Contracting Support System for PHC Health Units

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Abstract

This work develops a contracting support system for Primary Health Care (PHC). The system is based on multicriteria evaluation techniques, in particular by combining a means-ends network with the MACBETH approach. This system was designed in order to support Portuguese Family Health Unit's (USF) decision-makers, in real contexts of contracting, in the selection of the performance indicators that have the greatest impact on its user's health and the choice of their respective targets. The process starts by structuring, through a means-ends network, the link between performance indicators and objectives of PHC provision. Based on this map, a multicriteria model was built to evaluate each indicator contribution to the system's objectives, followed by the modulation of the effort associated with the obtained result in each indicator. The effort is captured by the acts that are closely related to the indicators, being afterwards used in a linear optimization method to define how USFs can allocate their resources in order to maximize their performance. The system was designed in a general way, presenting, however, flexibility to be customized to the characteristics of each PHC health unit. As a result, after the application of the developed methodology to Villa Longa USF, with custom developed software, was possible to determine the set of indicators, targets and acts that have the most potential to maximize the value created by the USF, fostering greater transparency, flexibility and celerity in the contracting process.

Keywords: Primary Health Care, Decision Support System, KPI Prioritization, Performance Evaluation

1. Introduction

Primary Health Care (PHC) represents the first level of contact for most of the population with the National Health Service (NHS), thus constituting an important first element of a continuing process of health care. Given its importance and necessity of evolution, they suffered in 2005 a reform that led to the creation of Family Health Units (USF) and three years later to Health Centers Agroupments (ACES). In 2009, it was operationalized a contracting process between these units by selecting a set of performance indicators, belonging to a list provided by the Central Administration of the Health System (ACSS), and the establishment of objectives for each indicator.

Each year, these objectives are established between ACES and USF, being the process formalized through the signing of a letter of commitment. Indicators with a degree of compliance above 90 % are considered for the calculation of an overall performance index (IDG). From a certain value of this index, an institutional incentive is assigned to USFs, being their professionals recompensed as well, if the unit belongs to the model B.

Since a few years have already passed since its operationalization, the contracting process is naturally facing new challenges, being of utmost importance to solve them for it to reach maturity and thus fulfill the objectives that led to its creation.

The contracting process in CSP has developed itself, for example, by providing a larger number of indicators and by creating tools that enable the comparison of performance between units.

However, there is still no correspondence between the mission of PHC and the available indicators, with regard to obtaining health gains. Thus, it's not clear, for a given USF profile, what are the set of indicators from which a performance improvement would result in greater health gains for the population. It's consequently not clear the allocation of resources that would provide the greatest efficiency and efficacy to the unit.

Furthermore, the effort required to achieve the established performance improvements it's also not considered. Consider that a particular USF has an upper limit in terms of effort (eg, working hours of its professionals), and that the effort required to improve performance may vary depending on the

type of indicator, its starting value and the objective value. Thus, for a given capacity of effort, it is necessary to equate the best combination of indicators and objective values that result in better overall performance and greater health gains. With this method, the contracting of the various target values becomes a reasoned process, based on the calculation of realistic efforts and integrating the various indicators into account.

In this paper it is developed a system that finds its motivation in these challenges and will result in a support system to the contracting process to allow, in a transparent manner and adapted to the profile of each USF and ACES:

In first place, to equate the set of indicators and targets that lead to greater health gains, while respecting the capacity of a pre-defined effort profile;

In second place, to calculate the effort needed to achieve a set of objectives in the contracted performance indicators. This way, it is possible to understand variations effort that result from changes in the defined objectives and/or indicators analysis;

In third place, to compare the overall performance of different units, with different profiles of performance and needs, as well as their performance in partial areas (like maternal care, control of chronic illness, etc.) by taking in consideration their performance indicator's results;

And finally, to compare units' overall and partial areas performance over time.

This comparison processes will allow the identification of units with better organizational capacity and overall management and/or relevant improvements according to their capabilities. This will be particularly relevant to identify good practices and to benchmarking purposes.

