

# BMJ Open Hospital readmissions and mortality following discharge against medical advice: a five-year retrospective, population-based cohort study in Veneto region, Northeast Italy

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## ABSTRACT

**Objectives** The aim of this study was to examine the odds of readmission and mortality after discharge against medical advice (DAMA) in the Veneto region of Northeast Italy, drawing on data from the regional archives of emergency department records and hospital discharge records.

**Design** A retrospective cohort study.

**Setting** Hospital discharges, Veneto region, Italy.

**Participants** All patients discharged after being admitted to a public or accredited private hospital between January 2016 and 31 January 2021 in the Veneto region were considered. A total of 3 574 124 index discharges were examined for inclusion in the analysis.

**Primary and secondary outcome measures** Readmission and overall mortality at 30 days after the index discharge against admission.

**Results** In our cohort, 7.6‰ of patients left hospital against their doctor's advice (n=19 272). These DAMA patients were more likely to be younger (mean age: 45.5 vs 55.0), foreign (22.1% vs 9.1%). The adjusted odds of readmission after DAMA was 2.76 (CI 95% 2.62–2.90) at 30 days (9.5% DAMA vs 4.6% not-DAMA), and the highest readmission rate was recorded in the first 24 hours after the index discharge. Mortality was higher for DAMA patients after adjusting for patient-level and hospital-level characteristics (with adjusted ORs of 1.40 for in-hospital mortality and 1.48 for overall mortality).

**Conclusions** The present study shows that DAMA patients are more likely to die and to need hospital readmission than patients discharged by their doctors. DAMA patients should be more committed to a proactive and diligent postdischarge care.

## INTRODUCTION

When patients decide to leave hospital before their treating physician advises them to do so, this is called a discharge against medical advice (DAMA).<sup>1 2</sup> The prevalence of DAMA in the USA is in the range of 1%–2% for inpatient hospitalisations and 1%–20% for admissions to emergency departments.<sup>2–4</sup>

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study showed that discharge against medical advice (DAMA) patients, after adjustment for patient-level and hospital-level characteristics, were characterised by higher odds of readmission and overall mortality within 30 days of index discharge.
- ⇒ The study evaluated the outcomes of a large unrestricted and unselected cohort of discharged patients, reducing the risk of selection bias.
- ⇒ The study evaluated as readmission any hospitalisation initiated within 30 days of an index discharge, using temporality as a proxy for relatedness with index discharge.
- ⇒ Out-of-hospital mortality may have been underestimated due to some deaths overlooked because they were recorded outside our region. The previous stated differential misclassification error towards underestimation could have shifted our results towards the null hypothesis because the probability of DAMA was higher for patients living outside the region; however, in contrast, the analysis found excess mortality among DAMA patients.

DAMA is a major concern for physicians and healthcare systems, as the disruption to patient care can lead to both disproportionate resource consumption and suboptimal patient health management.<sup>5 6</sup> DAMA patients face a higher risk of morbidity, such as asthma exacerbations, reinfarctions and adverse pregnancy outcomes for mother and fetus.<sup>5 6</sup> Moreover, a number of studies have shown that readmission rates at 30 days after DAMA are 40%–100% higher than for patients who complete their treatment and up to four times higher for admissions relating to particular conditions like asthma.<sup>1–3 7</sup> As a result, DAMA is associated with an increase in healthcare expenditure. The data indicate a 56% rise in costs in the event of readmissions

after DAMA; raw estimates of additional costs for 2014 range from \$8.6 million per year in Australia to \$822 million in the USA.<sup>2,3,8</sup>

