

Heart failure in primary care: co-morbidity and utilization of health care resources

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Background. In order to ensure proper management of primary care (PC) services, the efficiency of the health professionals tasked with such services must be known. Patients with heart failure (HF) are characterized by advanced age, high co-morbidity and high resource utilization.

Objective. To ascertain PC resource utilization by HF patients and variability in the management of such patients by GPs.

Methods. Descriptive, cross-sectional study targeting a population attended by 129 GPs over the course of 1 year. All patients with diagnosis of HF in their clinical histories were included, classified using the Adjusted Clinical Group system and then grouped into six resource utilization bands (RUBs). Resource utilization and Efficiency Index were both calculated.

Results. One hundred per cent of patients with HF were ranked in RUBs 3, 4 and 5. The highest GP visit rate was 20 and the lowest in excess of 10 visits per year. Prescription drug costs for these patients ranged from €885 to €1422 per patient per year. Health professional efficiency varied notably, even after adjustment for co-morbidity (Efficiency Index Variation Ratio of 28.27 for visits and 404.29 for prescription drug cost).

Conclusions. Patients with HF register a high utilization of resources, and there is great variability in the management of such patients by health professionals, which cannot be accounted for by the degree of case complexity.

Keywords. ACG, co-morbidity, heart failure, primary care, resource utilization.

Introduction

Heart failure (HF) is one of the main public health problems in developed countries. In Spain, its prevalence represents 1–2% of the population aged over 40 years,¹ and the disease is the leading cause of hospital admission among persons over the age of 65 years.² Moreover, as a consequence of demographic changes in developed countries, the prevalence of HF is steadily rising.

HF is a chronic disease, accompanied by high complex co-morbidity which has important implications for clinical results—including mortality, surgery, complications and patients' functional status—and also leads to increased health care costs, due to greater resource

utilization and a high polypharmacy rate.³ Ascertaining case complexity and resource utilization associated with HF will thus help improve the quality of case management and care provided by the health services attending such patients.

The Adjusted Clinical Group (ACG)⁴ patient classification system is of special interest in primary care (PC), in view of the fact that it classifies patients according to resource utilization. It differs from other patient classification systems in that it is longitudinal, patient oriented and able to describe the efficiency of health professionals in terms of patients' case histories in a reference population such as that diagnosed with HF in PC.

A designated goal of health services is to enhance the efficiency of utilization of public resources. Accordingly,

this study aimed, on the one hand, to ascertain the resource utilization associated with HF attended by PC physicians, by reference to the number of GP consultations, number of nursing consultations and cost of prescription drugs and, on the other hand, to quantify the variability shown by health professionals in the management of this disease.

Methods

We conducted a cross-sectional, observational, descriptive study in a PC health area setting in the Madrid Autonomous Region ('Comunidad de Madrid') over a period of 1 year. As databases, we used electronic medical records and the 'FARMADRID' pharmaceutical invoicing database. The methodology used to describe HF-related prevalence and co-morbidity was described in a previous publication. The research team made a selection of 26 high-prevalence/high-impact expanded diagnosis clusters (EDCs); HF is included in this list of 26 EDCs and its association with the other 25 chronic, high-prevalence/high-impact EDCs was analysed.⁵

The study included the electronic medical records of 198 670 persons, corresponding to the population allocated to 129 GPs who, by way of inclusion criteria, fulfilled the following two quality requirements in their electronic medical record keeping: (i) they kept records of over 64% of visits attended (75th percentile) and (ii) they registered a mean of more than four care episodes per patient.

Patients were classified using the ACG® Case-Mix System programme, version 7, developed at Johns Hopkins University.⁴ Each ACG represents a set of patients with a similar health resource utilization, so as to facilitate analysis of the results of the ACGs, which are in turn grouped into six categories or resource utilization bands (RUBs), according to expected utilization of resources, ranging from zero (RUB 0) to very high (RUB 5). ACGs are based on the premise that variation in resource utilization is related to case history and are thus useful for comparing populations in terms of case complexity, resource utilization and professional activity profiles. This system also allows for calculation of the Efficiency Index, which is defined as the ratio between mean observed and mean expected use according to the individual patient's case profile. The Efficiency Index is subdivided in terms of the cost unit being compared (visits, prescription drug cost, etc.). In other words, the Efficiency Index for medical visits to any given physician would be the mean of all patient visits divided by the mean of expected visits according to the complexity of such patients' cases. In order to ascertain the degree of variability prevailing among health professionals, we calculated the variation ratio (VR) for the number of visits per physician, prescription drug cost per physician and Efficiency Index for both.

The following data were recorded for each patient: age, sex and all diagnoses for which medical advice had been sought in 2007.

