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Evaluation of Patient's Safety Measures in Khartoum State Governmental Hospital 2014

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Abstract

Study purpose: this study aimed to evaluate patient safety measures in Khartoum state hospitals 2014. Methods: This is a descriptive cross-sectional hospital based study. A total coverage sampling technique was used to select All 8 Khartoum state governmental hospital ICUs. Findings: this study revealed that only half of the hospital ICUs (50%) has appropriate temperature and humidity control. only (12.5%) of participant Hospital ICUs have essential laboratory like ABG, and electrolyte available. All of the participant hospital ICUs (100%) have non-invasive pressure monitoring. All of the participant hospital ICUs (100%) have airway access equipment's. (75%) of the participant hospital ICUs doesn't have portable equipment's for transporting the patient. Only (75%) of nurses working in the participant hospital ICUs wash their hand between procedures. Conclusion: all Khartoum estate hospital ICUs are not well designed, not well staffed, and doesn't commit to infection control and prevention measures and by all meaning no attaining to patient safety. Recommendation: Patient safety in ICU is very important to delivery high quality care so it should be involved in the hospitals policy and assigned specific department of hospital like quality assurance to be responsible for monitoring patient safety. Hospitals continuous educational program should be organize the regular lectures and workshop about pt. safety and how to manage the critically ill patients and infection prevention. ICU staff should committed by infection prevention measures from hand washing, wearing gown, isolation, sterilization, and following the aseptic techniques in the procedures which require. key words: patient safety measures, Khartoum state hospitals, (ICU) intensive care unit.

Keywords

Patient Safety, Intensive Care Unite, Infection Control

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1. Introduction

1.1. Background

Peris Kiarie stated in her study that safety is a fundamental and essential attribute of quality health care. Patients Association revealed that only 45 per cent of National Health Service (NHS) organizations had patient safety as their first agenda item most of the time, with as average of 28 per cent of board meetings taken up by patient safety. National Patient Safety Agency (NPSA) nursing lead Woodward says it is essential to encourage a culture where health professionals can be open about patient safety and errors. [1].

acccording to John Lucio, Five million patients are admitted to intensive care units (ICUs) each year, and an estimated 10 percent die there. The daily cost per bed for critical care services is in the range of $2,300 to $3,000 and length of stay averages between six and nine days, full intensivist staffing would save 162,000 lives each year and $3.4 billion annually in the U.S., also according to WHO patient safety program and study conducted in the Eastern Mediterranean and African Regions of WHO the result shown almost a third of ICU patients impacted by harmful incidents died, 14%

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sustained permanent disability and 16% sustained moderate disability. [2].

With regard to patient safety in the ICU, research by Randi Ballangrud shows that incidents involving critically ill patients regularly take place. Errors related to medication, and procedures in connection with lines, catheters, drains, artificial airways and medical equipment are common. Rothschild found that most serious errors occurred during the ordering or execution of treatment, and that the main causes were slips and lapses rather than rule- or knowledge-based mistakes. In addition to breakdowns in team processes, stress and workload are associated with a greater risk of incidents. In a systematic review, West found a relationship between nursing resources and harmful incidents or mortality in two out of 15 studies. Despite the frequent number of incidents, Capuzzo found that errors were strongly underreported, and Elder found that ICU nurses felt uncomfortable about reporting errors. [3].

People with life-threatening diseases and injuries need intensive care according to Peris Kiarie. Intensive care which can also be referred to as critical care, involves close, constant attention by a team of trained health professionals. Problems that could need critical care treatment are like complications from surgery, accidents, infections and severe breathing problems. Equipments such as monitors, IV tubes, feeding tubes, catheters, and ventilators are commonly found in critical care units. They can be used to sustain life but can also increase the risk of infection. [1].

An intensive care unit is a specialized section of a hospital that provides comprehensive and continuous care for persons who are critically ill and who can benefit from treatment (Encyclopedia of Surgery). Intensive care or critical nursing deals with human responses to life-threatening problems. Nurses working in the ICU are 0responsible to ensure that this critically ill patients and families receive optimal care. Critically ill patients are those that are at high risk of life-threatening health problems. The more critical the health of the patient is, the more likely he or she is vulnerable and unstable therefore requiring intense nursing care. [1].

According to the World Health Organization 2011 report on patient safety, health care-associated infections (HCAIs) are those that the patient gets infected with when they are admitted in the intensive care unit. HCAI is one of the main issue that hinders patient safety and this can lead to the patient been admitted for a longer time than should, been disabled for a long time, strain of finances, high expenses experienced by the patients and their families and also having too many deaths. [1].

The college of intensive care medicine Said that An Intensive Care Unit (ICU) is a specially staffed and equipped, separate and self-contained area of a hospital dedicated to the management of patients with life-threatening illnesses, injuries and complications, and monitoring of potentially life-threatening conditions. It provides special expertise and facilities for support of vital functions and uses the skills of medical, nursing and other personnel experienced in the management of these problems. [4].

Shostek stated that The critical care setting is one of the most complex environments in a health care facility. Critical care units must manage the intersecting challenges of maintaining a high-tech environment and ensuring staff competency in operating the equipment, providing high-quality care to the facility's sickest patients, and tending to the needs of Staff members working in a very stressful environment. While other hospital unit May need to manage one or two challenges at a time, critical care settings must manage them all simultaneously while remaining focused on the delivery of safe patient care.

Generally, there are three organizational models for ICUs: the open model allows many different members of the medical staff to manage patients in the ICU; the closed model is limited to ICU-certified physicians managing the care of all patients; and the hybrid model, which combines aspects of open and closed models by staffing the ICU with an attending physician and/or team to work in tandem with primary physicians. [5].

Hugo S found out that More than 5 million patients per year are admitted to the intensive care unit in the united state 2007, Health care associated infection adversely impact approximately 5% of hospitalized patients that can lead to increase morbidity rate and death although the veracity of this number can be debated. Up to 45.8% of ICU admissions are reported to involve an adverse event, with 17.7% of patients experiencing an adverse event that could be considered serious. [6].

