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Health Insurance Pricing Audit

Smoking & BMI Risk

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Business Problem

Current pricing shows very high charges for smokers

Concern:

- Are all smokers truly high risk?

Objective:

- Audit pricing logic
- Identify who is actually driving costs
- Recommend fair, data-driven adjustments

Data Overview

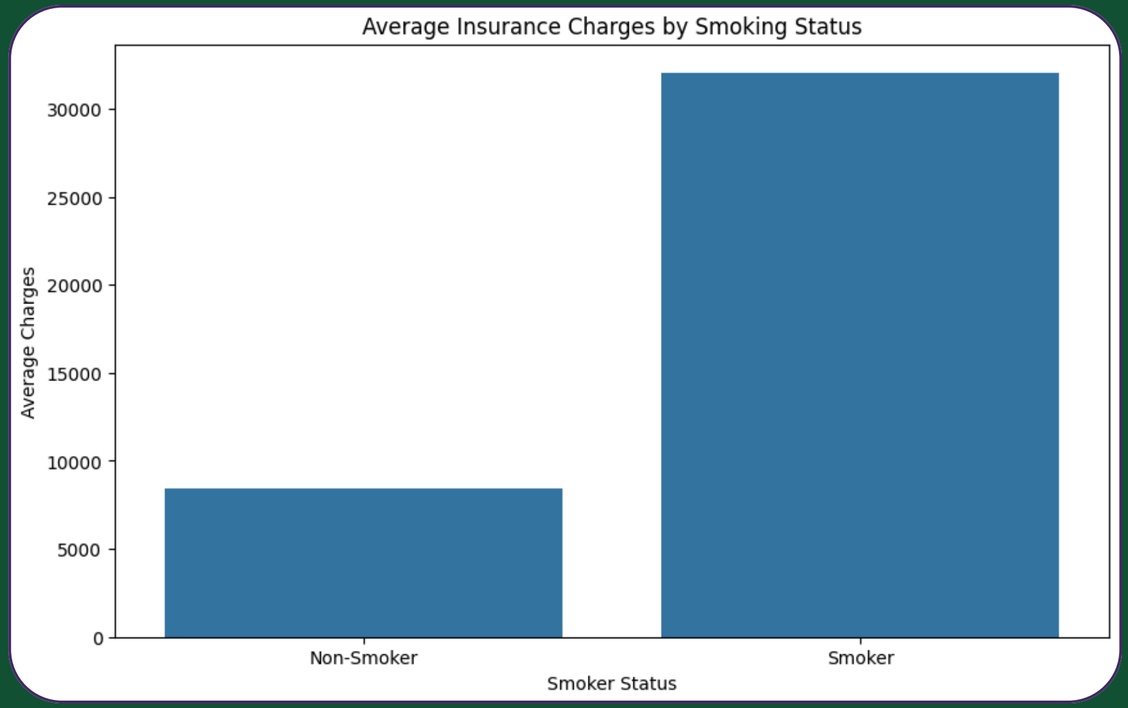
Our dataset includes **1,338 entries**

Key variables include:

- Age
- BMI
- Smoking status
- Region
- Medical charges

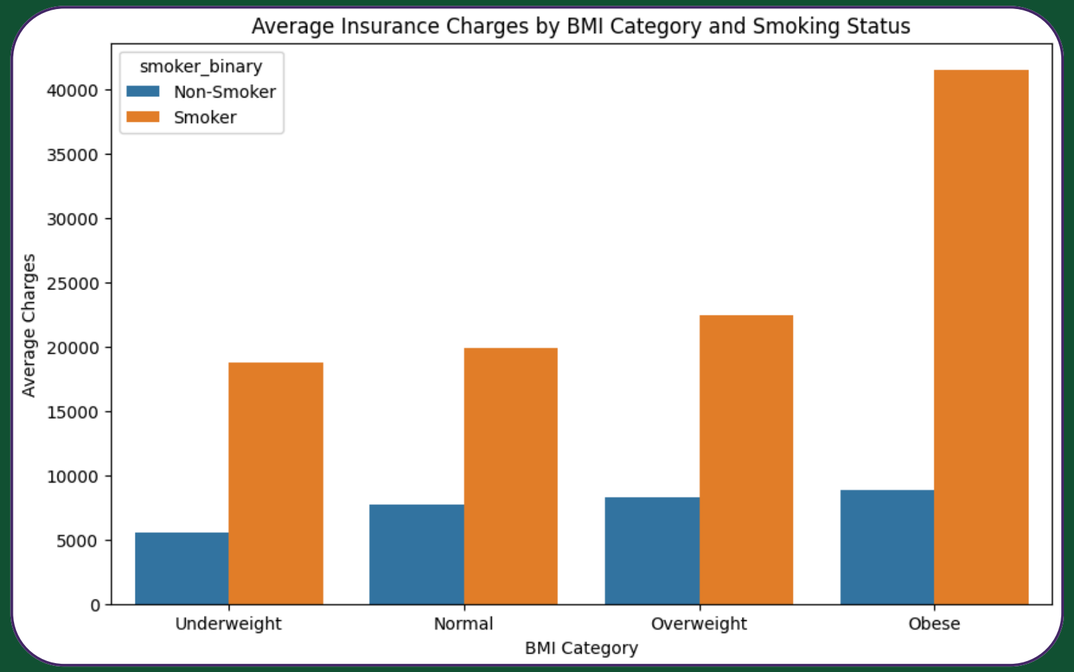
Initial Observation

1



- Smokers appear more expensive on average
- But averages hide important differences
- BMI suspected as key interaction factor

