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# Aging Society: Demographic Transition and Future Challenges in Iceland

Code ▾

MA615 Final Project - Fall 2025

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## Executive Summary

Iceland, a North Atlantic island nation with a population approaching 390,000, is experiencing a significant demographic transition. This report analyzes population aging trends using data from Statistics Iceland and the World Bank, spanning from 1841 to 2025, with projections through 2074.

### Key Findings:

- Iceland's population has grown from 57,133 (1841) to 389,444 (2025)
- The proportion of elderly (65+) increased from 8.1% (1960) to 15.6% (2024)
- Iceland crossed the "aged society" threshold (14%) in 2017
- Population projections range from ~453,000 (Low, declining after 2050) to ~698,000 (High) by 2074

# 1. Introduction

## 1.1 Background

Iceland is a Nordic island country in the North Atlantic Ocean, known for its dramatic landscapes, geothermal activity, and high quality of life. Despite its small population, Iceland provides an excellent case study for demographic analysis due to its comprehensive data collection and clear trends in population aging.

## 1.2 Research Questions

This report addresses the following questions:

1. How has Iceland's population changed over the past 184 years?
2. What are the trends in population aging?
3. How is the population distributed geographically?
4. What do projections suggest about Iceland's demographic future?

## 1.3 Data Sources

Source	Data	Time Range
Statistics Iceland	Population by age and sex	1841-2025
Statistics Iceland	Dependency ratios	1951-2025
Statistics Iceland	Population projections	2026-2074
Statistics Iceland	Population by municipality	2025
World Bank	Population 65+ (%)	1960-2024

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# 2. Data Preparation

## 2.1 Load Required Packages

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## 2.2 Load and Clean Data

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## 2.3 Data Quality Assessment

### 2.3.1 Missing Value Overview

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Missing Values in Population Data

Total_Records	Missing_Population	Missing_Percent
82140	20091	24.46

### 2.3.2 Detailed NA Analysis

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Missing Values by Sex Category

Sex	Records	NA_Count	NA_Percent
Non-binary/Other	20535	20091	97.8
Females	20535	0	0.0
Males	20535	0	0.0
Total	20535	0	0.0

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Missing Values by Time Period

Period	Records	NA_Count	NA_Percent
2022-2025	1776	0	0
Before 2022	80364	20091	25

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## Non-binary/Other category has data only for years: 2022, 2023, 2024, 2025

### 2.3.3 NA Pattern Interpretation

Upon investigation, all missing values originate from the “Non-binary/Other” sex category. The data contains four sex categories: Total, Males, Females, and Non-binary/Other.

Statistics Iceland introduced the Non-binary/Other category in 2022. Therefore, records from 1841-2021 naturally have NA values for this category since the classification did not exist at that time. The Total, Males, and Females categories have zero missing values across all 185 years (1841-2025).

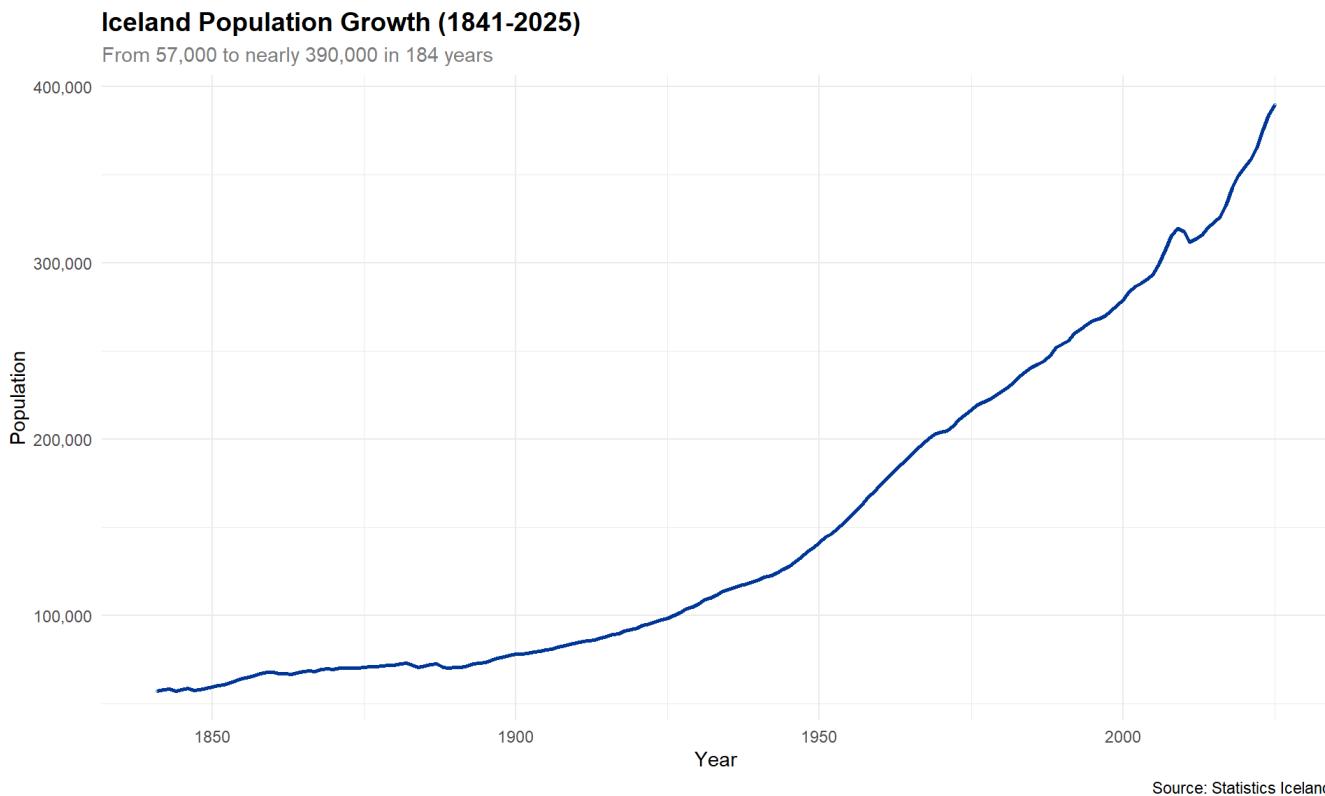
The NA count can be explained as follows: 181 years (1841-2021) multiplied by 111 age groups yields exactly 20,091 records with missing Non-binary/Other data. From 2022 onwards, this category has complete data.

