Title page

Emergency department admissions and economic costs burden related to *Ambulatory Care Sensitive Conditions* in older adults living in care homes

Admisiones en servicios de urgencias y costes económicos relacionados con *Ambulatory Care Sensitive Conditions* en adultos mayores que viven en centros residenciales

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Ethics approval and consent to participate

As this was an observational study in which clinical and administrative data were collected retrospectively, informed consent was not requested. All information obtained was anonymised and confidentiality of the data was guaranteed. All Research Ethics Committees of the collaborating centres approved the project according to their regulations.

Conflicts of interest

The authors declare that they have no competing interests

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Emergency department admissions and economic costs burden related to *Ambulatory Care Sensitive Conditions* in older adults living in care homes

Abstract

Objectives. To assess the frequency of emergency department admissions (EDA) for *ambulatory care sensitive conditions* (ACSC) and non-ACSC among older adults living in care homes (CH), to describe and compare their demographic and clinical characteristics, the outcomes of the hospitalisation process and the associated costs.

Method. This multicenter, retrospective and observational study evaluated 2,444 EDAs of older adults ≥ 65 years old living in care homes in 5 emergency departments in Catalonia (Spain) by ACSC and non-ACSC, in 2017. Sociodemographic variables, prior functional and cognitive status, and information on diagnosis and hospitalisation were collected. Additionally, the costs related with the EDAs were calculated, as well as a sensitivity analysis using different assumptions of decreased admissions due to ACSC.

Results. A total of 2,444 ED admissions were analysed. The patients' mean (SD) age was 85.9 (7.2) years. The frequency of ACSC-EDA and non-ACSC-EDA was 56.6% and 43.4%, respectively. Severe dependency and cognitive impairment were present in 56.6% and 78%, respectively, with no differences between the two groups. The three most frequent ACSC were falls/trauma (13.8%), chronic obstructive pulmonary disease/asthma (11.4%) and urinary tract infection (7.4%). The average cost per ACSC-EDA was €1,408.24. Assuming a 60% reduction of ACSC-EDA, the estimated cost savings would be €1.2 million.

Conclusions. Emergency admissions for ACSC from care homes have a significant impact on both frequency and costs. Reducing these conditions through targeted

interventions could redirect the avoided costs towards improving care support in residential settings.

Keywords: ambulatory care sensitive conditions, hospitalisation, care home, aged

Abbreviations. ACSC: Ambulatory care sensitive conditions; CH: Care homes; ED: Emergency department; EDA: Emergency department admissions; ACSC-EDA: Emergency department admissions by ACSC; EMR: Electronic medical record; CCI: Charlson Comorbidity Index score; MAT-SET: Andorran model of triage-Sistema Español de Triaje

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Resumen

Objetivos. Evaluar la frecuencia de admisiones en servicios de urgencias (ASU) por *ambulatory care sensitive conditions* (ACSC) y no-ACSC de personas que viven en residencias; describir y comparar sus características, y analizar los costes asociados.

Método. Este estudio multicéntrico, retrospectivo y observacional evaluó 2.444 ASU de personas ≥ 65 años que viven en residencias en 5 servicios de urgencias de Cataluña por ACSC y no-ACSC, en 2017. Se recogieron variables sociodemográficas, estado funcional y cognitivo, e información sobre diagnóstico y hospitalización. Se evaluaron los costes relacionados con ACSC-ASU y se efectuó un análisis de sensibilidad utilizando diferentes supuestos de disminución de ingresos por ACSC.

Resultados. La media de edad de la muestra del estudio fue de 85,9 (desviación estándar 7,2 años). La frecuencia de ACSC-ASU y no-ACSC-ASU fue del 56,6% y el 43,4%, respectivamente. El 56,6% y el 78% presentaban dependencia severa y deterioro cognitivo, respectivamente, sin observarse diferencias entre los dos grupos. Las tres ACSC más frecuentes fueron caídas/traumatismos (13,8%), enfermedad pulmonar obstructiva crónica/asma (11,4%) e infección urinaria (7,4%). El coste medio por ACSC-ASU fue de 1.408,24 €. Suponiendo una reducción del 60% de las ACSC-ASU, el ahorro de costes estimado sería de 1,2 millones de euros.

