1. INTRODUCTION

1.1. Hospital professional staff have a duty to provide quality care while safeguarding our patients from adverse events. Medical equipment and monitoring systems are installed in clinical areas for patient management and monitoring. Such devices and equipment's are with alarm systems that are triggered by physiological changes in the patient, by variations in measured parameters, or by system problems to ensure Patient Safety.

1.2. Clinical Alarm Management Program is defined as the process to manage clinical alarms and promote the monitoring of patients through safe use and response in a systematic, safe & coordinated approach to clinical alarm.

1.3. Team drawing its members from Nursing, Adult Critical Care, Pediatric Critical Care, Neonatal Critical Care, Adult Respiratory Care, Pediatric Respiratory Care, Rapid Response Team (Adult & Pediatric), Emergency Department (Adult & Pediatric), Anesthesia, Hemodialysis and Biomedical Engineering, will oversee the current implementation and future development of this program.

2. PURPOSE:

This policy aims to provide standardized guidance for the management of clinical alarms to include alarm settings, response, who has the authority to adjust the alarm default settings, and the preventive maintenance required.

3. APPLICABILITY:

This program policy applied to all patients undergoing continuous monitoring by all types of clinical monitors or medical equipment equipped with alarm system in all clinical areas.

4. DEFINITION OF TERMS:

4.1. **Clinical Alarm:** includes all patient physiologic monitoring and patient care equipment alarms (i.e., cardiac monitor alarms, fetal monitors, apnea alarms, infusion pump alarms, ventilator alarms, pulse oximeters, and emergency assistance alarms). Alarm systems that

are either built-in or attached to medical equipment and monitoring systems, and that are triggered by physiological changes in the patient, by variations in measured parameters, or by system problems. These include devices that are owned by the hospital and Demo devices deployed in clinical areas.

4.2. **Clinical Alarm System Management Program:** a program that oversees recommendations related to clinical alarm systems and implements risk reduction strategies related to clinical alarms. This program is developed, implemented, and Team.

4.3. **Physiological Alarms:** alarms that occur when a bodily function (e.g., heart rate, blood pressure, respiration rate) is outside the pre-set parameters that define the "normal" range for that function.

4.4. **Technical Alarms:** occur when the alarm is related to the function of the monitoring equipment, rather than to a physiological event. Examples include a poor signal, an artifact in the signal, a change in position by the patient, or a "leads off" alarm in which an electrode has become unattached.

4.5. **Actionable Alarms:** alarms that require a timely response, and potentially some type of therapeutic intervention, to avoid adverse effect. We measured response time to alarms occurring while there were no clinicians in the patient's room or at the bedside.

4.6. **Non-actionable Alarms:** true alarms that do not require therapeutic intervention.

4.7. **False Alarm:** alarms due to the transmission of misinformation, such as artifacts related to patient movement or incorrect lead placement.

4.8. **Nuisance Alarms:** High occurrence of non-actionable alarms that become annoyance to staff and distract from patient care, leading to alarm fatigue.

4.9. **Alarm Fatigue:** The psychological effect produced by too many alarms occurring in a clinical environment, causing clinicians to miss true clinically significant alarms, occurs when one is exposed to a large number of frequent alarms and consequently becomes desensitized to them causing longer response times or missing important alarms.

4.10. **Alarm Hazards:** originate from the plethora of medical devices with their unique characteristics that are coordinated in the clinical environment.

4.11. **Alarm Silence:** Temporarily or permanently, switch off alarm generated in alarm settings.

4.12. **Alarm Disable:** turning off the medical equipment alarm function or patient monitor so no alarms are triggered at all.

4.13. **Alarm Set:** designed to generate alarm signals and to warn the operator of hazards to the patient or operator due to the medical equipment or medical electrical system.

4.14. **Default Parameters:** one of a set of measurable factors that define a system, reviewed by designated qualified healthcare provider and approved by the program committee.

4.15. **Upper Value:** the highest value in a standard range of value.

4.16. **Lower Value:** the lowest value in a standard range of value.

4.17. **Qualified Health Care Professional**: health care workers that are competent in the management of clinical alarm systems, (for example physicians, nurses, pharmacist, Physical Therapist (PT), Occupational Therapist (OT), Respiratory Care Practitioner (RCP) and is engaged in the provision of care, treatment, or services as defined by their job description.

4.18. **Periodic Preventive Maintenance (PPM):** a scheduled maintenance routine, set out to ensure machinery, services, and equipment are all maintained at regular intervals.

4.19. **CPAP:** Continuous Positive Airway Pressure

4.20. **BiPAP:** Bi-level Positive Airway Pressure

4.21. **CRRT:** Continues Renal Replacement Therapy

4.22. **AED:** Automated External Defibrillator

4.23. **RCP:** Respiratory Care Practitioner

4.24. **AAMI:** Association for the Advancement of Medical Instrumentation.

4.25. **ECRI:** Emergency Care Research Institute.

4.26. **JCI:** Joint Commission International

5. POLICY:

5.1. PSMMC Leadership establishes Clinical Alarm System Management Program as continuous quality improvement and patient safety project.

5.1.1. The Team members are from Nursing, Adult Critical Care, Pediatric Critical Care, Neonatal Critical Care, Adult Respiratory Care, Pediatric Respiratory Care, Rapid

Response Team (Adult & Pediatric), Emergency Department (Adult & Pediatric), Anesthesia, Hemodialysis, Biomedical Engineering and Facilities Management & Safety.

5.1.2. Team members will meet on a regular basis to review and refine internal processes related to clinical alarm system management & safety.

5.1.3. Both internal and external data will be utilized to assist team members with decision making regarding best practices associated with clinical alarm safety.

