

Developing a Safe Culture through Implementation of Hazard Identification and Risk Assessment (HIRA) at a Tertiary Diabetes Centre

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Abstract

Hospital is a place where safety is of prime importance. Healthcare workers, patients and the public are vulnerable to injuries and illness due to unforeseen hazards at workplace^[1]. A study was conducted to develop a safe environment by implementing hazard identification, analysing and assessing the risk at a tertiary diabetes centre in Chennai. Hazard identification and Risk Assessment (HIRA) was done at departments of the hospital including the medical, paramedical and support services. In this paper, the proactive measure of risk identification and implementation of control measures was introduced through a step-by-step process. Hazards identified were classified and analyzed for the severity of impact. The process implementation was done for severe impact first, followed by moderate and then minimal impact risk. This was followed by the review of the implementation and its effectiveness. In this process, new risks, if any, were also identified. This implementation has been carried out for 3 years since 2017, and the cycle is being followed till date. Major impact hazards were addressed immediately through suitable risk management techniques, such as reducing the impact of risk, removing the risk, adopting preventive measures, substituting other means of mitigating the risks, etc. The teams were equipped through regular training on HIRA and guided to review risk and preventive measures regularly. This standardisation has imbibed a culture of safety within the organisation. From this exercise, HIRA matrix is prepared and the factors influencing hazards are controlled from time to time thereby reducing incidents and saving costs on damage.

Key Words: Hazard Identification, Risk Assessment, HIRA, Safety, Diabetes hospital

1. INTRODUCTION

Dr. Mohan's Diabetes Specialities Centre, (DMDSC), a world class Diabetes Care Centre was established in Royapettah, Chennai, India in September 1991, with an objective of providing comprehensive diabetes care and guidance to patients, to help them lead a full and healthy life despite diabetes. Currently DMDSC has its headquarters at Gopalapuram in Chennai and provides complete diabetes care under one roof.

About 640,000 patients have been registered since 1991, and spread across 32 cities and eight states of India with 50 branches. DMDSC is the largest chain of diabetes centres. The main aim of the centre is to ensure that patients have access to diabetes treatment as close to their residence as possible (www.drmoahans.com). The centre also focuses on increasing the awareness of the general public with respect to diabetes and its complications, diabetes management and updates on the newest in the field of diabetes. With the number of branches increasing, we find a surge in the number of people having better access to diabetes management.

1.1 Hazard identification and Risk Assessment (HIRA) technique

A hazard is any potential damage, harm or adverse health effect on a person (staff, patient or visitor) or hospital assets^[2]. "Hazard" is the cause or circumstances that have the potential to cause injury or illness to humans, property damage, and pollution to the environment or a combination of all^[3] and "risk" is the likelihood that the hazard will cause harm. Safety measures have to be implemented based on the identification of hazards and assessing the risks in order to provide a safe environment in the hospital. It is also the

responsibility of the employer to ensure the safety of staff and for the staff to safeguard the employer's property. The WHO has emphasised the necessity of implementing risk management programs in hospitals.

HIRA is a process of systematic and crucial review of hazards involving staff, services, equipment and environment aiming to identify the prevailing measures to safe guard from dangers and suggest additional control measures [4] through elimination, substitution engineering and administrative controls and PPE[5]. Usually hazard identification, estimation of exposure, and acceptability of risk [6] can be identified by risk assessment. Preparing a record and continuously monitoring the risk, identifying changes and making certain that the controls are effective are ways in which HIRA is carried out [5].

Innovations and new implementations at DMDSC, constitute one of the important path to its success. Many new approaches and strategies are being implemented continuously. One such process implementation is Hazard Identification and Risk Assessment. As per NABH 5th edition standard, Patient Safety and Quality Improvement PSQ.1.g; Responsibility of Management ROM 5a, ROM 5b, ROM 5c; Facility Management and Safety FMS 1 a-e mandates the identification and control of risks. At DMDSC, HIRA is not focussed as enforcement, but is instead covered by all departments as an essential requirement. In this review, the step by step process of HIRA analysis followed till date is covered. The step by step process enables individual employee understand about HIRA and its implementation, so that, it becomes an integral part of their routine just not a guideline.

