Variations in health services utilization by primary care patients

Victoria Bolaños-Carmona*, Ricardo Ocaña-Riola*, Alexandra Prados-Torres* and Pilar Gutiérrez-Cuadra*

University of Granada and *Andalusian School of Public Health, Spain

This study analyses how both ambulatory care groups (ACGs) and physician characteristics explain the variability in health-service use among primary care patients in Spain. During the period 1996–1997, data derived from 52,152 patients and their 38 respective primary care physicians were collected. The response variables were as follows: number of visits; diagnostic tests requested; and referrals to a specialist. ACGs are an important variable that should be taken into account in order to explain health-service utilization. As for professionals, age and the post they hold are essential factors. Most of the unexplained variability is caused by patient characteristics.

Introduction

From the past decade onwards, western countries have been going through a process of constant health-system reform. This process has been particularly aimed at controlling expenditure, ensuring efficiency in the provision of services, maintaining levels of acquired equity, and improving the quality of service delivery (Cabasés and Martín, 1997; Martín, 1997).

Furthermore, within the OECD (Organization for Economic Cooperation and Development) framework, it has been proved that an increase in expenditure does not always necessarily result in improved indicators of a population’s health. These populations can be influenced by other factors — such as the level of social equality, or lifestyle (Regidor et al., 1995; Wilkinson, 1992).

Recent reform policies in Europe still have not been completely defined but already present some trends. These include a moderate increase in health expenditure, incorporation of evidence-based medicine, control of health service use through the consolidation of the general practitioner (GP) as gatekeeper of the system, the existence of a sole financing body, and the introduction of prospective global budgets (Martín, 1997).

Within this general context, a considerable amount of information concerning determining factors in health-service utilization has been gathered (Peiró and Meneu, 1995). The basic conceptual model identifies three factors that determine health-service utilization: patients, professionals and the organization of services (Eisenberg, 1985; Hulka and Wheat, 1985; López, 1997; McPherson, 1995; McPherson et al., 1982; Revilla, 1991; Sarriá-Santamera and Sendra, 1993).

Many studies have illustrated that most of the differences in service utilization can be explained...
by user or patient factors and, in particular, by their state of health. The Patient Classification Systems are instruments designed to group patient types from a clinical point of view and, potentially, from a resource consumption perspective. These systems have emphasized the extent to which variability in health-service utilization is caused by case-mix differences (Carmona et al., 1997; Casas et al., 1997).

Among the many classification systems used for grouping consumption rate in ambulatory care, the ambulatory care groups (ACGs) have stimulated the greatest interest, owing to their implementation in the Spanish primary care system (Goldfield, 1993; Juncosa et al., 1996; Kolb and Cly, 1994). Some studies developed in Spain have shown that the frequency of visits to primary care centres can be explained in part by ACGs (Carmona et al., 1997; Juncosa and Bolíbar, 1997; Prados, 1997).

There are wide differences in health resource use in Spain that cannot be explained by dissimilarities within a population’s health. Variations in medical practice appear at all levels in care and health settings (Eisenberg, 1985; McPherson et al., 1982; Sarriá-Santamaria and Sendra, 1993). Eisenberg asserts that physicians decide how to use health resources, and upholds that clinical decision-making is based on the likelihood that patients suffer from a particular disease/condition. However, other factors also play a part—such as physicians’ obligations to their patients, physicians’ interests, their personal characteristics (such as speciality or age, practice style or environment) and accepted clinical leadership (Eisenberg, 1985). Other authors have analysed these factors in primary care settings, and have defined family physician characteristics according to their concept of professional practice. Some aspects related to the organization of the practice setting are included in that definition, such as teaching qualifications, the size of the health centre, daily work load, and the structure and extension of time available to patients.

New contribution

This paper analyses both ACGs and physician characteristics, with the aim of understanding the variability explained by these two types of factors in health resource utilization in primary care. This study is part of a broader project aimed at assessing the behaviour of ACGs in primary care in Spain.