For this analysis, historical trend analysis uses the Total, Males, or Females categories which have complete data. Gender-inclusive analysis would need to be restricted to 2022-2025. These NA values do not indicate data quality issues but rather reflect the evolution of gender classification in census methodology.

## 3. Historical Population Trends

### 3.1 Total Population Growth

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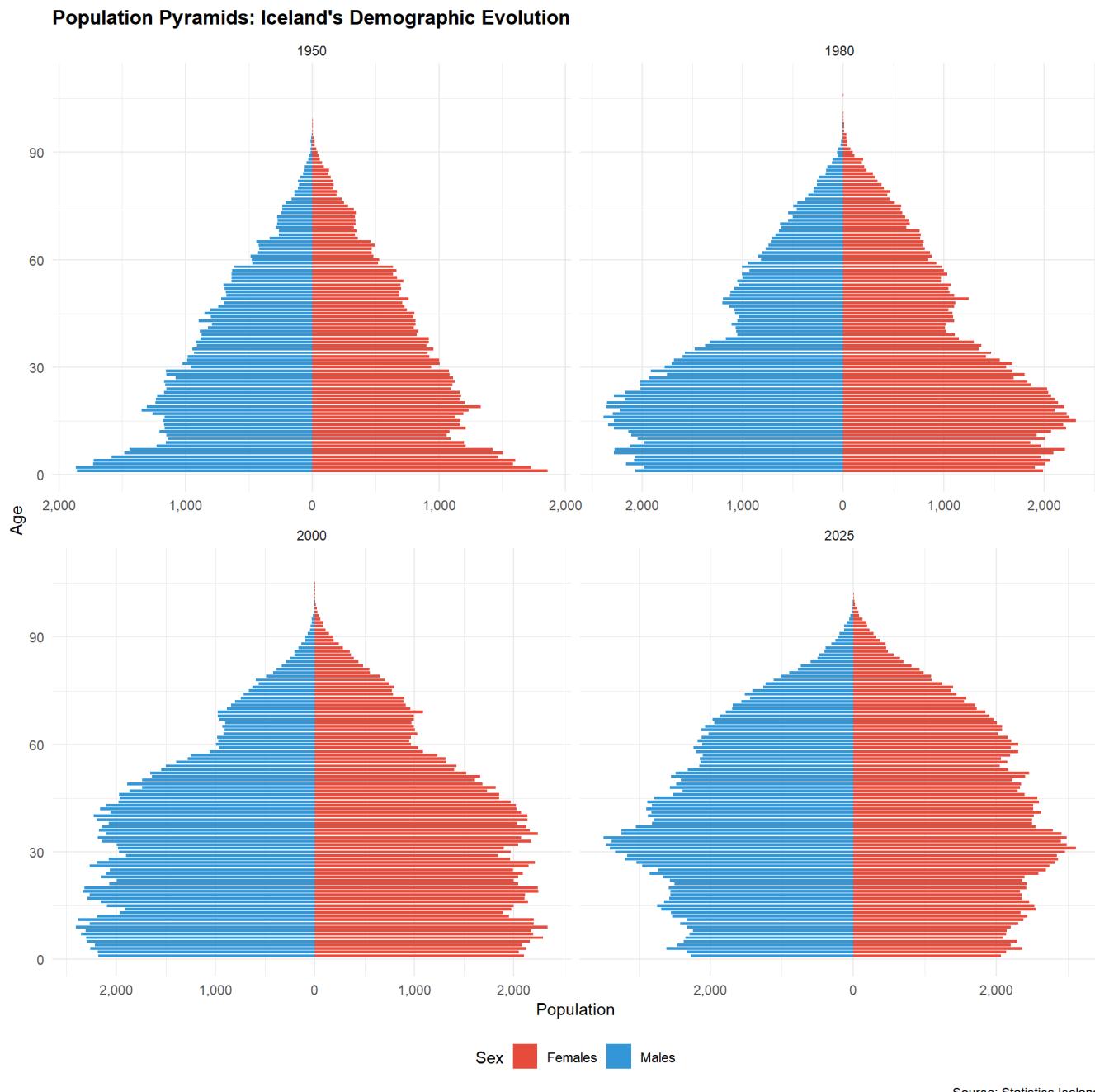


Iceland's population has grown nearly **7-fold** since 1841. Key growth periods include:

- **1900-1940:** Gradual growth from 78,000 to 120,000
- **1945-1980:** Post-war boom, population doubled
- **2000-present:** Continued growth with immigration

