# Strategic Patient Risk Stratification Analysis

## Clinical Risk Optimization for CardioCare Medical Centre

# 1. Company Context

**CardioCare Medical Centre** is a leading cardiovascular treatment hospital focused on improving early diagnosis, reducing emergency admissions, and optimizing the allocation of clinical resources.

The hospital faced increasing patient volumes and needed to identify **which patients were at highest risk of heart disease**, which indicators were most reliable, and how to improve early screening efficiency.

The leadership team commissioned this analysis to move beyond generic indicators and develop a **data-driven patient risk stratification strategy** that would improve triage decisions, reduce diagnostic inefficiencies, and enhance preventative care.

The analysis used patient clinical records to identify the strongest predictors of heart disease and uncover opportunities to improve screening protocols.

# 2. Business Questions

This analysis was designed to answer the following critical clinical and operational questions:

1. Which patient demographic group contributes the highest volume of heart disease cases?
2. Is cholesterol a reliable standalone indicator for predicting heart disease?
3. Which symptom presentation is the strongest predictor of heart disease?
4. How effective is exercise-induced angina as an early screening tool?
5. How can the hospital improve early detection while optimizing resource allocation?

6. Which screening strategy provides the highest clinical and operational efficiency?

# 3. Key Performance Indicators (KPIs)

The following KPIs were used to evaluate patient risk and diagnostic effectiveness:

## Patient Risk KPIs

- Heart Disease Prevalence by Age Group
- Heart Disease Conversion Rate by Chest Pain Type
- Hypertension Incidence Rate among High-Risk Patients

## Diagnostic Efficiency KPIs

- Average Cholesterol Level (Healthy vs Diseased Patients)
- Risk Probability of Exercise-Induced Angina
- Screening Accuracy Rate

## Operational Efficiency KPIs

- High-Risk Patient Volume by Segment
- Early Detection Opportunity Rate
- Predictive Strength of Clinical Indicators

# 4. Insights by Dimension

## A. Demographic Risk Analysis

**Key Insight:** Patients aged 50–59 represent the highest total burden of heart disease cases.

**Findings:**

- This group produced the highest number of positive heart disease diagnoses.
- A significant percentage had hypertension.

- Although patients aged 60+ had slightly higher individual risk, their total volume was lower.

**Business Interpretation:**

The 50–59 age group represents the most critical intervention point where preventative care can produce maximum impact.

## B. Cholesterol Effectiveness Analysis

**Key Insight:** Cholesterol alone is not a reliable predictor of heart disease.

**Findings:**

- Healthy patients averaged 241.8 mg/dL cholesterol.
- Diseased patients averaged 259.9 mg/dL cholesterol.
- The difference was too small to serve as a reliable screening filter.

**Business Interpretation:**

Using cholesterol as a primary screening tool creates high false positive rates and reduces diagnostic efficiency.

## C. Symptom Risk Analysis

**Key Insight:** Chest Pain Type 4 is the strongest predictor of heart disease.

**Findings:**

- Patients with Chest Pain Type 4 had over 55% probability of disease.
- This was the highest conversion rate among all symptom categories.

**Business Interpretation:**

Patients presenting this symptom require immediate clinical attention and prioritization.

## D. Diagnostic Test Effectiveness

**Key Insight:** Exercise-induced angina is a highly effective early screening tool.

**Findings:**

- Patients experiencing exercise-induced angina had a 74.2% probability of heart disease.

**Business Interpretation:**

Exercise stress tests provide strong predictive value and improve early detection efficiency.

# 5. Recommendations

Based on the analysis, the following strategic actions are recommended for CardioCare Medical Center:

## Recommendation 1: Prioritize Preventative Screening for Patients Aged 50–59

**Reason:**

This group represents the highest volume of heart disease cases.

**Impact:**

Improves early intervention and reduces emergency admissions.

## Recommendation 2: Stop Using Cholesterol as a Primary Screening Filter

**Reason:**

It lacks sufficient predictive accuracy.

**Impact:**

Reduces misdiagnosis and improves screening precision.

## Recommendation 3: Implement Immediate Triage Protocol for Chest Pain Type 4 Patients

**Reason:**

This symptom has the highest disease probability.

**Impact:**

Improves diagnosis speed and patient outcomes.

## Recommendation 4: Expand Use of Exercise Stress Testing

**Reason:**

Provides high predictive accuracy at lower cost.

**Impact:**

Improves early detection while reducing unnecessary advanced procedures.

## Strategic Clinical Impact Summary

By implementing these recommendations, CardioCare Medical Center can:

- Improve early detection rates
- Reduce diagnostic inefficiencies
- Optimize resource allocation
- Improve patient survival outcomes