Conclusiones. Las admisiones en urgencias por ACSC procedentes de entornos residenciales suponen un impacto significativo tanto en la frecuencia como en los

costes. La disminución de estas patologías mediante la aplicación de intervenciones específicas podría redirigir los costes evitados hacia la mejora del apoyo asistencial en los entornos residenciales.

Palabras clave: ambulatory care sensitive conditions, hospitalización, residencia, ancianos

Background

Up to 60% of care home (CH) residents may experience an emergency department admission (EDA) each year [1], and a remarkable number of EDAs have been classified as potentially preventable or inappropriate. Furthermore, nearly 55% of EDAs among CH residents may be for *ambulatory care-sensitive conditions* (ACSC) [2], which have been defined as health conditions-diagnoses for which timely and effective ambulatory care could help to reduce the risk of hospitalisation, either by preventing the onset of an illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease [3].

Reducing avoidable admissions for ACSC has been a goal of policy makers, commissioners and service providers for many years, based not only on the provision of services in a resource-constrained healthcare system and the high avoidable costs, but also because of the harmful outcomes of hospitalisation in frail older people [4]. In fact, this population may suffer from advanced stage of disease, functional dependence or severe dementia [5] and, for them, hospitalisation may be more deleterious than beneficial [4] because of an increased risk of functional impairment [6], delirium [7], nosocomial infections [8] or mortality [2].

In Spain, a rate of up to 16.5% of ACSC-related hospitalisations has been documented in people over 65 years of age living in the community [9]. However, there is a lack of data on the frequency of ACSC among CH residents, their characteristics and the costs associated with hospitalisation for ACSC in this population. Evaluation of these aspects could be useful in the development of cost-effective interventions that lead to a reduction of potentially avoidable hospitalisations and an improvement in the quality of care in the residential setting.

Aim

The purposes of the study were threefold: 1) to assess the frequency of EDA due to ACSC and non-ACSC among older people living in CH; 2) to describe and compare their demographic and clinical characteristics, as well as the outcomes of the hospitalisation process in both groups, and 3) to analyse the costs related to the ACSC EDA as well as the potential cost-savings in the ACSC group.

Material and methods

Design

The present study represents a secondary analysis of the *Caregency* study [10]. The Caregency study was a multicentre retrospective observational study covering the period between January the 1st and December the 31st, 2017.

Setting and participants

The population were CH residents aged 65 years or older who were admitted to the EDs of five public university hospitals in Catalonia, Spain, for any type of acute medical or non-medical disease. These hospitals provide health coverage for 10,517 CH beds [11,12], in both urban and rural areas. CHs could be owned and operated by public (governmental), non-profit or for-profit entities.

Procedures

The electronic registers were used to identify all visits by residents over 65 years of age who were referred to the EDs from the CHs in 2017. The study sample was randomly

selected within each hospital for further review and data collection. This ensured that data from all seasonal periods per hospital were examined. Using a data collection sheet, a trained team of medical or nursing professionals from each participating hospital collected the study variables by reviewing the participants' electronic medical record (EMR) and collecting data from the Minimum Basic Emergency Department Data Set (CMBD-UR)[13].

Measures

Baseline characteristics of the residents involved in the EDA

Sociodemographic characteristics of the EDA were collected. Functional status was assessed using the standardised Barthel Index score (range 0-100) in the previous three months, if available in the EMR [14]. A lower score indicates greater dependence. Further, the following Barthel Index categories were also used: non-dependence (Barthel index ≥95), mild (61-95), moderate (41-60) or severe dependence (≤40) [15]. If the Barthel Index score was not available, the researchers' extracted information on the "level of dependence" (independent, mild, moderate or severe dependence) as indicated in the resident's EMR, if available. Subsequently, a new variable was created to define the "compiled level of dependence" of the resident, combining the categories of the Barthel Index with those of the variable "level of dependence", being the four resulting categories: non-dependence, mild, moderate or severe dependence. Cognitive status in the previous 3 months was assessed according to the information obtained from the EMR for this period. Thus, we gathered information on whether the resident had cognitive impairment and whether the resident had a diagnosis of dementia**, in which case researchers were asked to specify the severity of dementia. In order to obtain**

