Panel 8

Do we need an Algorithm or an Electronic Tool to Enhance the Selection Process of Academic Medical Chairs?

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Abstract

The selection of medical chairs in academic institutions is an important process and a key task of deans and leaders of universities. Inadequate searches may result in a significant negative impact on the key strategic elements of a medical school and provoke repeated search efforts, increasing the costs of time, money, and effort. While the previous panels of the chair4medicine conference focused on specific characteristics of candidates for medical chairs, the aim of our panel was to identify the most suitable multiple criteria decision-making methods and computerized tools that synthesize these characteristics and support search committees in their candidate selection. Based on a scoping review of the literature, we identified the Analytical Hierarchy Process, as the most suitable multiple criteria decision-making method. Since no computerized tool was available we developed a new decision support system that fits the purpose of selecting academic medical chairs. The decision support system allows search committee members to weigh the relative importance of different requirements for the clinical chair position (e.g. clinical expertise, research record, leadership skills etc), to identify disagreement among committee members and to define the optimal candidate profile before any searching and evaluation is done (i.e. a priori). The decision support system also allows for more targeted identification of suitable candidates and for evaluating how well candidates fit with the required profile. While a decision support system does not take away any decisional power from the search committee, it may enhance the selection process of academic chairs with regards to transparency and consistency.

Introduction

Medical chairs need to ensure high quality of education, clinical services and medical research, but also need to have managerial skills for optimal use of human and financial resources [1]. The selection of medical chairs in academic institutions is an important process and a key task of deans and leaders of universities. Inadequate searches may result in candidates, who are poorly qualified or may not fit to the institution's culture. This can have a significant negative impact on the key strategic elements of a medical school or even the entire university. In addition, hiring an inadequate candidate may provoke repeated search efforts in the short-term, increasing the expenses of time, money, and effort [1]. Such an early failure may also induce a loss of determination and institutional confidence of those stakeholders most dependent on the success of the process [2, 3].

Faculty and physicians around the world report shortcomings in the selection of academic chairs in the field of medicine, mainly based on the lack of objectivity and transparency throughout the selection process. Furthermore, it is thought that the academic professional profile assessment may be currently subjective and prone to bias [4], manipulation, and misjudgement in some institutions [1, 5].

A major challenge for the assessment of candidates is the "multi-dimensionality" of selection criteria. Clinical, teaching, research and managerial skills and the personality of candidates need to be evaluated and be put into the context of the requirements of a specific chair position. Such a multi-dimensional assessment is, however, not unique to medical chairs. Academic institutions may learn from other areas and developments of modern management, and improve their traditional approaches and practices for recruiting and selecting academic medical chairs.

Numerous methods from decision sciences have become available that have the potential to support the decision-making process of selecting medical chairs by considering both quantitative (e.g. bibliometrics) and qualitative characteristics (e.g. professional and personal skills) of the candidates (see panel IV). Decision-making software based on several different models has become available to help individuals and organizations with their decision-making processes, typically resulting in ranking, sorting or choosing from among alternatives [6].

The aims of our panel were to

1) identify the currently available (computerized) multiple criteria decision-making approaches that may enhance the selection process of academic medical chairs, and
2) on the basis of the most suitable approach to implement a decision support system or adapt an existing tool that fits the purpose of selecting academic medical chairs, is user friendly, open source, and open access. Such a decision support system needs to consider both quantitative and qualitative characteristics of candidates, as discussed by the other panels of this consensus-building effort in a transparent and comprehensive way, and express the search committee's (un)certainty and (lack of) consensus associated with the quantitative and qualitative characteristics.
3) Finally, our aim was to develop recommendations for or against the use of electronic tools for selecting medical chairs.

Methods

Review of the literature

To achieve aim (1), we performed a scoping review [7] and searched databases including Google Scholar, and PubMed using the following terms in various combinations: selection of medical chairs, decision analysis, software, multiple-criteria decision-making. This scoping review focused on identifying the most suitable multiple criteria decision-making approach, that may enhance the selection process of academic medical chairs based on research papers, expert opinion, as well as on the popularity of its use. Furthermore, we searched the World Wide Web with the Google search engine and the literature to identify and characterize currently available computerized decision support systems.

Development of the electronic tool

For aim (2), we developed a web-based tool using Drupal 7, an open source software distributed under the terms of the General Public License. We followed the design science research approach, as described in [8], to develop a suitable solution for supporting the selection process of medical chairs.

Results

Which are the currently available decision support systems (Aim 1)?