The support system was conceived by creating, from scratch, of software that allows the implementation of the developed methodology and has been applied to a health unit: the Villa Longa USF.

2. Background

2.1. PHC units

The ACES consist on health services with administrative autonomy, constituted by various functional units that comprise one or more health centers, containing at least one USF or similar unit.

The USF are structures formed by a multidisciplinary team of health care providers adapted to a particular population, ensuring accessibility, continuity and globality of health care [1].

A USF covers a population that corresponds to the its registered users, always having a size superior then 4000 but inferior then 18 000 user [1]. At the present, about 5 million Portuguese are enrolled in USFs.

There are three possible models of USF development: A, B and C, which differ mainly in the degree of organizational autonomy, retributive model and professional incentives, financing model and legal status [2].

Model A corresponds to the initial form of all units and can receive institutional incentives, depending on his performance, up to an annual maximum of €20,000.

Model B is indicated for teams with greater organizational maturity and who are willing to accept a more demanding contractual level. Thus, they represent USF that previously were in the model A and then moved into B, by passing through an accreditation process. In this model, the USF starts to have a special remunerative regime for its professionals, based on their performance. The model C is not implemented yet.

2.2. The contracting process

The contracting process can be divided into two distinct parts, called external contracting and internal contracting, which involve the selection of indicators and targets. In total, there are 84 indicators, and these are detailed in the document " Identity Card of PHC Performance Indicators" [3].

The internal contracting process consists on:

- 12 national indicators, common to all USF and defined by the ACSS,
- 4 selected by ARS, common to the entire region
- 2 Indicators selected by ACES
- 4 indicators proposed by USF / UCSP,

The most used tools to assist the contracting process are called clusters and "rational decision of targets". In 2014, ACSS has developed the clusters model, which allows to set and view the percentiles results for the performance indicators used in both internal and external contracting processes, grouping USFs and ACES in context groups [4]. By comparison with the history of similar units, the ACSS wants to be able to estimate the effort rate to achieve the proposed targets.

The "rational decision of targets" exists in order to standardize the rational guiding to set targets along all units, assuring the homogenization of the negotiation process between all stakeholders, and harmonizing the level of demand [5].

In relation to the clusters tool, although it constitutes a considerable advance to define extremes of reference, it has, in the first place, the problem of not being continuous, presenting the results in discretized intervals, which may punish the units which are near the group limit. On the other hand, there is no evidence that the rate of effort can be extrapolated from the comparison with the history of similar units, if they even exist, and it doesn't take into account other possible relevant factors.

2.3. Literature Review

In the absence of appropriate tools for prioritization indicators, it was performed a literature review in order to verify the methods used in the literature. However, although some methodologies concerning the prioritization and selection of performance indicators, none allowed to find a solution to the addressed problem, ones because of flaws in their own methodologies and other due to the difficulty of its implementation to a wide scale.

It was found one one methodologie that joined AHP (Analytic Hierarchy Process) with SMART (Significant, Meaningful, Appropriate, Relevant and Time-bound) [9] and other that joined ELECTRE (ELimination and Choice Expressing the REality) with other less known procedure [10]. However, both the approaches fall into the "voting paradox", in which the order of the established ranking changes when one option is added or removed.

Still, one of methodologies aimed to solve the same problem as this paper [8] and didn't suffer from the same problems, since it relied in MACBETH [6] to evaluate the performance indicators. However, it had scalability issues since intended to be adapted to each USF. Since it provided a good theoretical fit, this work has been used as a basis for the methodology developed in this paper, which made its continuation, adaptation and improvement.

3. Implementation

The developed methodology followed the same set of steps that the work mentioned above, having a similar overall structure, and also using the MACBETH approach as a multi-criteria evaluation methodology. However, it is important to note that, to overcome the limitations presented, it was necessary to make considerable changes to the previous methodology, which involved changing the used hierarchical structure, a different approach to effort modulation and the creation of strategies to automatically adapt it to different units. As a result of the change in effort modulation, it was also necessary to develop a new method to calculate the most relevant performance indicators and respective targets.

