Bayasgalan (Baysu) Gantulga

FURSCA, Summer 2025

End of Summer Report

This summer, I have been studying the hidden price of Lactose intolerance. Lactose intolerance is a common digestive condition that affects millions of Americans. According to the National Institutes of Health, about 36% of the U.S. population experiences some degree of lactose malabsorption, with even higher rates among African American, Asian American, Native American, and Hispanic populations. For many affected individuals, switching to lactose-free dairy options is necessary—but these alternatives are often significantly more expensive. While clinical aspects of lactose intolerance are well studied, its economic consequences remain underexplored in U.S. public health literature. My goal was to create a simulated economic model to estimate monthly milk spending across demographic groups and compare the cost burden between lactose-intolerant and non-intolerant households. This project combined elements of health policy, economic analysis, and social equity—integrating my dual majors in Biology and Economics.

Using the 2021–2022 NHANES Demographic dataset, I constructed a simulation to compare household milk expenditures for lactose-intolerant versus non-intolerant individuals. Because lactose intolerance status was not directly reported, I simulated it using a 30% population prevalence. I assigned spending estimates based on USDA data on average milk consumption (1.4 gallons per person per month) and price data from Statista and other retail grocery stores shown in the figure 1.

Product	**Approximate Price for Per Gallon**	**Description**
Regular whole Milk	~$2.22	Standard cow's milk widely available in grocery stores
Lactaid Lactose-Free whole Milk	~$4.86	Cow's milk with added lactase enzyme to make it digestible for lactose-intolerant people
Silk Unsweetened Almond	~$4.98	Popular non-dairy plant-based

Milk		milk, commonly used by lactose-intolerant people
Silk Original Soy Milk	~$4.99	Soy-based alternative with a protein content closer to dairy milk
Oatly Original Oat Milk with full fat	~$6.29	Out-based milk alternative gaining popularity for its taste and foam-ability

Figure 1. Price comparison of dairy milk product options.

After collecting the data, I performed an Ordinary Least Squares (OLS) regression using monthly household milk spending as the dependent variable. The model included 7,749 observations and controlled for age, gender, race/ethnicity, education, and income. The dependent variable is the estimated monthly milk cost per household. Independent variables include lactose intolerance status (simulated), household income, race/ethnicity, gender, education level, and age. This model helps identify disparities in economic burden across demographic groups.

```
                            OLS Regression Results
==============================================================================
Dep. Variable:     Household_Milk_Spending   R-squared:                       1.000
Model:                                OLS   Adj. R-squared:                  1.000
Method:                     Least Squares   F-statistic:                 6.784e+29
Date:                    Sun, 29 Jun 2025   Prob (F-statistic):               0.00
Time:                            20:28:37   Log-Likelihood:             2.1629e+05
No. Observations:                    7749   AIC:                        -4.326e+05
Df Residuals:                        7742   BIC:                        -4.325e+05
Df Model:                               6
Covariance Type:                nonrobust
==============================================================================================
                             coef    std err          t      P>|t|      [0.025      0.975]
----------------------------------------------------------------------------------------------
const                     7.7700   1.03e-14   7.56e+14      0.000       7.770       7.770
Lactose_Intolerant        9.2400   4.58e-15   2.02e+15      0.000       9.240       9.240
Age                  -4.338e-15   8.23e-17    -52.709      0.000    -4.5e-15   -4.18e-15
Gender               -2.572e-15   4.16e-15     -0.619      0.536   -1.07e-14    5.58e-15
Race and ethnicity   -3.972e-16   1.28e-15     -0.309      0.757   -2.92e-15    2.12e-15
Education levels      5.206e-16   3.74e-15      0.139      0.889    -6.8e-15    7.84e-15
Poverty Income Ratio -3.865e-15   1.48e-15     -2.608      0.009   -6.77e-15   -9.59e-16
==============================================================================
Omnibus:                    19037.116   Durbin-Watson:                   0.766
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              630.312
Skew:                           0.276   Prob(JB):                    1.35e-137
Kurtosis:                       1.717   Cond. No.                        223.
==============================================================================
```

Figure 2. OLS Regression Result Model

The most significant finding was that households with lactose-intolerant members spent approximately **$9.24 more per month** on milk, a statistically significant difference ($p < 0.001$) shown in Figure 2. This confirmed that lactose intolerance does, in fact, result in additional monthly food expenses. Other demographic variables—such as age and income—were statistically significant but had very small effect sizes, indicating minimal economic impact in the context of milk spending. Interestingly, race, gender, and education level did not show statistically significant relationships. Although the model yielded an R-squared value of 1.000 (a perfect fit), this result likely reflects the simulated nature of the data and the deterministic way spending was calculated. Thus, results should be interpreted with caution and seen as a foundation for future empirical validation.

I plan to keep studying this project to apply economic methods to a biologically rooted public health issue. This experience has had a lasting impact on my academic growth and career goals. It has strengthened my skills in data analysis, research writing, and policy reasoning—and deepened my commitment to pursuing a future in medicine informed by health equity and economic insight. This experience has not only impacted my academic journey but also deepened my commitment to pursuing a future in medicine informed by health equity and economic insight. I plan to present this work at the Elkin R. Isaac Student Research Symposium in Spring 2026 and intend to expand the project into a departmental thesis. I also hope to refine my data and methods with real-world expenditure data or dietary recall surveys in the future.

I want to thank everyone who was involved in running FURSCA and my advisor Dr.Adamczyk for encouraging me and advising me every step of the way. I would also like to thank the generous donors ‘Richard.L and Barbara Meyer Student Research Endowment’ who made this opportunity possible through the FURSCA program.