## 3.2 Population Pyramids

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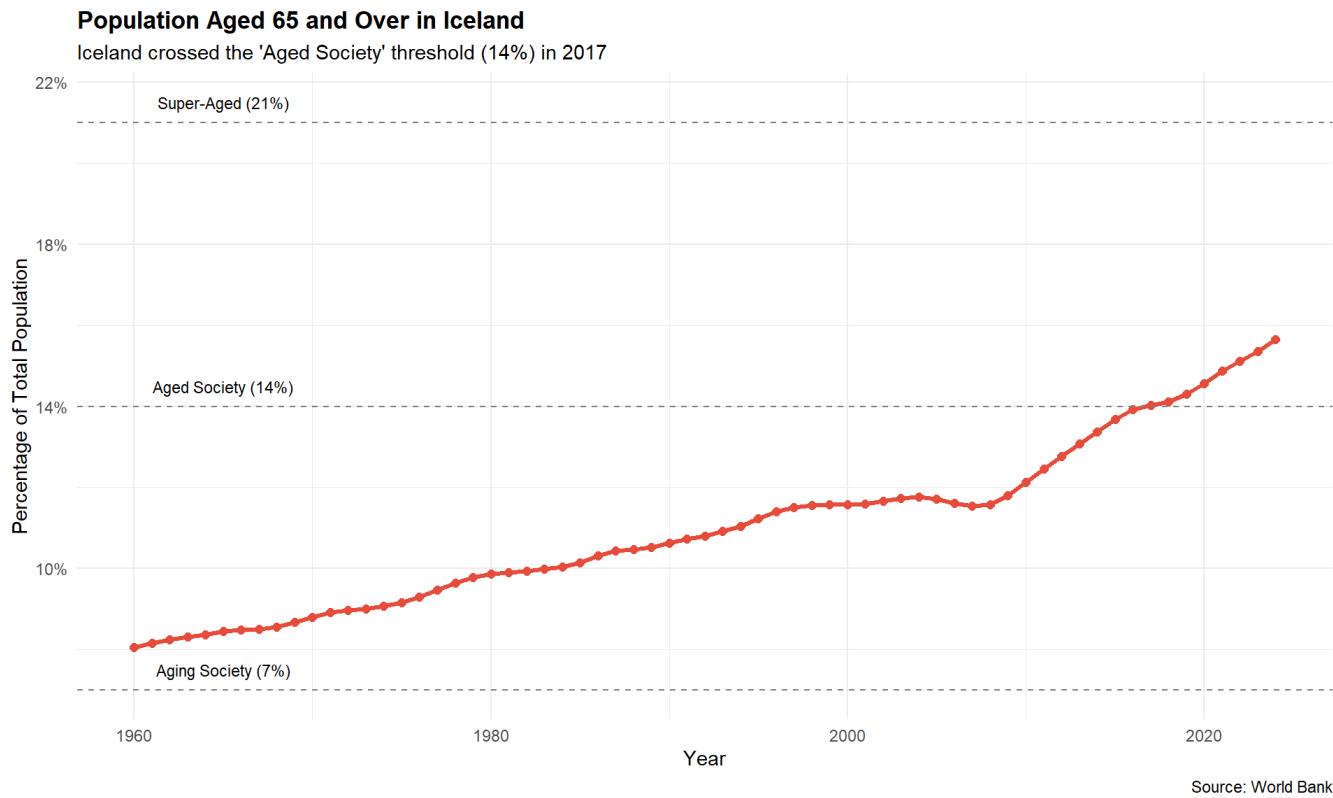


The pyramids show the transition from a younger population structure (1950) to an aging one (2025).

## 4. Aging Society Analysis

### 4.1 Population Aged 65+

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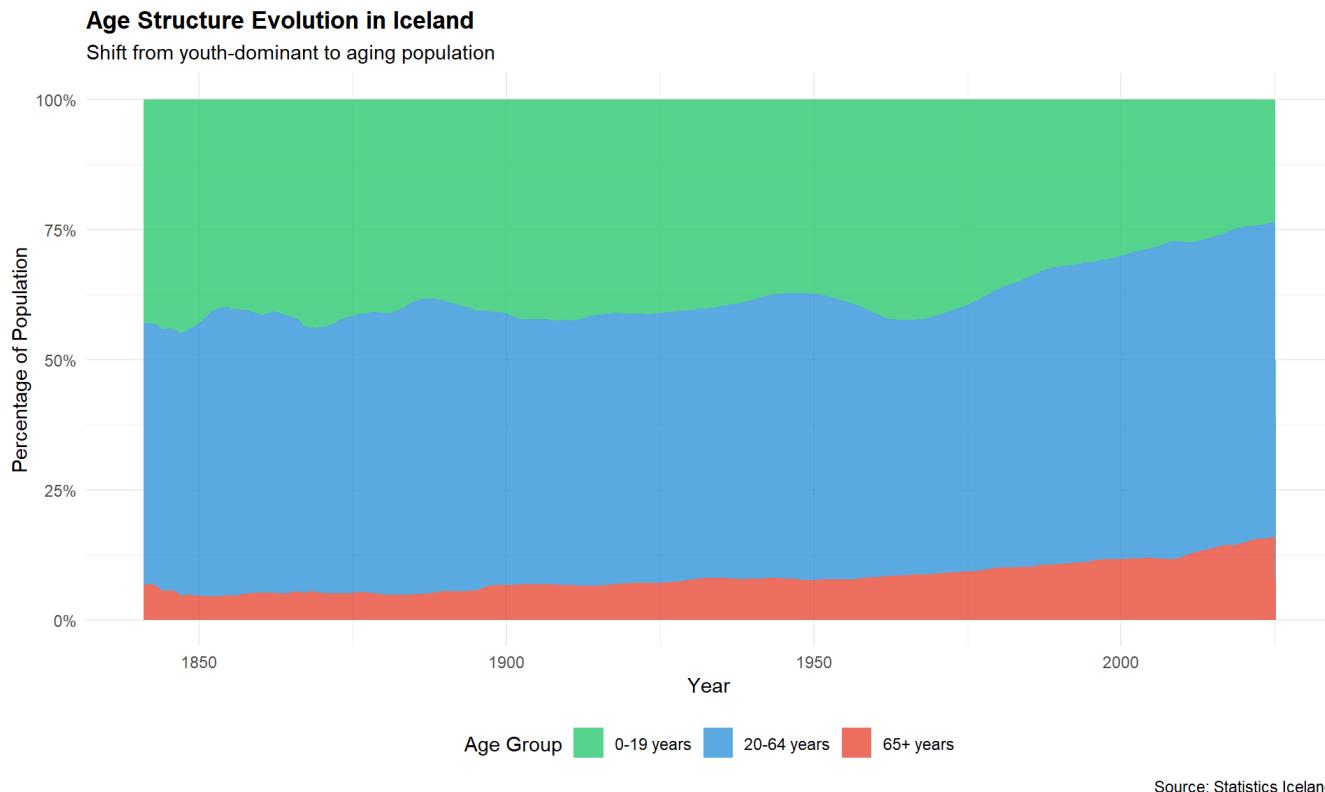