The statistical techniques used allowed us jointly to consider two factor levels: population-based factors and those concerning health care professionals. These factors contribute to an explanation of the variability observed in health service utilization. This is the first time that a multilevel model has been used to analyse the effectiveness of the ACGs in the Spanish primary care system.

Conceptual model

Health service utilization is an extraordinarily complex field, and various models have been proposed, from different perspectives, in order to explain the variability found. However, many authors concur with a basic conceptual model of factors that influence health service utilization (Eisenberg, 1985; Hulka and Wheat, 1985; López, 1997; Revilla, 1991; Sarriá, 1993). These factors can be put into three groups:

a) Factors that depend on the health system: range of available resources; financing and payment systems; organization and productivity of services; cover; and accessibility.

b) Factors that depend on the direct provider: personal factors of professionals and professional factors regarding the work environment.


In Spain, the health service is free and of a universal nature. It is also legally regulated throughout the entire country by La Ley General de Sanidad de 1984 (The Health Care Act of 1984). This legislation applies to all conditions, functions, locations and other accessibility factors relating to primary care centres; thus, the organizational characteristics are similar amongst all health centres. It is for this reason that of the three factors described above only professional and patient characteristics could contribute to an explanation of the variability in utilization of health services in Spain.

Direct provider characteristics have been studied by other authors, who have defined different types of doctors according to their conception of professional practice. Regarding
this definition, variables such as duration of consultation and the structure and amount of time dedicated daily to each patient have been examined (López et al., 1995). Both variables are essential in the provision of quality healthcare. On the one hand, the existence of an adequate flow of information between doctor and patient is needed in order to satisfy demand (Howie et al., 1989); on the other hand, high attendance loads tend to be related to an increase in the number of referrals to specialists (Bonal, 1991).

Some authors have also considered appointment-based consultation as an important tool in the development of healthcare programmes and one that can improve the satisfaction levels of both doctor and patient, and, indirectly, the execution of treatment (Navarro et al., 1992).

Regarding personal characteristics of doctors, different studies point to age and gender as important factors in explaining healthcare service utilization. Eisenberg and Nicklin (1981) demonstrated that age difference among doctors account for 5% of the variability in laboratory test requests and 3% for X-ray requests. Although there does not appear to be a clear consensus of opinion among published works, some studies have proposed a relationship between the female gender and a greater concern for psycho-social aspects and a greater dedication to preventive activities (Bertakis et al., 1995; Bonal, 1991).

Primary healthcare reform in Spain led to the introduction of the team coordinator or director. The coordinator is elected by all members of a primary healthcare team, and his/her function, strictly speaking, is limited to serving as a reference point in the transmission of the applicable rules and norms and to resolving conflict; however, a certain degree of personal leadership qualities is implied, a higher level of authority and a greater commitment to the overall objectives or ‘mission’ of the primary healthcare team (Aranda, 1994). These professionals also tend to have a higher level of training, a characteristic that could be an important factor when considering healthcare utilization.

Studies analysing patient and doctor characteristics simultaneously, using the same model, have not been undertaken in Spain so far. It is difficult therefore, to establish a conceptual framework for our environment with which to justify the variables studied in this work. We wanted to undertake an exploratory study that would represent a first step in an understanding of health service utilization in our country. The choice of many of the variables used was based on publications by investigators from other countries. Others were chosen with the aim of exploring their capacity to explain primary healthcare service utilization.

Methodology

In order to carry out this study, a descriptive observational design was used in a multicentre setting. Two primary sources of data were used. A total number of 38 primary care physicians working in 21 health centres in seven different Spanish regions (Andalusia, Aragón, Asturias, Castilla-La Mancha, Castilla-León, Catalonia and Madrid were included). Their care activity was recorded over 12 months, during the period 1996–1997. For each patient, the following variables were registered: age, sex, diagnosis, number of visits, diagnostic tests requested, and referrals to a specialist. The age, gender and diagnosis variables allowed the grouping of patients into ACGs. To do so, the grouping system developed by the John Hopkins University was used (Johns Hopkins University, 1997). A total number of 52,152 patients participated in the study.