5.2. Identify the most important alarm signals to manage based on risk assessment tool covering the following:

5.2.1. With input from the medical and clinical staff, all medical equipment with clinical alarms was inventoried in 2021 using a risk assessment tool that considered the severity and probability of an appropriate response by staff to a clinical alarm.

5.2.2. Using data obtained via literature searches, internal incident reports, vendor-supported recommendations, best practice, and risk assessment tool that considered the severity & probability the committee sets priority to patient safety providing the level of oversight/response based on the following risk levels:

5.2.2.1. Level A = High priority: could result in death if unattended.

5.2.2.2. Level B = Medium priority: could lead to unintended consequences if Unattended.

5.2.2.3. Level C = Low priority: little risk if unattended.

5.2.3. Refer to Appendices (A1, A2, B, C)

5.3. It is the responsibility of the clinical staff members to ensure that alarm systems are used appropriately and safely, and that sound levels are sufficient to notify staff in the event of an alarm.

5.4. Healthcare providers to follow the Clinical Alarm System Management Program. Recommendations related to proper management of the selected devices as stated in Appendix (D & E)

5.5. The importance of clinical judgment must be considered when adjusting alarm settings that go beyond recommended parameter settings. Qualified healthcare providers (i.e.,

Respiratory Practitioner, Nursing Staff, etc.) will use clinical judgment when discovering individual alarm settings that keep the patient safe and takes into consideration reducing the rate of 'false-alarms' to noise and promote healing with a quiet environment.

5.6. Qualified healthcare providers will work collaboratively with the physicians to set and change clinical alarms.

5.7. Qualified healthcare providers must consult with a physician and obtain an order when alarm parameters are adjusted outside of established default parameters. Order must be documented in physicians' orders sheet as per PSMMC policy and regulation. Refer to Appendix (D, E, & F)

5.8. Suspending or silencing alarms can be ONLY used temporarily to assess the patient's condition, prior to patient manipulation, or while assessing the setting of the alarm.

5.9. A clinical alarm can only be discontinued based on physician's order with clear documentation of the indication of alarm discontinuation.

5.10. Qualified healthcare providers must include modifications made to the alarm settings in their handovers if changes were made to the alarm setting outside of the default parameters.

5.11. Qualified healthcare providers must avoid setting alarm limits that are too narrow or not tailored to the patient condition and limit the parameters to actionable levels for each patient to minimize non-actionable "nuisance" alarms.

5.12. For alarms that are an integral part of a patient care device, the user must ensure that the alarms are set appropriately and functioning correctly before each use.

5.13. When a physician performs any clinical alarm changes, the physician must document it on the patient's order sheet. The physician must inform the primary nurse and the nurse in charge verbally as well to ensure timely adjustment of the parameters to minimize non-actionable "nuisance" alarms.

5.14. The sound quality/acoustics at the patient care areas should allow critical alarm signals to be audible. Ensure that all alarm systems/devices are audible especially in high volume areas, paying close attention to the alarm signal of patients situated away from the nurses' station or in isolation rooms.

5.15. At no time shall any healthcare provider bypass, disable, shut off, or adjust medical equipment alarm volumes to a level that cannot be readily heard when the alarm activates. Alarm may only be disabled when the patient is no longer receiving care in response to the alarm such as withdrawal of life support and patients with "Do Not Resuscitate" (DNR) status.

5.16. Default built-in alarm system settings are approved and authorized for application in by Clinical Alarms Systems Management Committee, and the equipment are programmed by biomedical staff or manufacturer's representative.

5.17. The hospital through its Bio Medical department develops and maintains a PPM (Periodic Preventive Maintenance) calendar all year round for all equipment under Clinical Alarm Systems Management Program as per PSMMC policy and regulation.

5.18. Unexplained or "nuisance" alarms may be indicative of equipment failure, the facility/unit staff member and/or medical staff member identifying the nuisance must replace the machine at the patient bedside and report it to the Biomedical department for replacement/ repair as per PSMMC related policy & regulation.

5.19. Qualified healthcare providers are educated about the purpose and proper operation of alarm systems for which they are responsible.

5.20. Biomed / manufacture representative on the processes for safe alarm management and troubleshooting must train all healthcare providers working in clinical areas.

5.20.1. Training on new alarm medical devices and updates to existing alarming medical devices, is mandatory.

5.20.2. Bio Medical Engineering should arrange a training session through its staff members or by the manufacturer's representatives.

5.21. Qualified healthcare providers handling clinical alarms are periodically updated of changes in the Clinical Alarm Systems program, by the committee, will be disseminated and communicated to staff via email, newsletters, and directly from managers.

5.22. Instances of non-compliance to safe clinical alarm use or any patient safety event that occurred related to clinical alarms are reported via the Incident Reporting System within 24 hours of their occurrences.

5.23. Data of non-compliance of safe use of clinical alarms and Incident Reports about clinical alarms are shared with Clinical Alarm System Management Program by Risk Management division, to identify and reduce risk factors that could impact patient care, share knowledge to clinical areas, recommend actions and evaluate the effectiveness of improvement.

5.24. Information about alarm related incidents, prevention strategies, and lessons learned should be shared with all stakeholders to improve practices and develop quality improvement initiatives.

6. PROCEDURES

6.1. When using a medical device with clinical alarm:

6.1.1. Qualified healthcare provider must indicate the frequency of monitoring in patient's medical record.

6.1.2. The physician must indicate the acceptable parameters for the alarm setting, if it falls out of the default settings, in physician order sheet, with clear documentation of the indication for deviation from the default.

6.1.3. The Health care provider must set alarms to recognize the potential risk of patient harm while limiting the potential for non-actionable "nuisance" alarms.

