

## Introduction

In the United States, individuals are oftentimes vastly underprepared for the costs associated with future long term care. With the rising need for assisted living and the rapidly increasing cost of long term care, it is important to plan and prepare for the possibility of incurring this large expense. We were approached by a local attorney to calculate the expected future costs of nursing home care so he can accurately educate his clients on financial strategy. For this project, we will calculate the expected present value of semi-private nursing home costs based on age and gender.

## Facts/Statistics

- In 2012, there were 1.4 million people in nursing homes nationally.
- More common in older people, 13% of people 85 or older reside in a nursing home and 1% of people ages 65-74.
- Of the population aged 65 or older in 1999, 52% of the nursing home population was 85 or older. 35% aged 75-84 and 13% aged 65-74.

## Methods

For our project, we used Actuarial Mathematics to determine an Expected Present Value (Actuarial Present Value) of future nursing home costs. Costs are calculated as an annuity because payments are made in intervals. We calculated this for individuals based on age and gender. Important tools included:

- Projected cash flows using an exponential model
- Probability table for length of stay in a nursing home based on age
- Expected future interest rates

Formula for Annual Actuarial Present Value of a Whole Life Annuity Immediate:

$$a_x = \sum_{k=1}^{\infty} v^k [1 - F_T(t)] = \sum_{t=1}^{\infty} v^t {}_t p_x$$

Where  $v = (1+i)^{-1}$  is the discount factor with respect to interest and  ${}_t p_x$  is the probability a life aged  $x$  survives  $t$  years

