

# *LaVie Insurance*

*Sales Strategy & Analytics*

*Establishing Life insurance risk premium using premature death (YPLL) forecasting*

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# Business objective:

Increase value of net premiums by 2% above inflation for our company using the risk of premature death per state

Despite strong operating margins our business is struggling to grow value of premiums beyond annual inflation rate (US-CPI)

# Key Definitions / Themes

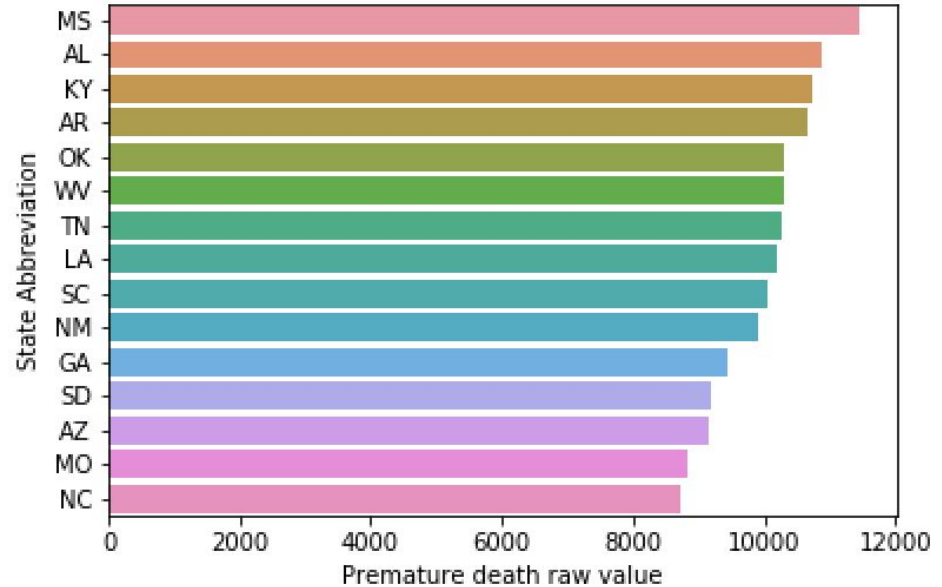
- **Claim / Death benefit:** amount of money the insurance company guarantees to the beneficiaries
- **Premium:** cost of insurance
- **Life Insurance Policy types:** whole life, term life, universal life, variable universal life
- **Current Industry Challenges:**
  - Premium growth has not outpaced inflation for the last two decades
  - Cost saving required
  - Model improvement for premium tailoring
  - Technology investments

# US Life Insurance Market 2020

- Life market size: \$868.5bn in premiums written
- Non-Life Size: \$1 trillion in gross written premiums
- 57% of americans have a life insurance policy contract
- Life Insurance & Annuities growth - 2020 : 1.6%
- Life Insurance & Annuities growth 2015 - 2020: -2.3%
- Average premium for 250,000 USD life Insurance policy: 814.56\$ p.a.
- Ageing Population in the US will increase payout frequency
  - 12.3% >65 years old in 2000
  - 21.6% >65 years old expected in 2040

# Premature Deaths by State (Years Potential Life Loss)

- Aggregation done at state level
- Measured as years potential life loss per 100,000
- Proxy for risk premium addition
- Dependent variable / prediction
- 31 predictors / explanatory variables initially



15 states with the highest amount of premature deaths

# Explanatory Factors of Premature Deaths

## *Baseline interpretation*

### Main variables

- Poor or Fair health: 0.64
- Poor physical health days: 0.64
- Poor mental health days: 0.59
- Adult smoking raw value: 0.66
- Adult obesity raw value: 0.45
- Children in poverty value: 0.69
- Frequent physical distress: 0.68
- Food insecurity: 0.6

### Interpretation

- Value used is correlation
- Correlation matches logical inference
- Simple OLS model yields an  $R^2$  of 62%

# Modeling Process

## Best model results:

- Alpha: 27
- 36 contributing factors (interactions + variables) to model
- $R^2$  (Train): 0.64
- $R^2$  (Test): 0.68

*We can answer more precise model information after the presentation*

## Steps

1. Extract precise interactions among the predictors
2. Simplification of dataset
3. Check for predictor risks (multicollinearity)
4. Apply solution
5. Reduce the number of variables
6. Pick best performing model

## Model types tested

1. Ridge (10 models run)
2. Lasso (10 models run)
3. Elastic Net (100 models run)

# Results interpretation

*Interpret factors explaining premature deaths  
and predict premature deaths*

**Explanatory power of factors:**

## Positive relationship

- **Children in poverty**
- **Poor mental health**
- **Income inequality + limited access healthy food**
- **Food environment index + diabetes prevalence**
- **Adult Smoking**

## Negative relationship

- **Overcrowded households + Population**
- **Air pollution**
- **College Attendance**
- **Flu vaccinations**



# Business Application & Future Implementation

Use future data to apply a % range  
increase

## Final Case Study

- Targeting risk adjusted revenue
- 2019 Sales: \$100,000,000
- 2020 Expected inflation: 3%
- CPI-linked 2020 Sales: \$103,000,000
- Model target: +2%
- Expected 2020 Sales: \$105,060,000
  - Change: +\$3,060,000

## Allocation of extra premium value

- Forecast YPLL across all 50 states per 100,000 people
- Scale YPLL to the insured population of each state
- Allocate \$ increase proportionally

Thank you for your attention.

Feel free to ask any questions!