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Gender, socioeconomic position, revascularization procedures and mortality in patients presenting with STEMI and NSTEMI in the era of primary PCI. Differences or inequities?

Roberto Gnavi [a,*], Raffaella Rusciani [a], Marco Dalmasso [a], Massimo Giammaria [b], Monica Anselmino [c], Daniela Paola Roggeri [d], Alessandro Roggeri [a]

[a] Epidemiology Unit, Regione Piemonte, Grugliasco (TO) ASL TO3, Italy
[b] Cardiology Department, Maria Vittoria Hospital, Torino ASL TO2, Italy
[c] Cardiology Department, San Giovanni Bosco Hospital, Torino ASL TO2, Italy
[d] ProCure Solutions sas, Bergamo, Italy

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ABSTRACT

Background: Several studies have reported gender and socioeconomic differences in the use of revascularization procedures in patients with acute myocardial infarction. However, it is not clear whether these differences influence patients' survival. Moreover, most of the studies neither considered STEMI and NSTEMI separately, nor included primary PCI, which nowadays is the treatment of choice in case of AMI. In an unselected population of patients admitted to hospital with a first episode of STEMI and NSTEMI we examined gender and socioeconomic differences in the use of cardiac invasive procedures and in one-year mortality.
Methods: Subjects hospitalized with a first episode of STEMI (n = 3506) or NSTEMI (n = 2286) were selected from the Piedmont (Italy) hospital discharge database. We considered the percentage of patients undergoing PCI, primary PCI and CABG, and in-hospital mortality. Out of hospital mortality was calculated through record linkage with the regional register. The relation between outcomes and gender or educational level was investigated using appropriate multivariate regression models adjusting for available confounders.
Results: After adjustment for age, comorbidity and hospital characteristics, women and low educated patients had a lower probability of undergoing revascularization procedures. However, neither in-hospital, nor 30-day, nor 1-year mortality showed gender or social disparities.
Conclusions: Despite gender and socioeconomic differences in the use of revascularization, no differences emerged in in-hospital and 1-year mortality. These findings could suggest that patients are differently, but equitably, treated; differences are more likely due to an inability to fully adjust for clinical conditions rather than to a selection process at admission.

1 . Introduction

Socioeconomic and gender disparities in the use of invasive cardiac procedures among acute myocardial infarction (AMI) patients have been reported in most countries, both with private [1–3] and universalistic health care systems [4–9]. These differences are often attributed to less opportunities to access effective treatments and, therefore, to a form of discrimination. However, it is neither fully clear whether lower socioeconomic position is a status which delays access to treatment or there is overuse by socially more advantaged patients [4,5], nor whether differences in treatment imply differences in outcomes [10]. Many studies have highlighted how 1-year mortality after an episode of AMI is higher in subjects from lower socioeconomic positions [4,8,9,11,12], but only a few have investigated whether socioeconomic differences in the use of revascularization procedures influence mortality after a first episode of AMI [4,11,13]. Moreover, most studies were conducted in the nineties or in the early 2000s, when fibrinolysis — not primary PCI (pPCI) — represented the most widely used reperfusion therapy [14], and STEMI and NSTEMI were considered together as AMI.

In recent years the number of patients undergoing coronary revascularization has increased significantly, thanks to frequent use of PCI and to the diffusion of drug eluting stents which has enabled intervention in ever more complex cases; furthermore pPCI has become the treatment of choice in the acute stages of the disease, while the use of coronary artery bypass graft (CABG) surgery has progressively reduced [15]. Increased availability of procedures also seems to reduce gender and socioeconomic differences in access [16,17].

* Corresponding author at: ASL TO3, Servizio di Epidemiologia, Via Sabaudia 164, 10095, Grugliasco (TO), Italy. Tel.: +39 01140188208.
E-mail address: roberto.gnavi@epi.piemonte.it (R. Gnavi).

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In Piedmont, as well as in Italy, a great increase in invasive coronary procedures was recorded [18], but it is not known if there are offered on an equal basis to those who need it. A first study relating to the years 1993–1994 did not show any difference in the use of coronarography or revascularization in AMI patients [19]; in contrast, still in the mid-1990s, a study carried out in Rome highlighted socioeconomic differences in access to CABG surgery [20]. Again in Rome, in the period 1998–2000, the probability of receiving PCI after a first episode of AMI was negatively correlated to area deprivation and educational level [21]. Nevertheless, despite the substantial increase in the use of angioplasty, especially primary, the existence of clear guidelines, and the diagnostic differentiation between STEMI and NSTEMI, no Italian study has recently assessed gender or socioeconomic differences in invasive coronary procedures and mortality. Italy, and Piedmont in particular, are characterized by low levels of ischemic heart disease mortality, as well as some of lowest socioeconomic inequalities in Europe [22,23]. This can partly be explained by the modest social differences in exposure to typical cardiovascular risk factor, however the role of access to therapies has been little explored [23].

The objective of this study was to evaluate whether socioeconomic and gender disparities exist in the use of revascularization for patients with first STEMI or NSTEMI, and whether these differences have an influence over mortality.

2. Methods and materials

2.1. Study population

As described elsewhere [24], the study was conducted in the Piedmont region (4,400,000 inhabitants in Northwest Italy, approximately 7.5% of the Italian population). Records of all patients discharged with a first AMI between January 1, 2008 and December 31, 2008 were retrieved from the Regional Database of Hospitalizations. In order to improve the homogeneity of the study population in terms of severity of the disease, we excluded patients with a previous Coronary Syndrome, or a previous AMI, patients hospitalized for malignancies in the 24 months preceding, or in the 12 months following the index event of AMI, patients with index hospitalization outside Piedmont, or living outside Piedmont. In order to appropriately include patients transferred from an hospital to another to undergo revascularization procedures, we defined the episode of hospitalization as the concatenation of different admissions, where the distance between the discharge date and the subsequent hospitalization was less than one day. This sequence is interrupted in case the patient was transferred to another structure for rehabilitation.

