



ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF BIOMEDICAL ENGINEERING

VII Semester

OBT357 BIOTECHNOLOGY IN HEALTH CARE

UNIT- 4 OUT PATIENT & IN-PATIENT SERVICES

4.3 Pediatric, neonatal units, Critical care units

4.3.1 Paediatric Unit:

A **Paediatric Unit** (also spelled *Pediatric Unit*) is a specialized hospital or healthcare department dedicated to the **medical care of infants, children, and adolescents** (usually up to 18 years of age). It is designed to address the unique physiological, psychological, and developmental needs of children.

Important Features of a Paediatric Unit:

1. Age-Specific Care

- Newborns (Neonatal)
- Infants and Toddlers
- Children
- Adolescents

2. Specialized Equipment

- Paediatric beds, incubators, ventilators, infusion pumps, and monitoring systems adapted for smaller bodies.

3. Staffing

- Paediatricians, paediatric nurses, neonatologists, respiratory therapists, child psychologists, and play therapists.

4. Common Services Provided

- Growth and development monitoring
- Immunizations

- Management of infectious diseases (measles, pneumonia, diarrhoea, etc.)
- Chronic illness management (asthma, diabetes, congenital heart disease)
- Emergency and intensive care for critically ill children

5. **Paediatric Intensive Care Unit (PICU)**

- Subsection for children requiring advanced life support and close monitoring.

6. **Child-Friendly Environment**

- Bright, colourful wards, play areas, and educational activities to reduce anxiety and support recovery.

4.3.1.1 Outpatient Services in Paediatric Units:

Outpatient services involve medical care where patients visit the hospital or clinic for diagnosis, treatment, or follow-up without staying overnight. These services are ideal for non-emergency conditions or ongoing care that doesn't require hospitalization.

Important Features:

- ❖ **Clinics and Assessments:** Pediatric outpatient departments offer specialized clinics for general pediatrics, allergies, asthma, diabetes, epilepsy, and other conditions. For example, Some Hospitals provide dedicated outpatient departments with play specialists and child-friendly areas for ages 0–16.
- ❖ **Diagnostic and Procedural Care:** Outpatient units, like the assessment unit at some Hospital for Children, conduct medical investigations (e.g., blood tests, imaging) and minor procedures, determining if inpatient admission is needed.
- ❖ **Support Services:** Play therapists, dietitians, and nursing staff trained in pediatric care create a supportive environment. For instance, Mersey and West Lancashire Hospitals offer play therapy and community nursing outreach.
- ❖ **Accessibility:** Services are often referral-based (e.g., via pediatricians or GPs) and include family-friendly amenities like waiting areas with play activities.

Examples:

- Routine check-ups, vaccinations, or follow-up for chronic conditions like diabetes.
- Speech, occupational, or physical therapy sessions, at Hospital's outpatient rehabilitation centers.
- Urgent care for non-critical issues, for children from newborn to 17.

4.3.1.2 Inpatient Services in Pediatric Units:

Inpatient services involve hospitalization, where children stay overnight or longer for intensive treatment, monitoring, or recovery from serious illnesses, injuries, or surgeries.

Important Features:

- ❖ **Specialized Care:** Pediatric inpatient units, like Kanchi Kamakoti CHILDS Trust Hospital's 500-bed unit, are staffed 24/7 by pediatric hospitalists, surgeons, and nurses trained to address acute and chronic conditions.

- ✓ General Pediatrics
- ✓ Pediatric Surgery and Urology
- ✓ Pediatric Emergency Care
- ✓ Pediatric Intensive care
- ✓ Pediatric Radiology
- ✓ Pediatric Anaesthesiology
- ✓ Pediatric Burns and Plastic surgery
- ✓ Pediatric Cardiology
- ✓ Pediatric Neurology
- ✓ Pediatric Orthopaedics
- ✓ Pediatric Pulmonology

- ❖ **Comprehensive Support:** Multidisciplinary teams include dietitians, respiratory therapists, physical/occupational therapists, and child life specialists to support recovery.
- ❖ **Family-Centered Environment:** Units prioritize family involvement, offering private rooms with sleeper sofas, parent TVs, and playrooms. Mayo Clinic's pediatric units include parent-sleep rooms and breastfeeding areas.

