# 2020 UCLA Case Study Competition

Team 19

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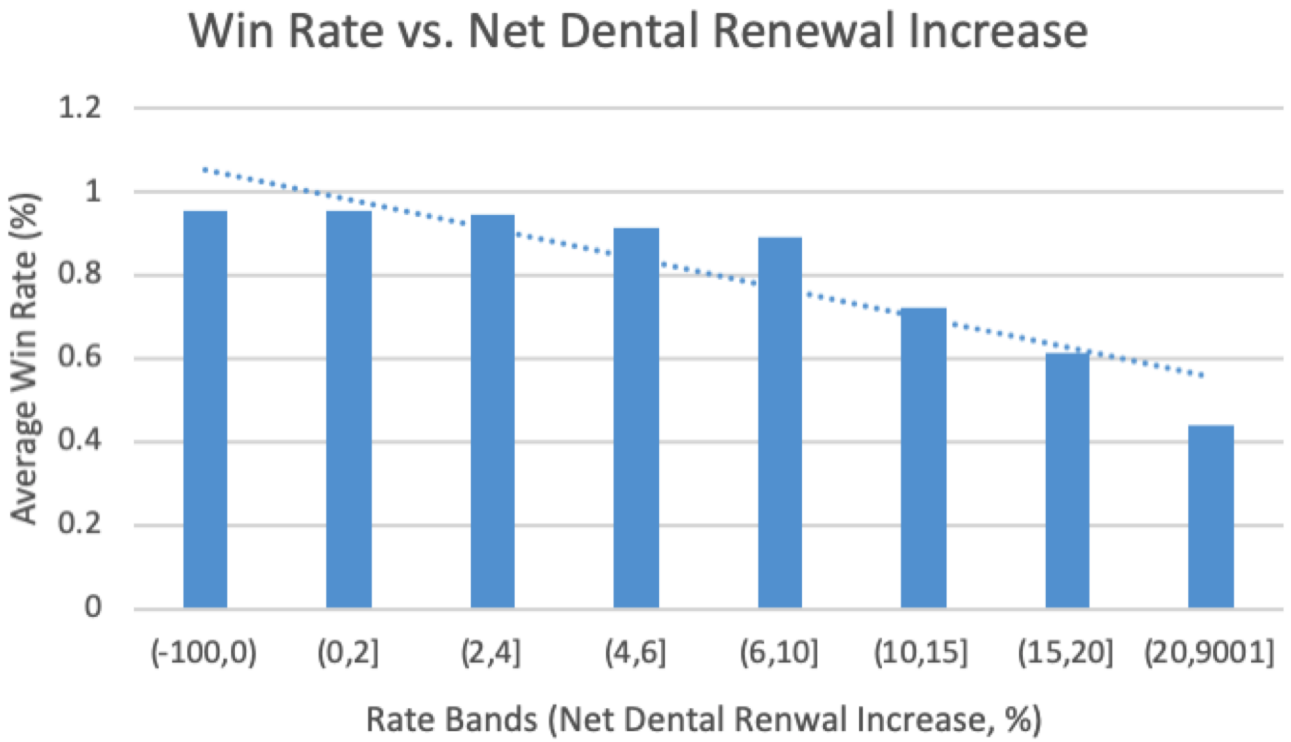
# Agenda

- Introduction
- Analyzing the Data
- Designing Renewal Probability Model
- Maximizing Profit vs. Maximizing Revenue
- Final Plan to Decrease Loss Ratio
- Implications