Every health centre included in this study had a similar organizational structure, conforming to a primary healthcare model, which can be considered as a representative sample of the total Spanish primary care system. Patients are designated to doctors using a geographical criterion, so each patient is always attended by the same doctor.

Once the patient-data gathering had ended, a questionnaire was distributed to each physician in order to gather information regarding his/her professional characteristics. More specifically, they were asked about age, gender, average time devoted to patients in each open surgery, average time spent with patients in each appointment-based surgery, and post held in the health centre (i.e. director or other).

The dependent variables used as a measure of service utilization were as follows: number of visits, number of referrals to a specialist and number of complementary tests per patient/year. The independent variables were classified into two groups: patient characteristics; and characteristics of the physician caring for them.

Owing to the structure of the data, which was grouped by physicians, the analysis was carried
out following a multilevel model for each dependent variable. This multilevel analysis had two levels of hierarchy: patients (level 1) and physicians (level 2) (Bryk and Raudenbush, 1992; Goldstein, 1995). This method has been used in health management studies undertaken by different authors, and its effectiveness has been proved (as opposed to other models, which do not take into account the hierarchical structure of data [Gatsonis et al., 1995; Leyland and Bosdy, 1997; Sixma et al., 1998]). The hierarchical model used in our analysis established a linear relationship between the outcome variable and patient and physician characteristics (Equation 1).

\[ Y_{ij} = \beta_0 + \beta_1 X_{ij} + \cdots + \beta_p X_{jp} + u_i + e_{ij} \] (1)

where \( Y_{ij} \) is the value of the outcome variable for patient \( i \), cared for by physician \( j \) and \( X_{ij} \), \( X_{jp} \) are the patient and physician characteristics. Moreover, two random effects were taken into account: one corresponding to the second level (\( u_i \)) and the other to the residual of the first level (\( e_{ij} \)). Both random components are distributed according to a normal distribution, with mean zero and variance \( \sigma_u^2 \) and \( \sigma_e^2 \), respectively.

In order to identify statistically significant predictor variables, a deviance change criterion was followed. The difference between the deviance of the model contained in the predictor variable and the same model without this variable was contrasted with a chi-square distribution, with degrees of freedom equal to the difference between the number of parameters to be estimated in both models. The level of significance used was 5%.

The unexplained variability rate caused by differences among physicians was calculated through an intraclass correlation — given by \( \sigma_u^2 / (\sigma_u^2 + \sigma_e^2) \). One minus the intraclass correlation is the degree of variance not explained in level one (i.e. caused by differences among patients (Goldstein, 1995)).

As with the ordinary linear regression model, it is possible to calculate the determination coefficient, \( R^2 \), for both levels. This coefficient measures the variability rate of the dependent variable, explained by the predictor variables of each one of the hierarchy levels. To do so, the variance of the explanatory model (with covariates) was compared to the null model (without covariates), following the methodology proposed by Snijders and Bosker (1994). In order to estimate the number of patients per physician, the harmonic mean was used. Its value was \( h = 38/0.0325 = 1167.88 \). Thus:

\[
\begin{align*}
R_1^2 &= 1 - \left( \frac{\sigma_u^2 + \sigma_e^2}{\sigma_{u_0}^2 + \sigma_{e_0}^2} \right) \\
R_2^2 &= 1 - \left( \frac{\sigma_u^2 + \sigma_e^2/h}{\sigma_{u_0}^2 + \sigma_{e_0}^2/h} \right)
\end{align*}
\] (2)

where \( R_1^2 \) and \( R_2^2 \) are the determination coefficients for level 1 (patient) and level 2 (physician), respectively, \( \sigma_{u_0}^2 \) and \( \sigma_{e_0}^2 \) represent the estimated unexplained variance for level 1 and level 2 in the null model, and \( \sigma_u^2 \) and \( \sigma_e^2 \) are the estimated unexplained degrees of variance for level 1 and level 2 in the explanatory model.