By contrast, the association of DAMA with a higher risk of premature death is still debated, as the scientific literature reports small increases in mortality rates or inconclusive results.<sup>2,3,5,7</sup> In two previous studies—one on patients discharged from 129 American Veterans Health Administration hospitals over the years 2004–2008 and another on a subpopulation of patients from an urban hospital in Canada—the authors found statistically significant increases in the risk of death for DAMA patients, with an adjusted HR of 1.11 at 12 months.<sup>5,9</sup> Conversely, a recent study conducted by Tan and colleagues in the USA showed a 20% lower risk of in-hospital mortality for DAMA patients than for all other patients.<sup>3</sup> The authors of the latter research made the point that their finding could be influenced by the study design, which did not capture deaths occurring outside the hospital. Finally, in an older, moderately sized, prospective study conducted by Hwang *et al* in Canada, the results failed to demonstrate any association between DAMA and mortality.<sup>7,10</sup> The previous studies, investigating clinical outcomes of DAMA patients, however mainly involved single-centre studies or focussed on a specific patient population (eg, Veterans Health Administration patients) and were generally conducted in countries other than European countries. In this study, we further investigate the odds of readmission and mortality after DAMA using data extracted from a large, unselected, routinely collected regional archive of emergency department records and hospital discharge records (HDRs) from the Veneto region of Northeast Italy. The goal of this research is to report on the health-related outcomes of DAMA patients, in order to provide useful information for the development of strategies to improve management and reduce the adverse outcomes of DAMA.

## METHODS

### Context

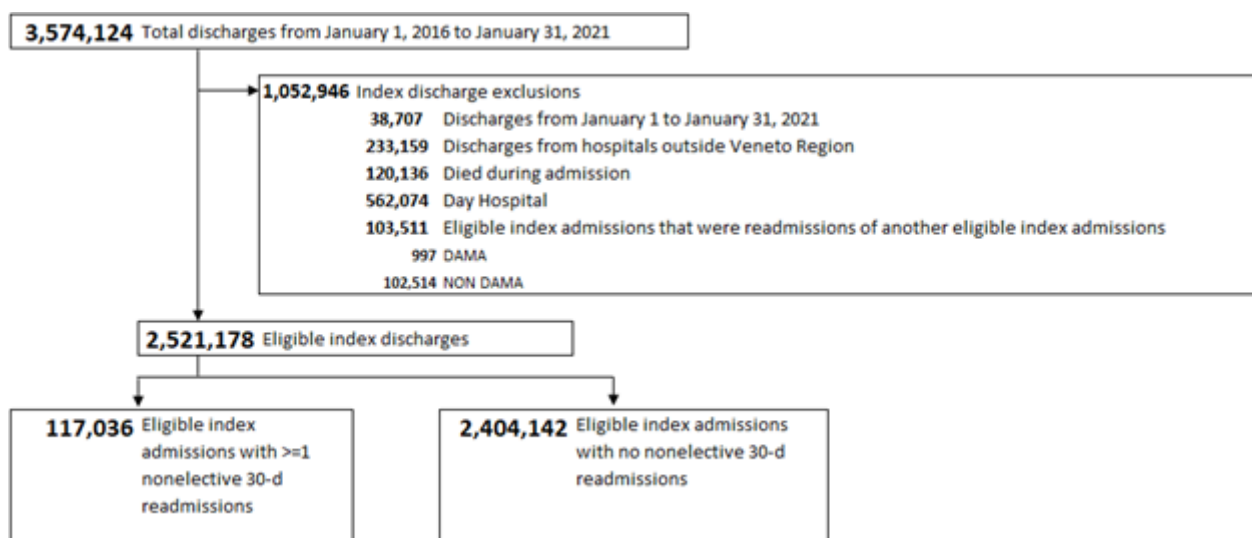
In Veneto region, healthcare services are provided by nine local social and healthcare units, two university hospitals, one highly specialised health research centre hospital and several certified private clinics, based on a hub-and-spoke organisational model. There are two levels of hospital services: hub hospitals in the province, which offer both basic and mid-level specialties for the territory of reference, as well as high-level specialties for a wider territory; and a spoke network of hospital facilities which should offer only basic services, that is, an emergency department and basic specialties of medium complexity specialties, providing diagnostic and care services for the territory of reference.

