A Century of Change: Birth Cohort-Specific Patterns in Smoking Histories in Japan (1910-2050)

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SUMMARY

- **Objectives:** Investigate smoking initiation, cessation, and prevalence across Japanese cohorts to guide intervention strategies.
- **Methods:** Utilized data from 34 National Health and Nutrition Surveys (NHNS) from 1986–2019, applying age-period-cohort models to estimate and forecast smoking patterns from 1910–1990 cohorts through 2050.
- **Results:** Smoking behaviors varied between genders and cohorts, with men having higher initiation and cessation rates. Projections indicate a decrease in smoking prevalence by 2030, with male prevalence dropping to 20% and female to 8%.
- **Conclusions:** This research provides critical data for micro-simulation models, delivering a detailed analysis of smoking trends over time and enhancing the design and efficacy of tobacco control measures in Japan.

INTRODUCTION

Japan's Smoking Landscape:
- Among the top ten smoking populations globally.[1]
- Smoking rate dropped to 20% in 2020.[1]
- Leading risk factor for mortality in Japanese adults: 200,000 annual tobacco-related deaths.[2,3]

Research Insights in the world:
- Smoking histories analyzed in the U.S. and Brazil focusing on age, gender, and birth cohorts.[4,5]
- Critical for assessing the impact of tobacco control interventions.

Research Gaps in Japan:
- Limited studies on cohort-specific smoking patterns.
- Previous models lack Japan-specific initiation and cessation rates.

Objectives:
- To analyze smoking patterns by birth cohorts in Japan.
- To forecast future smoking patterns to 2050.
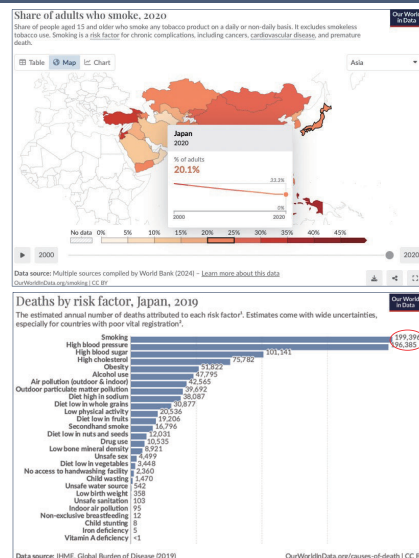
METHODS

Data source:
- National Health and Nutrition Surveys (NHNS) from 1986 to 2019.[6,7]
- Smoking Status: current, former, and never smokers available for all surveys.
- Initiation and Cessation: Data available for 1990-2010 surveys only.
- Cohorts Analyzed: from 1910 to 1990 (marked by diagonal lines).
- Assumptions: First cessation starts at age 15 (black dashed line), first initiation starts at age 8 (red dashed line).
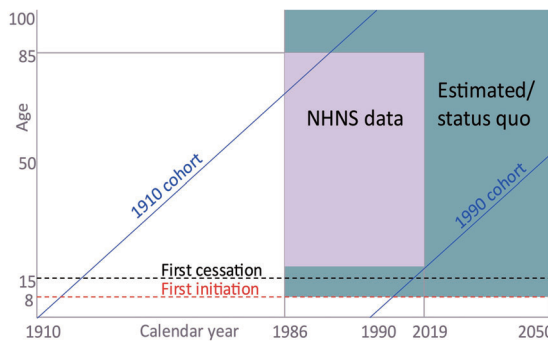
Compartment Model:
- Provides a practical framework to understand smoking behaviors, despite not capturing all complexities.
- Non-smokers can start smoking at specified times based on initiation rates.
- Smokers may quit according to cessation rates.
- Both non-smokers and ever-smokers are subject to mortality rates.
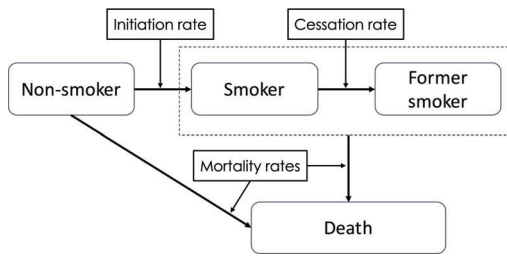
Smoking History Model:
- Estimate Ever Smokers: Calculate the probability of becoming an ever smoker based on initiation rates.
- Adjust using cross-sectional data.

$$P_E(a,c) = 1 - \prod_{i=1}^{a}[1 - p(i,c)]$$

Where p(a,c) is the age- and birth-cohort-specific inititaion rate

- Estimate Smoking Continuation: Determine the probability of not quitting from cessation rates.

$$Q(a,c) = \prod_{i=15}^{a}[1 - q(i,c)]$$

Where q(a,c) is the age- and cohort-specific cessation rate

- Calculate Current Smokers = Ever smoker * Probability of not quitting.

$$P_C(a,c) = P_E(a,c)Q(a,c)$$

Statistical Analysis:
- APC Models: Utilized age-period-cohort models to estimate smoking patterns by birth cohort (1910-1990) and gender, using generalized additive models with constrained natural cubic splines for nonparametric estimates.[4,8,9]
- Future Projections: assume the continuation of recent trends through 2050.

