

CU 1 - CU 2 : INTRODUCTION TO CRITICAL NURSING CARE NURSING

Critical Care Nursing	Nursing for life-threatening conditions.
Dynamic Care	Handles both actual and possible serious illnesses.
Three components	Knowledge + clinical skills + caring practice.

Healthcare changes because of :

1. Globalization
- Patients traveling abroad to get affordable medical access
2. Transcultural issues
- Adjusting hospital procedures for a patient has traditional or family decision making (may iba silang paniniwala)
3. Emerging illnesses
- Monitoring or tracking new illnesses to prepare seasonal vaccines before they spread globally
4. Technological advancement
- A doctor using a video app to consult patients in rural areas (gumagamit ng mga advance tech para sa mga patient na nasa rural areas)

HISTORY OF CRITICAL CARE

1800s	Florence Nightingale separated recovery patients.
Early 1900s	First 3-bed neurosurgical ICU at Johns Hopkins.
WWII	Shock wards cared for injured patients.
1950s	Mechanical ventilation helped create dedicated ICUs.
1960s - Present	Nurses became specialized in ICU, coronary, and nephron care.

PHILIPPINE FRAMEWORK

PRC-BON	• Creates Nursing Specialty Framework. • Sets international-level specialty guidelines. • Uses Technical Working Groups (TWG).
CCNAPI	• Holistic care. • Bio-psycho-social-spiritual approach. • Protects patient identity and dignity. • Promotes prevention, risk reduction, and education.

PHILIPPINE OF CRITICAL NURSES

OPTIMAL CARE	Safe, timely, fair care.
HOLLISTIC CARE	Treat the whole person.
ADVANCED SKILLS	Use technology and knowledge.

PALLATIVE CARE	Give comfort during unavoidable death.
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CCN should be:

- ★ Patient-centered
- ★ Safe
- ★ Effective
- ★ Efficient
- ★ Timely
- ★ Equitable

SIX CORE ROLES

Researcher	Uses evidence.
Manager/Leader	Leads staff
Patient Advocate	Protects patient rights.
Care Provider	Gives direct and indirect care.
Extended Role	Performs advanced tasks under protocol.
Educator	Teaches staff and family.

EXTENDED CLINICAL SCOPE

1. Perform ABG sampling.
2. Wean ventilator.
3. Adjust IV analgesia and sedation.
4. Perform and interpret ECG.
5. Titrate central line infusions.
6. Remove epicardial wires.
7. Remove femoral sheaths.
8. Remove chest tubes.

Biglang nag-Ventricular Tachycardia ang pasyente habang wala pa ang doktor. Dahil nasa protocol, ikaw ang nagsimula ng life-saving action.

PRACTITIONER ROLE

Direct Patient Care	• Detect patient changes. • Use advanced technology. • Start nursing interventions early. • Prevent deterioration. • Coordinate with healthcare team.
Indirect Patient Care	• Explain to family. • Reduce fear. • Help family cope.

ADVANCED PRACTICE

Clinical Nurse Specialist	• Improves ICU standards. • Educates staff. • Needs Master's degree. • Needs over 3 years continuous ICU experience.
Acute Care Nurse Practitioner	• Manages complex patient care. • Uses evidence-based practice. • Needs Clinical Master's. • Needs recognized CCN training.

Note : It requires bachelor degree

CRITICAL CARE NURSE TRAINING	
1	Orientation with preceptor
2	In-service training
3	Postgraduate Master's
4	Advanced certifications

Advanced Certifications:

- ACLS
- Pediatric ACLS
- Newborn Resuscitation
- CRRT
- Advanced IV Therapy
- Stroke Nursing

ICU STANDARDS (PHILIPPINES)	
Level 1	• Immediate resuscitation. • Short-term cardio-respiratory support. • Mechanical ventilator available. • Simple invasive monitoring. • Nurse ratio 1:3.
Level 2	• General critical care. • Step-down care. • Single-organ post-op support. • Medical director available. • Nurse ratio 1:2.
Level 3	• Tertiary referral ICU. • Multi-organ failure care. • Advanced respiratory support. • Specialist available 24/7. • Nurse ratio 1:1.

CRITICAL CARE POPULATION

- More patients are 65 years and older.
- 80% have at least one chronic illness.
- 50% have at least two chronic illnesses.
- Older population means more ICU admissions.

COMMON ICU ADMISSIONS

- Respiratory failure
- Post-operative care
- Ischemic heart disease
- Sepsis
- Heart failure

CRITICAL CARE UNIT (CCU)

- Area for critically ill patients who still have a chance to recover.

PATIENT CLASSIFICATION & TRIAGE

Ward Care	• Stable patient • Normal ward care • Outreach support if needed Ex: Stable ang vital signs ng pasyente kaya sa regular ward muna siya.
Level 1: Enhanced	• Close monitoring • Basic support • One organ support • Prevent deterioration Ex: Kailangan lang bantayang mabuti ang pasyente dahil may problema sa isang organ.
Level 2 : Critical	• Two organ support • Advanced support for one organ (except advanced

	respiratory) • Extended post-op care • Complex monitoring Ex: May problema ang pasyente sa kidney at puso kaya kailangan ng mas advanced na monitoring.
Level 3 : Critical	• Advanced respiratory support • Multi-organ support • Mechanical ventilation • Severe physiological problems Ex : Naka-ventilator ang pasyente at sabay na may problema sa ibang organs kaya Level 3 care ang kailangan.

ICU MANAGEMENT PATTERNS	
Open ICU	• Many physicians • Different decisions • Possible duplicated care Ex: Iba-ibang doktor ang nagbibigay ng order kaya minsan hindi pare-pareho ang plano.
Closed ICU	• Intensivist leads • Standard protocols • Efficient care Ex : Isang intensivist ang namamahala kaya pare-pareho ang sistema.
Semi - Closed ICU	• Shared management • Intensivist + primary physician • Clear authority Ex : Magkasamang nagde-decide ang intensivist at doktor.

ICU PHYSICIAN MODELS	
Consultant Intensivist	Gives expert advice.
Full-Time Intensivist	Always involved.
Single Physician	One doctor, less coordination.
Multiple Consultant	Many specialists, less coordination.

ICU LOCATION REQUIREMENTS :

- ★ Fast transport is priority.
- ★ ICU should be near ER.
- ★ Near Operating Room.
- ★ Near Trauma Ward.
- ★ One controlled entrance.
- ★ Separate emergency exit.

ICU TRAFFIC RULES :

- ★ Separate staff routes.
- ★ Separate equipment routes.
- ★ Separate visitor routes.
- ★ Protect sterility.

BED CAPACITY

- Ideal: 8–12 beds
- Minimum: 6
- Maximum: 24
- Level III: 3–5 ICU beds per 100 hospital beds
- Overall hospital: 2–20% ICU beds
- Isolation: 1 isolation bed per ICU bed

BED SPACE & VISIBILITY

- Open ward: 150–200 sq ft
- 6 ft between beds
- Single room: 225–250 sq ft
- Glass partitions for visibility

BED UTILITIES

Medical Gas	• Oxygen: 3 outlets • Compressed Air: 2 outlets
Suction	• 3 outlets • Gastric • Tracheal • Underwater seal
Electrical	• 16 power outlets • Equipment shelf at head end • Ceiling rails for IVs and blood bags

ICU ENVIRONMENT

- Temperature: 25–27°C
- Humidity: 40–50%
- Air exchange: 6–8/hour
- Positive pressure airflow
- Filter less than 10 microns
- Adjustable lighting
- Noise reduction
- TV and clock help patient orientation

ICU MULTIDISCIPLINARY TEAM

Medical Staff	Intensivists
Nursing	ICU Nurses
Allied Health	• Respiratory Therapist • Nutritionist • Physiotherapist • Pharmacist • Medical Technologist • Phlebotomist

CRITICAL CARE EQUIPMENT

Articulate bed	Moves into different positions.
Built - in scale	Measures patient weight.
360° Access	Nurse can reach the patient from all sides.
Wheeled Base	Easy to move.

VITAL SIGNS MONITOR

Green	ECG (Heart rhythm & rate)
Blue	SpO ₂ (Oxygen level)
White	NIBP (Blood pressure)
Yellow	RESP (Breathing rate)

FLUID AND MEDICATION DELIVERY

IV Infusion pump	• Continuous flow. • High-volume IV fluids. • Used for hydration. • Used for parenteral nutrition. • Used for continuous IV therapy.
Injection (Syringe)	• Micro-precision. • Low-volume delivery.

pump	• For vasopressors. • For inotropes. • Titratable medications.
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LIFE SUPPORT EQUIPMENT

Mechanical Ventilator	• Assists or replaces breathing. • Closed breathing circuit. • Monitors lung mechanics. • Monitors airway pressure.
Defibrillator	• Rhythm monitor. • Delivers life-saving shock. • Used for Ventricular Fibrillation (VF). • Used for pulseless Ventricular Tachycardia (VT).

CRASH CART

- Emergency trolley.
- Standardized contents.
- Fast access during Code Blue.

Crash cart checks :

- Check every shift.
- Document checklist.
- Monthly expiration check.
- Keep contents standardized.
- Place in accessible area.
- Defibrillator needs routine maintenance.