**Results**

**Characteristics of the study subjects**

During the data collection year, an average of 4.54 visits per patient took place (standard deviation [SD] = 5.12), in addition to 0.24 referrals to a specialist (SD = 0.54) and 0.37 requests for diagnostic testing per patient (SD = 0.81).

The average age of physicians in the study was 40 years; most were men (66%). Only 21% of them worked as centre director at the time of the study. On average, physicians devoted 6.5 minutes to each patient in open surgeries (SD = 1.78). Seventy-three percent of them devoted between one and two hours to patients in appointment-based surgeries, while 24% spent less than one hour and only 3% more than two hours with patients.

**Factors associated with variability in visits**

As a whole, ACG and physician characteristics explained 49% of the variability regarding number of visits. The intraclass correlation coefficient showed that 94% of the remaining variance, which was not explained by the multilevel model, is due to patient characteristics and 6% to differences among physicians. Most of the unexplained variability, therefore, is caused by differences among patients, and only a small percentage is due to professional characteristics (Table 1).

After analysing the results by levels, it was found that 49% of the variability among patients was explained by ACG factors. At the care level, physician characteristics explained 48% of the variance observed among professionals, but only the age was statistically significant, with an estimated regression coefficient of 0.083. According to this result, a physician who is 12 years older than another but has the same
Table 1  Multilevel analysis for visits

<table>
<thead>
<tr>
<th>Model</th>
<th>Level</th>
<th>Unexplained variance (SE)</th>
<th>Intraclass correlation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physician</td>
<td>1.595 (0.370)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>24.390 (0.151)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25.985 (0.399)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>All covariates</td>
<td>Physician</td>
<td>0.830 (0.193)</td>
<td>6%</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>12.367 (0.077)</td>
<td>94%</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13.197 (0.208)</td>
<td>100%</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Level</th>
<th>Covariate</th>
<th>Coefficient (SE)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All covariates</td>
<td>Physician</td>
<td>Constant</td>
<td>0.781 (1.257)</td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>0.083 (0.026)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gender</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>-0.297 (0.320)</td>
<td>0.353</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Director</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>0.041 (0.389)</td>
<td>0.916</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minutes devoted to patients</td>
<td>-0.125 (0.090)</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appointment-based surgery</td>
<td>&lt; 1 hour</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1–2 hour</td>
<td>-</td>
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<td></td>
<td></td>
<td></td>
<td>&gt; 2 hour</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>ACG</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Multilevel regression model without covariates. †Multilevel regression model including all covariates (age, gender, post held in health centre, minutes devoted to patients in each open surgery, time spent with patients in each appointment-based surgery, and ACGs). SE, standard error. Coefficients for ACGs have not been shown because there are too many categories; however, all were statistically significant.

Factors associated with variability in referrals to a specialist

A global analysis showed that ACGs and the post that physicians hold in their health centres are important variables in order to explain the number of referrals. The remaining professional characteristics studied in this paper were not statistically significant.

Most of the unexplained variability is due to patient characteristics (97%), while only 3% is caused by differences among physicians (Table 2).

In the analysis by levels, it was found that only 14% of the variability among patients could be explained by ACGs. At the care level, physician characteristics explained 41% of the variance observed among professionals, but only the post held by physicians in the health centre was statistically significant, with an estimated regression coefficient of 0.13. In light of this result, it can be asserted that the average number of referrals per patient per year is 0.13 times greater for health centre directors than for physicians in any other post with the same case-mix, controlling for the remaining physician characteristics.