According to the world health organization (WHO) Approximately 4.5 million with approximately 37.000 deaths as a direct consequence and 16 million extra _days of hospital stay per year as estimated in the European Union in the annual number of Health care associated infections (HAI) which also represents the most frequent adverse event affecting the hospitalized patients resulting in increased mortality and morbidity, longer hospital stay and disability,. The risk of acquiring (HAIs) is specially significant in intensive care units (ICU), where the world health organization (WHO) estimate that approximately 30% of patients are affected by one or more episodes of (HAI) with associated morbidity and mortality. [7].

There is not enough study published in this direction but we can mention one study which was carried out by Thrompson

in 26 hospitals with ICU from two African countries: Kenya and South Africa and six Eastern Mediterranean countries: Egypt, Jordan, Morocco, Sudan, Tunisia and Yemen used a collaborative model with the objective of measuring harmful events occurring in these hospitals ICU. It is the first large scale study which attempts to measure patient harm in hospitals ICU in these regions and the results show that patient safety in ICU concerns are as important in these regions as had been previously recognized in more economically developed ones. [8].

1.2. Problem Statement

ICU environment is the place where critically ill patients are admitted and delivered absolute care with no harm. The ICU environment should be designed in such away to prevent injuries to patients like proper bed spacing to prevent transition of infection. In order to prevent infections and maintain sterility of the unit, the ICU is designed to be a separate unit from the rest of other hospital units and have easy access to the related units like, ER, OR, RADIOLOGY departments. Perfect ICU design helps increasing patient safety by means of easy access in case of an emergency and prevention of infections. But most of Khartoum state hospitals ICUs are not well designed for patient's safety.

ICU staff plays a major role in pt. safety as they are highly knowledgeable and updated to current patient safety issues. The nurse: patient ratio makes the nurse focus on one pt. and provide good care, also increases patient's safety. Availability of other staff also increases pt. safety like psychologists, physiotherapist.

Infection is the one of the main problems which faces ICU pts. Infection prevention require many techniques to protect the patient. Most of these techniques are not available in many hospitals like hand washing which prevent transmission of infection and other measures like gown, goggles and ICU sterilization.

ICU patient need more care and close observations, Critically ill patients are at high risk for complications due to the severity of their medical conditions, the complex and invasive nature of critical care treatments and procedures, and the use of drugs and technology that carry risks as well as benefits and the incidence of injury or any harm for ICU patients can be fatal, or can lead to increased length of stay, been disabled for a long time, strain of finances, high expenses experienced by the patients and their families and also Having too many deaths.

1.3. Rationale

Pt. safety is a global public health issue, WHO estimates that millions of patients worldwide suffer from disabling injuries or death due to unsafe ICU health care practice, any patients admitted ICU need intensive care because patients are completely, sometimes partially, dependent on the nurse.

People with life-threatening diseases and injuries need intensive care. They are at constant risk for pressure ulcer, medication error, aspiration, monitoring error, equipment error, and other many problems due to unwell trained staff, and work over-load on the nursing team, Problems that could need critical care treatment are like complications from surgery, accidents, infections and severe breathing problems.

Equipments such as monitors, IV tubes, feeding tubes, catheters, and ventilators are commonly found in critical care units. They can be used to sustain life but can also increase the risk of infection.

Health care-associated infections (HCAIs) are those that the patient gets infected with when they are admitted in the intensive care unit. HAIs are, in fact, the fifth leading cause of death in acute care hospitals. The total economic burden for all HAIs in the acute care environment approaches $20 billion per year HCAI is one of the main issue that hinders patient safety and this can lead to the patient been admitted for a longer time than should, been disabled for a long time, strain of finances, high expenses experienced by the patients and their families and also having too many deaths, therefore this study will be conducted to evaluate the safety measurements in all of Khartoum state hospitals ICUs.

1.4. Objectives

1.4.1. General Objectives

To evaluate patient safety measures in Khartoum state hospitals 2014.

1.4.2. Specific Objectives

I. To evaluate the patient safety measures in ICU environment.

II. To evaluate the patient safety measures according to ICU staffing and ratio.

III. To evaluate the infection prevention measures in ICU

2. Literature Review

2.1. Introduction

With all its complexity, intensive care represents potential patient safety challenges, as critically ill patients are vulnerable to being exposed to incidents as a result of their severe conditions and need of high complexity care. Incidents involving critically ill patients frequently appear and is often potentially life threatening. A large proportion of contributory factors underlying critical incidents are

attributed to failures in team performance. [3].

Patient safety is stated as the fundamental principle of good patient care; hence research shows that one out of ten patients is harmed while receiving hospital care. Patient safety incidents lead to unnecessary suffering and are a major cause of prolonged hospital stays. Human errors are stated as the most common cause of patient safety incidents, although incidents should be seen as a result of complex system failure, rather than as the fault of the individual health care providers. Safety cultures are created through changes in health personnel's safety perspective and work behavior, and human resource professionals are essential and an important contributor in this development [3].

2.2. Definition of pt Safety

In this thesis, the use of "patient safety measures" is based on The European Network for Patient Safety, which defined culture of safety as: "an integrated pattern of individual and organizational behavior, based upon shared beliefs and values that continuously seeks to minimize patient harm which may result from the process of care delivery".

This definition differs from more neutral definitions, as it reflects a culture of safety in which actions are taken to reduce risk or harm to the patients. [3].

Patient safety is the prevention of errors and adverse effects to patients associated with healthcare, the care of critically ill patients is dependent on the use of complex medical equipment. Unfortunately this equipment has the potential to develop faults, to be used incorrectly or to fail. Patient safety is about "the reduction of risk of unnecessary harm associated with health care to an acceptable minimum [1].

2.3. Aspects on pt Safety

Critical care setting is one of the most complex environments in a healthcare facility. Critical care units must manage the intersecting challenges of maintaining a high-tech environment and ensuring staff competency in operating the equipment, providing high-quality care to the facility's sickest patients, and tending to the needs of staff members working in a very stressful environment. While other hospital units may need to manage one or two challenges at a time, critical care settings must manage them all simultaneously while remaining focused on the delivery of safe patient care. (5).

