

# Incidence of acute coronary syndrome between men and women: Integrative review

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## ABSTRACT

The objective of this study is to analyze the difference between the male and female genders regarding the number of cases of acute coronary syndrome (ACS)/acute myocardial infarction (AMI). This is an integrative literature review study, in which articles were searched in the following databases: MEDLINE, LILACS, SCIELO, BDEF. The articles were published between the years 2006 and 2018. Initially, 502 studies were found, 17 of which were selected to compose this research. Studies in general have pointed to a high incidence of ACS/AMI in males, however, a linear increase in the incidence of cardiovascular diseases in females has been observed in recent years. And that the factors associated with the appearance are hypertension, smoking, alcoholism, sedentary lifestyle and obesity, among others. In conclusion, the incidence of patients with ACS/AMI every year has been a major challenge for health institutions and health professionals. The gender most affected by these diseases is the male gender; however, the increase in new cases in women has increased linearly in recent years.

**Keywords:** Myocardial infarction, epidemiology, coronary disease, acute coronary syndrome.

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## INTRODUCTION

Cardiovascular diseases (CVDs) are the main diseases responsible for the increase in morbidity and mortality of most of the population. Among the CVD is Acute Myocardial Infarction (AMI), the main cause of death in developed and developing countries, which corresponds to more than 30% of deaths in Brazil, which makes it considered an important indicator of quality standards of

policies in collective health for being a disease with great impact (Jesus et al., 2013; Araújo et al., 2016).

The diagnosis of AMI is confirmed by electrocardiogram (ECG) leading to AMI classification with ST segment elevation (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI). These diagnostic methods can be identified by simple

interpretation of this test (Jesus et al., 2013). This test is considered the quickest and easiest to identify or not AMI, and is described by protocols and guidelines such as the EKG-port time that should be performed within ten minutes of the patient's arrival at the hospital (Torres and Marques, 2012).

In 2009, AMI was the third largest responsible cause of hospitalization in the Unified Health System (UHS). This represented a total of 10.2% of hospitalizations, a number that exceeds 25% when the population over 50 years of age is analyzed (Piegas et al., 2013).

It is estimated that 635,000 Americans will be hospitalized annually due to acute coronary syndrome. Regarding hospital mortality related to STEMI, there was a significant drop of 11.5% in 1990 to 8.0% in 2006. This decline is related to advances in clinical pharmacotherapy and reperfusion strategies such as primary percutaneous coronary intervention (PCI), and also to changes in patients regarding their demographic profile (Andrade et al., 2015).

In Brazil, according to data from the Unified Health System and the Ministry of Health, there were 84,945 deaths from ischemic heart disease in 2005. In 2008, information systems recorded 518 hospitalizations for AMI in Rio Grande do Sul. In the United States, approximately 1.5 million patients each year develop AMI, of which 40 to 50% are accompanied by an increase in the ST segment. Between 25 and 30% of non-fatal AMI are not recognized by the patient and are discovered by routine ECG or post-mortem examination. ECG associated with a good clinical history and physical examination is essential in the diagnosis of patients with chest pain and an advantageous resource, because it allows rapid and low-cost procurement (Damasceno et al., 2012).

It is worth mentioning that the death rates due to hospital and pre-hospital AMI are still significant, despite the decrease in the in-hospital phase, especially the incidence of the disease analyzed in Brazilian metropolises, represents a high cost for the country (Soares et al., 2009).

Regarding the most prevalent risk factor in the development of AMI, Systemic Arterial Hypertension (SAH) stands out, besides being evidenced as a significant rate of hospital mortality in patients with definitive diagnosis (Araújo et al., 2016). As for the most affected gender, it is perceived in the studies that the male gender still represents in an expressive way, the most affected gender when compared to the female gender.

Thus, this study aimed to analyze the difference between the male and female genders regarding the number of cases of Acute Coronary Syndrome (ACS)/AMI.

Describing these data may represent a warning to the representative health entities to intensify the strategies to combat, control and prevent CVDs, since this type of

disease is responsible for a high mortality rate in the world every year. In addition, this study may favor the knowledge of health professionals about the theme, which may help in the individual guidance between genders, favoring decision making, and in the prevention of associated complications of CVDs.

