Using Taiwan's National Health Insurance Database to Estimate Inpatient & Terminal Care of the Elderly

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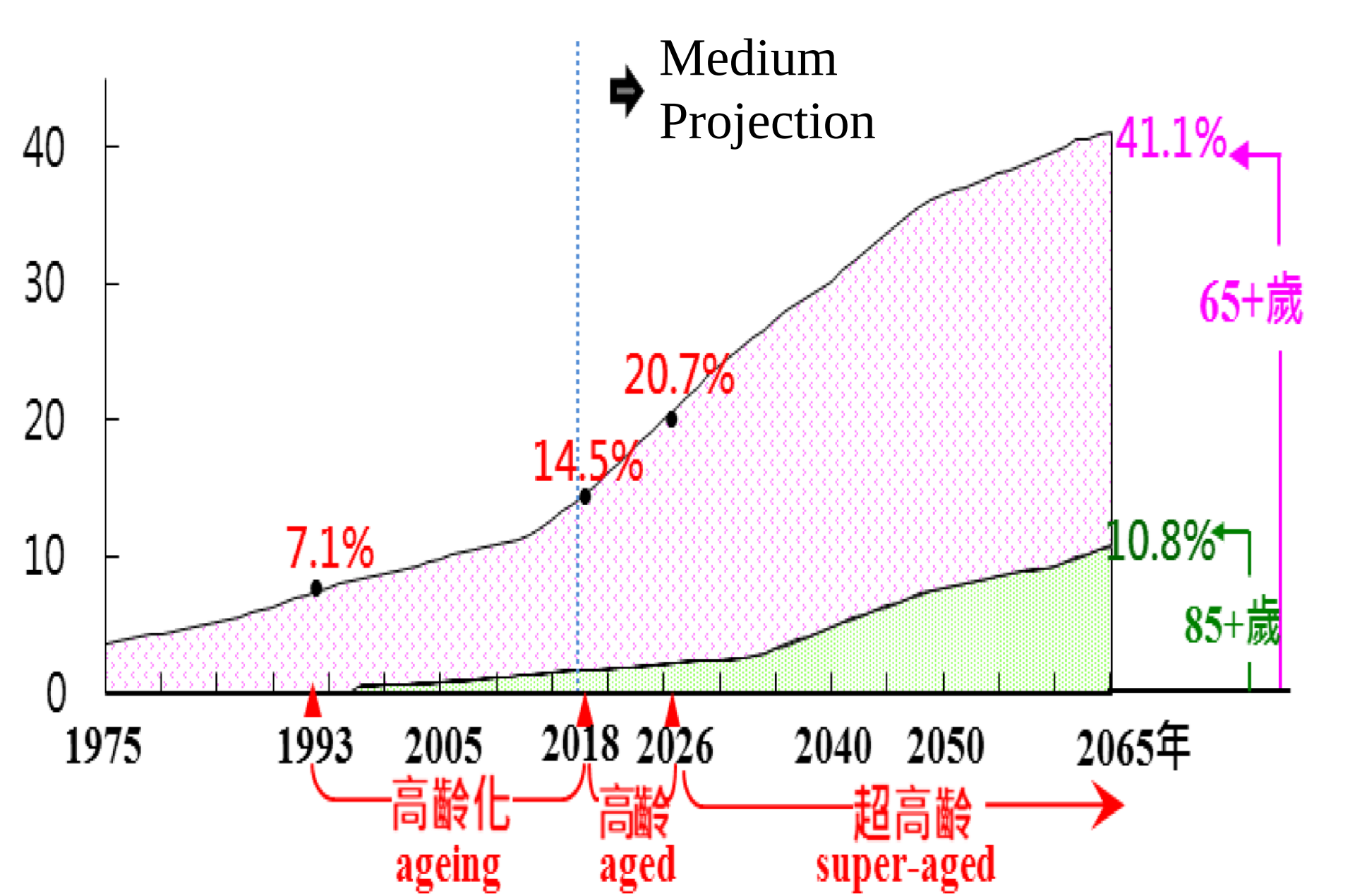
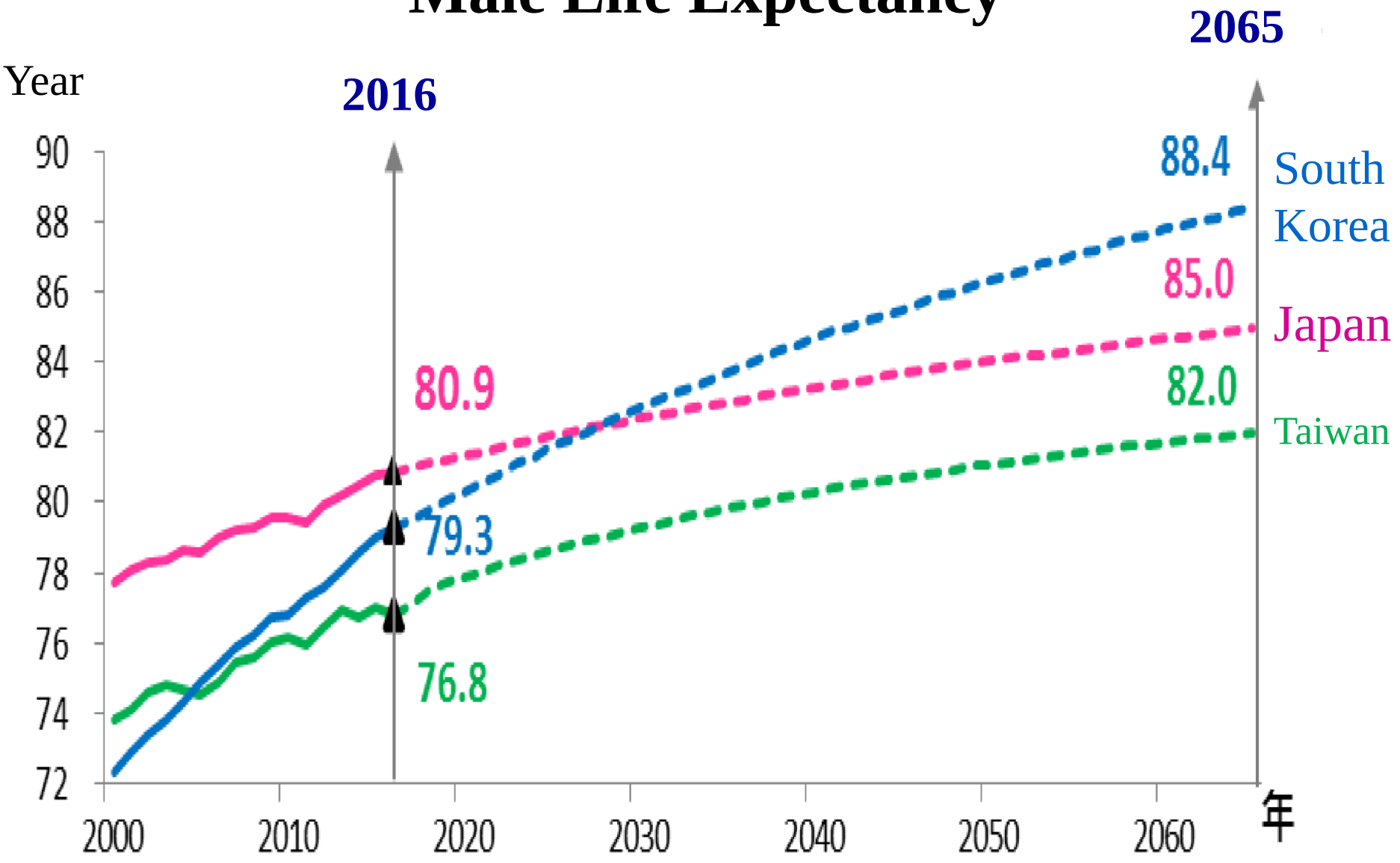
Summary

