

Managing the Risk of Needlestick Injury in U.A.E. Hospitals

إدارة خطر إصابة وخزة الإبرة في مستشفيات الإمارات العربية المتحدة

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Abstract

Healthcare sector is a field full of risks; hence, risk management is an important concern in healthcare industry. The motivation of this study is to identify effective practices, tools, and techniques in managing infectious risks in healthcare field, particularly the needlestick injury (NSI) risk. For this purpose, a review on the literature is done for studying risk management in general and risk management in healthcare field in order to collect wide range of knowledge about this topic and to know how to deal with risks when occurring. Current philosophies and practises have been studied and their effectiveness on dealing with risks has been presented as well. The NSI risk has been studied in details and some studies have been showed for this purpose. Interviewees were asked for holding interviews and take part in a qualitative research study relating to infectious risks management, case of needlestick injury. Five hospitals provided data concerning the practises done when an NSI occurs, and the application of the proposed conceptual framework which is the butterfly risk tool for NSI whether it was negative or positive case was also presented. Overall, this study proved that educating the staff about all risks types could occur in the hospital is essential in order to get the knowledge of preparing risk response plans that helps in reducing likelihood occurrence of the risk sources and avoiding risk. It will help also in mitigating the impact of the consequences and in transferring/diversifying risk. The educational and awareness programmes and sessions will act as activities for preventing and monitoring the control of risks sources and will work as controls for mitigating and correcting the risks consequences as well. Another highlighted point in this research was filling incidence reports when an injury occurred. The importance of this point is for reporting the risk immediately after occurring and not to hide this information as it will affect the injured person, as well as could affect other involved people working in the same area. In conclusion, recommendations for risk managers in hospitals have been proposed in order to manage risks in general by applying the proposed conceptual framework.

Keywords: Risk Management, Risk Management in Healthcare, Infectious Risks, Needlestick Injury (NSI), and Butterfly Risk Tool

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الخلاصة

إن قطاع الرعاية الصحية حقل محفوف بالمخاطر، وبالتالي، فإن إدارة المخاطر هي مصدر اهتمام كبير في مجال الرعاية الصحية. الدافع لهذه الدراسة هو تحديد الممارسات الفعالة والأدوات والتقنيات في إدارة المخاطر المعدية في مجال الرعاية الصحية، وخاصة خطر إصابة وخزة الإبرة. لهذا الغرض، سوف يتم استعراض المنتجات الأدبية لدراسة إدارة المخاطر عامة و إدارة المخاطر في مجال الرعاية الصحية لجمع نطاق وإسع من المعرفة حول هذا الموضوع ومعرفة كيفية التعامل مع المخاطر عند حدوثها. و قد تمت دراسة الفلسفات و عرض الممارسات الحالية و فعاليتها أيضا في التعامل مع المخاطر. و تم دراسة خطر إصابة وخزة الإبرة بالتفصيل، و وضحت بعض الدراسات التي أجريت لهذا الغرض. تم طلب إجراء مقابلات من مرشحين من بعض المستشفيات في الدولة والمشاركة في دراسة بحثية نوعية لإدارة المخاطر المعدية ، حالة إصابة وخزة الإبرة. خمسة مستشفيات في الدولة قدمت البيانات و المعلومات المتعلقة بالممارسات عندما حدوث إصابة وخزة الإبرة فيها، و تم تقديم تطبيق الإطار المفاهيمي المقترح والذي هو أداة الفراشة لإدارة الخطر لإصابة وخزة الإبرة سواء كانت الإصابة سلبية أو إيجابية. وبشكل عام، أثبتت هذه الدراسة أن تثقيف و تعليم الموظفين حول جميع أنواع المخاطر التي ممكن أن تحدث في المستشفيات هو أمر ضروري من أجل الحصول على المعرفة لإعداد خطط الاستجابة للمخاطر التي تساعد في الحد من حدوث احتمال مصادر المخاطر وتجنبها. وسوف تساعد أيضا في التخفيف من آثار العواقب في نقل / تنويع المخاطر. إن برامج التعليم والتوعية والدورات ستكون بمثابة أنشطة لمنع ورصد ومراقبة مصادر المخاطر، وسوف تعمل كضوابط لتخفيف وتصحيح عواقب المخاطر كذلك. و تم إبراز نقطة أخرى في هذا البحث و هي ملء تقارير الحوادث عند حدوث الإصابة. و تكمن أهمية هذه النقطة في الإبلاغ عن المخاطر مباشرة بعد حدوثها وليس إخفاء هذه المعلومات لأنها سوف تؤثر على الشخص المصاب، وكذلك يمكن أن تؤثَّر على أشخاص معنيين آخرين يعملون في نفس المنطقة. وفي الختام، تم اقتراح توصيات لمديري المخاطر في المستشفيات من أجل إدارة المخاطر بشكل عام من خلال تطبيق إطار العمل المفاهيمي المقترح في هذه الدر اسة.

الكلمات الرئيسية: إدارة المخاطر، *إدارة المخاطر في الرعاية الصحية*، مخاطر الأمراض المعدية، إصابة وخزة الإبرة، وأداة الفراشة لإدارة المخاطر.

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Dedication

To my parents,

who made all of this possible, for their endless encouragement and patience.

To my beloved one and my soul mate, my husband,

Mohammed Eid

who believed on me and supported me all over my studying period

To **my angels, my ultimate happiness, my daughters,**

Zeina and "my second baby who's not born yet"

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Abbreviations

NSI – Needlestick Injury

HBV – Hepatitis B Virus

HCV– Hepatitis C Virus

HIV- Human Immunodeficiency Virus

PEP-Post Exposure Prophylaxis

COSO-Committee of Sponsoring Organisation

ERM – Enterprise Risk Management

PCI – Preventive and Control of Infection

CDC - Centres for Disease and Control Prevention

WHO- World Health Organization

Chapter 1 – Introduction

1.1 Introduction/ Background

Risk and uncertainty both participate in people's lives (Davidsson, 2010). All characteristics of organizational activities were covered by risk and all levels of management integrate it. One of the key parts on any establishment's activities is risk management; achieving the establishment's objectives and aims efficiently and directly is its main plan in any organisation. Any changes or alterations of the organisation's internal and external environment are affected directly by the risk management of that organisation, meaning that, it is an on-going process. Actually, risks identification and control require incessant attention if the environment has been changed (Tchankova, 2002).

Decisions need to be made daily depending on different information and unknowns. The decision of crossing a road for instance needs complex and immediate evaluations of chances. It might be concluded that decision makers understand well that this world is risky and uncertain as per Davidsson (2010) since decisions were being made every day. This is different than what Knight (1921) claimed about risk and uncertainty. He showed the difference between risk and uncertainty, and how they have two different concepts, by using probabilities; risk can be measured whereas uncertainty has no way to be measured.

Since this research is solving a health care (or healthcare) issue, it is important to define what is healthcare. It is "the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans". Practitioners in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers deliver healthcare to patients. The work giving primary, secondary and tertiary care, as well as in public health is called healthcare (Wikipedia, 2011b).

As mentioned before, healthcare sector is a field full of risks; therefore, risk management is a significant issue in healthcare industry. Hospital trusts in United Kingdom highlighted the risks linked to healthcare and managed them through risk assessment (Brown, 2011). According to Wilson and Taylor (2011) all healthcare practises, by its nature, carries a risk, and according to

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Reason (2004); healthcare field has some characteristics that differentiate it from other risky fields like enormous diversity of its operations and equipment; degree of uncertainty; the occurrence of emergencies; and the patients' vulnerability. The relation between the customer and the employee of the organisation can define the level of risk in that organisation; this is what creates the most important difference between healthcare field and other risky industries, a few persons serve a large number of users in other industries while in the healthcare system there is a one to one or a few to one ratio.

For that, healthcare professionals use different philosophies, practices and tools to manage and reduce risks in their field. For example, Vredenburgh (2002) examined in his study six management factors usually included in safety programmes, which are management commitment, rewards, communication and feedback, selection, training, and participation, the level they added to the environment of safe work for the employees of the hospital.

Many types of risks in healthcare field will be shown later in this research; and an important one to be studied in details are the infectious risks. Using sharp tools, needles, and instruments for curing diseases is a technique used thousands of years ago (Gillis, 2000). For this research, the case of needlestick injury (NSI) which is an essential source of infectious risks in healthcare will be studied in details in a later chapter. In brief, NSI means "the introduction into the body of a health care worker, during performing his or her job, of blood or other potentially infectious material by a hollow-bore needle or sharp instrument, including, but not limited to, needles, lancets, scalpels, and contaminated broken glass" (Astrazeneca, 2003). Finally, a conceptual framework will be developed in order to study the case of NSI and to be applied in real life for such cases.

1.2 Research Issue/Problem

The researcher was inspired to do this research in order to identify effective practices, tools, and techniques in managing infectious risks in healthcare sector, specifically the needlestick injury (NSI) risk.

1.3 Aim and Objectives

The researcher aimed in this research to build a conceptual model for the needlestick injury when occurring in healthcare providers. So, the objectives are as follows:

- 1. Review the current literature on the nature of risks in general and in healthcare in terms of identification and categorization of the different risks.
- 2. Investigate the effectiveness of current philosophies, practices and tools used in healthcare sector to manage risks.
- 1. Evaluate the effectiveness of a conceptual framework that can be used as a foundation to inform Risk Management in healthcare.
- 2. Examine the effectiveness of current practices and tools in the management and control the risks associated with infections in NSI.

1.4 Research Questions

The researcher has extracted the following questions from the different literature studied and the different cases analysed, and they are:

- 1. What are the major risks related to the use of needlesticks in hospitals?
- 2. How effective are the current practices and tools in dealing with NSI's?
- 3. What are the best practices and tools used to manage such risk?

The above questions will help in deriving a conceptual framework at the end of this research where it is of high interest to present risk management model in healthcare sector.

1.5 Scope of Work

The plan of this research paper is to find the tools and techniques used to manage risks in healthcare organisations. It would be essential for such to occur is to first understand risk management in general, risk management in healthcare, what the risks in healthcare are, their types, and categories. By studying the different literature, understanding of risk management in healthcare will be cleared. Then, the review on different literature will help in building up a conceptual framework – model – that would be used as the basis of this research. After that, interviews will be hold with representatives from different hospitals that have applied risk management systems following the case study and qualitative research approach for collecting

the required data. At the end, the conceptual model will either be accepted or rejected depending on the collected data from the interviews.

1.6 Outline of this Study

The next chapter of *literature review* (*chapter 2*) will provide the foundation of this research by understanding the different studies done before. This chapter will present an introductory section of risk management in general, the definition, sources of risks and the steps and stages for managing risks. Then risks in healthcare will be presented as well; and types of healthcare risks; which will give a wide overview of the risks in healthcare sector. The current philosophies, practices and tools used in risk management will be shown and the effectiveness of using them will be presented as well. Finally the research focuses on one type of risks; i.e. the Needlestick Injury (NSI) which will be examined in details including the steps used to deal with such injuries when they occur.

Having studied the different literature, *chapter 3* will present the conceptual framework derived from the literature. In this chapter, a conceptual model for the management of needlestick injury risk will be showed in order to study its effect on the cases will be studied later. The *Butterfly Risk Tool* is adapted for the needlestick injury risk; this model helps in identifying the different stages in the risk management practice, it starts with identifying the event of the risk, i.e. identifying the sources and causes of the risk as well as the consequences on the injured person. Then, it helps in assessing the risk by identifying the likelihood of the sources and the impact of the consequence(s). After that, it shows the response plans for the risk, and finally it assists in recognizing the activities of risk control.

The research methodology chapter (*chapter 4*) will then follow where it will investigate the purpose, approach, strategy and technique that the research has undertook, and how data were collected. The case studies have been studied will be introduced and explained and the criteria of choosing them will be explained as well.

After that, the analysis of the case studies done through interviewing the concerned hospitals will be offered in *chapter 5* providing an understanding of the collected data through interviews for the five different case studies for the different five hospitals in U.A.E.

The *conclusions and recommendations* chapter, *Chapter 6*, latterly will recommend a conceptual model that could be used for managing risks in healthcare organisations, and recommendations for risk managements in order to deal with risks in general and in the case of needlestick injuries particularly. It will also introduce some recommendations for additional research in future.

Chapter 2 – Literature Review

2.1 Introduction

This chapter will present an introductory section of risk management in general, the definition, sources of risks and the steps and stages for managing risks. Then risks in healthcare will be presented as well; and types of healthcare risks; which will give a wide overview of the risks in healthcare sector. The current philosophies, practices and tools used in risk management will be shown and the effectiveness of using them will be presented as well. Finally the research will focus on one type of risks; the Needlestick Injury (NSI) risk which will be examined in details including the steps used to deal with such injury when it occurs.

2.2 Risk Management in General

Risk has been defined by the Association for Project Management as "an uncertain event or set of circumstances that, should it occur, will have an effect on achievement of one or more project objectives" (APM, 2006, P26).

Traditionally, risk has been viewed as exclusively negative, but in project management as shown in the definition before, risk has either positive or negative effects on the success of the project's objectives since the 'risk event' expression is used for both opportunities and threats equally, and both can be managed through a single risk management process (APM, 2006). Gardiner (2005, P 161) defined project risk to be "any event with an undesirable outcome for the project that may happen sometime in the future".

A survey of IT managers was done on a recent research revealed that although 49% of participants regarded risk as a negative event; 22% of participants answered that risk can include positive consequences of some event as well as negative aspects (Charette, 2002: cited in Gardiner, 2005). The traditional definition of risk is much accepted by organisations using official risk management rather than the definitions that allow the negative and positive effects; this conclusion has been specified by the same survey. These effects are also known as *downside* risks (negative effect) and *upside* risk (positive effect) (Gardiner, 2005).

Skipper (1997) has expressed risk as the variability of outcomes since it has no general definition. On the other hand, risk has been defined as the organization's lifeblood, and it is been managed directly wherever it appears by functional managers according to Shimpi (2001), while according to Gupta (2004a, b), risk "refers to the possibility of deviation from the standard path. These deviations reduce the value and imply unhappy situations".

After defining what risk is, it is important to know as well what the process of managing risks is. The risk management in healthcare is an intended approach to identify, evaluate, reduce and control hazards to patients, staff and visitors. It aims to stop spending limited insurance and actions resources and as an alternative of that, using them for the patient care development (Harris, 2000). Risk management planning focuses on the strategic role of preparing an overall plan to project risk is divided into number of activities. They are the activities of risk assessment which introduce methods that help identifying risks within the scope of a risk management plan, leading to their analysis and prioritization. The next considers risk control activities, including response planning, resolution, monitoring and reporting risks (Gardiner, 2005), Figure (1) below shows the chart of Risk Management Model according to Gardiner (2005).



Figure 1: Risk Management Model according to Gardiner (2005)

The first activity of risk assessment stage is identifying the risk. It builds up the base for the following steps in risk assessment which are risk analysis and risk prioritization. Identifying risks precisely guarantees risk management effectiveness (Tchankova, 2002). Williams et al. (1998) defined risk identification as "a process that reveals and determines the probable organizational risks as well as circumstances arising risks". By applying risk identification activity, the organization will be able to revise activities and places where its resources are bare to risks. Finding the sources of risks is an important practice in identifying risks. Different risks categorization can be used in managerial practice. A general categorization as per Williams et al. (1998) may use physical, social and economic sources. But, in more investigation on risk classification to cover all risk types in more detail; they represented risk sources depending on the environment as follows: "Physical environment; legal environment; and cognitive environment".

Second step of risk assessment according to Gardiner (2005) is risk analysis which is establishing the probability of the occurrence and its impact of all identified project risks. The project risk exposure can be calculated by using the equation: Risk exposure = probability of risk X its impact, once the two variables of each risk in the project have been determined. According to Kunreuther et al. (2004); it involves estimating the likelihood of a specific set of events occurring and/or their possible consequences.

The third and last step of assessing risk is risk prioritization, which is ranking or prioritizing each risk in order of significance (Gardiner, 2005). An example of this step is what Ruzante et al. (2010) did. They developed a framework for prioritizing foodborne risks; it considers public health impact in relation to three other factors which are market impact, consumer risk acceptance and perception, and social sensitivity.

The output from a risk assessment is used in the second stage of risk management which is risk control. Risk control is usually done at a senior level in the organization structure than risk analysis. This is because risk control places high pressure on those involved in the risk management process that make decisions with limited information. It consists of three practices: "risk response planning" which is the planning for responding to risks. "Risk resolution" which

is executing activities in the risk response plans in order to get rid of the risks, and "risk monitoring and reporting" which are tracking the project's progress in the direction of resolving the risks (Gardiner, 2005). De Zoysa and Russell (2003) supported this point when they showed in their study that the final stage of managing risks is implementing and developing plans to respond to the risk.

2.3 Risk Management in Healthcare Sector

The healthcare field is becoming riskier as the growing of population makes the expecting cost and the health related events more difficult; and the operating margins have been eroded because of the competition among providers, making the risk influence on productivity more distinct. Simultaneously, the healthcare delivery becomes more fragmented; as a consequence of this, the risk management is becoming more complex (Mulligan et al., 1996).

According to the executives of Healthcare Financial Management Association in the United States of America, risks in healthcare are divided into three types, business risk, financing risk, and event risk. Business risks may occur every day in a hospital because of numerous factors like, price rising, compliance issues, services offered, consumer demand shifts, geographic market, facilities, and staffing. The financing risk is the second type, which is the risk of having difference in the assets charge or the return from an investment than what is expected. It could be divided into "better-than-expected" and "worse-than-expected". The third and last type is the event risk; they call it the "killer of all risks". It is an unanticipated external event risk which is totally beyond the control of the hospital, like a natural disaster, severe financial downturn, or key regulatory change (HFM, 2008), Figure (2) below illustrates the types of risks according to HFM(2008).