## METHOD

This is an integrative literature review, adopting the PICO search strategy, which represents an acronym for (P) Population or Patient, (I) Intervention, (C) Control or Comparison, (O) "Outcomes" (outcome). As a population, the patients who developed AMI were emphasized. The intervention (I) and the control/comparison (C) do not apply to this study. The expected outcome/Outcomes is the knowledge of the gender most affected by ACS/AMI as well as the knowledge of factors associated with CVDs development, in order to draw attention to these factors and encourage their prevention. The selected studies are characterized as observational, descriptive, analytical studies that addressed the ACS/AMI and analyzed the male and female genders and the factors related to their emergence.

This review followed 6 interrelated steps: establishment of hypothesis or guiding question, sampling or literature search, categorization of the study, evaluation of studies included in the review, interpretation of results, synthesis of knowledge or presentation of the review.

The guiding question drawn from the PICO strategy focused on: What is the incidence of ACS/AMI between males and females described in the literature? Subsequently, a survey of articles was carried out between November 2017, using the following Health Sciences Descriptors (Decs): Myocardial infarction; Epidemiology; Coronary disease; Acute Coronary Syndrome. The descriptors were combined with each other using the Boolean operator "AND" to refine the search. The bibliographic survey was guided by the guiding question described above. Thus, a survey of scientific publications available in the Latin American and Caribbean Literature in Health Sciences (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO) and nursing database (BDenf) databases was conducted. Filters were used: articles available in full, publications from the period from 2008 to 2018 in Portuguese, English and/or Spanish.

The inclusion criteria were studies available in full, observational, descriptive, analytical; published between 2006 and 2018, which addressed ACS/AMI in humans within the scope of clinical practice, in which the authors are health professionals (nurses, physicians, pharmacists and physiotherapists). However, to compose the results of this research, we used studies published in the last 6 years (2012-2018). The exclusion criteria adopted were: 1) articles that did not address SCA/AMI, 2) articles published prior to the year 2012, 3) previous notes, 4) annals of events, 5) books or chapters, and 6) books. Articles with double publication or that were available in two or more databases were considered only once.

The results were then presented in two tables, the first consisting of the identification of the articles represented by the letter "A" followed by an Arabic number (A1, A2...A17) successively, classification regarding the methodological design, the level of evidence to which each study refers and the degree of recommendation according to the Oxford classification (Table 1). The second table was complementary to the first, containing the title, the sample size of each study represented by the letter (n) and the population affected according to male (GM) and female (GF) (Table 2). Table 3 shows demographic characteristics as to the average age of patients with AMI/ACS.

**Table 1.** Classification of the studies included in this review according to the level of evidence and recommendation according to "Oxford Centre for Evidence-based Medicine", Brasília-DF, 2018.

Articles	Method	Level	Grades of recommendation	Source
A1	Retrospective descriptive study	2C	B	Bahall et al. (2018)
A2	Prospective observational study	2C	B	Fernández-Rodríguez et al. (2017)
A3	Prospective observational study	2C	B	Marino et al. (2016)
A4	Descriptive, retrospective study	2C	B	Araújo et al. (2016)
A5	Retrospective descriptive study	2C	B	Andrade et al. (2015)
A6	Descriptive, longitudinal study	2C	B	Maier et al. (2015)
A7	Prospective observational study	2C	B	Soeiro et al. (2015)
A8	Cross-sectional descriptive study	2C	B	Andrade et al. (2015)
A9	Retrospective cohort study	2B	B	Sousa et al. (2015)
A10	Observational study, case series type	1C	A	Almeida et al. (2014)
A11	Retrospective descriptive study	2C	B	Araújo et al. (2014)
A12	Retrospective descriptive study	2C	B	Jesus et al. (2013)
A13	Prospective study	2C	B	Piegas et al. (2013)
A14	Descriptive and exploratory study	2C	B	Gil et al. (2012)
A15	Retrospective descriptive study	2C	B	Lopes et al. (2012)
A16	Prospective cross-sectional study	2C	B	Bastos et al. (2012)
A17	Descriptive prevalence study	2C	B	Torres and Marques (2012)

Source: Authors (2018).

**Table 2.** Characteristics between genders of patients with ACS/AMI according to the publications included in this review. Brasília-DF, 2018.

