SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF OPERATION THEATRE AND ANESTHESIA TECHNOLOGY – II Year

COURSE NAME: PRINCIPLES OF ANESTHESIA - 1

UNIT 1 - ANAESTHESIA MACHINE & MEDICAL GAS SUPPLY

TOPIC : Manifold Room Pipeline and Terminal unit

FACULTY NAME: Ms. Shanmuga Priya

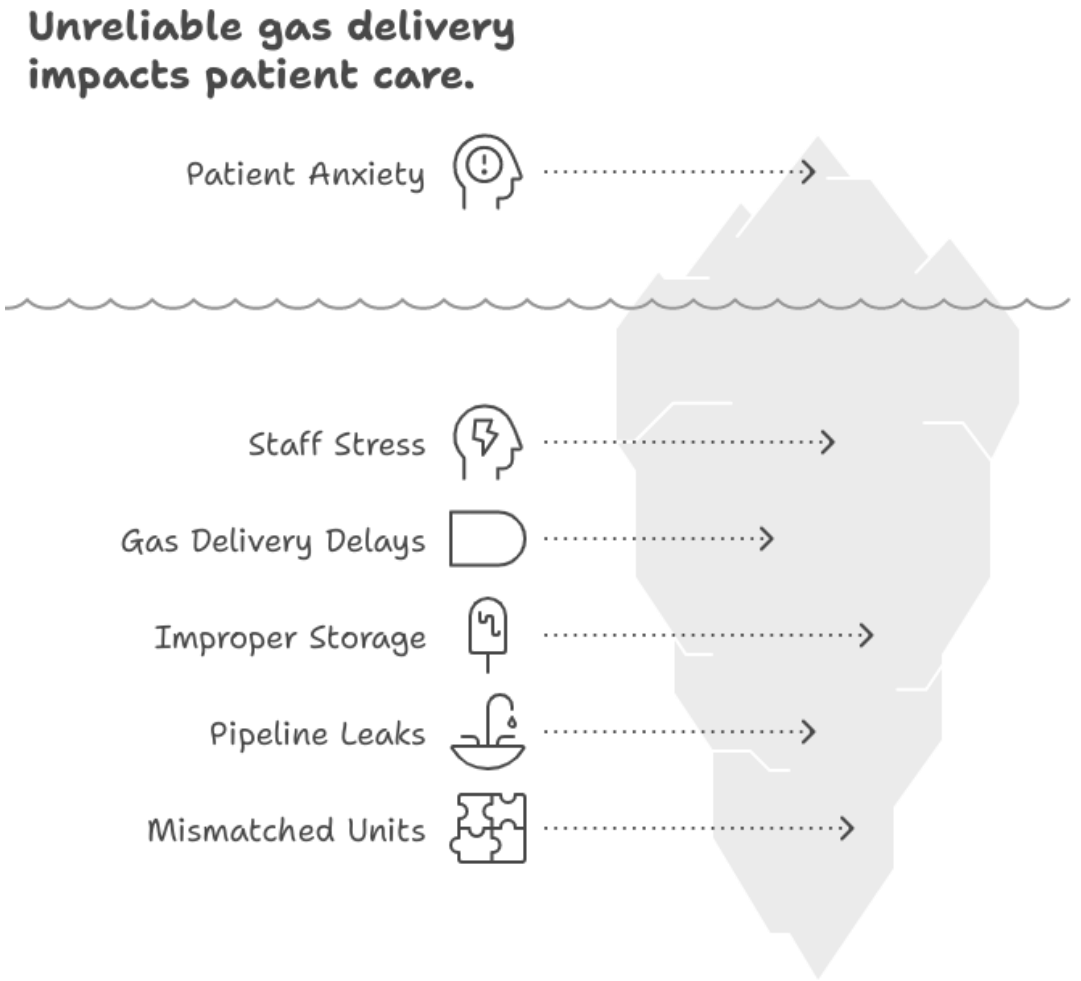
CASE PRESENTATION

Patient Profile:

In a 300-bed hospital, during an emergency surgery, a sudden pressure drop in the oxygen pipeline occurs due to a faulty manifold switchover in the manifold room. The anaesthesia technician notices alarms at the terminal unit in the OT, leading to brief interruption in gas supply. The patient, a 60-year-old undergoing cardiac surgery, experiences transient hypoxemia, causing anxiety among the surgical team. Investigation reveals inadequate maintenance of pipelines (corroded valves) and poor training on terminal unit checks. No permanent harm occurs, but the incident underscores the need for robust setup, precautions like regular inspections, and safety standards to prevent failures in medical gas delivery.