Figure 2: Risks Types according to HFM (2008)

Mulligan et al. (1996) identified four types of healthcare risks; they are Clinical Operating Risk, Event Risk, Pricing Risk and Financial Risk. Clinical Operating Risk is the differences risks in the incurred expenses in providing clinical services. Mulligan et al. identified the event risk differently than HFM, they defined it as the associated risk with changeable require for healthcare in the covered population. The third type as per Mulligan et al. is the Pricing risk, it is the risk inherent in setting values given the random costs of event risk, and the last type is the Financial risk. Capital, partner bankruptcy, cash how, accountability, and regulatory risks are examples of financial risks, this type is the crucial faced business risks by all corporations (Mulligan et al., 1996), Figure (3) below shows the risks types according to Mulligan et al. (1996).



Figure 3: Risks Types according to Mulligan et al. (1996)

Some researchers gave the risks care management the title of "problems". They mentioned some of them, like, "failure to monitor, observe or act, delay in diagnosis, incorrect risk assessment (e.g. of suicide or self-harm), insufficient handover, failure to note faulty equipment, failure to carry out preoperative checks, not following an agreed protocol (without clinical justification), not seeking help when necessary, failure to supervise adequately a junior member of staff, incorrect protocol applied, treatment given to incorrect body site and wrong treatment given"(Vincent et al., 2000).

Other risk types in healthcare field are the risks linked with the pharmacy practices. The risks had been classified into three types, clinical, conduct and health risks, and each risk has some hazards as per Phipps et al. (2011). The first type is the clinical risk; dispensing error like failing to notice or manage unpleasant events is the first hazard of this type. The second hazard is

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distributing error, like labelling errors and controlled drug mistreatment. The third one is incorrect advice given, e.g. misidentifying a condition. The fourth and last hazard is prescribing error, e.g. improperly prescribing medications to patients. The second type of pharmacy practice risks is conduct risks. Two hazards connected to this risk. The first hazard is misconduct related to work actions like breach of professional standards, and the second one is disreputable conduct outside of work, e.g. illegal conviction because of non-job-related activities. The health risk is the last risk associated with pharmacy practices. One hazard is linked to it which is the substance abuse III health, e.g. drug or alcohol violence, physical illness and rational sickness (Phipps et al., 2011). Figure (4) below shows the pharmacy practice risks, and check Appendix A for more examples on the hazards of these types.



Figure 4: Pharmacy Practice Risks according to Phipps et al. (2011)

Some other risk types connected to the healthcare facility itself as per Okoroh et al. (2006) are corporate risks, commercial risks, legal risks, financial and economic risks, facility transmitted risks, business transfer risks, and customer care risks.

2.4 Philosophies, Practices and Tools Used to Manage Risks in Healthcare and the Effectiveness of Applying Them

Disasters on the roads, in complicated surgery, in the air and in healthcare in general are usually the main causes of errors and mistakes done by humans. On the other hand, routine of blame and quick decisions obscure a more complex fact (Vincent et al., 2000).

Therefore, researchers found tools and practices to manage risks in health care and to minimize the losses. An assessment and analysis of difficult events process have been developed by the Clinical Risk Unit in the Department of Psychology, University College London, UK to be used by researchers. When an incidence is investigated, certain steps need be followed in all investigations. For the steps used, please refer to Appendix B (Vincent et al., 2000).

2.4.1 Risk Management Factors

Vredenburgh (2002) had discussed six management factors concerning safety culture: "participation", "training", "hiring", "rewards", "management support", and "communication/feedback".

The first factor is the *worker participation*. It is called also employee involvement; it involves persons or groups in the communication stream in the organisation and the decision-making procedure. In some organisations, the manager makes all decisions in that organisation and there will be no involvement and participation to the staff, on the other hand, employees can get full participation, where everyone linked with the decision is occupied (Vredenburgh A.G., 2002).

The second factor is *safety training*; employees must receive work-related safety training at work so that to be active participants in a safety programs. An administered and well-designed training programme should highlight techniques for safe work and to be derived from a true evaluation of demand. A programme based on performance feedback and goal-setting should follow the safety training (Cohen & Jensen, 1984). This programme evaluation should verify that the safe work techniques could be established to be successful and to endure beyond closing of the feedback of performance (Vredenburgh A.G., 2002).

The third factor is the *hiring process*; Turner (1991) shows that if staffing criteria for new employees include selecting liable people to display safety awareness approach in their work, the safety culture will be developed in the work environments. He added that if an organization encourages a safety-conscious image, the staffing process will be affected because candidates with compatible attitudes and potentials would be more likely to seek out this company to a desire for a safe work environment (Turner, 1991).

Then, the *reward* system; people are enthused to act in ways that guide to required consequences; they will behave well if this behaviour will lead to a pleasing outcome by conforming to a cultural norm. Culture is learned through a relationship between behaviours and consequences (Vredenburgh A.G., 2002). The reporting of a hazard or an unsafe act leads to an injury is reinforced by an accurately designed safety-incentive programme; this programme gives bonuses for employees who report these hazards for fewer lost-time accidents. A safety incentive programme must run parallel to safety education and training in an organisation. It must be directed at the avoidance of accidents, not punishment after an accident takes place (Peavey, 1995).

The fifth factor is the *management commitment*; Zohar (1980) found that the commitment to safety is a key factor affecting an organization's programmes of safety achievement and success. This management commitment will be showed through "job training programmes", "participation in safety committees", "consideration of safety in job design", and "review of the speed of work". An example of this according to Hofmann and Stetzer (1996), employees working for a careless manager about safety perceive; they will not emphasize on safety practises. Two factors are the most influential components of culture; they are the expression of management values safety degree is in its style and level of assumable risk. However, safety professionals have very little effect over these variables. Turner (1991) mentions that when discussions of safety are conducted in insincere public speaking, the phony statements are readily seen for what they are (Turner, 1991).

The last factor is the *communication and feedback*. Industrial accidents cause behaviours that are not frequently new, so the role of feedback concerning employees' performance is very

significant. Their causes are extremely rooted in past minor incidents, where workers were not hurt and the damage was insignificant (Kletz, 1993). Posted charts and a review of behavioural data in safety meetings can communicate performance feedback to the employees (Roughton, 1993).

2.4.2 Risk Management Tools

Some basic risk management facilitation methods according to European Medicines Agency are simple methods used to systematize risk management by organizing data and easing the decision-making process which are: Flowcharts, Check Sheets, Process Mapping, and Cause and Effect Diagrams (also called an Ishikawa diagram or fish bone diagram) (QRM, 2011).

Failure Mode and Effects Analysis (FMEA) is one of the famous quality improvement processes and risk management tools, it can be applied in industry and healthcare fields. It provides an assessment of possible modes of failure for processes and their potential effect on outcomes and/or the performance of the product. When failure modes are well-known; potential failures can be eliminated, contained, reduced or controlled by reducing risk. The analysis of complex processes can be broken down systematically into suitable steps by FMEA. Significant modes of failure could be summarized by this powerful tool, as well as the causing factors of these failures and the possible effects of the failures. It can be used well to identify and prioritize risks and screen the risk control performance effectiveness. The output of FMEA can be used as a guide resource operation or as a foundation for design or more analysis (QRM, 2011).

Failure Mode, Effects and Criticality Analysis (FMECA) is another tool for risk management. It is an extension of FMEA but it investigates the severity degree of the consequences, their incidence probabilities, and their detectability. For conducting such analysis, the product or process specifications should be recognized. Places where extra preventive actions might be suitable to reduce risks can be identified by this tool. FMECA can be applied in the pharmaceutical industry where it should be utilized for risks and failures correlated with the processes of manufacturing. Its outcome is a relative risk "score" for each failure mode, which is used to rank the modes on a relative basis for risks (QRM, 2011).

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Another practise for risk management is Fault Tree Analysis (FTA). This tool could be applied when a product or process had failed in its functionality. It assesses system (or sub-system) failures in sequence but can merge many failure sources by identifying fundamental chains. The results of this tool are symbolised in a tree of fault modes. Groups of fault modes form that are demonstrated with logical operators (AND, OR, etc.) at each level in the tree. Experts' process understanding was helped by FTA tool in recognizing causal factors. Establishing the root cause of the failure pathway shows the effectiveness of using this tool. Complaints or differences can be explored by this tool to ensure that planned development will completely determine the issue and not cause other issues (i.e. solve one problem however cause a different problem) and to entirely understand their root cause. Its effectiveness can be shown when assessing how numerous factors influence a given issue. An illustration of failure modes is the output of an FTA. It is helpful for both developing monitoring programs and risk evaluation (QRM, 2011).

Hazard Analysis and Critical Control Points (HACCP) is some other practise for managing risks. It is a practical, systematic, and preventative tool that declares the quality, reliability, and security of the product and the service. Technical and scientific philosophies can be applied by HACCP to evaluate, analyse, manage, and prevent the risk because of the development, design, manufacture, and use of products as it is planned approach. This tool consists of the following steps: (1) "conduct a hazard analysis and identify preventive measures for each step of the process"; (2) "determine the critical control points"; (3) "establish critical limits"; (4) "establish a system to monitor the critical control points"; (5) "establish the corrective action to be taken when monitoring indicates that the critical control points are not in a state of control"; (6) "establish system to verify that the HACCP system is working effectively"; (7) "establish a record-keeping system". Risks that are linked with physical, chemical and biological hazards might be identified by HACCP. It is most realistic when process and product understanding is satisfactorily complete to support the critical control point's identification. Risk management information is the output of a HACCP analysis which makes monitoring of crucial points in the manufacturing process and in other life cycle phases possible (QRM, 2011).

Hazard Operability Analysis (HAZOP) is one more philosophy for risk management. Deviations from the operating or design purposes cause risk events; is the theory where HAZOP is based on.

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"Guide-words" (e.g., No, More, Other Than, Part of, etc.) are used to identify hazards by HAZOP since it is a systematic practice used for this purpose. Potential deviations from normal use or design purposes can be identified by applying these "guide-words" to applicable parameters (e.g., contamination, temperature). Group of skilled employees are frequently used to cover the design of the process or product and its function. It is helpful to develop outsourced production, processes, and formulation by using this risk management tool, as well as the equipment and services for medicinal products and drug substances. Process safety hazards could be assessed by this powerful tool as well. A list of serious operations for risk management is the output of a HAZOP analysis which is the same as in the case with HACCP, which facilitates usual checking of critical points in the manufacturing process (QRM, 2011).

Another tool for managing risks is the Preliminary Hazard Analysis (PHA). It has been defined by QRM (2011) as "an analysis tool based on applying previous experience or knowledge of a hazard or failure to identify future hazards, hazardous situations and events that might cause hurt, in addition to estimate their likelihood of occurrence for a given facility, activity, product or system". PHA consists of: (1) "the identification of the possibilities that the risk event happens". (2) "the qualitative evaluation of the extent of possible injury or damage to health that could result" (3) "a relative ranking of the hazard using a combination of severity and likelihood of occurrence", and (4) "the identification of possible remedial measures". This tool might be of use when active systems are being analysed or risks where circumstances prevent a more general technique from being used are prioritized. The usage of this tool can be summarised as for process; product and facility design in addition to assessing the risks types for the general product type, then the class's products, and at last the specific product. PHA is frequently used in the project development process when the information on design details or operating procedures is minor; therefore, additional researches will get benefit of it because of being a precursor. In general, PHA identified risks that are further evaluated with other tools of risk management like the ones mentioned in this section (QRM, 2011).

Risk ranking and filtering is an additional tool for risk management. It is ranking and comparing tool. Multiple various quantitative and qualitative factors for each risk need to be assessed for risk ranking of complex systems. In order to capture factors involved in the hazard, this risk ranking and filtering method involves dividing an essential risk question into components as Managing the Risk of Needlestick Injury in U.A.E. Hospitals 26 / 109

needed. A single relative risk score combine these factors where can then be used for ranking risks. The risk ranking can be scaled or fitted to management or policy objectives by "filters as the form of weighting factors or cut-offs for risk scores". This tool can be used to prioritize developing sites for examination or review by regulators or industry. When the group of risks and the original consequences to be managed is different and difficult to evaluate using a single risk management tool, risk ranking methods are particularly very helpful. When the organisation needs to evaluate both quantitatively-assessed and qualitatively-assessed risks within the same organisational structure, risk ranking is very useful tool to be used for this purpose (QRM, 2011).

The last but not least tool for risk management is the supporting statistical tool. These tools can simplify and support quality risk management process. Effective data evaluation helps in determining the data set(s) significance and facilitates dependable decision making which can be enabled using these tools. Some of these major statistical tools frequently used in the pharmaceutical industry are: "Control charts, for example: Acceptance control charts, Control charts with arithmetic average and warning limits, Cumulative sum charts, Shewhart control charts, Weighted moving average", "Design of Experiments (DOE)", "Histograms", "Pareto charts", "Process capability analysis" (QRM, 2011).

By listing all these tools, philosophies, and practices for managing risks, it can be obvious that risks and hazards could be managed and controlled when using the correct tool for the right risk type.

2.5 An Infectious Risk: The Needlestick Injury (NSI) Case

As defined by Astrazeneca (2003) before, NSI means the entry into the health care employee body, during his/her job, of blood or other infectious material by a sharp instrument or needle, including, needles, scalpels, lancets, and contaminated broken glass. In the United States, health care workers work in hospitals and other health care providers are more than eight million in total, and more than 700,000 needlestick injuries occur for them yearly. This number could be more since half of these injuries go unreported. Nearly all reported injuries are for nursing staff (Astrazeneca, 2003). Healthcare facilities have all types of risks linked with infections; the list is

extensive of infection risks causes. These causes can deviate from improper hand hygiene to improperly processed instrumentation (Klacik, 2010).

Infectious risks in hospitals and healthcare providers can be divided into risks to patients themselves, and the other type is to the staff and employees of that hospital or healthcare provider. Strains and sprains, needle punctures, communicable diseases, toxic and hazardous substances, dermatitis (caused by handling cleansers, medicines, antiseptics, and solvents), and thermal burns (primarily in food service, laundry, and sterilizing areas) are some common types of injuries to hospital employees that have been recognized and identified. (Vredenburgh, 2002) The most familiar infection types obtained in hospitals are: "Urinary tract infections (UTI), injury infection", "Pneumonia (lung infection)" and "Bloodstream infection" (SGV, 2010).

The first state in the United States of America that became with legislation needing health facilities to comply with safe needle policy is the state of California on 1st August 1999. The principles include a condition to meet the terms with engineering controls that contain the technology of sharps prevention which include needleless systems and engineered sharps injury defence needles. The method of curing diseases using sharp tools, instruments and needles has been around for long time of years (Gillis, J., 2000)

Needlestick injuries are a frequent event in the healthcare environment. They may occur with recently contaminated sharps, and with needles that carry dry blood too. The infectiousness of Human immunodeficiency virus (HIV) and Hepatitis C virus (HCV) decreases within a couple of hours, while it remains stable during desiccation and infectious for more than a week with Hepatitis B virus (HBV) (Wikipedia, 2011).

These injuries are a risk for the workers in the hospital whose job is with patients directly, for instance; nurses, radiographers and laboratory technicians (especially phlebotomists), at the same time they are also a risk for those who do not work with patients directly. Other workers who are also exposed to needles' risk that have not been disposed of suitably, or are lost in patients' linen or are left on the trays of sterile procedure are the porters and domestic workers (Gillis, J., 2000).

Injury from used syringes and needles found in neighbourhood arouses much worry, especially when children find discarded needles and harm themselves while playing with them. Parents and health care providers panic that the needle may have been leftover by an injection drug user since the user is generally unknown. Even though the real infection risk is very low from this injury, the risk perception by parents results in much concern. Assessment and counselling are needed (CPS, 2008).

The needlestick injuries management has to be sensible and based on the best available evidence. Hepatitis B and C (HBV and HCV) transmission are the main risk while transmission of Human Immunodeficiency Virus (HIV) is the main public anxiety (UHS, 2011 and CCOHS, 2011). Antiretroviral Post Exposure Prophylaxis (PEP) has no exist data on the effectiveness of it apart from in the health care setting. PEP is prescribed to children on an individual basis when the risk of HIV is considered high by some paediatricians (UHS, 2011).

2.5.1 The Viruses

2.5.1.1 HBV

About 2 billion people in the world have been probably infected by HBV and who carries the virus are about 300 million people. In most western countries, the carrier rate is low, specifically in UK and USA, it is less than 1%, while it is above 10% in Africa and some parts of Asia, and in Taiwan is 17% (Shiao et al., 2002). Close personal contact with virus present in semen and saliva is the main route for the virus to be transmitted. Vertical transmission from mother to baby might be the most important transmission way worldwide. Estimation of 10-30% is for seroconversion after a needlestick with contaminated blood. Fulminate hepatitis can take place in up to 1%; even as most infected persons recover completely, and some infected persons go on to develop liver cancer or chronic hepatitis. Healthcare professionals may be stopped from continuing working in their chosen career if they become carriers of this virus. All healthcare personnel, like emergency and rescue teams staff, people with haemophilia, and other higher risk circumstances or careers must be vaccinated against HBV. Vaccination and immunoglobulin are supposed to be used as local guidelines that may vary in the event of a needlestick injury (Astrazeneca, 2003).

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2.5.1.2 HCV

HCV is the reason of the majority of post-transfusion hepatitis since has been identified in 1988. The rate of infection in healthy blood donors is about 0.02%, 6%, and 19% in northern Europe, Africa and lastly Egypt and parts of Africa respectively. Incidence is high in people with haemophilia and intravenous drug users because it is through blood or blood products transmission, and with vertical transmission from mother to child. Estimation of 1-10% is for seroconversion after a needlestick with contaminated blood. With 1 in 109 cases of infected people having an influenza-like sickness with jaundice, infection is asymptomatic. Most patients of HCV are identified after being infected with chronic liver disease in many years, with occurs in about half of them, with cirrhosis and liver cancer in common. Good epidemiology helps in determining the real incidence of HCV infection and liver disease. Antiviral agents may be given in case of needlestick injury, but there is no guarantee that they end the infection. HCV may be a key reason of losing employment if the healthcare worker has been infected as the risk of HCV transmission to uninfected patients is high. These are not minor risks; they are likely at 50% probability of one patient to be infected in 5,000 procedures carried out by an HCV infected surgeon in 10 years (Sulkowski et al., 2002: cited in Astrazeneca, 2003).