6.1.4. Qualified Health care practitioner based on physician's orders may only do alterations to parameters. The default settings should be followed if no specific order was entered in the physician's order sheet.

6.1.5. Alarm parameters may be adjusted as per the physician's order.

6.2. All Nursing staffs (e.g. Registered Nurses, Staff Midwives, Dialysis Technician), RCP, Anesthesia Care Practitioner, and other allied qualified health care practitioners:

6.2.1. Must ensure the readiness of the medical equipment at every shift, which includes inspecting, checking, and maintaining alarm equipped devices to provide accurate and appropriate alarm settings, proper operation, and detectability of alarm signals.

6.2.2. Check the PPM tag on the equipments/machines if it is updated.

6.2.3. Check individual alarm signals for accurate settings and volume prior each patient use and start of shift.

6.2.4. If a patient alarm is not working properly, the equipment should be replaced with a properly functioning one.

6.2.5. Ensure that all alarms are set to activate at appropriate settings for each patient's condition and are sufficiently audible with respect to Distances and competing noise within the unit.

6.2.6. Staff shall not bypass, shut off, or adjust alarm volumes to a level that cannot be readily heard when the alarm activates. Bypass of an alarm function is reported as an Incident Report.

6.2.7. Hospital staff trained to treat the patient must respond to alarms.

6.2.8. Reset parameters outside of the default settings according to the physician's order must be reviewed at least every 24 hours and documented in handovers.

6.2.9. Complete the daily checklist to ensure optimal functionality of the Medical machine.

6.2.10. Nursing/RCP, as applicable, shall ensure damp dusting/ clean machine daily prior to use.

6.2.11. Educate the patient, family members, watchers, and visitors about the alarms to avoid panic and in case of any event immediately inform the nursing station. All events must be documented in patient's medical records.

6.3. Respiratory Care Practitioners (RCPs):

6.3.1. Shall set the ventilator settings according to PSMMC approved policy and regulations; refer to Appendix (D).

6.3.2. Ventilator's setting may be adjusted above or below these recommended settings after reviewing physician order and considering patient specific condition.

6.3.3. All ventilator alarms will be checked by the in-coming shift Respiratory Therapist and following any patient transport.

6.3.4. Ventilator alarms may be adjusted above or below these recommended settings by physician order after considering patient-specific criteria.

6.4. Alarm failures and Alarm related incidents:

6.4.1. The Charge Nurse must remove the equipment to avoid any incident report.

6.4.2. The Charge Nurse or designee must generate a work order for Bio medical department.

6.4.3. Charge Nurse or designee must place a copy of work and paste a sign of "Out of Order" on the equipment to prevent any further use.

6.4.4. An Incident Report, indicating any event occurred during patient monitoring or equipment failure due to alarm system, which caused or may have caused at death or serious injury, serious illness or material change in the plan of care, should be reported within 24 hours.

6.4.5. Unexplained or nuisance alarm are indicative of equipment failure, and the hospital staff member identifying the nuisance must report them to the Biomedical department.

6.4.6. Hospital staff member shall not bypass alarm functions. Any bypass of alarm functions must be reported.

6.5. For more detailed instruction, refer to the following appendices:

6.5.1. Appendix C: Clinical Alarm Inventory at PSMMC 2021 – 3 pages

6.5.2. Appendix D: Clinical Alarm Devices Management 2021 – 5 pages

6.5.3. Appendix E: Clinical Alarm Default Parameters Settings 2021 – 4 pages

6.5.4. Appendix F: Clinical Alarm System Management Pathway – 2 pages

6.6. Staff education:

6.6.1. All healthcare providers in PSMMC dealing in clinical alarms must be educated and trained, for the purpose and proper operations of the Alarm system, by the Biomedical Engineering department and /or Manufacture Representative.

6.6.1.1. For nursing staff competency of Clinical Alarm System Management is required.

6.6.2. Training/education for certain systems has to be renewed on periodic basis as per recommendation of clinical alarm program or relevant stakeholders. By the Bio Medical Engineering.

7. REFERENCES:

7.1. JCIA 7th edition

7.2. Saudi Central Board for Accreditation for Healthcare Institutions, 3'" Edition

7.3. AAMI Foundation clinical alarm compendium, 2015 – 2020 (www.aamifoundation.org/coalitions/clinical-alarm-systems.)

7.4. Physiologic Monitoring Alarm Management: Helpful Resources from ECRI 2021.

7.5. Clinical Alarms, ECRI 2020.

8. APPENDICES:

8.1. Appendix A1: Committee Worksheets 1 – 2 pages

8.2. Appendix A2: Committee Worksheets 2

8.3. Appendix B: Identified Devices included in Clinical Alarm System Management Program 2021

8.4. Appendix C: Clinical Alarm Inventory at PSMMC 2021 – 3 pages

8.5. Appendix D: Clinical Alarm Devices Management 2021 – 5 pages

8.6. Appendix E: Clinical Alarm Default Parameters Settings 2021 – 3 pages

8.7. Appendix F: Clinical Alarm System Management Pathway – 2 pages

9. CONTRIBUTING DEPARTMENT(S):

Clinical Alarm System Management Program Committee.

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Appendix A1:

Team Worksheets, Adapted based on AAMI, ECRI, Sentinel Event Alert 50 & JCI recommendations & standards.