Understanding User Needs and Experiences

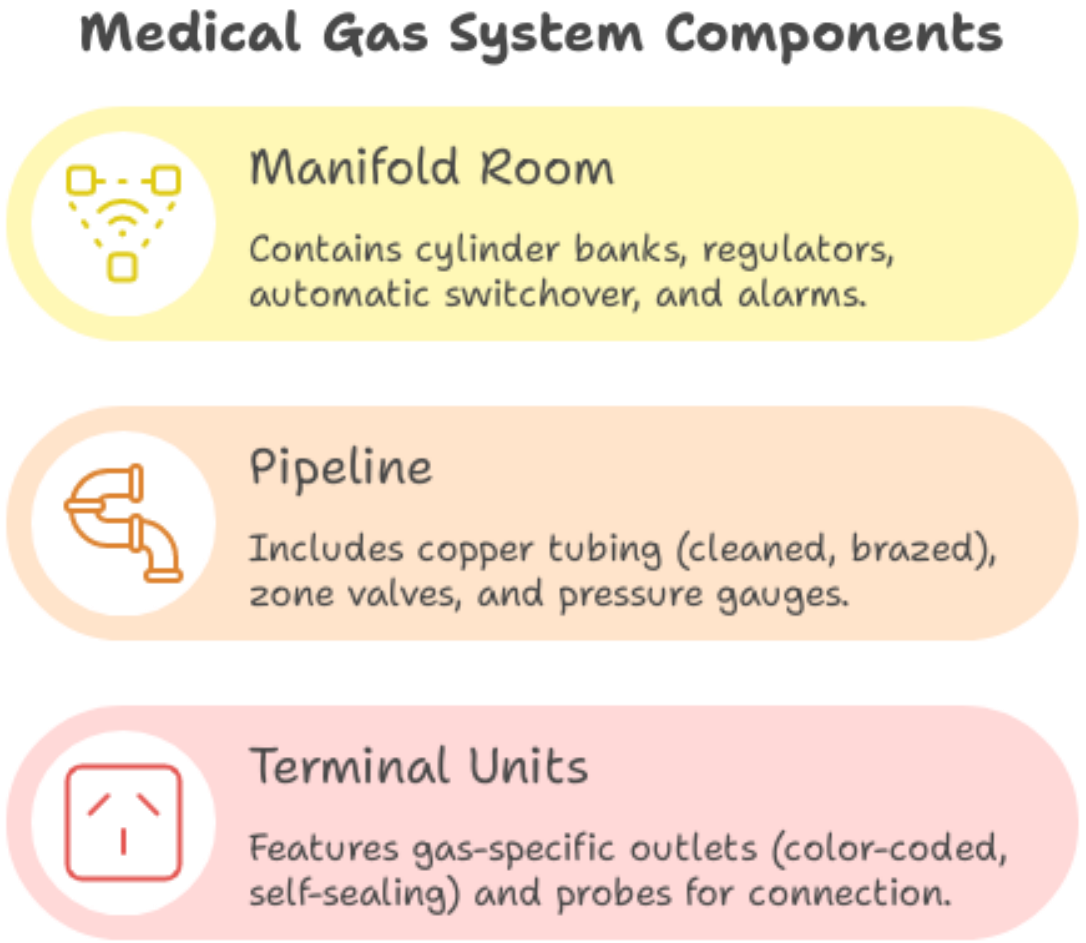
- The Empathize stage involves observing and engaging with stakeholders (e.g., technicians, nurses, patients) to understand challenges in manifold room, pipeline, and terminal unit operations.



