

Marwa Ben Moallem^{*}
Chema Derbel^{**}
Mohamed Haykal Ammar^{***}
Noura Béji^{****}
Diala Dhouib^{*****}

RISK PRIORITIZATION USING THE ANALYTIC HIERARCHY PROCESS (AHP) IN A TUNISIAN HEALTHCARE DEPARTMENT: A REAL-WORLD CASE STUDY

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Abstract

Nowadays, the Tunisian hospital environment is a complex organization in which the safety of the patient is of primary concern to the authorities. In our study we focus on the Obstetrics and Gynecology Department of CHU of Sfax. It should be noted that no risk management study dealt with the hospital logistic chain in this institution. Hence, the purpose of this paper is to develop a strategy targeting the control of risks related to the patient care activities. The proposed approach consists of two phases. First, a qualitative survey, based on 20 semi-structured interviews, is carried out to identify the problems related to care and logistic activities of the Obstetrics and Gynecology Department in CHU Sfax. Second, the assessment of the identified risks in the hospital context is a multicriteria decision problem. To perform the evaluation of the 12 objectives depending on the identified risks, we have chosen the AHP (Analytic Hierarchy Process) for its simplicity and flexibility.

* University of Sfax, Institut Supérieur de Gestion Industrielle, Research unit LOGIQ, Digital Research Center of Sfax, UR13ES71, 3021, Sfax, Tunisia, e-mail: benmoallemmarwa@live.fr.

** University of Sfax, Institut Supérieur de Gestion Industrielle, Research unit LOGIQ, Digital Research Center of Sfax, UR13ES71, 3021, Sfax, Tunisia, e-mail: chemaderbel@hotmail.com.

*** University of Sfax, Institut Supérieur de Gestion Industrielle, Research unit LOGIQ, Digital Research Center of Sfax, UR13ES71, 3021, Sfax, Tunisia, e-mail: medhaykal@gmail.com, ORCID: 0000-0002-6398-9536.

**** University of Sfax, Institut Supérieur de Gestion Industrielle, Research unit LOGIQ, UR13ES71, 3021, Sfax, Tunisia, e-mail: beji.noura@gmail.com.

***** University of Sfax, Institut Supérieur de Gestion Industrielle, Research unit LOGIQ, UR13ES71, 3021, Sfax, Tunisia, e-mail: dialadhoub@yahoo.fr.

The results of this study revealed a complexity of coordination between basic and peripheral services due to several factors. Moreover, the interviewees highlighted the importance of developing a risk management strategy in the Obstetrics and Gynecology Department of Sfax. Finally, we proposed to apply our research in other services of the hospital to control other kinds of risk.

Keywords: prioritization, AHP, semi-structured interviews, obstetrics department.

1 Introduction

Promotion of safety and quality of care has become a priority for health facilities. The hospital systems in Tunisia have not attached importance to such topics despite of their many difficulties. Therefore, a literature review has been conducted using research papers by different authors in order to solve each problem encountered in the health care establishment.

After in-depth research, we found several papers dealing with the problem of risk management in the hospital environment, and in particular, with patient care. In this context, Razurel et al. (2015) have created a map of the risks to patients associated with medical treatment (PECM) in order to implement an action plan of risk reduction. To carry out this a priori risk analysis, the Preliminary Risk Analysis (APR) method was implemented by a multidisciplinary working group. The realization of this risks map allowed to distinguish 148 scenarios, 35 of which with unacceptable criticality.

Most scenarios concern generic problems: Communication (27%), Human Factor (20%), Organizational Management (16%), and Technical and Environmental Safety / Infrastructure (15%). In addition, 54 initial risk control actions were proposed and the levels of effort to implement them were evaluated. (Weber et al., 2015) led a multicentre study to map the risks associated with medical treatment for dependent elderly people in Alsace. It was conducted in 2014 on a representative sample of 23 Alsatian schools with a self-assessment questionnaire composed of 198 items completed by each institution during multidisciplinary meetings. The results showed that the regional percentages of risk management from 63% to 85%. As a result, 30 vulnerabilities were identified. An analysis of them resulted in a list of 13 possible improvement actions. In addition, the study determined difficulties related to the absence of appropriate political risk management, reflecting in particular the lack of according between the institution staff and doctors.

