

# AI-powered Task-shifting for High Quality Fetal Ultrasound Service in Community Healthcare Settings

Nepal Applied Mathematics & Informatics Institute for research (NAAMII)

Institute of Medicine, Tribhuvan University Teaching Hospital(TUTH)

Paropakar Maternity and Women's Hospital (PMWH)

Family Welfare Division, Ministry of health and Population

Solukhumbu Polytechnical Academy

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**National Summit of Health and Population Scientists in Nepal**



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# Presentation Overview

- Background
- Objectives
- Methodology
- Results
- Conclusion



# Introduction



# Introduction

## Maternal Care in LMICs

- High maternal mortality persists in rural Low-and-Middle-Income Countries (LMICs) like Nepal due to a lack of early complication detection
- **The Barrier:** A critical shortage of both ultrasound hardware and trained experts (radiologists) prevents routine prenatal imaging
- To bridge this gap, Nepal employs **Task-Shifting:** delegating specific diagnostic tasks from highly specialized doctors to health workers with shorter training, such as nurses or midwives

# Introduction

## Motivation

- Health System Gaps: Traditional task-shifting often can fail due to high operator subjectivity
- AI has potential to be used in task-shifting for better USG interpretability
- However, most AI methods for fetal ultrasound diagnostics published in the literature offer limited validation using only ML metrics such as dice score or classification accuracy
- There is a need to evaluate AI's impact on clinical decision-making specifically in rural, resource-constrained settings like Nepal.

# Proposed Solution

A diagnostic support tool that analyzes "Blind Sweeps Obstetric Ultrasound" (BSOU) for classification in downstream task such as placenta location, fetal presentation to be deployed in low resource settings.

Point of Care  
Ultrasound

Task shifting



Artificial  
Intelligence

# Objectives

## General Objective

- Develop and evaluate an AI-powered task-shifting to assist community health nurses:
  - Identifying abnormalities
  - estimating anatomical markers during obstetric USG of pregnant women in community healthcare settings.

## Specific Objective

- Develop AI tools to automatically identify life-saving obstetric emergencies: viability, single or multiple, intra vs extra uterine, and placental location
- Perform field testing and pilot evaluation to assess the efficacy of AI-powered models that detect important ultrasound markers from BOUS videos, comparing it with routine reporting from radiologists and existing rural obstetric ultrasound scanning by nurses.



