Assessing the effectiveness of performance indicators in health organizations and professionals

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Bio Statements

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Abstract

Several questions have been raised regarding the credibility, and consequent real value, of the assessment of professional performance as a management tool, considering that there are reports of situations in which the professionals are being evaluated based on objectives to be accomplished rather on the excellence of the performance of its task. As such, this study aims to analyse the introduction of metrics for evaluating the performance of health professionals' performance indicators, and to identify the changes resulting from the introduction of performance indicators in the evaluation of physicians. Results reveal that physicians feel conditioned in the exercise of their professional activity by the need to comply with established performance indicators. Furthermore, it was also found that the cost reduction in primary health care may be insignificant when compared to the increase in secondary health care costs.

1. Introduction

The existence of extensive costs in the health sector, especially with the government share of the consumption of medicines, and their weight in the budgets of the most developed countries, has led to an increasing use of management tools in the health sector, with the clear objective of rationalising existing costs, creating a standard of action for health professionals who are faced with conceptually accepted situations as similar. The reason behind the introduction of performance indicators, in the evaluation of health organizations and professionals, is undoubtedly one of the most relevant issues in the universe of the National Health System, in Portugal and somewhat for all the most developed economies. We will then develop this issue, trying to identify the reasons that led to the gradual increase in the importance of these management tools and their introduction into this very specific sector of activity (Ferraro et al., 2020).

Using the statistical analysis technique called conjoint analysis, we will seek to assess whether doctors prescribe according to their convictions or, on the contrary, times when they are led to change their choice according to external stimuli or constraints. The presentation of the data resulting from this investigation demonstrates unequivocally the importance attributed by physicians to compliance with performance indicators as an attribute of a drug and how the evaluation of these performance indicators is conditioning the clinical practice of the physician (Varela & Dias; 2015; Costa et al., 2022b). We highlight a set of perspectives and opportunities that, properly explored, can provide the development of a correct assessment of the impact of the introduction of evaluation metrics at various other levels, in addition to the doctor's prescription. As such, the main objectives of this work are: (i) to understand whether the act of prescribing doctor is altered by the introduction of evaluation metrics and by the imperative need to meet them in the exercise of the choice of the drug to be used; (ii) to identify the hierarchies established in relation to the determinants of the medical act of prescription, after the introduction of evaluation metrics; (iii) to identify how these evaluation metrics may contribute to change the perceived quality of the national health system.

The article is structured as follows. Next section is dedicated to the literature review. Section 3 describes the research design and procedures. The results are presented in section 4, which is followed by section 5 where is detailed the validation of the analysis model. Finally, section 6 presents the conclusions.

2. Theoretical framework

We begin the literature review with the presentation of topics related to the evaluation of evaluation metrics, specifically in the health sector. We continue the literature review detailing the importance of generic medicine in a context of cost reduction in the health sector. We end with the presentation of practical measures of operationalization and articulation of the physician's prescription, with the promotion of generic and the use of evaluation metrics. Health care costs, which have grown significantly in the past decades (Baker and Rosnick 2005), and the quality of patient care are two of the most prominent concerns of public health officials today (Hung et al., 2019).

2.1. Research Gap

The reasons underlying the criteria for choosing the pharmaceutical product to be used in a given patient, after the correct diagnosis of the pathology to be treated, has for a long time intrigued several of those involved in the healthcare universe. Among the existing works known by the author, we highlight that of Green, Goldberg and Montemayor (1981), whose methodology we have now sought to follow, keeping the medical class as a target population, in order to know and validate the way in which the process of decision-making by the prescribing physician and the conditions to which he is subject, not leaving out of respect for the authors to consider their subsequent revisions and suggestions for improving the methodology they initially used (Green and Srinivasan, 1990).

It is also important to refer that at the time of the work by Green, Goldberg and Montemayor, no assessment metrics were defined that would condition the medical prescription act. Coscelli (2000) points out that a significant part of the existing literature on drug prescription focuses on the dimensions in which products differ, among others, the perceived effectiveness or brand awareness. Gonul et al. (2001) demonstrate that there is evidence that, in general, physicians' price sensitivity comes second, after medication efficacy and patients' condition. Carrera et al. (2018) suggests that physicians can perceive the price sensitivity of their patients and adjust their initial prescriptions accordingly, but only to response to a large and universal price change. Magno and Guzman (2019) find that in a developing healthcare system (...) drug prices play a substantial role in physician decision making and these findings have implications on policies encouraging generic uptake.

For Venkataraman and Stremersch (2007), a drug can be characterized by several attributes, such as the approved indications, its dosage, its potency, the method and frequency of administration, interaction with food and other drugs, its toxicity, its price, as well as its most evident characteristics, its effectiveness, and its side effects. The big question that we intend to answer is whether the physician is currently led to opt in some circumstances for medications that allow him to meet the objectives outlined for each evaluation metric, instead of opting for those that are based on conceptual or empirical knowledge and could provide better results in the treatment of their patients.

2.2. Conceptual model

As a model to follow for our research work, among the existing works and the author known, we highlight that of Green, Goldberg and Montemayor (1981), whose methodology we now seek to follow, maintaining as a target population the medical

class, in order to know and validate the way the decision-making process of the prescribing physician is structured and the conditions to which it is subjected , not leaving out the authors' respect to consider their subsequent revisions and suggestions for improvement to the methodology they initially used (Green and Srinivasan, 1990).