#### Demographic Thresholds:

- **Aging Society (7%)**: Existing statistics show Iceland was already an aging society by 1960
- **Aged Society (14%)**: Crossed in 2017
- **Super-Aged Society (21%)**: Projected within the next decades

## 4.2 Age Structure Evolution

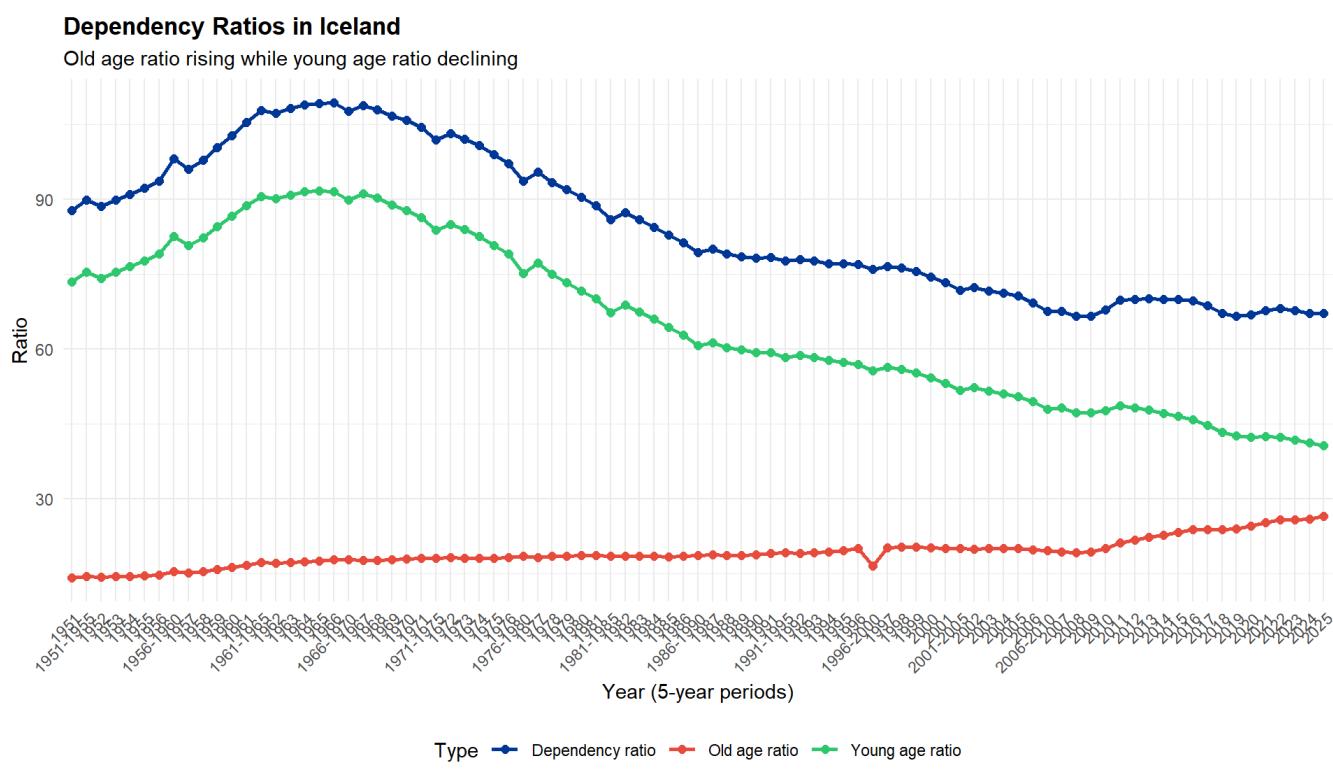
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Source: Statistics Iceland

## 4.3 Dependency Ratios

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Source: Statistics Iceland

The dependency data shows interesting temporal patterns. The total dependency ratio peaked around 1966 at approximately 109, subsequently declining to about 67 by 2020. This overall decline masks divergent trends in its components: the young age ratio decreased substantially from around 91 in the 1960s to 42 in 2020, while the old age ratio increased steadily from 17 to 25 over the same period.