- Prolonging Life & Medical Expenditure
- Taiwan National Health Insurance (NHI)
- Analysis of Inpatient Visits
- Analysis of Surgical Procedures
- Conclusion and Discussions



Ages 65+ Proportion in Taiwan (2018~2065 Projection)

Male Life Expectancy



Predicted Male Life Expectancy (2018~2065)

Ageing and Prolonging Life

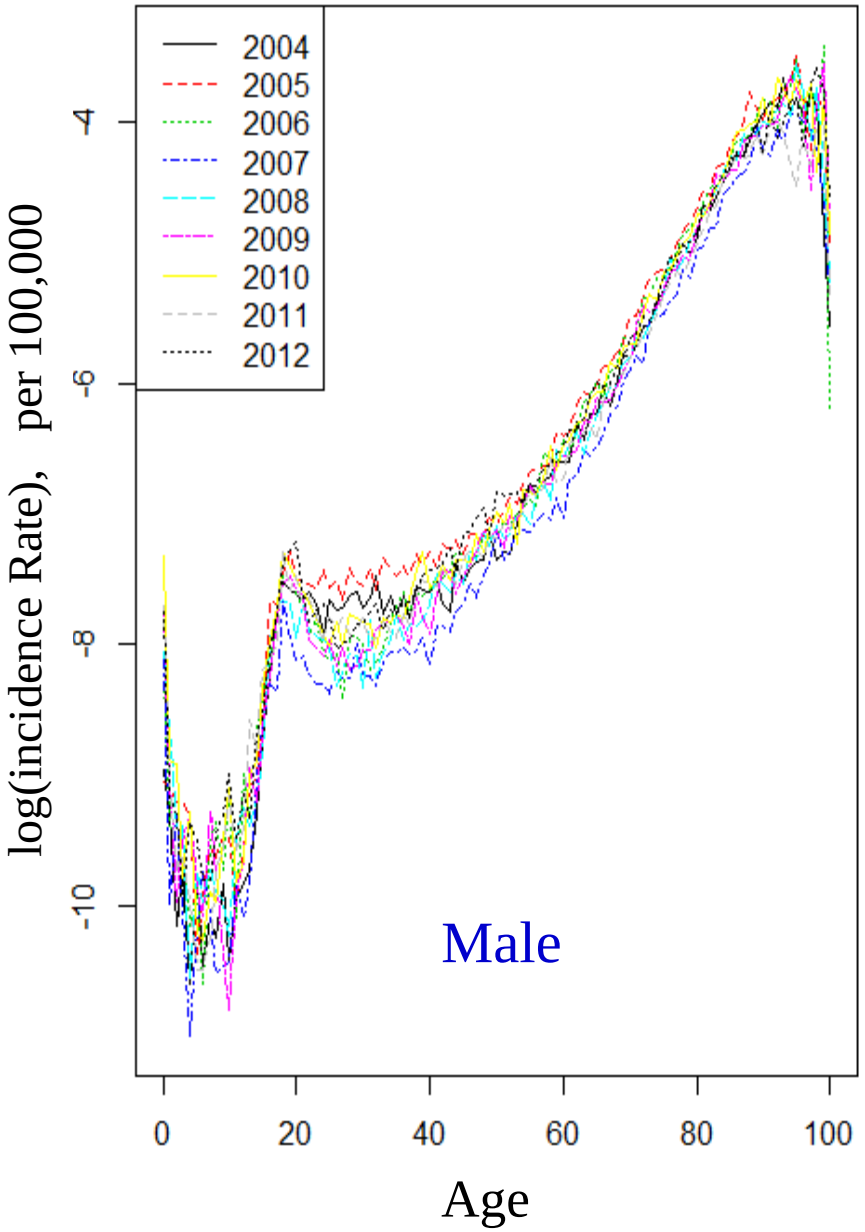
- **Prolonging life** and **population ageing** are common in many countries.

