Planning health professionals’ training in the early detection and brief interventions program to reduce alcohol consumption

Joana Carlota Afonso Faria*
joana.c.a.faria@gmail.com

Thesis to obtain the Master of Science Degree in Biomedical Engineering
Supervisors: Professor Teresa Grilo* and Professor Cristina Gomes**
*Centre for Management Studies of Instituto Superior Técnico (CEG-IST)
** Health Ministry
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Abstract – The training of health professionals in the field of excessive alcohol consumption can potentially increase their comfort in the process of prevention and early detection of this condition, as can also provide the knowledge and the necessary tools for an adequate provision of care, leading to a decrease in alcohol consumption among patients. Proper training planning is thus essential, but there are still few studies devoted to this subject. This dissertation proposes a model for supporting the planning of health professionals’ training in the Primary Health Care (PHC) sector in National Health Service-based countries. This model is based on linear programming, allowing determining how many health professional (both physicians and nurses) should be trained per year in each health unit and with which training package. The main contributions of this thesis are the following: i) it supports the training of health professionals in the field of excessive alcohol consumption, that have few studies; ii) it consider several planning goals like costs minimizations and maximization of contracted performance indicators on unit that provides this service; iii) it explores the associated uncertainty through sensitivity analysis; and iv) it provides a general framework capable of being adapted and applied to other contexts, such as smoking additions. As a case study, the model was applied in the context of Oeste Sul ACES in Lisbon, Portugal, and a variety of scenarios were explored. Results have confirmed that there is a severe lack of trained professionals in this field in Portugal.

Keywords - Excessive consumption of alcohol, Training planning, Mathematical Programming models, Primary Health Care, Performance indicators.

I. INTRODUCTION

The alcohol consumption is the third reason of sickness and death in the world (Dias, 2015). In 2014, Portugal was the eleventh country with higher alcohol consumption in the whole Europe (Público, 2014). It was shown that the alcohol consumption is based on the society activities since it is mainly consumed at party’s or pubs (Lourenço et al., 2014) and there is no evidence of genetic’s causes (Anderson, Gual, e Colom, 2005). The alcohol is responsible for many diseases like mental disorders and cardiovascular diseases, and a higher consumption leads to a bigger risk of onset these diseases. The alcohol consumption represents large costs, both tangible costs (in order of 123 billion euros) and intangible costs (270 billion euros) (Gomes, 2010).

The alcohol consumption is defined by the diary consumption of alcohol in grams (Fig. 1). The low-risk consumption is defined by a diary consumption lower that 20 g and 40 g in woman and men respectively (Anderson, Gual, e Colom, 2005). The hazardous consumption is defined by a consumption bigger than 20 g and lower than 40 g in woman and bigger than 40g and lower than 60 g in men (Anderson, Gual, e Colom, 2005). This consumption can have dangerous consequences for consumers’ health. The harmful consumption is the consumption bigger than 40 g and 60 g in woman and men, respectively (Anderson, Gual, e Colom, 2005). This consumption can affect the consumer in a physical, mental and social way (Moura George, 2014). Finally, the dependency consumption is the consumption where the alcohol consumption is a saw as priority (Anderson, Gual, e Colom, 2005).
Applying preventive strategies and an earlier detection may reduce the excessive alcohol consumption. This detection should be made by health professionals from primary health care centers (PHC) because PHC focus is on the health promotion and diseases prevention (Nunes et al., 2012). In PHC, the care is flexible and personalized over the time. The PHC is localized near urban centers and workplaces being the first health care element (WHO, 1978). A patient visits a health professional of PHC about 4 times a year, and they have a good relationship with their general practitioners (Gomes, 2010). Thus, the screening should be performed by these professionals because they can combine the diagnosis of excessive alcohol consumption with the treatment of other diseases.

There are many screening methods that can be applied on a regular medical appointment. These ones can be biochemical tests or a simple questionnaire, however, the most usage methodology is the questionnaires. There are many questionnaires but the most used are the AUDIT since they are short, flexible and easy to manage (Anderson, Gual, e Colom, 2005).