2.5.1.3 HIV

There is approximately 35 million identified HIV cases in the world, it is generally recognized that this is probable to be a gross undervalue. Prevalence for HIV is very high in Africa, and in other areas of the world including parts of western countries and parts of Asia, the prevalence is high as needle-sharing or sexual practices increase this risk. If specific treatments are instituted, the vertical transmission from mother to baby will not be considered high. Estimation of 0.1-0.3% is for seroconversion after a needlestick with contaminated blood. Although some HIV cases might be associated with short self-limiting sickness; most of the HIV seroconversions are clinically silent. A symptom free period of HIV is frequently many years, after this period, symptomatic HIV infection is linked with failure of the immune system and increasing viral load. Antiviral agents are now commonly used after needlestick injury from known (or suspected) HIV infected material and almost certainly this reduces infection. The practice of HIV infection treatment is diverse in different establishments although it is likely to be with two or even three antiviral agents (Astrazeneca, 2003).

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2.5.2 Researches of Needlestick Injuries in Healthcare Workers

Since 1990, number of studies and researches on healthcare workers injuries has been stated. It is most likely not inclusive as these researches are frequently cannot be found easily, and some of them published or will be published in not indexed electronically journals. They use different size of different samples, with diverse methods and were done at different times in different circumstances. For more details on these studies, refer to Appendix C (Astrazeneca, 2003).

2.6 Process of Dealing with NSI when Occurring

An NSI can occur when unintentionally a contaminated needle holing a finger. Wearing "precautionary latex gloves" may reduce contact to disease but it does not guarantee that an NSI will not occur in any field of work. If an NSI occurs, it is very important to follow defensive measures. The following steps explain how to respond to an NSI or deal with it when happening, especially for workers most near to the possibility of getting hurt (WikiHow, 2011). The first step is "encouraging bleeding at the site of injury" which means squeezing out the excess blood to encourage bleeding, in order to minimize the contaminated introduction of the virus (if any) on site and to be expelled out of the injured body, rather than encouraging entry to the bloodstream. This step includes washing with liquid soap and running water the injury site of the needlestick or sharp injury and looking for medical awareness (WikiHow, 2011; InviroMedical, 2009; UNISON, 2000; Health and Safety Executive, 2010; SGV, 2010 and Smith et al., 2001). The next step is checking HIV, HBV, and HCV status for both the affected employee and the person whose blood has been transmitted (WikiHow, 2011; Inviro Medical, 2009; UNISON, 2000; PatientUK, 2010; SGV, 2010 and Smith et al., 2001). PatientUK (2010) requires two more investigations plus testing the previous viruses which are liver function tests and female workers should have a B-hCG check to exclude pregnancy. Then, taking "prophylactic medication" (known as post exposure prophylaxis, or PEP) if possible in an hour of the injury if the person has been exposed to be HIV, HBV, and HCV positive and the worker affected status is negative. The rate of transmission can be reduced if anti-retroviral drugs given soon after probable infection (WikiHow, 2011 and SGV, 2010). For the previous step, UNISON (2000) requires to do vaccination for HBV. HIV or HCV has no vaccination at the present time. Hepatitis B has an effective vaccination which is different than the rest. After that, testing for follow up and medical supervision of the affected worker improvement have to be done regularly (WikiHow, 2011; Managing the Risk of Needlestick Injury in U.A.E. Hospitals 31/109

UNISON, 2000; PatientUK, 2010 and Smith et al. 2001). Inviro Medical (2009) requires retesting for hepatitis C after six weeks of the needlestick injury and again retesting for HCV antibodies and elevated liver enzymes at four to six months. For the exposure of HIV, retesting is encouraged at six weeks and once more at three, six and twelve months for HIV antibodies. The frequency of the tests depends on the risk of spread. Finally, reporting the incident. It is vital to inform the workplace about the injury occurred, and the collected data may help in improving the practices of the workplace for the future safety of everyone (WikiHow, 2011; Inviro Medical, 2009; UNISON, 2000; PatientUK, 2010; Health and Safety Executive, 2010 and SGV, 2010). Figure (5) below illustrates these steps and Table (1) summarizes all the steps from all references.



Figure 5: Process of dealing with NSI when occurring

		1	2	3	4	5	6	7	
Sam	Source	WikiHow (2011)	InviroM edical (2009)	UNISON (2000)	PatientUK (2010)	Health and Safety Executive (2010)	SGV (2010)	Smith et al. (2001)	TOTAL
1	Encourage the site of injury bleeding	Х		Х		Х		Х	4
2	Clean the Wound	Х	Х	Х		Х	Х	Х	6
3	Do not panic	Х							1
4	Check HIV, HBV, and HCV status of the affected worker and the person whose blood has been transmitted	Х	Х	Х	Х		Х	Х	6
5	Take prophylactic medication (known as post exposure prophylaxis, or PEP) preferably within an hour if the person has been exposed to, is HIV positive and worker effected status is HIV negative	Х					Х		2
6	Have follow up testing and medical supervision of the recovery.	Х	Х	Х	Х			Х	5
7	Report the incident	Х	Х	Х	Х	Х	Х		6
8	Vaccination for HBV			Х					1
9	Liver function tests at 3 and 6 months		Х		Х				2
10	Female workers should have a B-hCG check to exclude pregnancy				Х				1
11	Seek Medical Advice	Х				Х	Х		3
12	Do not scrub the wound whilst washing it					Х		Х	2
13	Do not suck the wound					Х			1
14	Dry the wound and cover it with a waterproof plaster or dressing					Х			1
15	Do treat mucosal surfaces such as mouth or conjunctiva by rinsing with warm water or saline							Х	1
16	Do Not swallow water used for rinsing the mouth							Х	1
	TOTAL	8	5	6	5	7	5	7	

Table 1: Steps When NSI Occurs

2.7 Summary of the Literature Review

The literature revision above has illustrated the risk management in general, and its definition was sought from different scientific resources, sources of risks, and the stages and steps for managing risks. There are two main stages for managing risks, which are *Risk Assessment* and the second is *Risks Control*. Risk assessment consists of three steps which are risk identification, analysis, and prioritization, and the risk control consists of three practices as well, they are risk response planning, resolution, and monitoring and reporting. Risk management in healthcare particularly is discussed and reviewed in details in this study. In this section; all types of risks in healthcare field have been discussed and highlighted. Different researchers using different methods, tools and philosophies have identified how to manage and reduce risk. Some of these tools and methods but not all are FMEA, FMECA, HAZOP, PHA, Risk ranking and filtering, etc. One type of risks has been highlighted in order to establish a framework for managing risks in healthcare, which is the infectious control risk, the case of needlestick injury (NSI) is studied in details. Sixteen different steps are proposed by seven references to deal with NSI when occurring. In the next chapter, a conceptual model will be proposed in order to deal with the needlestick injury risk.

Chapter 3 – Conceptual Framework

3.1 Introduction

This chapter will show a conceptual model for the management of needlestick injury risk in order to study its effect on the cases will be studied later. As mentioned earlier in the risk management section, the risk analysis process according to Lavoie (2011) corresponds with the event identification, risk assessment, risk response, and control activity components of "The Committee of Sponsoring Organizations of the Treadway Commission's (COSO's) *Enterprise Risk Management (ERM)-Integrated Framework*".

For the sake of this research, the *Butterfly Risk Tool* – Figure 6 - will be adapted for the needlestick injury risk. This tool as showed by Lavoie (2011) can help internal auditors in the organization to evaluate the effectiveness and contribute to the improvement of management's Enterprise Risk Management process.



Figure 6: Butterfly Risk Tool, adapted from (Lavoie, 2011)

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3.2 Description of the Butterfly Risk Tool

The COSO ERM framework "event identification" component addresses external and internal factors, risk/event categories, consideration of past events, and risk interdependencies. The "Butterfly Risk Tool" is planned to clarify, complete, and integrate those related concepts to improve management's risk analysis and enable internal auditors to perform a strong ERM effectiveness evaluation. Underlying this tool is a broader paradigm that considers and formally documents the risk sources and consequences for each potential event. Applicable at first during event identification, it encompasses and brings value to risk assessment, risk response, and control activities. Auditors using the tool could gain ideas to better assess whether management's event identification is complete and sufficiently detailed to provide value in the remaining phases of the risk management process. The image of a butterfly (Figure 6) illustrates the paradigm's two main dimensions: event identification and control activities. For event identification, the left wing refers to risk sources and the right wing to risk consequences. Risk sources include external and internal sources, risk factors, and risk indicators. Monitoring external and internal environments can enable management and auditors to identify new and emerging risks once typical inherent risks have been identified. Risk consequences consider types of impact and their potential extent and speed of realization. Many types of potential impacts need to be considered, including monetary, physical, informational, and loss of reputation and other intangible assets. Moreover, impact will vary depending on stakeholder scrutiny, powers, expectations, and sensibility. For risk assessment, likelihood relates to the left side and impact relates to the right side. Risk response options of "reducing likelihood" and "avoiding risk" apply on the left wing; options of "mitigating impact" and "transferring/diversifying risk" apply on the right wing. Preventive and monitoring control activities apply on the left; mitigation and corrective controls on the right. Risk interdependencies appear on the left when the consequence of an upstream risk becomes a source of the risk under analysis. On the right, a consequence of the risk could become a source of another downstream risk. Another feature of the tool is the inherent application of a process view and of an "extended organization" perspective at the junction of external and internal sources. A prerequisite to applying the butterfly risk tool effectively is a clear and shared definition of its key underlying concepts as will be shown in the next section when applying this tool to the needlestick injury risk. The concept of risk can be viewed as a set of potential scenarios that could go wrong in a specific external and internal environment. A Managing the Risk of Needlestick Injury in U.A.E. Hospitals 36/109
richer multi-source and multi-consequence analysis might encompass more than one risk scenario within a specific risk, therefore requiring those different aspects to be considered in subsequent phases of the analysis. Alternatively, many potential scenarios might be split up into individual risks to be assessed separately.

3.3 Benefits for Risk Analysis by applying the Butterfly Risk Tool

At first, the butterfly risk tool can be useful to management in preparing complete risk event identification and during subsequent steps in the process of risk management. It is not intended to be used by internal auditors to document systematically each risk in a risk profile, which would not be cost effective; instead, auditors should use it as a mind frame for reviews and assessments of management's risk event identification deliverable.

3.3.1 Risk Assessment

The butterfly tool facilitates risk measurement and can ensure the consistency and credibility of risk profiles. Moreover, it can enhance management and stakeholder "buy-in" of the risk assessment because sources and risk factors/ indicators are considered collectively to assess likelihood, and consequences are considered collectively to assess impact.

3.3.2 Risk Response Strategy

When remaining risk exceeds risk tolerance, the butterfly tool ensures that all significant external and internal sources and consequences are being addressed by a risk response strategy. It helps to determine the appropriate risk response strategy, including options to reduce likelihood and mitigate impacts. The tool also can ensure that risk factors/indicators are considered to establish a relevant and feasible risk response strategy. In addition, it can help management target sectors responsible for action plans addressing both external and internal sources. Additionally, the butterfly tool demonstrates that if a risk event cannot be prevented from an external source, available options remain such as mitigating the impact or transferring a portion of the impact outside the organization. Finally, management can use the tool to prepare an influence diagram showing upstream risks from the left and downstream risks to the right.

3.3.3 Control Activities

With the butterfly tool, control activities can be addressed better globally as a "portfolio" and by using a process view. The tool facilitates the integration of risk, risk response, and control activities. It also helps management and auditors understand the collective effect of a mix of preventive, monitoring, detective, corrective, and mitigation controls.

3.4 Targeting and Controls

Addressing significant sources and consequences to reduce their likelihood and mitigate their impact is a good start — but one additional dimension still needs to be considered. Risk management should target any risk area that would deserve greater attention such as a process, business unit, or system. For the risks addressed in "Applying the Butterfly Tool," the infectious needles and sharps would be targeted for both risk response strategy and control activity design. A risk paradigm must be maintained until the end of the risk analysis process. Applying systematic and widespread control activities rarely comes with cost effective risk management. Controls need to be balanced with corresponding risk assessments. Consequently, higher risk areas would deserve priority for additional or more intensive control activities. Conversely, control activities should be eliminated or reduced in intensity for low risk areas.

3.5 A Multifaceted Approach

Overall, the butterfly tool can help management better assess and prioritize risks as well as determine the most effective risk response and control strategy. Therefore, it can be used to evaluate to what extent the management's risk analysis tools contributes to rich and complete risk profiles. It also can enable internal auditors to perform a more effective ERM evaluation, recommend improvements, and better challenge and evaluate management's risk and control self-assessments. Moreover, the approach can support auditors when they facilitate risk assessment workshops and when they train management in gaining a common language and understanding of risk and control concepts.

3.6 Applying the Butterfly Risk Tool to the Needlestick Injury (NSI) Risk

As mentioned before, the butterfly risk tool is a risk management tool that manages and tries to understand the risk well. By displaying the different parts of this tool, the risk of NSI can be understood and all its characteristics will be cleared. It starts with identifying the event which is the NSI risk in this case, but in order to realize it well, some features need to be cleared, like the external sources of this risk, its internal sources, the factors and its indicators. By identifying all these, the risk of NSI sources will be cleared. After that, identify the NSI consequences and the effects on the injured person when being infected to this type of risks. By doing so, the first part will be identified which is the event identification part. The second part of managing risks is the Risk Assessment, for this type of risks, identifying the Likelihood of each of the sources mentioned before and the impact of the consequences on the injured person will help in assessing and evaluating the risk of NSI. Preparing the Risk Response plan that consists of Reducing Likelihood actions and Avoiding Risk activities for the sources and Mitigating Impact and Transferring/Diversifying risk for the consequences comes next. Finally, looking after the Activities of Risk Control in order to control the NSI risk when occurring; is the final step of the NSI risk management. This part consists of Preventive and Monitoring Control activities for the risk sources and the Mitigation and Corrective Controls for the risk consequences. The tool will be cleared more when the examples and the input from the different five cases populate the tool as in Appendix F.

3.7 Summary of the Conceptual Framework

In this chapter, a conceptual framework was developed based on current knowledge. The framework was adapted from a tool called "Butterfly Risk Tool" which is suggested by Lavoie (2011). It corresponds with the event identification, risk assessment, risk response, and control activity components of "The Committee of Sponsoring Organizations of the Treadway Commission's (COSO's) *Enterprise Risk Management (ERM)-Integrated Framework*". A description of this tool was presented and then the benefits for risk analysis by applying the Butterfly Risk Tool was also showed in order to understand the idea of applying such tool to this research. After that, a section showing the targeting and controls of this tool is presented, i.e. it might be applied to other types or risks rather than the needlestick injury. Then, a section of Managing the Risk of Needlestick Injury in U.A.E. Hospitals 39/109

showing that this tool is a multifaceted approach is presented as well. Finally, applying this tool to the research risk case was done, meaning explaining its parts and stages.

Chapter 4 – Research Methodology

4.1 Research Purpose

When a researcher attempts to do a research about an area of interest, he/she will do it for a certain purpose. Studies could be categorised as per Robson (2002) according to their purpose in addition to the strategy used for the research into three categories, *exploratory, descriptive* and *explanatory* (Robson, 2002: cited in Saunders et al., 2009). More than one purpose could be for the research done as it could have more than one strategy.

Exploratory approach is useful when the researchers are working on clarifying an understanding of a problem or issue. They are trying to find out "what is happening, to seek new insights, to ask questions and to assess phenomena in a new light" (Robson, 2002:59). Studying the different literature; discussing a subject with experts; and conducting focus group interviews are three key methods of doing this kind of research according to Saunders et al. (2009).

Descriptive studies are defined by Robson (2000) "to portray an accurate profile of persons, events or situations" (Robson, 2002:59 cited in Saunders et al., 2009). Exploratory research approach mentioned before might be extended to be descriptive research. These researches usually answer the questions of what, who, where, when, why and how.

In order to establish fundamental relationships between different variables, the *Explanatory* research method is recommended. The importance of this approach is in explaining the relationships between variables when studying a situation or a problem of the research (Saunders et al., 2009). This style indicates the way a certain event is explained. It could be either negative or positive.

For this research, an exploratory style is followed. The researcher is attempting to understand the problem of a needlestick injury and what will be followed and done when this problem is happened. Descriptive style will be used since the researcher needs to understand certain concepts on the information that would be collected before collecting them. The explanatory style will be followed as well when explaining the framework of facing a needlestick injury

occurred to one of the staff members. So the three research purpose approaches will be followed in this research.

4.2 Research Approach

Saunders et al. (2002) showed that the use of theory will be involved in the research project. The research findings and conclusions usually clear the theory of that research even if it was not clear in the research design. Clearing the research theory is important in order to help the researcher whether to use the appropriate approach for the research. There are two approaches concerning the design of the research project as per the clarification of Saunders (2009); the first one is the *deductive* approach; in this approach, the researcher build up the theory, hypothesis (or hypotheses) and design of the research plan in order to test the hypothesis. The second approach is the *inductive* approach. This approach developing the theory as a result of the data analysis and data collected. He added that applying these approaches in different research philosophies is important; indebting to positivism research is for to the deductive approach and the phenomenology research to use the inductive approach.

Researchers would use two categories of research methods in their researches: *qualitative* and *quantitative* methods (Javalgi et al., 2011). *Quantitative* methods are structured methods that search for quantifying the data using statistical techniques. These research techniques cover the criteria of choosing the respondents from the study population, the research tool they will use, and the methods used to examine agreed hypotheses about the relations between specific research variables of interest which are called statistical methods. Javalgi et al. (2011) have added that these methods are designed to guarantee objectivity, generalizability, and reliability. Alternatively, *qualitative* methods are unstructured methods that give insights and understanding of the researched problem (Malhotra 2007: cited in Janalgi et al., 2011). The researchers can better recognize the meaning that study participants assign to phenomena and situations by these methods, as well as explain the mental processes underlying behaviors. During data collection phase and analysis, the researcher generates the hypotheses of the research, and the measurement tends to be very subjective. In the qualitative research model, the data collection part involves the researcher him/herself, so the results may vary greatly depending on him/her (Javalgi et al., 2011).

