

# Application of the AHP Method in Prioritizing the Criteria for the Selection of Calibration Services Provider

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## ABSTRACT

Choosing the best instruments, measurement techniques and the most qualified service provider is of paramount importance for an equipment calibration service. For the definition of the most qualified company, selection criteria and weights related to the criteria will be used. Thus, the main objective of this work is to choose the best service provider, that is, the most qualified to perform the calibration services of medical and hospital equipment, considering the listed criteria. The method used was AHP (Analytic Hierarchy Process). It makes it possible to prioritize, give weight and validate the consistency of the evaluation criteria (considering the importance and relevance). As a result, the validation of the criteria weights was obtained. The company that obtained the best score was the company hired for the service.

**Keywords** – *Medical equipment, Calibration, Selection service provider, AHP method.*

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## INTRODUCTION

The calibration of equipment, that is, the comparison of biomedical/physiological quantities measured or provided by biomedical equipment, compared to a standard, provide each equipment's errors. An internal team can calibrate biomedical equipment, provided qualified, with defined calibration procedures, appropriate instruments, traceability, etc. When calibration is performed by a third-party service provider, it is appropriate to perform a calibration process, with defined criteria.<sup>1</sup> Enable the validation of the consistency of weights and measurements of the selection criteria. Contribute in such a way that the best qualified company performs the calibration services of the equipment. Maximizing patient safety. One of the known methods is the AHP (Analytic Hierarchy Process) Method,<sup>2</sup> which makes it possible to prioritize, give weight and validate the consistency of the evaluation criteria (considering the importance and relevance).<sup>3</sup> SCB Associates<sup>4</sup> proposes a model to validate the consistency of the weights assigned to each requirement evaluated. It is possible to use a scale with paired views of evaluation parameters to assess the degree of importance.<sup>5</sup> The main objective of this work is to choose the best service provider company, that is, the most qualified to perform medical-hospital equipment calibration services. Considering that the selection criteria and their weights will serve as a reference to choosing the company that obtains the best score, the specific objectives are: to prioritize, give weight and validate the consistency of the evaluation criteria (considering the importance and relevance) for the selection of service providers of calibration of medical-hospital equipment.

## METHOD

The method used was the AHP,<sup>2</sup> which allows prioritizing the evaluation criteria (considering the importance and relevance). The model provided by SCB Associates,<sup>4</sup> to validate the consistency of the weights assigned to each requirement evaluated. The following (Fig. 1) demonstrates the fundamental scale, with nine classifications of importance used in this model.

The initial weights for each criterion were defined by a specialized clinical engineering group composed of professionals with training of various academic levels and

Analytic Hierarchy Template: n= 14 ▾		Criteria
<b>Fundamental Scale (Row v Column)</b>		
Extremely less important		1/9
		1/8
Very strongly less important		1/7
		1/6
Strongly less important		1/5
		1/4
Moderately less important		1/3
		1/2
<b>Equal Importance</b>		<b>1</b>
		2
Moderately more important		3
		4
Strongly more important		5
		6
Very strongly more important		7
		8
Extremely more important		9

**FIGURE 1.** The schematic diagram of dental units.

professional experiences of up to 25 years in the area. With expertise in calibration laboratory and calibration services. Quality national and international certifications. As well as knowledge of norms related to the subject. A spreadsheet was sent with the 14 evaluation criteria for each service provider who participated in the selection to obtain the answers.

## RESULTS

The matrix (Figure 2) below demonstrates the degree of importance given, according to a fundamental scale (as shown in Figure 1), in the paired comparisons of 14 evaluation parameters.

The consistency index achieved with the method was 7% (Figure 3), indicating a good weight distribution.<sup>6</sup>

Then, considering the response of the service providers to the selection criteria, the specialized group of clinical engineering, listed the notes to each of the companies (Figure 4) so that it was possible to obtain the answer of which service provider was the best to perform the calibration of medical equipment.<sup>7</sup>