Nevertheless, the health professionals do not use this methodology because they do not feel comfortable with the intervention. Some studies, like BISTAIRS and PHEPA projects, had proven that the main difficulties felt by doctors are: i) lack of time and incentives; ii) diagnose the excessive alcohol consumption; and iii) fear of conflict with patients and frustrating consultancy (Dias, 2015) (Gomes, 2010). In some of these studies, the health professionals had training but in the end, most of them stated that the training is not enough (Dias, 2015). The same studies showed that the professional training will improve their knowledge and motivation over this topic.

We can thus conclude that it is essential to know the existing package of training that influences the motivation and self-stem of health professionals, and that improve the performance indicators.

Moreover, it is necessary to identify if there is a gap in the training planning of health professionals in excessive alcohol consumption area.

II. STATE OF THE ART

This revision over the state of the art was made to analyze which are the most adequate methodologies that can be used to solve the problem presented in the previous section.

There are many human resources planning perspectives but this thesis will be focused only on training. The methodologies used to support the planning of human resources training are: i) simulation models; ii) mathematical programming models; iii) dynamic systems; iv) portfolio prioritization. Within this group of methodologies, mathematical programming models prove to be the most adequate to deal with the challenge presented in this thesis. This method is flexible, easy to analyze and allow for exploring the impact of uncertainty while identifying the optimal training plan.

In health, there are a low number of support training planning models. However, there is a study from Michigan University that present a training planning problem in cardiothoracic transplant (Ballard et al., 2015). In this one, there is a huge uncertainty in the number of transplants and the number of professionals with the know to do the procedure, because most of them rise in the emergency services. So this simulation model will allow the identification of the necessary volume of transplants and the number of professionals formed. With historic data, it was simulated the number and time of transplants that can occur in a predefined time - 2 years. In this way, it was simulated 1000 years of residents, with different schedules and the different total annual number of transplants. It was concluded that for train 4 residents with compatible schedules to emergency situations it is necessary 90 cases. This conclusion is not nearly the expected number of cases, in fact, it is bigger (Chung et al., 2015).

Some other studies are the future doctors and nurses training planning. In Canada (Lavieri, & Puterman, 2009), it was built a linear programming model to support the hierarchical planning, where the goals were to found the optimal number of nurses to train, recruit and promote to manager. This model had a 20 years’ time horizon and the main goal was to achieve different specialization levels. This model had a user-friendly interface and is good to a what-if analysis. The main reasons to be used linear programming was: transparency, easy to obtain the optimal solution and easy to modify and realize a scenario analysis (What-if analysis).

In this way, with this search, it was showed that there are no studies in excessive alcohol consumption. So the present model will allow for planning health professionals’ training in the field of excessive alcohol consumption while considering the costs, improvement of performance indicators.
and uncertainty analyses. In this way, this project is an innovation for the present literature.

III. METHODS

a. Description

The proposed model aims at supporting the training planning of health professionals on early detection and brief intervention program in excessive alcohol consumption in any country with a National Health System.

Relying on the previous context, the training planning should consider different goals, like the cost minimization or the maximization of multiple performance indicators. Also, it is important to consider some rules to train the health professionals or some recourses limitation being them human or monetary.

b. Notation

Indices and Sets

- $p \in P$: health professionals
- $f \in F$: trainings, individuals and combined
- $o_f \in OF$: standard trainings
- $u \in U$: health units
- $t \in T$: time in years
- $i \in I$: performance indicators

Parameters

- $D_f$: the length of time of each training $f$, in hours
- $L_{of}$: maximum capacity of health professionals in each training $f$
- $N_{of}$: number of trainers for each training $f$
- $C_f$: cost per hour associated with each trainer for each training $f$
- $\text{impact}_{o_i,f}$: impact in each indicator $i$ from each training $f$
- $\text{meta}_{i,u}$: the value associated with the growing of each indicator $i$ in each unit $u$
- $SQ_{i,u}$: the initial value of each indicator $i$ in each unit $u$
- $N_{pu,p,u}$: number of health professional $p$ in each unit $u$
- $N_{pu,f,u}$: number of health professional $p$ in each unit $u$ with the training $f$
- $N_{of,f}$: trainings combinations
- $HF_t$: available work hours in each year $t$