### Study design

This is a retrospective population-based study conducted on a population of approximately 4.9 million residents in the Veneto region. Eligible index admissions were identified as detailed in figure 1. All patients in the Veneto region discharged after being admitted to a public or accredited private hospital between 1 January 2016 and 31 January 2021 were considered. Discharges occurring in the month of January 2021 were included not as index records but to follow-up our study cohort for 1 month. Day hospital admissions and discharges regarding patients who died in hospital were excluded.

We defined as non-elective any ordinary admission preceded by an emergency room visit in the 24 hours beforehand. Non-elective admissions for any diagnosis occurring within 30 days after the index discharge were considered as readmissions and treated as an outcome, not as a separate index case, whereas any subsequent admission more than 30 days after the initial index admission was counted as separate index cases.

Index admissions associated with a death within 30 days were identified from the population registry for overall



**Figure 1** Flowchart of how eligible index discharges were selected.

mortality. Using the HDR database, a specific analysis was also run on intrahospital mortality of patients readmitted after a previous DAMA.

The HDR database contains patients' sociodemographic data (sex, age, address and city of birth), clinical information and details relating to their hospital stay, such as the type of discharge (intrahospital transfer, discharge home or death), the ward, the dates of admission and discharge, primary and secondary diagnoses, surgical or medical procedures performed, and diagnosis-related groups (DRGs). The type of discharge was used to identify cases of DAMA. Diagnoses and procedures are coded using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) coding system currently used in Italy.

The population registry includes the date of death of residents in the Veneto region. Regional health records are routinely submitted to a standardised anonymisation process that assigns a unique anonymous code to each subject. This anonymous code allow linkage between different electronic health records without any possibility of back-retrieving the subject's identity. Linkage with this database was used to establish overall mortality at 30 days from the date of the index discharge.

Patients were grouped by sex, age, citizenship and residence. Clinical conditions were classified using DRGs, considering the 10 groups identified in the literature as most likely to be associated with DAMA, that is, psychiatric disorders (DRG 424–432), HIV-related conditions (488–490) and substance, drug and/or alcohol abuse or addiction (433 and 521–523). Other DRGs found associated with DAMA include: trauma (9, 27–33, 72, 83, 84, 235–237, 250–255, 280–282, 439–446, 454, 455 and 485–487), burns (505 and 507–511), poisoning (449–451), infectious diseases (21, 44, 67–71, 79–81, 89–91, 126, 238, 242, 320–322, 417–423, 560, 561, 575, 576, 578 and 579), neoplastic diseases (10, 11, 64, 82, 146, 147, 172, 173, 199, 203, 239, 257–260, 274, 275, 303, 318, 319, 338, 344, 346, 347, 353–357, 363, 366, 367, 401–404, 406–414, 465, 473 and 492) and pregnancy, childbirth and puerperium (370–384).

The hospital-level factors considered were: the nature of the healthcare received by the patient (highly specialised university hospital, other highly specialised hospital and spoke hospital), the type of hospital (private or public), the type of admission (for surgical or medical treatment) and the level of urgency (emergency or scheduled hospitalisations).

### Statistical analysis

Univariate and bivariate analyses were performed to summarise the data regarding patients' demographics and the hospitals' characteristics. Continuous variables were analysed using descriptive statistics (mean, SD, median and IQR). Frequencies and percentages were calculated for categorical variables. Student's t-test was used to calculate the mean differences between groups. The differences in frequency distributions between the

groups were examined with Pearson's  $\chi^2$  or Fisher's exact test, as appropriate. A  $p < 0.05$  was considered statistically significant.

The OR of non-elective readmission and of 30-day intrahospital and overall mortality were estimated using logistic regression in both univariate and multivariate models, adjusting for patient-level and hospital-level characteristics (age, sex, citizenship, residence, healthcare received, type of hospital and level of urgency). Covariates were selected a priori, based on evidence in the literature, to indicate that they are associated with a predisposition to DAMA and/or outcomes of DAMA in order to control for potential co-founders.

All statistical analyses were conducted using SAS (Statistical Analysis System) software V.9.4 (SAS Institute, Cary, North Carolina, USA).