Articles	Title	N	GF (%)	GM (%)	MA	Source
A1	Risk factors for first-time acute myocardial infarction patients in Trinidad	252	113 (45%)	138 (55%)	59.9 years	Bahall et al. (2018)
A2	Gender gap in medical care in networks for acute myocardial infarction with ST segment elevation: findings of the Catalan network Codi Infart	4380	961 (21.9%)	3419 (78.1%)	60.6 years	Fernández-Rodríguez et al. (2017)
A3	Epidemiological Profile and Quality Indicators in Patients with Acute Coronary Syndrome in the North Region of Minas Gerais - Minas Gerais Project Telecardio 2	277	95 (34.3%)	182 (65.7%)	62 years	Marino et al. (2016)
A4	Profile of the population affected by acute myocardial infarction.	106	36 (34%)	70 (66%)	65.3 years	Araújo et al. (2016)
A5	Clinical and angiographic profile of young patients submitted to primary percutaneous coronary intervention	489	151 (30.9%)	338 (69.1)	54 (≤45 years) 435 (>45 years)	Andrade et al. (2015)

Table 2. Continues.

A6	Pre hospital indicators in the evaluation of the quality of care to patients with acute coronary syndrome	94	45 (47.9%)	49 (52.1%)	20 ( $\leq 50$ years) 74 ( $> 50$ years)	Maier et al. (2015)
A7	Clinical characteristics and long-term evolution of young patients with acute coronary syndrome in Brazil	268	115 (43%)	153 (57%)	50 years	Soeiro et al. (2015)
A8	Evaluation of the waiting time of the initial electrocardiogram in patients with Acute Coronary Syndrome	116	53 (45.7%)	63 (54.3%)	66.3 years	Andrade et al. (2015)
A9	Epidemiology of coronary artery bypass grafting at the Hospital Beneficência Portuguesa, São Paulo	3011	906 (30.1%)	2105 (69.9%)	62.2 years	Sousa et al. (2015)
A10	Comparison of the Clinical-Epidemiological Profile between Men and Women in Acute Coronary Syndrome	927	556 (60%)	371 (40%)	67 years	Almeida et al. (2014)
A11	Clinical and epidemiological profile of patients with acute coronary syndrome	150	52 (34.7%)	98 (65.3%)	Years	Araújo et al. (2014)
A12	Profile of patients admitted with Acute Myocardial Infarction at Hospital de Urgência de Teresina-PI	240	105 (43.8%)	135 (56.2%)	years	Jesus et al. (2013)
A13	Behavior of Acute Coronary Syndrome. Results of a Brazilian Registration	2693	864 (32.1%)	1829 (67.9%)	years	Piegas et al. (2013)
A14	Clinical evolution of inpatients due to the first episode of acute coronary syndrome	234	72 (30.8%)	162 (69.2%)	58 years	Gil et al. (2012)
A15	Risk Factors Associated with Death by Acute Myocardial Infarction in the Intensive Care Unit of a Hospital do Sul de Minas Gerais	187	56 (30%)	131 (70%)	years	Lopes et al. (2012)
A16	Time of arrival of the patient with acute myocardial infarction in the emergency unit	52	12 (23.1%)	40 (76.9%)	years	Bastos et al. (2012)
A17	Study on the profile of patients with Acute Coronary Syndrome	145	53 (36.6%)	92 (63.4%)	years	Torres and Marques (2012)
	Articles N	13526	4207 (31.1%)	9319 (68.9%)		

Source: Authors (2018).

n = Participants affected by ischemic heart disease / Acute Coronary Syndromes in each study

N = Total number of patients affected by ischemic heart disease / Acute Coronary Syndromes in the 17 studies included.

GF% = Percentage of female patients

GM% = Percentage of male patients

MA = Media general age of patients affected by ACS/AMI.

## RESULTS

Initially, 502 articles were searched using the combined descriptors. After the use of filters (full text available, publications between 2008 and

2018), 148 articles remained. After the analytical reading (title and abstract), 43 articles remained. After the complete reading of the articles, 17 articles were selected to compose the final sample of the research, which were distributed

and synthesized in Tables 1, 2 and 3. This section presents the analysis of the results of this study, which aimed to verify which incidence of coronary syndromes between men and women.