Taking into account the developed methodology, initially the contracting process of CSP was structured by grouping the indicators, following its preselection, according to a logical structure, similar to the figure 1, in order to establish the link between these and the objectives of provision of PHC.

In a second phase, the objective was to measure, taking into account the profile of a standard USF, the quantitative contribution of performance indicators and corresponding objectives in improving the delivery of PHC.

In a third phase, the effort corresponding to acts associated with each indicator was quantified, in order to be possible to set realistic goals for each health unit.

Finally, by adapting the contribution of each indicator and corresponding effort, using the built valuation model and depending on the requirements, features and characteristics profile of each health unit, it is suggested the set of indicators and targets associated with the greatest potential to improve the delivery of PHC.

The method used for the computation of results was set as a linear programming problem, limited by the total number of hours available, and can also be divided into several stages.

First, it is determined the number of actions performed nowadays, taking into account the current results of the health unit.

Secondly, the number of performed actions is changed, using the method of generalized reduced gradients [7] together with the evolutionary Excel Solver method and using as the number of actions performed nowadays as starting point. This change will lead to changing in the current results of the health unit, reaching hypothetical results in each indicator. In turn, these hypothetical results are used to calculate the overall performance of the health unit. The variation of the number of performed acts stops when it can't exceed a certain total value after a pre-set computing time. When it happens, the number of acts and corresponding indicator results that maximize the value created by the USF are determined.

In order to support the structuring and evaluation processes, it was used a means-ends network and the MACBETH approach, respectively.

A means-ends network is a framework by objectives that suits to the resolution of this problem allowing, on the one hand, to structure the process of contracting through a hierarchical structure and, secondly, make it possible to quantify and adjust the contribution of performance indicators and corresponding objectives in improving the delivery of CSP, using the MACBETH approach.

The application of the MACBETH methodology includes a technical component and a social, equally important [6].

The technical component allows the construction of the model and involves the whole process of modeling the judgments made by decision-makers.

The social component, which leads to system implementation, can be decomposed into two phases: a meeting with a specialist in health indicators (Meeting A), on which is develop all the general part of the process, and a meeting with a decision maker of a USF (Meeting B), which adapts the previously developed part to the particular features of its unit.

The first meeting needs to be performed only once, in order to define the general model, while the second should take place in all units that intend to apply the system.

The set of activities inherent to this work can be divided into three main phases: (1) the definition of a methodology that seeks to address the challenges inherent in the contracting process, (2) the development of the technology required for application of the methodology (3) conducting interviews with experts in the contracting process with a view to structuring the model and (4) a test phase in which the proposed methodology will be applied to Villa Longa USF.

4. Results

As a result of the implementation of the developed methodology, using the support system, it was possible to obtain the results that are present in the images.

In table 1 it is possible to see the partial results of Villa Long USF for each indicator, being this values normalized so 0 % and 100 % can correspond to minimum and maximum, respectively, of the defined value functions. It can be seen that the overall performance of this USF is positive, as the results exceed 60 % in most of the performance indicators.

Figure 1 is the means-ends network produced in the structuring process. The indicators, means-objectives and end-objective are represented having an area proportional to the value that is currently being created by the Villa Longa USF. This allows the realization that most of the value created is in means-objectives as "Improving child surveillance", "Improving surveillance for diabetics", "Improving surveillance of hypertension", which are related to the means-objectives "Improving care for the vulnerable groups" and "Improving management of chronic diseases ". The final end-objective is "Improving PHC performance ". This figure allows professionals to quickly check the locations where it is being generated more value within the organization.

Figures 2 shows all the results from the computing simulation that allows the determination of the indicators and targets to contract.

Note that, since there were excluded several indicators in the different phases of the methodology, it was decided to determine the constraints of time taking into account the actions required to achieve the current results in the considered indicators. Thus, these results should be read as suggesting indicators and targets, taking into account only the existence of the indicators considered.