### Ethics

Data were treated with full confidentiality in accordance with Italian legislation, and no ethics committee's approval was needed. Before the database was made available to the authors, patient identifiers were replaced with anonymous codes. It was unnecessary to obtain patients' informed consent, given the anonymous nature of the data and its mandatory recording (anonymised data may be analysed and used in aggregate form for scientific studies without further authorisation). In fact, the data analysis was performed on anonymised aggregate data with no chance of individuals being identifiable. The study complied with the Declaration of Helsinki and with the recent Resolution No. 146 of 2019 of the Italian Guarantor for the Protection of Personal Data which also confirmed the allowability of processing personal data for medical, biomedical and epidemiological research and that data concerning health status may be used in aggregate form in scientific studies. To ensure confidentiality and anonymity, Veneto region removes all direct identifiers (eg, identifier health code number) and substitutes the identifier number in all datasets with a code, nonetheless permitting the linkage of different administrative database. Formal consent is not required for this type of study.

### Patient and public involvement

There was no patient or public involvement in the study.

## RESULTS

There were 2 521 178 eligible index discharges in the Veneto region during the period considered (2016–2020; [table 1](#)), with 7.6% episodes of DAMA ( $n=19\ 272$ ). The DAMA patients were more likely to be female (55.4% vs 52.7%), tended to be younger (mean age:  $45.5 \pm 22.0$  vs  $55.0 \pm 26.7$ ). The proportion of patients of foreign citizenship was also higher among cases of DAMA (22.1% vs 9.1%), with a DAMA rate of 25.2% among patients from other European countries.

**Table 1** Sample characteristics by DAMA group

Patients' characteristics, n (%)	DAMA (n=19,272)	Non-DAMA (n=2,501,906)	Total (n=2,521,178)	DAMA rate ‰	p Value
<b>Sex</b>					
Female	10,682 (55.43%)	1,318,345 (52.69%)	1,329,027 (52.71%)	8.0	<0.0001
Male	8,590 (44.57%)	1,183,561 (47.31%)	1,192,151 (47.29%)	7.2	
<b>Age, years, means (SD)</b>					
00	396 (2.05%)	195,372 (7.81%)	195,768 (7.76%)	2.0	<0.0001
01–05	293 (1.52%)	37,965 (1.52%)	38,258 (1.52%)	7.7	
06–14	310 (1.61%)	53,787 (2.15%)	54,097 (2.15%)	5.7	
15–24	2,146 (11.14%)	92,002 (3.68%)	94,148 (3.73%)	22.8	
25–44	7,254 (37.64%)	406,830 (16.26%)	414,084 (16.42%)	17.5	
45–64	4,391 (22.78%)	559,409 (22.36%)	563,800 (22.36%)	7.8	
65–74	2,003 (10.39%)	439,060 (17.55%)	441,063 (17.49%)	4.5	
75–84	1,649 (8.56%)	468,198 (18.71%)	469,847 (18.64%)	3.5	
85+	830 (4.31%)	249,276 (9.96%)	250,106 (9.92%)	3.3	
Missing	0 (-%)	7 (-%)	7 (-%)		
<b>Citizenship</b>					
Italy	15,011 (77.89%)	2,274,758 (90.92%)	2,289,769 (90.82%)	6.6	<0.0001
European Union	1,545 (8.02%)	59,750 (2.39%)	61,295 (2.43%)	25.2	
Elsewhere	2,716 (14.09%)	167,398 (6.69%)	170,114 (6.75%)	16.0	

DAMA, discharge against medical advice.

### Readmission rates

The overall 30-day all-cause readmission rate across all index discharges was 4.6% (table 2). The percentage of readmissions for DAMA patients was 9.5% versus 4.6% for patients discharged by their doctors, corresponding to an unadjusted OR of 2.19 (95% CI: 2.08–2.30; Table 3). Even after adjusting for patient-level and hospital-level characteristics, DAMA remained associated with higher odds of 30-day readmission (adjusted OR (aOR): 2.76; 95% CI: 2.62–2.90) compared with discharges arranged by doctors.