In many researches, the framework of an analysis of quantitative methods and research strategies are developing qualitative methods (Cicourel, 1964). However, combining both approaches has cleared as a viewpoint, which is discussed and practiced in different ways (Flick, 2009).

For this research, the *deductive* approach is followed, as the theory is understood and the research is done in order to test the theory, as well as the *qualitative* method will be used to collect needed data. Interviews will be conducted with the persons involved in the infection control practises in hospitals, especially for the case of needlestick injuries.

4.3 Research Strategy

The research strategy is the way that the researcher uses to express his/her work or data collected. According to Saunders et al. (2009), some of the strategies used for research purposes are: "experiment, survey, case study, grounded theory, ethnography, and action research".

Experiment strategy is a traditional research approach that linked to the research of the social and natural sciences, particularly psychology.

One of the popular and general strategies in management and business researches is the *survey* strategy. This strategy requires collecting data of a large amount from a huge population in an extremely reasonable means. This data collecting method based on a questionnaire where the questions are easy to be assessed and using this method is perceived a reliable by participants in general since it is simply understood.

Robson (2002:178) has defined the *Case study* strategy as "a strategy for doing research which involves an emporia investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence". If the researcher needs to enrich background understanding of the study and the performed processes, this strategy will be of special interest to him/her (Morris and Wood, 1991). More will be mentioned about case studies as it is the strategy of research for this research.

The management researchers have interpreted the following research strategy which is the *action research* in three common themes as per the literature. The first theme has been explained by Cunningham (1995) which focuses on the importance of the purpose of the research. The second theme is related to the participation of participants in the research. The finding of this action research strategy results from "involvement with members of an organisation over a matter which is of real concern to them" that has been argued by Eden and Huxham (1996). The researcher is an employee of the organisation within which the research and change process are on (Zuber-Skerritt, 1996). The third and last theme suggests that this method should have implications further than the immediate project; i.e. the results could update other contexts.

A good example of the inductive approach mentioned in advance is the *grounded theory*, where it is better to think of it as 'theory building' however an induction and deduction combination (Glaser and Strauss, 1967).

Ethnography research strategy comes from the field of anthropology. It is considered as an inductive research approach. This research process takes place over a comprehensive time period, it is a very time consuming strategy. New thinking patterns about what is being observed will continuously be developed by the researcher, so the process of the research needs to be approachable and flexible to change (Saunders et al., 2009).

The final strategy has been considered by Saunders et al. (2009) is the *archival research*. It uses documents and administrative records as the main data source. The term archival refers to recent as well as historical documents although it has historical connotations (Bryman, 1989).

4.4 The Case Study as a Research Method

The case study is a research strategy that helps in exploring the gap between the theory and the experience of practice. There is a difference in having an idea and making that idea real. Case studies are a helpful tool for research and teaching that focus on the practice and theory movements (Breslin and Buchanan, 2008).

Definitions of case study differ in their focus on defining the unit of study which is the case itself, the process which is the case study, and the product of the investigation which is the study report. The case study can be applied to too many topics; these topics are repeated by the most frequently encountered definitions of case studies. For instance, one definition is "the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result" (Schramm, 1971).

Real-life causal links that are too difficult for survey or experimental strategies can be studied as explained by Yin (2003) by the use of case studies. They can be used as well to describe an involvement within its real-life situation, to demonstrate topics within an assessment, and to explore unclear and multiple outcomes from an intervention. This approach enables many perspectives of participants to be analysed in depth and triangulated (Denzin, 1978) through different sources of data used to support findings (Stainton et al., 2010). The case study is used in many situations as a research strategy, to add to our "individual, group, organisational, social, political, and related phenomena" information. The research question itself decides which method of research to use.

Yin (2009) showed that the ideal research method is the case study for the "how" and "why" research questions since these questions are more *explanatory*. This is because that these questions deal with situations need to be checked regularly, rather than simple incidence or frequencies of occurring. This is supported also by Robson (2002), he showed that the case study approach can answer the questions of 'how?', 'why?' and 'what?' (Robson, 2002: Cited in Saunders, 2009).

The case study method has been chosen by the researcher of this study to be the research method followed. The reason behind this as mentioned earlier by Yin (2003) that a case like needlestick injury will not be occurred much in hospitals or healthcare providers, so using surveys for example will not give exact information or data about the case, and the best way is to interview people who live real life cases and situations. For this reason, case studies are the best choice for this research.

4.5 Selecting Cases Criteria

Selecting the final case(s) that will be part of the case study is a prior step need to be done before collecting data for the research; this is the first step for the researcher who is designing the case study research (Yin, 2009).

Research questions will decide the cases to be chosen for the research. Sometimes some case studies might be studied for the reason that the researcher has access to the data of the topic of the research question. Screening important case studies would be difficult for the researcher when many case studies available for him/her to choose from. In such situation, it is advisable to the researcher in order to keep away from any problems that may occur during collecting the data, to screen the final candidate case studies prior to start collecting the data (Yin, 2009). One of the problems that the researcher could face when selecting the cases that the needs of the research question(s) do not match the selected case. Before selecting the candidates of the research, a set of effective criteria should be prepared by the researcher where if the possible candidates meet the pre-set criteria then the researcher would consider them as part of the research. Sampling or choosing the candidates of the research saves time and should be considered in particular when the research deadlines are tight (Saunders et al., 2009). Sampling was divided into two techniques by Saunders et al. (2009) and they are "probability or representative sampling" or "non-probability or judgemental sampling". When the researcher needs to conclude the study from the chosen sample about a population to meet the objectives or to answer the research question(s), the best sampling type is the probability or representative sampling because this type is usually linked with survey-based strategies of research, i.e. a form of random selection of samples is utilised by using sampling type which differs than the judgemental or non-probability sampling that does not depend on random selection of possible cases.

The non-probability sampling was divided by Saunders et al. (2009) into five methods which are *quota, snowball, convenience, self-selection,* and *purposive.* The choosing of non-random cases according to certain fixed quota is called the *Quota* sampling; it is normally used for interview surveys. When the researcher is trying to find people for the research that is difficult to find, he/she uses the *Snowball* sampling as more cases can be achieved when one person informs Managing the Risk of Needlestick Injury in U.A.E. Hospitals 46 / 109

another about the research. The random selection of persons to take part in the research is called the *convenience* method (or *haphazard* sampling) where random persons are usually selected to participate in the research in the most convenient way. Generally, walkers are stopped and asked by the researcher.

Letting each case to explain the reason(s) of participation in the research is the *self-selection* sampling. People, who knew about the research through a form of media or advertising, contact the researcher and he/she collect the data from those who responded.

The researcher decides selecting the population of the case study based on the requirements and the judgement of the research needs, and this is what the *purposive* or *judgemental sampling* technique is.

For this research study, the researcher used *the non-probability or judgmental sampling* where the *purposive* method is followed.

According to this criterion, five hospitals were selected where a total of five cases have been explained. Each of the hospitals selected have implemented a procedure to prevent such injury. The criteria followed in this research are:

- 1. All hospitals have implemented a process or model of dealing with infectious risks and specifically for needlestick injuries. This is important for the research in order to apply the conceptual framework developed to the cases done and to get the input from the concerned regarding the case of needlestick injury.
- 2. They are all having safety or risk management committee. This criterion is very important and essential in order to know the steps of managing risks in the hospital and to get some information about the safety practices done during working hours.
- 3. They are all having either an infection control department or committee or office. As the core risk case for this research is needlestick injury which is an infectious risk, so having such department, committee or an office is a vital factor in order to know the practises and tools used for such risks.

4. They are all based in the U.A.E., so access to the data of this kind of risks and visiting the hospitals will be easy for the researcher, and to have live visits and to see the cases live rather than on documents or via telephone conversation.

4.6 The Research Case Studies

Initially, as the researcher is working in a hospital environment, a help was looked for from the coordinator of infection control and the head of the infection control committee to hold interviews with them, and to give some contacts of other infection control nurses or coordinators in other hospitals. The infection control nurse gave contacts of people in three different hospitals. But since only one person of these three was responded, so the researcher looked on other contacts over the internet. In order to provide feedback in the interview process; eight hospitals have been approached. Only three hospitals accepted to participate of the contacted eight, so the total was five hospitals. A total of five cases were studied and investigated of the selected five hospitals for the interviews. An explanation was given to the interviewees of the different hospitals about the process that would be undertaken, and that was done via telephone first. Afterwards, an official letter signed by the Head of Student Administration in the University was attached in an e-mail and sent to explain more the reason for the interviews, Appendix D. Meetings were scheduled according to the interviewees' agendas when they responded and agreed to be interviewed. The researcher needed more clarification about one point later, so after the first visit, an email sent to the interviewees with a copy of the additional questions needed to be answered, and they replied. A copy of the interview questions that have been asked during the interviews is in section 4.9 below. A copy of the email sent to the interviewees asking for more questions can be found in Appendix E, and the questions are in the last part of section 4.9 which is Negative and Positive Cases Questions. Depending on the amounts of times the interview was interrupted, they lasted between 30-60 minutes, and they took about 45 minutes for the uninterrupted interviews.

For this research, the researcher had reviewed a number of key documents related to the needlestick injury risk in particular; needlestick injury in children, safe use and disposal of sharps, infectious risks and other risks in general. Some documents related to this case were policies, procedures and guidelines of Hospital A as the researcher is working in. The access of Managing the Risk of Needlestick Injury in U.A.E. Hospitals 48 / 109

these documents was easy for this hospital while the interviewees of other hospitals refused to give access to their hospital's policies and procedures. In order to fill this gap the researcher reviewed a number of online policies of other hospitals internationally. These kinds of documents are important to the research in order to have ideas about the up-to-date policies, procedures and practices of dealing with such risks in hospitals and health care providers in general.

Table (2) below provides a summary of the people interviewed whereas Table 3 later provides a more detailed summary of the case studies.

	Hospital Referencing System							
	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E			
Interviewee 1	Interviewee 1 (A1)	Interviewee 1 (B1)	Interviewee 1 (C1)	Interviewee 1 (D1)	Interviewee 1 (E1)			
Position	Infection Control Committee Chair, Specialist Microbiologist	Hospital Infection Control Chairman, Medical Services Manager	Infection Control Practitioner	Head of the Prevention and Control of Infection (PCI) Office, Consultant, Medical Obstetrics	Consultant ICU, Chairman. Infection Control Committee, Head of Prevention and Control of Infection office			
Interviewee 2	Interviewee 2 (A2)	Interviewee 2 (B2)	-	Interviewee 2 (D2)	Interviewee 2 (E2)			
Position	Infection Control Coordinator	Infection Control Practitioner Nurse	_	Senior Infection Control Practitioner	Senior Infection Control Practitioner			
Interviewee 3	-	-	-	Interviewee 3 (D3)	Interviewee 3 (E3)			
Position	-	-	-	Infection Control Practitioner	Infection Control Practitioner			
Notes	Hospital A is newly operated, only since June 2011 The two interviewees were interviewed individually	The two interviewees were interviewed together	-	Hospital D is a specialised Obstetrics and Gynaecology and Paediatrics Hospital The three interviewees were interviewed together	The three interviewees were interviewed together			

 Table 2: Summary of interviewees

A summary of the participated interviewees in this study is provided in Table 3. For confidentiality purposes, the names and the hospitals names did not mentioned. For explanation and reference when required in the research, the positions of the interviewees and notes on the hospitals have been provided. A summary about each hospital is provided for more information below.

Hospital A:

This hospital is a newly opened private hospital in United Arab Emirates, Sharjah. It is a teaching hospital. It is opened in June 2011 and started to accept in-patients and out-patients. With 200 beds capacity, and almost all specialities available, the vision of its owner is to provide the people of the UAE in general, and Sharjah in particular, with in-country access to outstanding world-class healthcare services. The hospital is equipped with high-tech medical facilities and technology. This hospital is attached to one of the most important universities in UAE for Medical studies. For more information on this hospital, please refer to Table (3).

Hospital B:

Hospital B is eighty (80) beds, private hospital. It has two locations in Dubai, UAE. It provides higher care shared with a universal approach to lifestyle management with focusing on cure and prevention since it is a multi-specialty healthcare provider. It has more than 20 specialised clinics including the surgical and medical specialties. This hospital has been positioned as a chief comprehensive healthcare provider in the region because of the variety of medical specialties, higher diagnostic technology and exceptional services it provides. For more information on this hospital, please refer to Table (3).

Hospital C:

Hospital C is a (143) beds, private hospital. It is a general speciality hospital, which mission is "to provide high quality American standard healthcare that meets the needs and exceed the expectations of the people of Dubai, the UAE and the surrounding Gulf Countries". It was ranked number one in the region for health care services because of the high standards of the planning, designing, building and equipping. The management and clinical workers of this hospital work hard to meet these standards in everything they do for the patient daily. They fulfil Managing the Risk of Needlestick Injury in U.A.E. Hospitals 50 / 109

medical needs in comfortable and reassuring surroundings since they have the expertise to do so. It was the first hospital accredited by the Joint Commission International Accreditation (JCIA) in the Middle East. Please refer to Table (3) for more information on this hospital.

Hospital D:

Hospital D is a (399) beds, governmental hospital. It provides the following specialities: Gynaecology, Obstetrics, Paediatrics, Paediatric Surgery and Thalassaemia. All the required services and highly sophisticated equipments are supporting these specialities in order to offer a quality patient care. This hospital is focusing healthcare towards woman and children only which makes it the only and largest hospital in Dubai for this unique service. It is Dubai's chosen tertiary centre for women and children. They have successfully completed the vigorous international assessment from WHO/UNICEF that makes it the first fully accredited baby-friendly hospital in Dubai and UAE. For more information on this hospital, please refer to Table (3).

Hospital E:

Hospital E has attained many achievements in the field of medical specializations since opening in 1983. It is 750 beds, governmental hospital. Hospital E is offering the latest medical services in the areas of: Anesthesia, Ophthalmology, Orthopedic, Paediatrics, Physiotherapy, Obstetrics, Urology, Radiology, Nuclear Medicine / Medical Physics, Endocrinology, Nephrology, Rheumatology, Oncology, and E.N.T. For more information on this hospital, please refer to Table (3).

	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Location	Sharjah, U.A.E.	Dubai, U.A.E., it has two (2) locations	Dubai, U.A.E.	Dubai, U.A.E.	Dubai, U.A.E.
Private/Government Private		Private	Private	Government	Government
Operating Since	June 2011	-	-	-	1983
# of Beds	210, 21 operating only currently	80, 8 in the first location and 72 in the other one	143	pprox 400	750
# of Nurses in Hospital	Currently 105, it will increase as soon as the number of patients increased	278	300	≈ 600	+2000
Infection Control Department/Office/ Committee	Infection Control Committee	Infectious Diseases Department	Infection Control Committee	Prevention and Control of Infection (PCI) Office	Infection Control Office
Risk Management Committee	Yes	Yes	Yes, it is called Safety Committee	Risk Manager only	Yes
# of needlestick injuries / month	0-1 for nurses, doctors and housekeeping staff	0 of nurses, 2 for doctors, and 0 for technicians	0-4 approximately, for last year: member of CSSD, housekeeping staff, nurses, and physicians	0-1 for nurses, 1-2 for doctors	2-3 per month, depends on reporting by the injured persons
Special training for using needles	Yes, in general and nursing orientation	Yes, in orientation programmes for new joiners	Yes	Yes, in orientation programmes, twice per month	Yes, in orientation programmes upon joining, and in monthly programmes but for other practices in service education
Choosing needles and sharp instruments criteria	According to the technical product evaluation	Depending on the safety recommendations, and FDA (Food Drug Agency- USA) and EPA (Environment Protection Agency-UK) standards	According to the product standardization committee	According to patient safety	According to safety and quality of instrument, depending on product evaluation report and mentioning the justifications
# of People Interviewed	2	2	1	3	3

Table 3: Detailed summary of case studies

4.7 Data Collection Method

The qualitative approach of research is used for this study so the method of collecting the data will mainly be the interviews. The following will give information about different types of interviews and the selected type for this specific study.

Interviews could be categorised as per Flick (2009) into five different types. They are: the Focused Interview, the Semi-Standardized Interview, the Problem – Cantered Interview, the Expert Interview, and the Ethnographic Interview.

The *Focused Interview* was first developed by Robert Merton who was one of the most important sociologists in the United States and his colleagues (Merton and Kendall 1946) in the 1940s (Flick, 2009). The original objective of this interview type was offering a foundation for interpreting statistically important results on the impact of media in mass communication. In this type of interviews; non-direction, specificity, range and the department and personal background shown by the interviewee are the elements of the criteria that need to be taken in consideration (Flick, 2009).

The *Semi-Standardized or Semi-Structured Interview* was first suggested by both Brigitte Sheele and Norbert Groeben. They are psychologists, who have developed the approach of studying subjective theories as a special model for studying everyday knowledge. This approach was first developed in the 1980s and 1990s (Flick, 2009). Semi-structured interviews can be the most open-ended source of data, affording further qualitative evidence through predetermined but open-ended questions (Stainton et al., 2010).

The *Problem-Centred Interview* suggested by Andreas Witzel has been applied mostly in German psychology. It is been developed in the situation of biographical research interested in professional biographies of different groups of people.

This interview is characterised by three central criteria: *problem centring* which is the direction of the researcher to a significant social problem; *objective orientation*, meaning that technique are developed or modified regarding an object of research; and *process orientation* in the research process and in the object of research understanding (Flick, 2009).