With regards to the level of evidence and the

**Table 3.** Average age among patients with ACS / AMI.

Articles	N	MAF	MAM	GAA	Source
A1	252	-	-	59.9 years	Bahall et al. (2018)
A2	4380	69.8 years	60.6 years	65.2 years	Fernández-Rodríguez et al. (2017)
A3	277	-	-	62 years	Marino et al. (2016)
A4	106	-	-	65.3 years	Araújo et al. (2016)
A5	489	-	-	61.6 years	Andrade et al. (2015)
A6	94	-	-	20 (≤50 years), 74 (>50 years)	Maier et al. (2015)
A7	268	-	-	50 years	Soeiro et al. (2015)
A8	116	-	-	66.3 years	Andrade et al. (2015)
A9	3011	-	-	62.2 years	Sousa et al. (2015)
A10	927	68.6 years	63.9 years	67 years	Almeida et al. (2014)
A11	150	-	-	65 years	Araújo et al. (2014)
A12	240	-	-	61.92 years	Jesus et al. (2013)
A13	2693	-	-	62.9 years	Piegas et al. (2013)
A14	234	-	-	58 years	Gil et al. (2012)
A15	187	65.34 years	59.10 years	60.97 years	Lopes et al. (2012)
A16	52	-	-	62.35 years	Bastos et al. (2012)
A17	145	-	-	65.5 years	Torres and Marques (2012)
	13622				

N = Total number of patients affected by ischemic heart disease / Acute Coronary Syndromes in the 17 studies included.

MAF = Mean age of females

MAM = Mean age of males

GAA = General Average Age.

degree of recommendation of the studies, 15 articles (88.24%) presented as NE 2C; 1 study (5.88%) with NE 2B, masters with degree of recommendation "B" in the Oxford scale, and 1 study (5.88%) with NE 1C with degree of recommendation "A" (Table 1).

The 17 studies analyzed resulted in 13526 patients affected by ACS/AMS. Of this total, 4207 (31.1%) patients were female, compared to 9319 (68.9%) male patients. Regarding the individual analysis of each study, the 17 articles (100%) presented a higher incidence of ACS/AMI in males. However, it was noticed that there was a considerable increase in the incidence of ACS/AMI in female patients in recent years.

Regarding the age of patients with AMI/ACS pointed out in the studies, a higher incidence of cases occurred among patients over 50 years old. Regarding the age between men and women, some studies have shown that male patients were older compared to females (Table 3) (Fernández-Rodríguez et al., 2017; Almeida et al., 2014; Lopes et al., 2012).

## DISCUSSION

A study published in 2014 comparing the clinical profile between men and women with AMI showed that the overall mortality coefficient is higher among men than women in all the years considered. However, the SAH variable, when compared to its frequency between

genders, showed a higher incidence among women ( $p=0.001$ ), while smoking and alcoholism were more frequent in men ( $p=0.01$ ) (Almeida et al., 2014).

With regard to risk factors, studies have shown that there are several risk factors associated with AMI, including: marital status, retirement, family history of coronary insufficiency, history of SAH and Diabetes Mellitus (DM), smoking, physical activity, LDL-cholesterol, HDL-cholesterol, glucose, Body Mass Index (BMI), among others (Jesus et al., 2013; Araújo et al., 2016; Torres and Marques, 2012; Piegas et al., 2013; Andrade et al., 2015; Maier et al., 2015; Soeiro et al., 2015; Andrade et al., 2015; Almeida et al., 2014; Araújo et al., 2014; Lopes et al., 2012; Bastos et al., 2012; Ribeiro et al., 2013). These factors are always more frequent in males, but the increase in these factors in females in recent years has been significant.

Another study whose sample consisted of 50 patients demonstrated that 32% were smokers, with non-smokers prevailing, and many left the cigarette after being affected by acute myocardial infarction. And in relation to changes in cholesterol levels, 46% were at the desirable level of less than 200 mg/dl, but very close to this number and 44% with cholesterol levels between 200 and 240 mg/dl (Jaconodino et al., 2007).

Thus, in both studies, increased cholesterol and smoking are directly related to the number of cases of AMI. These factors, among others, are the main responsible for the increase in hospital morbidity due to

AMI. And that a large part of the target population demonstrates knowledge of the factors that trigger this pathology, but shows little importance due to not having witnessed it. The high rate of deaths from AMI in Brazil could be much lower if preventive and health education strategies were more emphasized from childhood, inserted in the school curriculum along with physical education, emphasize the signs and symptoms during a routine consultation.

The study by Feijó et al. (2015), demonstrated significant relevance in the influence of a genetic factor/family history when analyzing the pathophysiology of AMI and its possible predisposing factors in individuals under 40 years of age.

With regard to hospitalizations for treatment by AMI, a study conducted in 2012 with evaluation of 145 medical records of patients who developed AMI showed that as for the type of acute ischemic syndrome, 53.10% presented AMI with STEMI, 37.93% presented AMI NSTEMI, 0.69% presented unstable angina and 6.21% did not contain the data. Among the patients who underwent thrombolysis (n=52), 84.62% had indication for therapy (Torres and Marques, 2012).