a wide picture of the study sample, severity of dementia was determined according to the information available in the EMR (i.e. mild, moderate or severe dementia), and no validated grading systems or psychometric tests were necessary, as this would have probably led to a big amount of missing values for this variable. Multimorbidity was evaluated using the Charlson Comorbidity Index (CCI) score, with higher scores indicating greater 10-year mortality risk [16].

The MAT-SET (Andorran model of triage-Sistema Español de Triaje) scale was used to assess the emergency level (triage) of the resident on arrival at the ED with the triage categories provided by the scale (I-V) [17].

Concerning the destination after ED discharge, the return to the CH, admission to another hospital or intermediate care wards and "mortality during EDA" were identified. Information on the type of acute hospital admission ward (internal medicine, acute geriatrics, traumatology, emergency short-stay, general surgery, pneumology and other wards) and the type of intermediate care wards (subacute care, post-acute care, palliative care, long-stay medical, psychogeriatric) was gathered. Regarding mortality, we collected data on "mortality during EDA" and "mortality 30 days after ED discharge". "Short-term mortality" was considered for those cases that presented with either "mortality during EDA" or "mortality 30 days after ED discharge".

Ambulatory care sensitive conditions

Among the main diagnoses, ACSCs were identified using the list of 16 ACSCs for CHs proposed by Walsh *et al.* This list was selected by a panel of experts with clinical and health services research experience in the field of long-term care, by assessing appropriate diagnoses for this population group [18]. For the present study, respiratory

infections were included in the chronic obstructive disease/asthma group. In this way, EDAs with a main diagnostic corresponding to an ACSC (ACSC-EDA) and EDAs with a main diagnostic unrelated to an ACSC (non-ACSC-EDA) were identified.

Costs estimation related to the ACSC-EDAs

The costs related to each ACSC-EDA, which included both the costs generated by the ED admission *per se* and, where applicable, the subsequent costs of admission to other acute hospital or intermediate care wards, and hospitalisation at home, were calculated in euros (€). The unit rate and payment method established by the *Departament de Salut de la Generalitat de Cataluña*, adjusted to the year 2017, were used to measure costs [19]. The costs generated by EDA, other acute hospital wards or sub-acute care wards were generated by "discharge", while the costs generated by admission to the remaining intermediate care wards were determined according to the "days of stay" in these wards. As the number of "days of stay" in intermediate care wards was not available, a unit price was established according to the maximum stay recommended for each of these wards by the *Departament de Salut de la Generalitat de Catalunya* [20]. Supplementary Table 1 (Appendix A) shows the unit costs associated with each unit of admission (adjusted to 2,017).

Statistical Analyses

EDA characteristics were described using mean and standard deviation (SD) for continuous variables and absolute numbers and percentages for discrete variables. T-test for normal variables and non-parametric Mann-Whitney U test were used for group comparisons (ACSC-EDA vs. non-ACSC-EDA) of continuous variables, while Fisher's

exact test was used for categorical variables. All tests were two-sided at the 5% level of significance ($p = 0.05$).

The costs associated with ACSC-EDA were analysed. To calculate the average cost of an admission to an ED, hospital or intermediate care unit, the total number of admissions to these units and the total cost generated by these admissions were taken into account.

Following Walsh *et al.* [18], a sensitivity analysis was performed to estimate the admissions and cost savings that could be achieved assuming a 20%, 40% and 60% reduction in ACSC-EDAs.

All analyses were performed using IBM SPSS Statistics version 25 (IBM Corporation, Chicago, IL).