## Study Design

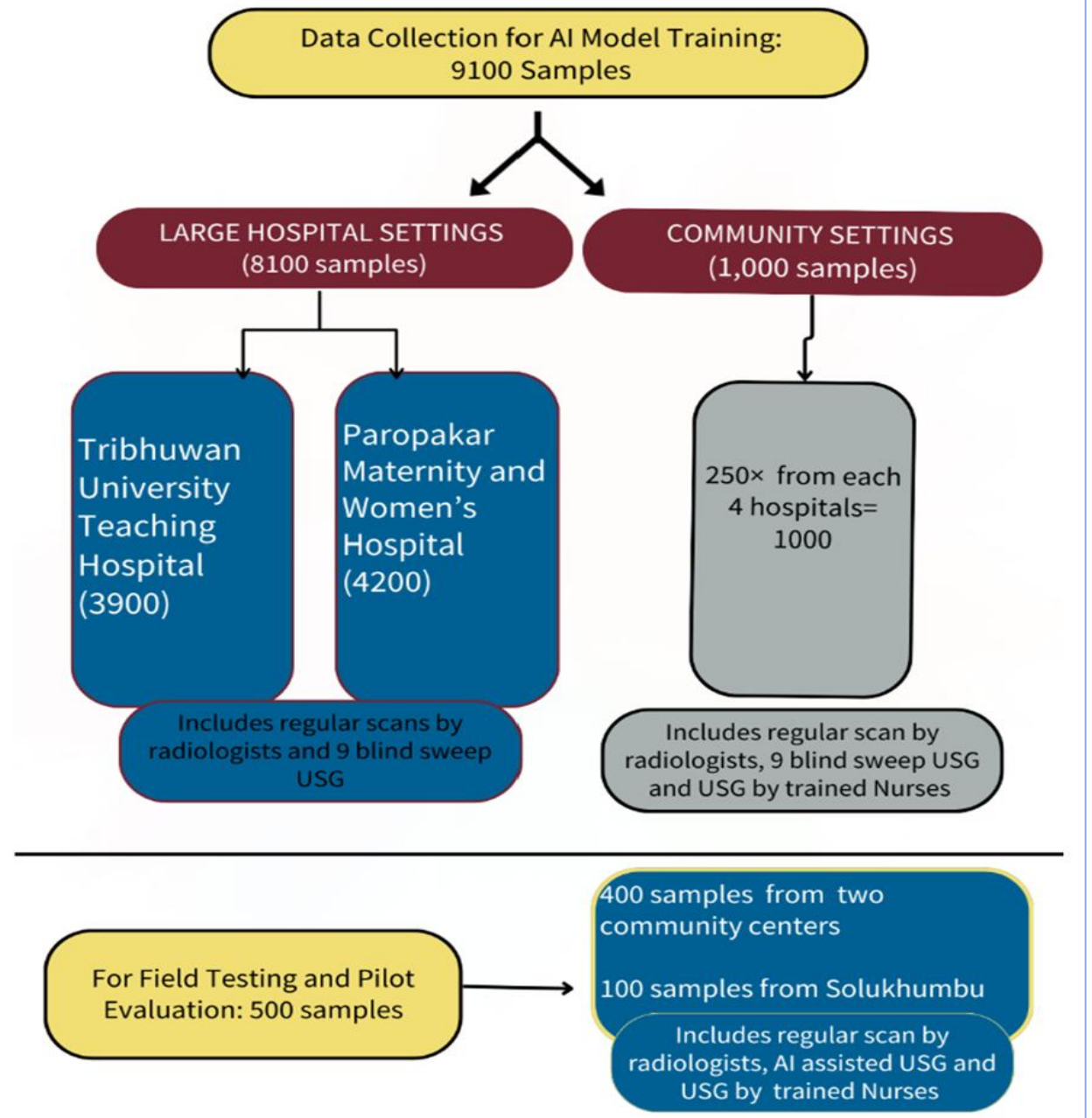
- Cross-sectional study design



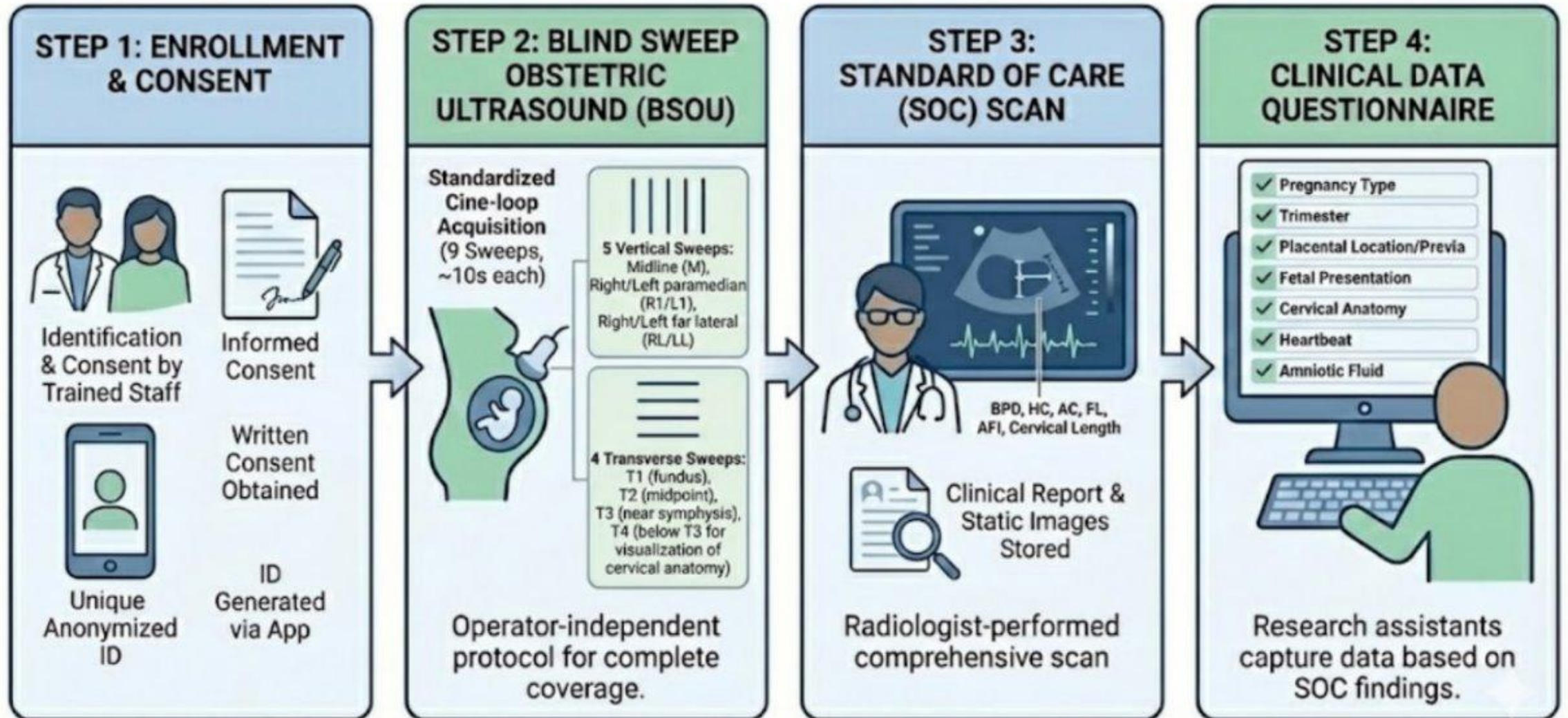
Category	Site / Institution	Sample Size
AI Model Development	Tribhuvan University Teaching Hospital (TUTH)	3900
	Paropakar Maternity and Women's Hospital	4200
	Bafekot Health Post, Rukum	250
	Salyantar Health Post, Dhading	250
	Melamchi Hospital, Sindhupalchowk	250
	Chaumala Primary Health Care Center, Kailali	250
	<b>Subtotal</b>	
Field Testing & Evaluation	Chandragiri Municipality – Machhegaun Health Post	200
	Kageshwori Manohara – Danchhi Health Post	200
	Health Facilities of Siraha and Kathmandu	100
Subtotal		500
<b>Grand Total</b>		<b>9100</b>