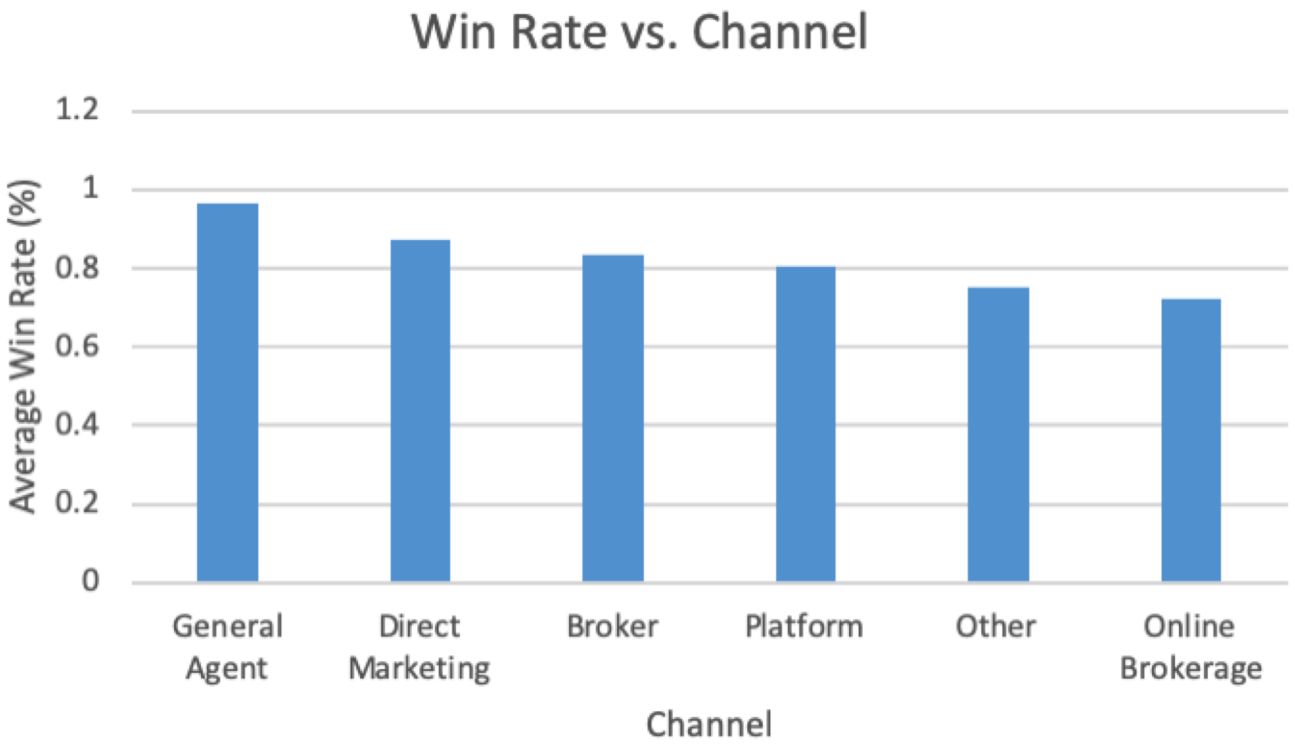
# Introduction

- **Goal:** Reduce loss ratio (losses ÷ premiums) to 0.70 over 3 years
- **Method:** enforce stricter renewal policy

