističkom značajnošću između muškaraca i žena (p<0,01). Prosječan BMI kod oba pola je bio u kategoriji prekomjerne tjelesne težine (27,69 kg/m2). Pozitivna porodična anamneza je utvrđena kod gotovo polovine ispitanika (49,4%), sa statistički značajnom razlikom između starosnih grupa i porodične anamneze (p = 0,036).

**Zaključak:** Od akutnog infarkta miokarda uglavnom oboljevaju muškarci u 60-im godinama života, dok žene oboljevaju u prosjeku 9 godina kasnije nego muškarci. Broj jedan faktor rizika kod oba pola je hipertenzija. S obzirom na veliki uticaj faktora rizika na nastanak akutnog infarkta miokarda, prednost se mora dati prevenciji i kontroli istih, posebno na primarnom nivou zdravstvene zaštite.

**Ključne riječi:** akutni infarkt miokarda, faktor rizika, pacijent