2

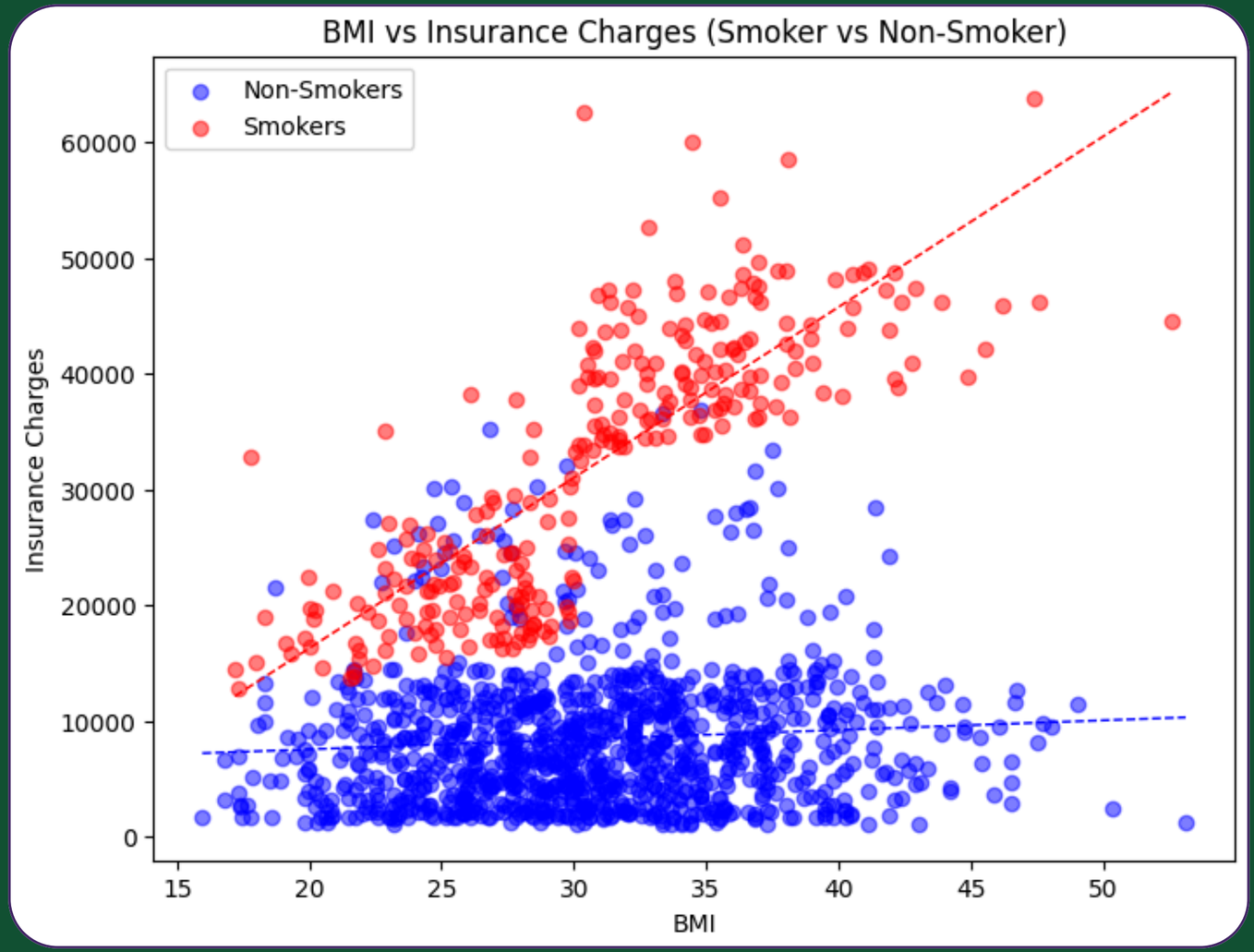


The Cost Cliff

- Costs remain relatively stable below BMI 30
- For smokers, costs rise sharply after BMI ≥ 30
- Non-smokers do not show this pattern