# Data Collection

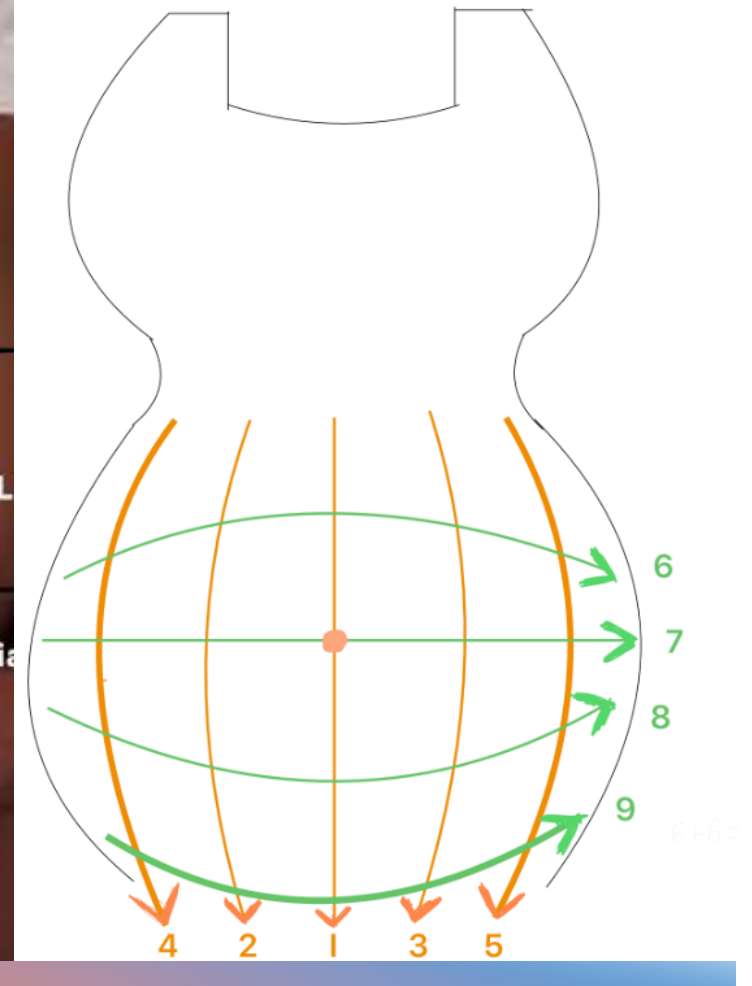
- **Target of 9,100 fetal ultrasound scans during 1<sup>st</sup> Phase:**
  - Two Large Scale Hospitals
  - Engaging 4 community sites
- Current Status:
  - **3700/3900** from TU hospital
  - **250/250** from Melamchi (Community)
  - 700/4200 from PMWH