2. METHODOLOGY

The step by step process of implementation of HIRA is outlined below:

Step 1 Need for HIRA & training on the concept

Patients coming to the hospital for treatment, trust the safe environment and believe that their health would improve by following the instructions given by the doctors. Hence it is essential to provide a safe place to the people walking into the hospital. It is impossible to eliminate all hazards, so the goal is to eliminate and/or control the hazards with critical and high potential risk [7]. Creating awareness among the staff on safety concepts is essential for them to participate in this safety culture program. This was done through facilitator (head of the department) training who in turn facilitated their staff training on the HIRA concept.

Figure 1: Flowchart - Implementation of HIRA



Step 2 Risk Identification

The hazards and the risks pertaining to the activities were identified by the service providers of medical, paramedical and support services. This was done by discussion with staff about hazards in their work place and inspection of facility from the safety perspective [1]. Many hazards were identified using common knowledge, such as slippery floor, criss-cross electrical wires, etc. All these inputs were collated by the heads of department and the risk list was finalised. For instance, fire hazards, slips or falls of patients, hazardous or toxic materials, unsafe work practises, non-availability of spill kit, working posture (ergonomic), physical working condition, high temperature, poor lighting levels, electrical shock [8].

Step 3 Risk assessment- Analysis of the impact (severity) of risk

Risk assessment is the analysis of the impact of the potential risk. Impact is the extent to which surrounding is affected. The impact of the risk 'if occurred' was evaluated by the team and was classified as severe, moderate and minimal risk. Trained facilitators (usually the process owners) along with their team were involved in the classification of each risk. This was held through brainstorming by multiple departments through each facilitator for their processes involving all categories of staff and their experience [9].

Step 4 Risk control and preventive measures

After the identification of the severity of risk, the high risk points (risks with severe impact) were segregated and action points for control measures or prevention of risk were developed. The appropriateness and feasibility for implementation were checked and the respective team were entrusted with the execution.

Step 5 Implementation of Risk Control measures

The control measures planned were discussed with the team for implementation. Flow charts were developed wherever necessary. Actions were taken based on the hierarchy of controls such as elimination, substitution, engineering control, administrative control and personal protective equipment [4]. During the implementation, changes in processes, process controls, etc. were discussed with the ground staff. The elimination or reduction of risk was also evaluated. In some cases, where risk could not be reduced, the preparedness to handle risk was checked.

Step 6 Monitoring occurrence and review of control

After implementation of the said action plan, the Head of the Department ensured that the actions were followed and the risks were prevented, or occurrence of risk was brought down. Incidents of occurrence were to be reported promptly [4] to the safety committee to validate the strength of the control measures and for this a new incident reporting system was introduced. This is now being monitored from time to time by the senior level staff.

Step 7 Standardisation of risk policy and procedure; and review of risk for control measures

The concerned process owners and the service providers were consulted for standardisation during the review of the respective SOP. This way the control measures such as the administrative controls and engineering controls which were implemented were standardised.

3. RESULTS

The step-by-step process of implementation is explained in the flowchart figure no.1. This includes Need for HIRA and Training, Risk Identification, Severity Analysis (Analysis of the impact of the risk), Mitigation / Control Measures, Implementation of Risk Mitigation Measures, Monitoring Occurrence and Review of Control and Standardisation of Risk Policy and Procedure. The various departments involved in identifying HIRA were classified under medical, paramedical and support services as mentioned in Table 1.