2.3.1. Environment

Patient environment is a place where pt admitted, and it play a major role in patient care process in intensive care unit the patient environment contain all ICU devices, monitoring, beds, equipments, and everything which can be used in patient care.

Carefully coordinated and selected ICU environment color palettes, material choices, furniture selections, window coverings, art, positive distractions, exposure to nature, and lighting choices can all produce a calming effect. Sky lights are an option if windows are not feasible. Providing visitors and families with access to a courtyard or patio recommended. Noise dampening materials and carefully selected music can contribute to a supportive environment for families [8].

2.3.2. ICU Sitting

The ICU should be a separate unit within the hospital with access to the emergency.

Department, operating theatres, radiology, and interventional cardiology and trauma unit.

Where relevant. [4].

2.3.3. ICU Design

The goal of the design process is to create a healing environment or psychological states of patients, staff, physicians, and visitors. Elements of healing environment include: materials and finishes that reduce noise levels, minimize glare, and support infection control; floor plans, equipment, and other features, such as human engineering principles, May enhance efficiency and effectiveness of patient care and minimize workplace Injury; stress-reducing furnishings And decor, incorporating natural light and views of nature; and thoughtful provision for the creature comforts of patients, families, and staff [8].

2.3.4. Physiologic Monitoring

There is perhaps no better way of monitoring a patient than by direct visualization.

There is a link between poor visualization of patients by nursing staff and Physicians and patient mortality. To achieve direct visualization, each patient's face and body position should be easily visualized. [8].

2.3.5. Oxygen, Compressed Air and Vacuum

According to wedel S, Centrally supplied oxygen and compressed air must be provided from main and reserve tanks. At least two oxygen outlets per patient are required. One compressed air outlet per bed is required; two are desirable. Connections for oxygen and compressed air outlets must occur by keyed plugs to prevent the accidental interchanging of gases. Audible and visible low and high pressure alarms must be installed both in each ICU and in hospital engineering. At least three vacuum outlets per bed are required. [9].

2.3.6. Temperature

Health care team and patient if possible should be able to control patient room temperature, and also according to patient body temperature [8].

2.3.7. Lighting

Patients exposed to increased intensity of natural sunlight have been shown to experience less perceived stress, use fewer analgesics, and have improved sleep quality and quantity, Bright light, both natural and artificial, has been shown to reduce depression among patients. Artificial light for general illumination and specific tasks is essential. A high-intensity light source for clinical procedures should be readily accessible. This light source may be portable, or wall or ceiling fixed. To prevent burns, in candescent and halogen light sources should be avoided, or if used, covered by a Lens or diffuser. Flexible arms, if used with this light source, must be mechanically Controlled to prevent the lamp from contacting bed linen. Each patient bed should also have a reading light that can be easily controlled by the patient. [8].

2.3.8. Sharps Disposal

Management of sharps, such as needles, blades, wires, and devices soiled with Body fluids, feces, and urine, necessitates serious design consideration. Sharps Containers must be placed within patient rooms where they are visible and within Reach, be placed in an area free from obstruction and in some cases be portable. Large sharps containers allow easy and safe disposal of sharps from invasive procedures smaller bedside containers often cannot hold larger items, such as Guide wires and catheters. [8].

2.3.9. Sterilization

Invasive medical and surgical procedures have the potential to expose patient to pathogenic microbes and lead to infection. If not properly disinfection or sterilized, medical devices and surgical instruments used in invasive procedures may be the carrier of infectious organisms and may lead to infection as discovered by Emily R in her study. Sterilization kills all microorganisms and high levels of bacterial spores, sterilization can be performed by steam, dry heat or chemical sterilants for health -sensitive items. High level disinfection kills all microorganisms but does not kill high numbers of bacterial spores and its techniques include: pasteurization and chemicals sterilants used for heat sensitive items. Intermediate level disinfection destroys bacteria in the growth phase, mycobacterium and most viruses and fungi but not bacterial spores. Low level disinfection kills bacteria in the growth phase and some fungi and viruses but does not kill mycobacterium or bacterial spores. Given the importance of disinfection and sterilization in the prevention of the transmission of infectious organisms, guidelines for disinfection and sterilization methods have been created and adopted by infection prevention program. [1].

Burke J stated In addition to the sterilization and disinfection of equipment, cleaning of the environment is also important. Numerous environmental surfaces exist in patient rooms, and studies have documented that a large proportion of these surfaces are missed during routine and terminal cleaning between patients. Studies have also shown that patients admitted to the hospitals room previously occupied by patients colonized or infected with C. difficile and drug resistant organisms are at an increased risk of acquiring these organisms [11]

2.3.10. Device Safety

According to Rossi M, The use of medical devices for monitoring, whether invasive or non invasive, have -to some extend-errors in the uses of these devices can range from improperly set alarms leading to detrimental outcomes from unrecognized complications to accidental removal life sustaining devices, such as endo-tracheal tubes and intra-aortic balloon pumps. Error can occur in 1 of 4 interactions. In united state these devices are classified into 3types; Non invasive devices; like monitors, and diagnostic and treatment equipment; such as x-ray machines, and Implantable and life -support devices; such as pacemakers, and implantable defibrillators. The number of Therapeutic device used was 22.1 per 1000 patient-days, with most commonly removed devices being naso-gasteric tubes (28.9%), supplemental oxygen (23.5%) and peripheral intravenous (IV) catheters (20.8%). [12].

2.4. Staffing

The concentration of staff and equipment to care for critically ill patients in one area of the.

Hospital encourages efficient use of expertise and resources and hence increases patient's safety. [4].