Factors associated with variability in requested diagnostic tests

Of all professional characteristics, only the post held in the health centre was statistically significant in explaining the variability in the number of
Table 2  Multilevel analysis for referrals to a specialist

<table>
<thead>
<tr>
<th>Model</th>
<th>Level</th>
<th>Unexplained variance (SE)</th>
<th>Intraclass correlation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null model*</td>
<td>Physician</td>
<td>0.012 (0.003)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>0.285 (0.002)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>0.297 (0.004)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>All covariates†</td>
<td>Physician</td>
<td>0.007 (0.002)</td>
<td>3%</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>0.247 (0.002)</td>
<td>97%</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>0.254 (0.003)</td>
<td>100%</td>
<td>–</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Level</th>
<th>Covariate</th>
<th>Coefficient (SE)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All covariates†</td>
<td>Physician</td>
<td>Constant</td>
<td>0.048 (0.223)</td>
<td>0.829</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>0.002 (0.003)</td>
<td>0.505</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gender</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Male</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>–0.018 (0.030)</td>
<td>0.549</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Director</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>No</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>0.130 (0.040)</td>
<td>0.001</td>
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<tr>
<td></td>
<td></td>
<td>Minutes devoted to patients</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Appointment-based surgery</td>
<td></td>
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<td></td>
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<td>&lt; 1 hour</td>
<td>–</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td>1–2 hour</td>
<td>–0.058 (0.037)</td>
<td>0.117</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 2 hour</td>
<td>0.021 (0.091)</td>
<td>0.817</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
<td>ACG</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

*Multilevel regression model without covariates. †Multilevel regression model including all covariates (age, gender, post held in health centre, minutes devoted to patients in each open surgery, time spent with patients in each appointment-based surgery, and ACGs). SE, standard error. Coefficients for ACGs have not been shown because there are too many categories; however, all were statistically significant.

diagnostic tests. The intraclass correlation coefficient showed that 96% of the remaining variability, not explained by the model, is mainly due to patient characteristics, not studied in this paper. Only 4% of this variability is caused by differences among physicians (Table 3).

The results of the analysis by levels showed that ACGs account for 16% of the variability among patients, whereas 44% of the variability among physicians is explained by the variables considered in the second level. Of physician characteristics, only the post held in the health centre was statistically significant, with a regression coefficient of 0.215. According to this result, the average number of requested diagnostic tests per patient was 0.215 times greater for health centre directors than for other physicians with the same case-mix, controlling for the remaining physician characteristics.

For the three dependent variables, the intraclass correlation coefficient showed that more than 94% of the unexplained variance is due to other patient characteristics, not studied in this paper. Less than 6% of this variability in health service utilization is caused by differences among professionals.

Discussion

The results show that the ACG classification system is a useful tool in identifying primary care case-mix, as suggested by other researchers (Greene et al., 1996).

The multilevel analysis carried out here proved that most of the variability in service utilization, as measured through the number of visits, diagnostic tests and specialist referrals, is due to patient characteristics, and only a small
proportion is caused by professional factors. After adjustment for physician and ACG characteristics, the intraclass correlation coefficient enabled us to identify the proportion of variability which could not be explained by these variables and which is due to other characteristics not included in this paper. Because of the low intraclass correlation between the three models in level 2 (physicians), most of the variability not explained in health service utilization is caused by patient characteristics, and only a small percentage—less than 6% in all cases—is due to physician characteristics. As regards visits, 49% of the observed variability was explained by patient characteristics—measured through ACGs—and physician characteristics. Of the remaining unexplained variability, 94% is caused by other patient variables not studied in this paper, and only 6% to physician factors.

As for the two other outcome variables studied (number of referrals, and number of diagnostic tests), there was a noticeable decrease in the total variability regarding visits that could be explained by the model; however, as with the number of visits, less than 4% of the variance not explained by the model depended on factors related to professionals.

As for patient characteristics, ACG factors explained 49% of the variability in the number of ambulatory visits, 14% of the variability in the number of referrals and 16% of the variability in the number of complementary tests. Thus, there might be other patient characteristics apart from ACG factors, of a socio-cultural or social and health nature, which have not been studied in this paper and which could explain a great deal of service utilization. Some authors have come to a similar conclusion. For example, Starfield et al. (1991)
acknowledge that there is a certain variability within each ACG because of the severity of patient symptomatology. This variability is not included in the patient classification system and leads to an underestimation of the resources consumed by the more severe processes.

