

**Group 3**  
**MS984**

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# Cardiovascular Disease Prevention Using AI-Enabled Pathways in Scotland

## **MEMBERS**

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# Introduction

## Cardiovascular Disease Prevention Using AI-Enabled Pathways in Scotland

- Cardiovascular disease (CVD) remains the leading cause of mortality in Scotland, averaging **~44,000 deaths** annually between **2017–2022**.
- Hospital discharges for CVD are consistently high, averaging **0.77 million per year**, producing a **discharge-to-death ratio of 17:1**.
- **NHS Lanarkshire** shows a lower ratio (11:1), suggesting higher severity and a need for improved prevention.
- Our project aims to support early CVD prevention by developing an AI-enabled pathway-driven chatbot aligned with clinical guidance.



Cardiovascular  
Disease

# OBJECTIVES

Support patients and clinicians through four prevention pathways

Lipid  
Management

Obesity  
Management

Glycaemic  
Control

Smoking  
Cessation

# OUR PRIMARY AIM

To design a safe, pathway-driven AI chatbot that strengthens early prevention of cardiovascular disease in Scotland.

01

Use Scotland-wide mortality & discharge data to identify patterns and gaps.

02

Reduce preventable CVD admissions long-term.

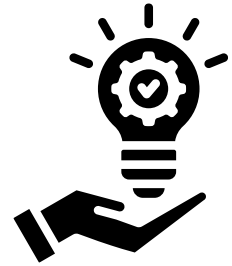
03

Provide consistent, evidence-based lifestyle and treatment guidance

04

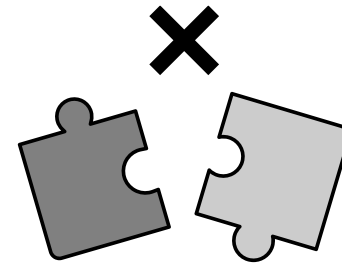
Select a safe, reliable AI model capable of healthcare-aligned communication.

# Past Solutions & How Our Solution Is Different



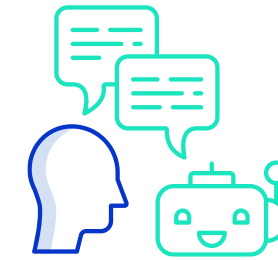
## Past Solutions

- NHS lifestyle apps
- Diabetes prevention programmes
- QRISK/ASSIGN risk tools
- GP-led counselling



## Gaps

- Fragmented services
- No unified prevention tool
- High clinician workload
- Limited follow-up
- Existing chatbots unsafe/inconsistent



## Our Solution

- One AI chatbot covering all 4 CVD pathways
- Uses GPT-5 for safe, structured guidance
- Automates screening + lifestyle support
- Provides reliable escalation (999 / 111)

# METHODOLOGY

01

## DATA ACQUISITION

- Scotland-wide CVD mortality data (2017–2022)
- Scotland-wide CVD discharge data (2017/18–2022/23)

02

## DATA PREPARATION

- Cleaned and structured datasets
- Created metrics: annual averages, discharge-to-death ratios, age distributions

03

## POWER BI DASHBOARD DEVELOPMENT

- Built visuals for mortality, discharges, diagnostic categories, age groups
- Applied board-level filters (e.g., NHS Lanarkshire)

04

## AI MODEL EVALUATION

- Tested GPT-4o, Claude 4 Opus, Gemini 2.5 Flash, GPT-5
- Assessed safety, escalation accuracy, and appropriateness

05

## CHATBOT DESIGN

- Integrated clinical pathway logic
- Layered rule-based decision trees + LLM conversation layer

# Data Analysis – Power BI



## ✓ Mortality & Discharge Trends

- Mortality: Stable between **43K–47K** deaths annually.
- Discharges: Extremely high activity, averaging **0.77M** per year.
- Discharge-to-death ratio: 17 to 1

## ✓ Diagnostic Burden

- **4.67M** Heart-related discharges
- **2.28M** CHD discharges
- **0.88M** Heart failure discharges
- **1.21M** Heart attack discharges
- **0.29M** Angina discharges

## ✓ Age Group Analysis

- **62.43%** Deaths Reported in 75+
- **21.03%** Deaths Reported in 65–74
- **15.39%** Deaths Reported in 45–64
- **1.15%** Deaths Reported in 0–44

# Chatbot Selection (Powered By Chatbase)

The image displays eight chatbot interface screenshots arranged in a 2x4 grid. Each screenshot shows a user's input and the chatbot's response. The user's input is: "Hi! What can I help you with?" followed by "I am unable to breathe normally" and "I have been smoking for 20+ years".

The chatbots shown are:

- GPT-4o (Top Left):** Responds with a general warning to seek medical help and offers resources for quitting smoking.
- Claude 4 Opus (Top Second):** Emphasizes that this could be a serious medical emergency and provides a list of immediate actions (call 999, go to A&E, or call NHS 111).
- Gemini 2.5 Flash (Top Third):** Provides a similar warning to GPT-4o and offers support for quitting smoking, mentioning NHS Inform.
- GPT-5 (Top Right):** Provides a warning and lists specific actions: call 999 for A&E or NHS 111 for advice.
- GPT-4o (Bottom Left):** Focuses on providing resources for quitting smoking, such as Quit Your Way Scotland.
- Claude 4 Opus (Bottom Second):** Explains that long smoking history contributes to breathing problems and provides a list of emergency and urgent actions.
- Gemini 2.5 Flash (Bottom Third):** Offers encouragement for quitting smoking and recommends reaching out to Quit Your Way Scotland.
- GPT-5 (Bottom Right):** Thanks the user for sharing and asks for more details about their smoking habits to provide better support.

# Chatbot Selection (Cost & Benefit)

## GPT-5

- The chatbot guides users through four major CVD prevention pathways
- UK-specific medical advice
- Consistent 999/111 escalation
- Structured responses
- Avoids over-diagnosis

## Benefits

- Reduced clinician workload
- Improved prevention engagement
- Enhancement of community health
- Consistent guideline delivery
- High ROI vs hospital admission costs (£3,900–£10,500 per MI case)

## Cost

- Development: £50k
- Maintenance & Support : £18k–20k
  - £306 / month
  - £3,673 per year
- Staff training minimal
  - One-time training £1500

# RECOMMENDATIONS

Implementing this AI-driven pathway approach offers a sustainable and scalable opportunity to reduce CVD burden across Scotland.

## Short-Term (0–6 months)

- Deploy GPT-5-powered chatbot as a prevention tool
- Integrate the 4 CVD pathways
- Embed into GP practice websites & community apps

## Medium-Term (6–12 months)

Measure impact using:

- Reduction in unnecessary GP appointments
- Patient engagement metrics
- CVD screening uptake
- Expand features (e.g., diet coaching, reminders)

## Long-Term (1+ years)

- Evaluate mortality & discharge trends
- Scale to additional NHS boards
- Continuous optimisation of pathway logic