Defining the System and Challenges

Definition:

The medical gas pipeline system (MGPS) includes the manifold room (housing gas sources), pipelines (distribution network), and terminal units (outlets for delivery). It ensures continuous supply of gases like oxygen, nitrous oxide, and medical air.



Defining the System and Challenges

Problem Statement: In hospital settings like the case, MGPS faces risks from faulty components (e.g., regulators) and inadequate precautions (e.g., no regular testing), leading to supply failures and patient harm.

Goal: Standardize setup and precautions for safe, uninterrupted gas delivery.

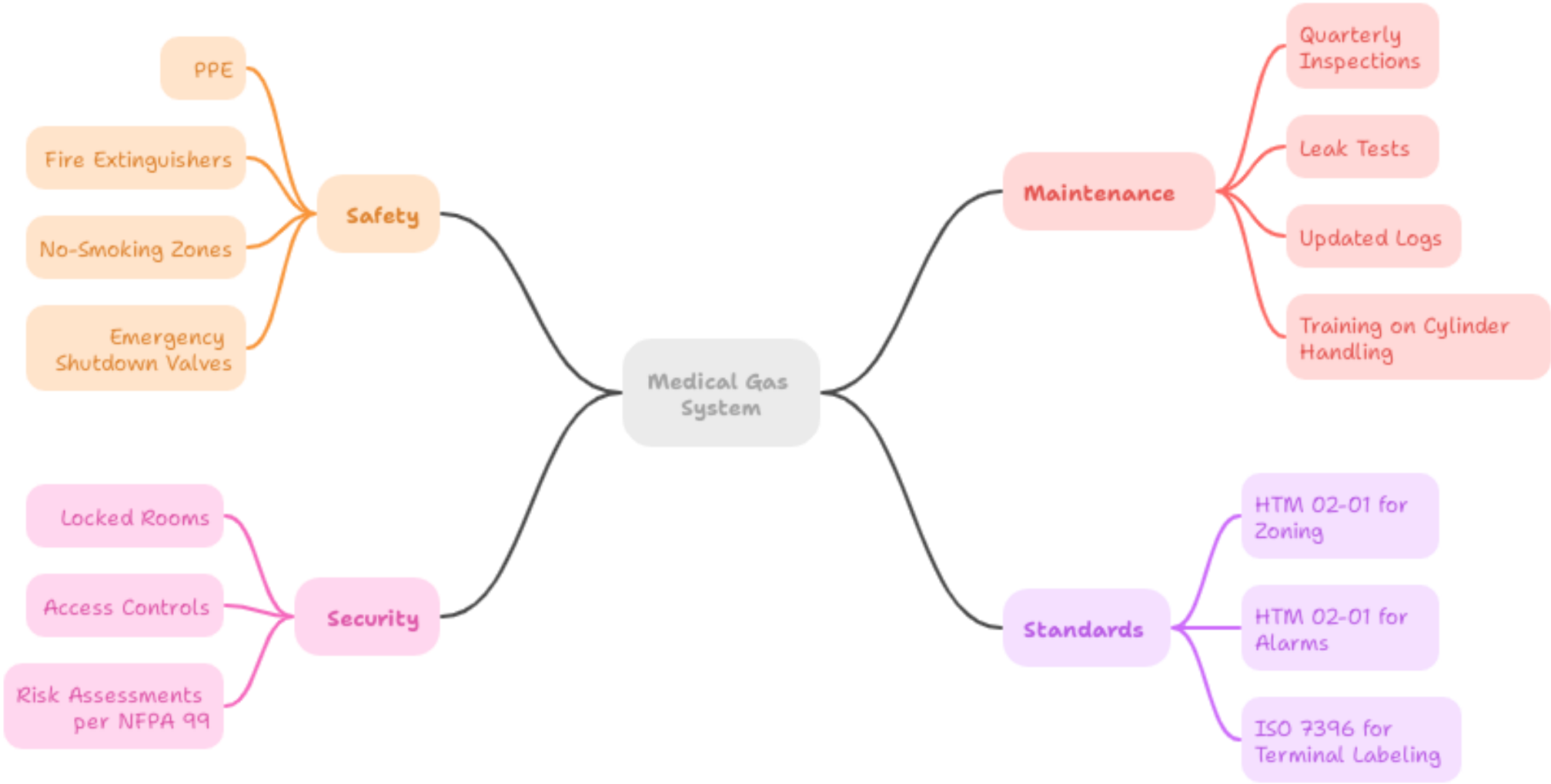
Ideate Stage: Brainstorming Solutions for Setup