Moreover, Cridelich (2012) has evaluated a new method of risk analysis specific to the management of the chemotherapy patient at the University Hospital Center (CHU) of Nice. First, 53 types of failures were identified using the Failure Modes, Effects, and Criticality Analysis (FMEA) method. Then, due to the limitations of FMEA, the author chose to use a method called Functional

Resonance Analysis Method (FRAM). Since this method integrates human and organizational factors which are adopted in the chemotherapy circuit to be evaluated via current methodologies of risk management. Using the collected data, this method allowed to well providing the risk, activity, and cost axes. In order to control the risk management in the operating rooms of Sahloul University Hospital in Sousse, a hub of hospital activity (Ben Kahla-Touil, 2012) compared the available risk management methods and chose to adapt the FMECA (Failure Modes, Effects and Criticalities) in the operating rooms. Then, the author proposed a decision support system for risk management called GRAMA (Risk Management through a MultiAgent approach) to lead the stakeholders in the operating rooms towards the best decisions for the purposes of minimizing the risks. Finally, a simulation based on the proposed approach was implemented at Sahloul Hospital. Also, Cordina-Duverger (2015) has studied the various hormonal and anthropometric risk factors for women with breast cancer. The approach is based on data from a case-control study conducted on the general population in France. This was to compare women using hormonal treatments, the weights at different periods of life, various reproductive and medical characteristics, using data obtained during the interviews. On the one hand, the results showed that the carcinogenic effects of hormonal treatments were due to synthetic progestin. On the other hand, an absence of a deleterious natural progesterone effect on the breast cancer risk was noted. Veyrier et al. (2016) have dealt with risk management of the patients' medical treatment (PECM) when the hospital insures the responsibility while getting home. The researchers have chosen AMDEC as the best method. Indeed, with each employee's feedback, in the hospital, they were able to formalize a new PECM (medication management) which was optimized, secure, and controlled when the patients were home on pass. The implementation of a nurse / patient traceability of medical intake and information allowed to fulfill the patient's needs. Renet et al. (2016) have confirmed that the care pathway of cancer patients is complex and brings about several difficulties. The objective of the study was to identify and quantify the risks induced by oral anticancer drugs. Based on the proposed care model, AMDEC was used to analyze the risks. In addition, the results showed that 80% of the identified risks were related to a lack of training and / or information for patients and / or health professionals. Depending on the multiplicity and the specificity of cancer, the care pathway depends on the type of cancer. So that the modeling of the course of care proposed in this study could serve as a basis for defining a specific path for each kind of cancer.

Nolin et al. (2016) conducted a study to help improve the prevention of cytotoxic risk in the pulmonology department, in order to protect the health of the exposed staff. A preliminary study in the pulmonology department with

30 non-medical agents, as well as another study of the various departments and the completion of a semi-directive questionnaire was carried out. The results highlighted insufficient consideration of direct and / or indirect exposure to cytotoxic agents in professional practices. These were explained by insufficient training regarding the risks and by outdated equipment.

Each author has chosen to study a definite type of risk and has fixed an objective to study or a risk to focus on, as Razurel et al. (2015) who chose to manage the risk associated with patient care. Since our study deals with an unknown background in the gynecology department of Sfax, we use a literature review as a source of inspiration and we choose to perform a preliminary exploratory research to understand the context.

2 Related research

2.1 Qualitative study: Identification of needs, objectives and stakeholder expectations related to a risk management strategy

The main purpose of a preliminary analysis related to the care of patients is to develop a deep understanding of the topic. This will prevent us from spending too much time, effort or money. Nevertheless, a multitude of data collection techniques is required to define our scope and identify the risks that can be generated within this service. Qualitative research is particularly appropriate when the observed factors are difficult to measure objectively (Aubin-Auger et al., 2009). According to Roche (2009) the objective of a qualitative study is to better understand and get closer to the goal in order to shed light on several elements to conduct a qualitative study properly, several techniques are available:

- **Individual interviews.**
- **Group interviews.**
- **Projective techniques.**

Although there are other techniques, individual interviews (non-directive and semi-directive) are usually chosen, which seems the most appropriate. The purpose of the individual interviews is to gather as much information as possible from the respondents. The number of respondents can be between 10 and 100, with interviews lasting 1 to 2 hours. These interviews were of two types: non-directive and semi-directive. The non-directive interviews give the respondent an opportunity to express himself/herself without specific themes to discuss without any particular “canvas”, with each respondent expressing himself or herself on the same subject. Consequently, an analysis of such an interview will obviously be very complex. For this reason, the semi-directive interviews seem the most appropriate for our study. It aims to guide the respondent through a pre-established interview guide whose main objective is to remember that all

the topics on the guide interview will be addressed and get as much useful information as possible. In many cases, we have chosen semi-structured interviews, which seem easier (or less complicated!) to implement.

The results of the analysis, identified by semi-structured interviews, are structured in the form of corrective actions or alternatives. The decision maker has to decide which action should be considered first. Therefore, we deal here with a Multi-Criteria Decision Making (MCDM) problem in healthcare evaluation.