Table 1: Departments Involved in identifying HIRA

Medical services	Diabetology unit, Diabetes Eye care Unit, Diabetes Foot clinic, Diabetes Cardiac unit, Diabetes Dental Unit, Diabetes Kidney unit, Psychological counselling, Obesity Management
Paramedical	Lifestyle Management (Fitness/Physio), Surgical unit & Operation theatre (OT), Nursing, Investigations unit, Wound dressing unit, State-of-the-art Clinical Laboratory, Radiology unit, Nutrition & Dietetics unit, Clinical secretary section, Pharmacy

Support	Front office, Home care, Call centre, Security, Maintenance, Catering, Medical records department, Housekeeping, Transport Supply chain management, kids zone, despatch section
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A total of 211 risks were identified. Some of the risks identified by the service providers are given in Table 2. While analysing, it was found that certain risks were repetitive in different locations. These risks were retained in the list (without being deleted as duplication) since the identified actions for each risk had to be implemented in the particular location by the service provider.

Table 3 describes the HIRA matrix identifying the impact of risk as minimal, moderate, severe. On analysis, it was found that 66% of the risks identified will have severe impact, 26% will have moderate impact and 8% minimal impact which is similar to previous studies[5]. From the matrix it was also found that the risk related to medical and paramedical services was 26% and support services risk was 64%.

Table 2: Details of the risks identified

Service type	Risk identified
Medical	Sudden emergency of patient during the procedure
Medical	Cross infection due to non-sterile instrument
Medical	Lack of expert updated knowledge for providing the best clinical care
Medical	Sudden stoppage of patient software while operating
Medical	Lapse in services to patient as critical alert result of test values were not informed
Medical	BP Apparatus non-functional
Medical	Not dispatching pending reports after final consultation
Medical	Local language was not familiar during consultation
Medical	Sterility not maintained in surgical dressing / OT
Medical	Oozing wound of patient leading to cross infection
Medical	Cross infection due to non sterile environment/ handling infectious patient
Medical	Allergic to fluorescein dye
Medical	Allergic to Mydriatic eye drops
Medical	Taking wrong test
Medical	Dispatch of wrong reports to patients

Paramedical	Radiation to staff during exposure
Paramedical	Improper use of radiation TLD badges
Paramedical	Abnormal Haemogram for staff
Paramedical	Fall of patient from couch
Paramedical	Injury while centering the x-ray tube
Paramedical	Exposure to pregnant women
Paramedical	Spillage of body fluids
Paramedical	Needle stick injury during blood draw
Paramedical	Splash of chemicals
Paramedical	Double prick/ Adverse reaction
Paramedical	Equipment breakdown
Paramedical	Lapse in administering medication or wrong medication
Paramedical	Cross infection through patients admitted for long duration
Paramedical	Issue of expiry medicines to patient
Paramedical	Dispensing wrong medicines
Paramedical	Medicines getting spoiled due to electricity fluctuation / breakdown
Paramedical	Dropping down the bottle medicines while arranging/ retrieving
Paramedical	Patient's M.No. wrongly entered in the report software
Support	Lapse in calibration / preventive maintenance of equipment
Support	Data Leakage
Support	Data accuracy and perfection
Support	If the Gas Range is not opened and closed properly it poses risk
Support	Wear and tear of gas pipelines poses risk to human and to the equipment
Support	Burns due to Steam, due to contact with direct flame
Support	Cranky calls at the reception/ threats through phone
Support	People trying to enter at night times into hospital campus
Support	Safety/protection of staff during the Home Care Travel
Support	Sample spillage inside collection box
Support	Slippery floor leading to falls
Support	Hazardous waste mixed with non-infectious waste
Support	Cross infection through patients admitted for long duration