Key Insight

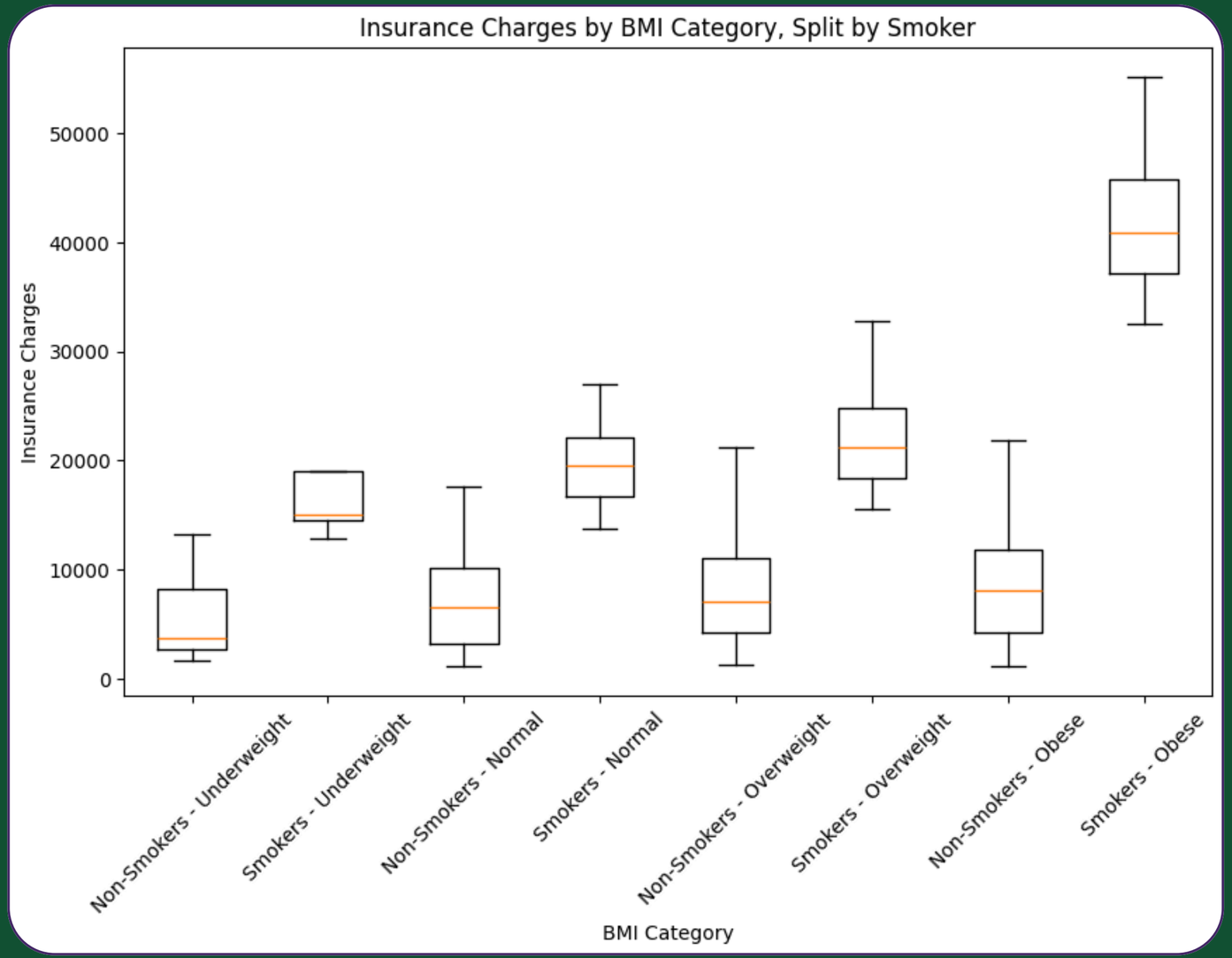
Smoking alone isn’t the issue — smoking + obesity is.



Distribution Proof

The boxplots illustrate the significant median charge differences between smoker and non-smoker BMI bands, highlighting the impact of obesity.

- Low-BMI smokers ≈ non-smokers
- Obese smokers have:
  - Higher medians
  - Wider cost spread
  - More extreme outliers



Quantifying the Difference

Averages only spike for obese smokers.

Segment	Average Charges
Non-Smokers (All BMI)	8,434
Smokers, BMI < 18.5 (Underweight)	18,810
Smokers, BMI < 25 (Normal)	19,942
Smokers, BMI < 30 (Overweight)	22,496
Smokers BMI > 30 (Obese)	41,558

Model Findings

Smoking interaction drives cost difference

Our analysis reveals that the interaction between smoking status and BMI is significant for fair pricing.

- BMI alone ≈ small effect
- Smoking alone ≈ small effect
- BMI × Smoking = major cost driver

Pricing Recommendation

This section outlines the **Proposed Risk-Based Pricing Adjestment** for customer segments to ensure fair pricing based on smoker and BMI status.

Customer Segment	Risk Multiplier
Non-Smokers	1.0
Smokers, BMI < 30	1.1
Smokers, BMI > 30 (Obese)	1.8 - 2.2

This aligns pricing with actual observed risk.

Business Impact

New Pricing Benefits and Trust Improvement

- Prevents overpricing low-risk smokers
- Accurately prices high-risk customers
- Improves fairness and trust
- Reduces churn and regulatory risk

Better pricing = better business + better fairness.

Key Takeaways

The audit reveals that:

1. Smoking alone is not the main cost driver
2. Obesity magnifies smoking-related risk
3. Data supports a tiered pricing approach
4. Recommended adjustments are simple and explainable

Thank You

GitHub Project link

Project Link

Tableau dashboard link

Medical Audit Dashboard