2.2 The MCDM Problem

According to Thokala et al. (2016), health care decisions are complex and involve trade-offs between multiple conflicting objectives. This has recently been identified as one of the most important issues in health system research. Using structured, explicit approaches to decisions involving multiple criteria can improve the quality of decision making a set of techniques, known as multiple criteria decision making (MCDM), are useful for this purpose. MCDM methods are widely used in other sectors, and recently there has been an increase in health care applications. In 2014, ISPOR (the International Society for Pharmacoeconomics and Outcomes Research) was charged with establishing a common definition for MCDM in health care decision making and developing good practice guidelines for using MCDM to aid health care decision making (Thokala et al., 2016). This shows the need for a scientific development of MCDM to support priority setting, which has recently been identified as one of the most important issues in health system research. Baltussen & Niessen (2006) have introduced various approaches to MCDM useful to prioritize health interventions, confirmed that MCDM should allow a trade-off between various criteria, and should establish the relative importance of criteria in a way that allows a rank ordering of a comprehensive set of interventions. In this paper, we deal with an obstetrics-gynecology department where the main challenge is that the resources are limited, making it impossible to provide each action with every effective intervention they might need or want at the same time. By summery, the purpose is to determinate the importance or urgency of actions that are necessary to preserve the welfare of patient or worker, and the establishment of actions or alternatives in order of their relative importance.

MCDM comprises a broad set of methodological approaches from operations research now being used increasingly in the health care sector, and it uses a structured and logical approach to model complex decision-making problems. Since its development, AHP has been one of the most widely used MCDM because of its simplicity and flexibility (Didem & Durmus, 2018).

AHP is a useful approach for evaluating complex multiple criteria alternatives involving subjective judgment. This tool is based on a comparative judgment of the alternatives and criteria which are not equally important, that explains the use of influences to reflect the importance of each purpose. In this context, Ammar et al. (2014) mentioned that AHP (Analytic Hierarchy Process) is an aggregation multi-criteria method developed by Tomas Saaty (1980). It is an effective tool to support complex decision making. In addition, AHP is “a theory of measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales” (Saaty, 2008). It is one of the more popular MCDM methods and has many advantages as well as disadvantages. One of its advantages is its ease of use. Its use of pairwise comparisons allows decision makers to weigh coefficients and compare alternatives with relative ease. It is scalable, and can easily adjust in size to accommodate decision making problems due to its hierarchical structures (Velasquez & Hester, 2013). Moreover, this method follows the decision-maker in the methodology for his problem formulation and allows to evaluate the importance of parameters.

3 The adopted methodology

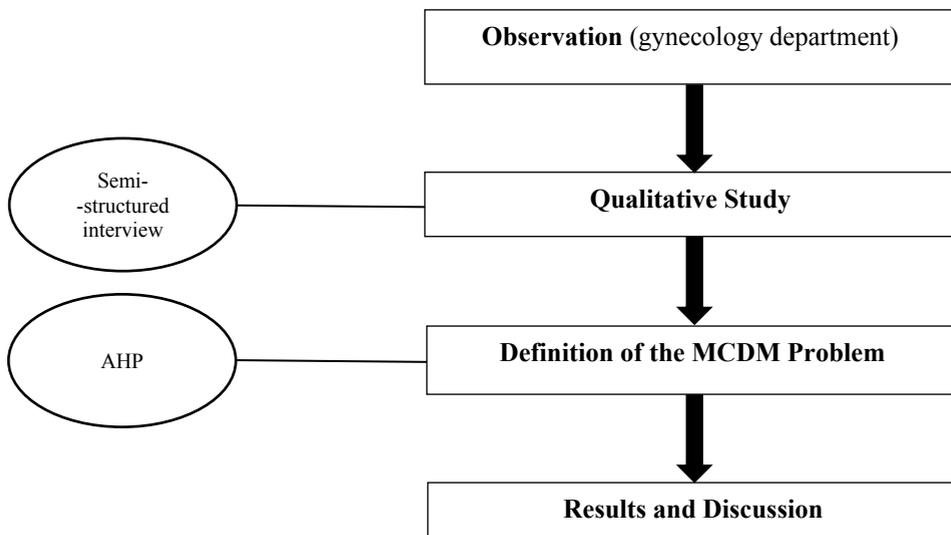


Figure 1: The adopted methodology

3.1 Observation

We visited the gynecology department and noticed the potential seriousness of adverse events associated with patient care. The presence of several types of incidents that may even put at risk the health care department together with the absence of a risk management policy, may create a number of problems, including:

- Miscommunication between departments can bring about dangerous situations.
- Misdistribution of tasks can cause incidents that put the patients' lives under risk.
- The hospital system includes a large number of activities. Communication between sectors seems difficult and the presence of several risks cannot be avoided.
- The awareness of the staff, patients, and visitors about the risks is still limited. In this regard, the managers of Sfax's Gynecology Obstetric are aware of negative effects caused by the absence of studies addressing the risks associated with the patient's medical treatment. So it is necessary to find a radical solution eliminating these failures.
- In view of the enormous flow of activities, due to insufficient human resources or equipment, the personnel is sometimes unable to take action.