Being indicators ordered by value creation potential, it is possible to check that the 4 indicators suggested for the internal contracting process correspond to the first to appear in the second row of figure 2: 40, 98, 49 and 30. The value of the proposed targets may be observed in the corresponding bars of the first row.

However, possibly being the most relevant part, as it provides the most tangible and easily understood data to professionals, is the third and fourth rows of figure 2. It is possible to verify the acts that require more investment, in the first line, and those who require disinvestment, present in the last line. This allows the determination of the most and least relevant acts to achieve the best calculated performance.

Note also that, in the the second row of figure 2, it is possible to see values below 0 and above 100. It is recalled that these values correspond to the reference levels " Neutral " and " Good " determined in this methodology, being possible for the other results to correspond to a value above or below those numbers.

5. Conclusions

The portuguese PHC has been undergoing a massive revolution over the past few years through the creation of health units with greater autonomy, responsibility and consequent greater influence on population health at local and national level.

Through the creation and implementation of the contracting process, conditions were created to assess and monitor the performance of different units, allowing the comparison and highlighting of inequalities, good and bad practice in the delivery of PHC across the country.

This process has led to important changes in the remuneration level of involved health professionals, being now in accordance to their practice and performance. The changes sparked an initial wave of enthusiasm, leading the focus to the achievement of objectives in order to improve the delivery of CSP. However, in order for this system to grow, there are significant structural problems that need to be solved.

This work was able to address and solve some of this problems, allowing to:

- Equate the set of indicators and targets that lead to greater health gains, while respecting the capacity of a pre-defined effort profile;
- Calculate the effort needed to achieve a set of objectives in the contracted performance indicators. This way, it is possible to understand variations effort that result from changes in the defined objectives and/or indicators analysis;
- Compare the overall performance of different units, with different profiles of performance and needs, as well as their performance in partial areas (like maternal care, control of chronic

Table 1: Partial results of Villa Longa USF for each indicator, concerning the value functions. The values are normalized so 0 % and 100 % can correspond to minimum and maximum, respectively, of the defined value functions.

ID	Partial Result
2	65%
3	59%
4	76%
6	100%
9	80%
10	79%
11	68%
12	83%
13	71%
14	81%
15	100%
16	68%
17	59%
18	84%
19	78%
20	43%
21	75%
22	58%
23	66%
24	66%
27	87%
28	95%
29	66%

ID	Partial Result
30	48%
31	62%
32	26%
33	60%
34	18%
35	94%
36	97%
37	87%
38	89%
39	58%
40	0%
44	25%
45	57%
46	69%
47	86%
49	19%
50	83%
53	68%
54	37%
55	52%
56	33%
57	18%
59	82%

ID	Partial Result
63	78%
64	92%
65	46%
67	88%
68	65%
70	53%
71	50%
74	71%
88	82%
89	68%
90	64%
91	66%
92	46%
96	46%
97	89%
98	31%
99	50%
264	50%
274	52%
275	75%
277	83%
278	98%

illness, etc.) by taking in consideration their performance indicator's results;

- Compare units' overall and partial areas performance over time.

In order to enhance its implementation and accuracy, it is suggested that future work relates to the limitations of the methodology, including through the validation of various assumptions by the utilization of experts. It is still very important to continue the development of the proposed effort modulation, allowing the consideration of synergies between indicators, material resources and hours of administratives, which may significantly affect the results.

In the future, the methodology and developed support system may present themselves as strong candidates to serve as a basis for the implementation of a new paradigm, presenting the flexibility needed to be adapted to other performance contracting processes.