Support	Lack of backup and recovery
Support	Disaster Management
Support	Malware /Virus
Support	Electrical Hazard-Short circuit during power change over EB to DG & DG to EB
Support	Mechanical hazards like moving/rotating machinery that can cause injury
Support	Rain water getting into the building
Support	While climbing up the rack for retrieving, staff may fall down
Support	While using the compressed system of filing staff fingers may get jammed
Support	Pest attack on the case sheets stored
Support	Storage of Ammonia
Support	Non availability of oxygen cylinders
Support	Safety during the travel while transporting staff
Support	Attrition of experienced employees
Support	Lack of technical knowledge on product and Product updates
Support	Theft of cash in storage
Support	Theft of cash in transit
Support	Unknown entity posing as Dr.Mohan's and giving negative inputs to public in social domain

Table 3 Risk Identification – Examples of different risks added in DMDSC

Departments	Impact of Risk		
	Minimal	Moderate	Severe
Medical	4	4	17
Paramedical	3	10	38
Support	11	40	84
Overall	18	54	139

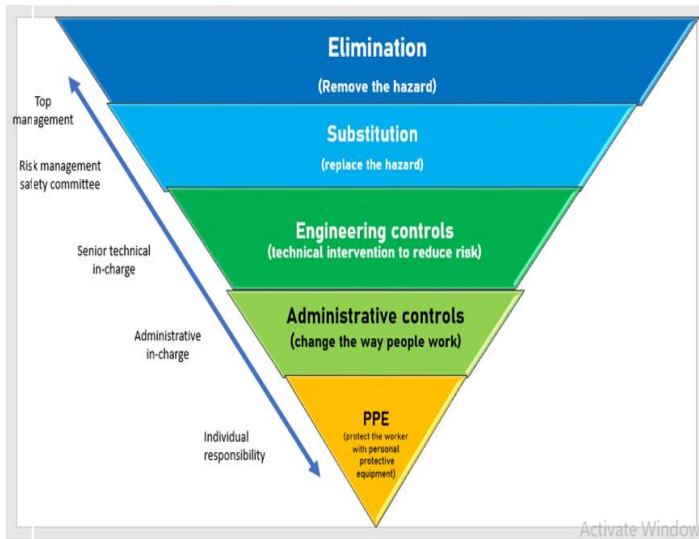
Figure 2 describes the following process

Elimination – Elimination of the risk is usually the most effective risk management method. Usually it involves a cost as it adopts upgraded technologies and innovation.

One example given in the Table 4 is explained here: Unsafe exit way while evacuating patients during emergency was a risk identified by the security department. When shifting patients to the assembly point during a fire or other emergency, the steel ramp exit way available was unsafe and

could cause a slip or fall, which was dangerous. Hence this was changed to concrete ramp way with good supportive sides and hand rails. A huge investment was involved but totally eliminated this risk and now provides a safe transit to the assembly point.

Figure 2 Risk mitigation - Hierarchy of controls Vs Responsibilities



Source: https://www.ccohs.ca/oshanswers/hsprograms/hazard/hierarchy_controls.html

Substitution- If elimination of the risk is not possible then substitution will be next control method that should be considered [3], example, a chemical used for fogging, if found to be cause eye irritation can be substituted with another chemical which does not cause irritation.

Engineering controls – the use of alarm panel for oxygen supply indicator level, sprinklers with fire alarm system, safety belts for patients to prevent patient fall etc. are examples of engineering controls. Many a time, hazardous/ infectious materials can be diluted/ separated by respective technical employees so as to make it hazard free.

Administrative control – this does not remove or replace the hazard. It minimises the hazard by preventive maintenance program, scheduling work reset program, restricting task to qualified staff, training, developing safe work procedure, emergency preparedness and use of personal protective equipment as may be required.