Worksheet 1

A	**Name of equipment with alarm:**			**Comments**
1	Is there a risk to patients if the alarm signal is not attended to or if it malfunctions?	Yes	No	
2	Is the alarm needed?	Yes	No	
3	Does the alarm unnecessarily contribute to alarm noise or alarm fatigue?	Yes	No	
4	Is there a potential for patient harm based on internal incident history?	Yes	No	
5	Are there best practices and/or guidelines available for review?	Yes	No	
6	Based on 1-5 above is this an important alarm signal to manage?	Yes	No	
B	**If YES to A6, establish policies and procedures related to the following:**			
		Reference policy(s) and best practice/guidelines		
1	Clinically appropriate settings for alarm signals			
2	When alarm signals can be disabled			
3	When alarm parameters can be changed			
4	Who in the organization has the authority to change alarm parameters			
5	Who in the organization has the authority to set alarm parameters to "off"			
6	Process for monitoring alarm signals			
7	Process for responding to alarm signals			
8	Checking individual alarm signals for accurate settings			
9	Checking individual alarm signals for proper operation			
10	Checking individual alarm signals for detectability			
C	**Developing Policies and Procedures & Education**	**Who**		**Date**
1	Responsible person/committee assigned to the development of policies and procedures & date for			

	completion		
2	Responsible person/committee assigned to educate staff and licensed independent practitioners about the purpose and proper operation of alarm systems for which they are responsible and date for completion		
D	**Related to B 1-10, ensure that the education, training, and competence have been demonstrated during orientation and periodically.**	**Who**	**Date**
1	Responsible person/committee assigned to review process and sample files/records for documents & date for completion.		
Notes of discussion by and person/committee assigned for any follow up.			

E	**Once follow-up has been completed and based on update, review the criteria, again respond to the questions:**			**Comments**
1	Is there a risk to patients if the alarm signal is not attended to or if it malfunctions?	Yes	No	
2	Is the alarm needed?	Yes	No	
3	Does the alarm unnecessarily contribute to alarm noise or alarm fatigue?	Yes	No	
4	Is there a potential for patient harm based on internal incident history?	Yes	No	

Appendix A2:

Team Worksheets, Adapted based on AAMI, ECRI, Sentinel Event Alert 50 & JCI recommendations & standards.

Worksheet 2

Name of equipment with alarm: Based on **SEA #50** have the following been established		**Yes**	**No**	**N/A**
Actions Required JCI recommendations and potential strategies for improvement The first five correspond to recommendations made by both the Association for the Advancement of Medical Instrumentation (AAMI) and ECRI Institute. *Note: For details, see the AAMI and ECRI Institute websites.*				
1. Has Leadership ensured that there is a process in place for safe alarm management and response in high-risk areas (as identified by the organization)?				
2. Will this equipment be placed on the inventory of alarm-equipped medical devices used in high-risk areas and for high-risk clinical conditions?				
2A. If yes, have default alarm settings and the limits been established as appropriate for each care area?				
3. If identified as an alarm-equipped medical device used in high-risk areas and for high-risk clinical conditions have alarm settings been identified, including identification of situations when alarm signals are not clinically necessary?				
4. If identified as an alarm-equipped medical device used in high-risk areas and for high-risk clinical conditions have guidelines been established for tailoring alarm settings and limits for individual patients?				
4A. The guidelines should address situations when can be limits modified to minimize alarm signals and the extent to which alarms can be modified to minimize alarm signals.				
5. Have processes been established to inspect, check, and maintain the alarm-equipped device to provide for accurate and appropriate alarm settings, proper operation, and detectability?				
5A. Has the frequency been based on criteria such as manufacturers' recommendations, risk levels, and current experience?				
Training and education				
6. Have all members of the clinical care team (as defined by the organization) been provided with training on the organization's process for safe alarm management and response in high-risk areas (as identified by the organization), and on the safe use of the alarmed medical devices on which they rely. (Also, are they provided				

with ongoing training on new alarmed medical devices and updates to alarmed medical devices, and ensure that new members of the clinical care team receive training on the alarmed medical devices on which they rely?)			
Equipment and physical environment			
7. Has a process been established to help reduce nuisance alarm signals such as to change single-use sensors (for example, ECG leads) according to manufacturer's recommendations, unless contraindicated?			
8. Has the area been assessed as to whether the acoustics in patient care areas allow critical alarm signals to be audible?			
Leadership and organizational planning			
9. Has the organization re-establish priorities for the adoption of alarm technology; the priority-setting process should drive technology adoption rather than allowing technology to drive the process?			
10. Has the organization established a cross-disciplinary team that includes representation from clinicians, clinical engineering, information technology, and risk management, to address alarm safety and the potential impact of alarm fatigue in all patient care areas?			
11. Established a process for continual improvement and constant optimizing of alarm system policies and configurations?			
12. Reviewed trends and patterns in alarm-related events to identify opportunities for improving alarm use?			
13. Implemented an alarm system management policy, including the periodic review of alarm coverage processes and systems, and the development of realistic, implementable strategies to address vulnerabilities?			
14. Does the organization share information about alarm-related incidents, prevention strategies, and lessons learned with appropriate organizations such as AAMI, ECRI Institute, and JCI?			