Setup Ideas: Modular manifold designs for easy switchover; smart sensors in pipelines for real-time monitoring; quick-connect terminal units.

Selected Ideas:

- Install oxygen depletion sensors in manifold rooms to detect leaks.
- Develop color-coded pipelines and terminals to prevent mix-ups.
- Create training programs on emergency response for gas failures.
- Use automated alarms at terminal units for low pressure.

Ideate Stage: Brainstorming Solutions for Setup



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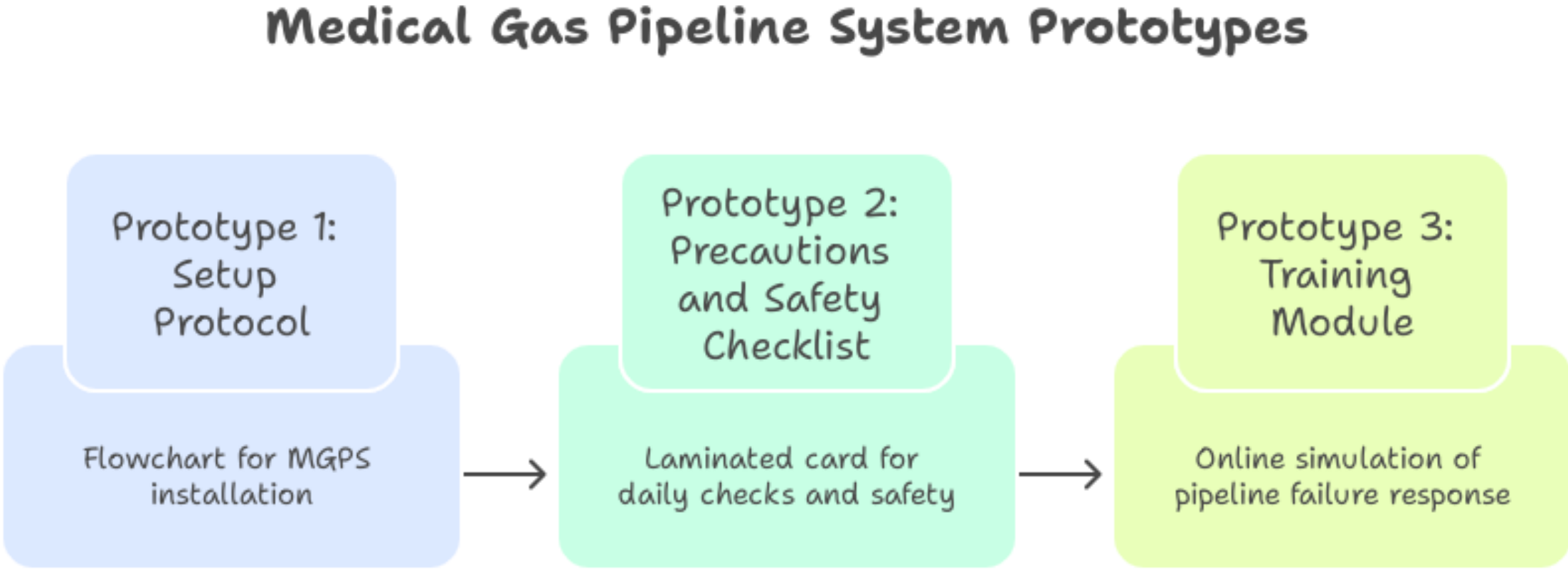
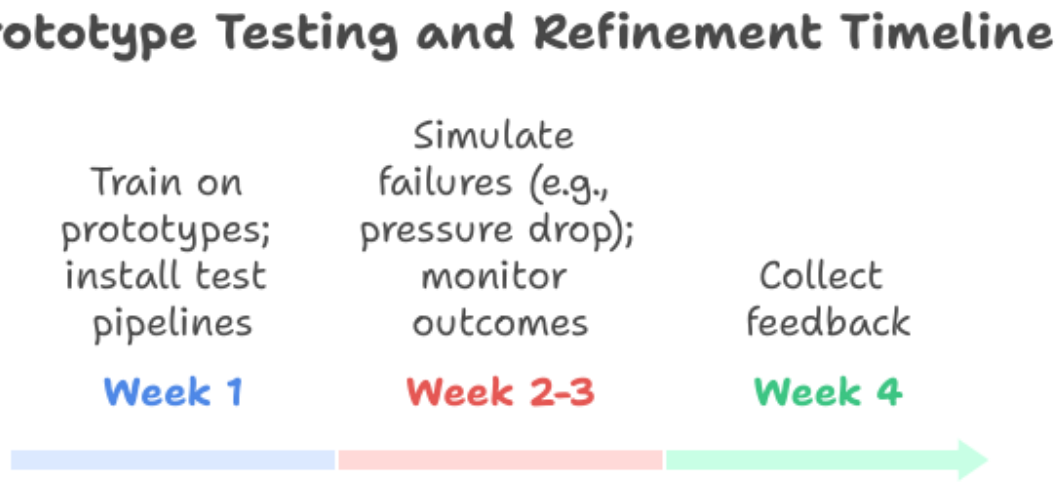
Prototype Stage: Developing Protocols and Tools