The *Expert Interview*; in contrast to biographical interviews, here the interviewees are of less interest as a whole person than their capacities as experts for a certain field of activity. There are three alternative approaches for this kind of interviews; exploration of a new field to generate hypotheses, systematising expert interview to collect contextual information, and the theory generation and reconstruction of expert knowledge (Flick, 2009).

The *Ethnographic Interview*; in this type of interviews, the participant observation is the principal method of collecting data. The interviewer looks for understanding the "life worlds" of the participants in the field, the interview is live, and the interviewer is interviewing the people around him/her. Ethnographic questions may be: *descriptive* questions, *structural* questions on how informants organise their knowledge and practices, and *contrast* question on how informants differentiate objects and events in their world (Flick, 2009).

The semi-structured interviews will be conducted in this research, so as to collect information about the case of needlestick injuries in hospitals and how to work with them when occurring.

4.8 Validity & Reliability

Validity and reliability are two important measurements need to be considered in any research. Within a research methodology context, validity means that proper, right measurements are made (Stainton et al., 2010). Saunders et al. (2009) mentioned that two emphases on research design: reliability and validity need more attention by the researcher because the opportunity of wrong answers will be reduced by both of them.

Field studies should study validity from four perspectives: statistical conclusions, internal, external, and constructs as per Cook and Campbell (1979). In other words, research should acquiesce data that are statistically significant, unbiased, generalizable to broader contexts and based on suitable measures. These validity concerns necessitate that results are correct, that they correspond to and precisely capture the state of affairs (Robson, 2002: cited in Saunders, 2000). Nevertheless, the importance of validity and reliability within the case study research design is abandoned by some authors such as Bryman and Bell (2003). Actually, they suggest that the researcher should decide the degree to which these research design criteria are suitable for the assessment of the research, given that they are less important within this case study context (Stainton et al., 2010).

Measurements for a research need to be reliable through stability and consistency (Robson, 2002) which means that the similar readings can be obtained by other researchers or on other occasions where same study might be conducted. As per Bryman & Bell (2003), the results of a study are repeatable. For this reason, it is significant to account for error and bias of participant and observer during data collection phase. Reliability goal is to reduce errors and biases in a research by ensuring repeating the same results and conclusions when the investigation is repeated by others (Yin, 2003: cited in Stainton et al., 2010).

4.9 Interview Questions

In this section, the interviews questions had been asked to the interviewees are as below:

Information about your Hospital

Hospital Name: Location: Number of beds: Number of nurses: Government/Private:

Information about the Interviewee

Please note that this information will be reserved confidential and will not be shared with anyone other than the interviewer Name: Department: Role in the Hospital:

Is there an Infection Control Department or Committee in your hospital? Are you apart of the Infection Control Department or Committee?

Risk Management Practice (Risk Assessment) Questions

- 1. Is there a committee for Risk Management in the hospital?
- 2. In case of an injury occurred? What is the practice you do for assessing this risk?

Risk Management Practice (Risk Control) Questions

- 3. After assessing the risk happened, what is the next practise for controlling this risk?
- 4. How your risk management committee close the risk case?

Needlestick Injury (NSI) Risk Questions

- 5. How common are NSI's?
 - a. How many injuries do your technicians or people in general have this risk in a month?
 - b. What kinds of NSI occurred usually in your hospital?

- 6. How can NSI's be prevented?
- Do you have special training for using needles for new or students in your hospital?
 a. How often does it take?
 - b. Do you do training for experienced persons on the new techniques?
 - c. How did your employees accept the change in the technique if it is more

efficient?

- 8. How does your hospital usually choose the needles and sharp instruments? In which criteria?
- 9. How does your hospital dispose Needles or sharp instruments?
- 10. Is there a Surveillance Programs for NSI's in your hospital?

In case of NSI Occur Questions

11. What is the first practise done in case of NSI happened?

- 12. When do you seek a help or medical advice?
- 13. How do you clean the wound?
- 14. For which viruses the blood tests are done?
 - a. Do you do it for HIV?
 - b. Do you do it for HBV?
 - i. Do you give vaccination for HBV?
 - ii. Who pay for it? The hospital or the employee?
 - c. Do you do it for HCV?
- 15. Do you do follow up tests for the injured employee?

- a. How often?
- b. For which viruses?
- 16. Do you report the incident?
 - a. To whom?
- 17. How long it takes in terms of time to finish all practices for NSI without the follow ups?

Negative and Positive Cases Questions

- 18. Of the cases mentioned earlier, how many were negative and how many were positive to the three mentioned viruses?
- If Positive, please continue, if Negative, stop, and thank you
 - 19. All the processes have been done immediately, how effective was applying these steps?
 - 20. When analysing this risk, what were the sources of identifying the event of this risk?
 - a. The external sources?
 - b. The internal sources?
 - c. The risk factors?
 - d. The risk indicators?
 - 21. What were the consequence(s) of this risk?
 - 22. When assessing this risk, what was the possibility of each of the sources mentioned earlier?
 - 23. What was the impact of the consequence(s) on the staff injured?
 - 24. What was the process for responding to this risk? i.e. to reduce the likelihood and avoiding this risk?
 - 25. What was the step(s) for mitigating the impact of this risk?

- 26. For controlling this risk, what were the activities done for preventing and controlling this risk?
- 27. What were the activities for mitigation and correction of this risk?

Chapter 5 – Data Analysis, Findings and Interpretation

5.1 Introduction

The researcher will present the different data that was obtained from the interviews in this chapter, as face to face interviews have been held as it is the research method of this study. First of all, the transcripts of the interviews will be interpreted separately. After that, the different themes and sub themes will be extracted from the interviews during the first and second reading phase of the answers in order to analyse the case studies, for each hospital or case, the possibility of injuries will be either negative or positive. For both of them, certain actions will be taken when occurring. Next, the results and findings of the analysis will be presented by finding the similarities and differences between all the case studies. Finally, the findings from the cases will be presented in terms of the butterfly risk tool which is the conceptual framework adapted.

5.2 Case Study – Hospital A

For hospital A, two interviews were held with two key persons for the infection control field; first one with the Chair of the Infection Control Committee, she is Specialist Microbiologist, and the other one was with the Infection Control Coordinator. As mentioned earlier in Table 4, hospital A is a newly operated hospital, so number of patients is small and also number of staff and nurses is not completed yet as per the recruitment plan. Only 21 beds of 210 beds are operated in all departments, so the cases of needlestick injuries will be limited. A committee of infection control was established in order to look after all infectious cases in the hospital. As a vision of this hospital management is not to hire a "Safety Manager or Engineer" which is justified that the safety of the hospital is the responsibility of all hospital staff, a risk (safety) management committee is established to look after the risks and safety issues in the hospital. A third important committee established is the quality committee which looks after increasing the quality standards of the hospital in terms of minimizing number of injuries occurring in the hospital so it is a key part of risk management and infection control committees, and each one of the three committees report to the other in a different way that serves the goal it was established for. The risk management practise adopted in this hospital is for, first, the injured staff of any risk has to fill in an incident report and submit it to the Infection Control Coordinator. The pre-caution standards are applied for the risk control process by the committee of Infection Control who reports the case to the committee members. As one of the practices done by this committee to ensure controlling the risks and avoiding them is the monthly environment monitoring programmes. The risk case closes usually by following up the patient and continual monitoring the hospital environment, and auditing the staff on the best infection control practices. After that, the case is documented and sent to the Prevention Medicine Department in Sharjah for statistical purposes.

For the needlestick injury for Hospital A, 0-1 cases per month were reported as it is still a new hospital and using the most recent techniques and tools for collecting blood samples. The standard practices done in order to prevent the injuries are not recapping the needles, disposing them directly into the sharp container; not to pass needles to other colleagues by hand, and by proper education and training through policies and procedures. Orientation and training programmes are done usually for both new staff as well as existing ones. The needles and other sharp instruments are chosen according to certain criteria like safety of the user, compliance of the staff, cost of the instrument, and according to the product technical evaluation they do in the hospital.

For disposing the needles and sharp instruments, sharp containers which are sealed properly, have date and time stamp, with the initial name of the disposal unit, were used and kept inside the regulated room, and then disposed, through WEKAYA company which is a private waste management company for Sharjah hospitals.

When an NSI occurs, certain procedures are in place to handle it which are summarised in the following points and they are compatible with the international standards of CDC - Centres for Disease and Control Prevention and WHO- World Health Organization:

- 1. Wash the wound under running water
- 2. Cover it if it is bleeding
- 3. Inform the supervisor in charge of the unit
- 4. Go to staff clinic, the physician will see the staff and complete the incident form
- 5. As a base line, blood tests HIV, HBV, and HCV should be done
- 6. Give the first dose for HBV, and immunoglobulin.
- 7. Following up after 6 months and 1 year.

8. Report it in written, if the incident is positive send the report to the Preventive Medicine Department in Sharjah.

The above procedures take about an hour to complete all steps including the blood tests. Following this system in handling such risk is very effective according to the interviewees. Routine follow up as per guidelines resulted in identification of infection on time for the injured person. Treatment was started immediately after base line laboratory tests preventing complications. Programmes of training and orientation are done regularly when new staff joins the hospital as well as monthly programmes are hold for existing as well as new employees, and in order to ensure compliance of these programmes, monthly randomly checks are done for all wards by the Infection Control Coordinator.

For hospital A, the researcher had the opportunity to interview a real injured case occurred in the hospital. The injured staff member was one of the housekeeping staff. It occurred when the mentioned staff was collecting the garbage bag from the housekeeping room, this bag was from the ICU, she was wearing gloves, but because the bag was tightly closed, the needle was coming out of the bag but she did not see it. Then, the injury occurred and she sustained a wound in her hand. The supervisor has been called immediately. She treated her by washing the wound with water and soup and then she sent her to the ER to do the necessary. The nurses in the ER department took two samples of blood and then they did blood tests for the three viruses, and then gave her injections for HIV and HBV.

5.2.1 Case Analysis – Hospital A

When analysing the case of Hospital A, major themes and sub-themes were extracted from the transcripts of the interviews that hold with the concerned in the hospital. Four major themes were extracted from this case. The first them is Event Identification, and from this theme, some sub-themes were extracted as well which are: Practices, Duty hours, Cultural, and Financial sub-themes. Most of the staff of this hospital as per A1 reported that "disposing the needles improperly" is a practice done that could cause a needlestick injury. Two good practices they are following that would affect the safety of the staff and the patients which are "having three committees for infection control, safety and quality", each one of these committee reports in the responsibility area and "choosing the sharps and needles upon the technical evaluation committee decision" which will be according to the international standards. Then she added that "healthcare and housekeeping staff lack of concentration" is most properly is a major reason of this type of injuries, the two factors fall under the long duty hours and cultural sub-themes. "Baseline serological tests for the affected staff and source (patient)" is another cultural factor reported by A1, she reported also that "affected staff acquired infection as a result of this event and subjected to treatment" and "the affected staff was withheld from performing duties in clinical areas unless completion of treatment duration and documentation of cure", these two factors are Cultural sub-theme of the Event Identification theme. Finally, some financial factors could be affected by this injury as per A1, "Significant resources were used to identify follow and treat the affected staff" and "Financial burden on the hospital". The second major theme extracted from Hospital A interview transcript is the Risk Assessment. From this theme, some sub-themes were extracted like Practices, Cultural and Financial sub-themes. "Filling the incidence forms" is a practice done by all staff in the hospital when an accident occur, reported by Interviewee 1. Interviewee 2 of Hospital A reported that "Non adherence to the policy /guidelines in place" will affect the assessment of the risk as this cultural sub-factor could cause major problems and risks for the staff and for the hospital itself. She added that as a discipline action "warning letters could be issued for the injured staff" for his/her careless attitude in this place. The other sub-factor is the "significant burden on hospital budget" that would affect the assessment of the risk of needlestick injury. The third theme identified by the researcher is the Risk Response theme for the risks occurring. One sub-theme was extracted which is the Educational sub-theme. Interviewee 1 has reported that "Immediate educational activity was organized for the awareness of the housekeeping staff on how the incident occurred, what were the consequences and what preventive measures should be taken" which is an action that may affect the response plan effectiveness for responding to any risk in the hospital. The final theme identified was the Risk Control Activities. Interviewees 1 and 2 insisted on "educating the staff" as an educational sub-theme for the risk control plan could be followed in the hospital to ensure the safety of the staff as well as the patients.

5.3 Case Study – Hospital B

For Hospital B case, 2 interviewees were interviewed as well together as the practise is one and their answers were similar. The first interviewee is the Manager of Medical Services, and Chairman of Hospital Infection Control, he is Specialist of Infectious Diseases. The second interviewee is the Infection Control Practitioner Nurse. They have Infection and Prevention Control Department in the hospital, and there is also a Risk Management Committee, they are networking with other hospitals by holding seminars on risks and infection control practices. As an initial step for risk management and risk assessment process, two forms need to be

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filled in for the case of an injury occurred, they are Occurrence Variance Report and Occupational Hazard Form. After that, for the risk control practice, the healthcare worker has to inform the nurse in charge about the risk, give her/him risk arrangement, and he/she has to be trained on the universal standard pre-caution actions. The case closes usually by reporting to DHA – Dubai Healthcare Authority for statistical purpose if the risk is infectious. The staff who are threatened to be injured by needlestick are the nurses, and to date no case of a nurse for this kind of risks in this hospital. The second threatened staff are doctors, and their number could be 2 per month while sewing in the Operation Room. Finally the technicians of collecting blood samples, and their number in this hospital is zero as well; this could be justified by the good training they are giving to their staff that qualifies them to do the job perfectly. These trainings are done in orientation and induction programmes for new staff regardless of the number of new joiners and experiences. They do them according the international agencies like WHO recommendations. They are choosing their sharp instruments and needles according to the safety recommendations, and FDA - Food Drug Agency (USA), and EPA - Environment Protection Agency (UK) and to be approved by the Infection Control Committee.

When an NSI occurs, they check if the injury is HIV positive, if it is, the case will be sent to other hospital for anti-retriever therapy; if it is HBV positive, the case has to be followed and to be given active Immunoglobulin urgently. If it is negative case, it will be followed up for 6 months, and followed for 3 doses vaccination for HBV. As HCV has no vaccination yet, the follow up will be for 6 months only. They are following up also for HDV and HGV. Finally the case is reported in written to the infection control practitioner, also in a monthly report as a KPI – Key Performance Indicator for Quality purposes.

5.3.1 Case Analysis – Hospital B

Hospital B interviewees 1 and 2 answers helped in extracting some major themes for this study. The first major theme is Event Identification, and a sub-theme of this major theme was extracted which is the Practices. Some good practices done as per Interviewee 1 are "not adhering to policies and procedures in the hospital" and "following the standards of the international organisations when choosing the sharps and needles to be used in the hospital", and "establishing Infection and Prevention Control Department in the hospital, and there is also a Risk Management Committee". The second theme extracted from the answers of Interviewees of Hospital B is the Risk Assessment. One sub-theme was extracted from this

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theme as per Interviewee 1 is the Practices theme and one of the practices done by staff of this hospital is *"filling incidence reports when any kind of risk occurring"*. Thirdly, Risk Response is the next theme identified by the researcher for this hospital. Educational sub-theme was extracted and Interviewee 2 reported that *"monthly induction programmes and seminars are done for internal staff and external visitors"*. Finally, the last theme extracted was the Risk Control Activities. Of this theme, the Educational sub-theme was extracted where "training is done for staff on a regular basis" as a risk control factor, as per the report of Interviewee 1 of Hospital B.

5.4 Case Study – Hospital C

One interviewee was interviewed in Hospital C. Her role is Infection Control Practitioner. In this hospital, no Infection Control Department; but the Infection Control committee takes care of all the infectious risks and cases. They do have a risk management committee but it is called safety committee. When an injury occurred, the usual practice they do is to report it to the nurse manager in written. They fill in an incident form, and then depending on the time of injury, if it is occurred during working hours, the injured staff goes to the primary care clinic, otherwise, he/she will go to the emergency room. The nurse in charge then assesses, classifies the injury and treats it accordingly. The case then sent to the Quality department in order to evaluate it. After that, risk control actions are taken like investigating the causes of the risk, and educating people and housekeeping personnel about the consequences of such injuries. As in other hospitals, this injury is occurring in very low rate; she declared that for the last year, 0-4 cases occurred. The staff members who are usually injured by this risk are nurses, physicians, and housekeeping staff. The most common injuries by sharp instruments occur are caused by needles. These injuries can be prevented by having the disposable containers near to the staff, and not hand to hand disposal of the needle (keep it in dish), and by teaching the nurses and technicians about not overwhelming the containers, and lastly educating the staff about these injuries and about the consequences of them. They do have training programmes for nurses. The criteria they use for purchasing needleless needles depend on the product standardization committee; they are looking now for needleless systems to be used in the hospital. She added, when a needlestick injury occurs, the following steps are done:

- 1- Squeeze the area of the injury
- 2- Wash under warm running water and liquid soap

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- 3- Report it to the line manager
- 4- Fill in incident report
- 5- Send the injured to primary care clinic or ER
- 6- Assess the risk to the injury
- 7- Take blood samples for testing the three viruses, HIV, HBV and HCV

When these steps have been completed, the injury is reported to the committee of infection control and performance improvement quality control committee. She declared that applying these steps was very effective in the majority of cases. These steps are not much different than what is being practised in Hospital A as mentioned earlier. The only difference is *"squeezing the wound*" and this point exclusively is a point of difference even in the literature as will be shown later.