The timing of readmissions also differed in that DAMA patients were more likely to be readmitted shortly after their

index discharge (figure 2). The rate of readmissions within the first 24 hours after the index discharge was 21.0‰ for DAMA patients. In the latter group, this rate remained stable in the first week and then slowly decreased, while for the DAMA group, it dropped rapidly after the first 4 days.

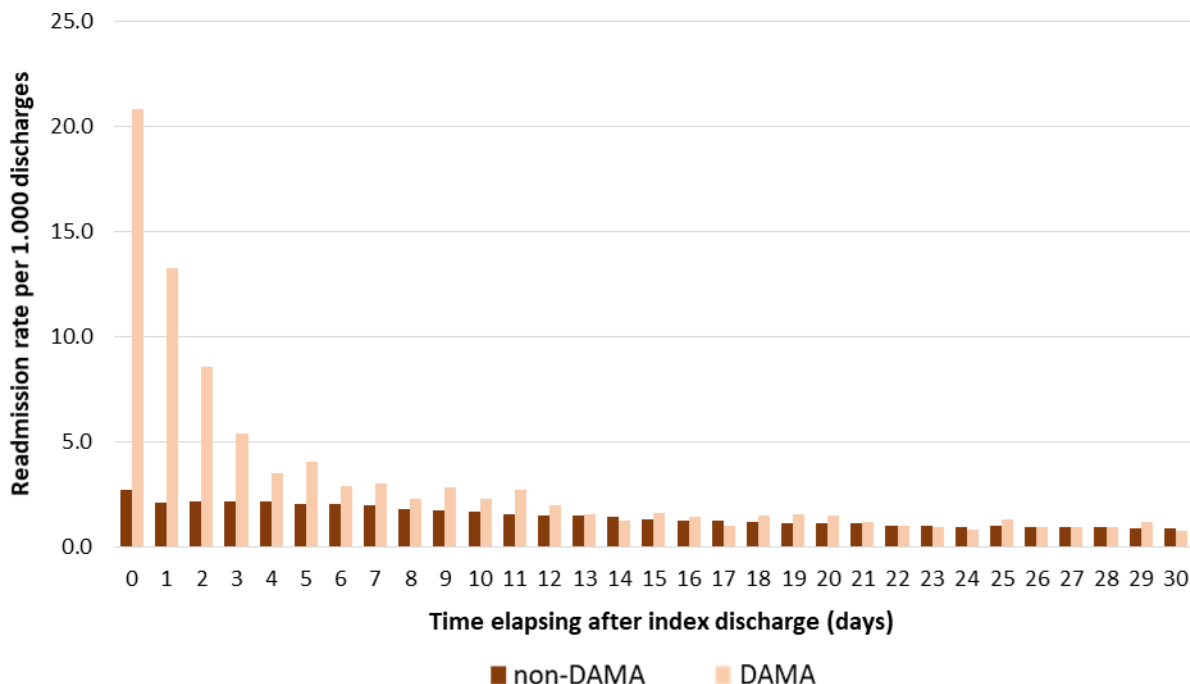
Patients discharged against medical advice were most frequently readmitted to the hospital with a diagnostic code that matched the discharge code (table 4). In particular, 67.5% of DAMA patients were readmitted with the same major diagnostic category code as discharge, compared with 43% of non-DAMA patients, and 24.1% of DAMA patients were readmitted with coincident DRGs code, compared with 16.2% of non-DAMA patients.

**Table 2** Thirty-day readmission rate and mortality rate, by group (DAMA vs non-DAMA)

Patient outcome	DAMA (n=19,272)	Non-DAMA (n=2,501,906)	Total (n=2,521,178)	p Value
<b>30-day all-cause readmissions, n (%)</b>				
Yes	1,839 (9.5%)	115,197 (4.6%)	117,036 (4.6%)	<0.0001
No	17,433 (90.5%)	2,386,709 (95.4%)	2,404,142 (95.4%)	
<b>30-day in-hospital mortality, n (%)</b>				
Yes	152 (0.8%)	23,937 (1.0%)	24,089 (1.0%)	0.0169
No	19,120 (99.2%)	2,477,969 (99%)	2,497,089 (99%)	
<b>30-day overall mortality, n (%)</b>				
Yes	349 (1.8%)	54,699 (2.2%)	55,048 (2.2%)	0.0004
No	18,923 (98.2%)	2,447,207 (97.8%)	2,466,130 (97.8%)	

DAMA, discharge against medical advice.