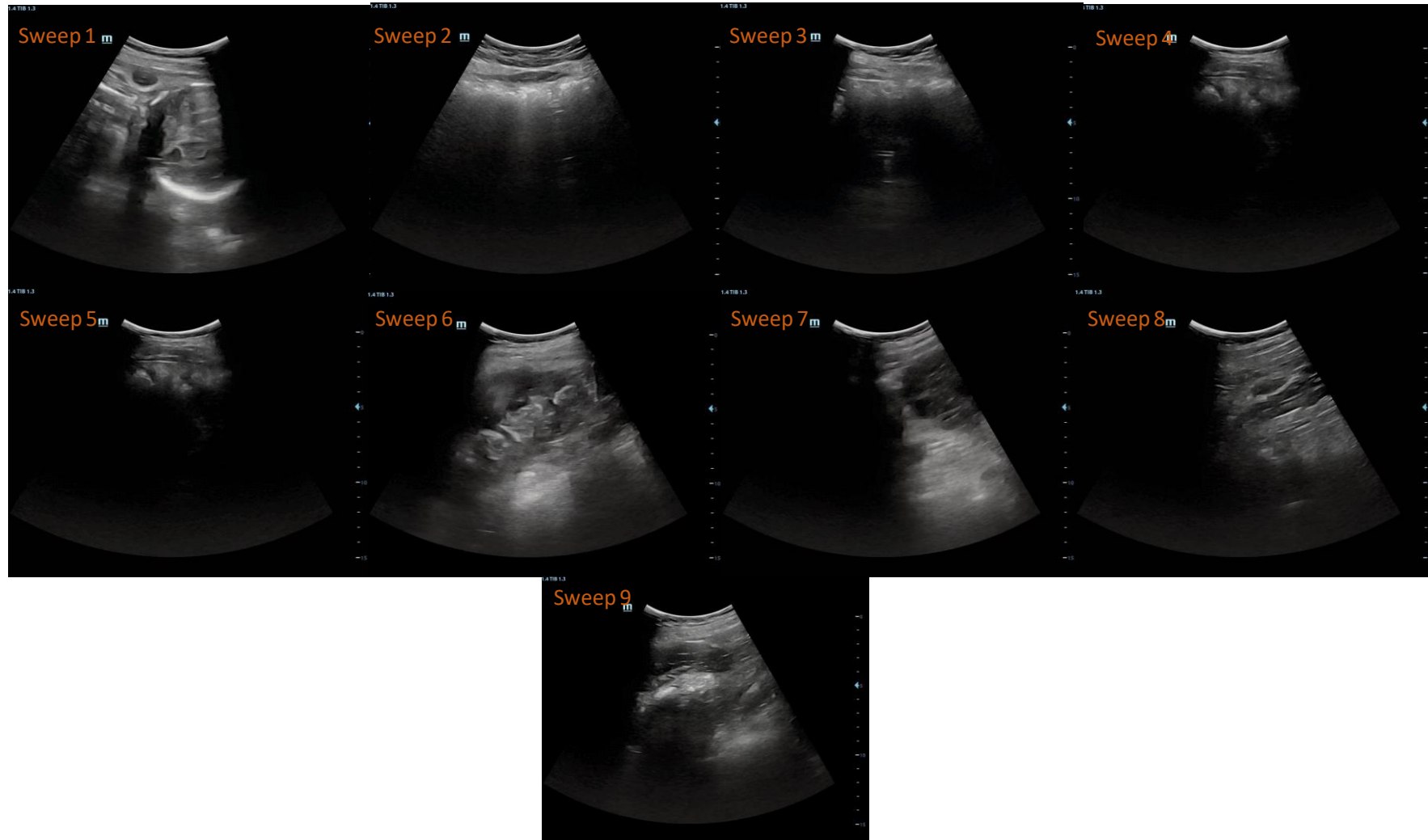
# Data Collection Overview



# 9 Blind Sweep Protocol



# BSOU Protocol (9-sweep)



BSOU: Capture multiple sweep videos following predefined trajectories

# Ethical Approval

- **Ethical Approval has been received from:**
  - Nepal Health Research Council (NHRC)
  - IRC of Tribhuban University of Teaching Hospital (TUTH)
  - IRC of Paropakar Maternity and Women's Hospital (PMWH)



Government of Nepal  
Nepal Health Research Council (NHRC)



Ref. No.: 2839

			testing and pilot evaluation Bayalpata hospital has been terminated	To combat slow data collection, new study sites have been added. One study site has been terminated because of infeasibility to work in that study site.
2	Sample Size	10000	9100	After careful consideration of available human and material resources, and within the study timeline, a sample size of 9,100 is achievable.
3	Validity and reliability of the tool	We will run a week-long camp at Bayalpata community centers to scan 120 pregnant women. Similarly, we will have nurses with brief training perform 120 scans at TUTH.	We will conduct field testing at the Chandragiri Municipality-Machhegaun health post and Kageshwori Manohara-Danchhi health post among the 500 cases.	As the study site at Bayalpata Hospital has been terminated and the research team has now collaborated with the Family Welfare Division (FWD), new sites have been added for the pilot evaluation.

The following documents were received and approved:

- Amendment submission form
- Progress report
- Support letter from Family Welfare Division and Paropakar Maternity and Women's Hospital
- Cover Letter from PI requesting Amendment and Continue review
- Updated Work plan

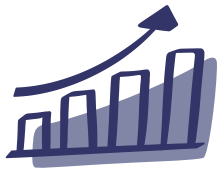
This approval is valid till May 2026.

If you have any questions, please feel free to contact the Ethical Review M&E Section of the NHRC.

Thanking You!