2.4.1. Medical Staff

There must be access to a range of specialty consultants appropriate for the designated role of the hospital. Each ICU must have a medical director who takes overall responsibility for the operation of the Unit. The director should be a Fellow of the College and have a full time commitment to the role, although these requirements cannot always be met in Level I ICUs. There must be sufficient specialist staff with experience in intensive care medicine to provide for patient management, administration, teaching, research, audit and ICU based activities outside of the ICU as required. There must be at least one specialist roistered to the unit at all times. There must be at least one other registered medical practitioner with an appropriate level of experience roistered

to the ICU at all times. These medical practitioners must have appropriate orientation and training and be competent in providing advanced life support. There must be access to a range of specialty consultants appropriate for the designated role of the hospital. [4].

2.4.2. Nursing Staff

Intensive care nursing is described as a specialized nursing care for acute and critically ill patients with manifest or potential failures of vital functions the first beginning of the specialty was attributed to Florence Nightingale, who pioneered the modern nursing, practices during the Crimean war [3].

There must be a nurse in charge of the unit with a post registration qualification in intensive care. There should be a supernumerary team leader in charge of ICU per shift who is a designated senior nurse with a post-registration qualification in intensive care. ACCESS (Assistance Coordination Contingency Education Supervision Support) nurses may be required depending upon the number of nurses with post registration qualifications in intensive care. The majority of nursing staff should have a post registration qualification in intensive care. All registered nurses must be competent in providing advanced life support and undertake refresher training annually. All nursing staff responsible for direct patient care should be Division 1 registered nurses. Enrolled nurses (Division 2 RNs) may be allocated duties to assist registered nurses. However, any activities that involve direct contact with the patient must always be performed in the immediate presence of a Division 1 registered nurse. [4]

2.4.3. Knowledge and Skills

Intensive care nurses need the highest level of professional knowledge and skills to ensure the quality and safety of patient care and that "there should be congruence between the needs of the patient, and the skills, knowledge and attributes of the nurse caring for the patient [3].

National Institute for Health and Clinical Excellence (NIHCE) stated: 'Members of staff who are caring for the patients that are admitted in the critical hospital sectors should have a high standard in how they monitor, measure, interpret and act to the critically ill patient should be tested to make sure that they are able to show them (NIHCE 2007). What should entail in these measurements is the heart rate, respiratory rate, temperature, how conscious they are the amount of urine they produce, systolic blood pressure and the saturation of oxygen. [1].

Contributing factors to inappropriate and potentially hazardous care delivery include the following. Nurses working out of their scope of practice in the ICU; nurses receiving inadequate orientation and workplace training; lack of adequate clinical and educational support systems in place; lack of knowledge of critical care nursing and therapies; nurses working in an unsafe ICU physical environment and nurses lacking awareness of occupational health and safety processes. [1].

2.4.4. Staffing Ratio

Staffing an adequate number of critical-care-educated nurses is essential for the delivery of high-quality ICU care. Researchers have begun to demonstrate the key role of critical.

Care nurses in intercepting medical errors in the ICU before they reach the patient. Appropriate nurse staffing levels are important to a safe work environment, which in turn is important to patient care and safety. WHO recommendation for ICU staff one to one for critically ill patient or pt. under mechanical ventilation and one to two for stable patients. [5].

The appropriate nursing staff: patient ratio and the total number of nursing staff required by each unit depends on many variables such as the total number of patients, severity of illness of patients, methods of roistering, as well as individual policies for support and monitoring in each unit. International guidelines require a minimum of 1:1 for ventilated and other critically ill patients and 1:2 nursing staff for lower acuity patients (clinically determined). Greater ratios may be required for patients requiring complex management. [4].

2.4.5. Other Staff

Depending on the needs of the unit, physiotherapists, radiographers, dieticians, technicians (including biomedical engineering and scientific officers), social workers, occupational therapists, and cleaning staffs are all required. Secretarial services should be available to support educational and administrative activities. These should be separate from ward clerk duties in the ICU. Larger ICUs should have an equipment officer to coordinate and oversee the selection, purchase and maintenance of equipment and disposables for the Unit, and a research coordinator to coordinate research activities and to collect and store research data. [4].

2.5. ICU Infection

HAIs are the most common complication seen in hospitalized patients. HAIs increase morbidity, mortality, costs and length of stay even after adjustment for underlying illness.

The Centers for Disease Control and Prevention (CDC) defines health care-associated infections (HAIs) as infections acquired while in the health care setting (e.g., inpatient hospital admission, hemo dialysis unit, or same-day surgery), with a lack of evidence that the infection was present or

incubating at the time of entry into the health care setting (10).

Health care–associated infections (HAIs) adversely impact approximately 5% of hospitalized patients, leading to increased morbidity and death. HAIs are, in fact, the fifth leading cause of death in acute care hospitals.9 the total economic burden for all HAIs in the acute care environment approaches $20 billion per year. A large number of these events are associated with temporarily placed biomedical devices, such as endo-tracheal tubes, indwelling urinary catheter, and central venous access devices. The personal and fiscal morbidity associated with these HAIs is significant is estimated to increase mortality by 18%, increasing ICU LOS on average by 13 days while adding $10 531 to $56 167 to the total hospitalcost.10–12 the risk for infection is actually greater within the ICU patient population. A multi-institutional study revealed that 19% of ICU patients develop an infection Sometime during their ICU stay. 13 the microbial pathogens and the percent occurrence Of selective HAIs have been documented by the Centers for Disease Control And Prevention's (CDC) National Healthcare Safety Network, Many of these infections occurring within the ICU pose a significant safety burden to this high-risk patient population. The implementation of evidence-based interventions directed against specific mechanistic components of selective HAIs offers the best opportunity for reducing risk and creating a safe and effective health care environment. Have been estimated to increase ICU length of stay by 4.3 to 15.6 days and account for more than 20% of total ICU costs. [12].

Healthcare-associated infections (HAI) represent the most frequent adverse event affecting hospitalized patients, resulting in increased morbidity and mortality, longer hospital stay, and disability. In the European Union, the annual number of HAIs can be estimated at approximately4.5 million, with approximately 37,000 deaths as a direct consequence, and 16 million extra-days of hospital stay per year. The risk of acquiring HAI is especially significant in intensive care units (ICU), where the World Health Organization (WHO) estimates that approximately 30% of patients are affected by one or more episodes of HAI with associated morbidity and mortality [3]. Catheter-related bloodstream infections (CRBSI) are among the leading HAI, together with urinary tract infections, surgical site infections, and ventilator-associated pneumonia [6].