When the study of Goldberg and Montemayor (1981) was conducted, there were no defined evaluation metrics that conditioned the medical act of prescription, which allowed a doctor to prescribe a particular drug because it really considered that this is the most appropriate to treat the pathology of a patient. It now seemed pertinent to frame this recent problem in the set of determinants of the medical act of prescription, seeking to add some value to the research work carried out in this area to date.

2.3. Assessment metrics in the health sector

Bertoldi et al. (2011) said that "increased spending on the health sector is a concern worldwide. These increases are related to several factors, including the aging of the population, demographic movements and epidemiological outbreaks, new and expensive medicines, in addition to the increase in the technological component. Drug spending contributes significantly to increased health spending, and has been increasing at an even faster rate than so far." At the end of the conclusions of his work, Coscelli (2000) refers to the current efforts in several OECD countries to reduce public spending on medicines by increasing the consumption of generic medicines.

Bolich's (1979) work, referred to by Bearden and Mason (1980), at the time highlighted the controversy that is now current, putting the question in the size of drug-producing companies, stating that "among pharmaceutical companies it is stated that the records of efficacy of generic drugs produced by small pharmaceutical companies, largely unknown, are significant. There is a growing need to make efforts to find a set of solutions that allow the proper management of existing resources, reducing costs but maintaining the quality of health services provided to the community (Sousa, et al., 2021). These efforts include substantial investment in several interconnected initiatives to achieve quality improvement, including the development of different sets of clinical guidelines, service standards and practice, the development of appropriate planning, performance evaluation and evaluation metrics, benchmarking and results reporting at national level (Brown and Pirkis 2009).

Andel, Davidow, Hollander, and Moreno (2012) showed evidence that doctors respond positively when their rewards are linked to their performance. Referencing a study conducted by the University of Illinois at Chicago, they point out that a group of primary health care physicians opted for a compensation plan with a lower fixed salary and an appreciation of the number of consultations and medical acts, to the detriment of a higher fixed salary. The percentage of queries increased from 11% to 61%, with each query paid between $22 and $30. The most recognized evaluation metrics are those related to the activity developed, assuming that 90% to 95% of cases reach the objectives in the established time interval (Williams, 2013).

2.4. Generic as a determinant of cost reduction in the health sector

The prescription of a drug is a fundamental component of health care, being affected by related problems such as its cost and quality and by an ineffective response to administrative measures that appropriately combine these two issues (Kuperman & Gibson, 2003; Shamliyan & others, 2008). For Van Nuys et al. (2018) cost-related nonadherence is common and associated with increased medical services use and negative health outcomes.

To overcome cost problems, several containment solutions have been identified, standing out among the most common: (1) definition of drug forms (Huskamp and others, 2005); (2) priority change to generic medication (Patterson et others, 2005); and (3) co-payment institution (Gibson, Ozminkowski, & Goetzel, 2005). Of the various measures that have been taken a little everywhere, in order to reduce these excessive expenses, the appearance of generic drugs is precisely part of this strategy of reducing the amount spent on prescription drugs, thus reducing the health expenditure bill (Silander, et al., 2019). Nevertheless, it is found that the user is available to pay a higher price for a branded product even after its patent expires, for recognizing it superior efficacy in relation to the generic drug which has now entered the market (Cosceli, 2000).

Advocates argue that generics do not demonstrate the same pharmaceutical properties as branded medicines and are part of a globalised strategy to reduce the state budget bill with medicines, disregarding the efficacy and safety that any medicine should offer. They oppose generic producers, with the use of several comparative studies showing the bioequivalence of the batches of generics used, against the active ingredients of the original brand name medicines. They also add that the use of generic medicines provides the same degree of user satisfaction at a much lower cost than branded medicinal products for both the user and the national health system.

Several studies have shown (Aronsson and others 2001; Bergman and Rudholm 2003; Granlund and Rudholm 2008) that generic medicines are generally marketed at prices lower than branded medicinal products and that their introduction has the effect of the generalreduction in the prices of medicinal products. Hellström and Rudholm (2004) however demonstrated that "when the market share of generic medicines increased, the number of side effects reported to health authorities also increased".

2.5. Operationalization of the cost reduction process in the health sector

For Shamliyan, Duval, Du, and Kane (2008), it is clear that any measure to contain the escalating costs in the health sector requires the intervention of the medical class. When these do not meet the desired reduction, in other cases, the achievement of cost reduction targets has resulted in certain situations in a decrease in the quality of health care. One form to promote the use of evaluation metrics is the use of electronic

recording systems of the clinical practice of physicians (Delpierre et al., 2004; DesRoches et others., 2008; Shamliyan et others., 2008; Wolfstadt and others., 2008).

The voluntary adoption of electronic registration systems of the clinical practice of physicians by health professionals can be sustained up to a certain level by governmental measures expressed in this sense (Goldman, 2009). The insurers were an example in the leadership of this process by encouraging the use of generic drugs in the plans presented, granting greater benefits to those who opted for this treatment solution to the detriment of branded drugs (Berndt, 2002; Phelps, 2003; Costa et al., 2022).