5.4.1 Case Analysis – Hospital C

Hospital C as mentioned before is running the highest quality healthcare standards, so the practices need to be done properly to reach this level of quality. When analysing the case of this Hospital, major themes and sub-themes can be extracted from the transcript of the interview that hold with the Infection Control Practitioner in the hospital. The researcher extracted four major themes from this case. They are: Event Identification, Risk Assessment, Risk Response and Risk Control Activities. From the first one, Event Identification, one subtheme was extracted which is the Practices sub-theme. The Interviewee reported that "poor *practice*" is one of the bad practices done by the nurses in working with needles and sharps sometimes that causes injuries and incidents. On the other hand, a good practice is summarised by "having Infection Control committee that takes care of all the infectious risks and cases, a risk management committee that is called safety committee which is responsible about the safety issues in the hospital and Quality department to ensure quality practices and to follow the risks and incidents" as per her report. Having these two committees will ensure following the latest standards of risk management and decreasing the injuries in the hospital. The second major theme is the Risk Assessment. It consists for two sub-themes which are Practices and Cultural sub-themes. "Filling the incidence forms" is a practice done by all staff in the hospital when an accident happen, reported by the Interviewee. She also reported that "Positive injury for HBV" could be concluded from the case of needlestick injury when occurring. The researcher has identified the third theme which is the Risk Response theme for the risks occurring. The Educational sub-theme is the only sub-theme was extracted. She has reported that "staff education, Introduce needle free devices where possible, and avoid *passing sharps directly to another person*". The final theme identified was the Risk Control Activities. The sub-theme of this major theme is the Educational sub-theme. She reported that *"Educating the staff"* is an important factor for controlling the risk of the hospital.

5.5 Case Study – Hospital D

In Hospital D, three persons have been interviewed altogether. The Head of the Prevention and Control of Infection (PCI) Office, she is Consultant of Medical Obstetrics. The second one is the Senior Infection Control Practitioner, and the last one is the Infection Control Practitioner. There is no department for infection control in the hospital, but there is a Prevention and Control of Infection (PCI) Office. In this hospital, there is no independent risk management department but it is part of the Quality department. When an injury occurred, they do environmental audit in the wards by nurses, filling in an incident report form as a first step of assessing the risk. The infection control office personnel close the risk case by reporting the case to the risk manager. In Hospital D, 0-1 cases for nurses done per month, while for doctors, 1-2 cases per month. This usually occurs while disposing the needles, or by the general wastes domestic staff. The most common sharp injuries occurred are the needlestick injuries. They declared that the injury could be prevented by educating staff, not to recap the needles, proper disposal of needles and safe handling to the surgeons in the operation room. They do have special training for using the needles for staff and it is taking place twice per month in the orientation programmes. They choose the needles and sharp instruments according to patient safety criteria, for instance needles should have safety feature and they have a cap. The sharps and needles are usually disposed in sharp box containers, the nurse locks it properly and then all these boxes are collected by private medical waste company, and Dubai municipality, daily or every alternate day collect these medical wastes. When an NSI occurs, the following steps are followed:

- 1. Wash the injury in running water and soap
- 2. Dry the area
- 3. Report to the nurse in charge by filling in an incident report
- 4. Go to the staff clinic
- 5. Collect blood samples to check the HIV, HBV, and HCV
- 6. Report to PCI and risk manager
- 7. Follow ups depending on the source every 6 weeks and 6 months

The whole process takes about 1 to 2 hours to be done excluding the follow ups. This process is very effective when reporting the incidents, but they suffer from two practices done by the staff, the first practice is when not reporting the incidents they had to the infection control department and another gap of this system they suffer from is using the old needles, they prefer to change them to most updated ones. The above steps are almost the same with the process done by both Hospitals A and C, because all hospitals rely on the international standards of CDC - Centres for Disease and Control Prevention and WHO- World Health Organization.

5.5.1 Case Analysis – Hospital D

The analysis of Hospital D leads us to 4 key themes and sub-themes that were extracted from the transcripts of the interviews that hold with the Infection Control Personnel in the hospital. The first theme is the Event Identification, and from this theme, four sub-themes were extracted as well which are: Practices, Duty hours, Cultural, and Engineering sub-themes. Some good practices followed in the hospital as per Interviewee 1 are "using policies and procedures in the hospital", "choosing the needles and sharp instruments according to patient safety criteria", and "establishing Prevention and Control of Infection (PCI) Office and Quality department" in order to ensure the quality standards to be followed in the hospital. The second sub-theme is the Duty hours of the staff, long duty hours lead to lack of concentration and thus "Number of reported injuries on a monthly period is increasing" according to Interviewee 2. The third sub-theme of this major theme is the Cultural subtheme; Interviewee 1 reported that "environment" and "violent patients" affect the needlestick injury risk enormously. The fourth and last sub-them is the Engineering. One of the interviewees reported that "availability of any required equipment for safety purposes e.g. sharp safe containers" will affect the safety of the hospital as the most efficient containers will guide to a better hospital. The second major theme extracted from Hospital D interview transcript is the Risk Assessment. From this theme, two sub-themes were extracted like Practices, and Cultural sub-themes. "Filling the incidence forms" is a practice done by all staff in the hospital when an incidence happen, reported by Interviewee 3. Interviewees 1 and 2 of Hospital D reported that "accidental disposal of sharps in the waste bins" and "Anxiety about any cause that can happen related to the injury" respectively will affect the assessment of the risk as these cultural sub-factors could cause major problems and risks for the staff and for the hospital itself. Risk Response theme is the third theme identified by the researcher. One sub-theme was extracted which is the Educational sub-theme. Interviewee 2 has reported

that "providing education to all staff" could affect the response plan effectiveness for responding to any risk in the hospital. The last theme recognized was the Risk Control Activities theme. Interviewees 1 insisted on "educating the staff" and "creating awareness about safety issues" as an educational sub-theme for the risk control plan for the hospital.

5.6 Case Study – Hospital E

For this hospital, Hospital E, three interviewees were interviewed together as well. The first interviewee was Consultant ICU, Chairman of Infection Control Committee, and Head of Prevention and Control of Infection office. The second interviewee is Senior Infection Control Practitioner, and the third interviewee's role in the hospital is Infection Control Practitioner. For this hospital they have an infection control office and committee, the personnel for the office are the head and the two practitioners, plus 75 infection control link nurses in all wards. There is a risk management committee in this hospital and the doctor – Interviewee 1 - is a member of it. From the point of view of the doctor, the practices for assessing risks in general have to be done before the risk occurred. After assessing the incident, the practises done for controlling the risk are taking the precaution actions for the risk (like isolation if needed), and then confirming the diagnosis. The risk is usually closed by the risk management committee, if there is any breach, an incident report will be sent to the concerned department. About the reported cases for the needlestick injury, the number of injuries in this hospital is 2-3 per month, and the majority are negative. The common sharp injuries occurred in this hospital usually are the needlestick, they occur either during the blood execution by nurses or blood collecting staff, or during needles disposing. These kinds of injuries could be prevented by educating and training the staff, and following the policy about this injury. They have special training for using needles and it is done upon joining of new staff, they are monthly programmes. The hospital usually chooses the needles and sharp instruments upon safety of the device, efficiency, and the quality, and this is done through product evaluation process for quality. The needles and sharp instruments are disposed through standard wall mounted sharp boxes, they are easy to access, locked, kept away from children, and designed to be used once only. When a needlestick case occurs, they do the following practices:

- 1- Wash the injury with running water and soap and do not squeeze it
- 2- Antiseptic it
- 3- Go to the staff clinic or ER depending on the time of the injury

- 4- Do blood tests for HIV, HBV, and HCV
- 5- Do follow ups after 6 weeks and 6 months
- 6- Report the incident to the Quality and Infection Control committees

The above steps are the same of Hospitals A, C, and D in most of them which means that following the international standards of dealing with needlestick injury is a goal of all hospitals interviewed and this means they look for quality of practice in their hospitals.

5.6.1 Case Analysis – Hospital E

The major themes extracted from the interview transcript of Hospital E case when analysed were: Event Identification, Risk Assessment, Risk Response and Risk Control Activities. Three sub-themes of the first major theme were extracted by the researcher, and they are: Practices, Duty hours, and Cultural sub-themes. Most of the cases of needlestick injury can be treated because of the practice of "past incidents", reported by Interviewee 1. He added that a good practices done in the hospital in order to ensure safety is "having an infection control office and committee, and a risk management committee". The other sub-theme is the Duty hours for the staff. Interviewee 1 reported that "long duty hours, will cause loosing of mind, lack of sleep, and lack of concentration" which will affect negatively on the performance of the staff and will cause major problems. "Violent and non-compliant patients" and "possibility of changing the life by the injury" are two factors of cultural subtheme reported by Interviewee 1 of Hospital E. The second major theme is the Risk Assessment. Interviewee 1 mentioned that "staff could be withheld from performing duty" if they are infected by this injury, this is a factor of the Cultural sub-themes of this theme. "Filling the incidence forms" is a practice done by all staff in the hospital when an accident happen, reported by the Interviewee 1, this is a factor of the Practices sub-theme. The third theme is the Risk Response theme that has been identified by the researcher. Two sub-themes were recognized when talking about this theme for this hospital; the first one is the Cultural sub-theme where the Interviewee 2 reported that "counselling in personal basis" when being infected by this type of risk which is needlestick injury. The other sub-theme for Risk Response theme is the Educational sub-theme. Interviewee 1 has reported that "educational activities to teach the staff in case of exposure". The final theme identified was the Risk Control Activities. Three sub-themes were identified for this theme, they are: Educational, Cultural, and Engineering sub-themes. He reported that "Educating the staff" is an important factor for controlling the risk in the hospital, "pre-employment" which is a factor of Cultural sub-theme that ensure employing qualified staff in the hospital, and finally the Engineering

theme where Interviewee 2 reported that "*engineering of the sharp container*" is an important factor that ensures safety in the hospital.

5.7 Findings from the Analysis of the Case Studies

Five cases have been studied in this research from five different hospitals in UAE. The case studies are about the needlestick injuries in these hospitals. The sample of this study is five hospitals only since it is a pure qualitative research and this is too small to make any conclusions based on statistics. From what has been analysed previously, it can be noticed that four major themes have been identified from the different interviews transcripts which are Event Identification, Risk Assessment, Risk Response, and Risk Control Activities. Of the four themes, some sub-themes were associated with each one, e.g. for the Event Identification theme, five different sub-themes were recognized in the analysis, they are: Practices, Duty hours, Cultural, Financial and Engineering sub-themes. The second theme, Risk Assessment, has three sub-themes recognized that are Practices, Cultural, and Financial sub-themes. Thirdly, the Risk Response theme which consists of two sub-themes, they are the Cultural and Educational sub-themes. Finally, the Risk Control Activities theme which consists of three sub-themes, they are Education, Cultural and Engineering sub-themes. After analyzing the five cases of the five different hospitals, some of the steps found in the literature are different than what is found in the case studies. The step of "encouraging bleeding at the site of injury" which means squeezing out the excess blood and to encourage bleeding, is an old practise done in the past, while now all the cases encourages not to squeeze the bleeding and just clean it with liquid soap and running water except of case of Hospital C. Otherwise this, all other steps are approximately the same and the sequence could vary from one hospital to another.

5.7.1 Commonalities between Cases

Some of these themes and sub-themes are common between different hospitals have been studied. The commonalities between them can be cleared from the point of the good practice of "having three or two committees of Infection Control, Safety or Risk Management, and Quality department or committee" which comes under the Practices sub-theme of the Event Identification Theme. Another common point was "filling incidents reports" for the injuries or risks. This point follows the Practices sub-theme as well but for the theme Risk Assessment. The third point which is a joint point between two different themes and sub-themes which is "Educating the staff", this falls under the themes of Risk Response and Risk

Control Activities and the sub-themes Educational for both themes. Having these points in common tells that existing of specialised parties like the mentioned committees in the hospital for identifying the risks in general is very important and helps in centralising the tasks and responsibilities. For the second point, filling the incidents reports is an important action needs to be taken in order to know how to assess the risk occur regardless of what is this risk. Finally, education and awareness programmes, sessions, and seminars are fundamental for each hospital and for risk management process specifically in order to ensure Risk Response Plans as well as Risk Control Activities need to be takes and done when a risk occurs.

5.7.2 Differences between Cases

On the other hand, some themes and sub-themes extracted differ from hospital to another. Some sub-themes were unique just for one hospital, e.g. the Financial sub-theme of the Event Identification and Risk Assessment themes is extracted from Hospital A interview only were the interviewees considered "financial burden on the hospital" and "significant resources were used to identify follow and treat the affected staff" factors. Also, the Culture sub-theme of both Risk Response and Risk Control Activities was extracted from Hospital E interview transcript only, where "Counselling in personal basis" and "Pre employment" factors appears in this hospital only. Last difference comes from Hospital E as well where Engineering sub-theme of the Risk Control Activities theme is identified for "engineering of the sharp container" factor; they take in consideration this factor and work for improving it.

5.8 Findings in Terms of Applying the Risk of NSI to the Butterfly Risk Tool

In this section, the butterfly risk tool will be applied to each hospital case. Data gathered from the interviews will be used to identify each theme and sub-themes extracted.

5.8.1 Hospital A

From what was mentioned earlier in the case of Hospital A and from the input of the interviewees, answers could be fitted to the model of butterfly, i.e. identifying the sources of the risk where consist the left wing and the risk consequences where locate in the right wing. For example, the practice – sub-theme of the Event Identification theme – of disposing the needles improperly could be an external source of the needlestick injury risk. Another input which is the "healthcare and housekeeping staff lack of concentration" is falling under both internal sources of the risk and risk factor of the needlestick injury. As a risk indicator, the input from Interviewee 1 which is the "baseline serological tests for the affected staff and source" could be considered as an indicator to the needlestick injury. Four points mentioned and they fall under the risk consequences which are: affected staff acquired infection as a result of this event and subjected to treatment, affected staff was withheld from performing duties in clinical areas unless completion of treatment duration and documentation of cure, significant resources were used to identify follow and treat the affected staff, and financial burden on the hospital. So, it could be noted that the input from interviewees for the first theme extracted is fitting the first step of the risk management process of the butterfly risk tool adapted. By checking the answers from the interviewees of Hospital A, some of these answers fit the second step of the risk management which is the Risk Assessment. "Non adherence to the guidelines" and "filling incidence reports" are two likelihood factors of the causes causing the risk of needlestick injury, and the significant burden on hospital budget and issuing warning letter to the staff are the impact of the consequences could occur to the injured staff. Educating the staff or education and awareness sessions are the last points that fit the last two steps of the risk management model adapted in this study. For the Risk Response Plan, educating the staff is an important action can be followed in order to reducing likelihood and avoiding risks as well as mitigating impact and transferring/diversifying risks, and for the Risk Control Activities stage of managing risk, also education and awareness sessions are of great benefit to Preventive and monitoring control activities that could be applied to control the risks and for Mitigation and corrective controls. Table (4) below demonstrates the inputs from the interviewees.
<u>NSI</u> <u>risk</u>		Left Risk S	Right Wing Risk Consequences		
	External sources	Internal sources	Risk factors	Risk indicators	Consequences
Event Identification	disposing the needle improperly	The housekeeping staff	Staff lack of concentration	Baseline serological tests for the affected staff and source (patient)	 Affected staff acquired infection as a result of this event and subjected to treatment Affected staff was withheld from performing duties in clinical areas unless completion of treatment duration and documentation of cure Significant resources were used to identify follow and treat the affected staff Financial burden on the hospital
ant		Like	Impact		
isk Assessme	 Non-adher Filling the 	rence to the guide	 Significant Burden on Hospital Budget Issuing warning letter to the staff 		
R.	Red	lucing Likelihoo	d and Avoiding	Rick	Mitigating impact and
onse		lucing Likelinoo	u anu Avoluing	NI5K	transferring/diversifying risk
Risk Resp	Immediate edu awareness of t occurred, wha measures shou	ucational activity he housekeeping t were the consecute and be taken	or the incident preventive	Starting educational activities	
vities	Preve	ntive and monit	Mitigation and corrective controls		
Risk Control Acti	Educating the	staff			Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken

Table 4: Applying the butterfly tool to case of Hospital A

5.8.2 Hospital B

When applying the data gathered from interviews of Hospital B representatives to the model of our study, it can be found that the points are matching some of the steps of the model of risk management. For example, the input of "*not adhering to policies and procedure in the hospital*" by Interviewee 1 is falling under the internal sources of the risk of needlestick injury. After that, using discipline actions with the injured person is a consequence of this injury, as per his input. A point mentioned which is "*filling the incidence forms*" is an action done can help in assessing the risk occurred, i.e. for the Risk Assessment stage. Finally, as in the case of hospital A, holding education and awareness sessions for staff is the last point that fit the last two steps of the butterfly model adapted in this study. For the Risk Response Plan, educating the staff is an important action can be followed in order to reducing likelihood and avoiding risks as well as mitigating impact and transferring/diversifying risks, and for the Risk Control Activities stage of managing risks, also education and awareness sessions are very important to preventive and monitoring control activities that could be applied to control the risks and for mitigation and corrective controls. Table (5) below demonstrates the inputs from the interviewees of Hospital B.

<u>NSI</u> <u>risk</u>		Left Risk S	Right Wing Risk Consequences		
cation	External sources	Internal sources	Risk factors	Risk indicators	Consequences
Event Identifi		Policies and Procedures			Discipline actions
ent		Likel	ihood		Impact
Risk Assessm	Filling the inc	idence forms			
onse	Red	lucing Likelihoo	d and Avoiding	Risk	Mitigating impact and transferring/diversifying risk
Risk Resp	Educational ad	ctivities and train	Educational activities		
ctivities	Preventive and monitoring control activities				Mitigation and corrective controls
Risk Control A	Educating the	staff	Educational activities		

Table 5: Applying the butterfly tool to case of Hospital B

5.8.3 Hospital C

One interviewee from Hospital C has been interviewed to give information about our case. She reported some points that can be fitted in the adapted model in this study which is the butterfly risk tool. First point which was part of the first sub-theme (Practices) of the first theme (Event Identification) is poor practice which can be identified as an internal source of the needlestick injury. For the risk assessment stage of risk management, two points can fit the Likelihood and the Impact parts. Filling the incidence form can help in the assessing process and being positive for HBV is an impact of the consequence of being affected to HBV from the injury. "Staff education; Introduce needle free devices where possible; avoid passing sharps directly to another person" are practices and educational advices for reducing likelihood and avoiding risk point of the Risk Response stage of managing the risk of needlestick injury. The same previous point could be applicable for mitigating impact and transferring/diversifying risk point in the model. Finally, some Activities for Risk Control are *"Educating the staff*" and *"Management oversight, segregation of duties, re-enforcement of policies and procedures, and training*" as per the input from the interviewee. Table (6) below demonstrates the inputs from the interviewees of Hospital C.