Top of crash cart

Defibrillator Area

- Adult paddles.
- Pediatric paddles.
- Conductive gel.

ECG Supplies

- ECG cables.
- Electrodes.
- Recording paper.

Basic Equipment

- BP apparatus.
- Clock.
- Adult stethoscope.
- Pediatric stethoscope.
- Sharps container.
- Razor.
- ETT tape.
- Manual resuscitation bags (infant–adult).

Side & back Attachments

Side Attachments

- Oxygen cylinder.
- Pressure gauge.
- Flow meter.
- Oxygen tubing.
- Portable suction.
- Yankauer tips.

Rear Attachments

- Cardiac board.
- Resuscitation algorithms.
- Crash cart checklist.
- Code Blue record forms.

Drawer 1 : Medications	<u>Arrest & Arrhythmia Drugs</u> - Epinephrine - Amiodarone - Adenosine - Vasopressin - Norepinephrine - Verapamil - Ketamine - Magnesium Sulfate - Normal Saline Flush <u>Reversal Agents</u> - Naloxone – Opioid reversal. - Flumazenil – Benzodiazepine reversal. <u>Pre-Mixed Drugs</u> - Atropine - Calcium Chloride 10% - D50 - Adrenaline - Lidocaine - Sodium Bicarbonate - Dopamine
Drawer 2: Airway	<u>Basic Ventilation</u> - AMBU bag (BVM) - Non-rebreather mask - Nasal cannula <u>Airway Accessories</u> - Oral airways - Magill forceps - Artery forceps - Tongue depressor - Suction catheter - Lubricating jelly - NG tube - Scissors <u>Advanced Airway</u> - ET tubes - Tracheostomy tubes - Inner cannulas - Minitrach sets
Drawer 3: Vascular access	<u>Access Equipment</u> - Angiocath - IO needle - 3-lumen central line - Chest tube - Butterfly needle - Syringes (1–50 mL) - ABG kit - Scalpel <u>Preparation Items</u> - Tourniquet - Alcohol swab - Betadine - Skin disinfectant - Sterile gauze - Transparent tape - Silk suture - Cutting suture
Drawer 4 : Tubing & Fluids	<u>Tubing</u> - 3-way stopcock - Extension tubing - Macro drip set - Micro drip set - Horizon cassette - Buretrol - Blood tubing - Blood tubes - Armboard <u>Base Fluids</u> - D5W - Lactated Ringer's

	- Normal Saline
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IV - FLUIDS

D5W	- Gives free water. - Gives calories. - Preserves muscle. - Carrier for continuous IV medicines.
Lactated Ringers’s	- Isotonic fluid. - Has balanced electrolytes. - For blood loss. - For surgery. - For trauma. - For severe burns.
Normal Saline (0.9%)	- Isotonic fluid. - Expands blood volume. - For dehydration. - For wound irrigation.

Bag - Valve - Mask	- First emergency breathing support. - Gives positive pressure ventilation. - Works without external gas. - Reservoir bag can deliver nearly 100% oxygen. - Transparent mask lets nurse see secretions.
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Laryngoscope	● Hinge – Connects blade. ● Knurled Grip – Better hand grip. ● Power Unit – Powers the light.
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Macintosh Blade	● Curved blade. ● Goes into vallecula. ● Lifts epiglottis indirectly. ● Best for adults.
Miller Blade	● Straight blade. ● Touches epiglottis directly. ● Best for infants. ● Best for pediatric patients. ● Best for floppy epiglottis.

Oropharyngeal Airway (OPA)	● Holds tongue forward. ● Prevents airway blockage. ● Measure: Mouth corner → Jaw angle. ● Do not use if gag reflex is present.
Nasopharyngeal Airway (NPA)	● Keeps airway open through the nose. ● For intact gag reflex. ● For trismus. ● For facial trauma. ● Measure: Nose tip → Earlobe. ● Lubricate before insertion.
Endotracheal Tube (ET Tube)	● Stylet – Gives shape. ● Cuff – Seals trachea. ● Prevents aspiration. ● Allows mechanical ventilation. ● Pilot balloon checks cuff inflation.

NURSING PROCESS

Assessment	Collect information.
Planning	Set goals and prepare.
Implementation	Do nursing actions.
Evaluation	Check results and improve care.

Patient & Family Rapport

Ask in this order:

1. Health status
2. Present illness
3. Current treatment
4. Past medical history
5. Social history
6. Illness perception

Documentation

1. Record assessment.
2. Use paper chart or EMR.
3. Helps all healthcare workers coordinate care.

SIX FOUNDATION PRINCIPLES

Clinical Vigilance	Watch closely.
Anticipation	Prepare early.
Early Detection	Catch changes fast.
Infection Prevention	Prevent hospital infection.
Relational Care	Good communication.
Crisis Intervention	Give immediate emotional support.

INVISIBLE THREATS

Physical Protection	• Prevent hospital-acquired infection. • High risk with ventilators. • High risk with invasive lines. • High risk with antibiotics.
Emotional Protection	• ICU causes emotional stress. • Nurse acts as advocate. • Help patient express feelings. • Teach coping.

EMERGENCY CRISIS INTERVENTION

Identify & Assess	Check patient quickly.
Call for help	Activate Code Blue/RRT.
Position & ABC	Secure Airway, Breathing, Circulation.
Intervene	Give emergency treatment.
Stabilize & Record	Maintain balance and document.

ADMISSION MODELS

Priority Model	Admit based on who benefits most from ICU.
Diagnostic Model	Admit based on disease or organ affected.
Objective Criteria Model	Admit based on vital signs, labs, ECG, and other measurable findings.

ICU PRIORITY MODEL (TRIAGE)

Priority 1	• Critically ill • Hemodynamically unstable • Needs ventilator • Needs vasoactive drugs • High recovery potential • No treatment limits Examples: ★ Acute respiratory failure ★ Shock needing invasive monitoring
Priority 2	• High-risk • Currently stable • Needs continuous monitoring • May biglang lumala anytime • No treatment limits Example: ★ Chronic illness with acute severe illness
Priority 3	• Critically ill • Low recovery chance • Has treatment limits • May DNI/DNR Examples : ★ Metastatic cancer with infection ★ Cardiac tamponade ★ Severe airway obstruction
Priority 4	• Usually not for ICU • Very low risk or terminal illness • ICU Director decides if exceptional Examples : ★ Minor post-op ★ Stable low-risk patientEnd-stage terminal illness

Cardiac System	Ischemia & Infarction • Complicated MI • Unstable angina • Dysrhythmia • Hemodynamic instability • Persistent chest pain Rhythm Problems • Complex arrhythmia • Complete heart block • S/P cardiac arrest Pump Failure • Cardiogenic shock • Acute CHF with respiratory failure • Hypertensive emergency • Cardiac tamponade • Dissecting aortic aneurysm
Pulmonary System	Respiratory Escalation • Progressive respiratory deterioration • Needs specialized respiratory care • Acute respiratory failure • Needs intubation Other Cases : • Pulmonary embolism with instability • Massive hemoptysis

Neurological system	Brain Pressure - Severe head injury - Intracranial hemorrhage - Subarachnoid hemorrhage - Cerebral vasospasm Altered Mental Status - Stroke with altered mental status - Coma - Status epilepticus - CNS disorders worsening - Meningitis with respiratory compromise Brain Death - Brain-dead or possible brain-dead - Continue care while organ donation is evaluated
Drug Ingestion & Overdose	Admit if overdose plus: - Hemodynamic instability - Altered mental status - Seizure
Gastrointestinal system	- Esophageal perforation - Fulminant hepatic failure - Severe pancreatitis - Life-threatening GI bleeding
Endocrine & Metabolic	Endocrine Crisis - DKA - Thyroid Storm - Myxedema Coma - HHS - Adrenal Crisis Electrolyte Crisis - Severe sodium imbalance - Severe potassium imbalance - Severe calcium imbalance - Severe magnesium imbalance - Severe phosphorus imbalance
Surgical , Sepsis & Others	- Complex post-op care - Septic shock - Lightning injury - Near drowning - Severe hypothermia - Severe hyperthermia - Invasive hemodynamic monitoring

OBJECTIVE PARAMETER MODEL

Pillar I – Vital Signs	- HR below 40 - HR above 150 - SBP below 8MAP below 60 - DBP above 120 - RR above 35
Pillar II – Laboratory Values	Electrolytes - Na below 110 or above 170 - K below 2.0 or above 7.0 - Ca above 15 Oxygen & Acid-Base - PaO₂ below 50 - pH below 7.1 - pH above 7.7 Others - Glucose above 800

	Toxic drug level
Pillar III – Imaging	- Brain hemorrhage - Subarachnoid hemorrhage - Dissecting aortic aneurysm - Ruptured organs with instability
Pillar IV – ECG	- MI with complex arrhythmia - Sustained VT - VF - Complete heart block with instability
Pillar V – Physical Findings	Neurological - Unequal pupils - Coma - Continuous seizure Respiratory - Airway obstruction - Cyanosis Cardiovascular - Cardiac tamponade Renal - Anuria Trauma - Burns over 10% TBSA

CROSS - SYSTEM MATRIX

Cardiovascular	MAP below 60, VT/VF
Neurological	Hemorrhage, coma
Respiratory	PaO ₂ below 50, cyanosis
Renal/Metabolic	Na/K/pH extremes, glucose above 800, anuria

FUTURE HEALTH CARE DRIVERS

Healthcare Demand	- More demand - Cost-effective care - Limited government support
Workforce Shift	- Senior nurses retiring - Progressive care handles more complex patients
Nursing Mandate	- Follow evidence-based triage - Use objective assessment - Aim for best patient outcomes

Ethical - Based on right and wrong
Legal - Based on written law

ETHICS	MORALS
Study of right conduct	Beliefs learned from family, religion, and culture
Thinks about moral choices	Says what should and should not be done

Guides healthcare decisions	Shapes personal behavior
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Ethical Architecture of Critical Care

- Sa ICU, mahirap ang mga desisyon dahil limitado ang resources at kritikal ang kondisyon ng pasyente.
- Ginagamit ang 6 Ethical Principles para maiwasan ang moral distress.