Some examples are given in Table 4a along with the action proposed. Some of the actions proposed include replacing hazardous chemicals with safer ones. Eliminating those that could be removed such as mercury from the hospital, providing the standard chairs by replacing the older ones for setting the right postures for staff to avoid ergonomic issues, providing adequate lighting in the work environment, installing alarm call system, educating personnel on safe practises, equipping all hospital equipment with proper

Risks Identified	Department Name	Impact analysis			Preventive or control measures proposed
		Min	Mod	Sev	
Unsafe exit way while excavating patients during emergency	Security			✓	Steel ramp exit way to be changed to concrete ramp way Good supportive sides without gaps Continuous hand rails for holding Antiskid flooring Fluorescent stickers at the bends and turns Antiskid stickers in the ramp ending.
Cross infection through patients admitted for a long duration	Nursing			✓	Thorough cleaning followed by fumigation is to be ensured before admitting next patient to the same room. Training to be held for nursing staff to notify the house-keeping on the long stay Swab culture of the room to be taken to determine the intensity of cleaning and its validation Standardisation to be done – to be added in the HICSOP, Nursing Sop and House-keeping SOP
Incidur used for fogging all areas causing eye irritation	Housekeepin g			✓	Substitute to be used for fogging to prevent eye irritation or procedure to be amended to prevent staff to be isolated during fogging Fogging to be done after peak hours and lock area to make it effective Photos of the fogging process to be taken and shared to the infection control committee members
Issue of expired medicines to patient	Pharmacy			✓	Medicine recall from patient. Patient is to be explained by higher authorities. Two months prior to expiry an alert will have to be given in the system, so that the stock can be immediately separated and sent to supplier. Training to be given to all pharmacists to double check before issuing the medicine to patient
Fire Hazard	Supply chain Management			✓	Immediate announcement of Code red alarm. ERT members to be strengthened to handle. Patients to be safely shifted. Fire control through Appropriate numbers of Fire extinguishers, Fire alarm panel, Install water sprinklers in all floors, Hose water pipes Nomination of safety officer to oversee Safety rounds at regular intervals Announcement system to all areas to alert the entire team

Table 4a Risk impact analysis – Examples from DMDSC

Min – Minimal; Mod – Moderate; Sev – Severe; ✓ indicates the category of risk

earthing systems, providing floor with electrical insulation under power panels, fire alarm systems and fire panels, installing warning signs for slippery floors, placing anti-skid floor sticker tapes, strengthening the fire-fighting team and developing firefighting skills through mock drills, training staff on PPEs, hand wash steps etc. The responsibilities for implementation (including the designation of the staff responsible) were assigned as given in Table.4b.

It was ensured that the service providers consistently followed up with the implementation team assured That these were implemented. Training was given to the relevant and appropriate staff to ensure that the changes in the system were understood by the ground level staff even before implementation. The control measures and the actions taken were recorded and discussed during the committee meeting. Some examples of delegation of this action point are given in Table 4b.

As a team, this is reviewed once in 6 months to find out if there are any occurrences, and its effectiveness in reducing the risk or if new preventive measures are needed. This is now being done as a regular practice and is reflected in the standard operating procedure of the respective service documents.

4. DISCUSSION

This study has identified various hazards under medical, paramedical and support services and also the control measures such as elimination, substitution, engineering controls, administrative controls and PPE. It has been observed that some processes carried out in the Hospital unit entail severe risk which requires continuous monitoring and periodic control measures to be implemented. The majority of risks identified were in the severe impact category and that was identified with respect to support services.

Review of risk is a continuous process. New risks may be identified, new control measures can be established and new innovation techniques and engineering controls are being encouraged in the system. However, when these are regularised, it is essential to standardise them and include them in the SOPs. This has led to improving the safety measures which is reflected in the SOP and paves a path to building a culture of safety among the employees.