Dr. Pramod Joshi  
Member-Secretary



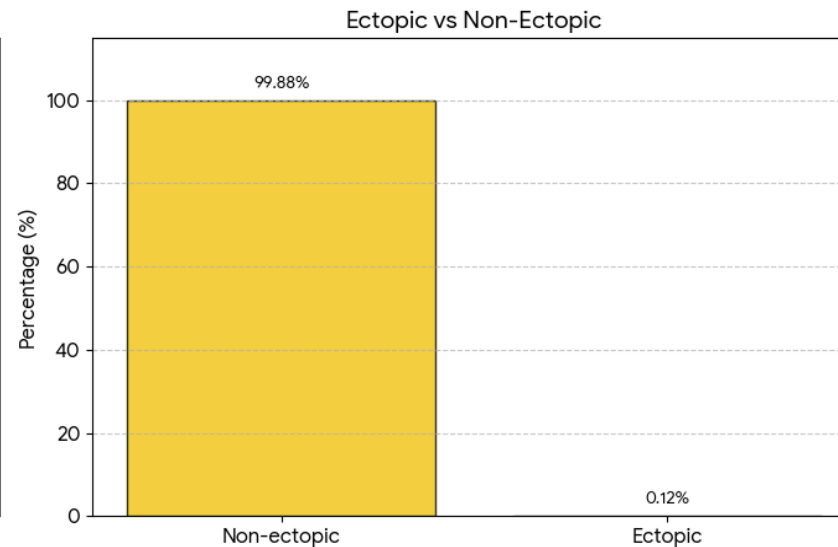
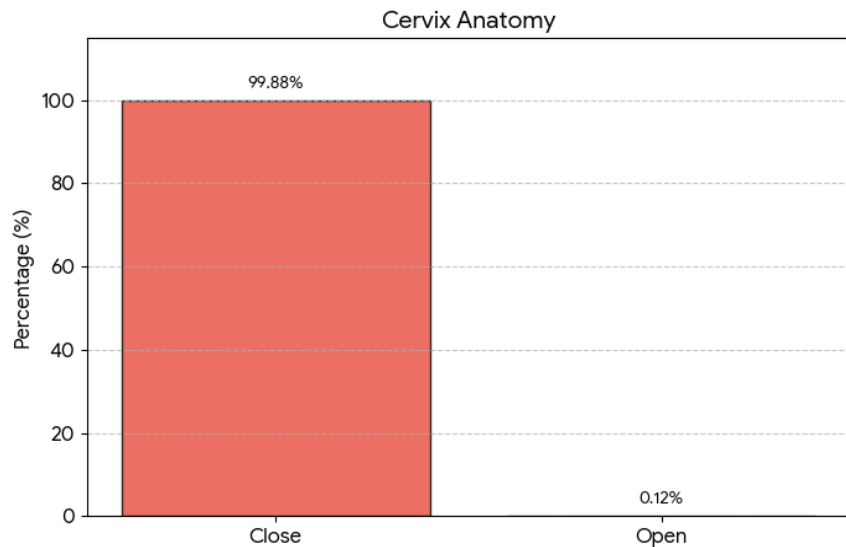
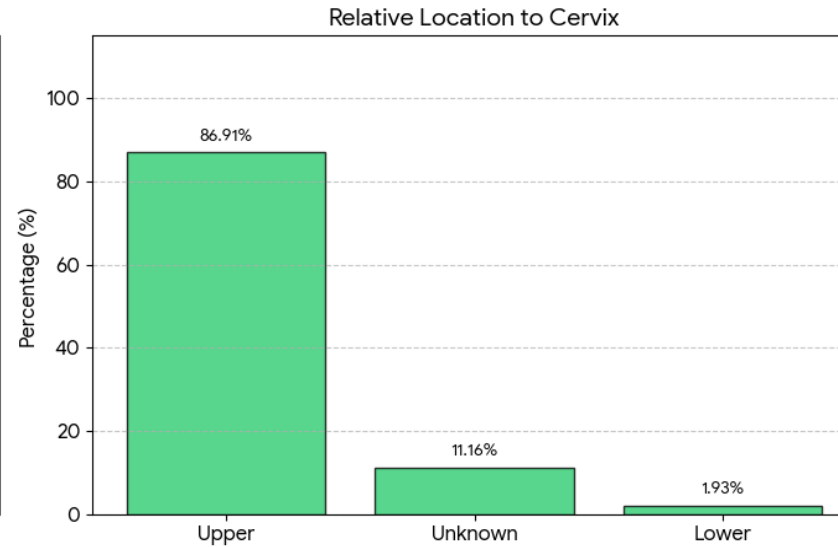
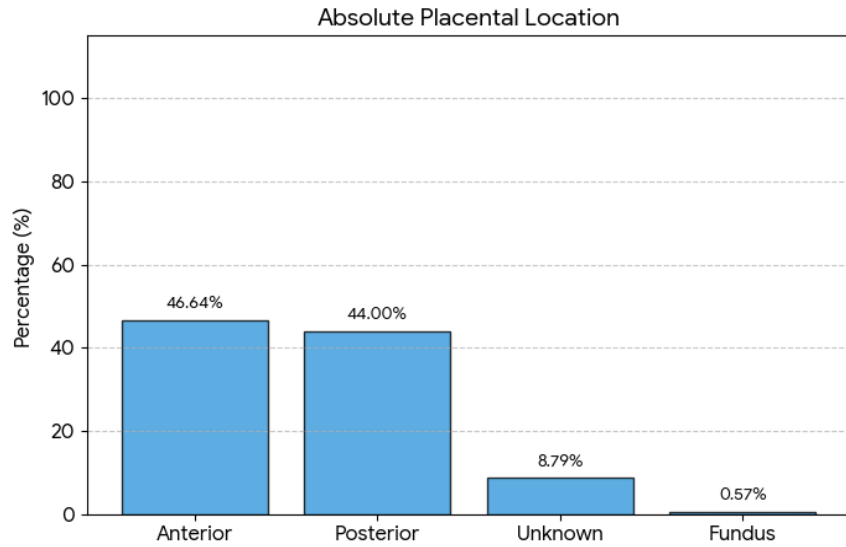