The ACG-system grouper requires the codes of the International Classification of Diseases, 9th or 10th version (ICD-9 or ICD-10)⁶ in order to generate the necessary EDCs. The episodes registered were, therefore, recoded using the International Classification of Primary Care (ICPC)/ICD-9 Conversion Dictionary, developed by Sicras-Mainar.⁷ From a pragmatic point of view, patients were deemed to have presented with HF in any case where this diagnosis appeared in their clinical histories as ICPC code K77, which, when transformed into EDCs, matched EDC code CAR05. Using this case-definition criterion, prevalence of HF attended by GPs was calculated with a 95% confidence level.

All statistical analyses were performed using the SPSS statistical package, version 15.0, with frequency distributions and their 95% confidence levels being calculated for qualitative variables, where pertinent, and means and their standard deviations being calculated for quantitative variables. For number of visits, prescription drug cost and Efficiency Index, the VR was calculated as the ratio between the maximum and minimum values of a series, in the form of unrefined values and refined (5th to 95th percentiles) and interquartile values (25th to 75th percentiles), with extreme values thus being discarded. The VR of the Efficiency Index quantifies the variation in the variable studied (number of visits and prescription drug cost) adjusted for the degree of complexity of the patients on the physician's list.

Results

After applying the record keeping quality criteria, 129 GPs were selected, who represented all but two of the health centres in the area, one rural and one urban. Of the total registered population of 198 670 (52.35% women), the total number of persons attended was 149 417, and the breakdown showed that these accounted for 75% of the registered population, that >30% were aged over 55 years and 20.85% were aged over 65 years, and, lastly, that 43.30% were men and 56.70% were women.

As mentioned, the epidemiological characteristics of the study sample were described in detail in a previous publication.⁵ A total of 1377 patients were diagnosed with HF and all were ranked in RUBs 3, 4 and 5. As can be seen from [Table 1](#), the distribution of such patients broken down by co-morbidity showed that 45.2% were in RUB 4, 32.5% in RUB 3 and the remaining 22.3% in RUB 5. All of these were, therefore, patients with high resource utilization.

As shown in [Table 2](#), there was an increase in resource utilization related to patient complexity. The mean PC medical consultation index rose with RUB level to 12.4,

15.2 and 17.7 visits per HF patient per year, with statistically significant differences among the three [one-factor analysis of variance (ANOVA), $F = 28.37$, $P < 0.01$].

Similarly, the mean nursing consultation index in each RUB also rose with RUB level to 8.16, 9.95 and 11.05 visits per year, with statistically significant differences in RUB 3 versus RUBs 4 and 5 (one-factor ANOVA, $F = 13.48$, $P < 0.01$).

The higher the RUB level, the higher the mean prescription drug cost per patient, with a cost of €884.93, €1278.86 and €1422.32 per year per patient. Again, there were statistically significant differences in RUB 3 versus RUBs 4 and 5 (one-factor ANOVA, $F = 5.95$, $P < 0.01$).

Variability in clinical management was calculated using the Efficiency Index and the pertinent VRs. The results of this calculation are shown in Table 3.

The VRs for number of visits and prescription drug cost were 48.92 and 729.73, respectively, and continued to be high when calculated for values included in the interquartile range, i.e. 1.47 for medical visits and 1.60 for prescription drug cost. The variation in data was maintained after adjustment for degree of patient complexity (Efficiency Index), with practically the same values for cases included in the interquartile range, i.e. 1.47 versus 1.44 for number of visits and 1.60 versus 1.57 for prescription drug cost.

TABLE 1 Distribution of co-morbidity in the respective RUBs

	Number of cases	RUB 3 (%)	RUB 4 (%)	RUB 5 (%)
HF	1377	32.5	45.2	22.3
HF alone	42	78.6	14.3	7.1
HF + 1 EDC	94	45.7	44.7	9.6
HF + 2 EDCs	163	45.4	44.2	10.4
HF + 3 EDCs	229	38.4	46.7	14.8
HF + 4 EDCs	268	31.7	46.3	22
HF + 5 EDCs and over	581	21.5	46.6	60.4

Discussion

Both PC resource utilization associated with HF and the difference in the way in which health professionals approach such patients are of a high magnitude.

Our results show that the impact of HF on resource utilization is highly significant, since 100% of patients are ranked in RUBs 3, 4 and 5. Hence, as other authors have already indicated, HF entails high resource utilization,^{8,9} which can be clearly observed in Table 1. It is noteworthy that the percentage of HF patients with more than four related diseases in RUB 5 account for 80% of this band and over 60% of RUB 4; as was expected from the methodology used, health resource utilization is closely linked to patients' disease burden and, by extension, to their co-morbidity; these results are in line with those obtained by other authors.¹⁰⁻¹³

As shown in Table 2, the number of visits paid to GPs' medical practices was in accordance with patients' respective RUBs and the same situation applied to nursing consultations. Sicras-Mainar *et al.*¹⁴ have reported that there is a significant correlation between health cost and co-morbidity burden. We found that Sibley's study in Canada displayed similarities to ours as regards persons included in RUBs 4 and 5, among whom there was a mean of 15 visits per patient per year to the PC physician¹⁵; while it should be borne in mind that this was a general population and not a population of HF patients, the most likely probability is nevertheless that RUB 4 and RUB 5 status was assigned to persons with chronic diseases and co-morbidity and that this thus yielded a result so similar to that obtained by us for HF patients in our area.