In our setting, physician characteristics can explain a small but significant percentage of the variability in health resource consumption. It is the first work carried out in the primary care environment in Spain with the aim of identifying and quantifying the influence of factors other than the state of a patient’s health in health service utilization.

There has been no other comparable research in our setting from which to draw comparisons, but we can rely on some work carried out in the American health system (Powe et al., 1996; Salem-Schatz et al., 1994; Stuart and Steinwachs, 1993; Weiner et al., 1991; Weiner et al., 1995). In the Salem-Schatz paper, which focused on the analysis of referrals from the first to the second level, patient physician and organization characteristics were analysed jointly. The authors showed that care pressure and ACGs could explain 24% of the variability in referrals to a specialist. The low explanatory power of these variables points to the same trend as marked by our study.

Of the physician characteristics studied in this paper, only age and the fact of being the health centre’s director (or not) were statistically significant when explaining health resource utilization. With respect to the number of visits, age explained most of the variability among physicians. For the number of referrals and the number of complementary tests, only the post held by professionals was statistically significant. As yet, we do not know how to explain this result; however, it is possible that directors in a health centre are more qualified than physicians holding other health centre posts. In Spain, the post of director is an elected one, chosen by his/her colleagues. Therefore a director is normally one of the best physicians at the centre.

Other studies focusing on the analysis of the number of visits have shown that the variable most influencing resource consumption is a professional’s training (Weiner et al., 1995). Bonal (1991) considers that interns and family physicians generate 5% more requests for analysis and 3% more requests for X-rays than other physicians. Greenfield et al. (1992) also presented similar results for adult patients with chronic diseases.

Different styles of practice vary with gender. Several authors have observed that women have better communication skills with patients than men, and a greater dedication to preventive activities, screening and treatment of psychosocial disorders (Bensing et al., 1993; Bonal, 1991; Hernández-Monsalve et al., 1992). This research did not find differences in health resource utilization among patients cared for by male and female professionals.

The greater dedication of time (in minutes) to each patient has been considered as one of the most significant achievements of our primary care reform in Spain. In this study, however, this variable does not predict an important change in the number of visits when other physician and patient characteristics are taken into account. This is why, when trying to determine service utilization, the way of using this time for physician/patient interaction could be more relevant than the actual time spent with patients.

One of the potential limitations of this study comes from the sampling technique used. Convenience sampling ensures the participation of subjects in the study; however, we cannot control for a possible systematic selection bias. Consequently, the study will have little external validity. It is unlikely, however, that patients assigned to physicians willing to participate in the study have social, demographic or clinical characteristics very different from those of non-participating physicians.

There is another aspect, related to the type of sampling, that can condition the results herein—registration of patient data. It is likely that participating physicians had more opportunity to register data on the study variables. Far from suspecting an over-registration of data on participating physicians, however, it is likely that there is an under-registration among the nonparticipating physicians. Consequently, our results could only be extrapolated to primary care physicians as a whole if the latter were aware of this issue and felt motivated enough to register their care activity systematically.

The type of participating professional is also an important factor. It is likely that physicians included in our study have a better disposition and professional attitude than those who were invited to participate in the study but refused. Yet, differences between professional practice
patterns are not always clearly different from those of physicians who have not been invited to participate.

Conclusion
This paper enabled us to highlight the fact that most of the variability in health service utilization in Spain is due to patient characteristics measured through ACGs, which constitute an important variable that needs to be taken into account when explaining the number of visits per year (even if it is not crucial either for the number of referrals or for the number of requested diagnostic tests). Other socio-cultural or social health variables not included in this study could explain considerably a certain level of service utilization. As for physician characteristics, the age of professionals and the post they hold in the health centre play an important role in explaining service utilization in primary care.

As a corollary of our findings, and since most of the unexplained variability is caused by patient characteristics, we suggest that future efforts at an in-depth understanding of conditioning factors in resource use are directed towards the development of registration systems that would allow the understanding of other patient variables. These may include the existence of social support networks, their degree of autonomy or their level of access to healthcare services.

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