STEMI events were identified through the ICD9-CM codes: 410.1–410.6, 410.8, 410.9, while NSTEMI events were identified by the 410.7 code.

Educational level was retrieved from the discharge chart and classified into four categories: high (university/high school, i.e. ≥13 years of education), medium (middle school, up to 12 years of education), low (primary school/no formal education, i.e. ≤8 years of education) and missing.

Age was factorized in 10-year age bands from 51 to 80 years, and below 51 or more than 80.

Co-morbidities were summarized by the Charlson index [25] considering the diagnosis at discharge of the AMI event, and factorized in three classes (0, 1, 2 or more).

To account for characteristics of the hospitals we considered, for in-hospital outcomes, four classes of admitting ward (CCU, Cardiology, General Medicine, or other), and on-site availability of angiography facilities in the admitting hospital. For out-of-hospital outcomes (30-day, and 1-year mortality), we considered three classes of discharging ward (CCU, Cardiology, or other).

2.2 . Outcomes

Interventional procedures were identified on the basis of the IDC9-CM codes reported in the discharge chart, and classified as coronary angiography (codes: 88.55, 88.56 and 88.57), PCI (codes 36.01, 36.02, 36.05 and 36.06) and CABG (codes 36.1x and 36.2). As the hospital discharge chart only records the dates of hospital admission and of surgical procedures, but not their exact hour, patients were considered to have undergone pPCI if the procedure was done on the same day of the hospital admission. As a consequence, patients admitted late in the evening, and undergoing a revascularization after midnight, were not considered as pPCI.

Information on in-hospital mortality was retrieved from the hospital discharge database, while out of hospital mortality was retrieved by means of record linkage with the regional mortality register.

2.3 . Statistical analysis

Use of revascularization and mortality are presented as percentages. The relation between in-hospital outcomes and explicative variables was investigated using a logistic regression model and is presented as odds ratio (OR). The possible interactions among educational level, gender, age and cardiac procedures were tested by forcing the appropriate product terms in the multivariate models.

As for out-of-hospital mortality, patients were followed for 365 days after discharge. Information was available for all but five patients. The follow-up ended either at the date of death or end of follow-up. Days of follow-up were calculated as the difference between the date of discharge, and the appropriate date of interest. Poisson regression was used to estimate adjusted rate ratios (RR), and 95% confidence intervals were estimated. The models included all the variables described above and were fitted using PROC LOGISTIC and PROC PHREG by SAS System, version 9.2.

As the archives were linked together by a unique anonymous identifier that is encrypted to protect patients' privacy, ethical committee approval and informed consent were not required.

3 . Results

In the accrual period, 5792 individuals were hospitalized for a first AMI episode (60.5% STEMI, 39.5% NSTEMI). Tables 1 and 2 show their baseline characteristics.

Patients with STEMI were younger (mean age 68.9 for STEMI and 70.7 for NSTEMI), had less comorbidities (Charlson index ≥ 2, 27.8% and 29.2% respectively), and had higher educational levels (low educational level 46.9% and 51.2% respectively). More than 80% of patients with STEMI and 74% with NSTEMI were first admitted in a CCU. Revascularization procedures were more frequent among STEMI patients, and in those first admitted in a hospital with on-site angiography facilities; on the other hand, CABG was more frequently performed among NSTEMI patients and in those admitted in a hospital without an angiography facility on-site. pPCI was performed in 40.4% of STEMI patients (47.4% in those first admitted in a CCU), and 6.7% of NSTEMI; if a wider definition of pPCI was used (i.e. PCI performed within 1 day from hospital admission) percentages would increase to 45.9 and 18.9 respectively. In-hospital mortality showed the steepest differences, being 11% for STEMI and 4.3% for NSTEMI, reflecting the different clinical characteristics of the two diseases.

Table 3 reports the results of the multivariate logistic models for in-hospital outcomes.

There were clear differences in favor of men and more educated patients for angiography, PCI and pPCI. The likelihood of undergoing a cardiac procedure decreased, and in-hospital mortality increased, with increasing age and number of comorbidities. Admission to CCU and to a hospital with an angiography facility on-site were strongly associated with invasive cardiac procedures. These results were similar for both STEMI and NSTEMI patients even if the socioeconomic gradient was less steep among NSTEMI. CABG was more strongly associated to younger age, higher comorbidity and no angiography facility on-site. Despite these gender and socioeconomic differences in accessing interventional procedures, neither gender, nor educational level was associated with in-hospital mortality. None of the interactions among educational level, gender and age was statistically significant (p-value > 0.05), with the only exception being, for NSTEMI, an effect modification of gender, educational level and PCI (p-value = 0.0241).

Table 4 shows crude mortality rates and adjusted rate ratios 30 days and 1 year after discharge.

Thirty-day mortality was 2.47% for STEMI, and 1.87% for NSTEMI, and one-year mortality was 8.05% and 8.23% respectively. Women and less educated STEMI patients were at higher risk of dying within the first year after discharge: 1-year mortality risk was 13.8% for women compared to 5.3% in men and 12.3% for low compared to 3.8% for high educated patients. NSTEMI mortality risks didn't differ substantially. However, neither gender nor educational level was associated with unfavorable outcomes after adjustment for main confounders.

4 . Discussion

Although prior studies have identified gender and socioeconomic differences in the use of revascularization procedures in patients with AMI, little data are available on the use of pPCI, PCI, and on 1-year