Device–associated infection (DAI) plays an important part in hospital acquired infection.

The surveillance of device–associated infections (DAIs) in intensive care units (ICUs) has become more important, according to the three largest surveillance systems, the pooled mean rates of DAIs were: ventilator–associated pneumonia (VAP), 1.3–13.6 per1000 ventilator–days; central line–associated blood stream infection (CLABSI), 2.0–7.6 per 1000 catheter–days; and catheter–associated urinary tract infection (CAUTI), 2.0–6.3 per 1000 catheter–days [5-7]. In addition, DAIs has been associated with significant cost and mortality the crude mortality rates of ICU patients with DAI were 32.9–43.7%. [6].

2.6. ICU Infection Prevention

2.6.1. Hand Hygiene

Although hand washing is considered the cornerstone for disrupting the transmission of health care–associated pathogens, the strength of its scientific efficacy has produced mixed results. There is no argument that the hands of all health care workers become contaminated during the execution of their duties and that this contamination can be transferred to inert surfaces or other patients and/or staff members. [12].

The WHO has assigned 5 events for hand hygiene; 1- before patient contact to prevent transmission of organisms from hands to patients, 2- Before performing any aseptic tasks to prevent transmission of intrinsic and extrinsic contamination, 3- after exposure to blood or body fluids to protect yourself and health care environment from contamination, 4- after patient contact to protect yourself and health care environment from contamination, 5- after contact with patient environment to protect yourself health care environment from contamination [12].

2.6.2. Gloves

Gloves used to protect patients and health care worker from infection transition:

NG Siew Hian discovered that Wearing gloves is not a substitute for hand hygiene, Wear non-sterile gloves when in contact with blood, saliva, body fluids, Secretions, excretions, contaminated items or surfaces, mucous membranes and non-intact skin. Wear sterile gloves for procedures such as arterial annulations', bone marrow aspiration, bronchoscopy, central venous catheterization, haemodialysis catheter insertion, lumbar puncture, pulmonary artery catheterization, peritoneal dialysis catheter insertion, tracheotomy, chest tube insertion and urinary catheterization, dressing and tracheal suction. Change gloves after contact from a contaminated to a clean site on the same patient. Remove gloves promptly after use and dispose used gloves into the Yellow clinical waste bin. [13].

2.6.3. Masks and Personal Respiratory Protection Devices

Mask used to protect patients and health care worker from air

born infection, Surgical mask is to be worn during procedures to prevent health care workers (HCW) respiratory secretions from contaminating sterile sites (e.g. dressings, central venous and arterial cannulation) and/or to reduce the risk of splashing of patients body fluids to HCW (e.g. tracheal intubation, tracheal suction, tracheostomy, chest physiotherapy). It is to be used on patients who are coughing to limit spread of infectious respiratory secretions. Particulate filter personal protection device (N95), which is capable of filtering 0.3micron particle, is to be worn when attending to patients with infectious air-borne diseases (e.g. pulmonary tuberculosis) Powered Air Purifying Respirator (PAPR) is to be used by HCW when carrying out aerosol-generating procedures in patients with highly infectious and deadly airborne diseases e.g. tracheal intubation in patients with severe acute respiratory syndrome (SARS). [13].

2.6.4. Protective Eye Wear or Face Shields (Goggles)

Wear protective eyewear or face shield during procedures that are likely to generate splashes of blood, body fluids, secretions e.g. tracheal intubation, tracheal suction, tracheostomy, dressing, physiotherapy, and chest tube insertion.

Personal eye glasses and contact lenses are not considered adequate Eye protection. [13].

2.6.5. Gowns

Gowns used to protect health worker from infection transmission:

Wear plastic apron to protect HCW's clothing from contamination with blood or body fluids e.g. physical examination, tracheal intubation, tracheal suction, dressing, sponging, physiotherapy. If there is a risk of splashing of large amount of blood or body fluids, wear impermeable or fluid-resistant gown to protect HCW's clothing and skin. Wear sterile gown during aseptic procedures e.g. tracheostomy, central venous catheterization, lumbar puncture, chest tube insertion common ICU procedures [13].

2.6.6. Isolation

According to Siegel JD, Patients are placed in isolation as an intervention to prevent the spread of infectious agents among other patients or, in some cases, to protect the health care worker. In health care, isolation refers to various measures taken to prevent contagious diseases from being spread from a patient to other patients, health care workers, and visitors, or from others to a particular patient. Various forms of isolation exist, some of which contact procedures are modified, and others in which the patient is kept away from all others. In a system devised, and periodically revised, by the U. S. Centers for Disease Control and Prevention (CDC), various levels of patient isolation comprise application of one or more formally described "precaution". Isolation is most commonly used when a patient has a viral illness. Special equipment is used in the treatment of patients on the various forms of isolation. These most commonly include gowns, masks, and gloves [14]

The CDC identified different forms of isolation which are used to prevent illness transmission according to the mode of transmission of bacteria or virus. 1- Strict isolation is used for diseases spread through the air and in some cases by contact. Patients must be placed in isolation to prevent the spread of infectious diseases. Those who are kept in strict isolation are often kept in a special room at the facility designed for that purpose. Such rooms are equipped with a special lavatory and care giving equipment, and a sink and waste disposal are provided for workers upon leaving the area. 2- Contact isolation is used to prevent the spread of diseases that can be spread through contact with open wounds. Health care workers making contact with a patient on contact isolation are required to wear gloves, and in some cases, a gown. 3- Respiratory isolation is used for diseases that are spread through particles that are exhaled. Those having contact with or exposure to such a patient are required to wear a mask. 4- Reverse isolation is used to prevent a patient in a compromised health situation from being contaminated by other people or objects. 5- high isolation is used to prevent the spread of unusually highly contagious, or high consequence, infectious diseases (e.g., smallpox, Ebola virus). It stipulates mandatory use of gloves, goggles, waterproof gown, surgical mask or Sometimes negative pressure rooms or powered air-purifying respirators (PAPRs) are also used. [14].