Variables

- $X_{p,u,f,t}$: number of professionals $p$ in a unit $u$ to be formed with a given training $f$ in a year $t$
- $k_{t,f}$: number of training $f$ to be performed in a year $t$
- $Y_{p,u,of,t}$: number of professionals $p$ trained in a given unit $u$ with a given standard training $of$ in a year $t$
- $w_{p,u,of,t}$: number of professionals $p$ in a unit $u$ without the standard training $of$ at a given year $t$
- $j_{p,u,of,t}$: number of professionals $p$ in a unit $u$ which missing a given training $f$, which includes a standard training $of$ in a given year $t$
- $c_t$: number of hours used to train in a given year $t$
- $Z_1$: optimization variable for cost minimization
- $Z_2$: optimization variable for the improvement indicators maximizing

\[ Z_1 = \max \text{minimize } \sum_{t \in T} \sum_{f \in F} k_{t,f} \times C_f \times N_{of} \times D_f \]

\[ Z_2 = \max \sum_{u \in U} \sum_{i \in I} p_i \times abs(\text{indicator}_{i,u} - SQ_{i,u}) \]

c. Objective

Depending on the context and priorities of the problem, the goal considered can be different.

If the context is to regulate the spending costs, then the objective is to minimize the cost associated with the payment of the trainers working hours dedicated to training. In this case, the objective function is the equation 1.

If the focus is on the improvement of the performance indicators, the objective is to maximize the improve of each indicator (equation 2). In this one is necessary to take in account if the indicator is mandatory or optative.

\[ Z_1 = \max \sum_{t \in T} \sum_{f \in F} k_{t,f} \times C_f \times N_{of} \times D_f \]

\[ Z_2 = \max \sum_{u \in U} \sum_{i \in I} p_i \times abs(\text{indicator}_{i,u} - SQ_{i,u}) \]

d. Constraints

1-Maximum capacity of health professionals for each training
\[
\sum_{u \in U} \sum_{p \in P} x_{p,u,t} \leq k_{t,f} \times L_0, \forall \ t \in T, f, \quad (3)
\]

The equation 3 ensures that the number of professionals that are receiving the training \(f\) is not bigger than the capacity of the same training, once it is not allowed an overcrowded training.

2- Maximum value of the indicator per unit

\[
\sum_{t \in T} \sum_{p \in P} \sum_{f \in F} x_{p,u,t} \times \text{impacto}_{f,i} + SQ_{i,u} \quad (4)
\]

The equation 4 ensures that the indicator \(i\) does not exceed the value 1, after the professionals' training \(f\). The maximum value of the indicator is 1, or in percentage 100%.

3- Minimum value of the indicator per unit

\[
\sum_{t \in T} \sum_{p \in P} \sum_{f \in F} x_{p,u,t} \times \text{impacto}_{f,i} + SQ_{i,u} \geq 0, \forall \ u \in U, i \in I \quad (5)
\]

The equation 5 ensures that the value of the indicator \(i\), after the training \(f\), is not lower than 0.

4- Maximum number of health professional that can be trained per unit

\[
x_{p,u,t} \leq \ j_{p,u,of,t}, \forall \ p \in P, u \in U, of \in OF, t \in T \quad (6)
\]

The equation 6 allows the number of professionals \(p\) to train in a unit \(u\), in a given year \(t\) with the training \(f\) is not bigger than the number of health professionals in a unit without the training in a given year \(t_{-}\). For example, if in the initial time \(t=0\), in a given unit, exists 10 doctors without any training, and if in the same unit in the time \(t=1\) there are 3 doctors trained with a standard training \(f_2\), then in the time \(t=2\) there are only 7 doctors that can be trained with a given training that includes the standard training \(f_2\).