Appendix B: Identified Devices included in Clinical Alarm System Management Program 2021

1 All devices with monitors of patients' vital signs of all kinds (including bedside patient monitors)

2 Pumps:

- 2.1 Infusion pumps
- 2.2 Syringe pumps

3 Ventilators:

- 3.1 Critical Care Ventilators
- 3.2 Transport Ventilators
- 3.3 BiPAP Machines
- 3.4 CPAP Machines
- 3.5 Long-term/Home-care Ventilators

4 High Flow Nasal Cannula Delivery Machine

5 Active Humidifier / CPAP Humidifier

6 Nitric Oxide Delivery Systems

7 Anesthesia Machines

8 Infant incubators

9 Warmers

10 Pulse oximeters

11 Apnea monitors

12 Transcutaneous Sleep Monitors

13 End-tidal CO2 monitors

14 Dialysis machines (CRRT, peritoneal dialysis, hemodialysis)

15 Fetal monitors

16 ECMO Machine

Appendix C: Clinical Alarm Inventory at PSMMC 2021 (1 of 3)

Clinical Equipment Alarms	Central Monitor Y or N	Priority A-Highest; could result in death if unattended. B- High priority; may lead to unintended consequence if unattended. C- Low priority; little risk if unattended.	Risk: Level of Oversight needed A-High/B-Moderate/C-Low	Alarms are set by end users Y or N	Level of oversight typically available	PPM Schedule	Adult ICUs	Adult Long Stay Unit	PICU	PLSU	NICU	L&D	Adult ER	Pediatric ER	Operating Rooms	Remote Area (Endoscopy, Radiology/MRI)	Urology	Endoscopy	Radiology/MRI	Adult Wards	Pediatric Wards	Dialysis	Lab, Blood Bank	Patient Transport
VENTILATOR ADULT & PEDIATRIC	N	A	A	Y	Q3 to Q4	6M	X	X	X	X	X		X	X							X				
VENTILATOR TRANSPORT ADULT & PEDIATRIC	N	A	A	Y	Q4 & PRN	6M	X	X	X	X	X	X	X	X						X	X				X
BIPAP/CPAP MACHINE	N	A	A	Y	Q3 to Q6	6M	X	X	X	X	X			X							X				
HIGH FREQUENCY A3000 & B3000 ADULT & PEDIATRIC	N	A	A	Y	Q3 to Q4	6M	X	X	X	X	X		X												
NITRIC OXIDE	N	B	B	Y	Q3 to Q4	6M	X	X	X	X	X			X											
HIGH FLOW NC MACHINE	N	A	A	N	Q3 to Q6	6M	X	X	X	X	X		X	X							X				
ACTIVE HUMIDIFIER	N	B	B	N	Q4 to Q6	6M	X	X	X	X	X		X	X							X				
VENTILATOR NEONATAL	N	A	A	Y	Q4 to Q7	6M					X														
VENTILATOR TRANSPORT NEONATAL	N	A	A	Y	Q4 to Q8	6M					X	X													X
Anesthesia machines	N	A	A	Y	Q4	6M									X	X									
Infusion Pumps (IV, PCA, syringe ,or epidural)	N	A	B	Y	Q4	6M									X	X									
B-Braun	N	A	A	Y	Q4	6M									X	X									
Fluid Warmer	N	A	B	Y	Q4	6M									X	X									
Bair Hugger™	N	A	B	Y	Q4	6M									X	X									
Video Larengoscopy (C-Mac, McGrath, GlideScope)	N	A	A	Y	Q4	6M									X	X									
Ultrasound	N	B	B	Y	Q4	6M									X	X									
NeuroTherm	N	A	A	Y	Q4	6M									X	X									
STORZ	N	A	A	Y	Q4	6M									X	X									
Halyard Cooled Radiofrequency	N	A	B	Y	Q4	6M									X	X									
DLAB Thermo Machine	N	A	B	Y	Q4	6M									X	X									
Blood Bank Refridgerators/Freezers	N	B	B	Y	Q4	6M									X	X									
Infusion Pump	N	A	B	Y	Q1 to Q2	6M	X	X	X	X	X	X	X	X	X			X	X			X			

Appendix C: Clinical Alarm Inventory at PSMMC 2021 (2 of 3)

Clinical Equipment Alarms	Central Monitor Y or N	Priority A-Highest; could result in death if unattended. B-High priority; may lead to unintended consequence if unattended. C- Low priority; little risk if unattended.	Risk: Level of Oversight needed A-High/B-Moderate/C-Low	Alarms are set by end users Y or N	Level of oversight typically available	PPM Schedule	Adult ICUs	Adult Long Stay Unit	PICU	PLSU	NICU	L&D	Adult ER	Pediatric ER	Operating Rooms	Remote Area (Endoscopy, Radiology/MRI)	Urology	Endoscopy	Radiology/MRI	Adult Wards	Pediatric Wards	Dialysis	Lab, Blood Bank	Patient Transport
Syringe Pumps	N	A	B	Y	Q1 to Q2	6M	X	X	X	X	X	X	X	X	X			X	X			X			
Thermometer	N	B	A	Y	Q4	6M	X	X	X	X	X	X						X	X			X			
Apnea Monitor	N	A	A	Y	Q1	6M			X													X			
Infant Warmer	N	B	B	Y	Q1	6M			X																
Infant Resuscitaire	N	B	B	Y	Q1	6M						X													
Cardiotocograph Machine	N	A	A	Y	Q1	6M							X												
Defibrillator	N	A	A	Y	Q1	6M	X	X	X	X	X	X	X	X	X			X	X			X	X		
Cardiac Monitor	N	A	A	Y	Q1 to Q4	6M	X	X	X	X	X	X	X	X	X				X						
Vital Sign Monitor	N	A	A	Y	Q4	6M		X	X	X		X	X	X	X			X	X			X			
Pulse Oximeter	N	A	A	Y	Q4	6M	X	X	X	X	X	X	X	X	X			X				X			
Hilrom Bed	N	C	C	Y	Q6	6M	X	X	X	X	X	X	X	X	X			X				X			
DVT Machine	N	B	B	Y	Q4	6M	X	X	X	X	X	X	X	X	X			X							
Infant Incubator (Regular)	N	B	B	Y	Q4	6M					X														
Infant Incubator (Omnibed)	N	B	B	Y	Q4	6M						X													
Transport Incubator	N	B	B	Y	Q1	6M						X	X												
Transport Portable Monitor	N	A	A	Y	Q1	6M						X													
Syringe Infusion Pump (small volume 10mls)	N	A	B	Y	Q1	6M						X													
Portable Cardiac Monitor	N	A	A	Y	Q1	6M	X	X						X											
Warming Cabinet	N	C	C	Y	Q4	6M								X	X										
Medication Fridge	N	B	B	Y	Q6	6M		X	X	X				X	X								X		
CRRT Machine	N	A	A	Y	Q4	6M	X																		
Volume View Machine	N	A	A	Y	Q4	6M	X																		