Autonomy	➤ Respect the patient's right to choose. ICU Uses : • Honor advance directives. • Respect DNR. • Respect DNI. • Allow proxy decisions if patient cannot decide.
Veracity	➤ Tell the complete truth. Clinical Use : • Explain diagnosis. • Explain risks. • Explain benefits. • Give alternative options. <i>Veracity-Autonomy Engine</i> - A patient can only make a real choice if they know the truth.
Beneficence	➤ Do what is best for the patient ICU Example : Give life-saving pressors. Improve pain management.
Nonmaleficence	ICU Example : - Avoid futile invasive treatment.
Fidelity	➤ Stay loyal, trustworthy, and confidential. Three Pillars : Commitment – Keep promises. Advocacy – Speak for the patient. Confidentiality – Protect privacy.
Justice	➤ Treat everyone fairly. Care must depend on: • Clinical need • Objective criteria • Not social status • Not personal bias Time & Attention : - Divide nursing care fairly. Micro-Allocation : - Decide who gets limited equipment. Macro-Allocation: - Manage ICU beds and staffing.

Beneficence vs Autonomy

- Treatment can save life, but patient refuses.

ex :

Ayaw ng pasyente magpa-blood transfusion kahit makakatulong ito.

Fidelity vs Justice

- Helping one family too long may delay care for others.

ex :

kinakausap ng nurse ung isang pamilya habang may ibang pasyenteng kailangan ding asikasuhin.

Beneficence vs Nonmaleficence

- Balance helping with avoiding suffering.

ex :

Iniiisip ng team kung itutuloy pa ang masakit na procedure na wala nang malaking pakinabang.

End-of-Life Dignity (ACCM)

Two Main Goals:

1. Palliative Focus – Relieve pain and make dying peaceful.
2. Biological Needs – Give food, hydration, and comfort based on patient wishes.

Everyday ICU Ethical Decisions

Interventions :

- CPR decisions
- Withholding treatment
- Withdrawing treatment

Boundaries

- Futile care
- Euthanasia

Transitions

- End-of-life care
- Palliative care

Spectrum of Critical Care Intervention

1. Curative Intent - Full treatment with CPR and invasive support.
2. Re-Evaluation Phase - Check if treatment still works.
3. Palliative Intent - Focus on comfort.

CPR - Default emergency response, but should be re-evaluated.

DNR -Means no CPR.

Important:

- ➔ Not abandoning the patient.
- ➔ Focus becomes comfort.
- ➔ Protect dignity.

Withholding - Do not start treatment.

Withdrawing - Stop treatment already started.

Important: Both have equal ethical weight and follow patient autonomy and hospital policy.

Medical Futility - Treatment no longer gives reasonable benefit.

When this happens :

- Communicate openly.
- Align with patient values.
- Move toward palliative care.
- Consider treatment withdrawal.

Euthanasia - Comes from the Greek words meaning "good death." Also called "mercy killing."

Types of End-of-Life Modalities

1. Active Euthanasia - Deliberately causes death.

- 2. Passive Euthanasia - Allows death by intentionally not giving life-sustaining treatment.
- 3. Withholding/Withdrawing Treatment - Do not start or stop treatment so the natural disease continues.

Foundational Codes of Practice

ANA Ethical Code for Nurses

- Main moral guide for nurses.

HIPAA

- Protects patient privacy and medical information.

Republic Act 9173 (Philippine Nursing Act of 2002)

- Protect the public.
- Regulatory Power
- Gives the Board of Nursing authority to regulate nursing practice.

Prohibited Acts :

1. Unprofessional and unethical conduct.
2. Gross incompetence or serious ignorance.
3. Malpractice or negligence.
4. Fraud or false statements to get a license.
5. Practicing while suspended.

LEGAL RESPONSIBILITIES OF REGISTERED NURSE

Prepared Functions	Do only what you are trained to do.
Competent Practice	Perform duties correctly.
Proper Delegation	Delegate only to competent staff.
Patient Observation	Act based on patient assessment.
Know Agency Policies	Follow hospital policies.

LEGAL LIABILITY

Corporate Liability	Hospital is responsible for a safe environment and competent staff.
Vicarious Liability (Respondeat Superior)	Employer is responsible for an employee's wrongful acts done during work.
Negligent Supervision	Failure to supervise or delegate properly.
Captain of the Ship Doctrine	Lead physician or surgeon is responsible for actions under their supervision.
Malpractices	Professional negligence causing patient harm.

INFORMED CONSENT

Voluntary	No force
Adequately Informed	Patient knows risks, benefits, and alternatives.
Legal	Patient can legally decide.

Capacity	
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Advance Directives

- Patient's future healthcare instructions if they can no longer decide.

Living Will	States end-of-life wishes.
Durable Power of Attorney for Healthcare	Chooses someone to make medical decisions.

Six Legal Flashpoints in Critical Care :

1. Medical Documentation
2. Informed Consent
3. Incident Reports
4. Brain Death
5. Organ Donation
6. Advance Directives

Incident Documentation

- Record any unusual event that caused or could cause harm.

Protocol :

- Done by the responsible nurse or witness.
- Complete it immediately.
- Make it factual, objective, and legal.

Trigger	Unusual event happens.
actor	Responsible nurse or witness writes it.
action	Record facts immediately.

DOCUMENTATION

Incorrect	Correct
Avoid: - Judgmental words - Assumptions - Personal opinions - Non-clinical speculation Example words to avoid: "mistress" "jealous" "making a scene"	★ Facts only ★ Exact quotes ★ Professional actions ★ Chain of command ★ Security involvement ★ Patient monitoring

Clinical Restraint Protocols

- Any intervention that limits movement.
- Applies to:
 - Environmental restraints
 - Mechanical restraints
 - Pharmacological restraints

Proportionality Rule

- Always use the least restrictive method.
- Example:
Soft wrist ties instead of four-point restraints if only preventing IV removal.

Physical Restraint	Device that limits movement.
Chemical Restraint	Medication used mainly to control behavior or movement, not as standard treatment.

Clinical Rules and Time Limits

Initiation Checklist	Before restraints: Licensed practitioner order Patient evaluation Trained staff Inform patient and family
15 Minute rule	Check regularly: Nutrition Hydration Hygiene Vital signs Circulation Range of motion Psychological comfort Readiness to remove restraint
24 hr rule	Orders cannot exceed 24 hours without reassessment and new written documentation.

Organ Donation	- A person can legally allow organ donation - Can be authorized through a written will. - Can also be authorized by signing a donor card. - Nurses can serve as official witnesses.
Declaring Brain Death	- Brain death is the legal and clinical end of life. Medical Criteria Brain death means either: - Irreversible stop of circulation and breathing, OR - Irreversible loss of all brain functions, including the brain stem. Requirements - One physician not involved in treatment documents it. - A second independent physician confirms it. Three Essential Findings: - Coma - No brainstem reflexes - Apnea
Medico - Legal Cases	- These cases require documentation and reporting. Nine Cases - Injuries and burns - Alleged assault - Suspected poisoning or intoxication - Suspected criminal offense - Court-referred cases - Suspected criminal abortion - Unconscious/comatose patient with unclear or unnatural cause - Brought dead or sudden unexpected death - Suspected self-inflicted injury or attempted suicide

Obligations to Unconscious Patients

Autonomy Proxy Model	If the patient cannot decide, the nurse acts as a legal and clinical proxy.
Implied Consent	The law assumes an unconscious patient would agree to life-saving treatment.

Primary Nursing Obligations

Assess	Monitor vital signs and condition continuously.
Protect	Prevent injury, pressure ulcers, and protect dignity.
Document	Record patient status and care accurately.

About 75% of hospital deaths happen after chronic expected illnesses needing end-of-life support.

Feature	Palliative Care	Hospice Care
Life Expectancy	No time limit	6 months or less
Curative Treatment	Allowed	not allowed
Location	Hospital, extended care, nursing home	Usually at home
Care Oversight	Multidisciplinary team	Family and visiting hospice nurses

Evidence-Based Practice (EBP)

- Use research, clinical experience, and patient preference together

Benefits :

- Improves patient outcomes.
- Increases patient safety.
- Reduces practice differences.
- Lowers healthcare costs.