Decision support systems (DSS) are used to support organizations with their decision-making processes, typically resulting in scoring, ranking, sorting, or choosing from multiple alternatives [9]. The use of DSS in a selection process is supported by a variety of computerized multiple-criteria decision-making methods. These can be categorized into four basic types:

1) Software designed for brainstorming and problem structuring without any quantitative component including scenario planning and mind mapping.
2) Software that analyzes single-trait decision-making with uncertainty using decision trees and influence diagrams.
3) Software that concentrates on uncertainties and probability analysis including the Bayesian belief nets and Monte-Carlo simulation.
4) Software providing a computerized ranked list or options from a group typically implementing a decision method, such as multiple objective decision analysis, multiple criteria decision-making, such as the **Analytic Hierarchy Process (AHP)** [10].

What is the Analytic Hierarchy Process (AHP) and why is it the most suitable method for the selection of medical chairs process?

Of all the multi-criteria methods, **AHP** [11] was identified as the most comprehensive and suitable approach to multi-criteria decision-making problems of selection and ranking for the following reasons:

1) AHP models are applicable to group decision settings.
2) AHP is flexible since many methods can be used to enhance the views and judgments of group participants in the priority setting process including multiple, diverse criteria such as qualitative as well as quantitative information.
3) In case of significant disagreement among the group members’ judgments, in a common objective context, their average as well as (dis)agreement can be calculated to reflect the degree of uncertainty.
4) AHP is considered to be the most reliable existing multi-criteria decision-making method.
5) AHP in the most popular compared to other methods [12].

Briefly, the AHP first decomposes the decision-making problem into a hierarchy of sub-problems. Then, the relative weight of importance of the different criteria is assessed by pair-wise comparisons. These weights are then used to calculate a score for each selection alternative. Information is decomposed into a hierarchy of alternatives and criteria information is then synthesized to determine relative ranking of alternatives. Both qualitative and quantitative information can be compared using informed judgements to derive weights and priorities. The so-called consistency index measures the extent to which the decision-maker was consistent in their responses (Figure 1) [13, 14].

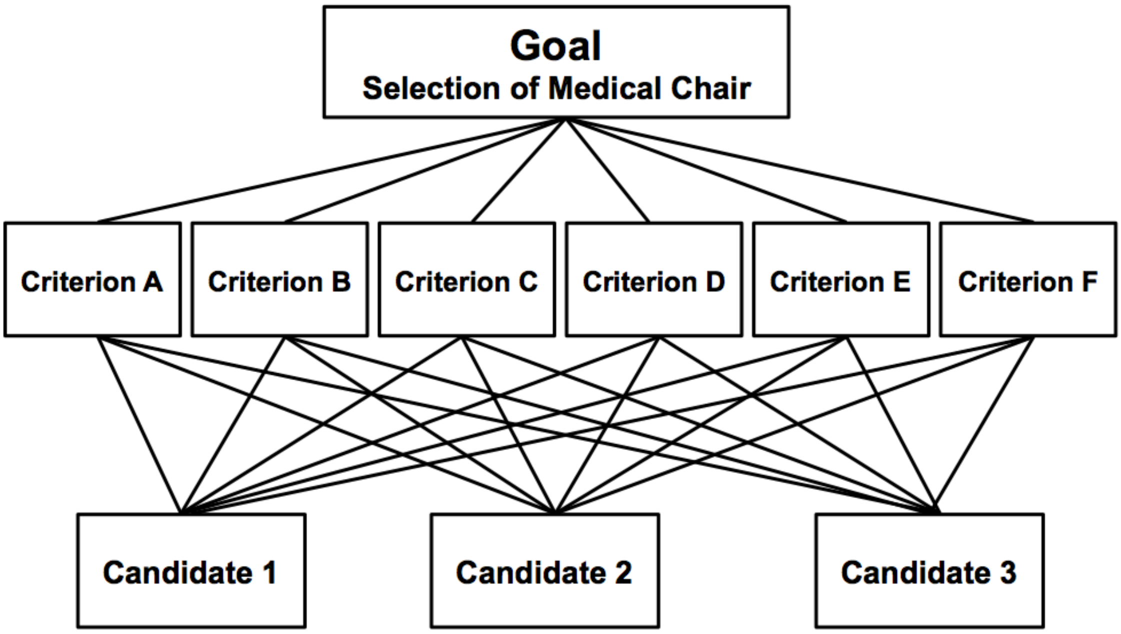

Figure 1: AHP schema for selecting a medical chair. In this example, there is one goal, three candidates and six criteria for selection among them.