Risks Identified	Preventive or control measures proposed	Responsibility	Control established
Unsafe exit way while excavating patients during emergency	Steel ramp exit way to be changed to concrete ramp way Good supportive sides without gaps Continuous hand rails for holding Antiskid flooring Fluorescent stickers at the bends and turns Antiskid stickers in the ramp ending.	Chief operating Officer, HOD-Projects, HOD_security,	Elimination of falls through sides of the steel rails, prevent slips
Cross infection through patients admitted for a long duration	Thorough cleaning followed by fumigation before admitting next patients to the same room. Training held to nursing staff to notify the house-keeping on the long stay; HOD assigns for more than 30 days stay Swab culture of the room taken to determine the intensity of cleaning and its validation Standardisation done – reflected in the HICSOP, nursing Sop and House-keeping SOP	HOD-Nursing and House keeping	Process Administrative Engineering control
Incidur used for fogging all areas causing eye irritation	Viroff 753 as a Substitute to be used for fogging to prevent eye irritation. Fogging to be done after peak hours and lock area to make it effective Photos of the fogging process to be taken and shared to the infection control committee members	HOD_House keeping, Infection control nurse and HIC committee	Substitution Administrative Process/ engineering control
Fire Hazard	Announcement system of Code red to all areas to alert the entire team ERT members to be strengthened to handle. Patients to be safely shifted. Fire control through Appropriate numbers of Fire extinguishers, Fire alarm panel, Install water sprinklers in all floors, Hose water pipes Nomination of safety officer to oversee. Safety rounds at regular intervals. Mock drill held and the sprinklers, hose lines and fire panel checked Procedure standardised by reflecting in Security and Safety SOP	HOD-Security & ERT members	Engineering control

Table 4 B Risk mitigation - control and preventive measures taken at DMDC

Benedict's test used to check sugar is a heating method involves flame and posing a risk of fire hazard	Urine sugar analysed through analyser – urine strip method	HOD-Nursing & HOD – laboratory	Substitution
Radiation hazard during x-ray procedure	Use of lead apron, lead gonads, lead sheets to protect the staff. Console room built to protect staff from exposure	HOD-Radiology	Engineering control
Issue of expired medicines to patient	Medicine recall from patient through proper documentation. Patient is called and explained by higher authorities regarding the medicine by higher authorities. Alert for short expiry - Two months. Double check before issue. Training was given to all pharmacists on double check before issuing. Alert developed for short expiry medicines- appears in the system- stock is separated and sent to supplier. List of short expiry medicines two months prior is taken by HOD to see if nil exist	HOD-Pharmacy and Senior staff- Pharmacy	Elimination through Administrative control and alert system
Breakdown of critical equipment	Annual maintenance contract to have the preventive maintenance done regularly	HOD_BME	Administrative control
Lack of knowledge on latest in field of Diabetes- knowledge on diagnosis and treatment	International Diabetes Updates & certificate course in Evidence based Diabetes mellitus. Talks, panel discussions and symposiums on Diabetes updates for all doctors thereby improvising knowledge base on Diabetes and understanding the latest in the field of Diabetes management. Involving doctors in education through you tube and other social media thus encouraging themselves to update in their field. Urging the doctors to participate in external national and international conferences. Sharing needed knowledge and latest updates through whatsapp share. Development of a tool which can assist in the diagnosis of type of Diabetes. Test results in the app can customise the treatment of patient with Diabetes Introduction of DIANA- an organisation developed tool with artificial intelligence assisting the consultant in the diagnosis of patient on the type of Diabetes	Chairman, Vice Chairman, Managing Director, HOD & senior consultants- Diabetology & Management of the institution along with IT team	Administrative control Elimination of lack of knowledge on diagnosis

5. CONCLUSIONS

Through the continuous process of risk review, HIRA is now integrated as a regular activity to prevent risk occurrence. This study revealed several risks with severe impact and identification of related activities for which control measures have been recommended and implemented. Implementation process is monitored and followed and the study has regularised the facility and safety rounds in the hospital on monthly basis. Mock drills and continuous training on emergency handling have also been regularised. Thus, the study has helped the management and employees to focus on the safety of the patients, staff and the hospital environment. It also has led to minimizing occupational injuries and accidents. It has assured that the culture of safety is built into the system and is part of the working environment.

ACKNOWLEDGEMENT

The authors fully acknowledge the management and staff of DMDSC for entire support in implementing HIRA and there is no conflict of interest raised during publishing.

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