Three core elements:

Best Available Evidence	High-quality research
Clinical Expertise	Nurse's knowledge and experience
Patient preferences	Patient's values and choices

Five Steps EBP process

Ask	Make a clear question using PICO.
Search	Find evidence in reliable databases.
Appraise	Check if evidence is valid and useful.
Integrate	Combine evidence, expertise, and patient preference.
Evaluate	Check results and improve practice.

Spider Framework	- Qualitative/Mixed-Methods Research - Sample - Phenomenon of Interest - Design - Evaluation - Research Type
PICO Framework	- Clinical/Quantitative Research - Patient/Problem - Intervention - Comparison - Outcome

Evidence Appraisal

Before using research, check if it is:

- Valid & Applicable – Good quality and fits the patient.
- Invalid/Inapplicable – Poor quality or not relevant.

Hierarchy of Evidence

Level A	RCTs, systematic reviews, meta-analysis (highest).
Level B	Good non-randomized and observational studies.
Level C	Expert opinion and descriptive information.
Level ML	Uses multiple evidence levels together.

AHA / ACC Recommendation Classes

Class 1	Strongly recommended.
Class 2a	Reasonable to do.
Class 2b	May be considered.
Class 3 no benefit	No proven benefit.
Class 3 Harm	Harmful; should not be done.

ICU EBP Targets

- Sedation management and delirium prevention
- VAP prevention
- Fluid resuscitation and goal-directed therapy in sepsis
- Early mobilization to prevent ICU-acquired weakness

Clinical Practice Guidelines (CPGs)

- Systematic recommendations that help healthcare workers make the right clinical decisions.

Why CPG’s are used :

Variability	Standardizes care in different hospitals.
Cost	Avoids unnecessary tests and treatments.
Quality	Improves patient outcomes.
Legal Liability	Gives a recognized legal standard for practice.

Guideline Development Process

Identify Topic	Choose an important clinical problem.
Multidisciplinary Group	Form a team of experts (6–15 members).
Gather Evidence	Review research systematically.
Make Recommendations	Turn evidence into clinical advice.
Outside Review	Check validity and usefulness.
Update	Revise when new evidence appears.

ICU Hospital-Acquired Infections (HAIs)

- Infections that patients get while staying in the ICU.

Overall Risk

- Patients staying more than 2 days in the ICU have a high risk.
- 8.4% develop at least one HAI.

Common ICU HAI’s:

Bloodstream Infection	45% incidence; 44% are catheter-related (CLABSI/PLABSI).
Urinary tract Infection	25% incidence; 99% are CAUTI.
Pneumonia	6% incidence; 97% are VAP.

IHI Care Bundle

- A group of evidence-based practices that work better when done together.

Bundle Multiplier:

- $1 + 1 + 1 > 3$

Doing all practices together gives better results than doing them separately.

DUAL VALUE :

Patient - Centric	System - Centric
Better recovery and shorter ICU stay.	Better use of hospital resources and lower costs.

Target ICU Bundles:

VAP	VAP Bundle
Catheter Bloodstream Infection	CLABSI & PLABSI Bundle
Urinary Catheter UTI	CAUTI Bundle
Post-operative Risk	SPB (Surgical Procedure) Bundle

Ventilator-Associated Pneumonia (VAP)

- A new lung infection that develops after being on a ventilator.

48-Hour Rule :

- VAP happens when the infection appears:
- 48 hours or more after intubation or tracheostomy.
- The infection was not present before ventilation.

Clinical Impact :

- 2nd most common hospital-acquired infection (15%).
- Affects 25% of intubated patients.
- Adds 1–3 weeks to hospital stay.
- Mortality: 13–55%.

VAP Microorganisms:

- Early Onset (96 hours)
- Pseudomonas aeruginosa
- Acinetobacter spp.
- MRSA

VAP Diagnosis :

- Need a new or progressive chest X-ray infiltrate plus at least two of these:
 - Fever over 38°C
 - Leukocytosis or Leukopenia
 - Purulent (pus-like) secretions

VENTRICULAR BUNDLE:

PILLAR 1	• Head of Bed 30°–45° - Raise the head of the bed. Reason: • Reduces aspiration. • Helps lung expansion.
PILLAR 2	• Daily Chlorhexidine Oral Care - Use 0.12% Chlorhexidine. - Lowers bacteria in the mouth.
PILLAR 3	• Daily Sedation Vacation - Stop continuous sedatives every day. - Check if the patient can be weaned.
PILLAR 4	• PUD Prophylaxis - Give PPIs or H2 blockers. - Protect against peptic ulcer disease.
PILLAR 5	• DVT Prophylaxis - Use compression devices or anticoagulants. - Prevent DVT and pulmonary embolism.

Central Line-Associated Bloodstream Infection (CLABSI)

- Bloodstream infection caused by a central line.

Diagnostic Parameters

All three are required:

1. Positive blood culture.
2. Infection is not from another body site.

3. Happens more than 48 hours after central line insertion.

Common CLABSI Organisms :

- Coagulase-Negative Staphylococci
- Enterococci
- Klebsiella
- MRSA
- Pseudomonas
- Acinetobacter
- Escherichia coli

Central Line Prevention Bundle :

PROTOCOL 1	• Hand Hygiene - Wash hands before touching the sterile field.
PROTOCOL 2	• Maximal Barrier Precautions Use: Cap Mask Sterile gown Sterile gloves Full-body sterile drape
PROTOCOL 3	• Chlorhexidine Skin Antisepsis - Clean the skin with chlorhexidine before insertion.
PROTOCOL 4	Optimal Site Selection: • Subclavian Vein - Lowest infection risk (preferred). • Femoral Vein - Highest infection risk (avoid unless necessary).
PROTOCOL 5	Daily Review of Line Necessity - Check every day if the central line is still needed.

Catheter-Associated Urinary Tract Infection (CAUTI)

- UTI caused by an indwelling urinary catheter.

Epidemiology:

- UTIs make up 36% of all Hospital-Acquired Infections (4th most common HAI).
- 80% of hospital-acquired UTIs are CAUTI.
- Infection risk increases by 3–7% every day the catheter stays in place.

Common Pathogens:

Escherichia coli (24%)	Most common gut bacteria.
Candida spp. (21%)	Fungal infection.
Klebsiella pneumoniae (10%)	Forms biofilm.
Pseudomonas aeruginosa (10%)	Hospital-acquired organism.

CAUTI Diagnostic Signs :

- Fever over 38°C
- Chills
- Costovertebral tenderness
- Suprapubic or flank pain

- Decreased mental or functional status
- New hematuria or foul-smelling urine

CAUTI PREVENTION :

PHASE 1	• Placement - Hand hygiene before and after. - Sterile insertion technique.
PHASE 2	• Maintenance - Keep a closed drainage system. - Keep urine bag below the bladder. - Empty the bag regularly. - Avoid kinks in tubing. - Avoid pulling the catheter.
PHASE 3	• Daily Assessment - Check every day if the catheter is still needed. - Remove it as early as possible.

Sepsis Golden Hour Protocol

- Sepsis is a dangerous body response to infection that can cause organ failure.

Common Infection Sources:

- Lung (Pneumonia)
- Bloodstream/Catheter infection
- Abdomen (Appendicitis, Infectious Diarrhea, Gallbladder Infection)
- Urinary Tract (CAUTI)
- Skin/Soft Tissue
- Meningitis
- Unknown origin

One-Hour Command Bundle :

DERIVATIVE 1	Measure Serum Lactate - Check lactate immediately. Target Values: • 0.5–1 mmol/L : Normal • Above 2 mmol/L : Repeat in 2–4 hours • 4 mmol/L or more : Septic Shock indicator
DERIVATIVE 2	Blood Cultures Before Antibiotics : • Collect at least 2 sets. • Use 2 different sites. • Include central line if present. • Give antibiotics only after cultures.
DERIVATIVE 3	Broad-Spectrum Antimicrobials : • Give IV broad-spectrum antibiotics. • Cover Gram-positive, Gram-negative, and anaerobic organisms. • Add antifungal if needed. • Give within 1 hour.
DERIVATIVE 4	Fluid Resuscitation : • Give Normal Saline or Lactated Ringer's. Start if: • Hypotension, or • Lactate 4 mmol/L or

	more. • Target: 30 mL/kg crystalloid bolus.
DERIVATIVE 5	Vasopressor Therapy : • Start if hypotension continues after fluids. • Primary drug: Noradrenaline (Norepinephrine). • Target: MAP 65 mmHg or higher.

CU 3 : ALTERED VENTILATION

RESPIRATORY SYSTEM

Upper Airway (Conditioners & Protectors)	Lower Airway (Conductors & Exchangers)
• Nasal Cavity – Filters, warms, and moistens air. • Pharynx – Passage for air (and food in some parts). • Larynx – Voice box and airway protector.	• Trachea – Main airway tube. • Primary Bronchi – Two main branches to the lungs. • Lungs – Main organ for gas exchange.