5- Budget / limit of training hours

In the case of a budget limit for the health professional's training in the scope of excessive alcohol consumption in necessary to define the equation 7.

\[
\sum_{f \in F} k_{t,f} \times C_{f} \times N_{f} \times D_{f} \leq B_{t}, \forall \ t \in T \quad (7)
\]

The equation 7 verify if the budget is not overrated in a given year.

Besides that, it is necessary to that in account the maximum number of training hours available.

\[
H_{f} \times N_{ht} \geq \sum_{f \in F} k_{t,f} \times D_{f} \quad (8)
\]

The equation 8 prevents the exceed the number of annual hours.

6- Indicators goals

To achieve the goals for each indicator, the equation 9 is essential.

\[
\sum_{t \in T} \sum_{p \in P} \sum_{f \in F} x_{p,u,t} \times \text{impacto}_{f,i} + SQ_{i,u} \geq meta_{i,u} + SQ_{i,u}, \forall \ u \in U, i \in I \quad (9)
\]

The equation 9 will ensure that the indicator \(i\), in the end, is going to be unless the initial value with the indicator growth that was congratulated for a given unit.

7- Number of health professionals formed

The equation 10 and 11 set the number of professionals \(p\), in a unit \(u\), that was formed with a standard training \(of\) in a given year \(t\). This equation allows a known of the number of health professionals trained in a unit with a standard training in a given year because each professional only should have a given standard training in a given time horizon. The equation 10 have the parameter \(npf_{p,u,of,t}\), because in the initial time there are formed professionals.

\[
w_{p,u,t} = npu_{u,p} - y_{p,u,of,t}, \forall \ p \in P, u \in U, of \in OF, t \in T \quad (10)
\]

The equation 12 set the health professionals \(p\), that was not formed in a given unit \(u\) with a standard training \(of\) in a given year \(t\). Each professional can only have one standard training of each type, so it is
necessary to see how many health professionals do not have that training. However, this equation is only for standard training, so it is necessary to know for all training.

\[ f_{p,u,of,t} = N_{of,f} \times \omega_{p,u,of,t}, \forall p \in P, u \in U, of \in OF, t \in T \text{ } \epsilon \text{ } N_{of,f} \]  

(13)

The equation 13 set the number of professional \( p \) in a given unit \( u \) that are necessary to form with a training \( f \) that includes the standard training \( of \), in a given year \( t \). This one will ensure what is the number of health professionals in a given unit, in a given year that does not have a standard training being those trainings the ones that they can receive.

8- Number of hours used for training

\[ c_t = \sum_{f \in F} k_{t,f} \times D_f, \forall t \in T \]  

(14)

The equation 14 set the number of used hours to a training in a given year \( t \).

IV. RESULTS AND DISCUSSION

a. Dataset and assumptions used

The description of the dataset used is presented in table A1, in appendix A. The model was applied in the context of Oeste Sul ACES in Lisbon, Portugal, that have 11 health units (USF/UCSP) and two contracted indicators:

- Proportion of patients with age higher or equal to 14 years, with alcohol consumption registration - indicator A;
- The proportion of excessive alcohol consumption patients, with consultation in the last 3 years - indicator C.

The first indicator corresponds to screening activities and the second to excessive alcohol consumption identification.

To apply the model, it was considered that 8 standard trainings are available, and that 120 trainings are derived from the first ones. Also, several assumptions were needed to assign impacts do different trainings – e.g., standard training \( f_1 \) have impact on performance indicator A and C (0.04 and, 0.005 respectively), and \( f_5 \) only have impact on indicator C (0.0035).

b. Scenarios under study

This data was used to explore several scenarios (Fig. 2).

The first scenario (1A) refers to a situation where one wants to plan the health professionals’ training without any restriction in terms of budget, i.e., the question is “How much would it cost to achieve the pre-defined goals for the contracted indicators”. The goal of this scenario is thus to analyze how expensive would be the training of professionals to achieve the desired indicators, in one year.