The prices for software range from open source to 10,000 USD for a professional version (free, e.g. http://sourceforge.net/projects/priority). Some Web-based decision analysis software can cost more than 10,000 USD for enterprise versions. Most of the software runs on the Windows operating system, and few also run on the Macintosh and Unix operating systems [10]. However, since none of the available open source software was found to fit the exact purpose of selecting academic medical chairs, we decided to develop our own electronic tool based on the recommendations of the panels and the discussion at the consensus conference [15].

Development of our electronic tool to enhance the selection process (Aim 2)

Our electronic tool was designed specifically for supporting the selection of academic medical chairs. We, a priori, defined a number of prerequisites, some of which could not be met by existing open source software:

1) Our software is open access and open source,
2) user and mobile friendly,
3) web-based and compatible with all different explorers,
4) based on the analytic hierarchy process method,
5) modified to include all specific criteria identified by the other panels of the chair4medicine conference including all relevant quantitative and qualitative criteria for the candidate selection,
6) assess and report the certainty and consistency of the weight given to the criteria as well as the candidates, and,
7) include confidence intervals in the final scoring of the candidates. Our electronic tool alpha version 1.01 is currently distributed under the GNU General Public License [16] and is available for use or download at [17]: www.chair4medicine.uzh.ch

How could our electronic tool be integrated in the selection process?

There may be differences in the local procedures and guidelines related to the selection of academic medical chairs in several institutions, the general proposed process below [1] may reflect that of most institutions worldwide including the integration of our AHP tool (Figure 2).

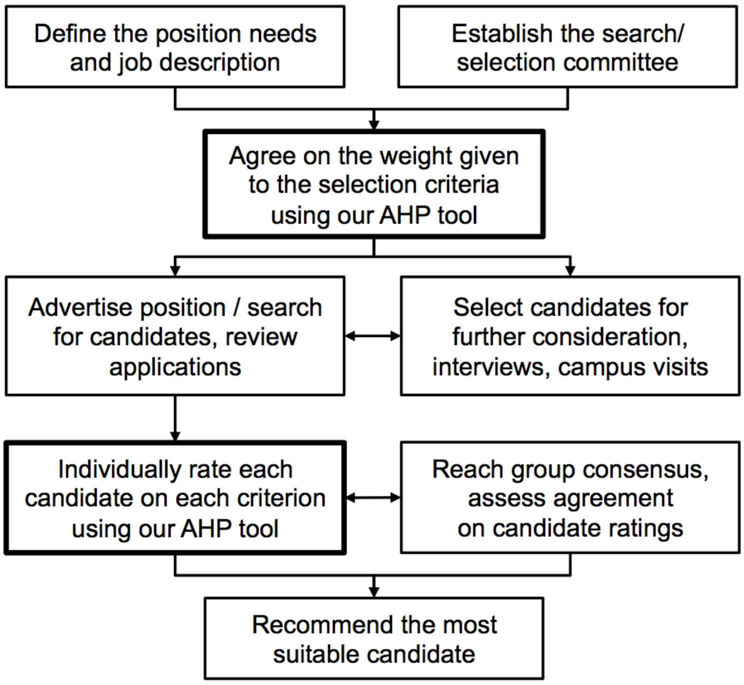

Figure 2: A simplified flow chart of the selection process of academic medical chairs having our AHP tool integrated in two separate steps (**bold boxes**). Adapted and modified from [1].

After the board of a university or a department has made a decision on a medical chair position and has established the search committee, the members of the search committee need to define the key requirements for the chair position (e.g., clinical expertise, research record, leadership skills etc). In a second step the search committee decides how much weight is given to each of the criteria. This is where the decision support system comes into play. It allows search committee members to weigh the relative importance of the different requirements for the chair position and to identify disagreement about these weights among committee members. It is important that these weights are determined before any searching or evaluation of candidates in order to have an unbiased starting point, that reflects and documents the opinion of the search committee about the key criteria and their (relative) importance.

There are several instruments that may be used for defining the weight of importance of the different selection criteria of the candidates. The Visual Analogue Scale (VAS) is a widely used instrument for assessing subjective characteristics or attitudes that cannot be otherwise directly measured [18] (Figure 3). However, while the VAS may be used for the assessment of each individual criterion it does not allow for pairwise comparison of different criteria that reflect their relative weights. Also, the VAS is less discriminatory, when compared to other methods such as the Best-Worst Scaling (BWS) that is used for pairwise comparisons. One advantage of using BWS to elicit criteria preferences is that it may allow the members of the selection committee to make trade-offs between the criteria [19]. In contrast, in performing VAS tasks, there are no trade-offs involved so that method may be less sensitive to detect differences in the scores of the criteria being rated [20].