They simultaneously started a process of changing prescription habits and consequent cost reduction by circulating information on the existence of generic drugs alternative to brand-name drugs, monitoring the prescription patterns of each physician and developing forms of medications for preferential use in the workplaces of physicians under their influence (Rice, 2011). Andel et al., 2012 show that physicians respond strongly to incentives, even if marginal, when they are directly linked to their overall remuneration. For Lexchin and Fugh-Bernan (2021), the ultimate solution is to eliminate all industry relationships from the practice of medicine. This finding can undoubtedly be considered the perverse effect of a measure that no one will dare to contradict as to its initial goodness. In turn, when assessing trends in the specific service of drug use internally and establishing comparison with external examples, stimulating prescribing practices similar to those of institutions with a high level of performance, Oʹ Neal, (2012), demonstrates to have achieved better results of patient care and the desired cost reduction.

3. METHODOLOGY

3.1. Research design

This research aims to make some contribution to understand whether the use of management tools, such as performance assessment metrics in this case, are currently being considered by doctors when prescribing a medicine in their daily professional life and, furthermore, identifying the extent to which the choice of that medicine is conditioned. We will also try to identify how the choice of attributes that determine the physician's prescription is hierarchised at this time, establishing the points of divergence, if any, in view of what happened before the introduction of performance evaluation metrics. One of the shortcomings already identified in relation to this work is the inability to assess and quantify to what extent the quality of primary health services and the treatments provided will be affected using assessment metrics in the health sector and the alleged change in the prescribing habits of doctors working in family health units.

3.2. Target population

The target population study of this research has some particularities, since it consists of individuals who exercise the power of choice of a particular drug to be used by a third person, the user of the health unit where the doctor carries out his activity. This justifies the choice by the part of the population that operates in USF, since more than on doctors who work in a hospital environment, it is on these that the scrutiny of their individual activity will be carried out and as an integral part of a multidisciplinary team with objectives to be fulfilled in each time space. In 2012, there were a total of 43,863 physicians in Portugal, of which 31,773 are specialist physicians and the remaining 16,441 have no assigned specialty, a group that includes general practitioners who do not have the specialty of general and family medicine (PORDATA, 2021).

3.3. Methodological approach and hypotheses

Our research made use of two exploratory surveys that were used to select a number of relevant values and determine their hierarchy. We also chose the statistical method that best suited the objectives defined. Based on the statistical method, we were able to rank the values that were most relevant to this analysis. At the end of our work, we describe the data collection process used on the doctors polled. As already mentioned in chapter one, the model to be followed for our research work was that of Green, Goldberg and Montemayor (1981), whose research methodology in the phases of collecting and statistical processing of information, we now seek to follow, keeping as target population the medical class, and the conditions to which it is subject, not neglecting the authors to consider their subsequent revisions and suggestions for improving the methodology they initially used (Green and Srinivasan, 1990).

Using the technique of statistical analysis called conjoint analysis, the same used by the aforementioned authors, we will seek to assess whether the existing perception among the medical class regarding their behavior as prescribers is actually correct and finds correspondence in the act of prescribing per se, that is, do doctors actually always prescribe according to their convictions, or, on the contrary, are there times when they are led to change their choice, depending on external stimuli or constraints?

The option for the statistical analysis technique of conjoint analysis allows the researcher to answer questions such as: (i) Which product features are or are not important to the consumer?; (ii) What levels of product features are most, or least, desirable in the consumer's mind? The virtue of conjoint analysis is to ask the respondent to make choices in the same way that the consumer presumably makes – choosing features, one over the other – trade-offs.

The respondent's task is to order or evaluate each profile, which constitutes a product containing its most relevant basic characteristics, from the most important to the least important, depending on the proposed assessment scale. From these rankings or assessments, the joint analysis identifies utility values for each modality, for each variable, considering the responses of all individuals in the sample. These utility values can be used to identify the relative importance of each variable in choosing a product.

This is an important aspect of joint analysis. As in other experimental models, the intention is to select only those factors (independent attributes), which are believed to influence the subject's choice the most (the dependent variable).

Even after careful selection of factors (attributes) and modalities for the study, the number of cases to be evaluated in a meaningful way is often excessive. For a case in which we had five attributes, each with three preferred modes, we would have to study 243 cases (3x3x3x3x3) – clearly too many to make its execution possible, while maintaining the necessary and indispensable objectivity. Fortunately, as an alternative to the full factorial model, we can use an orthogonal model – a subset of all possible combinations that allows us to estimate the utilities for all selected attributes.

While it is true that the estimate improves as the number of profiles increases, the information is not lost by omitting some combinations. This is because the identified utilities for each level of each variable can be extrapolated to equate the combinations that were not evaluated by the respondents. By default, SPSS generates a minimum number of cases necessary for the orthogonal model according to the needs for estimating the utility of the attributes. This number can be increased or decreased according to the specific needs of each study.

The questions we will try to answer are:

1. Is compliance with performance evaluation metrics considered by the physician in the act of prescribing?

2. Does the fact that the physician is focused on meeting the assessment metrics change their prescribing habits?

3. The fact that the doctor changes his prescription habits, could it affect the quality of the treatment given to the patient?

The model developed includes data from two ancillary studies and data from a main study, and includes the following hypotheses:

H1: The perception of physicians in relation to the way they rank the attributes of the medication they prescribe is matched in their daily clinical practice;

H2: Physicians are aware of the need to achieve the objectives of the proposed evaluation metrics;

H3: The need to achieve the goals of the proposed evaluation metrics will affect the physician's prescribing habits;

H4: Changes in physician prescribing habits are influenced by socio-demographic attributes.