According to report published in American medical news in March 2013 by kevian B, there is top ten ways to improve patient safety. there is Improve hand hygiene compliance, Use barrier precautions to stop the spread of infections, Implement care bundles to prevent central line-associated bloodstream infections, Use real-time ultrasonography when placing central lines, Use protocols to reduce catheter-associated urinary tract infections, Employ preoperative checklists to reduce surgical complications, Improve venous thrombo-embolisms prophylaxis, Use preventive intervention care bundles to cut rates of ventilator-associated pneumonia, Avoid hazardous drug abbreviations, Use mult-icomponent interventions to prevent pressure ulcers. [15].

As observed in the literature there is many studies was done in safety measures for ICU patients by the health foundation, the situation is different and varies between the different studies according to the aspect of the study, and there is many studies published investigating the issue of patient safety

measures in ICU, since it is locally needed to further investigation of actual statistics and figures and associated factors regarding patient safety measurements in ICU. A small number of studies have found a relationship between safety culture or climate and hospital morbidity, adverse events and readmission rates. But other studies have found that safety culture has no impact on patient outcomes. There is more evidence that improving safety culture impacts on staff safety behaviors and injury rates among staff. [16]

One study was to establish a baseline understanding of the safety culture in Australian intensive care units done by chaboyer W. In a nationwide study of physicians and nurses in 10 Australian intensive care units, the Safety Attitudes Questionnaire intensive care unit version was used to measure safety culture. Descriptive statistics were used to summarize the mean scores for the 6 subscales of the questionnaire, and generalized-estimation-equations models were used to test the hypotheses that safety culture differed between physicians and nurses and between nurse leaders and bedside nurses. A total of 672 responses (50.6% response rate) were received: 513 (76.3%) from nurses, 89 (13.2%) from physicians and 70 (10.4%) from respondents who did not specify their professional group. Ratings were highest for teamwork climate and lowest for perceptions of hospital management and working conditions. Four subscales, job satisfaction, teamwork climate, safety climate, and working conditions, were rated significantly higher by physicians than by nurses. Two subscales, working conditions and perceptions of hospital management, were rated significantly lower by nurse leaders than by bedside nurses. the study concluded that measuring the baseline safety culture of an intensive care unit allows leaders to implement targeted strategies to improve specific dimensions of safety culture. These strategies ultimately may improve the working conditions of staff and the care that patients receive. [17].

One of those studies was conducted in Karlstad University – Sweden about the patient safety in intensive care unit, in 2013. Data were extracted to a standard spreadsheet and synthesized using a narrative synthesis, study is carried out by using descriptive and explorative design with combining quantitative and qualitative method. The study include seven intensive care units and ten (R. N) and data was collected through the use of questionnaire and check list, The RNs had positive perceptions of the outcome of the ICUs' overall patient safety culture; though, incident reporting was found as an area with potential for improvement, and hospital management support for patient safety and teamwork across hospital units. The study concluded that Patient safety culture measurements have the potential to identify areas of strength and Areas in need of improvement. Simulation-based team training is appropriate for creating awareness of clinical practice and a common understanding of structured work in teams with regard to patient safety. [3].

Another study that was conducted in London by douglas M aimed at improving patient safety. It included 10 case studies of health care organizations, clinical teams, and learning collaborations that have designed innovations in five areas that hold great promise for improving patient safety nationally: promoting an organizational culture of safety, improving teamwork and communication, enhancing rapid response to prevent heart attacks and other crises in the hospital, preventing health care–associated infections in the intensive care unit, and preventing adverse drug events throughout the hospital. Participating organizations ranged from large integrated delivery systems to small community hospitals. The study focused on the hospital setting because that has been the focus of most patient safety improvement efforts to date. [18].

3. Methodology

3.1. Introduction

This chapter presents the research design and methodology adopted in the study. It describes the development of the research instrument and the methods used for data collection. The research method chosen was related to the aims and the objectives of study.

3.2. Study Design

This is a descriptive cross-sectional hospital based study.

3.3. Study Area

The study was conducted in Khartoum state hospitals; Khartoum is one of the eighteen states of Sudan. Although it is the smallest state by area, it is the most populous. It contains the country's largest city by population, Omdurman, bahri, and the city of Khartoum, which is the capital of the state as well as the national capital of Sudan. The capital city contains offices of the state, governmental and non-governmental organizations, cultural institutions, and the main airport,

3.3.1. Khartoum Teaching Hospital

Khartoum teaching hospital was established 1964, which lies in Khartoum locality, the capital of Sudan. It has the largest number of patients coming from all different Khartoum localities and occasionally from other states. Khartoum teaching hospital has 2 ICU units with a maximum of 10 beds for both. Khartoum hospital is bounded from east by Khartoum faculty of nursing, from west by the national laboratory Khartoum university of medicine, from south by

betoken street and almslman bridge and from north its bounded by doctors street fedail hospital.

3.3.2. Alshaab Specialized Teaching Hospital

Alshaab specialized teaching hospital was built on the a land which was a muslim burial land, in expense and funded by the world health organization and supervise by dr. Zainal abiding Ibrahim and dr. mamoun Hassan sharif, it was opened by the president Ibrahim abboud in 1959 and was known as the revolution chest hospital, in1962 joined the section of cardiology, founded by dr. alnoor abdul-majid hospital and thus expanded new sections of the heart and chest surgery (cardiothoracic) and cardiac catheterization and X-ray diagnostic CT- head and brain.

New compound was established as sulieman abu saleh nursery center, which was the first dean of faculty of nursing in Sudan to teach and train nurses. Centers (receiving emergency cases of the chest accidents, also head and heart injuries).

Now the hospital has two main departments (cardiology and chest). The hospital is located in center of Khartoum and bounded by the west by Khartoum teaching hospital, and east by Khartoum teaching dental hospital, from the north by Istiballa Street, and from south by Army Avenue.