Figure 3 shows how the decision support system offers pair-wise comparisons and provides a ranking according to their relative importance. Each member of the search committee compares each criterion with one another (e.g., clinical competence vs. teaching skills) and expresses how much more important the first criterion is compared to the other one (in this example clinical competence is considered a little more important, than teaching skills).

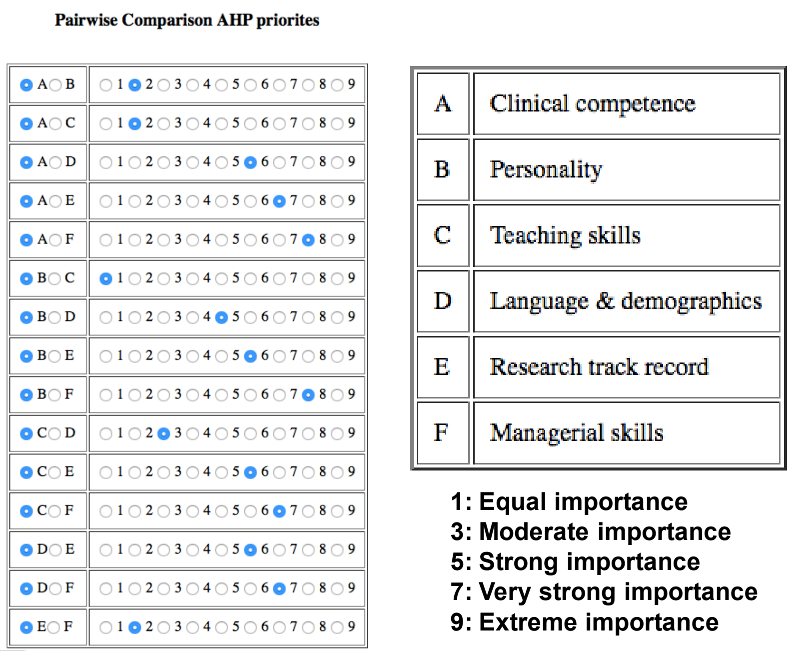

Figure 3: Example of the use of the AHP multiple pairwise comparisons of six criteria.

For each member of the search committee the relative weights can then be calculated (Figure 4). In this example clinical competence receives the largest weight followed by personality and teaching skills, whereas the research track record and managerial skills receive little weight. For each member, the consistency of the answers can be calculated. The value of the consistency ratio is higher, if there is less consistency. For example, if the criterion clinical competence is rated higher than teaching skills, and if teaching skills is rated higher than the research track record there is inconsistency, if the research track record is rated higher than clinical competence. A consistency ratio of <10% is (arbitrarily) considered to represent good consistency.

Decision Matrix and Priorities

	A	B	C	D	E	F	Priorities
A	1	2	2	6	7	8	0.371
B	0.5	1	1	5	6	8	0.249
C	0.5	1	1	3	6	7	0.212
D	0.17	0.2	0.33	1	6	7	0.107
E	0.14	0.17	0.17	0.17	1	2	0.037
F	0.13	0.13	0.14	0.14	0.5	1	0.026

A	Clinical competence
B	Personality
C	Teaching skills
D	Language & demographics
E	Research track record
F	Managerial skills

Consistency Ratio= 0.074 or 7.4%

Principal Eigen Value = 6.4561

Figure 4: Example for the results of the weighting task. The relative weights add up to 1.0 and the consistency ratio expresses how consistent the answers of the search committee member were.

Once each member of a search committee has completed the weighting task the results can be compared among the members of the search committee. Potential differences in the weights given to the different criteria can then be made explicit and discussed. The consensus about the relative weights should be reached before searching and evaluating the candidates, and used to target the search and identification of potential candidates accordingly.

Once all applications have been submitted to the search committee the AHP tool can now be used to evaluate the candidates. It may make sense to use the AHP tool only for candidates that have a chance to get the clinical chair position. For example, if clinical skills have received a large weight it may not make sense to further evaluate candidates that do not have much clinical experience. The same applies to other key criteria. Once a shorter list created with all candidates eligible for the chair position each member of the search committee individually rates each candidate on each criterion using the guidance provided by the other panels of the Chair4Medicine initiative (e.g. how to evaluate leadership skills). This way, not only the ranking for each candidate will be made explicit, but also the agreement among the committee members will be identified to reflect the level of certainty. There are various ways to calculate the match between the candidates and the ideal profile of the candidates, as reflected by the weights.