- ❖ **Conditions Treated:** Inpatient units manage a range of issues, from acute illnesses (e.g., pneumonia) to complex cases (e.g., cancer, heart surgery). Specialized units like PICUs (Pediatric Intensive Care Units) or NICUs (Neonatal ICUs) handle critical cases.
- ❖ **Transition Support:** Hospitals provide discharge planning and home care education to ensure a smooth transition.

Examples:

- ❖ Kanchi Kamakoti CHILDS Trust Hospital (KKCTH), Chennai- Pediatric Intensive Care Unit (PICU): Established in 1991, this was the first private-sector PICU in Chennai, renovated in 2004 with 17 beds (10 ICU, 7 High Dependency Unit).
- ❖ Government Kilpauk Medical College Hospital, Chennai - Pediatric Inpatient Ward: Handles approximately 3,000 inpatient admissions annually, treating a wide range of pediatric conditions, from infections to chronic illnesses, primarily serving lower socioeconomic groups in Chennai and neighboring Andhra Pradesh.

4.3.2 Neonatal units:

- ❖ A **Neonatal Unit** is a specialized hospital ward dedicated to the care of **newborn babies**, especially those who are **premature, ill, or require special medical support** after birth.
- ❖ **Functions of Neonatal Units**
 1. **Thermal regulation** (incubators, warmers).
 2. **Respiratory support** (oxygen therapy, CPAP, mechanical ventilation).
 3. **Nutritional support** (tube feeding, parenteral nutrition).
 4. **Infection control & treatment** (antibiotics, sterile environment).
 5. **Monitoring & follow-up** (growth, neurodevelopmental assessment).
 6. **Parental involvement** (Kangaroo Mother Care, counseling).

4.3.2.1 Inpatient Services in Neonatal Units

Inpatient services in neonatal units, often referred to as Neonatal Intensive Care Units (NICUs) or Special Care Baby Units (SCBUs), are designed to provide round-the-clock care for newborns requiring intensive medical attention. These services cater to babies born prematurely, with low birth weight, or with medical conditions needing specialized treatment.

Level I – Basic Newborn Care Unit

- ✓ For healthy, full-term babies.
- ✓ Provides routine postnatal care, feeding support, and monitoring.
- ✓ Manages minor conditions like mild jaundice or feeding difficulties.

1. Level II – Special Care Newborn Unit (SCNU/SCBU)

- ✓ For babies who need extra monitoring and short-term support.
- ✓ Manages moderate prematurity (32–36 weeks), low birth weight, or mild infections.
- ✓ Provides incubators, phototherapy, oxygen, and feeding support.

2. Level III – Neonatal Intensive Care Unit (NICU)

- ✓ For critically ill or very premature babies (<32 weeks or <1500 g).
- ✓ Equipped with ventilators, CPAP machines, infusion pumps, advanced monitors.
- ✓ Handles respiratory distress, sepsis, congenital anomalies, and surgical cases.

3. Level IV – Advanced NICU (Tertiary Care)

- ✓ Highest level of neonatal care.
- ✓ Provides complex surgeries, extracorporeal life support (ECMO), and specialized interventions.
- ✓ Staffed with neonatologists, pediatric surgeons, and advanced nursing care.

❖ **Multidisciplinary Teams:**

- Include neonatologists, neonatal nurse practitioners, respiratory therapists, dietitians, lactation consultants, and developmental specialists. These teams provide comprehensive care, including respiratory support, nutritional management, and neurological monitoring.
- Family-centered care is emphasized, encouraging parental involvement in daily rounds and care plans to foster bonding and emotional support.

❖ **Facilities and Technology:**

- NICUs feature advanced equipment like incubators, ventilators, and bedside imaging. Many units have private rooms or pods to promote family bonding and reduce stress, with amenities like parent lounges or sleep rooms.
- Specialized programs, such as neonatal transport teams, ensure safe transfer of critically ill infants from other facilities.

Examples of Inpatient Care:

- Care for preterm infants (as early as 23 weeks gestation), low birth weight babies (<2.3 pounds), or those with conditions like respiratory distress, congenital heart defects, or infections.
- Transitional care units allow mothers and babies to stay together for less intensive needs, such as phototherapy or nasogastric feeding.