Test Stage: Evaluating and Iterating Solutions

- **Results**:
  - Reliability improved by 30%; faster responses with alarms.
  - Feedback: Simplify checklists; add mobile alerts.
- **Iteration**:
  - Refine protocol: Integrate IoT for remote monitoring.
  - Update checklist: Include multilingual labels.
  - Enhance module: Add scenarios for terminal unit errors.



In-Class Assessment

- **Case-Based Question (10 points)**: In the scenario, identify the main issue (pressure drop) and recommend two precautions. Justify with standards.
- **Short Answer (5 points)**: List three components of MGPS and explain their roles.
- **Group Discussion (5 points)**: Ideate one solution for pipeline maintenance. Present its benefit.
- **Multiple Choice (5 points)**:
  - What standard governs MGPS installation? a) ISO 9001 b) NFPA 99 c) HTM 01-01 d) OSHA 1910
- **Reflection (5 points)**: Write a brief paragraph on how DT improves MGPS safety.
- **Total**: 30 points *Submit written answers and discuss group activity in class.*

Summary

- **Empathize**: Understand staff stress and patient risks from system failures.
- **Define**: MGPS as gas distribution with manifold, pipelines, terminals; setup per NFPA 99.
- **Ideate**: Solutions like sensors, training, color-coding for safety.
- **Prototype**: Protocols, checklists, modules for reliable operations.
- **Test**: Evaluate for reliability, iterating on feedback.
- **Learning**: DT ensures user-centered, safe medical gas systems.

References

- **Book**: Dorsch JA, Dorsch SE. (2020). *Understanding Anesthesia Equipment*. 6th ed. Wolters Kluwer.
- **Website**: England NHS. Health Technical Memorandum 02-01: Medical gas pipeline systems. https://www.england.nhs.uk/wp-content/uploads/2021/05/HTM_02-01_Part_A.pdf (Accessed October 21, 2025).
- **Journal**: Shrivastava S, et al. (2021). Safety Challenges in Hospital Medical Gas Systems. *Journal of Healthcare Engineering*, 2021, 1–8. https://www.hindawi.com/journals/jhe/2021/8841342/ (Accessed October 21, 2025).

THANK YOU