# Are The Win Rates Intuitive?



# Are The Win Rates Intuitive?

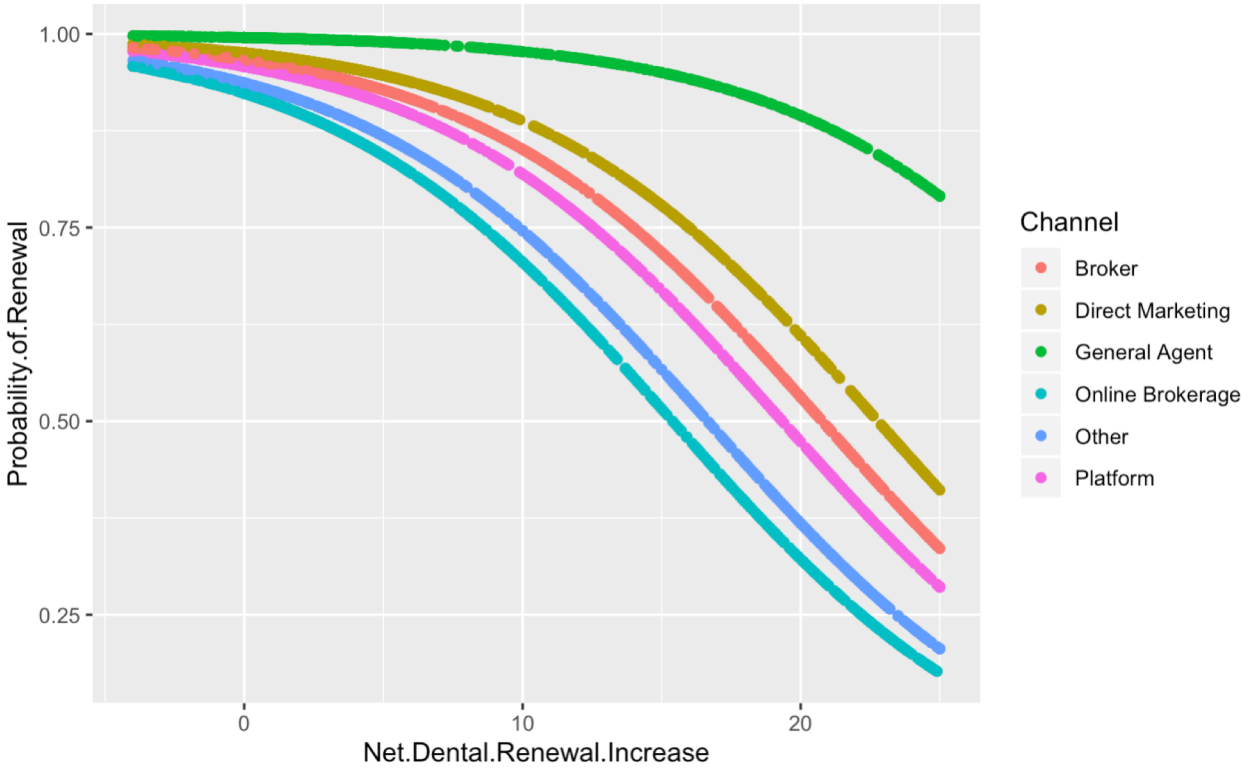


# Renewal Probability Model

# Renewal Probability Model

- Generalized Linear Model (GLM) - **Logistic Regression**
- Modeling the **probability of a group renewing their policy**
- Lowest error rate using **Channel** and **Net Dental Renewal Increase**

# Renewal Win Rate Curves



# Implementing the Model

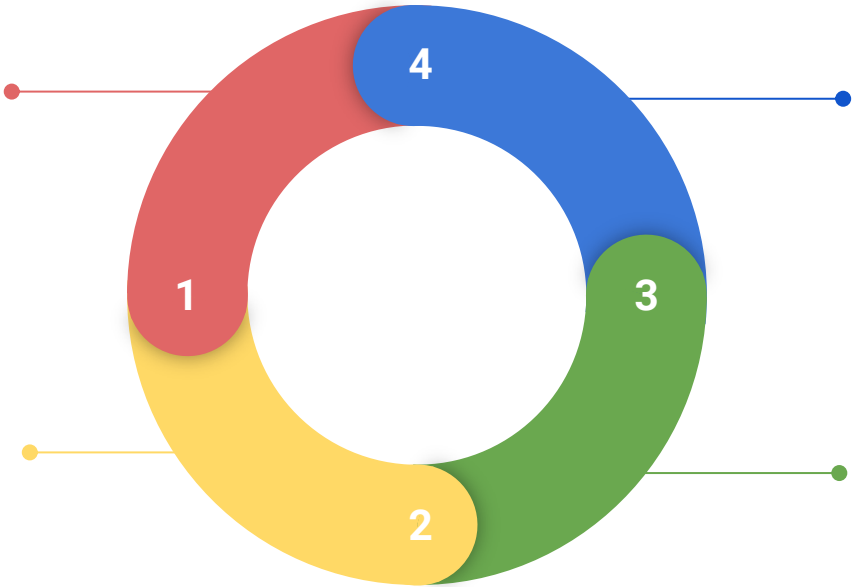
Assumptions:

- Assume losses and other expenses are constant
- Renewals each year are independent of rate increases from previous years

# Process

1. Generate probabilities of renewal for each group

2. If probability exceeds 50%, then assume renewal




4. Adjust rate increases to obtain desired loss ratio

3. Adjust rates and repeat the process for 3 years

# Maximizing Revenue

- Strategically decreased rates by hand
- Profit is also maximized
- **Not realistic** (100% win rate, 10% rate incr. for low LR groups)

| Loss Ratio (%) | Rate Increase Yr 1 (%) | Rate Increase Yr 2 (%) | Rate Increase Yr 3 (%) |
|---|---|---|---|
| (0,25] | 10 | 5 | 0 |
| (25,50] | 10 | 10 | 5 |
| (50,75] | 15 | 10 | 10 |
| (75,100] | 15 | 15 | 10 |
| (100,150] | 15 | 15 | 10 |
| (150,9999] | 15 | 15 | 15 |

| | 2020 | 2021 | 2022 |
|---|---|---|---|
| Expected Premiums | $119.4 million | $133.7 million | $144.4 million |
| Expected Claims | $92.7 million | $92.7 million | $92.7 million |
| Expected Payoff | $26.6 million | $41.0 million | $51.6 million |
| Expected Loss Ratio | 77.7% | 69.4% | 64.2% |
| Win % | 100% | 100% | 100% |