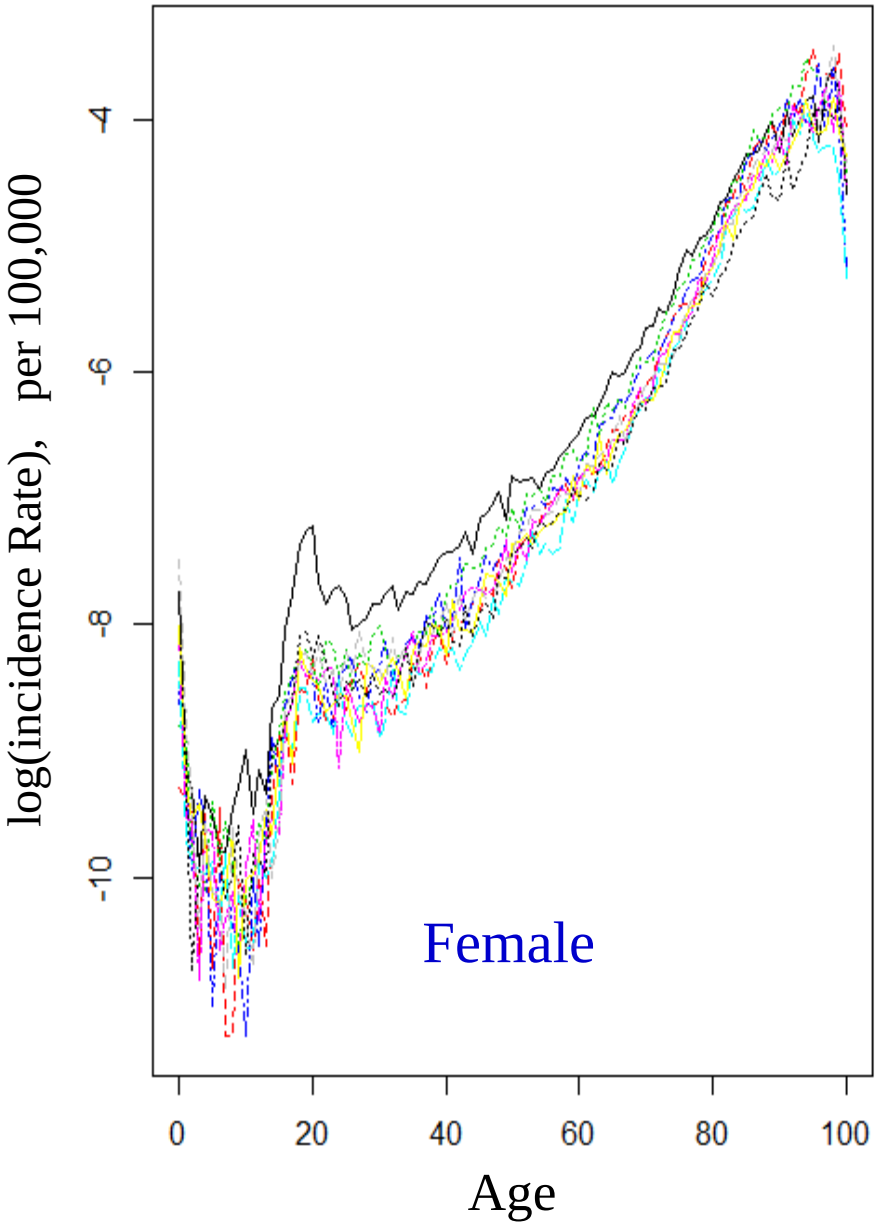
→Many social insurance systems are jeopardized by the increasing longevity (e.g., Medicare).

- Medical expenditure of Taiwan's elderly is about 5 times of the national average

→The incidence rates of catastrophic diseases (e.g., cancer) increase with age.