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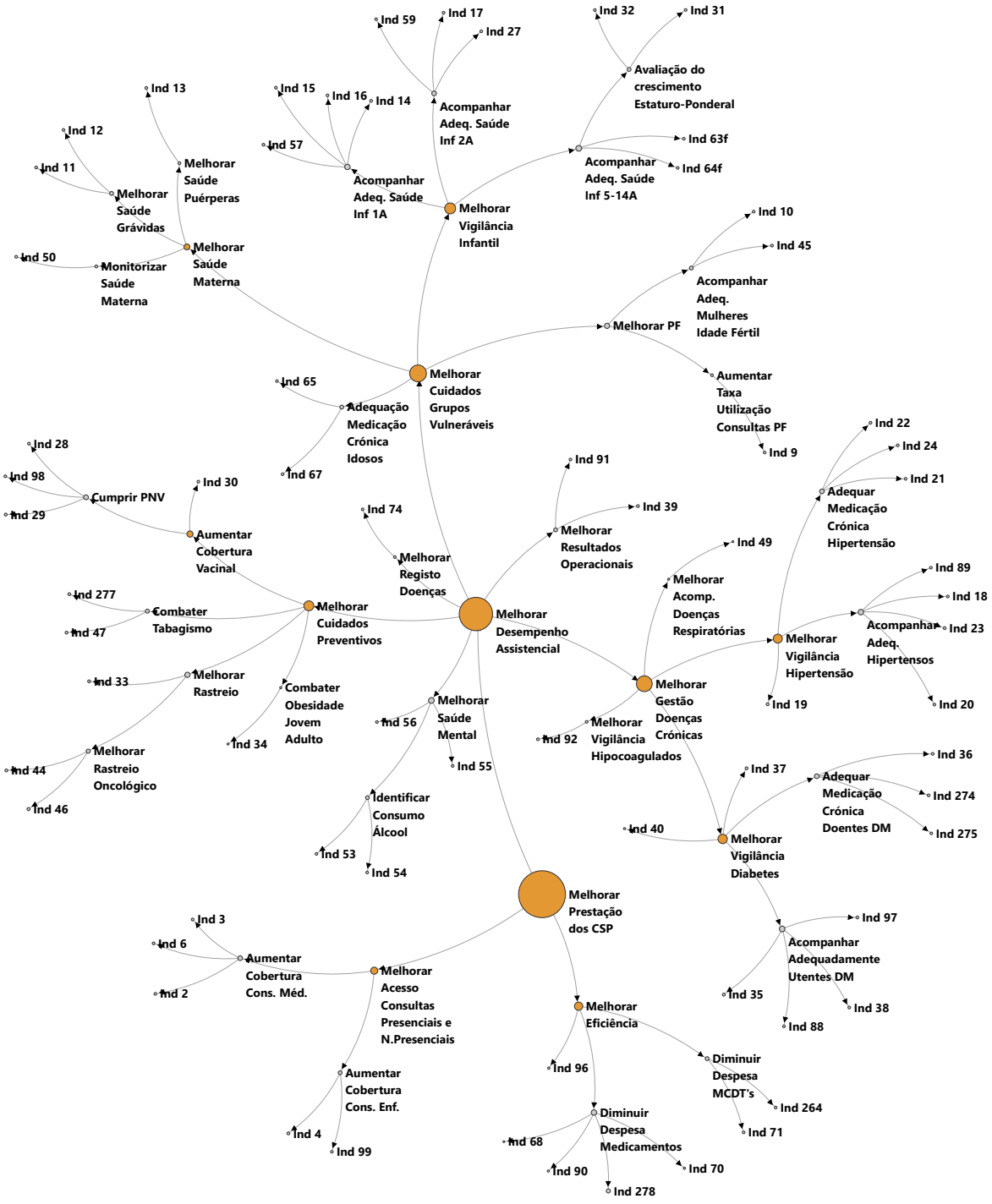

Figure 1: Means-ends network produced in the structuring process. The indicators, means-objectives and end-objective are represented having an area proportional to the value that is currently being created by the Villa Longa USF.

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Figure 2: Comparison between the actual result/value/act, according to the implemented model and the result proposed by the computational simulation. The results are ordered by the largest variation between actual and proposed results.