# Results

# Label Distribution

Category	Values	Counts	Percentages
Absolute placental location	['Posterior', 'Anterior', 'Fundus', 'Unknown']	[616, 653, 8, 123]	[44, 46.64, 0.5, 8.7]
Relative location of placenta to cervix	['Upper', 'Lower', 'Unknown']	[1261, 28, 162]	[86.9, 1.9, 11.16]
Cervix anatomy	['Close', 'Open']	[1617, 2]	[99.8, 0.2]
Ectopic vs non-ectopic	['Non-ectopic', 'Ectopic']	[1680, 2]	[99.88, 0.12]

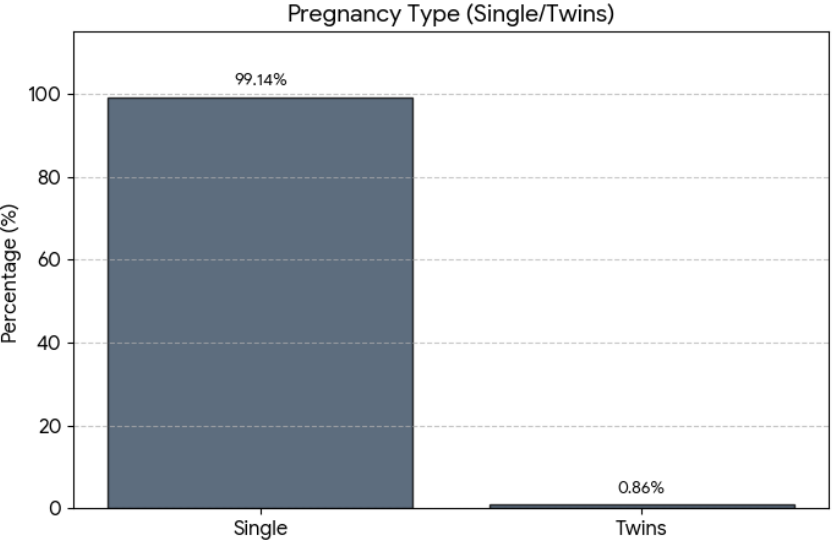
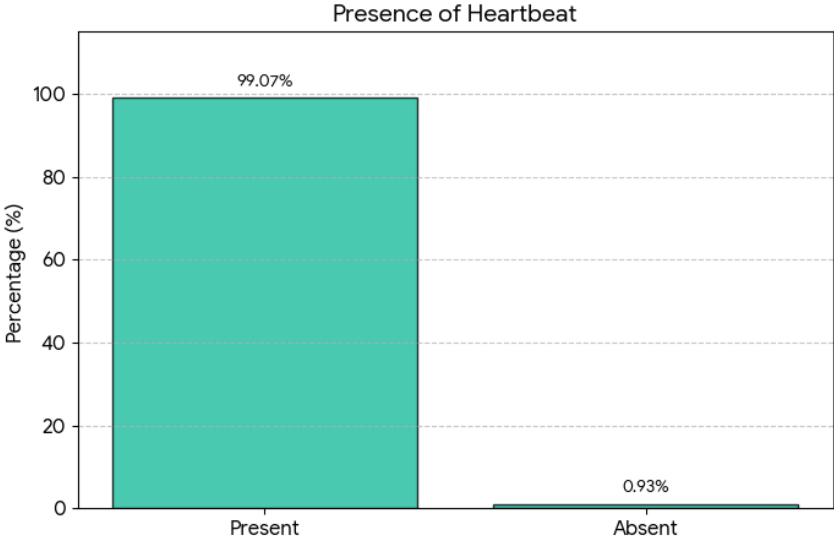
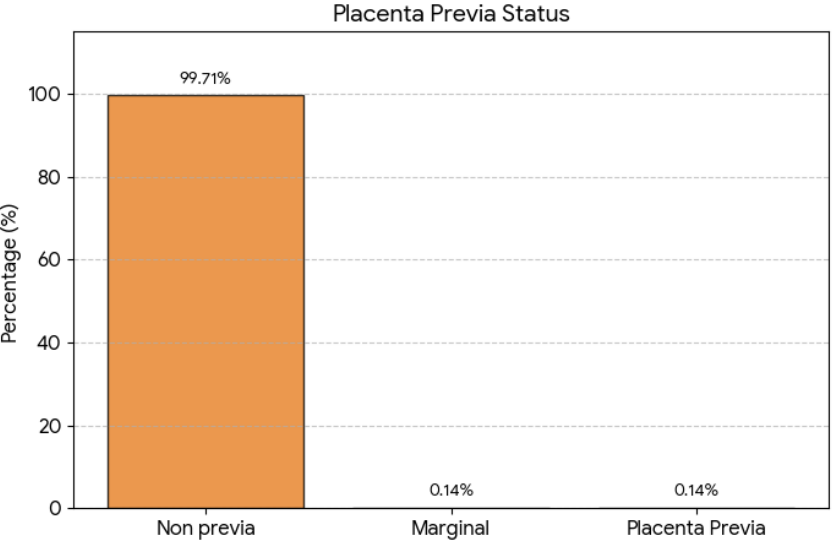
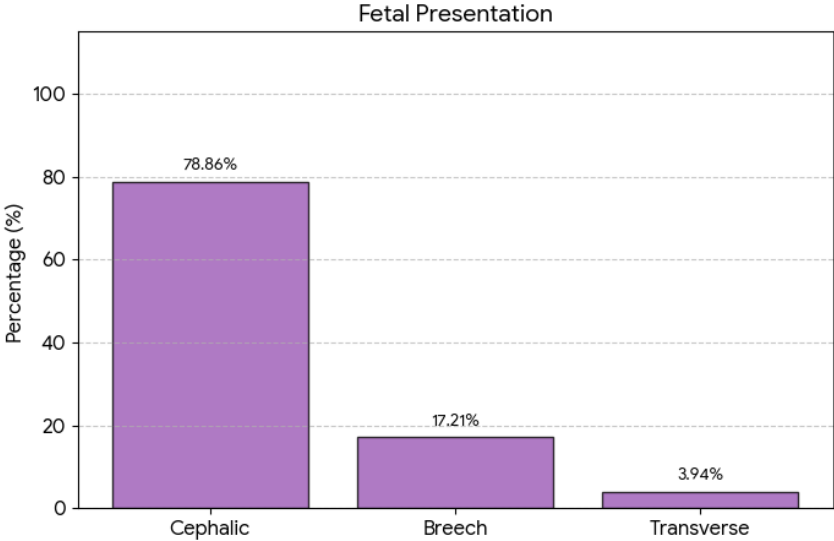
# Label Distribution