3.3.3. Khartoum Bahri Teaching Hospital

Is bounded by west by alsayid ali merghani mosque, and from east by almaona street. The hospital contain different departments, emergency, medicine, surgery, obstetrics, pediatrics, and an ICU of 5 beds capacity.

3.3.4. Omdurman Teaching Hospital

Its the biggest public hospital in western Khartoum area. Its bounded from west by wadi saydna high school for boys, from north by doctors road, and from south by khalifa square. It has an emergency department, medicine, surgery, pediatrics, and an ICU of 4 beds.

3.3.5. Ahmed Gasim Specialized Hospital

Its bounded from west by DHL- Khartoum north, and from east by alsar alsunna mosque. It include a heart surgery complex, kidney transplant, cardiac catheterization department, renal and heart wards, clinics for renal and heart, and an ICU of 10 bed capacity.

3.3.6. Ibnsina Specialized Hospitals

Its bounded by west by mohammed najeeb street, from east by king abdel aziz street and Saudi Sudanese bank, from north by 23th street, and from south by Mahmoud wad ahmed street.

The hospital is specialized with 3 major departments (ENT, GIT, and urology), major theatre, dialysis unit, and two HDU in medicine, urology wards, and an ICU of 2 beds in theatre department.

3.3.7. Ibrahim Malik Teaching Hospital

Its bounded by west by mohammed najeeb's street, from east by alshafa black 40 east mosque, from north by Abdullah sinin grocery. It has medicine, surgery, obstetric, pediatrics, and emergency departments, and an ICU with 7 bed capacity.

3.3.8. Alnw Teaching Hospital

Its located in Omdurman althawra altamna. It's a public hospital with an emergency department, and an ICU with 2 beds capacity with central oxygen, the hospital have over 70 beds capacity.

3.4. Study Population

All Khartoum state governmental hospital ICUs

3.5. Study Variables

3.5.1. Dependent Variables

Patient's safety.

3.5.2. Independent Variables

ICU Environmental measures, staffing and ratio measures and infection control measures.

3.6. Data Collection

The data for this research was collected using observational check list as tool for data collection. The tool was extracted and designed after careful review of the literature and the previous studies and ICU guidelines from ministry of health, and it was modified and adapted according to Khartoum state hospitals. After the tool is designed, a pilot study was done. It included a total of 3 hospitals. The items for the check list was found to have the ability to estimate patients safety measures, and based on this small pilot study results, the check list was adopted.

3.7. Sample Size and Sampling Technique

3.7.1. Sample Size

This study included all 8 Khartoum state hospitals ICUs.

3.7.2. Sampling Technique

The research technique is a total coverage sample for all Khartoum state hospitals ICUs.

3.8. Data Processing and Analysis

The data is analysed by using SPSS package and the results is showed in figures, graphs and tables that contains frequency and percentage of the result findings. The data is

analysed using a chi-square test as a procedure to analyse the findings.

3.9. Ethical Consideration

(1) The research is respecting the rights of participants, treat data with confidentiality no harm for the subject.

(2) Approval from University of Medical Sciences and Technology – Faculty of Nursing Sciences is taken.

(3) Permissions from study areas are taken.

(4) Approval from ministry of health for data collection from study area is taken.

4. Results

Table 1. Demonstrates patient's safety measure in Khartoum state governmental hospitals ICUs.

Item		Done		Not done	
ICU environment:		**Freq.**	**Percent**	**Freq.**	**percent**
1	20feet between each adult bed.	0	00.0	8	100.0
2	30m^2 isolation room space.	2	25.0	6	75.0
3	Wash basin for each bed.	1	12.5	7	87.5
4	Oxygen, medical air and suction for each bed.	5	62.5	3	37.5
5	Light control for each bed.	3	37.5	5	62.5
6	Access to natural light through windows.	5	62.5	3	37.5
7	Privacy tool (curtains).	6	75.0	2	25.0
8	Space for staff (nursing station).	7	87.5	1	12.5
9	Resuscitation equipments.	8	100.0	0	00.0
10	Communication system (phone).	3	37.5	5	62.5
11	Computer and data collection equipment.	0	00.0	8	100.0
12	Appropriate air condition and temperature.	4	50.0	4	50.0
13	Storage area.	5	62.5	3	37.5
14	Seminar room.	3	37.5	5	62.5
15	30m2 office space for in charge nurse and nursing educator.	5	62.5	3	37.5
16	Meeting room.	1	12.5	7	87.5
17	15m^2 space for medical office.	4	50.0	4	50.0
18	Use the sterile hand to remove the suction catheter.	30	100.0	0	00.0
19	ABG machine.	1	12.5	7	87.5
20	ICU is a separate unit.	3	37.5	5	62.5
21	Access to ER, OR, radiology.	4	50.0	4	50.0
22	Circulation monitoring through pulse, ECG.	8	100.0	0	00.0
23	Respiration monitoring through ABG analysis	8	100.0	0	00.0
24	Oxygenation monitoring through pulse oxymetery & ABG.	8	100.0	0	00.0
25	Monitoring equipments: ECG machine.	7	87.5	1	12.5
26	Monitoring equipments: invasive &non invasive BP machines.	8	100.0	0	00.0
27	Monitoring equipments: thermometer for temperature.	7	87.5	1	12.5
27	Monitoring equipments: pulse oxymetery.	8	100.0	0	00.0
28	Monitoring equipments: ventilators.	7	87.5	1	12.5
29	Hand ventilating assemblies.	8	100.0	0	00.0
30	Suction apparatus	8	100.0	0	00.0
31	Air way access equipments.	8	100.0	0	00.0
32	Invasive &non invasive monitoring equipments	8	100.0	0	00.0
33	Defibrillation &pacing facilities.	7	87.5	1	12.5
34	Chest drainage equipments.	1	12.5	7	87.5
35	Infusion &specialized pumps.	6	75.0	2	25.0
36	Syringe &specialized pumps.	6	75.0	2	25.0
37	Specialized beds	8	100.0	0	00.0
38	Portable transport equipments.	2	25.0	6	75.0
39	Central monitor	1	12.5	7	87.5
Staffing and ratio:					
40	ICU director (intensive or anesthesiologist)	5	62.5	3	37.5
41	ICU head nurse (BLS, ACLS, ATLS)	7	87.5	1	12.5
42	ICU medical.	7	87.5	1	12.5
43	Nursing staff with ICU experience.	8	100.0	0	00.0
44	1:1 nurse: patient ratio (with mechanical ventilator).	5	62.5	3	37.5
45	1"2 nurse: patient ratio (low severity).	5	62.5	3	37.5
46	Physiotherapist.	4	50.0	4	50.0
47	Radiotherapist.	1	12.5	7	87.5
48	Dietitian.	5	62.5	3	37.5
49	Cleaning staff	8	100.0	0	00.0
50	Psychologist.	1	12.5	7	87.5