RESULTS

Prevalence of current smoker
- Males: Consistent peaks and declines, with a peak in mid-1950s cohorts.
- Notable dip in 1940 cohorts due to WWII supply shortages.
=> Model's ability to capture temporal influences on smoking behaviors
- Females: Lower prevalence in earlier cohorts, peaking in 1980 cohorts, lagging 20 years behind males.
=> Shifts in social norms, as smoking becoming socially acceptable for Japanese women since mid-20th century.
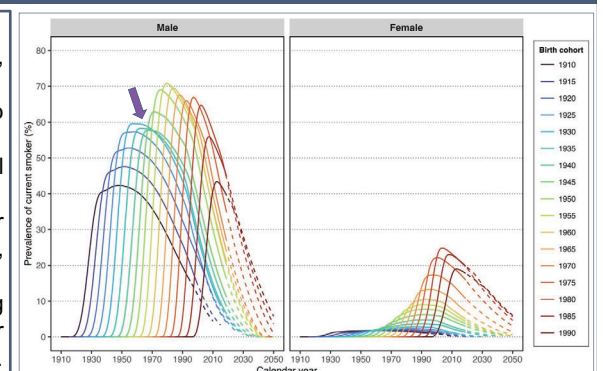
Smoking initiation probabilities
- In both genders, initiation rises from age 10, peaks in late teens, then declines sharply, with minimal initiation observed after age 30.
- Initiation peak in the mid-1950s in males; and in the 1980s in females.
- Age Shifts: Recent cohorts show a shift towards younger initiation ages for both genders, from 20s to late teens.
=> Urgent need for early preventive measures and intervention strategies that specifically target younger populations
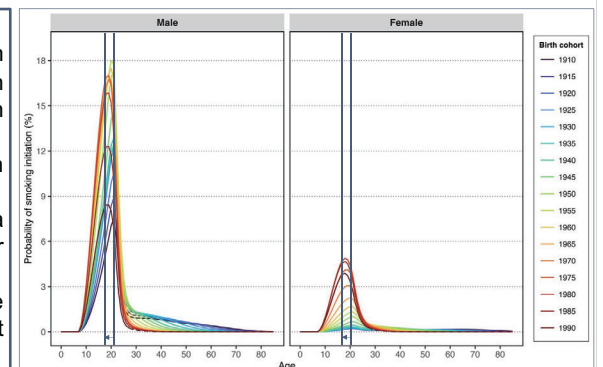
Smoking cessation probabilities
Gender Differences:
- Higher cessation probabilities in males compared to females.
- Males show a gradual increase across cohorts, with a spike after age 50.
- Females show a slower rise with age, with no clear turning points.

=> Important to develop gender-specific public health strategies to effectively reduce smoking rates for women.
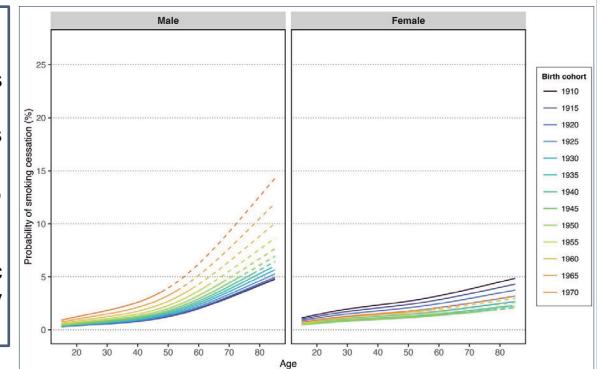
Estimate and projection of smoking prevalence, 1986-2030
- Males: Steady decline observed; projected to reach about 20% by 2030.
- Females: Increase until 2005, followed by a slight decrease; projected to approach 8% by 2030.

=> Model Accuracy: Slight deviation from actual NHNS estimates, but captures overall trends effectively.
=> Highlights progress in reducing smoking rates in Japan.
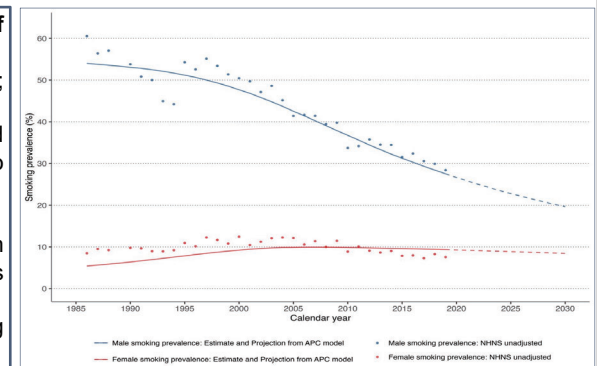
CONCLUSIONS

- We examined patterns of smoking prevalence, initiation, and cessation.
- Both genders show reduced smoking prevalence, but slower declines in females and delayed cessation highlight the need for tailored public health interventions.
- Shift towards earlier initiation in younger cohorts emphasizes the need for early prevention and youth-targeted strategies.
- **Recommendations:** Sustained, focused efforts are crucial to address challenges specific to women and youth, aiming to decrease smoking-related health risks and enhance public health in Japan.

ACKNOWLEDGMENT

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COI DISCLOSURE INFORMATION

I have no financial relationships to disclose.