Appendix C: Clinical Alarm Inventory at PSMMC 2021 (3 of 3)

Clinical Equipment Alarms	Central Monitor Y or N Priority A-Highest; could result in death if unattended. B-High priority; may lead to unintended consequence if unattended. C-Low priority; little risk if unattended.	Risk: Level of Oversight needed A-High/B-Moderate/C-Low	Alarms are set by end users Y or N	Level of oversight typically available	PPM Schedule	Adult ICUs	Adult Long Stay Unit	PICU	PLSU	NICU	L&D	Adult ER	Pediatric ER	Operating Rooms	Remote Area (Endoscopy, Radiology/MRI)	Urology	Endoscopy	Radiology/MRI	Adult Wards	Pediatric Wards	Dialysis	Lab, Blood Bank	Patient Transport
Intermittent Pneumatic Compression	N	A	A	Y	QH	6M	X																	
ECMO	N	A	A	Y	QH	6M	X																	
Liver Dialysis Machine	N	A	A	Y	QH	6M	X									X								
Bair Hugger - warming machine	N	A	B	Y	QH	6M	X								X									

Appendix D: Clinical Alarm Devices Management 2021 (1of 5)

Type of Equipment	Recommended appropriatesettings for the alarm signals?	Who has the authority to set default alarm parameters?	When should alarm parameters be changed?	Who has authority to change alarm parameters?	When should alarm parameters be disabled?
Mechanical Ventilator/Transport Ventilator Adult & Pediatric	Customize to individualize patient: • Upper Pressure limit: + 5-10 of PIP, • PEEP 2 to3 above set PEEP • Respiratory Rate: + or - 10, • Apnea: 10 to 20 seconds, • Minute Ventilation: 25% to 50%	Trained and competent RCP	According to setting changes accepted by physician	Trained and competent RCP	Should not be disabled while in use
BiPAP/CPAP Pediatric & Adult	Customize to individualize patient: • High Inspiratory Pressure: 30-40 cmH2O, Pedaitric 5 to 10 above IPAP • Low Inspiratory pressure: 3 below set EPAP, • Respiratory Rate: + or - 10, • Apnea: 10 to 20 seconds, • Minute Ventilation: 25% to 50% from measured MV, • VT: + or - 25% from measured volume, • Leak compensation 70 L/M or set auto compensation	Trained and competent RCP	According to setting changes accepted by physician	Trained and competent RCP	Should not be disabled while in use
High Frequency Oscillator	Adult High pressure 10 cmH2O > mPAW Low pressure 10 cmH2O < mPAW Pedaitric High pressure 5 cmH2O > mPAW Low pressure 5 cmH2O < mPAW	Trained and competent RCP	According to setting changes accepted by physician	Trained and competent RCP	Should not be disabled while in use

Appendix D: Clinical Alarm Devices Management 2021 (2 of 5)

Type of Equipment	Recommended appropriatesettings for the alarm signals?	Who has the authority to set default alarm parameters?	When should alarm parameters be changed?	Who has authority to change alarm parameters?	When should alarm parameters be disabled?
High Flow Nasal Cannula Delivery Devices	Default alarms	None	None	None	N/A
Nitric Oxide Delivery System Adult & Pediatric	Adult High NO 5 ppm > set NO Low NO 5 ppm < set NO NO2 3 to 5 ppm Pediatric High NO 5 ppm > set NO Low NO 5 ppm < set NO NO2 2 to 3 ppm	Trained and competent RCP	According to setting changes accepted by physician	Trained and competent RCP	Should not be disabled while in use
Active Humidifier Adult & Pediatric	32-39 Celsius Default if Auto Alarm Set	Trained and competent RCP	According to setting changes accepted by physician	Trained and competent RCP	Should not be disabled while in use

Appendix D: Clinical Alarm Devices Management 2021 (3 of 5)

Type of Equipment	Recommended appropriatesettings for the alarm signals?	Who has the authority to set default alarm parameters?	When should alarm parameters be changed?	Who has authority to change alarm parameters?	When should alarm parameters be disabled?
CTG MACHINES	FETAL HEART RATES FROM 110-160 BPM, SPo2 of the Mother BELOW 95-100%, VITAL SIGNED SBP- (H)160mmHg - (L)90mmHg DBP (H)90mmHg - (L) 50mmHg MAP (H) 120mmHg - (L) 60 mmHg, HR (H) 120b/min - (L) 45 b/min RR (H) 30 b/min - (L) 8 b/min	Trained and competent Staff Nurse	According to setting changes accepted by physician	Trained and competent Staff Nurse	Should not be disabled while in use
Apnea Monitor	Neonatal- >10-12 seconds Adults - >20 seconds Pediatrics - >15 seconds	Trained and competent Sleep Technologist	Per physician order	Trained and competent Sleep technologist	Should not be disabled while in use
Transcutaneous Sleep Monitors	Norm: 35-45 Default alarm: >55	Trained and competent Sleep Technologist	Per physician order	Trained and competent Sleep technologist	Should not be disabled while in use
Hemodialysis Machines (Adult and Pediatrics)	Temperature High > 75 mm Hg Low < - 50 mm Hg Venus Pressure High > 200 mm Hg Low < 90 mm Hg	Trained Dialysis nurse	N/A	Physician	Should not be disabled while in use
Peritoneal Dialysis Machines (Adult and Pediatrics)	Low drain volume < 85 % of the filled volume	Trained and competent nursing staff	N/A	Physician	Should not be disabled while in use