Results

A total of 12,580 EDAs of older adults living in CH were identified. Of these, a final sample of 2,444 EDAs was obtained after random sampling, corresponding to 1,982 older residents.

The characteristics of CH residents involved in EDAs and comparison between ACSC and non-ACSC EDAs are shown in Table 1. In brief, the global EDA were predominantly of women (67.7%), with a mean age of 85.9 years (SD 7.2), and a median (1st quartile-3rd quartile) of CCI of 3 (2-4). A wide proportion were functionally impaired (44.3% showed a severe compiled degree of functional dependence) and with cognitive impairment (78% of EDA). Among them, 56.6% suffered from advanced dementia.

There were no statistically significant differences between the two groups studied (ACSC and non-ACSC EDA) in terms of sociodemographic characteristics, multimorbidity, and functional and cognitive status.

[Please include Table 1 around here]

The characteristics and outcomes of the EDA, as well as the outcomes according to the presence of ACSC as main diagnosis are shown in Table 2.

The majority of residents were discharged to CH (52.6%), with 44% experiencing hospitalisation (either in acute, intermediate care wards or hospital at home). Differences in admission units were found between non-ACSC-EDA and ACSC-EDA. Finally, higher short-term mortality was observed in non-ACSC-EDA vs. ACSC-EDA (17.9% vs. 14%; p=0.009).

[Please include Table 2 around here]

The frequency of each ACSC and the top 10 non-ACSC diagnoses, as well as the frequency of admission to other acute or intermediate care wards for each diagnose are described in Table 3.

[Please include Table 3 around here]

Table 4 displays the detailed costs related to ACSC by unit of admission and the average cost per EDA admitted to an ED, acute or intermediate care units.

The overall costs of ACSC-EDAs was €1,948,997.30 with an average cost per EDA of €1,408.24.

Table 5 provides the results of the sensitivity analysis. Based on these analyses, between 400 and 1200 admissions per year and between €390,000 and €1,170,000 in costs could be avoided by achieving these percentage reductions in ACSC-EDA.

[Please include Table 4 around here]

[Please include Table 5 around here]

Discussion

The present study found that, in a sample of 2444 EDA in 5 university hospitals in Catalonia (Spain) of CH residents, more than half of the EDA (56.6%) had ACSC as a main diagnosis. Globally, EDA were predominantly women, with a mean age of 85.9 years, high multimorbidity and high levels of functional and cognitive impairment. EDA presenting with ACSC did not differ from those without ACSC in these characteristics. Furthermore, about 44% of all EDA required hospital admission, with similar proportions among ACSC and non-ACSC EDA. Short-term mortality was slightly higher in the group without ACSC, which could be explained by a tendency towards a higher severity level at triage in this group. The most frequent ACSC identified in our study were falls/trauma, chronic obstructive pulmonary disease/asthma, urinary tract infection and congestive heart failure.

Previous international studies have reported varying proportions of ACSC-EDA (often named as ACSC hospitalisations) among CH residents, with ACSC-EDAs ranging from

19% to 43% [21–23]. The different populations studied and the ACSC lists used could explain these variations. For example, Walsh *et al.* [18], using an ACSC list similar to the one used in the present study, reported ACSC-related hospitalisation frequency of 39% but their study population included not only CH residents but also people receiving community-based services. Conversely, Ouslander *et al.* [24], documented higher ACSC hospitalisation rates (67%) than those observed in our study.

With regard to the ACSC identified, international research has also identified chronic obstructive pulmonary disease/asthma, urinary tract infection, falls/trauma and congestive heart failure, among the top ACSCs [18,25,26].

In terms of costs, the present study found that the average cost per ACSC-EDA was 1,408.24 € (including the costs of ED and admission to hospital or intermediate care wards after ED discharge), resulting in an overall cost for all ACSC EDA of around 2 million €. Our sensitivity analysis suggested that the cost savings could have ranged from 390,000 to 1,170,000 €. Thus, the research team considered that at least this amount of money could have been invested in interventions to prevent ACSC-related EDA.