Then it was analyzed the most current situation, where a budget constraint is imposed. Two different situations were analyzed:

i. In scenario 2A it is intended to plan the training offer when a limited budget exists and when the aim is to achieve the targets imposed for contracted indicators, but unlike scenario 1, taking more time to achieve them (not requiring that the targets had to be met in one single year, because the available budget may not be enough); the time frame was changed to five years, since this was the time window that the expert told that it is expected to achieve each goal for each performance indicator;

ii. In scenario 2B it is analyzed which are the maximum improvements for different indicators, using the available budget. Here the goal is to maximize the improvements in contracted indicators, as an alternative to minimizing costs.
Finally, two additional scenarios were analyzed, in which some of the indicators that are currently optional change to mandatory. It was analyzed the two following scenarios, with a time frame of five years:

i. In scenario 3A it is proposed to analyze which are the maximum improvements for performance indicators, using the available budget. In this case, the indicator A was mandatory and this indicator will have a weight of 1, the indicator C was optional and will have a weight of 0.2.

ii. In scenario 3B it is intended to analyze which are the maximum improvements for indicators, using the available budget and with both mandatory indicators. The two indicators should have a weight equal to 1.

**c. Results**

Results obtained under each scenario are described below.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Number of professionals to form</th>
<th>Total hours of training</th>
<th>Cost [€]</th>
</tr>
</thead>
<tbody>
<tr>
<td>scenario 1A</td>
<td>Doctors: 50</td>
<td>Nurses: 49</td>
<td>Total: 99</td>
</tr>
<tr>
<td>scenario 2A</td>
<td>Doctors: 112</td>
<td>Nurses: 146</td>
<td>Total: 259</td>
</tr>
<tr>
<td>scenario 2B</td>
<td>Doctors: 109</td>
<td>Nurses: 150</td>
<td>Total: 259</td>
</tr>
<tr>
<td>scenario 3A</td>
<td>Doctors: 110</td>
<td>Nurses: 149</td>
<td>Total: 259</td>
</tr>
</tbody>
</table>

From Erro! A origem da referência não foi encontrada. it is clear that if there is not a budget restriction or limit resources (scenario 1A), the monetary consume would be 7700 €, with 84 total hours of the training. However, in reality, there is a limited budget for training health professionals in the alcohol consumption area. In scenario 2A it was found that probably the training impact is low, and in this way, it is impossible to achieve the indicators goals within the five years’ time frame. This also occurs because the ACES budget is much smaller (in average 1294 € per year) than the value achieved in scenario 1A (7700 €).

When the goal is the maximization of the improvement of performance indicators (scenario 2B) there is a big change in costs, time and training health professionals. However, every time the goal is to maximize the improvement of the indicators, there are no changes in training time, monetary costs and a number of professional to be trained. It was found that the set of training to teach have are equal and their distributions over the years are equal too. Once there is a limited budget, the training is the simplest possible (standard training) and there is never a more compost training. It was observed that the indicator A in all maximization scenarios have the same values in all units and the indicator C in all...
maximization scenario is lower than the defined target indicator in some units (unit 2,4,7 and 10 in scenario 3A and 3B and unit 7 and 10 in scenario 2B).

In mathematical models, it can be made a sensitivity analysis. So these analyses were made to control the impact of some decisions related to the train offered.

Since the time horizon was five years, some of the parameters have a big associated uncertainty. In this way, a sensitivity analysis to the trainings impact on the performance indicators and in the optative indicator weight is performed (Table 2).

### Table 2 – Parameters analyzed within the sensitivity analysis. Initial value and the value that will be analyzed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial value</th>
<th>Sensitivity analysis’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training impacts in each indicator</td>
<td>Table B1a</td>
<td>Table B1b</td>
</tr>
<tr>
<td>Weight of optative indicators</td>
<td>0.2</td>
<td>0.1 e 0.3</td>
</tr>
</tbody>
</table>

It was considered these two parameters for the sensitivity analyses because these ones have a lot of uncertainty. It was used the scenario 2A to analyze the training impact and the scenario 3A to analyze the optative indicator weight.

It was found that the previous training impact does not allow achieving the pre-defined final value of indicators. However, it was found that the training impact and the budget would be influenced in the chosen training since there is a reduction of 3150 € and 21 hours, comparing with scenario 1A. The indicators values are at least the same as the predefined target indicators.