Appendix D: Clinical Alarm Devices Management 2021 (4 of 5)

Type of Equipment	Recommended appropriatesettings for the alarm signals?	Who has the authority to set default alarm parameters?	When should alarm parameters be changed?	Who has authority to change alarm parameters?	When should alarm parameters be disabled?
CRRT machine (Adult)	High pressure: > 180 mmHg Low Pressure: <60 mmHg	Trained and competent nursing staff	Per protocol and/or Physician	Trained and competent nursing staff	Should not be disabled while in use
CRRT machine (Pediatrics)	High pressure: > 180 mmHg Low Pressure: <60 mmHg	Trained Dialysis nurse	N/A	Trained Dialysis nurse	Should not be disabled while in use
Infusion Pump/Syringe Pump	Adult Pressure Mode=up to 300 mmHg Pediatrics = up to 75 mmHg Neonate peripheral iv line = up to 75 mmHg Neonate PICC = up to 150 mmHg	Trained and competent nursing staff	Should be checked before starting any medication and will be adjusted according to the age, cannula/ CL	Trained nursing staff according to documented Physician order	Should not be disabled while in use
End Tidal CO2	Adult (L) 30 cmH2O, (H) 55 cmH2O Pediatric (L) 30 cmH2O, (H) 50 cmH2O	Trained and competent RCP	Trained and competent RCP with physician approval	Trained and competent RCP	Should not be disabled while in use
Vital signs monitors (with or without cardiac monitors) (Adult, Pediatric/ Neonates)	Refer to Appendix E	Trained staff	Per physician order	Trained nursing staff	Should not be disabled while in use
Pulse oximeters (Adult, Pediatric/ Neonates)	Refer to Appendix E	Trained staff	Per physician order	Trained nursing staff	Should not be disabled while in use

Appendix D: Clinical Alarm Devices Management 2021 (5 of 5)

Type of Equipment	Recommended appropriatesettings for the alarm signals?	Who has the authority to set default alarm parameters?	When should alarm parameters be changed?	Who has authority to change alarm parameters?	When should alarm parameters be disabled?
Infant Warmers/ Overhead warmer	For the infant warmer - pre heat setting IS 100% then will be wean gradually by 5% according to baby temperature Temperature < 36.5°C or >37.5°C,	Trained and competent nursing staff	Per physician order	Trained and competent nursing staff	Should not be disabled while in use
Incubator (regular isollette and omnibed) (Neonates)/ Transport incubator (Neonates)	Provide the gestational age of the baby, post-natal age, and weight and the device built-in system will adjust the temperature of the incubator ex. 34 weeks, day 1, 1700 will have a built-in recommended range=34.5-35.5C Default Temp: 33-37 degrees Humidity 40% - 80% according to gestational age , weight and postnatal age	Trained and competent nursing staff	Per physician order	Trained and competent nursing staff	Should not be disabled while in use
ECMO Machine	For Adult parameters: Refer managing patient on extracorporeal membrane oxygenation (ECMO) protocol.	Perfusionist	Per physician order	Perfusionist	Should not be disabled while in use ns

ADULT MEDICAL/SURGICAL ICU / ER

Appendix E: Clinical Alarm Default Parameters Settings 2021 (1 of 3)

Heart Rate		Respiratory Rate		Oxygen Saturation	End-tidal Carbon Dioxide	
Low	High	Low	High	Low	Low	High
50	120	8	35	92	30	55
25% to 40% above and below patient norms						

Table 1. Heart Rate, Respiratory Rate, Oxygen Saturation, and End-tidal Carbon Dioxide: Default Parameter Settings by Facility, Medical/Surgical ICU

Systolic Blood Pressure		Diastolic Blood Pressure		Mean Blood Pressure	
Low	High	Low	High	Low	High
90	160	50	90	60	120
40% change	40% change	40% change	40% change	40% change	40% change

Table 2. Blood Pressure: Default Parameter Settings by Facility, Medical ICU

Heart Rate		RespiratoryRate		Oxygen Saturation	End-tidal Carbon Dioxide	
Low	High	Low	High	Low	Low	High
50	130	8	30	92	30	55
25% to 40% above and below patient norms						

Table 3. Heart Rate, Respiratory Rate, Oxygen Saturation, and End-tidal Carbon Dioxide: Default Parameter Settings

Systolic Blood Pressure		Diastolic Blood Pressure		Mean Blood Pressure	
Low	High	Low	High	Low	High
90	160	50	90	60	120
25% to 40% above and below patient norms					

Table 4. Blood Pressure, Default Parameter Settings byFacility, Emergency Department

Appendix E: Clinical Alarm Default Parameters Settings 2021 (2 of 3)

PICU/PEDs ER/NICU

Pediatric General ICU and Pediatric Emergency Department						
Parameter		Default Settings by Age Range				
		0–12 Months	1–3 Years	4–7 Years	8–14 Years	> 14 Years
Heart Rate	Low	100	80	60	60	60
	High	180	150	130	110	100
Blood Pressure	Systolic low	60	60	75	95	100
	Systolic high	105	105	110	125	130
	Diastolic low	30	30	40	45	50
	Diastolic high	65	65	75	80	85
	Mean low	30	30	40	45	50
	Mean high	105	105	110	125	130
Oxygen Saturation	Low	94	94	94	94	94
	High	100	100	100	100	100
Respiratory Rate	Low	25	20	18	14	12
	High	60	40	35	24	20

Table 5. Pediatric General ICU and Pediatric Emergency Department, Default Parameter Settings by AgeRange.