**Figure 2** Readmission rates by timing of readmissions (during the 30 days after discharge) for DAMA versus non-DAMA patients.

### In-hospital and overall mortality rates

On univariate analysis, the 30-day in-hospital mortality rates were lower for DAMA patients (OR: 0.82; 95% CI: 0.70–0.97). After adjusting for the characteristics of patients and hospitals, however, the odds of dying in hospital within 30 days became higher for DAMA patients (aOR: 1.40; 95% CI: 1.19–1.65; [table 3](#)).

Similar results emerged for overall mortality rates: univariate analysis indicated a smaller OR for DAMA patients (OR: 0.83; 95% CI: 0.74–0.92), but after adjusting for other covariates, it became higher for DAMA than for other patients (aOR: 1.48; 95% CI: 1.33–1.66).

### DISCUSSION

The present study found that DAMA patients faced greater chances of being readmitted to hospital and higher mortality rates than patients leaving the hospital in accordance with their doctors' recommendations.

The 7.6‰ rate of DAMA found in this study is only slightly higher than the 6‰ previously reported by Saia *et al.*<sup>11</sup> and in line with a publication by Hasan and colleagues regarding a hospital in Pakistan,<sup>12</sup> but it appears to be lower than the rates reported in most of the American-based scientific literature.<sup>3–5 7</sup> The reasons behind these results are not yet known but may have to do with differences in study design. For instance, most American studies did not include patients under 18 years old, and the type of healthcare system makes Italian patients less likely to worry about the costs of their hospital stay due to the universal coverage ensured by the Italian health system.<sup>11</sup> The choice to include the entire population, including minors, in the study is useful in highlighting that people under the age of 14 tend to be less interested in the issue of DAMA. In fact, DAMA rates for patients under the age of 14 are similar to those observed for the over-65 population and substantially lower than those found for the

**Table 4** Distribution of 30-day readmissions by diagnostic code coincidence between index admission and readmission

Diagnostic code coincidence	DAMA (n=1,839)	Non-DAMA (n=115,197)	Total (n=117,036)	p Value
MDC code coincidence, n (%)				
Yes	1,241 (67.5%)	49,502 (43.0%)	50,743 (43.4%)	<0.0001
No	598 (32.5%)	65,695 (57.0%)	66,293 (56.6%)	
DRG code coincidence, n (%)				
Yes	444 (24.1%)	18,637 (16.2%)	19,081 (16.3%)	<0.0001
No	1,395 (75.9%)	96,560 (83.8%)	97,955 (83.7%)	

DAMA, discharge against medical advice; DRG, diagnosis-related group; MDC, major diagnostic category.

**Table 3** Univariate and multivariate logistic regression analysis of 30-day readmission and mortality rates

Index discharge disposition status	OR (95% CI)					
	30-day readmission rate		30-day in-hospital mortality rate		30-day mortality rate	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Non-DAMA	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
DAMA	2.19 (2.08–2.30)	2.76 (2.62–2.90)	0.82 (0.70–0.97)	1.40 (1.19–1.65)	0.83 (0.74–0.92)	1.48 (1.33–1.66)

Adjusted for age, sex, citizenship, place of residence, disease category, type of hospital and type of admission (for surgical or clinical care and urgent or not urgent).  
DAMA, discharge against medical advice.

15–64 age groups. However, it is worth noting that people in these age groups may not be completely independent, and therefore, this outcome may be the consequence of a set of complex factors that determine the balance between the beliefs of the proxies (eg, parents or guardians), the needs and struggles of the family, and the preferences of the patient.<sup>13–16</sup> When we considered the other characteristics of our DAMA patients, they were more likely to be foreign or to live some distance away from the hospital. Hoyer and colleagues noted in a German study that coming from abroad was a positive prognostic factor for DAMA, while living within the country but far away from the hospital was not.<sup>17</sup> In our sample, DAMA was more likely for patients living within the European Union (25.2%) than for those coming from further away (16.0%), possibly suggesting that the desire in returning to a distant home can affect the willingness to leave the hospital against medical advice.