Item		Done		Not done	
ICU environment:		Freq.	Percent	Freq.	percent
Infection control measures:					
51	Hand washing& gloves.	6	75.0	2	25.0
52	Mask.	5	62.5	3	37.5
53	Sterilization.	8	100.0	0	00.0
54	Isolation room.	0	00.0	8	100.0
55	Gown.	1	12.5	7	87.5
56	Goggles.	0	00.0	8	100.0

5. Discussion

This is descriptive hospital base study, it was conducted to evaluate the safety measurements in Khartoum state hospitals ICU in governmental hospitals ICU by total coverage sampling technique it involve 8 ICU.

The main objective of the study is to evaluate the safety measurements in intensive care units in Khartoum state hospitals.

One of the specific objectives of the study to assess the patient safety measures according to ICU environments which was answered in section one that shows there isn't any hospital committed by the standard spaces between the ICU beds. Which it is very important to maintain the staff work comfortably, maintain the pt. privacy and also can decreased the risk of transmission of infection.

More than half ICU (62%) has suction for each bed; each bed should have his own suction machine, and different suction catheter (Endo-tracheal suction, mouth suction) for different usage for one patient to prevent transmission of the infection

Concerning appropriate temperature control, this study revealed that 50% of ICUs has appropriate temperature and humidity control, low temperature in ICU environment will give faulty readings on the pulse oxymetery for oxygen saturation. And also will make the patient hypothermic.

The availability of essential laboratory investigation is assessed in this study such as ABG, ELECTROLITE, only 12.5% of participant Hospitals have essential laboratory like ABG, and electrolyte available.

62.5% of participant ICU are considered separate unit in their hospitals while 50% of them have a direct access to ER, OR, RADIOGRAPHY.

100% of participant ICU monitoring pt. circulation through pulse and ECG, respiration through ABG, and oxygenation through pulse ox meter. The study also assessed availability of the equipments for patient monitoring the result show 100% of participant hospitals have non invasive pressure monitoring, pulse ox meter, temperature through cardiac monitor or thermometer, blood pressure, pulse rate, temperature, and oxygen saturation considered main signs to monitoring and observe the patient. 100% of ICU has resuscitation equipments; also 100% of the participant hospitals have airway access equipments, hand ventilating assemblies, except one hospital doesn't have defibrillator, 75% of hospitals have infusion pump and syringe pump The result indicates that all Khartoum state hospitals are well equipped which helps in early detection of complications and maintenance of patients lives.

The availability of equipments for transporting the patients the result show 75% of the participant hospitals doesn't have portable equipments for transporting the patient. ICU patient when transported to the any department like dialysis, radiography departments. Need potable equipments such as portable monitor, ventilator, to assess the patient status during transportation, unavailability of these equipments mean pt. can expose for high level of the thread.

The second specific objective was assessing the safety measurements in ICU according to the ICU staffing and ratio. The result show the 62.5% of the participant hospitals have ICU director which specialized in intensive care units (intensives, or anesthesiologist), while 87.5% of the participant ICU have ICU resident (medical) and ICU head nurse, only one hospital (12.5%) has special radiographer and psychologist while half hospitals (50%) have physiotherapist, 62.5% of ICU nurses working by the (one to one) ratio for critically ill patient (patient on mechanical ventilator) and (one to two) for lower severity patients. Proper staffing ratio enables maximum provision of care warranted by staff members.

The last specific objective aimed to assess the safety measurements in ICU according to the infection prevention. 75% of the participants wash their hand between procedures while but don't wear goggles or gown except one hospital but 5 hospitals use the mask during ICU care and all participant hospitals sterilized their ICU through different methods of sterilization. Proper infection prevention measures increases patients survival by decreasing the risk for infections hence increasing patients safety.

6. Conclusion

A descriptive hospital base study has been conducted to evaluate safety measurements in intensive care units in Khartoum state hospitals 2014 it involve 8 hospitals from 48 hospitals in all Khartoum state they were selected by total coverage sampling.

Most of hospitals ICU are fully equipped and designed by the equipments essential to support patient life but the missed point in all ICU designed there is no standard spaces between ICU beds, and many hospitals does not have isolation room for cases which required isolation, most of ICU don't have their own ABG machine. The ICU unit should separate unit but many hospital structure and design includes the ICU to the rest of hospital units.

About ICU nursing staff many hospitals are not committed by the standard nurse patient ratio, one to one or one to two for lower severity pt's, and other staff which considered part of the patient care half hospitals don't have physiotherapist, and most of them don't have psychologist, and radiographer special for ICU.

Infection prevention considered one of the main and important issues of the patient safety approximately all hospitals sterilized their ICU through different methods of sterilization but there is no isolation for cases that need isolation.

7. Recommendation

This research recommends that:

Patient safety in ICU is very important to delivery high quality care so it should be involved in the hospitals policy and assigned specific department of hospital like quality assurance to be responsible for monitoring patient safety.

Hospitals continuous educational program should be organize the regular lectures and workshop about pt. safety and how to manage the critically ill patients and infection prevention.

ICU staff should committed by infection prevention measures from hand washing, wearing gown, isolation, sterilization, and following the aseptic techniques in the procedures which require.

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