# Maximizing Profit (Payoff)

- Conservative approach
- Strategically decreased rates by hand
- More realistic

| Loss Ratio (%) | Rate Increase Yr 1 (%) | Rate Increase Yr 2 (%) | Rate Increase Yr 3 (%) |
|---|---|---|---|
| (0,25] | 0 | 0 | 0 |
| (25,50] | 0 | 0 | 0 |
| (50,75] | 5 | 5 | 5 |
| (75,100] | 10 | 10 | 10 |
| (100,150] | 15 | 15 | 15 |
| (150,9999] | 20 | 15 | 15 |

| | 2020 | 2021 | 2022 |
|---|---|---|---|
| Expected Premiums | $108.9 million | $117.7 million | $126.3 million |
| Expected Claims | $84.8 million | $84.8 million | $84.8 million |
| Expected Payoff | $24.1 million | $32.9 million | $41.5 million |
| Expected Loss Ratio | 77.9% | 72.1% | 67.1% |
| Win % | 95% | 95% | 95% |

# Implementing Improvements

# Future Improvements

## #1 (see next slide)

Apply rate changes to **each policyholder** (continuously)

**More accurate** than using discrete loss ratio bands

## #2

Use **all factors** as predictors for renewal probability

Results in **very low error**

## #3

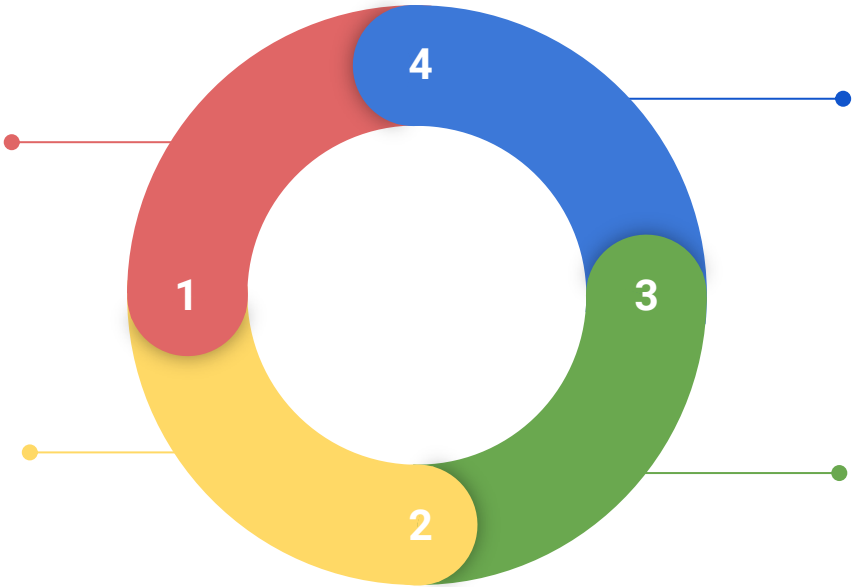
Factor in a **3% historical average annual inflation**

Will generate **more accurate** financial expectations

# Process

1. For groups with Loss Ratio <= 0.7, do not increase rate

2. Take groups with Loss Ratio > 0.7 and subtract Loss Ratio by 0.7




4. Repeat for each year based on prev. year's projected Loss Ratio

3. Divide the difference by 3 & cap result at 20%. Then, apply result as rate increase

# Final Strategy

- **Naturally diminishing rate increases** (good)
- Customer's loss ratios decrease over time
- **Lower win rate**, but that is expected
- However, **fairest and most realistic profits** are achieved

| | 2020 | 2021 | 2022 |
|---|---|---|---|
| **Expected Premiums** | $98.5 million | $104.1 million | $108.5 million |
| **Expected Claims** | $74.4 million | $74.4 million | $74.4 million |
| **Expected Payoff** | $24.1 million | $29.7 million | $34.1 million |
| **Expected Loss Ratio** | 75.5% | 71.5% | 68.6% |
| **Win Loss %** | 88% | 88% | 88% |

# Final Strategy

## Weakness

Each year's **renewals** are assumed to be **independent of rate increases**

In reality, **rate increases can affect future renewal rate**

## Weakness

Each policyholder's **yearly losses** are assumed to be **constant**

In reality, **losses may vary from year to year**

## Trade-off

By not using more (or all) predictors, **accuracy may be limited**

However, model is more **simple and interpretable**

# Other ways to reduce loss ratio

Decrease policy limit

Increase deductibles

Ad campaigns to proactively promote healthy dental habits

Incentive programs
Ex. free movie tickets for being cavity-free

# Thank you!