### Readmission rates

As expected, readmission rates in our study were higher for DAMA patients than for patients discharged by their doctors (9.5% vs 4.6%). The aOR of 2.76 resulting from our study (95% CI: 2.62–2.90) is higher than the 1.35 obtained by Glasgow and colleagues in their large 5-year study on the American Veterans Health Administration hospitals (95% CI: 1.32–1.39) and lower than the 9.5 (95% CI: 3.3–27.4) reported in a Canadian publication by Choi *et al* on two matched cohorts of 328 patients.<sup>5,9</sup> The lack of large, population-based, epidemiological studies on DAMA makes it difficult to draw conclusion on these data, though factors like the cultural context (such as patients' beliefs) and the type of health service (such as funding issues) presumably play a role in giving rise to different results in different countries.

Our study also examined the time elapsing before patients were readmitted, showing that the odds of DAMA patients being readmitted were considerably higher in the first few days. Two previous studies confirm this finding, reporting a higher probability of readmission in the first 2 weeks.<sup>9,10</sup> These studies concluded that the main reason for the higher readmission rates in the first few days was probably the negative health effect caused by leaving the hospital early rather than an effect caused by the worse clinical condition of DAMA patients;<sup>10</sup> in fact,

the readmission rates were similar among DAMA patients and controls after the first 15 days. After discharge, a planned follow-up also by hospital doctors (eg, via home health aide visits and telephone encounters) to manage residual clinical problems may help ensure continuity of care for this population.

### In-hospital and overall mortality rates

Few published studies have focussed on mortality after DAMA, with inconsistencies in their findings, most likely due to differences in study design, follow-up windows, variables for the analysis adjustment and criteria for defining cases of DAMA.<sup>2,3,5,7,9</sup> The present study, focusing on the mortality rate at 30 days, showed that DAMA patients were at substantially higher risk of death than patients discharged by their doctors (1.40 aOR, 95% CI: 1.19–1.65), even 30 days after leaving hospital. As in previous research by Tan *et al*, DAMA appeared to be a protective factor on univariate analysis, but the upshot changed after adjusting for age in the multivariate logistic regression model.

A previous study conducted a sample of psychiatric patients found that DAMA patients were more likely to commit suicide. This finding suggests that better postdischarge care could be valuable for DAMA patients, as some of them may be severely affected by the consequences of the condition that brought them to the hospital, and as DAMA patients more often present with psychiatric comorbidities that result in additional barriers in seeking, accessing and appropriately following up care.<sup>18</sup> More broadly speaking, these findings suggest that, in cases of DAMA, hospital personnel themselves should refer patients to general practitioners or take a proactive approach to patient care and closely monitor their health.

### Conclusion

Our work adds to a small number of studies focussing on DAMA in the general population. The results confirm once more that DAMA is a prognostic factor for higher mortality and morbidity rates. The present findings can be seen as a starting point for future research, with a view to providing policy makers with useful data to improve the quality of care and monitoring of DAMA patients in order to prevent any exacerbation of their condition or the occurrence of life-threatening emergencies.

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**Contributors** MS conceived the work and coordinated all study phases. VB and AB coordinated all study phases, read and approved the final manuscript as submitted. LS and SB carried out the statistical analyses, read and approved the final manuscript as submitted. MS coordinated and supervised data collection, revised and approved the final manuscript as submitted. AB and AM drafted the manuscript. MS, SC and TB revised the manuscript. MS is responsible for the overall content as guarantor.

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**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** Since all analyses were carried out on routinely collected anonymized records, the study was considered exempt from approval by the Local Ethics Committee.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request. The datasets analysed during the current study are not publicly available but are available from the author on reasonable request.

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