<u>NSI</u> <u>risk</u>		Left W Risk Sou	/ing urces	Right Wing Risk Consequences	
nt cation	External sources	Internal sources	Risk factors	Risk indicators	Consequences
Eve Identifi		Poor practice			
ent	Likelihood Filling the incidence form				Impact
Risk Assessme					Positive for HBV
ponse	Reducing Likelihood and Avoiding Risk			Mitigating impact and transferring/diversifying risk	
Risk Res	Staff education; Introduce needle free devices where possible; avoid passing sharps directly to another person			Staff education; Introduce needle free devices where possible; avoid passing sharps directly to another person	
rol S	Preventiv	e and monitor	ing control	Mitigation and corrective controls	
Risk Cont Activitie	Educating the	staff			Management oversight, segregation of duties, re-enforcement of policies and procedures, training

Table 6: Applying the butterfly tool to case of Hospital C

5.8.4 Hospital D

The input for this hospital helped the researcher in recognising the butterfly tool model well. The interviewees were answering the interview questions in a way that helped in categorising and applying them to the model easily. They reported the following which are the left wing of the butterfly of our medal, i.e. the sources of the risk. The external sources could be the environment and violent patients that cause the needlestick injury. Not adhering to the policies and procedures of the hospital could be an internal source of the needlestick injury; availability of any required equipment for safety purposes e.g. sharp safe containers is a factor to the risk, and finally number of reported injuries on a monthly period is an indicator to this risk. For the second stage of risk management, two points were reported by the interviewees that could help in assessing the risk occurred; they are "accidental disposal of sharps in the waste bins, and non-adherence to the policy /guideline in place" and "anxiety about any cause that can happen related to the injury". Educating the staff is the last point that fit the last two steps of the risk management model adapted in this study. For the Risk Response Plan, provide education to all staff is an important action can be followed in order to reducing likelihood and avoiding risks as well as mitigating impact and transferring/diversifying risks, and for the Risk Control Activities stage of risk management, education for creating awareness about safety issues is of great benefit to Preventive and monitoring control activities that could be applied to control the risks and for Mitigation and corrective controls. Table (7) below demonstrates the inputs from the interviewees of Hospital D.

<u>NSI</u> <u>risk</u>		Left Win Risk Sour	Right Wing Risk Consequences		
_	External sources	Internal sources	Risk factors	Risk indicators	Consequences
Event Identification	 Environment Violent patient 	Policies and procedures	Availability of any required equipment for safety purposes e.g. sharp safe containers	Number of reported injuries on a monthly period	
ent		Likeliho	Impact		
Risk Assessm	Accidental disposa adherence to the po	l of sharps in the olicy /guideline i	Anxiety about any cause that can happen related to the injury		
ponse	Reducin	ng Likelihood ar	lisk	Mitigating impact and transferring/diversifying risk	
Risk Res	Provide education	to all staff	Follow up and education for creating awareness about safety issues		
Risk Control Activities	Preventiv	e and monitorir	vities	Mitigation and corrective controls	
	Educating the staff		Follow up and education for creating awareness about safety issues		

Table 7: Applying the butterfly tool to case of Hospital D

5.8.5 Hospital E

For this hospital, the interview was very rich in the information that was provided by the interviewees. So, sorting the answers according to the butterfly risk tool will be easy since they are clear. For example, the cultural – sub-theme of the Event Identification theme – which is violent patient, could be considered as an external source of the needlestick injury risk. "Loosing of control, out of mind, long duty hours, and lack of sleep" could be considered as internal sources of the needlestick injury. Some risk factors are "non-complaint patient" and "staff lack of concentration" as per Interviewee 1 of this hospital. As a risk indicator, the input from Interviewee 1 which is the "past incidents" could be considered as an indicator to the needlestick injury. One point has been mentioned and it falls under the risk consequences is that this injury could change the life of the injured staff. One point was mentioned before as a factor of the Cultural sub-theme of the Risk Assessment theme which is "staff was withheld from performing duty. Suffered treatment related adverse effects", this point can be considered as the impact of the consequence happened to the injured. The point of "educational activities to teach the staff in case of exposure" can fall in the Risk Response stage to reducing likelihood and avoiding risk, and "counselling in personal basis" could be used for mitigating impact and transferring/diversifying risk. For the last stage of managing risks using the model of butterfly, activities that could be done in order in ensure Preventing and monitoring control could be "educating the staff" and "engineering of the sharp container". Lastly, in order to mitigation and correct controls, the following could be done as per the input from Interviewee 1 "pre-employment" and "awareness sessions for new and existing staff by Infection Control or Quality meetings". Table (8) below demonstrates the inputs from the interviewees of Hospital E.

<u>NSI risk</u>		Left V Risk So	Right Wing Risk Consequences		
ion	External sources	Internal sources	Risk factors	Risk indicators	Consequences
Event Identificati	Violent patient	Loosing of control, out of mind, long duty hours, lack of sleep	 non- complai nt patient staff lack of concentr ation 	Past incidents	This injury could change the life
ent		Likelil	hood		Impact
Risk Assessme	It's very rare, c	elumsy	Social/Emotional/Psychologic al consequences: Staff was withheld from performing duty. Suffered treatment related adverse effects		
esponse	Redu	cing Likelihood	Mitigating impact and transferring/diversifying risk		
Risk R	Usually educat exposure	ional activities to	Counseling in personal basis		
ol	Preven	tive and monito	Mitigation and corrective controls		
Contr vities	1. Educating	the staff			1. Pre-employment
Risk (Acti	2. Engineerir	ng of the sharp co	2. Awareness sessions for new and existing staff by Infection Control or Quality meetings		

Table 8: Applying the butterfly tool to case of Hospital E

5.9 Summary of the Findings

After analysing the five cases of hospitals, the key findings have been highlighted to the risk of needlestick injury in particular and to risks in general. Four key themes have been identified from the interviews transcripts and they are Event Identification, Risk Assessment, Risk Response, and Risk Control Activities. Some sub-themes were associated with each one of the four themes, e.g. for the Event Identification theme, five different sub-themes were recognized in the analysis, they are: Practices, Duty hours, Cultural, Financial and Engineering sub-themes. The second theme, Risk Assessment, has three sub-themes recognized that are Practices, Cultural, and Financial sub-themes. Thirdly, the Risk Response theme which consists of two sub-themes; they are the Cultural and Educational sub-themes. Finally, the Risk Control Activities theme which consists of three sub-themes, they are Education, Cultural and Engineering sub-themes. Some similarities were found between the cases studied and they are "having three or two committees of Infection Control, Safety or Risk Management, and Quality department or committee", "filling incidents reports" and "*Educating the staff*". After that, findings in terms of applying the butterfly risk model were specified for each one of the hospitals. The researcher attempts to answer the research questions as follows:

Q1: What are the major risks related to the use of needlesticks in hospitals?

A1: From the literature, interviews and findings, the researcher found that being infected to HBV, HCV, or HIV is the major risk can occur to the injured. Of course, other consequences could be happened as well because of this injury like, being withheld from performing duties in clinical areas, changing the life of the injured person, some financial risks like financial burden on the hospital and significant resources will be used to indentify follow and treat the affected staff which will cost the hospital. Anxiety about any cause that can happen related to the injury is another risk can be associated with the infection of this risk.

Q2: How effective are the current practices and tools in dealing with NSI's?

- A2: The current practices used in dealing with NSI according to the international standards of CDC Centres for Disease and Control Prevention and WHO- World Health Organization and according to the findings from the different hospitals are:
 - Clean the wound with water and liquid soap
 - Seek medical advice

- Do blood tests to check HIV, HBV, and HCV status of the worker affected and the person whose blood has been transferred from
- Follow up testing and medical supervision of recovery
- Report the incident

These practices were found not that effective hence some of the practices were away in one of the hospitals studied because one step not mentioned above which is squeezing the wound, is an old practise done old days.

Q3: What are the best practices and tools used to manage such risk?

A3: From the literature, so many tools were studied to manage risks like FMEA, FMECA, FTA, HACCP, HAZOP, PHA, and others, they are effective but with certain kind of risks. For the risk of needleestick injury, a model was adapted from Lavoie (2011), which is the *Butterfly Risk Tool* which proved that it is the best practice to manage this risk as it allows using certain steps for managing the risks, first it starts with identifying the even by finding out the sources of the risk, and its consequences, secondly it assesses the risk, after that, it sets a Risk Response Plan for it in order to know how to respond to it and finally it specify the activities could be used to Control the risk.

Chapter 6 – Conclusions and Recommendations

6.1 Conclusion

This study aimed to formulate a conceptual framework for the needlestick injury when occurring in hospitals and healthcare providers. For that, some objectives were set in order to reach this goal. First of all, risk management in general was studied and then risk management in healthcare in terms of classification of the different risks as well as investigating the effectiveness of current philosophies, practices and tools used in healthcare sector to manage risks. A conceptual framework was used in this study which is adapted from Lavoie (2011) is the Butterfly Risk Tool. Five Hospitals located in U.A.E. were visited and a total of five cases were studied and analysed. A conceptual framework – model- (Table 9) below was adapted from the literature, which is done by Lavoie (2011), the researcher used it as it is the source of the interview questions where the data was gathered, analysed and reported on. This conceptual framework can be used for any type of risks to analyse and manage.

	<u>Risk</u>	Left Wing Risk Sources				Right Wing Risk Consequences	
1.	Event Identification	External sources	Internal sources	Risk factors	Risk indicators	Consequences	
2.	Risk Assessment	Likelihood				Impact	
3.	Risk Response	Reducing Likelihood and Avoiding Risk				Mitigating impact and transferring/diversifying risk	
4.	Risk Control	Preventive and monitoring control				Mitigation and	
	Activities		acti		corrective controls		
	Table 9. Butterfly Risk Tool for Risk Management						

itterfly Risk Tool for Risk Manager

The idea behind this model is identifying all sources and consequences of the risk in order to identify the event which is the risk of needlestick injury in this case, and then assessing the risk by identifying the occurrence likelihood of the sources and the impact of the consequences of this risk on the injured, after that looking for a risk response plan so as to reduces the likelihood and to avoid the risk of the sources and to mitigate the impact and transfer/diverse the risk, and finally applying the risk controlling activities, which consists of the preventive and monitoring control activities and mitigation and corrective controls of the risk consequences.

When applying the risk of needlestick injury case to this tool, the most important key found is educating the staff about all kinds of risks could occur in the hospital environment and especially for this case of needlestick injury as it is an infectious risk. It is essential in order to prepare risk response plans which will help in reducing likelihood occurrence of the risk sources and avoiding risk and will help in mitigating the impact of the consequences and in transferring/diversifying risk. The education programmes, awareness sessions, and training courses will act as activities can be applied in hospitals to control the risks might occur. These programmes and sessions will be activities for preventing and monitoring the control of risks sources and will work as controls for mitigating and correcting the risks consequences. Further point has been emphasised when this risk was applied to the butterfly risk tool was filling incidence reports when an injury occurred. The importance of this point is for reporting the risk immediately after occurring and not to hide this information as it will not affect the injured person only, but could affect other involved people working in the same area.

6.2 Recommendations

Risk managers as well as the infection control personnel in hospitals should use the recommendations below to address the research issue that has been raised in this research. They are as follows:

- Any risks in hospitals have to be identified first before any action taken, identification here in terms of identifying the sources of the risk like the external sources, internal sources, risk factors and risks indicators. This is very important to be done in order to identify the consequences of the risk occurred.
- 2. Risk assessment to be done for the risk occurred, it can be done by identifying the probability and likelihood of each of the sources identified before, and by identifying the impact of the consequences of this risk on the injured person, as well as all other parties involved.
- 3. Risk response plan should be set in order to recognize how this risk could be minimized by reducing the likelihood of the sources caused the risk and to avoid the risk in the future, as well as to mitigate the impact of the consequence(s) and transferring and / or diversifying risks.
- 4. At the end of the risk management process and the most important part for this study is the identification of risk control activities, which could be done through preventive and monitoring control activities, and mitigation and corrective controls.

- 5. An important recommendation is to get all the vaccinations when joining the hospital for working, and particularly for HBV.
- 6. Increase the awareness and education channels of safety and risk management in hospitals.
- 7. Increase the budget of safety and risk management in healthcare in order to follow the most recent technologies in practising safety.

6.3 Limitations of the study

- a. Generality; the sample size in this qualitative study is small, only five cases, and the results only discussed and showed negative cases of NSI and none positive ones.
- b. Generality; the research was based only in the U.A.E. and might not be applied in other countries.
- c. Information constraints; because of the ethical issues and confidentiality, the researcher was not able to get access to the hospitals policies

6.4 Recommendations for further studies

- a. Apply the *Butterfly Risk Tool* to other risks in order to study its effectiveness for other risks, whether infectious or non-infectious risks.
- b. Study the *Butterfly Risk Tool* for other industries rather than healthcare field, and examine its effectiveness by applying it in practise.
- c. Increase the sample of the study, for this research the sample was five cases only, the more cases the better results.
- d. Use quantitative research based on a survey in order to study the nurses' perspectives about the updated preventive methods for needlestick injuries in hospitals.
- e. Use cross sectional researches with joint research methodologies in order to study the case in more depth and with more data from more concerned in the field of healthcare.
- f. Engage the organisational leadership input by doing a research for this case in order to enhance the importance of safety and risk management in hospitals.

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Appendices

Appendix A

Taxonomy of hazards in pharmacy practice

Type of risk	Hazard	Examples
Clinical	Dispensing error	Failing to ensure appropriateness of prescribed medication
		Failing to detect or manage adverse events Failing to monitor the effectiveness of medication
	Distribution error	Incorrect strength/dosage
		Controlled drug mishandling
	Incorrect advice given	Misidentifying a condition Failing to refer a patient to GP
	Prescribing error	Inappropriately prescribing medication
Conduct	Misconduct related to work activities	Violation of professional standards Behaviour towards other people Dishonesty/fraud
	Disreputable conduct outside of work	Criminal conviction/caution due to non work-related activities
Health	Substance abuse	Drug or alcohol abuse
	III health	Mental illness

Table 10: Taxonomy of hazards in pharmacy practice (adapted from Phipps D.L. et al., 2011)

Appendix B

Summary of investigation process

Summary of investigation process

All investigations consist of a series of steps that should be followed, as a matter of routine, when an incident is investigated:

1. Ascertain that a serious clinical incident has occurred and ensure it is reported formally. Alternatively identify an incident as being fruitful in terms of organisational learning

2. Trigger the investigation procedure. Notify senior members of staff who have been trained to carry out investigations

3. Establish the circumstances as they initially appear and complete an initial summary, decide which part of the process of care requires investigation, prepare an outline chronology of events, and identify any obvious care management problems

4. Structured interview of staff:

Establish chronology of events

Revisit sequence of events and ask questions about each care management problem identified at the initial stage

Use framework to ask supplementary questions about reasons for each care management problem

5. If new care management problems have emerged during interviews add them to initial list. Interview again if necessary

6. Collate interviews and assemble composite analysis under each care management problem identified. Identify both specific and, where appropriate, general contributory factors

7. Compile report of events, listing causes of care management problems and recommendations to prevent recurrence

8. Submit report to senior clinicians and management according to local arrangements

9. Implement actions arising from report and monitor progress

Figure 7: Summary of investigation process, (Vincent et al., 2000)

Appendix C

Studies of Needlestick Injuries in Healthcare Workers (adapted from Astrazeneca, 2003)

Reference and Country	Setting	Study	Results	
Memish et al, 2002 Saudi Arabia	600 bed tertiary hospital with 2,800 employees	Prospective study using EPINet from 1997-2000	364 reported injuries over 4 years, with average 33/1,000 Commonest were accidents to nurses, phlebotomists, respiratory therapists and paramedics One HCV seroconversion	
Newsom & Kiwanuka, 2002 Uganda	280 healthcare workers in Ugandan teaching hospital in one month	Voluntary anonymous questionnaire asking about recall on nee	Response rate 64% 55% had needlestick injury Average of two injuries per worker per year Calculated cumulative rates of HBV and HIV seroconversion	
Shiao et al, 2002 Taiwan	16 randomly selected hospitals, with 10,500 workers	Questionnaire about needlestick injuries in previous 12 months	Response rate 83% 87% had needlestick injury Hollow bore needle in 64% Calculated seroconversion rates for various classes of workers in Taiwanese health service	
Abu-Gad & Al-Turki, 2001 Saudi Arabia	11 of 38 hospitals of eastern province with a reporting system	Retrospective record analysis	282 injuries Most occurred in nurses, and most related to use of syringes, and most occurred in those with fewer than five years experience	
Karstaedt & Pantanowitz, 2001 South Africa	102 interns in Johannesburg and Soweto	Anonymous questionnaire recalling all percutaneous injuries	At least one percutaneous injury in 83% of interns, 43% from HIV positive source. Rate was 0.45 per person during intern year and 0.24 during three student years. Most injuries (69%) involved a hollow bore needle	
Puro et al, 2001 Italy	18 acute care hospitals over five years, 16,000 beds and 35,000 employees	Prospective study of occupational risk of infection	11,000 percutaneous exposures, 65% caused by hollow bore needles Five year rates varied by location and job, from 1% to 14%	
Alzahrani et al, 2000 UK	10 hospitals in Manchester between 1992 and 1999	Retrospective examination of all needlestick incidents	2,646 incidents over 7 years HBV in 0.8% source patients	
Moens et al, 2000 Belgium	Prevalence of HCV in Belgian hospital workers	5,064 workers gave samples during annual occupational medical examination, of15,600 employed	33% of workers received at least one needlestick injury	
Varma & Mehta, 2000 India	100 third year medical students in 1996 and 1997	Questionnaire survey	106 responses from 200 (53%) Most injuries when drawing blood Rate was 1.5 injuries per student per month	
Cassina et al, 1999 Switzerland	Percutaneous injuries in an operating room	1000 consecutive procedures over four months	73 injuries per 1000 procedures calculated lifetime HIV transmission was 1 in 333	
Goob et al, 1999 USA	US Army medical centre	Hazard analysis of bloodborne disease transmission	Annual incidence of exposure was 94/1,000 healthcare workers, with 84% from sharps. House officers most at risk.	
Ippolito et al, 1999 Italy	41 hospitals, 63,000 employees in modified EPINet programme	Recording occupational exposure over 5 years to 1998	19,860 exposures, 75% percutaneous. Highest rates in surgeons and nurses 10,122 hollow bore needlestick injuries 1 in 100 seroconversion for HCV and 1 in	