3.4. Exploratory Surveys

We began by identifying the values doctors relied on when determining which pharmaceutical product to prescribe. First, we used a sample of 25 randomly chosen doctors who through individual interviews provided us with a list of the main attributes a product must display to be a prescription candidate.

The results of their unprompted answers yielded the following results. Price (8 times quoted), Eficacy (5 times quoted), KPI Achivement (4 times quoted) and the Company Institutional Brand (2 times quoted); Previous Experience with Product; KOL; Sales Rep; Safety; Patient´s Choice; Scientific Evidence. Since it was important to determine which of the attributes were most relevant to the decision-making process, we shortened the list to including only factors deemed important by at least three doctors. This produced the following short-list: Efficacy; Price; KPI; Company Institutional Brand.

To validate the first impression, we subsequently asked the same 25 physicians to define a hierarchy relative to the previous choices, considering the 10 attributes mentioned by the participating group as the most important in defining the medication to prescribe to the patient. To do so, they should attribute, during the choice process, 4 points to the most important attribute, 3 points to the second most important attribute, 2 points to the third most important attribute and 1 point to the fourth most important attribute. The sum of the total values obtained for each attribute allowed the following global result to be obtained for the established preference relationship:

Figure 1 - Hierarchical List of Most Valued Attributes in Choosing a Medicine
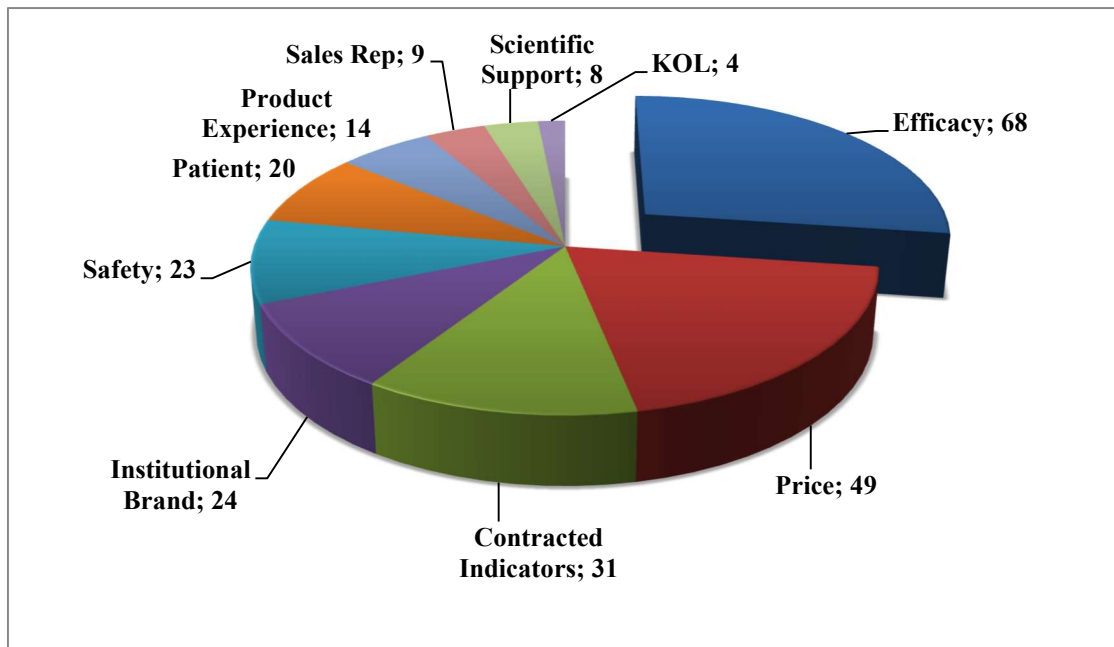
It is from this hierarchy of attributes that, as we will see later, we will structure our data collection process, with the target population of this work.

3.5. The choice of attributes used in the data collection process

The option for joint analysis, as a statistical analysis technique for the treatment of data collected from the sample of the target population of this investigation, requires the limitation of the number of attributes to be considered in the elaboration of the questionnaire used.

Based on the aforementioned exploratory study, let us recall the four attributes that were mentioned as the most important in choosing a drug to be prescribed by the physician and that will allow us to meet our goals:

• Effectiveness (68 points out of 250 possible);

• Price (49/250);

• Contracted Indicators (31/250);

• Institutional brand (24/250).

Note that these four attributes together reach 68.8% (172/250) of the total points awarded, which translates into an acceptable margin of safety in their use, as a representation of the real importance given to them by physicians in your professional daily life.

The **Efficacy** of a drug is directly related to the pharmacodynamic properties - the mechanism of action, and the pharmacokinetic properties - absorption and bioavailability, of the active substance of the administered drug.

Price, at a time when there are more and more constraints in relation to drug costs, as we have already seen in the chapter dedicated to the bibliographic review, would almost necessarily have to be included in the list of attributes referenced by physicians, so often with that they will have to struggle with this concern in their daily activity. Hellerstein (1997) assesses physicians' preferences comparing branded products versus generic products and concludes that physicians prescribe more generics to patients who belong to some health subsystem, with the lower price of the generic product being the determining factor for this to happen.

Contracted Indicators are, as the theme of this investigation announces, the attribute on which this work is structured, since it is through their compliance that physicians will see their performance more or less valued, with all the consequent consequences for the corresponding financial recognition and possible career progression.