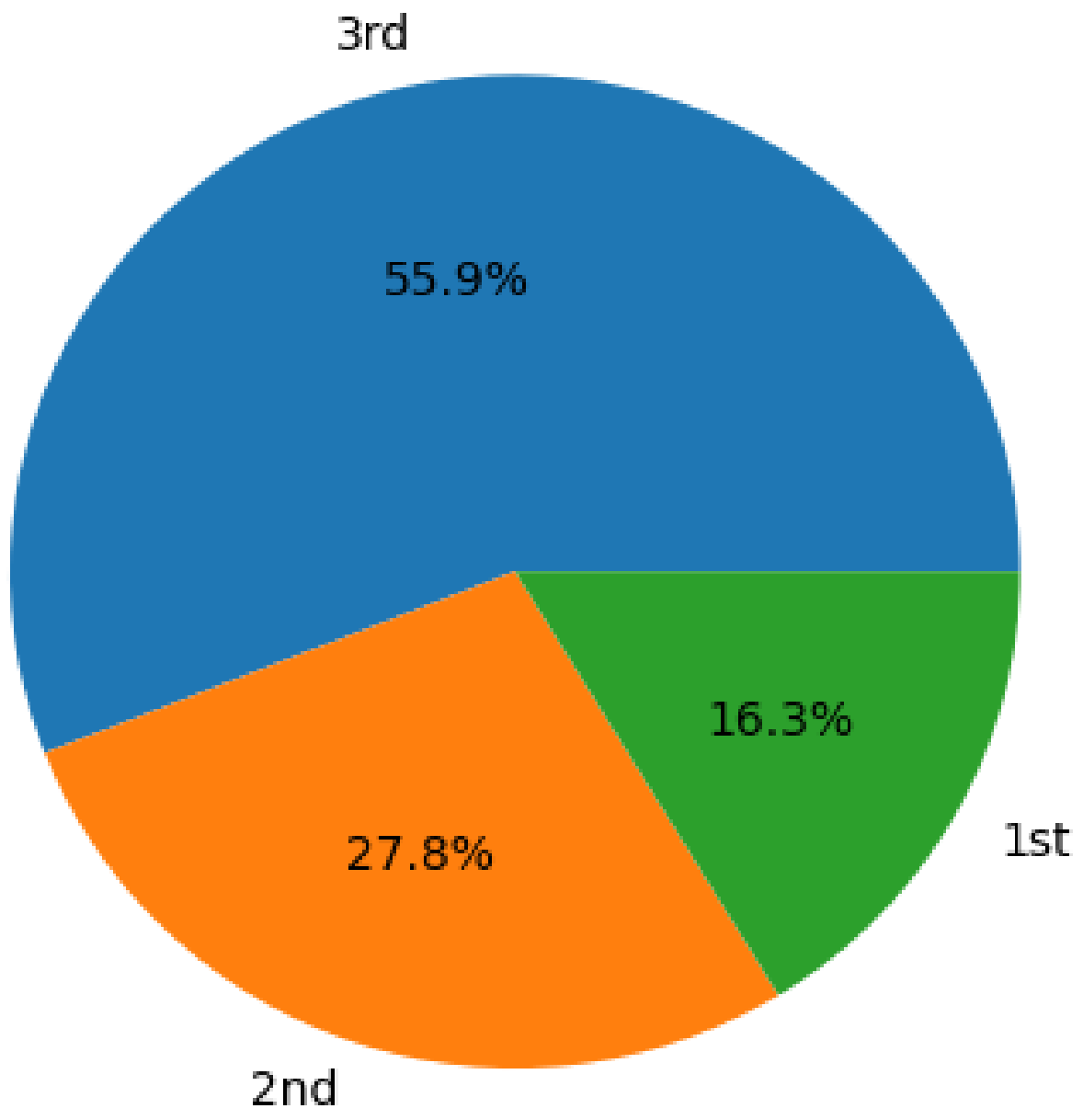
# Label Distribution

Category	Values	Counts	Percentages
Fetal presentation	['Cephalic', 'Breech' 'Transverse']	[1022, 223, 51]	[78.85, 17.2, 0.3]
Placenta previa or Non-previa	['Non previa', 'Marginal' 'Placenta Previa']	[1397, 2, 2]	[99.7, 0.014, 0.014]
Presence of heartbeat	['Present', 'Absent']	[1602, 15]	[99.07, 0.03]
Single vs multiple pregnancy	['Single', 'Twins']	[1610, 14]	[99.13 , 0.82]

# Label Distribution



# Trimester Distribution



# Model Performance on Fetal Presentation

## Data used

- Used total of **212** studies: 146 train, 21 Val, 45 Test
- Used **1250** studies from **FAMLI2 dataset**: 850 train, 200 valid, 200 test
- Labels were extracted from SOC scans
- Classification of **Cephalic vs Non-Cephalic** Presentations

Task	Model(Accuracy/F1-score)			
	FAMLI	AI-Sarosh (This Study)	FAMLI+AI- Sarosh(This Study)	SOTA
Fetal Presentation	73.33/75.11	75.56/56.00	75.56/43.04	~95.00

# Model Performance on Placenta Location

## Data used

- Used total of **212** studies: 146 train, 21 Val, 45 Test
- Used **1250** studies from **FAMLI2 dataset**: 850 train, 200 valid, 200 test
- Labels were extracted from SOC scans
- Classification of **Anterior** and **Posterior** Placenta

Task	Model(Accuracy/F1-score)			
	FAMLI	AI-Sarosh (this Study)	FAMLI+AI-Sarosh (This Study)	SOTA
Absolute placental location	88.64/88.43	84.09/83.97	<b>95.55/95.44</b>	N/A



# Product

# Product

## The AI Platform

- **Operational System:** A platform integrated with a PACS system to receive, store, and visualize data (DICOM format).
- **Interactive Components:**
  - **Mobile App:** Generates unique anonymized patient IDs.
  - **9-Sweep Protocol:** Standardized cine-loop videos (approx. 10 seconds each) across the abdomen (e.g., Right lateral, Midline, Transverse).
  - **Dashboard:** Allows experts to annotate clips and visualize analytics by day, week, or month.



# Conclusion

- **Objective:** Aiming to improve the diagnostic accuracy of obstetric ultrasound performed by community health nurses.
- **Conclusion:** Potentially fundamentally transforming task-shifting by scaling high-quality fetal ultrasound to remote community centers.
- **Next Steps:**
  - ***Data Collection Completion:*** Ongoing through August 2026.
  - ***Field Testing:*** Conducting pilot evaluations on 500 samples to compare AI-assisted nurse diagnosis against radiologist standards.
  - ***Model Refinement:*** ML researchers will continue coding annotated data to build and validate the final model.



**Ranjana Koirala, RN, MPH**  
***Research Project Manager, NAAMII***

Ranjana Koirala is a Research Project Manager at NAAMII with a multidisciplinary background in Nursing Science and Public Health. Her work focuses on advancing AI-driven health research, with an emphasis on innovation, evidence generation, and real-world application in low-resource settings.

She is committed to leveraging artificial intelligence to address pressing public health challenges and improve equitable health outcomes.

**Thank You !**