The gynecology department faces several difficulties. This is why a literature review was conducted in order to solve each problem found by them in the health care establishment. Due to the lack or absence of studies in this department we have used information provided from literature and our visit. Our target is to perform a risk analysis, determine and prioritize several potential risks that can cause malfunction of the Obstetrics and Gynecology Department of Sfax.

3.2 Qualitative study

A semi-structured interview was selected for this study as a qualitative method, in the Obstetrics and Gynecology Department, for several reasons: on the one hand, this tool allows new ideas to be brought up during the interview based on what the interviewee says. On the other hand, it allows to obtain the required qualitative results and provide an appropriate balance in data collection and subsequent analysis.

20 interviews were conducted, with persons of various levels of knowledge and experience working at the hospital (nursing and administrative staff), belonging to different departments (gynecology, hygiene, supply, underwear, pharmacy, etc.). The interviews were intended to guide the response of the respondents around various themes previously defined by the interviewers and recorded in an interview guide.

In this paper, we proceeded as follows:

- **Sample selection**
- **Pre-test and validation of the interview guide**
- **Conducting interviews**
- **Analysis interviews**

A. Sample selection

We took into account different views on the risks that occurred in the Obstetrics and Gynecology Department, expressed by 20 respondents. We divide the sample in two different groups:

- Choice of respondents belonging to external departments (pharmacy, supply, underwear, hygiene).
- Selection of respondents working in the Gynecology and Obstetrics Department (resident doctors, anesthetists, instrumentalists, supervisors, nurses, midwives, workers, etc.).

B. Pre-test and validation of the interview guide

A “test interview” is necessary with a gynecologist and a midwife to decide what questions to ask them. Their opinions and reactions, and the changes they proposed, were taken into account in the creation of a final interview guide to be applied in the Obstetrics and Gynecology Department of Hedi Chaker Academic Hospital in Sfax.

C. Interviews

The purpose of an individual interview is to gather as much information as possible from the interviewees. The number of interviews can be between 10 and 100, with a duration from 1 to 2 hours. This sample makes it possible to foresee the time spent on the interviews and the cost generated by such a study, in either money or time (Roche, 2009). All interviews were conducted face-to-face during a period of three months. There are 20 interviews, and the following table provides information from the interviews.

Table 1: Interview information

Number	Stakeholders	Position	Duration (min)
1	Doctors	Resident	70
2			72
3		Assistant	69
4			77
6	Supervisors	Supervisor of internal gynecology	76
7		Supervisor of the postpartum Department	80
8		Supervisor of the Internal Gynecology Department Day Hospital	82
9	Nurses	Internal Nurse in Gynecology Department	58
10			66
11	Midwives	Teacher Trainer at the delivery room	67
12		Midwife in operating room	61
13	Anesthetists	Anesthetist in the operating room	63
14	The instrumentalists	Instrumentalist in the operating room	75
15			82
16		Internal Instrumentalist in Gynecology Department	55
17	Pharmacy		91
18	Administration	Manager of Supply Department	66
19	Underwear	Underwear Manager	59
20	Hygiene	Head of the Hygiene Department	74

D. Interviews analysis

Before the analysis, we present an interview guide composed of six themes, and the questions proposed in it focused on:

First, the risks related to the daily activity of the hospital, as identified by professionals. Second, the impact of the implementation of a risk management strategy in health care institutions, its objectives, by whom it should be managed and who are the stakeholders who can contribute to its success.

The interview guide is composed of six topics:

Topic 1: Need for Risk Management in hospital systems

- What kind of activities are you performing?
- Are there documents in which the problems that have occurred during certain operations were recorded? What is the recorded information?
- Before the medical interventions, do you prepare scenarios to facilitate interventions in unforeseen situations?
- In case of a medical intervention, do you inform the patient about the potential risks? If so, what are the impacts of this information on the patient?
- What is the frequency of white operations or staff preparations for unforeseen problems?

- Are there scenarios already prepared by the different stakeholders (even subcontractors) to intervene in the event of an incident?
- How to sensitize the staff to critical situations and various potential hazards?
- Do you consider it useful to develop a strategy aimed at controlling the risks that can be generated when you carry out your professional activity?

While it is possible to take notes about the respondents' answers, we recorded a voice clip (with permission) in order to receive appropriately the correct information.