In the context of this work, it is intended that the responding physician, in the case of always keeping in mind the fulfillment of the objectives of the contracted indicators (metrics), when defining the medicine to prescribe to a user, choose the 100% value, which represents the concern in fully achieving the objective set for it.

In case the physician does not base his choice in relation to the medicine to be used in his clinical practice, on the fulfillment of the objectives of the contractual indicators (metrics), but does not fail to integrate them in his decision process, he must choose the value 50% . Finally, physicians who do not care at all about meeting the objectives of the contracted indicators (metrics) should opt for the 0% value.

The choice of indicators to be contracted should take into account the prevalence of problems, their importance (severity), the impact on costs (efficiency), health, quality of life and citizen satisfaction.

These Contracted Indicators will still be for many health professionals and especially for the class that is the object of study in our research, a problem to overcome, more than a true management tool whose main mission is to define excellence objectives, the means to achieve them and correct any deviations from the defined targets.

The practice of primary health care, centered on Indicators, happens when there is a predominant concern with the areas assessed by the Indicators (i.e. more restricted and more tapered, instead of the globality, characteristic of primary health care); and when you are more concerned about reaching high goals, focusing on tasks that require high effort rates.

The concern will shift to clinical areas related to the indicators (more than with people), with the risk of being less careful in following up on other health programs.

The **Institutional Brand**, in the health area, must be understood as the guarantee of the quality of the medicine to be used by the physician, both in a situation of continuity and in a situation of initial experimentation. As Moss and Schuiling (2004) recommend, it is essential to create brand names that are related to corporate brands and not exclusively to products – there is a need to create strong corporate brands with a clear brand identity, because both physicians and patients seek assurance quality and security that the corporate brand can provide.

Powerful brands also generate trust - a critical success factor for pharmaceuticals that impact human health. As Janakiraman and Others argue in their 2008 work, it is important to note that there is a marked tendency for physicians to prescribe the same substance to different patients, simply because it was the substance previously prescribed. Now, if there is trust in a product of a certain company, logically the tendency will be to generalize this trust to all brands of that company, reducing the desire to change. In order to establish a differentiated pattern of choice, on the cards presented to the responding physicians, we selected three institutional brands of laboratories that have been commercially active in Portugal for at least two years.

3.10. The methodology for collecting information and the structure of the model used

The process of gathering information for the joint analysis was carried out between December 2018 and May 2019. For data collection, the valuable collaboration of some

sales representatives was used, who carry out their professional activity by detailing the most pertinent information about the medicines of their companies with the doctors of the family health units.

For this purpose, they were previously informed about the interview model to be followed during individual contact with prescribers, in order to ensure convergence in the data collection to be carried out by all interviewers and to avoid that the individual attitude of each one could influence the type of answers obtained. The interview process consisted of the presentation by each medical information delegate, to the responding physician, of a set of twenty cards representing the profile of a product based on the four attributes mentioned above, each comprising three different levels.

As mentioned in a previous phase of this work, the different modalities presented for each of the four attributes sought to establish a balanced relationship between them, close to that existing in the daily life of the prescriber. When we are faced with attributes such as efficiency (60%, 75% and 90%) and price (30, 60 and 90), the intervals between the three modalities, to be representative of a competitive added value, must be necessarily wider. that justifies the use of one product over another. The definition of the number of cards to present to the doctor results from the application of the formula used to calculate the number of cases to be considered, that is:

3 (price levels) X 3 (importance levels of contracted indicators) X 3 (effectiveness levels) X 3 (institutional brands)

So, we would have a total of 81 cases to present to the physicians responding to the questionnaire, something that would be impractical due to the inherent delay in each of the interviews, as well as the objectivity of their ordering. The use of the SPSS program allowed us, through the creation of an orthogonal plan (see annex), to reduce the valid cases to a total of 20, including 4 holdouts. It is important to mention here that, despite having managed to reduce the number of cards used in the process described above, from 81 to 20, this type of interview lasted an average of 30 minutes, which had some impact on the length of the period established for the work of field, since it lasted for almost six months.

Then, the responding physician should sort the 20 cards presented in descending order of importance, which included the 4 holdouts, considering that each one of them would represent the profile of a pharmaceutical product to be prescribed in the previously diagnosed pathology. Each interviewer, in this case the sales representative, without ever interfering in the respondent's choices, would then be responsible for recording the preferences expressed, in a form suitable for this purpose, as well as collecting from the doctor , the name (optional, since the physicians were identified by the initials of their first name and surname only in order to differentiate the answers in the process of collecting them), age, and Regional Health.

4. **RESULTS**

Regarding gender, there was a balanced distribution between the responding physicians, 59 (49,6%) women and 58 (50,4%) men, which somehow reflects the reality we find in the Portuguese universe of the medical profession. Regarding the age of respondents, there was a predominance of subjects in the age group under 40 (35%; n=41), while the over 60 age group was the least represented (5%; n=6).

The frequency analysis of the first preference indicated by clinicians (Table 1) reveals that the preferred product profiles are those represented by the profiles of card 17 (holdout) and card 6, which does not fail to indicate the vectors that guide your choices, that is, orientation towards a product profile: with as low a price as possible; that allows the performance indicators to be met; with the highest efficiency belonging to a reference company.