Reducing ACSC-related admissions in CH has been an important goal in different healthcare systems for years [27–29], and several interventions have been reported that could help achieving this aim.

Young *et al.* [30], identified four factors that were significantly associated with reduced ACSC admissions among CH residents: effective communication between nursing staff and physicians regarding the resident's condition, physicians being able to treat residents within the CH and transferring them to hospital as a last resort, providing

better training and support for nursing staff and aides regarding end-of-life care, and facilitating access to complementary test results.

Some interventions based on the management of certain commonly referred conditions (often classified as ACSC) have been suggested. Loeb *et al.* [31] compared the use of a clinical care pathway with usual care for CH residents who developed symptoms of pneumonia and other lower respiratory tract infections in 22 nursing homes in Ontario, Canada. Their results showed a reduction in the rate of hospital admissions, resulting in substantial cost savings.

Other research studies have more widely focussed on reducing potentially 'avoidable' or 'preventable' hospital admissions among CH residents. In fact, several definitions of this concept have been used [32], including ACSCs but also aspects other than ACSCs such as the priorities and wishes of the CH residents' and the availability of resources in CHs, among others [33].

Selected multifactorial interventions including, among other activities, regular visits by general practitioners or geriatricians, additional training for care centre staff or the improvement of relationships between care providers have shown positive results in reducing potentially preventable hospitalisations [34–38]. Recently, Carter *et al.* [39] found promising evidence for the effectiveness and cost-effectiveness of a nurse led, early intervention program in preventing unnecessary hospital admissions in CH.

Finally, some studies have analysed the effects of interventions aimed at reducing hospital admissions among CH residents in general. Graverholt *et al.* performed a systematic review on this topic and concluded that, although the quality of the evidence is low, several interventions may have an effect on reducing hospital admissions in this population [40]. Conversely, Kane *et al.* [41], in a randomised controlled trial using the

INTERACT training and implementation support, which included tools that help CH staff identify and evaluate acute changes in CH resident condition and document communication between physicians, care paths to avoid hospitalization when safe and feasible, advanced care planning and quality improvement tools, found no benefits in rates of hospitalisation or ED visits among CH residents.

To the best of our knowledge, the present study is the first one providing national data for Spain on the frequency of EDAs related to ACSCs in a large sample of CH residents, as well as the characteristics of the CH residents involved in these EDAs, their requirements for admission to acute or intermediate care wards, the specific ACSC involved, and the associated costs. The results of this study could be used for the development and implementation of interventions aimed at preventing potentially avoidable hospitalisations among frail older adults living at CH.

Other strengths of the present study are its multicentre design, and the long time-period covered, which favoured the understanding of the economic impact of EDA throughout a one-year period.

This study has limitations. The retrospective study design is prone to measurement errors and missing data. However, data were carefully obtained from each participant's medical record by a group of trained researchers who were medical or nursing professionals from each participating hospital. **Due to a relevant number of missing values for the Barthel Index, the level of dependence of the participants was measured using a non-validated instrument in many cases, which could have led to an over or infra-estimation of this variable. Furthermore, due to a lack of data, an estimation was done for the days of admission to intermediate care, which may have led to an over or infra-estimation of the costs. Finally,** potentially avoidable

hospital admissions were measured by identifying only ACSCs, and no data could be collected on other aspects of appropriateness, such as care preferences or priorities of participants and their caregivers, or on secondary diagnoses.

Conclusions

The present study found that EDA due to ACSC are frequent among CH residents, being falls/trauma, chronic obstructive pulmonary disease/asthma, urinary tract infection and congestive heart failure the most frequently identified ACSCs. The cost savings associated with reducing EDA due to ACSC could be invested in the implementation of interventions aimed at preventing potentially avoidable hospitalisations in this population. The results of this study may provide a basis for the development of cost-effective interventions with this aim.

Appendix A.

Supplementary Table 1. Unit costs related to each unit of admission (adjusted to 2017)

Appendix B.