All the respondents are unaware of the scenarios already prepared within the hospital to intervene in the event of an accident.

- * 80% of the respondents (medical / paramedical committee) confirmed the existence of scenarios at the universities participating in university workshops, while 20% said that they manage the situations in time according to the experienced problem.
- * lack of codified risk awareness within the hospital (codified awareness is only taught throughout the academic path for the paramedical and medical committee), and staff is verbally informed at the beginning until it becomes a routine, according to all respondents.
- * 95% of the respondents emphasized the existence of non-codified corrective measures. In the event of an incident they manage the situations in time or they follow the hierarchy (recourse to the manager) if need arises.
- * 95% of the respondents stated the absence of documents in which the problems that occurred during certain operations were recorded.
- * 90% of the respondents found that the development of the risk management strategy is very useful.
- * Some problems, such as the lack of qualified personnel, equipment and the intervention of other services or organizations, are definitely the main causes of the malfunction of the Department, according to 90% of the respondents, 25% of which added the problem of poor information flow between the internal and external stakeholders.
- * 10% of the respondents underline the existence of financial and procedural constraints that prevent them from intervening.

Topic 2: Objectives, expectations and requirements for the development of a risk management strategy in hospital systems

- What are the potential goals of developing a risk management strategy in the hospital systems?
- What are the different dimensions that need to be taken into account when developing this strategy?
- Do you have any requirements or recommendations that you want to include in the proposal for a risk management strategy in the hospital systems?

From our semi-directive interviews, we can state that risk management aims to:

- * Organize continual procedure reminders against incidents for the entire hospital committee, according to 70% of the respondents.
- * Sensitize all the stakeholders through ongoing training, according to 50% of respondents.
- * Develop job profiles that determine the specific task for each stakeholder (who does what and how?), according to 45% of the respondents.
- * Improve the cooperation between the different departments, according to 40% of the respondents.
- * Develop recall procedures for the recommendations made by the medical committees and forensic medicine experts, according to 30% of the respondents.
- * Provide a dependent central sterilization department, according to 20% of the respondents.
- * Have data traceability for the staff as well as the patients, according to 20% of the respondents.
- * Have codified corrective measures relating to each incident, as reported by 20% of the respondents.
- * Provide comfort and safety conditions for the staff and improve the environmental quality for the patient, according to 15% of the respondents.

Topic 3: Responsibilities at the development level of a risk management strategy in hospital systems

- What are the different stakeholders that need to participate in the development of a risk management strategy in HS (hospital systems)?
- Are there regulatory ways to be taken into account when developing a risk management strategy in HS?
- Who is the stakeholder capable of leading the development of this strategy?
All respondents stated that they are training to participate in the development of a specific strategy to manage risks
- * 55% of the respondents suggest that the management of the Department should designate a management specialist to cooperate with the medical, paramedical and administrative committee; 15% of respondents said that this strategy should be led by the administration, and 30% of respondents emphasized that this strategy should be headed by Head of Department.
- * 45% of the respondents underline the need for a codified, approved and updated procedure for each risk situation, for instance: if we do this, what should we do after ... why and when? etc.
- * 30% of the respondents want to have a check list of the operational linen at the beginning and at the end of each operation.
- * 15% of the respondents want to obtain an approach that ensures the quality and safety of the Department.

Topic 4: Environment and interaction with other departments at the level of development of a risk management strategy in hospital systems

- Are there other departments / organizations that can influence the activities you are performing?
- How do you manage the risks created by disruptions from other department(s) and / or organization(s)?
- Who is the stakeholder with whom you have most problems?
- * 90% of the respondents indicated that they are in coordination with all external departments.
- * Around 60% of the respondents pointed out the difficulties with the supply department and the pharmacy department, especially in terms of limited availability of single-use clothes, and wish to move towards a policy of supplying this type of clothes to avoid the risk of infections, as well as to adapt the operational linen budget to the need of the department (especially surgical gowns) with the need to sensitize all the stakeholders to this policy.
- * 35% of the respondents report the problems with the Hygiene Department. These respondents disregard regular visits to this department, which they find fundamental, in order to reduce the frequency of the infection risk.
- * 30% of the respondents experience difficulties with the Underwear Department.
- * Multipurpose clothes are often poorly maintained according to 25% of the respondents, while the other 5% want the Underwear Department to work in the afternoon.
- * 15% of the respondents notice that the Biomedical Department can influence their progress within the service, they even offer regular maintenance of equipment.
- * 10% of the respondents mentioned the existence of coordination problems with the Maintenance Department.