In indicator weight, it was found there is no change in the number of trained professionals, cost and necessarily trained hours. However, there is only a minimal change in the improve of the indicator C. If the weight of the indicator is 0,1 the indicator final value is a little lower than if the weight indicator is 0,2, and the opposite occur with the 0,3 weight. So it was concluded that the training distribution depends on the indicator weight.

### V. FINAL REMARKS

The alcohol consumption had been a major problem in Portugal, over the years. Some studies showed that there is a gap in the professionals’ training and there are no incentives in this field. In this way, it was done a bibliographic revision and it was found that there is no study about the professionals’ training in alcohol consumption area. So, the proposed model is based on linear programming, that allows to determine the necessary training to perform in each health unit and how many professionals in each unit should receive those training, annually. The main contributions of the present study are the following:

i) it acts over the training of health professionals in the field of excessive consumption of alcohol, a health care area not widely studied;

ii) it takes into account several goals and not only costs, unlike the other models in health;

iii) it applies sensitivity analysis so as to explore the impact of uncertainty in planning decisions, and uncertainty analysis is not widely explored in others planning models in the health care sector;

iv) it provides a general framework capable of being adapted and applied to other contexts, such as smoking additions.

So as to illustrate the usefulness of the proposed model, it was applied to a Portuguese case study, namely, it was applied to Oeste Sul ACES in Lisbon, Portugal. The main results prove a lack of training in excessive alcohol consumption area – in fact, results show that in the unit with lower indicators the health professionals need to have an average of 2 trainings in distinct areas.

However, it was also found that the training impacts in the indicators are low and it is not possible to achieve the pre-defined indicator goals with the available budget (scenario A). Further, it was observed that it should be invested in f5 training (training design to fit each user query) regardless the objective (minimizing cost or maximization of performance indicators) of planning considered. This training is found in all the scenarios (1A, 2B, 3A and 3B).

With the sensibility analyses, it was found that the attached importance for each indicator results in a change in training distribution, depending on the weight of indicator is greater or less.

One of the limitations related to this thesis is related with some of the data used to apply the model. One of the data problems was the ones used to calculate the training impact of the indicators. This data problem is related to the lake of detailed about the training was given, ie, there are no training information about the topic, time, capacity - for exempla, Anderson et al (2004) said that the trained professionals have a screening ratio 2.2 times bigger than the screening ratio of the professionals who does not have any training; however this author does not say anything about the topic or hours number of the training. So to simplify the problem it was assumed that these training has a maximum capacity of 30 professionals and the topic and hours number are not significant.
In order to overcome some of the problems faced within the scope of this thesis in terms of lack of data, it is recommended to:

- Built a database for each ACES in Portugal, where it is possible to access easily to the number and tip of existing professionals with an extra university training. It would be necessary to change the way of access to training because actually there is a free application and there is no limit of professional type or limit of professional from each USF/UCSP or ACES;
- Built a platform to share experience between health professionals, that deal with excessive alcohol consumption patients, to improve the motivation and reduce some of the difficulties showed in the introduction;
- Define a number of trained health professionals to train and a limit hour to do them;
- Realization of studies to determine the direct impact of each training in the performance indicators.
- Define a budget only for training health professionals in excessive alcohol consumption.

There are other information in trainings that do not take into account in this thesis and they are important to a reliable application. For example, the cost associated with the move of professionals between the training and the clinic. There will be some studies to account those costs and also productivity cost.

Besides those recommendations, there should be additional work in terms of methodological issues.

In the future, some of the performance indicators would be mandatory. In that way, it would be useful to prioritize the mandatory indicators instead of the optional indicators. In this thesis, it was decided to ask the expert about the appropriated weight for each indicator (mandatory or optional). However, it should be done a MACBETH (Measuring Attractiveness by a Categorical Based Evaluation Technique) methodology. With this methodology, it would be evaluated what are the indicators that should be mandatory in an initial situation and their importance. MACBETH is the best way to achieve a concise result, since this is an iterative method that allows the dialogue based on qualitative judgment, by decision makers, about the difference in attractiveness between the options (Bana Consulting, 2015).