Table 1- Frequency of doctor´s 1st choice

Cards	Frequency	Percentage
2	1	0,9
4	4	3,4
6	49	41,9
7	6	5,1
10	4	3,4
15	2	1,7
16	1	0,9
17*	50	42,7
Total	117	100,0

*Holdout

The utilities for each level of each attribute were calculated using clinicians' preferences (Table 2), and it can be said that the greatest utility attributed by clinicians (card 7) is for a product with a high price, with high performance indicators, with efficacy high and MSD brand.

Table 2 - Value of utilities for each profile

Card Number	Price	Performance Indicator	Eficacy	Brand	Utility
1	90	50	60	Krka	1.34
2	90	100	90	Krka	10,233
3	90	50	75	MSD	7,194
4	30	100	75	Tecnifar	10,56
5	60	100	75	Krka	7,915
6	30	50	90	MSD	12,589
7	90	100	90	MSD	12,744
8	90	0	75	MSD	4,988
9	90	100	90	MSD	12,744
10	30	100	60	MSD	8,108
11	60	0	90	MSD	9,358
12	90	0	60	Tecnifar	0,754
13	60	50	90	Tecnifar	10,673
14	60	100	60	MSD	7,083
15	30	0	90	Krka	7,782
16	90	100	90	Tecnifar	11,853
17*	60	100	90	MSD	25,623
18*	60	100	60	Krka	4,572
19*	90	50	60	MSD	3,851
20*	90	0	90	MSD	8,332

As we can see in the analysis of the general framework of results for the entire sample, given the estimated utilities presented, we would be in the presence of the ideal product to prescribe if it belonged to MSD, cost 30 Euros, allowed to comply with the performance indicators at 100% and had an effectiveness of 90%.

As the option mentioned is not available among the profiles of the model, the choice of physicians focused on the profiles that were closest to the best option in conceptual terms. Thus, profiles 17 and 7 were more often preferred, that is, those with a higher value for the expected utility. Table 3 shows the relative importance of the attributes studied in the model. Attributes with higher utilities naturally assume greater importance for the model in question. In exact values, we will have the following relative importance for each attribute, manifested by the sample of the studied population:

Table 3 - Relative Importance of model´s attributes

	Relative importance
Brand	16,093
Price	14,964
Performance indicators	28,715
Efficacy	40,227

These values result from the quotient between the sum of the importance attributed by everyone to each of the attributes and the number of individuals in the sample. We thus found that the sample of physicians selected for this investigation demonstrates a clear concern with the effectiveness of the medications they use in their patients. This result validates the hypothesis1 defined for the study, that is, the perception of physicians in relation to the way they rank the attributes of the medication they prescribe, has a correspondence in their daily clinical practice.

At the same time, the importance attributed to compliance with performance indicators as a determining attribute in their clinical practice, with a relative importance almost equal to the sum of the relative importance of the brand and the price (Graph 8), clearly underlines how this attribute is considered in the choice of a drug for the user of family health units of the national health system. Furthermore, if we specifically consider the usefulness in the model of each level of the performance indicators attribute (Graph 6), we find that physicians totally reject the possibility of not fitting their prescribing habits into the minimum compliance with the established indicators. This issue is evidenced by the fact that physicians attribute a 0% utility to the level of total disregard for performance indicators in their clinical practice. Thus, hypothesis 2 is confirmed, physicians are aware of the need to achieve the objectives of the proposed evaluation metrics.

The appearance of performance indicators, as an attribute considered in the prescription of a drug, is the observation that physicians change their prescription depending on their compliance, changing the traditional hierarchy of the most valued attributes so far, by the introduction of a variable so far not considered for this purpose. Thus, hypothesis 3 is confirmed, the need to achieve the objectives of the proposed evaluation metrics, effectively alters the physician's prescription habits.

5. Validation of the Analysis Model

The correlation between the estimated preferences and the observed preferences of the different profiles presented proved to be strong and significant, Pearson's and Kandall's Tau having the same behavior also been observed in the holdout profiles (Kendall's Tau). These results reveal that the factors considered fit properly to the proposed model.

The importance of the four holdouts used to validate the results, which allowed confirming the hierarchy of preferences expressed by physicians and registered in the model, is highlighted here. Regarding the adjustment of the analysis model considered, we can verify that there is a strong correlation between the utility values predicted by the model and physicians' preferences for each product profile (card), and that this is statistically significant (Table 4). Thus, we are faced with an appropriate model to explain the prescribing behavior of physicians.

Table 4 - Description of the correlation between model attributes

	Value	P-value
Pearson's R	0,984	0,000
Kendall's tau	0,941	0,000
Kendall's tau (Holdouts)	1,000	0,021

Outlier Clinicians

The adequacy of the analysis used allowed the identification of a high number of clinicians whose marked preference is opposed to the expected preference (reversals). In the model, 52 clinicians are identified who presented a "reversal" profile, that is, they manifest a preference contrary to the existing common logic. Regarding the efficacy factor, there are 3 clinicians who prefer products with less efficacy. We identified 30 clinicians prefer higher priced products and 19 clinicians prefer products that give them lower compliance rates for performance indicators.

Characterization of the segments found: socio-demographic attributes

Next, we will try to identify which socio-demographic attributes can influence physicians' preferences and how they do so.

Influence of the ARS sub-region on physicians' preferences

To assess the possibility that the first preference indicated by clinicians depends on the ARS sub-region where clinicians exercise their activity, the chi-square test ($\chi 2$) with Monte Carlo simulation was used, considering a probability of error of 0.05. At a descriptive level, it was observed in the ARS Lisboa and Vale Tejo sub-region, a greater number of clinicians who preferentially selected card 6 (26.5%) and card 17 (16.2%) as their first preference. In the other subregions the same type of behavior was observed, except for the ARS Centro subregion, in which clinicians preferentially selected card 17 (Table 5).