Sicras-Mainar, in two studies undertaken in 2003 and 2008, observed that the mean prescription drug cost in the registered population was €387 and €310 per patient per year, respectively.^{16,17} Moreover, 10% of health service users have been identified as hyper-consumers, in view of the fact that they account for 60%

TABLE 2 Distribution of resource utilization by RUB

	RUB 3	RUB 4	RUB 5
Mean physician consultations (95% CI)	12.48 (11.70–13.26)	15.27 (14.51–16.03)	17.7 (16.50–18.91)
Mean nursing consultations (95% CI)	8.16 (7.15–9.18)	9.95 (9.01–10.89)	11.05 (9.64–12.46)
Mean prescription drug cost (95% CI)	884.93 (803.48–966.38)	1278.86 (1122.12–1435.59)	1422.32 (1292.08–1552.57)

CI, confidence interval.

TABLE 3 VR of utilization of medical visits and prescription drugs, both crude and adjusted for case complexity

	Mean visits per physician	Efficiency Index: visits	Mean prescription drug cost per physician	Efficiency Index: prescription drugs
VR	48.92	28.27	729.73	404.29
VR 5–95	3.56	3.06	7.36	3.72
VR 25–75	1.47	1.44	1.60	1.57

of the total pharmaceutical cost.¹⁸ Data not published in this study reveal a prescription drug cost per patient per year of €242 in the total population attended over the course of 1 year. Comparing both sets of data to the results obtained from our series, the high prescription drug cost associated with HF patients (€885–€1422 per patient per year) is evident. This highlights the fact that over-utilization of resources by persons diagnosed with HF is not exclusively due to HF *per se*; instead, it is in great measure due to related co-morbidities, which make for decompensation due to treatment non-compliance (oversight or errors in dosage), drug interactions, the increasing severity of certain diagnoses, which are risk factors for diseases of greater importance, or simply the complexity and difficulty of treating these patients. Apart from increasing the number of consultations at the respective care levels, resource over-utilization also raises prescription drug costs, hospitalizations and, ultimately, mortality.

All these results serve to guarantee the efficacy of the tool used in this analysis, namely, the ACG system, since the expected gradient in resource utilization is maintained in accordance with the RUB allocated.

One of the main functions of service management is to enhance the efficiency of resource utilization, yet the task of assessing when appropriate use is made of such resources poses a difficulty that stems from the complexity of the causes underlying the different degrees of service utilization; in this regard, morbidity has been previously identified as the factor having the greatest predictive power.¹⁹ It is, however, as or more important to ascertain the variables that influence the behaviour of professionals, insofar as number of consultations and prescription drug costs are concerned. Juncosa *et al.*²⁰ reported that the variable that best explains resource utilization is co-morbidity but failed to explain the full extent of the variability in such utilization. Likewise, our results (focused on HF patients in PC) point to an enormous variability in clinical management on the part of professionals, even when adjustment is made for case complexity, in that the refined VR of the Efficiency Index exceeded 3, both for visits (3.06) and for prescription drug costs (3.72), and indeed it should be stressed that the unrefined VR of the Efficiency Index for prescription drug costs was in excess of 400 points. These results are very relevant, since they show that some physicians approach their patients in ways that differ greatly from those adopted by other physicians whose patients present with similar case profiles, a situation that enormously hinders health management planning. HF patients are characterized by enormous complexity in their co-morbidity profiles, yet this circumstance is not envisaged in clinical practice guidelines designed, among other things, to reduce variability in the management of such patients, with the result that such guidelines fail to attain their designated goal.

The data for this study were furnished by a clinical/administrative database, meaning that we could include all patients seen and all visits to all physicians' offices throughout 2007 and that the sample was thus in no way 'selected'. Even so, such databases introduce study biases with regard to the quality, validity and thoroughness of the data; accordingly, we selected those physicians whose records were considered most reliable in terms of quality. Another limitation to extrapolating the data to the general population is the fact that the study population was limited to individuals over 14 years of age.

In conclusion, while the study of the clinical management of HF patients using the ACG system reveals no differences with respect to the results obtained in the general population, it does nonetheless highlight the need to undertake new studies that associate service efficiency with physician-specific factors, which, taken together with the complexity of individual cases, may possibly account for the differing approaches taken by professionals to patients having similar case histories.

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Conflict of interest: none.