## 5. Geographic Distribution

### 5.1 Population by Municipality

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Top 15 Municipalities in Iceland (2025) - Total population: 389,444

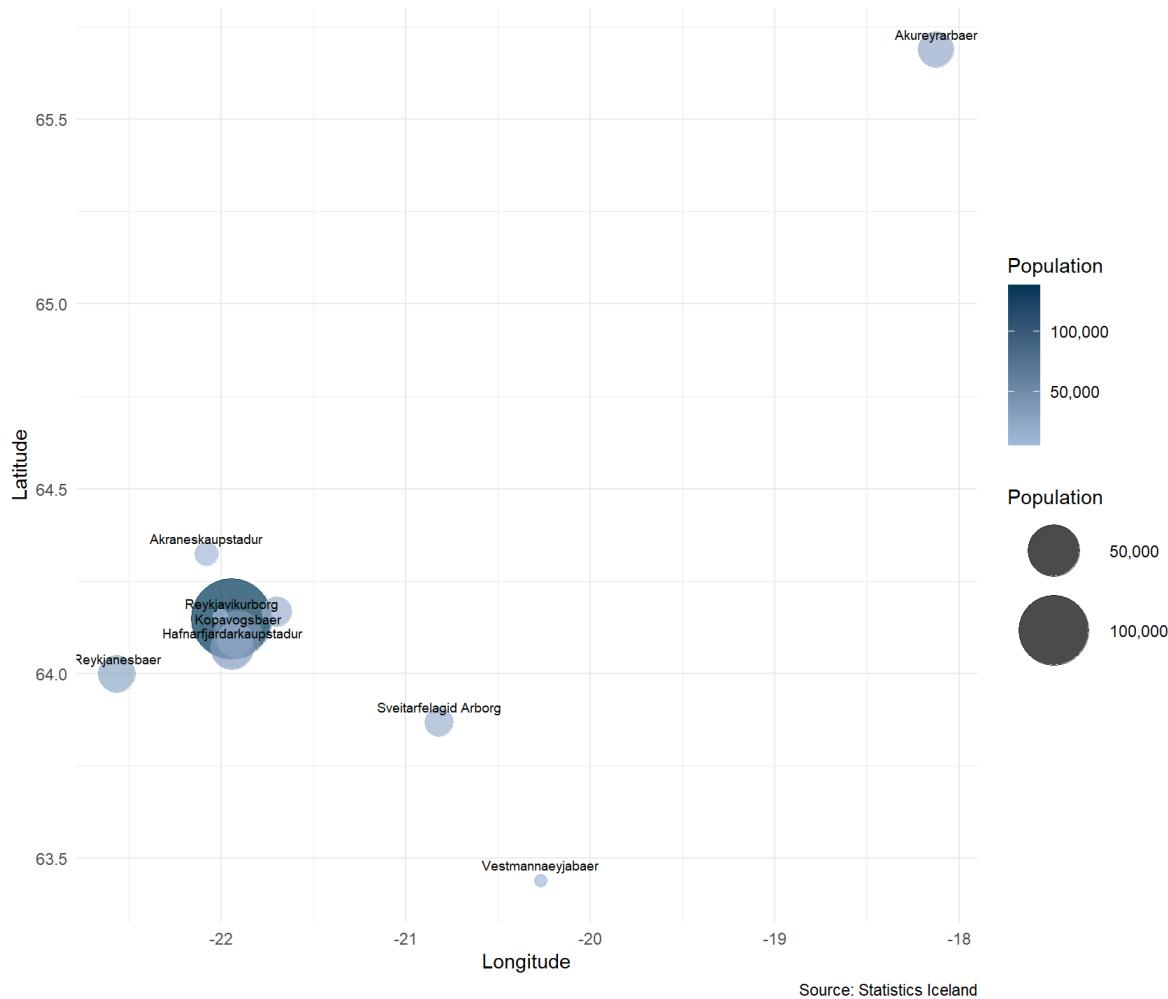
Rank	Municipality	Population	Percent
1	Reykjavikurborg	138,772	35.6%
2	Kopavogsbaer	40,040	10.3%
3	Hafnarfjardarkaupstadur	31,525	8.1%
4	Reykjanesbaer	22,499	5.8%
5	Gardabaer	20,116	5.2%
6	Akureyrarbaer	20,050	5.1%
7	Mosfellsbaer	13,715	3.5%
8	Sveitarfelagid Arborg	12,064	3.1%
9	Akraneskaupstadur	8,285	2.1%
10	Fjardabyggd	5,247	1.3%
11	Mulathing	5,232	1.3%
12	Seltjarnarnesbaer	4,585	1.2%
13	Vestmannaeyjabaer	4,470	1.1%
14	Skagafjordur	4,316	1.1%
15	Borgarbyggd	4,102	1.1%

### 5.2 Population Distribution Map

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### Population Distribution in Iceland (2025)