4.3.2.2 Outpatient Services in Neonatal Units:

Outpatient services focus on follow-up care for infants discharged from the NICU or those requiring ongoing monitoring without hospitalization. These services ensure long-term health and developmental progress.

❖ **Follow-Up Clinics:**

- ✓ Neonatal follow-up programs monitor high-risk infants for developmental delays, neurological issues, or complications like bronchopulmonary dysplasia (BPD). These clinics often involve developmental-behavioral pediatricians and specialists in cardiology, neurology, or ophthalmology.

- ✓ Example: Nationwide Children's Hospital offers outpatient care through programs like the Comprehensive Center for BPD, providing telemedicine and follow-up for infants with chronic lung conditions.

❖ **Community and Home Support:**

- ✓ Community neonatal nurses provide ongoing care for infants with complex needs, such as home oxygen or nasogastric feeding, ensuring a smooth transition from hospital to home.
- ✓ Parent education and support groups, like those at UPMC or Denver Health, help families manage post-discharge care, including breastfeeding support and coping strategies.

❖ **Specialized Outpatient Services:**

- ✓ Ophthalmology screening for retinopathy of prematurity, a condition affecting premature infants, is often conducted on an outpatient basis.
- ✓ Nutritional and feeding support through programs like the Infant Feeding Disorders program at Nationwide Children's Hospital.

Out-Patient Services (OPD)

These are services provided to newborns who do not require admission but need **follow-up and monitoring** after discharge.

- ❖ **Neonatal follow-up clinics** – growth & development monitoring.
- ❖ **Immunization services** – as per national immunization schedule.
- ❖ **Screening for disorders** – metabolic, hearing, vision.
- ❖ **Management of minor conditions** – mild jaundice, feeding difficulties.
- ❖ **Parental guidance & counseling** – breastfeeding support, nutrition, hygiene, newborn care education.

4.3.3 Critical care units:

- ❖ Critical care units (CCUs), also known as Intensive Care Units (ICUs), are specialized hospital departments that provide intensive medical treatment and continuous monitoring for patients with life-threatening illnesses or injuries.
- ❖ They are distinct from other hospital wards due to their high level of specialized care, advanced equipment, and lower patient-to-staff ratio.

4.3.3.1 Who needs critical care?

Patients are admitted to a CCU when they are in a critical condition and require specialized, round-the-clock attention. Common reasons for admission include:

- ❖ **Serious illnesses:** Conditions such as heart attack, stroke, respiratory failure, sepsis (a severe infection), or organ failure (e.g., kidney or liver failure).
- ❖ **Major trauma:** Injuries from severe accidents, like a car crash, fall, or severe burns.
- ❖ **Post-operative recovery:** Patients who have undergone major or complex surgery may be admitted to the CCU for close observation during the initial recovery period.
- ❖ **Severe infections:** Life-threatening infections that require immediate and intensive treatment.

4.3.3.2 Types of Critical Care Units

Hospitals, especially larger ones, may have different types of critical care units that specialize in specific conditions or patient populations. Some of the common types include:

- ❖ **Medical Intensive Care Unit (MICU):** Cares for patients with severe medical conditions like pneumonia, sepsis, or multi-organ failure.
- ❖ **Surgical Intensive Care Unit (SICU):** Focuses on patients recovering from major surgery or those with complications from surgical procedures.
- ❖ **Coronary Care Unit (CCU) / Cardiac Care Unit (CCU):** Specializes in patients with severe heart conditions, such as heart attacks, heart failure, and life-threatening arrhythmias.

- ❖ **Neonatal Intensive Care Unit (NICU):** Provides care for critically ill newborns, including premature babies and infants with congenital disorders.
- ❖ **Pediatric Intensive Care Unit (PICU):** Caters to critically ill children.
- ❖ **Neurological Intensive Care Unit (NeuroICU):** Treats patients with serious neurological conditions like traumatic brain injuries, strokes, or brain tumors.
- ❖ **Trauma Intensive Care Unit (TICU):** Found in hospitals certified to treat major trauma, with a team dedicated to handling serious and complex injuries.