References

- Banegas-Banegas JR, Rodriguez-Artalejo F, Guallar-Castillon P. Situación epidemiológica de la insuficiencia cardiaca en España. *Rev Esp Cardiol Supl* 2006; 6:4c–9c.
- Instituto Nacional de Estadística. *Encuesta de morbilidad hospitalaria. 2009.* www.ine.es (accessed on 22 January 2012).
- Poses RM, McClish DK, Smith WR *et al.* Results of report cards for patients with congestive heart failure depend on the method used to adjust for severity. *Ann Intern Med* 2000; 133: 10–20.
- Weiner JP, Starfield BH, Lieberman RN. Johns Hopkins Ambulatory Care Groups (ACGs). (1192) A case-mix system for UR, QA and capitation adjustment. *HMO Pract* 1992; 6: 13–9.

- ⁵ Carmona M, García-Olmos LM, Alberquilla A *et al*. Heart failure in the family practice: a study of the prevalence and co-morbidity. *Fam Pract* 2011; **28**: 128–33.
- ⁶ Organización Mundial de la Salud. *Clasificación Internacional de Enfermedades. 9ª Revisión. Modificación Clínica. CIE-9-MC*. 7th edn. Madrid, Spain: Ministerio de Sanidad y Consumo, 2010.
- ⁷ Sicras-Mainar A. Impacto económico de las enfermedades y pacientes atendidos en atención primaria. Adaptación de los Grupos Clínicos Ajustados (ACGs) en nuestro medio. *Tesis Doctoral*. [dissertation]. Departamento de Salud Pública. Facultad de Medicina. Universidad de Barcelona 2002.
- ⁸ Oliva J, Jorgensen N, Rodriguez JM. Carga socioeconómica de la insuficiencia cardiaca: revisión de los estudios de coste de la enfermedad. *Pharmacoeconomics Span Res Art* 2010; **7**: 68–79.
- ⁹ Braunschweig F, Cowie MR, Auricchio A. What are the costs of heart failure? *Europace* 2011; **13** (suppl 2): ii13–7.
- ¹⁰ Reid R, Evans R, Barer M *et al*. Conspicuous consumption: characterizing high users of physician services in one Canadian province. *J Health Serv Res Policy* 2003; **8**: 215–24.
- ¹¹ Broemeling AM, Watson D, Black C. *Chronic Conditions and Co-morbidity Among Residents of British Columbia*. Vancouver, BC: Centre for Health Services and Policy Research, 2005.
- ¹² Starfield B, Lemke KW, Herbert R, Pavlovich WD, Anderson G. Comorbidity and the use of primary care and specialist care in the elderly. *Ann Fam Med* 2005; **3**: 215–22.
- ¹³ Tooth L, Hockey R, Byles J, Dobson A. Weighted multimorbidity indexes predicted mortality, health service use, and health-related quality of life in older women. *J Clin Epidemiol* 2008; **61**: 151–9.
- ¹⁴ Sicras-Mainar A, Navarro-Artieda R, Ruiz-Torrejón A, Prados-Torres A. Influencia de la comorbilidad crónica sobre el coste sanitario. *Cartas científicas. Med Clin (Barc)* 2011; **138**: 179–80.
- ¹⁵ Sibley LM, Moineddin R, Agha MM, Glazier RH. Risk adjustment using administrative data-based and survey-derived methods for explaining physician utilization. *Med Care* 2010; **48**: 175–82.
- ¹⁶ Sicras-Mainar A, Serrat-Tarres J. Medida de los pesos relativos del coste de la asistencia como efecto de la aplicación retrospectiva de los *Adjusted Clinical Groups* en atención primaria. *Gac Sanit* 2006; **20**: 132–41.
- ¹⁷ Sicras-Mainar A, Velasco-Velasco S, Navarro-Artieda R *et al*. Obtaining the mean relative weights of the cost of care in Catalonia (Spain): retrospective application of the adjusted clinical groups case-mix system in primary health care. *J Eval Clin Pract* 2013; **19**: 267–76, doi:10.1111/j.1365-2753.2012.01818.x.
- ¹⁸ Prados TA, Sicras MA, Estelrich BJ *et al*. Identificación de pacientes hiperconsumidores de farmacia en atención primaria. *Aten Primaria* 2009; **41**: 453–9.
- ¹⁹ Casajuana Brunet J, Bellón Saameño JA. Gestión de la consulta en Atención Primaria. In: Martín Zurro A, Cano Pérez JF (eds). *Atención Primaria Conceptos: organización y práctica clínica*. Barcelona: Doyma, 2003, pp. 102–4.
- ²⁰ Juncosa S, Bolibar B, Roset M, Martínez C. Influencia de la unidad de análisis en los estudios de utilización de recursos en atención primaria. *Gac Sanit* 1999; **13**: 53–61.