UPPER RESPIRATORY

Nasal Cavity Physiology (Biological HVAC)	Nasal Blood Supply & Nosebleeds
<u>PRIMARY FUNCTION:</u> Filtration - Thick nose hairs (vibrissae) trap large particles. Heating - Blood vessels warm cold air. Humidification - Nasal lining adds moisture to dry air. <u>SECONDARY FUNCTION:</u> Olfaction - Sense of smell. Phonation Assistance - Helps produce clearer voice.	<u>Kiesselbach Plexus</u> - Front part of the nose. - Superficial blood vessels. - Most common source of anterior nosebleed. <u>Woodruff Plexus</u> - Back part of the nose. - Larger and deeper vessels. - Causes severe posterior nosebleed. <u>Paranasal Sinuses</u> • Frontal • Ethmoid • Sphenoid • Maxillary Functions: Speech Resonance - Improves voice quality. Air Preparation - Warms and moistens air. Structural Balance - Makes the skull lighter. Immune Defense - Produces mucus for protection.

	<u>Pharynx</u> - Nasopharynx – Air only. - Oropharynx – Air and food. - Laryngopharynx – Directs food to the esophagus and air to the trachea. <u>Larynx</u> Vocalization - Contains vocal cords. Patency - Cartilage keeps the airway open. Protection - Epiglottis closes the airway during swallowing.
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LOWER RESPIRATORY

Trachea	Mucociliary Escalator
- About 20 C-shaped cartilage rings support the trachea - Open back portion allows the esophagus to expand during swallowing.	- Ciliated pseudostratified columnar epithelium – Protective lining - Goblet Cells – Produce mucus. - Cilia – Move trapped dirt upward to the throat.

RIGHT AND LEFT PRIMARY BRONCHUS

Trait	Right	Left
Width	Wider	Narrower
Length	Shorter	Larger
Angle	More vertical	More horizontal
Clinical risk	Higher aspiration	Low aspiration risk

AIRWAY ZONE

CONDUCTION ZONE	RESPIRATORY ZONE
Pathway : - Trachea - Primary Bronchi - Lobar Bronchi - Segmental Bronchi - Terminal Bronchioles Function: - Transports, filters, warms, and humidifies air. - No gas exchange.	Pathway : - Respiratory Bronchioles - Alveolar Ducts - Alveolar Sacs - Alveoli Function : - Main site of oxygen and carbon dioxide exchange.

ALVEOLAR CELL TYPES

TYPE I	TYPE II
Thin and flat cells.	Cuboidal cells.

- Cover most of the alveoli. - Main site of gas exchange.	- Produce surfactant. - Reduce surface tension. - Prevent alveolar collapse.
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Alveolar Macrophages

- Clean foreign particles and germs inside alveoli.

Pleural Membrane

- Visceral Pleura
 - Covers the lungs.
- Parietal Pleura
 - Lines the chest wall.
- Pleural Space
 - Small space with lubricating fluid.
 - Allows smooth lung movement.

Physiology of Respiration

Two Stages of Respiration:

EXTERNAL	- Happens in the lungs. - Oxygen enters the blood. - Carbon dioxide leaves the body.
INTERNAL	- Happens in body tissues. - Oxygen goes to cells. - Carbon dioxide returns to the blood.

Three process of external Respiration:

1.Ventilation	Air moves in and out of the lungs.
2. Pulmonary Perfusion	Blood flows around the alveoli.
3. Diffusion	Oxygen and carbon dioxide move from high concentration to low concentration across the alveolar-capillary membrane.

OXYGENATION

Alveolar-Capillary Diffusion:

CO ₂ Out	O ₂ In
- CO₂ moves from blood to alveoli. - CO₂ is exhaled.	- O₂ moves from alveoli to blood. - O₂ binds to hemoglobin.

PaO ₂	SpO ₂
Oxygen dissolved in arterial blood plasma Test : ABG (Invasive) Normal : 80–100 mmHg	Percent of hemoglobin carrying oxygen Test : Pulse Oximeter (Non-invasive) Normal : 93–99% (or >95%)

CEILING EFFECT	HYPEROXEMIA
- SpO₂ stops at 100%. - Extra oxygen will not increase SpO₂.	- Too much oxygen raises PaO₂ dangerously. - Can cause oxygen toxicity.

PRESSURE PUMP PRINCIPLES

Inspiration	Expiration
- Active process. - Chest expands. - Negative pressure pulls air in.	- Passive process. - Chest compresses. - Positive pressure pushes air out.

VENTILATION DYNAMICS

Parameter	Rest	Inspiration	Expiration
Diaphragm	Neutral	Descends	Ascends
Chest Wall	Neutral	Outward & Upward	Inward & Downward
Intrapulmonic Pressure	Equal to atmosphere	Negative	Positive
Intrapleural Pressure	Negative	More negative	Stays negative

DUAL CONTROL OF RESPIRATION

CHEMORECEPTORS:

CENTRAL	PERIPHERAL
- Located in the Medulla. - Monitor CO₂ and H⁺.	- Located in Carotid Arteries and Aortic Arch. - Monitor arterial O₂.

BRAINSTEM FUNCTIONS :

MEDULLA	PONS
- Main breathing pacemaker. - Controls diaphragm. - Activates intercostal and accessory muscles.	- Pneumotaxic Center - Controls breathing rate. - Apneustic Center - Controls breathing depth. - Prevents inspiration from stopping too early.

Continuous Feedback Loop :

- Chemoreceptors detect gas changes.
- Signals go to Medulla and Pons.
- Brain sends signals through the phrenic nerve.
- Diaphragm and intercostal muscles adjust breathing.

Mechanics of Respiratory Failure (V/Q Mismatch)	Dead Space Ventilation (High V/Q)	Silent Unit (Absent V/Q)
Shunting (Low V/Q) - Simple Key Terms - Ventilation blocked.	- Air reaches alveoli. - Blood flow is blocked. - No gas exchange.	- No air movement. - No blood flow. - Total gas exchange

- Blood flow continues. - Blood misses oxygen. Clinical Causes - Airway obstruction - Atelectasis - Mucous plugging - Structural defects	Clinical Causes: - Pulmonary Embolism - Pulmonary Infarction	failure. Clinical Causes - Severe ARDS - Tension Pneumothorax
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Respiratory Dynamics & Acid-Base Regulation

CO₂ Solubility :

- CO₂ is 20× more soluble than O₂ in blood.
- CO₂ + H₂O → Carbonic Acid (H₂CO₃).
- Carbonic Acid → Bicarbonate (HCO₃⁻) + Hydrogen

Metabolic Acidosis Compensation	Metabolic Alkalosis Compensation
Trigger: - Too much acid or low bicarbonate. Response: - Hyperventilation (Kussmaul breathing). Result: More CO ₂ leaves → pH rises.	Trigger: - Too much base or acid loss. Response: - Hypoventilation. Result: CO ₂ stays → pH lowers toward normal.

Respiratory Acidosis	Respiratory Alkalosis
Cause: - Hypoventilation. - CO₂ increases. - Carbonic acid increases. - pH decreases.	Cause: - Hyperventilation. - CO₂ decreases. - Carbonic acid decreases. - pH increases.

PRIMARY PULMONARY VOLUMES

Tidal Volume (TV)	- Normal quiet breath - Value : - 500mL
Inspiratory Reserve Volume (IRV)	- Extra air inhaled after a normal breath. - Value : - 3, 000 mL
Expiratory Reserve Volume (ERV)	- Extra air exhaled after a normal breath. - Value : - 1,100 mL
Residual Volume (RV)	- Air that always stays in the lungs. - Prevents alveolar

	collapse. - Keeps gas exchange continuous. - Value : - 1,200mL
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DERIVED PULMONARY CAPACITIES

Inspiratory Capacity (IC)	- Maximum air inhaled after a normal exhale. - Normal: ~3,500 mL.
Functional Residual Capacity (FRC)	- Air remaining after normal exhale. - Resting balance of lungs and chest wall. - Normal: ~2,300 mL.
Vital Capacity (VC)	- Maximum air exhaled after maximum inhale. - Measures breathing strength. - Normal: ~4,600 mL.
Total Lung Capacity (TLC)	- Total maximum lung volume. - Normal: 5,800–6,000 mL.

Obstructive Disease	Restrictive Disease
- Asthma and COPD - Air trapping. - RV increases a lot. - TLC increases. - VC decreases.	- Pulmonary Fibrosis - Stiff lungs. - RV decreases. - VC decreases. - TLC decreases greatly.

STANDARD RESPIRATORY ASSESSMENT

Step 1	Emergency Triage - Check ABC (Airway, Breathing, Circulation). - Look for emergency signs. If ABC is absent : - Call for help. - Start CPR. If ABC is present : Continue assessment Impending Respiratory Crisis Signs Accessory Muscle Use : - Scalene muscles. - Sternocleidomastoid muscles. - Intercostal retractions. - Shoulder elevation. Chest Excursion Deficit: - Chest expansion is less than 1¼–2¾ inches (3–6 cm). Systemic Warning Signs : 1.Mentation - Confused - Anxious - Agitated 2.Skin - Pale - Diaphoresis - Cyanosis 3.Position - Uses tripod position to breathe easier.
Step 2	Subject History Presenting Illness Ask about:

	- Dyspnea - Cough - Chest pain - Wheezing - Hemoptysis - Orthopnea - Fatigue - Clubbing - Cyanosis Past Health Ask about: - Pertussis - Cystic fibrosis - Asthma - Heart failure - Previous surgeries - Diagnostic tests - Current medicines - Oxygen use Personal & Social Exposure Ask about: - Tobacco - Alcohol - Substance use - Asbestos - Chemical vapors - Coal dust - Allergens - Heating/ventilation - Recent travel Family & Systems Review Check: - TB history - Emphysema history - HEENT - Cardiac - Gastrointestinal - Neuromuscular - Musculoskeletal Dyspnea Grading : Grade 0 - Breathless only during heavy exercise Grade 1 - Breathless when hurrying or walking uphill Grade 2 - Walks slower than others or stops while walking Grade 3 - Stops after walking about 100 yards (91 m) Grade 4 - Breathless even at home or while dressing Sputum Assessment : Volume - Measure total sputum in 24 hours. Appearance - Record color and consistency. Chronicity - Note changes from usual sputum. Hemoptysis - Record presence, amount, and frequency of blood in sputum.
Step 3	Objective Inspection Visual Inspection - Central Cyanosis - Blue color from low arterial oxygen. - Labored Breathing - Visible hard breathing.