			500 for HIV
Lee et al, 1999	3,239 participants of	Recording	Response rate 90%
USA	examination for	occupational	56% had one or more injuries
	emergency medicine	exposure over training	Hollow-bore needles accounted for 31%
	residents		injuries
Shen et al, 1999	137 fourth year medical	Questionnaire about	Response rate 77%
UK	students trained in	sharps and needlestick	33% had one or more injuries
	universal precautions	injuries in third and	Surgery accounted for 70% of injuries
		part of fourth year	Hollow-bore needles accounted for 34%
			injuries
Wise & McCormick, 1999	75 anaesthetists in two	Postal survey	Response rate 69%
UK	anaesthetic departments		50% had at least one needlestick injury from
			hollow bore needle
Knight & Bodsworth, 1998	Registered nurses in a	Questionnaire about	Response rate 48%
Australia	Sydney teaching hospital	knowledge of	76% suffered occupational exposure in
		precautions and risk	previous 6 months
			Percutaneous exposure 65 per 100 nurse
G 11 1 1007	27 1 1 1	100/ 60 500	years Date (2007
Gumodoka et al, 1997	27 wards, labour rooms,	10% of 3,500	Response rate 93%
Tanzania	operating theatres	employees interviewed	10% had skin prick during previous week,
		about knowledge of	and overall rate was 5 per year
		HIV transmission	Five year risk of HIV transmission was 1 in
Descie & Meandlinger	Madiaal students and	A	So to 1 in //, depending on occupation
Resnic & Noerdlinger	Medical students and	Anonymous	Response rate 60%
1995	Nouse stall in 1200 bed	questionnaire to 650	32% had exposure over previous 6 months,
USA	high rates of HIV	nouse stall, with 15	with 1 in 20 involving HIV positive source
	lingh fates of HIV	questions relating to	
Smedley et al. 1005	15 occupational health	Prospective data	1 102 incidents
LIK	departments in Wessex	collection	Rates for various staff ranged from 9 to 44
UK	and Oxford regions	concetion	ner 1 000 per vear
Chia et al 1994	House officers	Self-administered	Response rate was 79%
Singapore	undergoing training at a	recall questionnaire	1.2 needlestick injuries per month per house
Singupore	major hospital	recan questionnane	officer
Stotka et al. 1991	General medical wards	Prospective survey of	In doctors there were 644 exposures with
USA	of two Virginia acute	occupational exposure	0.57 needlesticks per doctor per year
	care hospitals	over 8-9 months	In nurses there were 235 exposures, with
	I I I I I I I I I I I I I I I I I I I		0.83 needlesticks per nurse per year
McCormick et al. 1991	Medical school staff	Prospective	Annual incidence of sharps injuries
USA		epidemiological	187/1,000 workers, with highest rates in
		survey	cleaners and nurses, with two thirds of
			injuries in nurses
McGeer et al, 1990	All house staff (88) in a	Anonymous	Response rate 100%
Canada	hospital	questionnaire recalling	0.7 injuries per person per year
	· ·	all percutaneous	Hollow-bore needles accounted for 98%
		injuries	injuries

Table 11: Studies of NSI's in Healthcare Workers (adapted from Astrazeneca, 2003)

Appendix D

The Official Letter sent to candidates



7 January 2012

To whom it may concern

This is to certify that Ms. Soha Mustafa (Student ID: 90033) is a registered student on the Master of Science – Project Management programme in The British University in Dubai since September 2009.

As part of her programme requirements, she is to collect data through various methods. We request you to assist her so she can conduct her data collection visit and interviews as appropriate.

This letter is issued on Ms. Mustafa's request.

Yours sincerely,

Nandini Uchil Head of Student Administration

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Appendix E

The Official Email sent to candidates for additional information

- The attached document was last part of the interview (Negative and Positive Cases Questions)

Dear All,

I would like to thank you so much first for your help in the interview I conducted for my dissertation, it was of great help and I really appreciate it.

Could you please help me one more time and answer the questions in the attached document, it won't take more than 5 minutes :) and it will be of great add to the dissertation.

Thanks in advance, I really appreciate your quick response to them as I need to finish my writing in two weeks :)

Kind regards,

"The Researcher"

Appendix F

Data Collected from the Interviews

<u>NSI risk</u>		Left	Right Wing		
	Risk Sources				Risk Consequences
	External sources	Internal sources	Risk factors	Risk indicators	Consequences
	1. Disposing the needles improperly	1. Healthcare and Housekeeping staff (A1)	1. Patient's history of possible risk factors predisposing him	1. Past incidents (E1)	3. Affected staff acquired infection as a result of this event and subjected to treatment (A1)
Event Identification	2. Environment (D2)	 (A1) (A1) (A1) (A1) (A1) (A1) (C1) (C1)<td>Hepatitis B C and HIV (A1)</td><td>2. Baseline serological tests for the</td><td>4. Was withheld from performing duties in clinical areas unless completion of treatment duration and documentation</td>	Hepatitis B C and HIV (A1)	2. Baseline serological tests for the	4. Was withheld from performing duties in clinical areas unless completion of treatment duration and documentation
	3. Violent patient (D2, E1)		2. Availability of any required equipment for safety purposes	and source (patient) (A1)	 5. Significant resources were used to identify follow and treat the affected staff (A1)
		4. Loosing of control, out of mind. long	containers (D2)	3. Number of reported	6. Financial burden on the hospital (A1)
	duty lack	duty hours, lack of sleep	patient (E1)	monthly period (D2)	7. Poor practice (C1)8 This injury could change the life (E1)
		(E1)	4. staff lack of concentration (E1, A1)		o. This injury could change the file (E1)

	Likelil	Impact	
ssessment	 Accidental disposal of sharps in the w policy /guideline in place (D2) It is very rare, clumsy (E1) 	 Social/Emotional/ Psychological consequences: Staff was withheld from performing duty. Suffered treatment related adverse effects (A1, E1) 	
Risk A		2. Significant Burden on Hospital Budget (A1)	
			3. Positive for HBV (C1)
			4. Anxiety about any cause that can happen related to the injury (D2)
	Reducing Likelihood	and Avoiding Risk	Mitigating impact and transferring/diversifying risk
Response	1. Immediate educational activity was organized for the awareness of the healthcare staff1. Staff education; Introduce needle free devices where possible; avoid	1. Perform Risk assessment , provide education to all staff (D2)1. Usually educational activities to teach them in case of exposure (E1)	 Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken (A1)
Risk	on how the incidentpassing sharps directly to another person (C1)		2. Staff education; Introduce needle free devices where possible; avoid passing sharps directly to another person (C1)
	consequences and what preventive		3. Follow up and education for creating awareness about safety issues (D2)

	measures should be taken (A1)				4.	Counseling in personal basis (E1)
	Prev	ventive and monitor	ing control activitie	s		Mitigation and corrective controls
ctivities	 Educating the staf Engineering of the 	ff (A1, C2, D2, and E e sharp container (E2)	1))		1.	Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken (A1)
c Control A					2.	Management oversight, segregation of duties, re-enforcement of policies and procedures, training (C1)
Risk					3.	Follow up and education for creating awareness about safety issues (D2)
					4.	Pre-employment (E1)
					5.	Education for new and existing staff, Infection Control or Quality meetings (E1)

 Table 12: Collected Data from the Interviews

2. Event Identification

1.1 Risk Sources

1.1.1 External sources

- 1.1.1.1 Disposing the needles improperly (A1)
 - Interviewee 1 from Hospital A reported that not disposing the needles properly could be an important external source for this injury.

1.1.1.2 Environment (D2)

• Interviewee 2 from Hospital D sees that the environment might be an external source of this injury. If the hospital environment is stressful or blaming one; the staff will be always stressed and tensioned and this could affect his/her job.

1.1.1.3 Violent patient (D2, E1)

• A third external source could be the patient himself/herself. When trying to take the blood sample, he/she will resist or remove the hand suddenly, which will cause an injury; this has been stated by the interviewees 2 and 1 of hospitals D and E respectively.

1.1.2 **Internal sources**

1.1.2.1 Healthcare staff (A1)

- From Hospital A, interviewee 1 sees that healthcare staff themselves are a possible internal source of this kind of injuries. As explained in all other internal sources, the staff is the key factor of the sources; he/she is the one who will cause the source.
- 1.1.2.2 Poor practice (C1)
 - One of the internal sources of this injury is poor practice in using needles, as per Interviewee 1 of Hospital C.

1.1.2.3 Policies and procedures (D2, B1)

• Interviewees 2 and 1 of Hospital D and B respectively believe that policies and procedures followed in the hospital could be one of the sources of this injury. Whether they exist but not used or not exist, i.e. not adhering to these policies.

1.1.2.4 Loosing of control, out of mind, long duty hours, lack of sleep (E1)

• Interviewee 1 of Hospital E combined 4 possible internal sources of this injury in one point; loosing of control. When loosing the control, any possible risk might occur, especially when working with sharp instruments or needles. The rest of the mentioned sources in this point will lead to loosing the control of the staff.

1.1.3 Risk factors

- 1.1.3.1 Patient's history of possible risk factors predisposing him/her Hepatitis B C and/or HIV (A1)
 - Interviewee 1 of Hospital A sees that the patient's history could be an important risk factor for being infected by HBV, HCV, or HIV.
- 1.1.3.2 Availability of any required equipment for safety purposes e.g. sharp safe containers (D2)
 - A risk factor of needlestick injury according to Interviewee 2 of Hospital D could be the availability of some equipment or instruments for safety reasons, like the sharp safe containers, they are a major reason of this kind or risks if not used properly.

1.1.3.3 Non-complaint patient (E1)

- The non-compliant patients are risky factor for NSI. If they are not helping and trying to resist not in purpose but as a habit, they can cause the injury for the staff, as per Interviewee 1 of Hospital E.
- 1.1.3.4 Staff lack of concentration (E1, A1)
 - According to Interviewees 1 of Hospital E and A; lack of concentration and loosing focusing is a risk factor for such injury.

1.1.4 **Risk indicators**

1.1.4.1 Past incidents (E1)

- One indicator of this risk is past incidents. According to Interviewee 1 of Hospital E, past incidents could help in predicting such kind of risks, which will help in taking the preparations to avoid or to know how to deal with it in case it is occured.
- 1.1.4.2 Baseline serological tests for the affected staff and source (patient) (A1)
 - According to Interviewee 1 of Hospital A, these serological tests can tell a lot about the case, whether it is positive or negative, it can help in following up the case, or taking primary actions towards it.

1.1.4.3 Number of reported injuries on a monthly period (D2)

• This is a very important indicator of this risk. It tells if it is serious and occurring a lot in a hospital or health care provider, and it tells what to do in order to avoid it or to investigate the sources.

1.2 Consequences

- 1.2.1 Affected staff acquired infection as a result of this event and subjected to treatment (A1)
 - As an outcome of this infection as per Interviewee 1 of Hospital A, infected staff could be warned for this injury as this is a result of being careless and not concentrated on work.
- 1.2.2 Was withheld from performing duties in clinical areas unless completion of treatment duration and documentation of cure (A1)
 - As a consequence of this injury, the infected staff could be withheld and stopped from working in clinical areas which will affect his/her career experience, mentioned by Interviewee 1 of Hospital A.
- 1.2.3 Significant resources were used to identify follow and treat the affected staff (A1)
 - A result of this type of injuries is using some resources to treat the infected staff while these resources could be used for other injuries, as per Interviewee 1 of Hospital A.
- 1.2.4 Financial burden on the hospital (A1)
 - She added that, this consequence is very important as this injury could cause extra financial expenses to the hospital.

- 1.2.5 This injury could change the life of the injured person (E1)
 - In case the injury was positive to one of the mentioned viruses, it could change the life of the injured person, as all his/her life activities, work, and even personal life will be affected, showed by Interviewee 1 of Hospital E.

3. Risk Assessment

1.1 Likelihood

- 1.1.1 Accidental disposal of sharps in the waste bins, and non-adherence to the policy /guideline in place (D2)
 - Disposing the sharp instruments and needles suddenly in the waste bins and not following the policy or guidelines of the hospital will affect the likelihood of this injury to be occurred and increase it as per Interviewee 2 of Hospital D.
- 1.1.2 It is very rare, clumsy (E1)
 - According on Interviewee 1 of Hospital E, the likelihood of this injury is very uncommon and rare.

1.2 Impact

- 1.2.1 Social/Emotional/Psychological consequences: Staff was withheld from performing duty. Suffered treatment related adverse effects (A1, E1)
 - As per Interviewees 1 of Hospitals A and E, there will be social, emotional and psychological impacts of this injury. It will affect their lives, and will not be normal as before. They need to consider too many things so on.
- 1.2.2 Significant Burdon on Hospital Budget (A1)
 - One of the impacts of this injury will be on the hospital budget as it will affect it financially for tests, treatments, and could affect the reputation of this hospital as will, Interviewee 1 of Hospital A has declared this.
- 1.2.3 Positive for HBV (C1)
 - Another impact of this injury could be the infection to HB virus which will affect the life of that staff.

- 1.2.4 Anxiety about any cause that can occur related to the injury (D2)
 - He/she will be nerves and tensioned about this injury and anything linked to it, according to Interviewee 2 of Hospital D.

4. Risk Response

1.1 Reducing Likelihood and Avoiding Risk

1.1.1 External sources

- 1.1.1.1 Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken (A1)
 - Interviewee 1 of Hospital A is suggesting holding educational activities and training sessions to give knowledge to the concerned.

1.1.2 Internal sources

- 1.1.2.1 Offer training programmes for staff on the new tools and techniques (Researcher)
 - The researcher is proposing this point in order to decrease the internal sources of this risk.
- 1.1.2.2 Staff education; introduce needle free devices where possible; avoid passing sharps directly to another person (C1)
 - Interviewee 1 of Hospital C is suggesting educating staff by initiating the needleless devices and not to pass the needles or sharp instruments to other persons directly.

1.1.3 Risk factors

- 1.1.3.1 Perform Risk assessment, provide education to all staff (D2)
 - Interviewee 2 of Hospital D is suggesting educating staff about risk management and risk assessment in order to reduce and avoid the risk factor of needlestick injury.

1.1.4 Risk indicators

- 1.1.4.1 Usually educational activities to teach them in case of exposure (E1)
 - Interviewee 1 of Hospital E is suggesting educational activities for staff to avoid the risk indicators of this risk.

1.2 Mitigating impact and transferring/diversifying risk

- 1.2.1 Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken (A1)
 - This point has been repeated by Interviewee 1 of Hospital A for mitigating the impact and transferring the risk as she is keen to educate people about the importance of this matter and the importance of its consequences.
- 1.2.2 Staff education; introduce needle free devices where possible; avoid passing sharps directly to another person (C1)
 - This point has been repeated as well by Interviewee 1 of Hospital C, also because she thinks it is very important point to mitigate the impact and transfer the risk of needlestick injury all staff in the hospital has to take it.
- 1.2.3 Follow up and education for creating awareness about safety issues (D2)
 - According to Interviewee 2 of Hospital D, the impact of this risk can be mitigated by following up and educating the staff about safety.
- 1.2.4 Counseling in personal basis (E1)
 - When the risk occurs, the injured person will be very emotional touched as his/her life will be changed, especially if the case was positive, so one point for mitigating the impact of this injury is to counsel some expert person in this matter, as per Interviewee 1 of Hospital E.

5. Risk Control Activities

4.1 Preventive and monitoring control activities

- 4.1.1 Educating the staff (A1, C2, D2, and E1)
 - Four interviewees of different hospitals see that education activities for staff will help in controlling the risks by preventing and monitoring this control activity.
- 4.1.2 Engineering of the sharp container (E2)
• Interviewee 2 of Hospital E mentioned the point of the engineering of the sharp container is a main point for preventing and controlling the risk of needlestick injury. When changing the box engineering, the function of it will be much efficient.

4.2 Mitigation and corrective controls

- 4.2.1 Immediate educational activity was organized for the awareness of the healthcare staff on how the incident occurred, what were the consequences and what preventive measures should be taken (A1)
 - As mentioned before, this point has been repeated for the third time now for its importance from by Interviewee 1 of Hospital A. Educating staff about the risk and injury occurred will help in mitigating and correcting the controls of this risk.
- 4.2.2 Management oversight, segregation of duties, re-enforcement of policies and procedures, and training (C1)
 - These four points have been suggested by Interviewee 1 of Hospital C to correct the controls in order to control the risk.
- 4.2.3 Follow up and education for creating awareness about safety issues (D2)
 - Following up is an action suggested by Interviewee 2 of Hospital D to control the risk as well as assessing it.
- 4.2.4 Pre-employment (E1)
 - An interesting point by Interviewee 1 of Hospital E is to look after the steps and procedures done by the employer to hire the staff. When looking and investigating the candidate's history, the employer will control his/her actions for future.
- 4.2.5 Education for new and existing staff, Infection Control or quality meetings (E1)
 - Interviewee 1 of Hospital E sees in holding educational sessions about such risks for staff and/or infection control or quality meetings for them will help in controlling this kind of risks and might mitigate it.