In this thesis, it was not possible to present a MACBETH model, but it is considered very important to define the weight indicators in a less biased way.

It is also important to develop a stochastic model to do a complete sensitivity analysis. This would be based on a scenarios tree that will allow an evaluation of uncertainty impact, like the indicators impact.

The model presented in this thesis is thus an innovation in the health sector like it was showed with the research done to choose the correct methodology.

Concluding, it is expected that this model would be used to support training health professionals not only in excessive alcohol consumption but also in other tips of consumption.

VI. REFERENCES


Moura George, Francisco (2014). «Detecção Precoce e Intervenção Breve no Consumo Excessivo de Álcool».


VII. APPENDIX

Appendix A - Description of data used in the application model

Table A1 – Summary of data used in the model application.

<table>
<thead>
<tr>
<th>Dada</th>
<th>Collection mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators</td>
<td>Initial value (SQ)</td>
<td>Initial value of performance indicators in each unit</td>
</tr>
<tr>
<td></td>
<td>Interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meta</td>
<td>Growth value for each indicator in each unit</td>
</tr>
<tr>
<td></td>
<td>Interview with an expert</td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>Synergies</td>
<td>Relationship between training</td>
</tr>
<tr>
<td></td>
<td>EMPECO .2015 and interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of time</td>
<td>Length of time, in hours, for each training</td>
</tr>
<tr>
<td></td>
<td>EMPECO .2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
<td>Capacity of each training</td>
</tr>
<tr>
<td></td>
<td>Interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of trainers</td>
<td>Necessary trainers number for each training</td>
</tr>
<tr>
<td></td>
<td>Interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost of trainers per training</td>
<td>Cost of trainers, in each training, per hour</td>
</tr>
<tr>
<td></td>
<td>Interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impact</td>
<td>Impact of each training in each indicator</td>
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<td></td>
<td>Anderson, Gual e Colom, 2005</td>
<td></td>
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<tr>
<td></td>
<td>Anderson et al., 2004 and interview with an expert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of health professionals</td>
<td>Number of health professionals per unit</td>
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<tr>
<td></td>
<td>Oliveira e Soares ,2015</td>
<td></td>
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<td></td>
<td>National Institute of Statistics, 2014 and interview</td>
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<td></td>
<td>with an expert</td>
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<tr>
<td></td>
<td>Number of health professionals trained</td>
<td>Number of trained health professionals per unit</td>
</tr>
<tr>
<td></td>
<td>SIARS e BD da ACSS-DPS,2015 E EMPECO ,2015</td>
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</tr>
<tr>
<td>Dada</td>
<td>Collection mode</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td>SICAD, 2016 and interview with an expert</td>
<td>Budget available per year</td>
</tr>
<tr>
<td><strong>Available hour for training</strong></td>
<td>Percentage of hours available for training</td>
<td>SICAD, 2016 and interview with an expert</td>
</tr>
</tbody>
</table>

**Appendix B** - Training impact in performance indicators  
*Table B1 – Training impact in performance indicators. a) initial values; b) changed values*  

<table>
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<th>Training</th>
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<th>( l_c )</th>
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<tbody>
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</tr>
<tr>
<td>( f_2 )</td>
<td>0.4</td>
<td>-</td>
</tr>
<tr>
<td>( f_3 )</td>
<td>-</td>
<td>0.7</td>
</tr>
<tr>
<td>( f_4 )</td>
<td>-</td>
<td>0.7</td>
</tr>
<tr>
<td>( f_5 )</td>
<td>-</td>
<td>0.7</td>
</tr>
<tr>
<td>( f_6 )</td>
<td>-</td>
<td>0.6</td>
</tr>
<tr>
<td>( f_7 )</td>
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<td>-</td>
</tr>
<tr>
<td>( f_8 )</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

<table>
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<th>( l_c )</th>
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<tbody>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
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<td>( f_8 )</td>
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<td>0.7</td>
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