Topic 5: Potential effects of developing a risk management strategy in hospital systems

- What are the potential impacts of developing a risk management strategy in the hospital systems on the health system and the quality service?
- How can we successfully implement a risk management strategy in the hospital systems?
- * Cover the lack of human and material resources, according to 6% of the respondents.
- * Create a motivating atmosphere that helps to reduce the risk and master own tasks, consequently improving the quality of care, according to 55% of the respondents.

- * Sensitize and raise awareness of the staff towards the hazards and mainly towards the risks of infections from several sources, as emphasized by 50% of the respondents.
- * Ensure a perfect and timely sharing of information with rapid cooperation between stakeholders, claimed 35% of respondents.
- * Define a very clear risk management process for each incident, as well as corrective actions to be taken, said 10% of the respondents.

Topic 6: Do you have any additional information?

- * 30% of the respondents said that the circuit of multipurpose operational linen is slow and expensive (personal expenses, energy-consuming equipment).
- * 10% of doctors found themselves dealing with tasks they are not supposed to do.
- * 10% of the respondents are of the opinion that setting up a quality / safety approach is essential to control the risks.
- * We must see more awareness of women's psychology, said 10% of respondents.

With multidisciplinary support, we could formulate 12 alternatives that will be the objectives in this case and four criteria that are presented below (Table 2):

Table 2: Alternatives and criteria

Alternatives	Criteria			
	Security	Awareness	Comfort	Communication
A1	Create attractive signs to remind of security measures.			
A2	Provide mandatory postgraduate training controlled by an independent organization.			
A3	Develop procedures for the staff dedicated to medical and care activities.			
A4	Reduce the number of delayed surgical procedures in order to reduce the number of risks to the health of patients.			
A5	Define a policy for a single-use linen while taking into account budgetary, social and health aspects.			
A6	Establish a communication procedure with the patient.			
A7	Establish the job profile for each category of health professionals.			
A8	Trace incidents that have already occurred and take steps to control their causes.			
A9	Implement a risk policy within the respective areas of responsibility across the institution that allows an institution to consider external, internal, financial and other risks which could put the organization at risk.			
A10	Develop new methods to improve staff and equipment management (staff allocation, equipment allocation, etc.).			
A11	Provide comfort and safety for the staff and improve the quality of the environment for the patient.			
A12	Improve cooperation and information sharing between the departments to reduce daily problems, mainly with pharmacy / supply and hygiene.			

When risk analysis is done in an appropriate way, it leads to a series of recommendations that must be made to eliminate or reduce the risks. Which risk has the most impact? What are the priorities of Maternity Management? It is logical that the most serious risks, which have the highest impact, are considered first. Next, it is necessary to determine the impact on each objective. These selection decisions were made by the head of department.

4 Prioritization hierarchy at the strategy level

These objectives do not have equal importance, which explains the use of the influences in order to impact the importance of each aim. As Ammar et al. (2014) stated, the AHP (Analytic Hierarchy Process) method is a multicriteria aggregation method developed by Saaty (1980). It is an effective tool for dealing with complex decision making. Moreover, it is the multicriteria analysis best subject to responses because it guides the decision maker towards the methodology of formulation of his problem and it proposes method of evaluation of the importance of the parameters. Saaty (2001) suggested the following steps when applying AHP to study multicriteria problems. First, hierarchy, metrics and contributory factors are defined. In general, this hierarchy contains three levels: first, the focus or the goal, second, the objective/criteria for achieving the goal, and finally the evaluation criteria for deciding the objective. Step 4 consists in estimating the relative priorities (weights) of the decision criteria. We construct a set of pairwise comparison matrices for each of the lower levels with one matrix for each element in the level immediately above by using the relative AHP scale measurement shown in Table 3.

4.1 Decision hierarchy

The first step in an AHP analysis is to build a hierarchy for the decisions. This is also called decision modeling and consists in building a hierarchy to analyze the decision. The main objective must also be identified in this level. In our case, the goal is to choose the most important action that should be considered from among several potential alternatives. All criteria that might influence the decision are already mentioned in the previous section (P.11).