Circle size and color indicate population

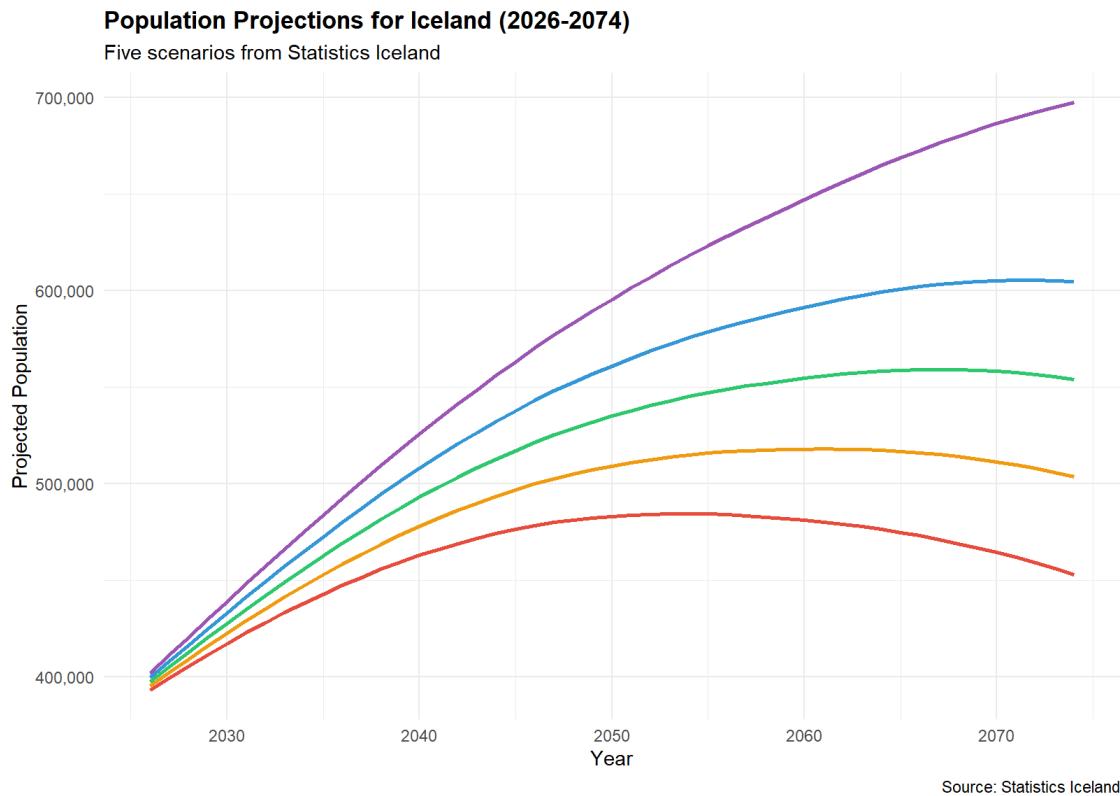


The map reveals a stark geographic concentration. The Greater Reykjavik Area alone accounts for over 60% of the national population. Outside the capital region, Akureyri stands as the largest urban center with approximately 20,000 residents. This southwest concentration reflects both historical settlement patterns and modern economic opportunities.

## 6. Future Projections

### 6.1 Projection Scenarios

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## 6.2 Projected Population Summary

Projected Population by Scenario - Selected years: 2030, 2040, 2050, 2060, 2074

Variant	2030	2040	2050	2060	2074
Low (L2)	417,091	463,022	483,052	481,142	452,979
Low-Medium (L1)	422,420	478,091	509,107	517,967	503,633
Median	427,648	493,056	535,059	554,673	554,179
High-Medium (H1)	432,977	508,125	561,114	591,498	604,833
High (H2)	438,879	525,903	595,521	647,146	697,507

The projection scenarios diverge substantially over time. Under the median scenario, population reaches approximately 554,000 by 2074. The high scenario (H2) suggests population could approach 700,000, while the low scenario (L2) shows a different trajectory—peaking at around 483,000 in 2050 before declining to approximately 453,000 by 2074.

## 7. Statistical Modeling

# 7.1 Exponential Growth Model

We fit an exponential growth model to the historical population data to understand long-term growth patterns.

**Model:**  $P(t) = P_0 \times e^{r(t-t_0)}$

Where:

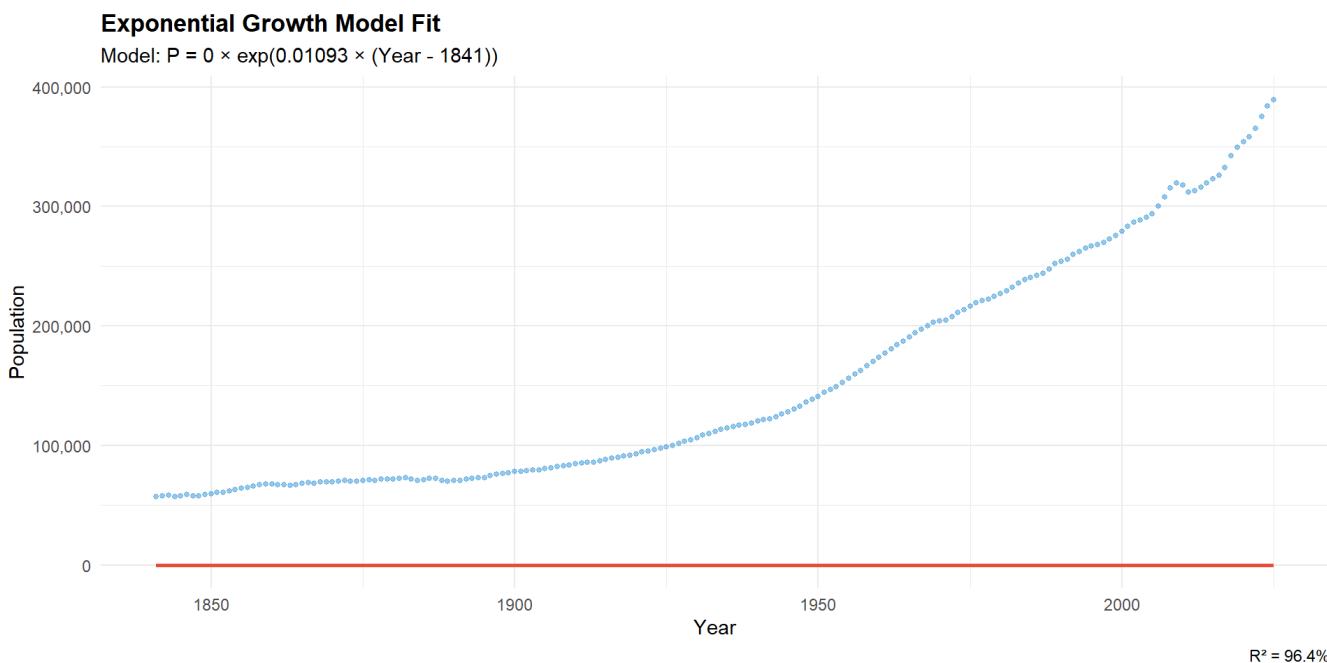
- $P(t)$  = Population at year  $t$
- $P_0$  = Initial population
- $r$  = Growth rate
- $t_0$  = Base year

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## Exponential Growth Model Statistics

Metric	Value
R-squared	96.4%
Annual Growth Rate	1.1%
Doubling Time	63.4 years
Growth Rate (r)	0.01093

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## 7.2 Aging Trend Model

We model the trend in population aging (65+ percentage) to predict when Iceland might reach “super-aged society” status.

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Model Comparison: Linear vs Quadratic

Model	AIC	R_squared
Linear	85.7	95.1%
Quadratic	48.1	97.3%

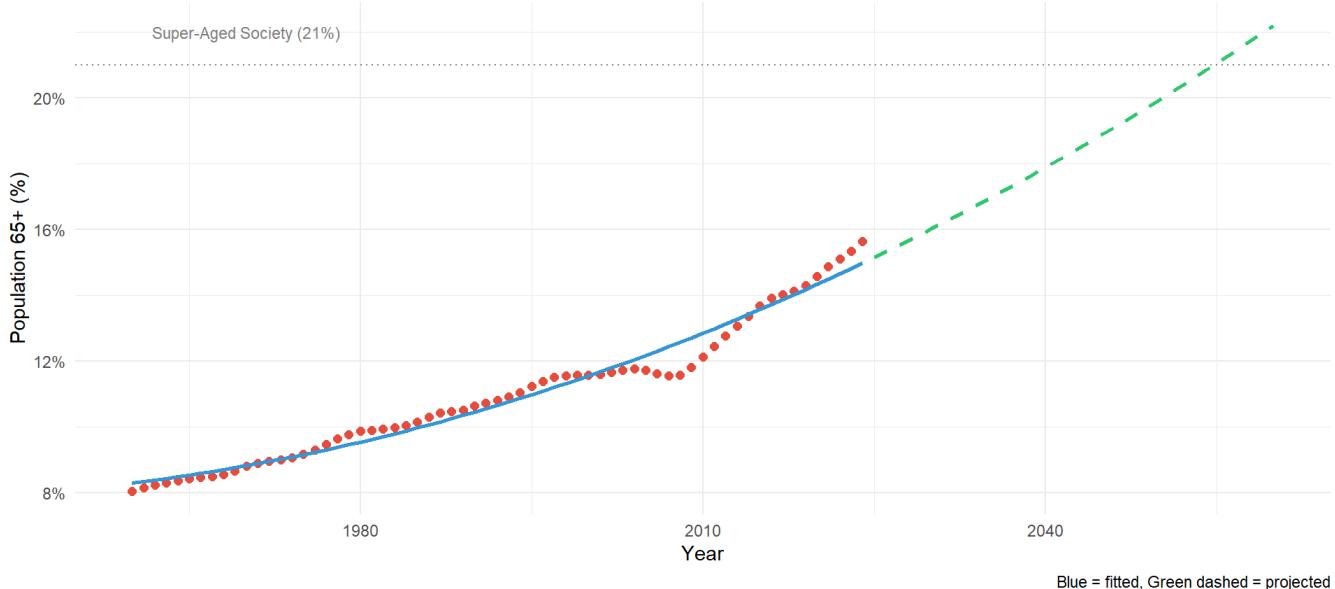
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### Aging Trend Model with Projections