Taiwan's Incidence Rate of Catastrophic Diseases





Study Goal

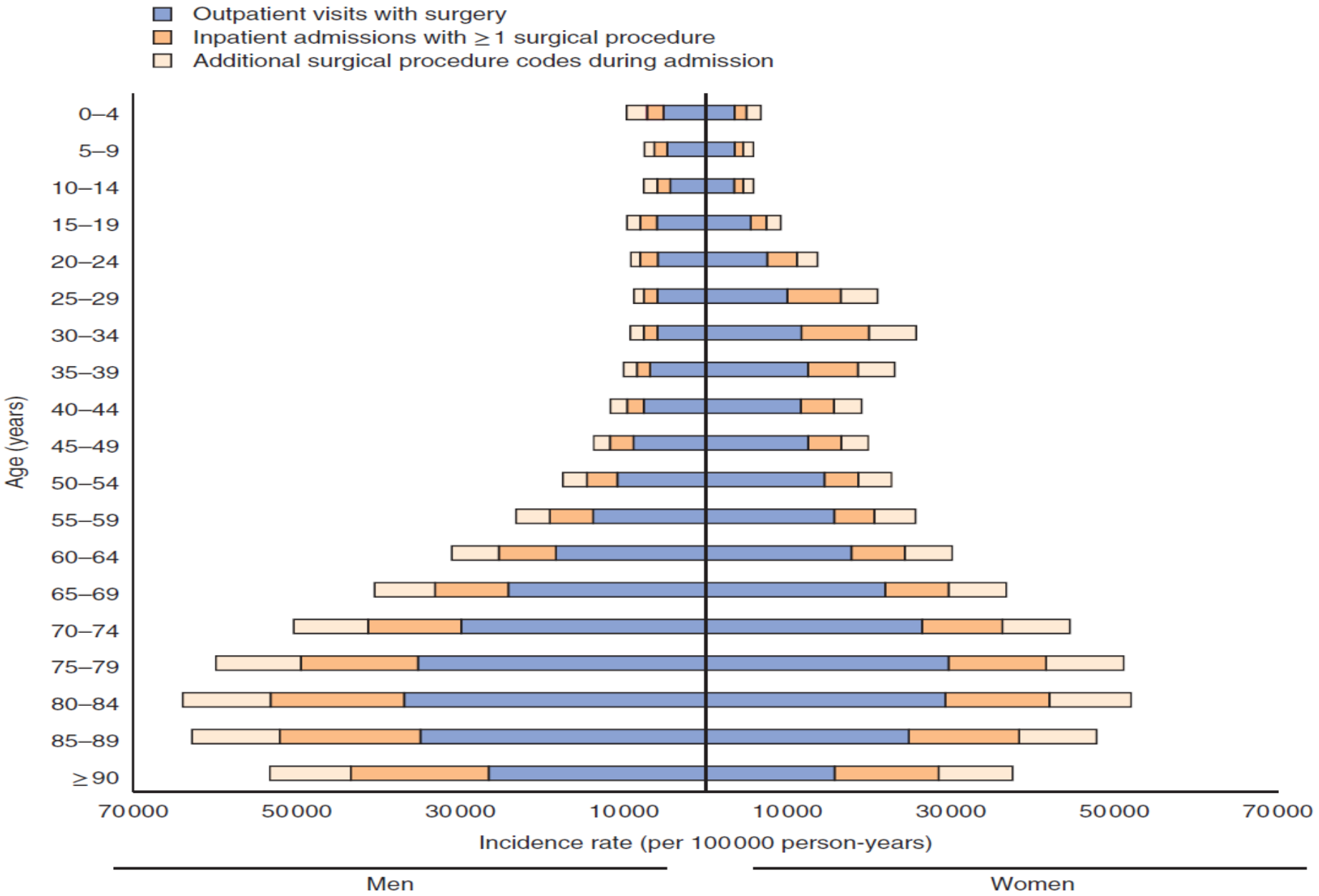
- The study objective is on the inpatient and end-of-life needs of Taiwan's elderly.

→We want to evaluate the impact of population ageing on Taiwan's national health insurance system. (e.g., in-patient, outpatient, & surgeries)

Note: Not many past studies on these topics.

"*Population-based incidence rate of inpatient and outpatient Surgical*" (Omling et al., 2018)

Incidence Rates of Surgical Procedures (Sweden 2006-13)



Source: Population-based incidence rate of inpatient and outpatient Surgical (2018)

Taiwan's National Health Insurance

- Taiwan started the national health insurance (NHI) in 1995, and more than 99% population are covered (excluding oversea workers).
- Researchers can purchase random sample from the NHI database (limit one million people).

→We purchased two sample data sets:

(1) 2005 million population sample,

(2) 2005 million elderly sample.