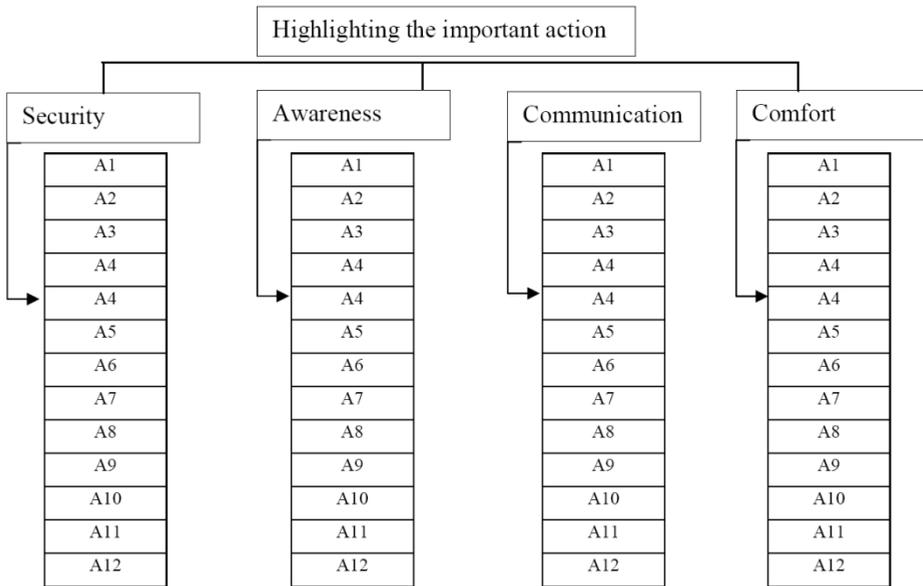


Figure 2: Decision hierarchy

4.2 Pairwise comparison matrix of criteria

Since not all the criteria have the same importance, the second step in the AHP process is to derive the relative priorities (weights) for the criteria. The relative importance between two criteria is measured on a numerical scale from 1 to 9, as shown in Table 3.

We recall that the importance of the criteria of our study was made according to the order of importance established by the decision maker.

Table 3: Saaty’s pairwise comparison scale

Verbal judgment	Numeric value
Extremely important	9
	8
Very strongly more important	7
	6
Strongly more important	5
	4
Moderately more important	3
	2
Equally important	1

Table 4: Random consistency

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RIC	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

The matrix is filled using the formula

$$a_{ji} = \frac{1}{a_{ij}}$$

We define a coherence index (CI) as follows:

CI = $(\lambda_{\max} - N - 1) / N$, where N is the number of the elements being compared (the higher the CI, the more inconsistent the judgments, and vice versa).

A coherence ratio is defined as the ratio of the calculated consistency index and the random inconsistency coefficient (RIC) of a matrix of the same dimension. The consistency ratio is given by the following formula:

$$CR = CI / RIC \times 100$$

CR it must be less than 10% to make consistent judgments, where RIC is a random inconsistency coefficient that represents the average of the indices calculated at each calculation for various N (size of the square matrix).

Table 5: Pairwise comparison matrix of criteria

Criteria	Security	Awareness	Comfort	Communication	Priority Vector
Security	1	2	5.00	6	49.60%
awareness	0.50	1	5	4	31.19%
Comfort	0.2	0.20	1	0.25	6.36%
communication	0.16	0.25	4.00	1	12.85%
Sum	1.8	3.45	15	11.25	100.00%

$$\lambda_{\max} = 4.095, \text{ we have } W1 = \begin{pmatrix} 0.4960 \\ 0.3119 \\ 0.0636 \\ 0.1285 \end{pmatrix}$$

According to the results in Table 5, it is clear that we attach greatest importance to the security criterion (0.4960), followed by awareness (0.3119) and communication (0.1285). The comfort factor has the minimum weight (0.0636).

4.3 Pairwise comparison matrix of criteria with respect to each criterion

In this step we have chosen to focus on the security criterion (Table 6). The same steps are performed for each pairwise comparison with respect to awareness, communication and comfort.

Table 6: Pairwise comparison matrix of alternatives with respect to the security criterion

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	Priority Vector
A1	1	0.142	0.5	0.2	0.25	0.5	0.2	0.2	0.2	3	3	0.166	2.60%
A2	7	1	7	4	4	6	0.5	6	0.5	8	8	2	16.60%
A3	2	0.142	1	0.2	0.25	0.333	0.2	3	0.33	3	3	0.166	3.70%
A4	5	0.25	5	1	3	4	0.33	4	0.33	7	7	0.5	9.80%
A5	4	0.25	4	0.33	1	4	0.33	3	0.33	6	6	0.5	7.20%
A6	2	0.166	3	0.25	0.25	1	0.25	4	0.2	5	5	0.25	5.00%
A7	5	2	5	3	3	4	1	4	0.5	8	6	2	16.20%
A8	5	0.166	0.33	0.25	0.33	0.25	0.25	1	0.2	5	5	0.25	4.20%
A9	5	2	6	3	3	5	2	5	1	9	9	3	20.60%
A10	0.33	0.125	0.33	0.142	0.166	0.20	0.125	0.2	0.111	1	1	0.125	1.30%
A11	0.33	0.125	0.33	0.142	0.166	0.2	0.166	0.2	0.111	1	1	0.125	1.30%
A12	6	0.5	6	2	2	4	0.5	4	0.3	8	8	1	11.50%
Sum	42.66	6.87	38.49	14.51	17.41	29.48	5.85	34.60	4.11	64.00	62.00	10.08	

$$\lambda_{\max} = 13.567 \text{ CI} = 0.096, \text{ CR} = 9.62\% < 10\% \text{ (acceptable)}$$

5 Model synthesis

In this step we calculate the overall priority (also called final priority) for each alternative; that is, the priorities that take into account not only our preference of alternatives for each criterion but also the fact that each criterion has a different weight. We are using all the values provided in the model. This step is called model synthesis.