Quadratic model - Predicted to reach 21% around 2055



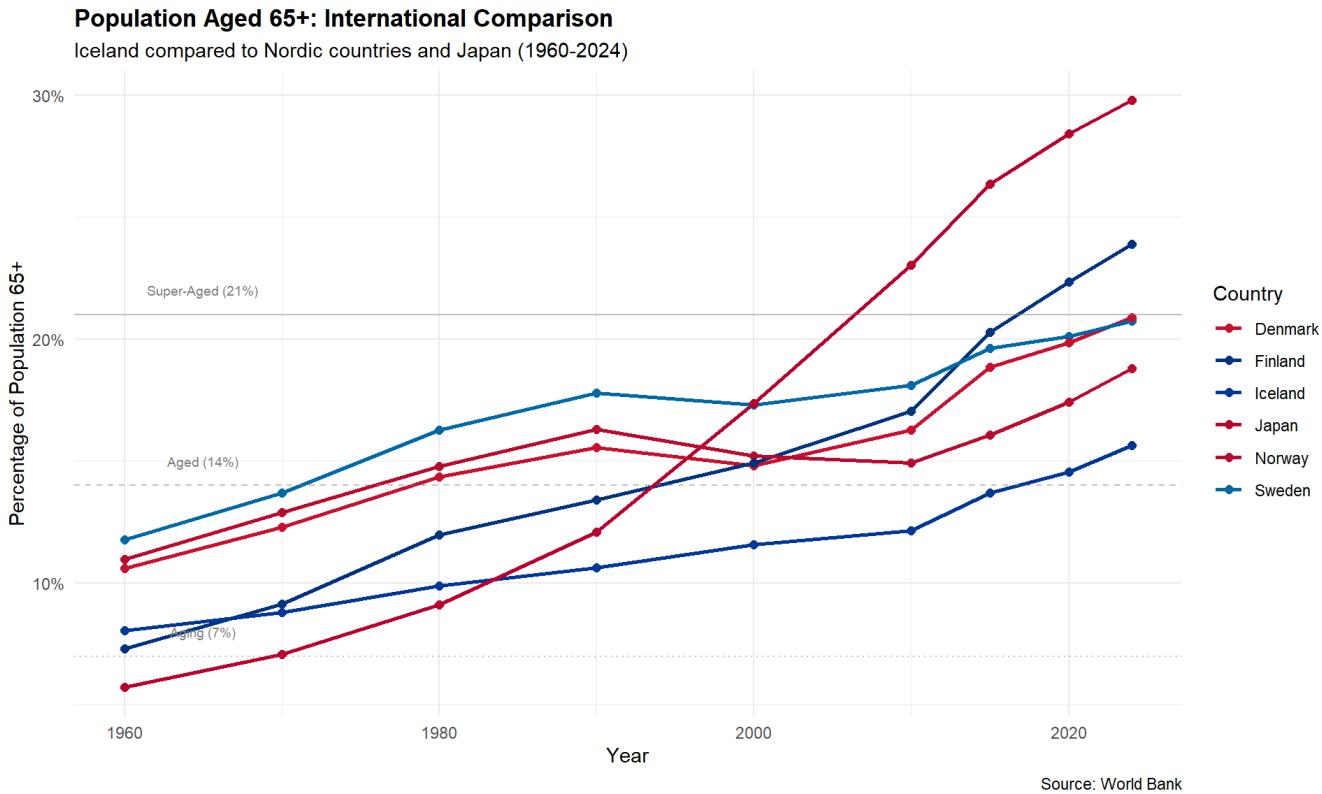
Based on the Quadratic regression model, Iceland is projected to reach “super-aged society” status (21% aged 65+) around 2055. The model explains 97.3% of the variance in aging trends. Given the accelerating nature of this trend, proactive policy interventions may be warranted.

## 8. International Comparison

## 8.1 Iceland in Nordic Context

Comparing Iceland with other Nordic countries and Japan provides valuable context for understanding aging trends.

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## 8.2 Comparison Summary

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Aging Comparison: Iceland vs Other Countries (1960-2024)

Country	1960 (%)	2024 (%)	Change (pp)	Annual Change
Japan	5.7	29.8	24.1	0.377
Finland	7.3	23.9	16.6	0.259
Denmark	10.6	20.9	10.3	0.161
Sweden	11.8	20.8	9.0	0.141
Norway	11.0	18.8	7.8	0.122
Iceland	8.1	15.6	7.5	0.117

Several patterns emerge from this comparison. Iceland maintains the youngest population among Nordic countries, with only 15.6% aged 65+ as of 2024. Japan, with nearly 30% of its population over 65, serves as a useful benchmark for understanding what lies ahead. Among the Nordic countries, Finland is aging most rapidly and may provide relevant policy lessons for Iceland. Notably, all countries in this comparison show acceleration in aging rates over time.

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## 9. Conclusion

### 9.1 Summary

This analysis reveals several important demographic trends in Iceland. The population has grown steadily from 57,000 in 1841 to 389,000 in 2025, representing nearly seven-fold growth over 184 years. The country has transitioned from an “aging society” to an “aged society,” with the 65+ population now exceeding 15% of the total.

Geographically, population distribution remains highly concentrated, with over 60% residing in the Greater Reykjavik area. Future projections from Statistics Iceland suggest population could range from approximately 453,000 (low scenario) to 698,000 (high scenario) by 2074, depending on fertility, mortality, and migration assumptions.

The exponential growth model fits historical data well ( $R^2 > 95\%$ ), while aging trend analysis suggests Iceland may reach “super-aged” status around 2055. Compared to other Nordic countries, Iceland currently has the youngest population age structure, which provides time to develop policy responses.

### 9.2 Policy Implications

These demographic shifts have implications for multiple policy domains. Healthcare systems will need to accommodate expanded elderly care services. Pension systems may require adjustments given increasing life expectancy. Immigration policy could play a role in maintaining the working-age population. Regional development policies may need to address the growing urban-rural population imbalance.

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## References

1. Statistics Iceland. (2025). Population statistics. <https://px.hagstofa.is/> (<https://px.hagstofa.is/>)
2. World Bank. (2024). Population ages 65 and above (% of total population). <https://data.worldbank.org/> (<https://data.worldbank.org/>)