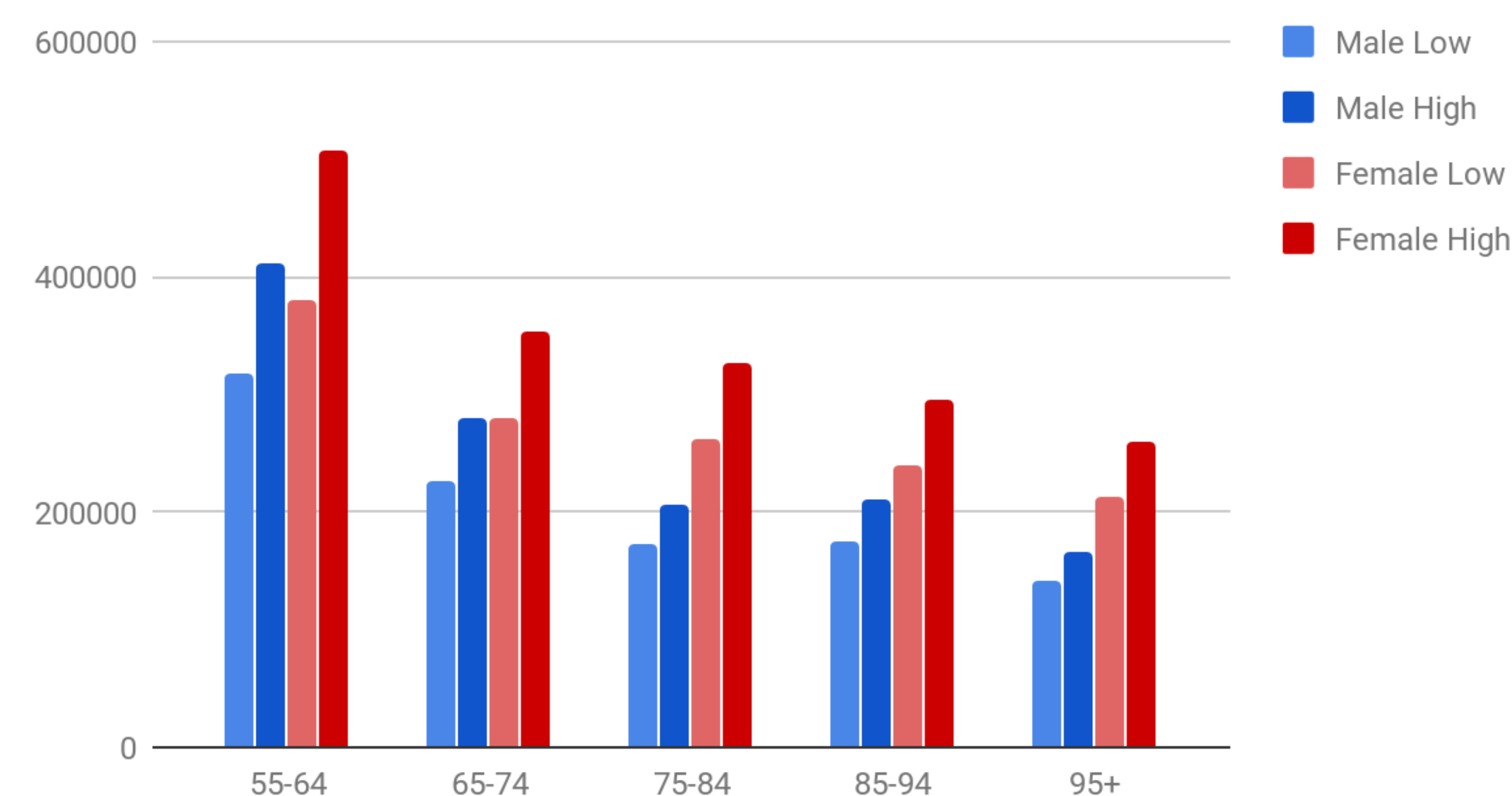
## Assumptions

- Projected future costs increase exponentially and can range +/- 5% of the estimate
- Expected average interest rate over next 10 years is 3.6% and can range +/- 3%
- Interest rates are constant
- Length of stay in a nursing home ranges between 1.8 and 2 times the probability given by our resource (from 1984)

## Results

- Results are given in a range from lowest actuarial present value of expenses to highest actuarial present value of expenses based on age range, gender, and semi private room rates in Ohio
- Females consistently can expect higher expected present values compared to male counterparts
- The lowest expected present value of costs would be for a male life over the age of 95 at \$141,700

Low and High Cost Estimates



| Age   | Male Low | Male High | Female Low | Female High |
|-------|----------|-----------|------------|-------------|
| 55-64 | 317,500  | 411,800   | 379,900    | 508,200     |
| 65-74 | 225,900  | 278,800   | 279,000    | 353,900     |
| 75-84 | 173,700  | 207,000   | 261,800    | 327,100     |
| 85-94 | 175,600  | 210,800   | 239,700    | 295,700     |
| 95+   | 141,700  | 165,700   | 211,800    | 269,700     |

## Discussion

- The higher expected present value of nursing home costs for females can partially be attributed to the fact that females historically have more longevity than males, leading to longer stays in the nursing home.
- If the same method was to be applied to private room nursing home costs, the expected present value of the expense would be higher than the semi-private room.
- Adding on additional services with nursing home care, such as baths, laundry, meals, housekeeping, and maintenance, will also increase costs.
- People may not be aware how expensive nursing home care can be. Purchasing long term care insurance can be very beneficial. In addition, properly saving/investing money will help you in the future with these costs.
- The public should be educated on the possibility of enduring these high costs in order to plan for future financial wellness.

## Future Work

Given our findings about nursing home expenses, future work would entail calculation of the actuarial present value of long term care costs beyond just the nursing home. This would include private room costs, home care, assisted living, adult day care, etc. Additionally, since the relationship status of individuals can have influence on health and access to care, it would be beneficial to evaluate the differences between single and married individuals expected present value of costs.

## Works Cited

- Compare Long Term Care Costs Across the United States. (n.d.). Retrieved February 10, 2018, from <https://www.genworth.com/about-us/industry-expertise/cost-of-care.htm>
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