However, inferential statistics allow us to state that the first preference expressed by clinicians is independent of the sub-region where they exercise their activity ($X2=0.222$; $p=0.216$).

Table 5 - Chi-Square Test with Monte Carlo simulation

	Card	ARS Lisbon Vale Tejo n (%)	ARS North n (%)	ARS Alentejo n (%)	ARS Algarve n (%)	ARS Center n (%)	Total n (%)	P-value
First preference	4	1(0,9%)	1(0,9%)	2(1,7%)	0(0%)	0(0%)	4(3,4%)	0,202
	6	31(26,5%)	10(8,5%)	4(3,4%)	3(2,6%)	2(1,7%)	50(42,7%)	
	7	2(1,7%)	0(0%)	1(0,9%)	1(0,9%)	2(1,7%)	6(5,1%)	
	10	1(0,9%)	2(1,7%)	0(0%)	0(0%)	1(0,9%)	4(3,4%)	
	15	1(0,9%)	0(0%)	1(0,9%)	0(0%)	0(0%)	2(1,7%)	
	16	0(0%)	0(0%)	1(0,9%)	0(0%)	0(0%)	1(0,9%)	
	17	19(16,2%)	12(10,3%)	9(7,7%)	3(2,6%)	7(6%)	50(42,7%)	
Total n (%)		**55(47%)**	**25(21,4%)**	**18(15,4%)**	**7(6%)**	**12(10,3%)**	**117(100%)**	

Influence of gender on physicians' preferences

To assess whether the first preference indicated depended on the gender of the clinicians, Fisher's exact test was used, considering an error probability of 0.05. At a descriptive level, it was observed that in both genders there was predominantly the choice of cards 6 and 17 as the 1st preference. However, inferential statistics allowed us to state that clinicians' first preference is independent of gender ($X2=0.290$; $p=0.920$) (Table 6).

Table 6 - Fisher's exact test

First Preference	Card	Gender		Total n (%)
		Masculine n (%)	Feminine n (%)	
	4	1(0,9%)	3(2,6%)	4(3,4%)

6	25(21,4%)	25(21,4%)	50(42,7%)
7	4(3,4%)	2(1,7%)	6(5,1%)
10	2(1,7%)	2(1,7%)	4(3,4%)
15	1(0,9%)	1(0,9%)	2(1,7%)
16	0(0%)	1(0,9%)	1(0,9%)
17	25(21,4%)	25(21,4%)	50(42,7%)
Total n (%)	**58(49,6%)**	**59(50,4%)**	**117(100%)**

Influence of age on physicians' preferences

To assess whether the first preference indicated by clinicians depended on their age, the chi-square test (χ2) with Monte Carlo simulation was used, considering an error probability of 0.05. At a descriptive level, it was observed that, in any age group, clinicians mostly selected card 6 or card 17 as their first preference (Table 7).

Table 7 - Chi-Square Test with Monte Carlo simulation

	Card	< 40 years n(%)	40-50 years n(%)	51-60 years n(%)	> 60 years n(%)	Total n (%)	p-value
First preference	4	2(1,7%)	0(0%)	2(1,7%)	0(0%)	4(3,4%)	
	6	16(13,7%)	15(12,8%)	18(15,4%)	1(0,9%)	50(42,7%)	
	7	1(0,9%)	5(4,3%)	0(0%)	0(0%)	6(5,1%)	
	10	2(1,7%)	1(0,9%)	1(0,9%)	0(0%)	4(3,4%)	
	15	2(1,7%)	0(0%)	0(0%)	0(0%)	2(1,7%)	0,215
	16	0(0%)	0(0%)	1(0,9%)	0(0%)	1(0,9%)	
	17	18(15,4%)	11(9,4%)	16(13,7%)	5(4,3%)	50(42,7%)	
	Total n (%)	**41(35%)**	**32(27,4%)**	**38(32,5%)**	**6(5,1%)**	**117(100%)**	

Conclusion on the Influence of socio-demographic attributes on physicians' preferences

After analyzing these three sub-chapters, it is shown that socio-demographic attributes, such as the place (ARS) where they work, gender or age, do not influence the first

choices of responding physicians, considering the product profiles presented. Thus, we reject hypothesis 4, considering that it has not been demonstrated that the change in physician's prescribing habits is influenced by socio-demographic attributes.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Theoretical contributions

After discussing the results and touching on the main points of this research, it is now crucial to compare them with the literature review to deepen the conclusions of this study. The presentation of the data resulting from the present investigation unequivocally demonstrates the importance attached by doctors, who exercise their professional activity in the context of a family health unit, to compliance with performance indicators as an attribute of a medicine, thus contributing to filling the gap in relation to the way in which the evaluation of these performance indicators is conditioning the physician's clinical practice.

There are a number of perspectives and opportunities that, duly explored, may provide the development of a correct assessment of the impact of the introduction of evaluation metrics at several other levels, in addition to the doctor's prescription. The quality perceived by users, the total cost of the health sector, the relationship between spending on primary health care and spending on secondary health care, may, among others, be topics of genuine interest for future investigations.