4.3.3.3 Roles and Responsibilities of the Critical Care Team

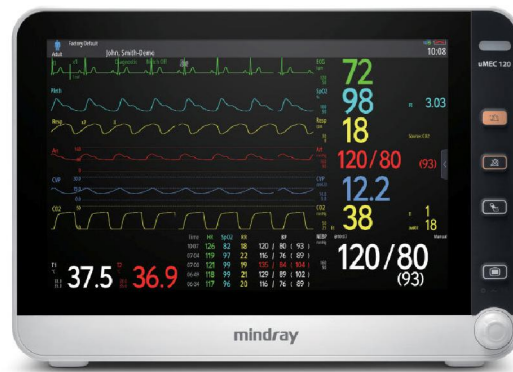
The CCU is staffed by a multidisciplinary team of highly trained healthcare professionals who work together to provide comprehensive care.

- ❖ **Intensivist/Critical Care Specialist:** A physician with specialized training in critical care medicine. They oversee the patient's care, make rapid decisions, and manage complex medical problems.
- ❖ **Critical Care Nurse:** A highly skilled nurse who provides direct patient care, including continuous monitoring of vital signs, administering medications, managing life-support equipment, and assisting with procedures. The patient-to-nurse ratio is much lower in a CCU, often 1:1 or 1:2.
- ❖ **Respiratory Therapist:** Specializes in managing patients' breathing and is responsible for setting up and monitoring ventilators and other respiratory equipment.
- ❖ **Other specialists:** The team may also include pharmacists, physical therapists, dietitians, and other specialists to provide holistic care.

4.3.3.4 Equipment and Technology

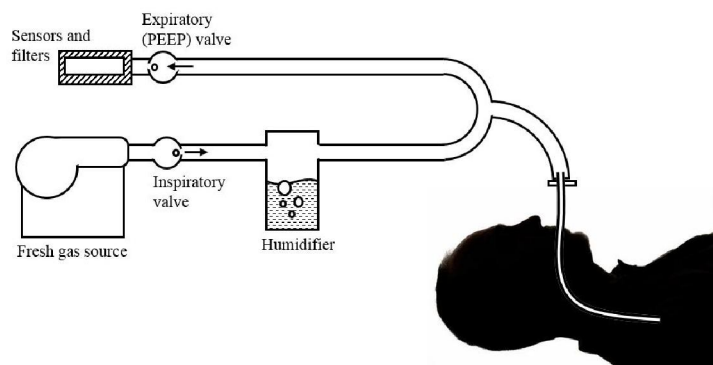
CCUs are equipped with advanced medical technology to support and monitor critically ill patients. Some of the key equipment includes:

- ❖ **Patient Monitors:** These devices continuously track vital signs such as heart rate, blood pressure, respiratory rate, and oxygen saturation, displaying the data in real-time.



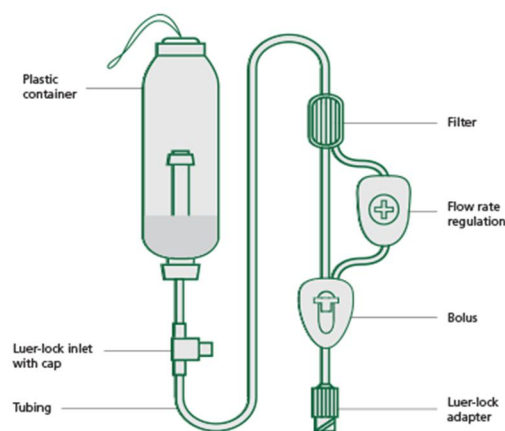
Patient Monitors

- ❖ **Ventilators:** Machines that assist or take over breathing for patients who are unable to breathe on their own.



Ventilators

- ❖ **Infusion Pumps:** Devices that deliver precise amounts of medications, fluids, or nutrition intravenously.