Group authorship

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Table 1. Characteristics of the CH residents involved in EDA (n=2,444) and comparison between ACSC-EDA and non-ACSC-EDA

Variables	ACSC-EDA (n,%) (1384, 56.6)	Non-ACSC-EDA (n,%) (1060, 43.4)	*p*	Overall EDAs (n=2,444)
Age (years), mean (SD)	85.7 (7.3)	86.2 (7.1)	0.066	85.9 (7.2)
Women, n (%)	946 (68.4)	711 (67.1)	0.513	1,657 (67.8)
Charlson Comorbidity index (range 0-37)*, median (Q1-Q3)	3 (2-4)	3 (1-4)	0.002	3 (2-4)
Cognitive Impairment, (n, %) **	1,031 (79.1)	744 (76.4)	0.125	1,775 (78)
Missing values, n	81	86		167
Dementia, n (%) **	741 (59.7)	563 (60.3)	0.791	1,304 (59.9)
Missing values, n	142	126		268
Severity of dementia, n (%)			0.816	
Mild Dementia	69 (10.5)	47 (9.4)		116 (10)
Moderate Dementia	220 (33.4)	165 (15.5)		385 (33.6)
Severe Dementia	369 (56.1)	286 (57.4)		655 (56.6)
Missing values, n	75	73		148
Barthel Index for activities of daily living (range 0-100)*, median (Q1-Q3)	40 (10-70)	45 (15-70)	0.132	40 (15-70)
Missing values, n	777	601		1.378
Level of dependence, n (%) ***			0.278	
Non-dependence	45 (7.7)	49 (11.3)		94 (9.2)
Mild	114 (19.5)	80 (18.4)		194 (19.0)
Moderate	202 (34.5)	148 (34.0)		350 (34.3)
Severe	224 (38.3)	158 (36.3)		382 (37.5)
Missing values, n	192	166		358
Compiled level of dependence, n (%) ****			0.124	
Compiled-non-dependence	53 (4.4)	59 (6.6)		112 (5.4)
Compiled-mild	282 (23.7)	221 (24.7)		503 (24.1)

Compiled-moderate	313 (26.3)	234 (26.2)	547 (26.2)
Compiled-severe	544 (45.6)	380 (42.5)	924 (44.3)
Missing values, n	192	166	358

Abbreviations: ACSC, Ambulatory Care-Sensitive Conditions; EDA, Emergency Department Admissions; EMR, Electronic Medical Record; SD, Standard Deviation; Q1, first quartile; Q3, third quartile

* Underlined scores are most favourable.

** Cognitive status was assessed according to information obtained from the EMR (dichotomous variable)

*** Residents without registered Barthel index.

**** Combination of the categories of the Barthel Index and "level of dependence" variables: compiled-non-dependence (Barthel index ≥95 or "non-dependence"), compiled-mild (Barthel index 61-95 or "mild"), compiled-moderate (Barthel index 41-60 or "moderate"), or compiled-severe (Barthel index ≤40 or "severe") dependence.

Table 2. Characteristics and outcome of CH residents during their stay in the ED and comparison between ACSC-EDA and non-ACSC-EDA, including hospitalisations