Table 7: Synthesis of the model

	Criteria	Security	Awareness	Comfort	Communication	Overall priorities
	Criteria Weights	0.4960	0.3119	0.036	0.1285	
Actions	Action A1	0.026	0.172	0.132	0.165	0.09230455
	Action A2	0.166	0.104	0.012	0.104	0.1285696
	Action A3	0.037	0.169	0.043	0.171	0.0945846
	Action A4	0.098	0.099	0.055	0.055	0.0885336
	Action A5	0.072	0.076	0.171	0.033	0.0698129
	Action A6	0.050	0.043	0.162	0.177	0.0667882
	Action A7	0.162	0.157	0.132	0.132	0.1510343
	Action A8	0.042	0.037	0.022	0.022	0.0359913
	Action A9	0.206	0.211	0.173	0.187	0.1982444
	Action A10	0.013	0.013	0.102	0.020	0.0167447
	Action A11	0.013	0.014	0.198	0.012	0.0194846
	Action A12	0.115	0.121	0.056	0.202	

Once the above steps have been completed, it is possible to make a decision. This constitutes the last step in our AHP analysis. For this, it is necessary to compare the overall priorities obtained and whether the differences are large enough to allow for a clear choice. To give the importance (or weight) of each criterion (security, awareness, comfort and communication), action 9 is the most preferable one (with the overall priority = 0.1982444).

6 Discussion

The department stakeholders emphasized the importance of integrating an institutional risk management policy and implementing it. It is obvious that the needs and the objectives identified during the semi-structured interviews must be set up in the Department to cover all the activities. But the priorities will be influenced by the weights given to the criteria. It is useful to perform a sensitivity analysis to see how the final results would change if the weights of the criteria changed. This process allows us to understand the robustness of our original decision and what are the drivers (which criteria influenced the original results). This is an important part of the process and, in general, no final decision should be made without performing a sensitivity analysis. Note that in our example, criterion A9 (Implementation of risk policy within their respective areas of responsibility across the institution, that allows an institution to consider external, internal, financial and other risks which could threaten the organization) has a great importance (priority 19.824%). The questions that we can ask at this stage are: What would be the best objective if we changed the importance of the criteria? What if we gave the same importance to all the criteria? And what if we gave more importance, for example, to A7 (Establish the job profile for each category of health professionals)? Calculations show that even if we change the

weights, the results remain the same, with high importance of criterion A9. Although the adopted methodology in this study has been quite useful in prioritizing different risks, it is not without some limitations. A major limitation is that the rating scale used in the AHP analysis is conceptual, uses a discrete scale of 1 to 9 which cannot handle uncertainty and the presence of the ambiguity in deciding the priorities of different attributes. There are also risks of bias while making pairwise comparisons of different factors. Therefore, one should be careful in assigning a relative score to different factors. This study can be further extended by considering a Fuzzy AHP approach or ANP so as to revise this model after considering some other factors in judgment expressions.

7 Conclusion

The objective of this research was to carry out a qualitative study based on a preliminary analysis in order to identify the needs, requirements and expectations of the respondents regarding risk management of medical activities in the Obstetrics and Gynecology Department of the Academic Hospitals of Sfax. Moreover, we propose to determine the prioritization of the objectives to be achieved by the risk management using the AHP method since it is an effective tool to deal with complex decision-making. It is also the best multicriteria analysis method because it follows the decision maker in the methodology to formulate his problem and in particular because it proposes a method of evaluation of the important parameters.

For this, we contacted the stakeholders of the Obstetrics and Gynecology Department in the Hédi Chaker Academic Hospital of Sfax, their risk management needs and their objectives through a qualitative study.

We analyzed the obtained findings in order to identify the objectives to be taken into account in risk management, to determine the relevance of each objective and, finally, to establish the coherence of the judgments of these objectives.

Our purpose is to provide the decision-maker with tools for decision aid to assure a continuous improvement of performance. Therefore, a framework will be allowed to be explored by a multidisciplinary team in the future. In future research, we propose to apply our results in other departments of the hospital to control other types of risks.

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