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# Epidemiology of Acute Cardiovascular and Cerebrovascular Events in the Lombardy Region: A Population-Based Study (2015–2021)

*Torrigiani Ginevra*[1,2], *Baviera Marta*[2], *Zambon Antonella*[1]

*(1) Laboratory of Quantitative methods for Life, Health and Society (QmLHS-Lab), Department of Statistics and Quantitative Methods, University of Milano-Bicocca, Milan, Italy*
*(2) Laboratory of Cardiovascular Prevention, Department of Health Policy, Istituto di Ricerche Farmacologiche Mario Negri IRCCS, Milan, Italy*

CORRESPONDING AUTHOR: *Torrigiani Ginevra, ginevra.torrigiani@unimib.it*

## INTRODUCTION

Cardiovascular and cerebrovascular diseases represent one of the leading causes of morbidity and mortality in Italy [1]. Acute events such as myocardial infarction and ischemic stroke have a significant clinical, economic, and social impact. Each year, approximately 150,000 new cases of myocardial infarction and 200,000 strokes are registered in Italy, with a substantial healthcare burden especially among the elderly [2,3]. In Lombardy, in 2020, diseases of the circulatory system were the leading cause of death, accounting for about 34,000 deaths, corresponding to 25% of the total [4].

Despite advances in prevention and treatment strategies, territorial and sociodemographic disparities in the distribution of events persist [5]. Temporal and spatial analysis of acute event incidence, particularly at the sub-regional level, represents an essential tool to guide healthcare planning and to evaluate the effectiveness of public health policies.

The analysis of acute event incidence is therefore a key instrument to monitor the effectiveness of prevention strategies and healthcare responses. Observing trends over an extended time frame allows detection of significant trends and potential inequalities in access to care or in the distribution of risk factors [6].

## OBJECTIVE

This study aims to describe the epidemiology of acute cardiovascular and cerebrovascular events in the Lombardy Region between 2015 and 2021, analysing temporal trends and differences by sex, age, and Local Health Protection Agencies (ATS). Additionally, it seeks to assess the presence of significant differences between ATS in terms of in-hospital mortality for these events.

## METHODS

The study population includes all residents of Lombardy aged ≥45 years who were hospitalized for an acute cardiovascular or cerebrovascular event between 2015 and 2021.

To identify incident events, new cases were selected for each year by excluding individuals who had experienced the same type of event in the five years prior to the hospitalization date.

Events were identified using regional administrative healthcare databases, specifically hospital discharge records (SDO), based on selected ICD-9-CM codes for myocardial infarction, unstable angina, acute heart failure, ischemic and haemorrhagic stroke, and transient ischemic attack.

Annual incidence was estimated by calculating crude rates, stratified by sex and age group, using person-time denominators.

Temporal trends were analysed using Poisson regression models to estimate the annual rate variation and assess its statistical significance.

To compare geographic differences, age- and sex-standardized incidence rates were calculated for each ATS through direct standardization, using the Lombardy population as the standard.

Results are presented as rates per 100,000 population with 95% confidence intervals (CIs).

To explore geographic heterogeneity in in-hospital mortality for the studied acute events, a multilevel logistic regression model was implemented, adjusted for age, sex, and comorbidities. Subsequently, a fixed-effects model was used to assess whether there were statistically significant differences in in-hospital mortality across the different ATS.

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## RESULTS

A total of 260,725 residents of Lombardy aged ≥45 years who experienced an acute cardiovascular or cerebrovascular event were included. Of these, 42.5% were female, and the overall median age was 76 years (IQR: 65–83).

The average annual rate was higher in men than in women across all age groups. In the ≥75 age group, the rate was 2,162 per 100,000 population (95% CI: 2,138–2,187) in men and 1,236 per 100,000 (95% CI: 1,222–1,231) in women (p<.001). Marked differences (p<.001) were also observed in the 45–59 age group: 293 per 100,000 (95% CI: 289–297) in men vs. 167 (95% CI: 165–170) in women.

Age and sex standardized incidence rates varied across ATS from a minimum of 622 per 100,000 population (95% CI: 600–663) to a maximum of 771 (95% CI: 739–783), highlighting geographic differences.

Finally, the multilevel logistic model showed a random-effect variance between ATS of 0.007, indicating limited geographic heterogeneity in in-hospital mortality. However, based on the fixed-effects model, only one ATS showed a significantly lower in-hospital mortality probability compared to the others.CONCLUSIONS

The study showed a significant temporal reduction in the incidence of acute cardiovascular and cerebrovascular events in Lombardy between 2015 and 2021, with higher rates in men and older age groups. Although substantial territorial variability in in-hospital mortality at the ATS level was not observed, some localized differences point to the need for targeted investigations and interventions to address potential territorial health inequalities.

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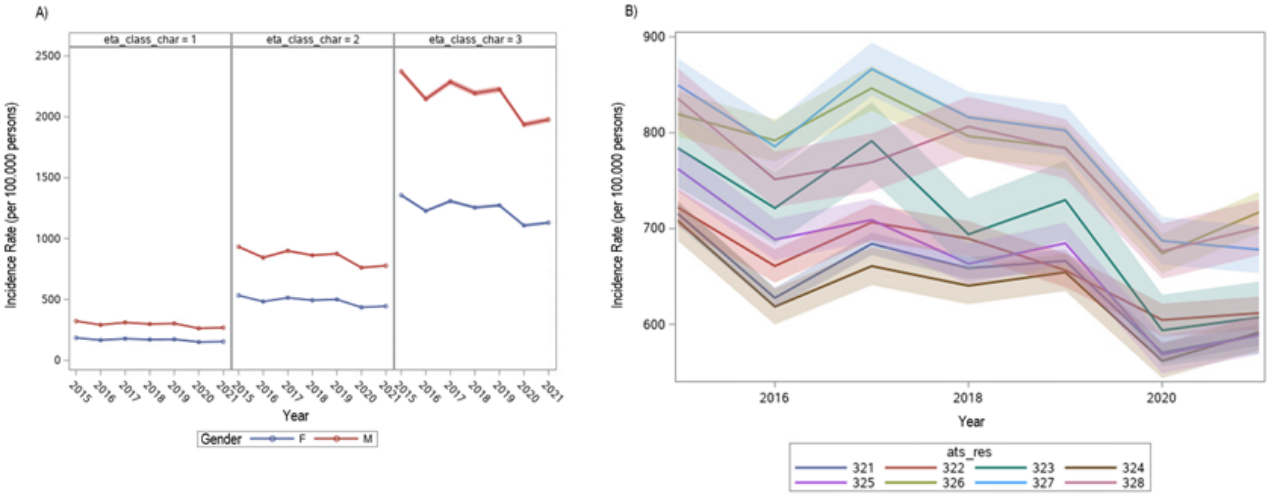
Figure 1. A) Temporal trend of incidence rates stratified by sex and age group (per 100,000 population); B) Temporal trend of incidence rates by Health Protection Agency (ATS), standardized by sex and age (per 100,000 population).

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