Variables	ACSC-EDA (n,%) (1384, 56.6)	Non-ACSC-EDA (n,%) (1060, 43.4)	*p*	Overall EDA (n, %) (n=2,444)
Triage Score, n (%)			0.066	
I-II	210 (15.1)	182 (17.1)		392 (16.0)
III	607 (43.8)	455 (42.9)		1062 (43.4)
IV-V	397 (28.6)	256 (24.1)		653 (26.7)
Missing values, n	146	191		337
Discharge Destination, n (%)*			<0.001	
Care Home	738 (53.3)	547 (51.6)		1285 (52.6)
Hospital ward	389 (28.1)	372 (35.1)		761 (31.1)
Intermediate Care Ward	211 (15.2)	79 (7.5)		290 (11.8)
Hospital at home	16 (1.2)	12 (1.1)		28 (1.1)
Palliative Care at Home	3 (0.2)	3 (0.3)		6 (0.2)
Other	5 (0.4)	1 (0.1)		6 (0.2)
Admissions to hospital or Intermediate care wards, n (%) **	616 (44.5)	463 (43.6)	0.652	1,079 (44.1)
Acute Hospital Ward after EDA, n (%)	389 (28.1)	372 (35.1)	<0.001	761 (31.1)
Internal Medicine	195 (50.1)	85 (30.4)		280 (36.7)
Acute Geriatric Unit	103 (26.4)	53 (14.2)		156 (20.4)
Traumatology	6 (1.5)	106 (26.0)		112 (14.7)
Short-stay Unit (Emergency room)	46 (11.8)	22 (5.9)		68 (8.9)
General Surgery	1 (0.2)	30 (8.6)		31 (4.0)
Pneumology	18 (4.6)	6 (1.6)		24 (3.1)
Other***	17 (4.1)	62 (16.6)		79 (10.3)
Missing values, n	3	8		11
Intermediate Care Ward after EDA, n (%)	211 (15.2)	79 (7.5)	<0.001	290 (11.8)

Subacute Care ward	202 (95.7)	62 (78.4)		264 (91.0)
Post-acute Care ward	1 (0.5)	4 (4.3)		5 (1.7)
Palliative Care ward	6 (3.0)	13 (14.1)		19 (6.5)
Long-stay medical ward	1 (0.5)	0 (0,0)		1 (0.3)
Psychogeriatric ward	1 (0.5)	0 (0.0)		1 (0.3)
Missing values , n	0	0		0
Mortality during EDA, n (%)	22 (1.6)	46 (4.3)	<0.001	68 (2.8)
Mortality 30 days after ED discharge,, n (%)	169 (12.2)	142 (13.4)	0.631	311 (12.7)
Missing values , n	17	11		28
Short-term mortality, n (%)****	191 (14)	188 (17.9)	0.009	379 (15.7)

Abbreviations: ACSC, Ambulatory Care-Sensitive Conditions; EDA, Emergency Department Admissions; ED, Emergency Department

* Deceased in ED are excluded

** Admissions to hospital at home are included

*** Admissions to Cardiology, Vascular Surgery, Digestology, Endocrinology, Nephrology, Neurosurgery, Neurology, Oncology, Psychiatry, Urology are included.

**** During EDA or 30 days after ED discharge

Table 3. Frequency of ACSCs and top 10 non-ACSC, and frequency of admission of EDA to hospital or intermediate care wards (n=2,444)

Main diagnoses	Frequency of EDA n (%)**	Frequency of EDA with admission to other hospital or intermediate care wards * n (%)***
ACSC	1,384 (56.6)	616 (44.5)
Fall or trauma	338 (13.8)	12 (3.6)
Chronic obstructive pulmonary disease, asthma	279 (11.4)	182 (65.2)
Urinary tract infection	181 (7.4)	88 (48.6)
Congestive heart failure	152 (6.2)	112 (73.7)
Pneumonia	129 (5.3)	114 (88.4)
Dehydration	52 (2.1)	34 (65.4)
Skin ulcers, cellulitis	40 (1.6)	8 (20.0)
Anemia	39 (1.6)	14 (35.9)
Altered mental status, acute confusion, delirium	31 (1.3)	11 (35.5)
Constipation or fecal impaction obstipation	31 (1.3)	5 (16.1)
Diarrhea, gastroenteritis	28 (1.1)	13 (46.4)
Poor glycemic control	28 (1.1)	8 (28.6)
Seizures	24 (1.0)	6 (25.0)
Psychosis, agitation, organic brain syndrome	21 (0.9)	8 (38.1)
Hyper- and hypotension: separate conditions	11 (0.5)	1 (9.1)
Weight loss, nutritional deficiencies	-	-
Non-ACSC	1,060 (43.3)	463 (43.6)
Fractures	203 (8.3)	112 (10.5)
Pain	113 (4.6)	16 (1.5)
Ischemic stroke	68 (2.8)	41 (3.8)
Bronchoaspiration	68 (2.8)	40 (3.7)