	3. Clubbing - Enlarged fingertips from long-term low oxygen. 4. Chest Symmetry & AP Diameter - Check equal chest expansion. Normal Chest - Normal AP and transverse diameter. - Proper spinal alignment. Barrel Chest - Increased AP diameter. - Caused by chronic air trapping. Associated Disease - Obstructive diseases. Kyphosis - Forward spinal curve. - Flattened chest shape.
Step 4	Objective Auscultation Breathing Patterns : Normal - 12–20 breaths/min - Normal breathing Tachypnea - More than 24 breaths/min - Fever, anxiety, exercise, respiratory insufficiency, alkalosis, pneumonia, pleurisy Bradypnea - Less than 10 breaths/min - Athletes, CNS depression, diabetic coma, neurologic damage Hyperventilation - Fast and deep breathing - Exercise, fear, anxiety, CNS disorders, metabolic acidosis Kussmaul - Rapid, deep, labored breathing - Diabetic Ketoacidosis (DKA) Adventitious Lung Sounds Crackles (Rales) - High-pitched popping sound. - Air passes through fluid-filled or collapsed airways. - Heard during inspiration. Fine Crackles - Hair-rubbing sound. Coarse Crackles - Low-pitched gurgling sound. Associated Disorders • Pneumonia • Pulmonary edema • ARDS • Heart failure Wheeze - High-pitched musical sound. - Happens during inspiration or expiration. - Caused by airway narrowing. Associated Disorder: - Asthma Ronchi • Deep snoring-like sound. • Thick secretions in large airways.

	• Changes or clears after coughing. Pleural Friction Rub - Harsh grating sound. - Inflamed pleura rub together. Associated Disorder • Pleuritis Stridor - High-pitched inspiratory sound. - Severe upper airway obstruction. - Medical emergency. Associated Disorders • Croup • Epiglottitis • Foreign body aspiration
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PULSE OXIMETRY (SPO2)

- Measures oxygen saturation using light.
- Deoxygenated Hb absorbs more red light.
- Oxygenated Hb absorbs more infrared light.

Weak or Lost Signal :

- Check RR, LOC, skin temperature, and capillary refill.
- Check pulse near the probe.
- Check edema and connections.
- Warm the hand or move the probe.

Environmental Interference:

- Bright light can affect readings.
- Cover the probe or reduce light.

Motion Artifact

- Tremors or shivering cause inaccurate readings.
- Keep the limb still.

CAPNOGRAPHY (ETCO2)

- Measures CO₂ at the end of exhalation.
- Used with ET tube, oral airway, or nasopharyngeal airway.

Normal Values :

- 35–45 mmHg Normal
- Below 35 Hypocapnia (Hyperventilation)
- Above 45 Hypercapnia (Hypoventilation)

Phase 1

- Baseline
- CO₂-free air from dead space.

Phase 2

- Expiratory Upstroke
- CO₂ rapidly rises.

Phase 3

- Alveolar Plateau
- Peak CO₂.
- Final EtCO₂ reading.

Phase 4

- Inspiratory Downstroke
- Fresh oxygen lowers CO₂

EtCO₂ Decision Tree :

Level 1 (45–50 mmHg)

- Wake the patient.
- Monitor every 15 minutes for 1 hour.
- Check hypoventilation, pain, and sedation.
- Reduce narcotics or reposition device if needed.

Level 2 (Persistent above 45)

- Notify the physician.

Level 3 (50 mmHg or higher)

If not normal within 5 minutes:

- Activate Rapid Response Team.
- Notify MD.
- Obtain ABG.
- Consult RT/RRT.

CHEST X- RAY (CXR)

- Detect lung disease.
- Detect infiltrates.
- Detect abnormal shadows.
- Detect foreign objects.
- Confirm ET tube placement.
- Confirm chest tube placement.

MRI	CT SCAN
• Magnetic field + radio waves • Soft tissue & blood flow • No ionizing radiation • Differentiate lung tumors Protocol : - Remove all metal. - Very noisy. - Lasts 15–30 minutes. - No talking or moving. - Claustrophobic patients may need sedation.	• Computerized X-rays • Detailed chest images • Uses IV contrast • Fast chest evaluation Protocol : - Check iodine or shellfish allergy before contrast. - Contrast may cause warm feeling or metallic taste. - Stay still during the scan. - Drink plenty of water afterward. - Urine discoloration may happen and is harmless.

CT Scan Variants

1. Helical CT
 - Detects lung nodules.
2. Axial CT
 - Best for lung tissue and airways.
3. Low-Dose CT
 - Main screening test for lung cancer.

THE OXYGEN PATHWAY

Allen's Test (Collateral Circulation)

Step 1 : Occlude	• Support the wrist. • Patient clenches fist. • Compress both radial and ulnar arteries.
Step 2 : Unclench	• Patient opens the hand. • Keep both arteries compressed. • Palm becomes pale.
Step 3 :	• Release ulnar artery only.

Release	• Keep radial artery compressed.
Steep 4: Assess	• Palm should turn red/pink within seconds. - If yes → Proceed with radial puncture. - If no → Test the opposite arm.

Arterial Blood Gas (ABG)

Before the Draw:

- Document oxygen therapy.
- Room air
- Nasal cannula (L/min)
- Mask type
- Ventilator FiO₂
- Use a heparinized syringe.

During the Draw:

- Done by MD, RT, or trained ICU nurse.
- Preferred site: Radial artery.
- Alternative: Brachial or Femoral artery.

After the Draw :

- Press firmly for at least 5 minutes.
 - Longer pressure if on anticoagulants.
 - Tape the gauze.
 - Transport sample on ice.
- Watch for:
- Bleeding
 - Hematoma
 - Coldness
 - Numbness
 - Tingling

Normal ABG Values :

- PaO₂
- Oxygen in plasma
 - 80–100 mmHg
- SaO₂
- Oxygen on hemoglobin
 - 93–99%
- pH
- Acid-base balance
 - 7.35–7.45
- PaCO₂
- Respiratory component
 - 35–45 mmHg
- HCO₃
- Metabolic component
 - 22–26 mEq/L

Acid-Base Drivers

1. Respiratory Driver (PaCO₂)
 - Controlled by the lungs.
 - High PaCO₂ (>45) = More acidic.
 - pH goes below 7.35.
2. Metabolic Driver (HCO₃⁻)
 - Controlled by the kidneys.
 - High HCO₃⁻ (>26) = More alkaline.
 - pH goes above 7.45.

Primary Acid-Base Disorders

1. **Respiratory Acidosis**
 - ABG
 - pH below 7.35
 - PaCO₂ above 45
 - HCO₃⁻ above 26 (if compensated)

Causes:

- CNS depression
- Hypoventilation
- Respiratory arrest
- Severe airway obstruction

Early Signs:

- Tachycardia
- Tachypnea

Late Signs :

- Bradypnea
- Confusion
- Hypotension
- Lethargy
- Coma

2. Respiratory Alkalosis

ABG

- pH above 7.45
- PaCO₂ below 35
- HCO₃⁻ below 22 (if compensated)

Causes:

- Hyperventilation
- Anxiety
- Severe pain
- Wrong ventilator settings
- Gram-negative bacteremia
- Pulmonary embolism

Early Signs :

- Paresthesia
- Light-headedness
- Anxiety
- Palpitations

Late Signs :

- Tetany
- Seizures
- Cardiac arrhythmias

3. Metabolic Acidosis

ABG

- pH below 7.35
- PaCO₂ below 35 (if compensated)
- HCO₃⁻ below 22

Causes:

- Severe diarrhea
- Diabetic ketoacidosis
- Lactic acidosis
- Shock
- Intoxication
- Renal failure

Early Signs :

- Fruity breath
- Headache
- Lethargy
- Nausea
- Vomiting

Late Signs :

- Abdominal pain
- Tremors
- Confusion
- Kussmaul breathing
- Coma

4. Metabolic Alkalosis

ABG

- pH above 7.45
- PaCO₂ above 45 (if compensated)
- HCO₃⁻ above 26

Causes:

- Severe vomiting
- Prolonged NG suction
- Hypokalemia
- Diuretics
- Steroid therapy
- Excess alkali intake

Early Signs :

- Slow breathing
- Tight muscles
- Twitching

Late Signs :

- Confusion
- Tetany
- Seizures
- Dizziness
- Coma

Respiratory Diagnostic Modalities :

Invasive	Non - Invasive
• ABG • Fluoroscopic Examination • Bronchoscopy • Pulmonary Angiogram • Thoracentesis	• Pulse Oximetry • Sputum Examination • Spirometry

Mechanics of Breathing & Machine Control: FiO2 Escalation Spectrum

Low-Flow Oxygen Devices	High-Flow Oxygen Devices
Nasal Cannula - 1–6 L/min - 21–44% FiO₂ Simple Face Mask - 5–10 L/min - 40–60% FiO₂ Face Tent - Humidified oxygen. - Good for claustrophobic patients.	Non-Rebreather Mask (NRB) - At least 10 L/min - 80–95% FiO₂ - One-way valve prevents CO₂ rebreathing. High-Flow Nasal Cannula (HFNC) - Up to 100% FiO₂ - Needs humidification. Tracheostomy Collar / T-Piece - At least 10 L/min - Needs humidification. - Reduces room-air mixing.