Neonatal ICU				
Parameter		Default Settings by Age Range		
		Pre-term	31–34 Weeks	35 Weeks–Term
Heart Rate	Low	99	79	79
	High	201	201	201
Blood Pressure	Systolic low	70	—	—
	Systolic high	200	—	—
	Diastolic low	40	—	—
	Diastolic high	100	—	—
	Mean low	50	25	25
	Mean high	140	—	—
Oxygen Saturation	Low	90	90	92
	High	100	100	100
Respiratory Rate	Low	20	20	20
	High	90	90	90

Table 6. Neonatal ICU, Default Parameter Settings by Age Range.

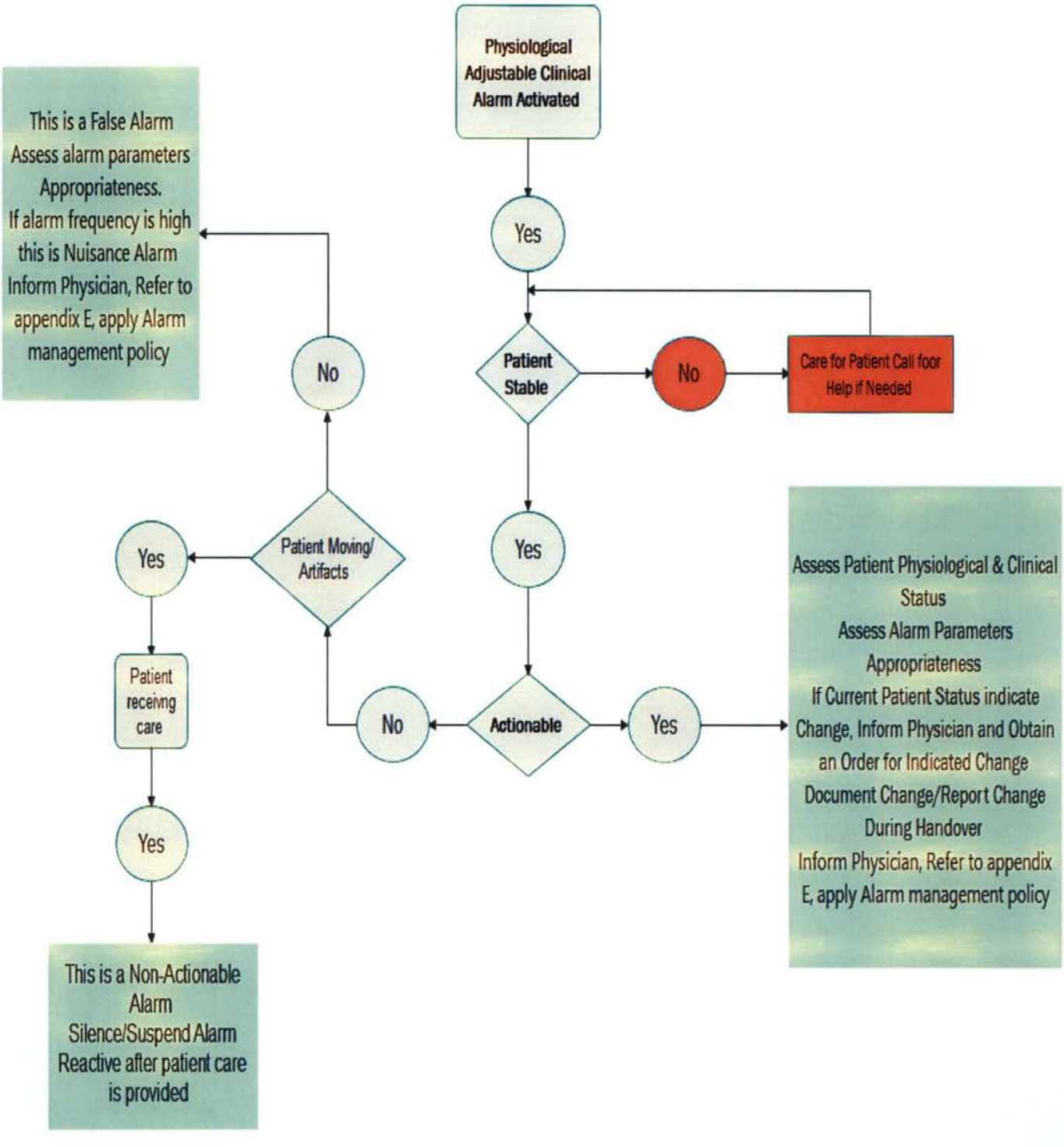
PICU/PEDs ER/NICU

Appendix E: Clinical Alarm Default Parameters Settings 2021 (3 of 3)

Neonatal ICU Age Range: ≤ 90 Days		
Parameter		Default Settings
Heart Rate	Low	90
	High	210
Blood Pressure	Systolic low	55
	Systolic high	90
	Diastolic low	20
	Diastolic high	60
	Mean low	30
	Mean high	60
Oxygen Saturation	Low	92
	High	100
Respiratory Rate	Low	20
	High	90
End-tidal Carbon Dioxide	Low	30
	High	60

Table 7. Neonatal ICU Default Parameter Settings

Appendix F: Clinical Alarm System Management Pathway (1 of 2)



Appendix F: Clinical Alarm System Management Pathway (2 of 2)