Sepsis	56 (2.3)	40 (3.7)
Respiratory failure	51 (2.1)	36 (3.4)
Gastrointestinal bleeding	39 (1.6)	24 (2.2)
Arrhythmias	38 (1.6)	17 (1.6)
Syncope/lipotimia	34 (1.4)	5 (0.4)
Ischaemia	27 (1.1)	18 (1.6)

Abbreviations: ACSC, Ambulatory Care-Sensitive Conditions

* Admissions to hospital at home are included

** Percentages referring to whole study sample (n=2444)

*** Percentages referring to the number of EDA for each condition

Table 4. Costs related to ACSC-EDA according to the units of admission

Unit of Admission	ACSC n (€)
Emergency Department Ward (n (€))	1,384 (144,835.60)
Hospital Ward after EDA*´(n (€))**	405 (1,426,319.89)
Medical Wards **	378 (1,298,180.52)
Surgery Wards ***	11 (73,189.93)
Intermediate Care Ward after EDA (n (€))	211 (377,841.81)
Subacute Care Ward	202 (351,686.04)
Post-acute Care Ward ****	8 (18,455.54)
Long-stay Medical Care Ward ****	1 (6,685.28)
Overall Cost (including admission to the ED and other hospital or intermediate care wards)	1,384 (1,948,997.30)
Average cost *per* EDA (including admission to the ED and hospital or intermediate care wards)	1,384 (1,408.24)

Abbreviations: ACSC, Ambulatory Care-Sensitive Conditions; ED, Emergency Department; EDA, Emergency Department Admission

* *Includes hospital at home*

*** Medical wards include: cardiology, digestology, endocrinology, internal medicine, geriatrics, pneumology, neurology, oncology, psychiatry, nephrology, emergency short stay unit and intensive care unit.*

**** Surgery wards include: traumatology, urology, general surgery, vascular surgery and neurosurgery.*

**** The cost is calculated on the basis of the number of days of admission according to the maximum stay recommended for each of these wards by the Departament de Salut de la Generalitat de Catalunya [20]

Table 5. Results of sensitivity analysis on the estimated reduction in the frequency and cost of ACSC based on assumptions about the proportion of avoidable admissions to ED, other hospital and intermediate care wards that could be prevented.

Category	Frequency of ACSCs, costs and admissions/savings assumptions
Overall admissions for ACSCs (n)	1,384
Overall costs for ACSC (€)*	1,948,997.30
Average cost *per* ACSC EDA (€)	1,408.24
Assumption 1: 20% of admissions defined as ACSC from an outpatient point of view are avoided. *	
Ambulatory Care-Sensitive Conditions prevented (n)	277
Estimated cost savings for Ambulatory Care-Sensitive Conditions prevented (€)	390,081.11
Assumption 2: 40% of admissions defined as ACSC from an outpatient point of view are avoided. *	
Ambulatory Care-Sensitive Conditions prevented(n)	553
Estimated cost savings for Ambulatory Care-Sensitive Conditions prevented (€)	778,753.98
Assumption 3: 60% of admissions defined as ACSC from an outpatient point of view are avoided. *	
Ambulatory Care-Sensitive Conditions prevented (n)	830
Estimated cost savings for Ambulatory Care-Sensitive Conditions prevented (€)	1,168,835.09

Abbreviations: ACSC, Ambulatory Care-Sensitive Conditions

* Includes admissions to ED, other hospital and intermediate care wards

Tabla (Table)

Supplementary Table 1. Unit costs related to each unit of admission (adjusted to 2,017)

Unit of Admission	Unit cost (euros)
Emergency Department Unit *	104.65
Hospital Ward after EDA	
Medical wards*	3,434.34 €
Surgery wards*	6,653.63 €
Intermediate Care Ward after EDA	
Subacute care *	1,741.02
Post-acute Care**	89.59
Long-stay medical**	59.69

Abbreviations: EDA, Emergency Department Admissions

* *Cost per discharge*

** *Cost per stay (days of admission)*