Oxygen Toxicity

Critical Threshold

- FiO₂ above 50% for more than 24 hours is risky.

Progression:

- Capillary leak
- Pulmonary edema
- Acute Lung Injury (ALI) or ARDS

- Mechanism :
- High oxygen removes nitrogen.
 - Alveoli collapse (absorption atelectasis).

Airway Management Escalation

- Basic
- OPA (Oropharyngeal Airway)
 - NPA (Nasopharyngeal Airway)

- Advanced
- LMA (Laryngeal Mask Airway)
 - Combitube

- Definitive
- Endotracheal Tube (ETT)

Endotracheal Intubation (RSI)

- Indications :
- Airway Protection
 - Unconsciousness
 - Coma
 - Loss of gag reflex
 - Loss of cough reflex
 - Aspiration risk

- Airway Obstruction
- Trauma
 - Burns
 - Anaphylaxis
 - Infection
 - Laryngeal edema

- Respiratory Failure
- Hypoxemia
 - Hypercapnia
 - Exhausted breathing muscles

- Controlled Ventilation
- General anesthesia
 - Long-term ventilator support
 - Therapeutic hyperventilation

- RSI Goals
- Reduce aspiration risk.
 - Improve intubation conditions.
 - Maximize patient safety and comfort.

RSI Medications :

Induction Agents	Etomidate - Fast onset, stable BP Ketamine - Bronchodilator Propofol - Fast onset, lowers BP Midazolam - Minimal cardiovascular effect, higher dose may be needed
Paralytic Agents	Succinylcholine - Short-acting, hyperkalemia risk Rocuronium - Long-acting, reversed by Sugammadex
Pretreatment Drugs	Fentanyl - Reduces stress response

	Lidocaine - Lowers ICP, reduces bronchospasm Atropine - Prevents bradycardia
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- Positive Pressure Ventilation (PPV)**
- Goal: Support gas exchange until the disease improves.
 - Negative Pressure: Normal breathing pulls air in.
 - Positive Pressure: Machine pushes oxygen into the lungs through an ETT or tracheostomy tube.

- Cycling Methods :
1. Volume-Cycled
 - Breath ends after reaching the preset tidal volume.
 2. Pressure-Cycled
 - Breath ends after reaching the preset airway pressure.

- Lung-Protective Triad (VALI Prevention)**
- Prevents Ventilator-Associated Lung Injury (VALI).
 - Uses lung-protective ventilation.

- PEEP (Positive End-Expiratory Pressure)**
- Mechanism :
- Keeps positive pressure after exhalation.
 - Normal: 2–5 cm H₂O
 - Lung protection: 10–15 cm H₂O

- Benefits:
- Keeps alveoli open.
 - Opens collapsed alveoli.
 - Increases Functional Residual Capacity (FRC).
 - Improves oxygenation.
 - CPAP gives the same effect during spontaneous breathing.

- High PEEP Warning :
- Above 10 cm H₂O can:
 - Reduce venous return.
 - Reduce cardiac output.
 - Cause severe hypotension.

- Nursing Action:
- Increase IV fluids.
 - Give vasopressors if needed.

- Core Ventilator Parameters**
- Tidal Volume (Vt)
- Air delivered with one breath.
 - Based on Ideal Body Weight and lung condition.

- Respiratory Rate (RR)
- Mandatory breaths per minute.

- Fraction of Inspired Oxygen (FiO₂)
- Oxygen concentration delivered.

<i>RR</i>	<i>Set breaths per minute (Normal: 12–20/min)</i>
<i>FiO₂</i>	<i>Oxygen percentage delivered</i>
<i>PEEP</i>	<i>Prevents alveolar collapse (5–15 cm H₂O)</i>
<i>PIP</i>	<i>Highest inspiratory pressure (Keep below 30–35 cm H₂O)</i>
<i>Vt</i>	<i>Target: 6–8 mL/kg IBW</i>
<i>IE Ratio</i>	<i>Normal: 1:2 to 1:3</i>
<i>Ti</i>	<i>Inspiratory time</i>
<i>Flow</i>	<i>Gas delivery speed</i>
<i>Trigger Sensitivity</i>	<i>Patient effort needed to start a breath</i>
<i>Pressure Support</i>	<i>Extra pressure during spontaneous breaths (5–20 cm H₂O)</i>
<i>Plateau Pressure</i>	<i>Reflects lung compliance (Keep below 30 cm H₂O)</i>
<i>Minute Ventilation (VE)</i>	<i>RR × Vt</i>

VENTILATION MODES

A. Volume Modes	<u>Assist-Control Ventilation (AC/ACV)</u> - Gives preset volume. - Gives minimum preset rate. - If patient breathes, machine still gives full preset volume. - If patient does not breathe, machine gives the breath. Use Cases : ● Newly intubated ● Severe respiratory failure ● Very weak breathing muscles <u>Synchronized Intermittent Mandatory Ventilation (SIMV)</u> - Gives preset breaths. - Matches the patient's effort. - Allows spontaneous breaths between machine breaths. Use Case : ● Weaning. ● Prevents patient from fighting the ventilator
B. Pressure Modes	<u>Pressure-Controlled Ventilation (PCV)</u> - Gives pressure until the preset limit. - Controls plateau pressure. - Reduces Ventilator-Induced Lung Injury (VILI). Clinical Use : ● ARDS ● Low lung compliance ● Persistent hypoxemia despite high FiO₂ and PEEP Important Nursing Point : ● Sedation is needed. ● Neuromuscular blockade may be needed. ● Asynchrony can cause a big drop in SaO₂. <u>Pressure-Regulated Volume Control (PRVC)</u> - Adjusts pressure every breath.

	- Reaches target tidal volume. - Keeps airway pressure safe. <u>Pressure Support Ventilation (PSV)</u> - Adds pressure during spontaneous inspiration. - Usually 8–20 cm H₂O. - Reduces work of breathing. - Increases comfort. <u>Continuous Positive Airway Pressure (CPAP)</u> - Continuous positive pressure. - 5–10 cm H₂O. - Same effect as PEEP. - No machine-delivered breaths.
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Step-Down Continuum

- Total Control AC/PCV
 - Machine controls breathing.
- Shared Control SIMV
 - Patient breathes between machine breaths.
- Supported Autonomy CPAP/PSV
 - Patient controls breathing with pressure support.
- Independence T-Piece/Extubation
 - Patient breathes alone.

Weaning Strategies

- AC Weaning
 - Gradually lower the control rate.
 - Patient strengthens breathing muscles.
- T-Piece Protocol

Use when the patient is:

Awake

Alert

Breathing comfortably

Has a strong gag reflex

Has a strong cough reflex

Maintains oxygen level equal to or above ventilator oxygen

Nursing Monitoring During Weaning

Watch for:

- Rapid breathing
- Shallow breathing
- Accessory muscle use
- Decreased LOC
- Increased CO₂
- Decreased SpO₂
- Tachycardia
- Acute respiratory distress

CU 4- 5 : ALTERED VENTILATION

- Pulmonary Embolism (PE)**
 - A blood clot blocks the pulmonary artery, so blood cannot flow well to the lungs.

Embolus Journey :

- Origin – Usually starts as DVT in the deep veins of the leg.
- Transit – Travels to the right atrium → right ventricle → pulmonary artery.
- Impact – Blocks lung blood flow → less oxygen → tissue damage.

Other Causes (Non-Thrombotic) :

- Fat – Long bone fracture
- Air – Central line or trauma
- Amniotic fluid – Childbirth complication
- Tumor cells – Cancer
- Foreign objects – IV device fragments

Virchow's Triad

Three reasons why clots form:

1. Venous stasis – Blood stays still.
2. Vessel wall injury – Blood vessel is damaged.
3. Hypercoagulability – Blood clots easily.