6.2. Managerial implications

The objective of this investigation was to identify, as clearly as possible, whether the use of evaluation metrics in a distinct professional class such as the medical class and in a sector of activity as sensitive as that of health, conditions or not the medical act of prescribing and in if so, also identify the degree of importance that the physician attaches to compliance with the defined assessment metrics.

After analyzing the results obtained, we believe it is pertinent to admit that it has been possible to demonstrate that the choice that the doctor makes regarding the product to be prescribed respects the noblest principle of the exercise of his profession, to treat the patient with the most effective medication. However, as we wanted to demonstrate, this choice is currently highly conditioned by the introduction of evaluation metrics in primary health care organizations.

We were also able to understand from the analysis of the results of this work that the theoretical perception that doctors have in relation to the weight of performance indicators in their prescription is clearly inferior to the value they actually attribute to it in their professional daily life.

When we look at the strongest reasons invoked by the medical profession to support their prescription, the effectiveness of the product and compliance with established performance indicators, we are led to conclude that professionals in this class nowadays seek, above all, the obtaining high success rates with the therapeutic means available to them, but there is also a latent concern with meeting the objectives of the established performance indicators, which directly contribute to their evaluation index as a health professional, with implications for their monthly remuneration and career progression.

If the question of the importance of the efficacy and safety of a pharmaceutical product has, over the years, generated consensus among the authors of the various works published on this topic, the valuation of performance indicators by the prescribing physician is unequivocally a variable that only more recently began to be considered in the process of choosing a drug. What results from this investigation is the deep conviction that efficacy and performance indicators gain a new projection as attributes that determine the medical act of prescribing, clearly overlapping the price and the institutional brand in terms of importance for the prescribing physician. .

In this way, it will make sense to focus efforts on trying to understand how the change in physician prescribing habits is affecting drug prescription costs in the national health system. It will also be important to assess whether, in the medium and long term, there will not be a process of transferring costs from the primary health care sector to the secondary health care sector. We believe that the existence of groups of physicians for whom the considered attributes have significantly different importance has been demonstrated here.

6.3 Limitations and future/further research

The lack of research that specifically addresses the issue of ranking the attributes that define the prescribing physician's preference, including the use of metrics to evaluate the physician's own performance as one of these attributes, is undoubtedly a limitation to this work, because the existence of such references could somehow serve as a term of comparison for this work and would serve as a guideline in situations that eventually need some contribution to its validation.

Even so, even with the absence of this guideline, it was possible to achieve the objectives we set ourselves and to give third parties the possibility of having a base structure for future investigations on the topic now presented. The author would also like to have had a broader sample base than the one presented, especially with regard to professionals from the Northern Regional Health Association. However, the complexity of the type of interview required by the statistical model chosen for the validation of the proposal presented in this work, as well as the average duration of each interview, estimated at around 30 minutes, and the degree of proximity required between interviewer and interviewee. To get the doctor to express his preferences regarding his prescription, some of the currently existing tools could not be used to carry out the

questionnaires remotely, which in another context could have contributed to the increase in the number of respondents.

It is important to point out that only doctors who work in family health units were considered in this work. In the future, physicians who work in personalized healthcare units or in a hospital environment may also be included in future investigations, to provide a more comprehensive view of the national healthcare system in Portugal. We can still consider a limiting factor, the number of attributes considered in this work, although this stems from the use of conjoint analysis as a statistical method. Although this is a particularly appropriate technique to assess the degree of importance of attributes considered relevant in a context close to reality, it tends to limit the number of attributes to consider under penalty of losing the objectivity that should guide this type of work.

The results obtained will always be more reliable the smaller the relevant attributes. In this study, as already mentioned, we only considered the four attributes initially indicated by the doctors as being decisive in the medical act of prescribing. It has been shown that there may be other attributes with decisive weight in the decision-making process of prescribers, which in future investigations may be used using a combination of attributes that is partially different, or increased, in order to be able to cross-reference the information now obtained. with another to be obtained in future investigations.

It was outside the scope of this investigation, since it wanted to maintain its objectivity, the evaluation of the economic impact, which the introduction of evaluation metrics to health professionals may have downstream, in terms of the total costs of the national health system. This investigation is not intended to be the closing of a cycle, but a starting point for other works that, in a positive way, intend to contribute to an increasingly rational use of existing resources in the health sector in Portugal.

We believe that the foundations will have been laid for future investigations to seek to assess the impact of the introduction of evaluation metrics on the quality of the national health service perceived by its users and by the professionals on whom these metrics apply. It will also be important to assess in future works whether the main objective of introducing evaluation metrics in the organizational context of the national health system – the reduction of costs in the health sector – is being achieved, to what extent and with what consequences for all. those in which they are directly or indirectly related to it. This type of information will be essential, even so that the highest government bodies can make the necessary corrections, if necessary. Since this is a project in relation to which no one will dare to question its evident relevance, it is important to make known the advances that have been achieved, otherwise there may be a demobilization on the part of all those involved in this true undertaking (Pereira et al., 2021).

It was not the object of this work to understand whether the more rational management of existing human resources actually leads to an effective reduction in the costs associated with primary health care in the first instance and whether there will be a

transfer of these costs to secondary health care. Thus, this will undoubtedly be an interesting theme for future research in this area, which will also be an important aid in defining future strategies for the Portuguese national health system. In this perspective, we are convinced that it is possible to consider several of the conclusions drawn from this investigation as interesting and the purpose achieved of laying the foundations for the continuity or further complementarity of the topics discussed here.

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