An analysis of the data collection from a study conducted between 2002 and 2003 showed that age above 60 years is a factor linked to hospitalization rate, an indicator of patient severity and an important predictor of death, with a clear correlation between age and probability of death (Evangelista et al., 2008).

Another study conducted in 2009 with 64 patients showed that 54.7% of the patients evaluated had dyslipidemia, 93.8% were hypertensive, 26.6% smokers, 37.5% diabetics and 67.2% were sedentary. In both cases the disease that motivated the hospitalization was ACS (Pena et al., 2009).

Thus, the most effective way to reduce the impact of CVDs, at the population level, is the development of prevention actions and treatment of their related factors. The multidisciplinary team should know the risk factors involved in triggering acute coronary syndromes more present in its area of action.

Regarding the initial treatment of ACS, a study conducted in 2005 with 3,600 patients verified the low use of the main medications in the studied population, both on arrival at the hospital and on discharge. At admission, the use occurred in only 26.2% of patients, beta-blockers in 14%, statins at 9% and angiotensin-converting enzyme inhibitors at 29.9%, while the combined use of aspirin, beta-blockers and statins were recorded in only 4.5% of patients (Santos et al., 2006).

The initial treatment performed in 50 patients (32%) was venous thrombolysis, and ten of them (20%), without recanalization criteria, were referred for rescue angioplasty. Forty-one patients (26%) underwent primary angioplasty, and in about 40% of them the procedures were performed with a balloon door time of less than 90 minutes. The majority of patients (42%) were maintained

in clinical treatment, although they arrived at the emergency room in time to perform some type of reperfusion (Santos et al., 2006).

Regarding the therapeutic combination between and the power of currently recommended therapies such as thrombolysis, antiplatelet agents, beta-blockers, angiotensin-converting enzyme inhibitors and angioplasty in the number of lives saved, it is not clear (Baena et al., 2012).

Another study carried out by Takiuti et al (2007) with 611 randomized patients showed that 483 patients were monitored for quality of life evaluations and demographic profile questionnaire. These patients formed the following therapeutic groups: coronary artery bypass grafting 161 patients (33.3%), percutaneous coronary angioplasty 166 patients (34.3%) and medical treatment 153 patients (32.4%) being monitored periodically. In the study it was possible to verify that the patients of the three therapeutic options were similar when related to clinical conditions, angiography, use of medications, laboratory tests, among others. Of the patients in follow-up, 86% presented, at the admission of the study, angina symptoms class II or III; 34% reported the occurrence of previous myocardial infarction; 32% were smokers.

All patients received specific medications for cardiac involvement and other comorbidities. Regarding the clinical treatment after four years of follow-up, of the 153 patients referred for clinical treatment, 12 (7.7%) were victims of acute myocardial infarction, 24 (15.3%) were submitted to coronary artery bypass grafting surgery and 19 (12.1%) died. In addition, five patients (3.1%) suffered an episode of stroke and 40 (25.6%) reported symptoms of angina pectoris (Takiuti et al, 2007).

In both studies it was noticed that the treatment related to AMI is varied and dependent on the clinical situation and diagnosis of the affected patient. The abandonment of practices considered as risk factors are relevant with regard to the ease and effectiveness of the proposed treatment, reducing mortality. With regard to the infarctomy/aneurysm procedure associated or not with coronary artery bypass grafting, little evidence was found on the subject.

Although CVD have several risk factors for their involvement, there are not many studies that address the theme, from the perspective of male and female genders, their spatial distribution and their interactions with stressors, socioeconomic and environmental factors.

## CONCLUSION

The present study showed a higher prevalence of cases of CVD/ACS/AMI in male patients. However, the number of cases of heart disease described in the literature in female patients also draws the attention of professionals and authorities in the area of health.

The results also suggest the importance of controlling

and preventing risk factors associated with CVD, such as hypertension, smoking, diabetes mellitus, obesity, dyslipidemia, among others.

Due to the scarcity of high level studies of evidence that evaluate the risk factors, which characterizes a limitation of this study, we suggest new studies with more representative samples. However, the results, although limited, already reveal the need to seek planning of interventions to promote the health of the population, aimed at the prevention of risk factors, aiming at the prevention of heart disease, thus ensuring greater survival and mortality reduction.

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