Risk Factors :

- Strong
- Hip/pelvis/leg fracture
- Hip/knee replacement
- Major surgery
- Spinal cord injury
- Major trauma

Moderate

- Central line
- Cancer
- Heart failure
- Respiratory failure
- HRT/oral contraceptives
- Paralytic stroke
- Postpartum
- Previous VTE
- Thrombophilia

Weak

- Bed rest over 3 days
- Long travel
- Old age
- Laparoscopic surgery
- Obesity
- Pregnancy
- Varicose veins

Pathophysiology :

1. Body tries to dissolve the clot.
2. Blood vessel spasms.
3. Lung pressure rises.
4. Blood flow decreases.

Signs by Severity :

- Less than 50% blockage
- Shortness of breath
- Anxiety
- Chest pain
- S3/S4 heart sounds
- Crackles

More than 50% blockage :

- Feeling of doom
- Severe dyspnea
- Tachycardia
- Confusion
- Right heart failure
- Hypotension
- PEA arrest

Special Presentations :

- Fat Embolism Syndrome
- Symptoms may appear after 24 hours
- Restless
- Confused
- SOB

- Petechiae on chest/neck
- Wheezing
- Severe low oxygen

Air Embolism

- Palpitations
- Sudden weakness
- Tachycardia
- Severe hypoxemia

Diagnostic Tests

- First-line
- D-Dimer
- ECG
- Chest X-ray
- ABG

Advanced

1. CTPA – Main non-invasive test
2. Pulmonary angiography – Gold standard
3. PA catheter
4. MRI
5. V/Q scan

Wells Score

Major (+3)

- DVT signs
- PE most likely

Moderate (+1.5)

- HR over 100
- Immobilized 3 days
- Recent surgery
- Previous DVT/PE

Minor (+1)

- Hemoptysis
- Active cancer

Interpretation

- 4 or below – PE unlikely → D-Dimer.
- More than 4 – PE likely → CTPA.

PESI

- Used to know how severe PE is.

High-risk factors include:

- Age over 80
- Cancer
- Heart failure
- Lung disease
- HR at least 110
- SBP below 100
- Low oxygen
- Altered mental status

Treatment

- Oxygen
- Mechanical ventilation if needed
- LMWH
- UFH
- Fondaparinux

Thrombolytics

- Streptokinase
- Alteplase
- Only for unstable patients

Do NOT give if

- Brain bleeding risk
- Recent surgery

- Major trauma
- Bleeding disorder

If thrombolytics cannot be used:

- Catheter thrombectomy
- Surgical embolectomy

Long-term

- Warfarin
- DOAC
- Usually 3–6 months
- IVC filter if anticoagulants cannot be used.

Nursing Priorities

- Improve oxygenation.
- Monitor blood pressure.
- Reduce anxiety.
- Prevent another clot.

2. Acute Respiratory Distress Syndrome (ARDS)

- Severe lung injury where oxygen cannot enter the blood well.
- Progresses from ALI to severe ARDS.
- Lung becomes swollen.
- Gas exchange becomes poor.
- Refractory hypoxemia – Oxygen stays low even after giving oxygen.

Earliest Warning :

- Increased respiratory rate.

SIRS Watch

- Hypotension
- Tachycardia
- Hypothermia

Causes :

Direct

- Aspiration
- Pneumonia

Indirect

- Sepsis
- Major trauma

Pathophysiology :

1. Alveolar changes
 - Type I cells damaged.
 - Type II cells make less surfactant.
2. Endothelial changes
 - Capillaries leak fluid.
 - Pulmonary vasoconstriction.
 - Alveoli collapse.
3. Progression
 - Alveoli collapse.
 - V/Q mismatch.
 - Harder to breathe.
 - Intrapulmonary shunt.
 - Severe hypoxemia.

Six Injury Phases :

1. Initial injury
2. Increased permeability
3. Fluid flooding
4. Surfactant loss
5. Oxygen cannot cross
6. Fibrosis

Clinical Stages :

Stage 1 (0–12 hrs)

- Restless
- Tachypnea
- Respiratory alkalosis
- Clear CXR

Stage 2 (24 hrs)

- Cyanosis
- Crackles
- Patchy infiltrates
- Refractory hypoxemia

Stage 3 (Days 2–10)

- Agitation
- Generalized edema
- Air bronchograms
- MODS signs

Stage 4 (Over 10 days)

- Oliguria
- Poor skin
- Hypercapnia
- Pneumothorax

Treatment

ER

- Early intubation
- Mechanical ventilation
- Treat the cause

ICU

- Low tidal volume
- PEEP
- Conservative fluids
- ECMO if needed

Medications:

- Antibiotics
- Bronchodilators
- Corticosteroids
- Diuretics
- Surfactant
- Sedatives
- NMBAs

Nursing Care :

- Prone position at least 16 hours.
- Monitor ETT.
- Strict I&O.
- CVP monitoring.
- Suction only when needed.
- Chlorhexidine oral care.
- Sedation vacation when appropriate.

3. Acute Respiratory Failure (ARF)

- The lungs suddenly cannot provide enough oxygen or remove carbon dioxide.

Critical Values

- PaO₂ at most 50
- PaCO₂ over 50
- pH below 7.35
- SaO₂ below 85%
- Dangerous CO₂ over 60

Type 1

- Oxygen problem
- Low PaO₂
- Normal or low CO₂

Type 2

- CO₂ problem
- High PaCO₂
- Muscle fatigue

Combined

- Both oxygen and CO₂ problems.

Causes

- Mucus plugging
- Weak cough
- Sedatives
- Narcotics
- Pneumonia
- Sepsis
- Pneumothorax
- Heart failure
- PE

Treatment Path

- Oxygen
- Intubation
- Mechanical ventilation

Medications

- Antibiotics
- Bronchodilators
- Steroids
- Diuretics
- Inotropes

Nursing Care

- Continuous SpO₂.
- Listen to breath sounds.
- Watch accessory muscles.
- Frequent vital signs.
- Strict I&O.
- High Fowler's.
- Keep normal temperature.

4. Pneumothorax

- Air enters the pleural space, causing the lung to collapse.

Collapse Process

1. Air enters pleural space.
2. Negative pressure is lost.
3. Pressure becomes positive.
4. Lung collapses.

Types :

Spontaneous

- No obvious injury
- Common in young, tall, thin smokers

Traumatic

- Blunt trauma
- Penetrating injury
- Medical procedure
- Ventilator barotrauma

Open vs Tension

Open

- Air enters and leaves.

Tension

- Air enters but cannot leave.
- Pressure keeps increasing.
- Medical emergency.

Tension Progression

- Mediastinal shift
- Tracheal deviation
- Healthy lung compressed
- Heart compressed

Assessment

Subjective

- Sudden chest pain
- Shortness of breath

Objective

- Uneven chest movement
- Absent breath sounds
- Tachycardia
- Tachypnea
- Trachea shifts
- Air seen on CXR

Danger Signs

- Tracheal deviation
- Severe hypotension
- Cyanosis
- PEA arrest
- Rising ventilator pressure

Treatment

- Oxygen
- Pain relief
- Needle decompression
- Chest tube

ICU Nursing

- Semi-Fowler's.
- Keep chest tube closed.
- Water seal intact.
- No kinks.
- Watch bubbling.
- Watch infection.
- Monitor SpO₂ and BP.

5. Chronic Obstructive Pulmonary Disease (COPD)

- A long-term disease where airflow becomes blocked.

Exacerbation Cycle

1. Air trapping
2. Poor gas exchange
3. Increased work of breathing
4. Muscle fatigue
5. Respiratory failure

Subjective Signs

- Progressive SOB
- Difficulty breathing
- Productive coughFatigue
- Poor appetite
- Confusion from CO₂ retention

Objective Signs

- Cyanosis
- Tachypnea
- Accessory muscles
- Tachycardia
- Crackles
- Wheezes
- Tripod position
 - Leaning forward helps accessory muscles lift the chest.

Diagnostics :

- ABG
- Chest X-ray
- CBC
- CRP
- BMP
- Sputum culture

ER Management

- Oxygen target 88–92%
- Nebulized SABA
- SAMA
- Corticosteroids
- Antibiotics if needed

Warning: Too much oxygen can worsen CO₂ retention.

ICU Triggers

- pH below 7.25
- SpO₂ below 88%
- Muscle exhaustion
- Confusion
- Coma

Ventilation :

- BiPAP/CPAP first if awake.
- Intubation if NIV fails.

Nursing Priorities :

Airway

- Huff coughing
- Hydration
- Suction only when needed
- High Fowler's

Gas Exchange

- Pursed-lip breathing
- Continuous SpO₂
- Controlled oxygen
- Watch for CO₂ narcosis

ICU Care

- Early feeding
- Monitor arterial line
- Watch ventilator synchrony
- Sedation vacation
- VAP prevention

6. Pneumonia

- Infection causes inflammation and fluid in the alveoli, making oxygen exchange difficult.

Why It Is Dangerous?

- Can progress to hypoxemia.
- Can lead to septic shock.
- Can cause multi-organ failure.

Care Phases

1. Assessment
2. ER stabilization
3. ICU care

CURB-65

Each is 1 point:

C – Confusion

U – Urea above 7 mmol/L

R – RR at least 30

B – Low BP

65 – Age at least 65

- Higher score means more severe pneumonia and higher level of care.

Scenario: Lolo na 70 years old, nalilito, mabilis huminga, at mababa ang BP. Mataas ang CURB-65 kaya kailangan ng mas agresibong treatment.

ER Management

- ABCs
- Empiric antibiotics
- Fluid resuscitation

ICU Management

- Mechanical ventilation
- Vasopressors
- Ventilator bundle

Nursing Priorities

- Monitor breathing.
- Check SpO₂ and vital signs.
- Give antibiotics on time.
- Encourage coughing if able.
- Position for easier breathing.
- Prevent complications while on a ventilator.