It is possible that, after evaluating the candidates, that the weighting of the key requirements change. For example, a candidate may present a novel area of research that fits well with the strategy of the department or the university. As a consequence, the search committee may reconsider their weights and give more weight to the research track record than at the beginning. Although it may appear preferable not to change to initial weights, it is quite common that the weights changes during the process of evaluating candidates. The AHP tool helps to keep track of changes and thereby documents how much and why the weighting of key criteria changed. Thereby, the search and evaluation process becomes more transparent and accountable, than it is currently the case. Finally, the search committee will have to reach group consensus on candidate ratings and recommend the most suitable candidate(s) to the board of the department, faculty or university.

Discussion

The selection of medical chairs in academic institutions is an important process and inadequate selection may result in candidates, who are poorly qualified or may not fit to the institution's culture leading to a significant negative impact on the key strategic elements of a medical school or even the entire university [1]. We firstly identified the Analytical Hierarchy Process (AHP), as the most suitable method among the currently available computerized multiple criteria decision-making approaches, that may enhance the selection process of academic medical chairs, and secondly developed a new decision support system updating the existing available AHP methods by fulfilling the specific needs in selecting academic medical chairs.

Analytic hierarchy process is one of the numerous multi-criteria decision-making methods that was originally developed by Saaty [14]. Briefly, it is a method to derive ratio scales from paired comparisons. The input can be obtained from actual measurements such as number of publications, years of clinical experience, or from subjective judgment such as charisma. The ratio scales are derived from the principal Eigenvectors [21], and the consistency index is derived from the principal Eigenvalue [13, 14]. This was based on the natural human ability to make sound judgments about problems. Such approaches include simplicity, usefulness for individuals or groups, intuition, compromise, and consensus, without prejudice towards specialized skills or knowledge [1]. The structure of AHP consists of a hierarchy of criteria and sub-criteria cascading from the decision objective or goal. By making pair-wise comparisons at each level of the hierarchy, participants can develop relative weights, called priorities, to differentiate the importance of the criteria [1].

AHP is one of the most widely used methods by decision makers and researchers. Many studies were published based in different fields such as planning, selecting the best alternative, resource allocations, resolving conflict, optimization, evaluation, diagnostics in medicine, and cost-benefit analysis. The different areas of applications include personal, social, the manufacturing sector, political, engineering, education, industry, government, sports, stock exchange, banking, as well as general, environmental, and project management [22]. In the field of faculty employment, AHP was already successfully employed in several occasions. In the case of Bloomsburg University of Pennsylvania in 2005, the available faculty position involved quantitative methods/operations management, set at the department of management in the college of business. The AHP method was successfully integrated in the selection process, and provided the final recommendation of a candidate [1]. In Paraiba Valley of Brazil in 2009, the faculty selection process was available for the logistics discipline that is part of the business and administration course. Several quantitative, as well as qualitative attributes, were considered and the most suitable candidate was elected using solely the AHP method [5]. However, to the best of our knowledge, the AHP method was not reported for the selection of an academic medical chair.

A comparison study of the functionality of the most common commercially available decision support systems [23], including Expert Choice® [24] that was co-developed in 1983 by Saaty, failed to identify the "best" software for general use as different contexts required different emphases on the different stages and thus some software fitted better with one context than others. Furthermore, a decision analysis software survey conducted in 2012 [10] identified at least 36 different decision analyses products from 24 vendors, each sharing many similar as well as various different features. Nearly all developers were heavily criticised by the lack of effort to build in some form of coaching into their products so that even a novice can be confident that their models are producing sensible results [10]. Thus, we decided to develop our own open source and open access decision support system customized according to the precise needs for the selection of academic medical chairs. Our tool was based on the validated AHP method and modified to include all important criteria for the candidate selection identified by the panels of the chair4medicine conference [15]. Furthermore, it was modified to assess and report the agreement among the selection committee members upon the desirable weight of importance given to the different assessment criteria of the candidates as well the overall level of certainty of the final recommendation.

In summary:

The structural, search phases and the final selection of academic medical chairs can be enhanced with the use of the analytic hierarchy process as it ensures transparency and consistency of the decisions made. Our software is available for free and is advanced by including both quantitative and qualitative criteria as well as including variance, confidence, certainty, and consistency. The obvious next steps would be to formally evaluate and externally validate our proposed decision making system.

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