Calibration Selection Criteria															
Pairwise Comparison Matrix															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Requirement 15
1	1	1/5	1/5	1/6	1/9	1/3	1/4	1/9	1/5	1/2	1/2	1/3	1/3	1	
2	5	1	1/2	1/2	1/4	1/3	1/4	1/7	1/5	2	2	1/2	2	1	
3	5	2	1	1	1/2	1/4	2	1	1/9	1/3	1	1	1	1	
4	6	2	1	1	1	1/4	1	1	1/9	1	2	2	2	2	1
5	9	4	2	1	1	1/4	2	1	1/9	1	2	2	2	2	1
6	9	4	4	4	4	1	8	8	1/2	8	8	8	8	8	1
7	3	3	1/2	1	1/2	1/8	1	1/2	1/9	1/4	1	1	1	1	1
8	4	4	1	1	1	1/8	2	1	1/9	1/4	1	1	1	1	1
9	9	7	9	9	9	2	9	9	1	9	9	9	9	9	1
10	5	5	3	1	1	1/8	4	4	1/9	1	3	3	3	3	1
11	2	1/2	1	1/2	1/2	1/8	1	1	1/9	1/3	1	1	1	1	1
12	2	1/2	1	1/2	1/2	1/8	1	1	1/9	1/3	1	1	1	1	1
13	3	2	1	1/2	1/2	1/8	1	1	1/9	1/3	1	1	1	1	1
14	3	1/2	1	1/2	1/2	1/8	1	1	1/9	1/3	1	1	1	1	1
Req	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

FIGURE 2. Model provided by SCB Associates.<sup>4</sup>

	AHP		Consistency check
1	0.015	1.5%	Consistency OK 7%
2	0.031	3.1%	
3	0.041	4.1%	
4	0.051	5.1%	
5	0.057	5.7%	
6	0.215	21.5%	
7	0.034	3.4%	
8	0.043	4.3%	
9	0.311	31.1%	
10	0.083	8.3%	
11	0.028	2.8%	
12	0.028	2.8%	
13	0.033	3.3%	
14	0.030	3.0%	
15	0.000	0.0%	

FIGURE 3. Consistency index achieved with the method.

Weights	Criteria	Supplier A	Supplier B	Supplier C	Supplier D
100,0%	Criteria	67%	70%	83%	92%
1,5%	1 - ID: ENABLE ART	10,0	10,0	7,5	10,0
3,1%	2 - COMMITMENT:	10,0	10,0	10,0	10,0
4,1%	3 - KNOW HOW:	7,5	10,0	6,0	7,5
5,1%	4 - QUALIFICATION:	5,0	5,0	10,0	10,0
5,7%	5 - RASTREABILITY:	8,0	8,0	8,0	8,0
21,5%	6 - UNCERTAINTY CALCULATION:	3,5	6,5	8,3	10,0
3,4%	7 - METHODS, PROCEDURES AND REVIEW	10,0	10,0	10,0	10,0
4,3%	8 - SCOPE OF CALIBRATION SERVICE AND ELECTRICAL SAFETY	10,0	10,0	9,4	10,0
31,1%	9 - BEST MEASUREMENT CAPABILITY	8,1	7,8	6,5	8,4
8,3%	10 - ACCREDITATION	0,0	0,0	9,0	10,0
2,8%	11 - FLEXIBILITY	10,0	5,0	10,0	10,0
2,8%	12 - SERVICE BONUSES	10,0	10,0	5,0	10,0
3,3%	13 - TIME CALIBRATION	10,0	2,5	10,0	2,5
3,0%	14 - LOGISTICS	10,0	10,0	10,0	10,0

FIGURE 4. Supplier's notes for each criterion.

## DISCUSSION

It is important to highlight that it is necessary to evaluate and select the calibration service providers of biomedical equipment. The AHP methodology for the listed evaluation criteria was shown to be consistent. However, there can always be points to be improved and new versions to be proposed and tested, from this model. Or considering other models.

## CONCLUSION

The AHP methodology proved to be adherent and assisted in the selection protocol of a calibration service provider. That is, it helped validate the weights of the criteria listed to evaluate the quality of the provider. Thus, it contributed to hiring the most qualified company to perform the calibration services of biomedical equipment, considering the criteria listed. The application of this method improved the evaluation process and choice of the provider, impartially increasing confidence and comprehensiveness. Considering that the equipment park is dynamic, each year changes with new approaches and technologies. Given the above, it can be observed that the implemented proposition of improving this selection process was successfully achieved.

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