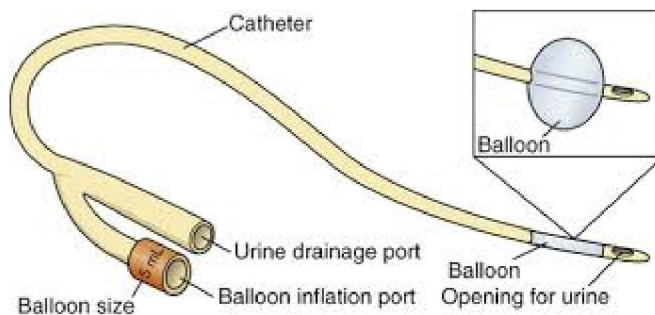


Infusion Pump

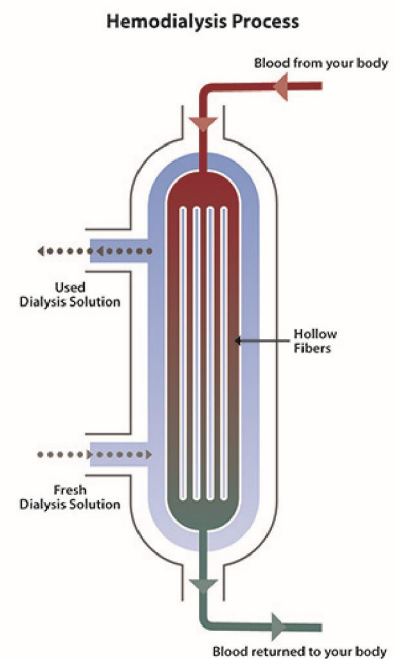
- ❖ **Defibrillators:** Used to deliver an electric shock to the heart to restore a normal rhythm in cases of cardiac arrest.
- ❖ **Dialysis Machines:** For patients with kidney failure, these machines act as an "artificial kidney" to remove waste and excess fluid from the blood.
- ❖ **Catheters and Tubes:** Various tubes and lines are used for a variety of purposes, including feeding (feeding tubes), draining fluids (catheters and drains), and administering medications (IV lines and central lines).



Defibrillators



Catheters



Dialysis Machines

4.3.3.5 Inpatient Services in Critical Care Units:

Inpatient services are those that require a patient to be formally admitted to a hospital and stay overnight for treatment and continuous observation. This is the very definition of critical care. Patients in critical care units (CCUs) are by nature unstable and require the highest level of care, which can only be provided in an inpatient setting.

- ❖ **Continuous Monitoring:** Patients' vital signs (heart rate, blood pressure, oxygen saturation, etc.) are monitored 24/7 by advanced equipment and a dedicated team of nurses and doctors.
- ❖ **Life Support:** Many CCU patients require life-sustaining treatments such as mechanical ventilation to help them breathe, or dialysis for kidney failure. These services necessitate constant supervision and are exclusively inpatient.
- ❖ **Specialized Treatments:** Inpatient critical care involves the administration of powerful and specific medications, like vasopressors to maintain blood pressure or antibiotics for severe infections. The dosage and effects of these medications require round-the-clock monitoring.
- ❖ **Post-Surgical Care:** Patients who have undergone major, complex surgeries are often moved to a critical care unit for a period of intensive observation to manage pain, monitor for complications, and ensure a stable recovery.
- ❖ **Multi-Organ Support:** The CCU team is equipped to manage and support multiple failing organ systems simultaneously, a level of complexity that is not possible in an outpatient setting.

4.3.3.6 Outpatient Services in Critical Care:

While the direct care in a critical care unit is exclusively inpatient, there is a growing recognition of the need for **post-critical care outpatient services**. These services do not take place in the CCU itself but are crucial for the long-term recovery of critical care survivors.

Patients who have spent a significant amount of time in a CCU often suffer from what is known as Post-Intensive Care Syndrome (PICS). PICS is a collection of physical, cognitive, and psychological impairments that can last for months or even years after a patient is discharged.

Outpatient services for critical care survivors are designed to address these long-term issues and may include:

- ❖ **Physical and Occupational Therapy:** To regain strength and mobility after a prolonged period of immobility.

- ❖ **Psychological Counseling:** To help patients and their families cope with the trauma, anxiety, and post-traumatic stress disorder (PTSD) often associated with a critical illness.
- ❖ **Medical Follow-up:** Regular appointments with a critical care specialist or other relevant doctors to manage chronic conditions or new health issues that arose from their time in the CCU.
- ❖ **Nutritional Support:** Guidance from a dietitian to help patients regain weight and strength.

In summary, the terms "inpatient" and "outpatient" are not interchangeable in the context of a critical care unit. **Critical care itself is a purely inpatient service** due to the need for continuous, high-level monitoring and life-sustaining support. However, **outpatient services play a vital role in the follow-up care** and long-term recovery of patients after they have been discharged from the CCU.