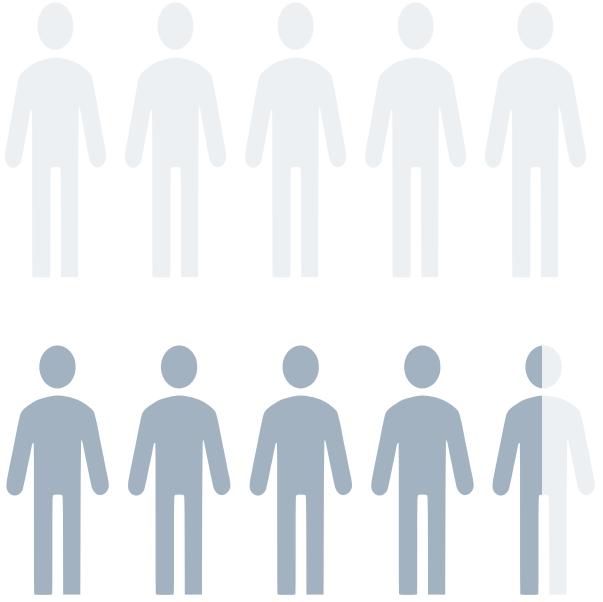
Data Decsription

2005 Taiwan Population

2005 Population Sample

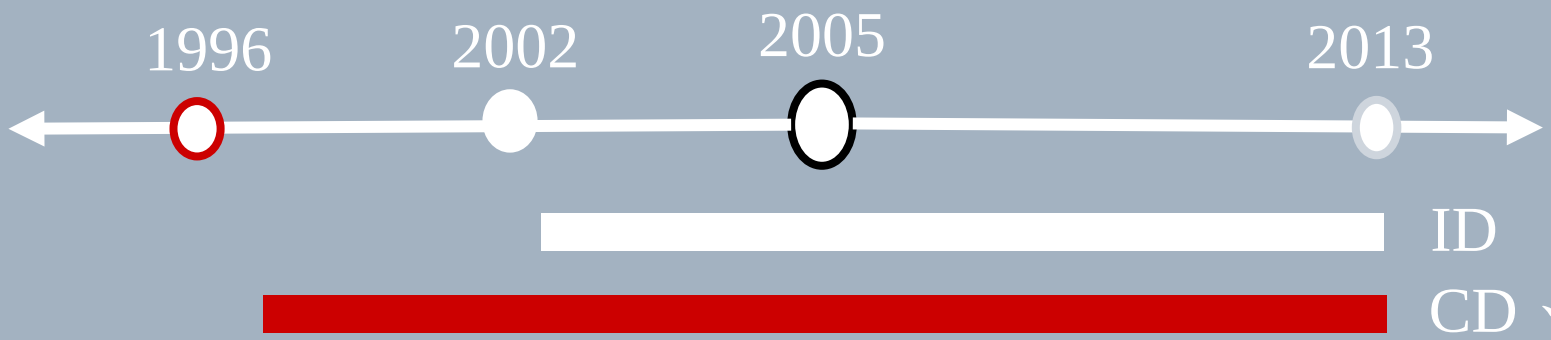
4.6%

Proportion

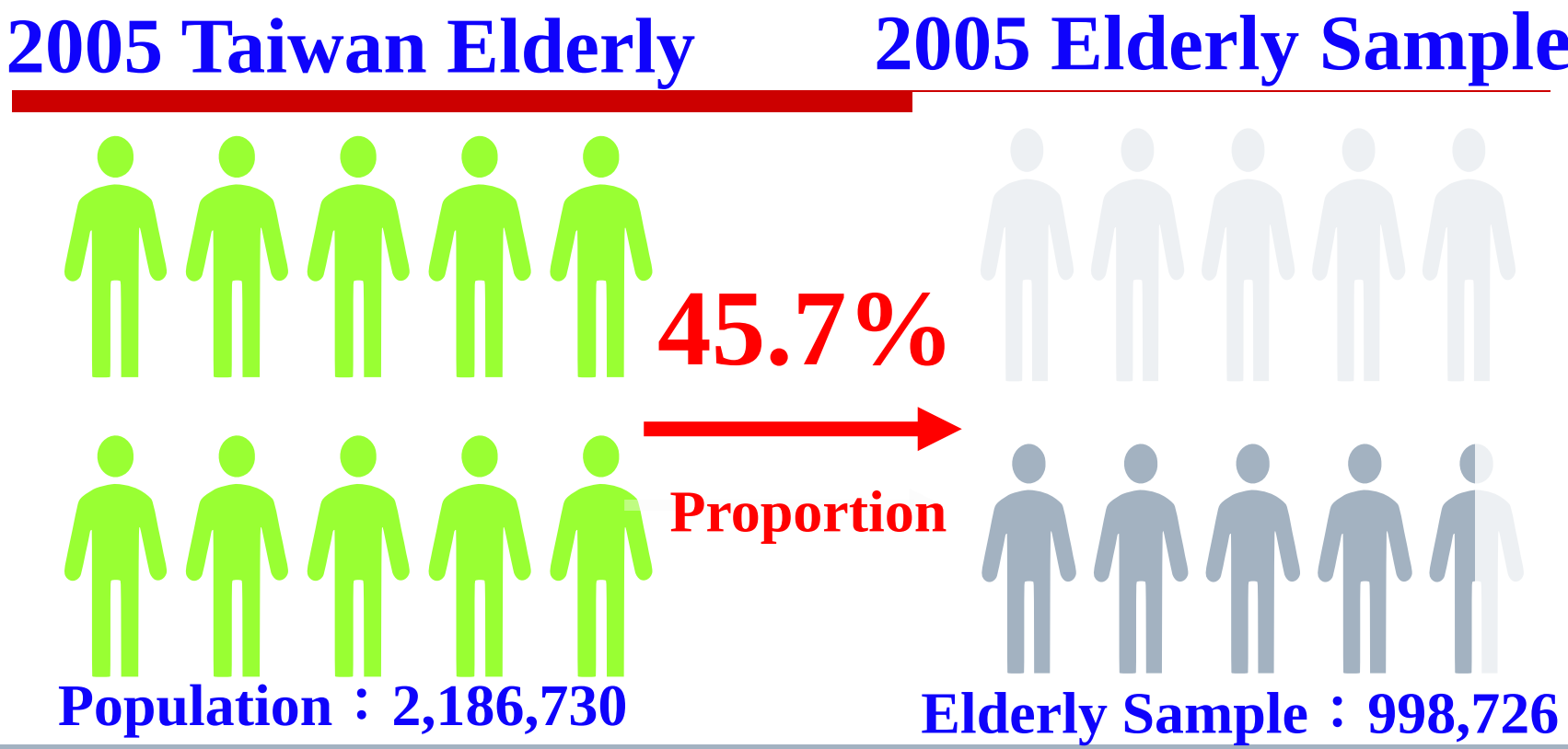


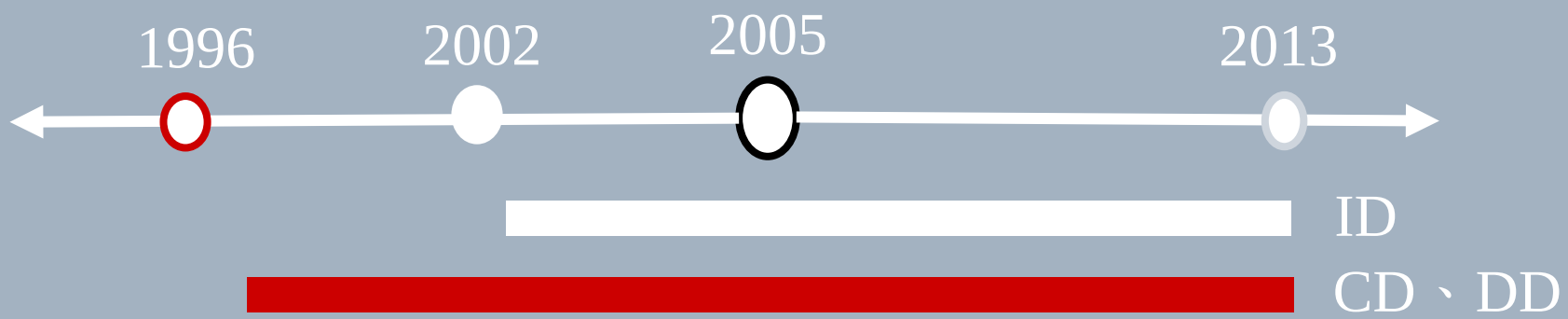
Elderly：2,186,730

Edlerly Sample：100,399



Data Decsription (conti.)





Handling Big Data

- The **size** and **quality** of NHI database make data analysis difficult.

→The size of two sample data sets is more than 1TB (or 1,024GB).

- Need to rely on information technology and data scientists (e.g., IT experts).

→We have a team of statistical analyst.

→Cannot apply regular data analysis software.

Data Preparation and Cleaning

- Data cleaning is a big issue, since the health care data are from different hospitals.

→At least 50% work of data analysis is on data prepparation and cleaning.

- Data Discrepancy?

→e.g., The death records are not complete in NHI database, and many are questionable!

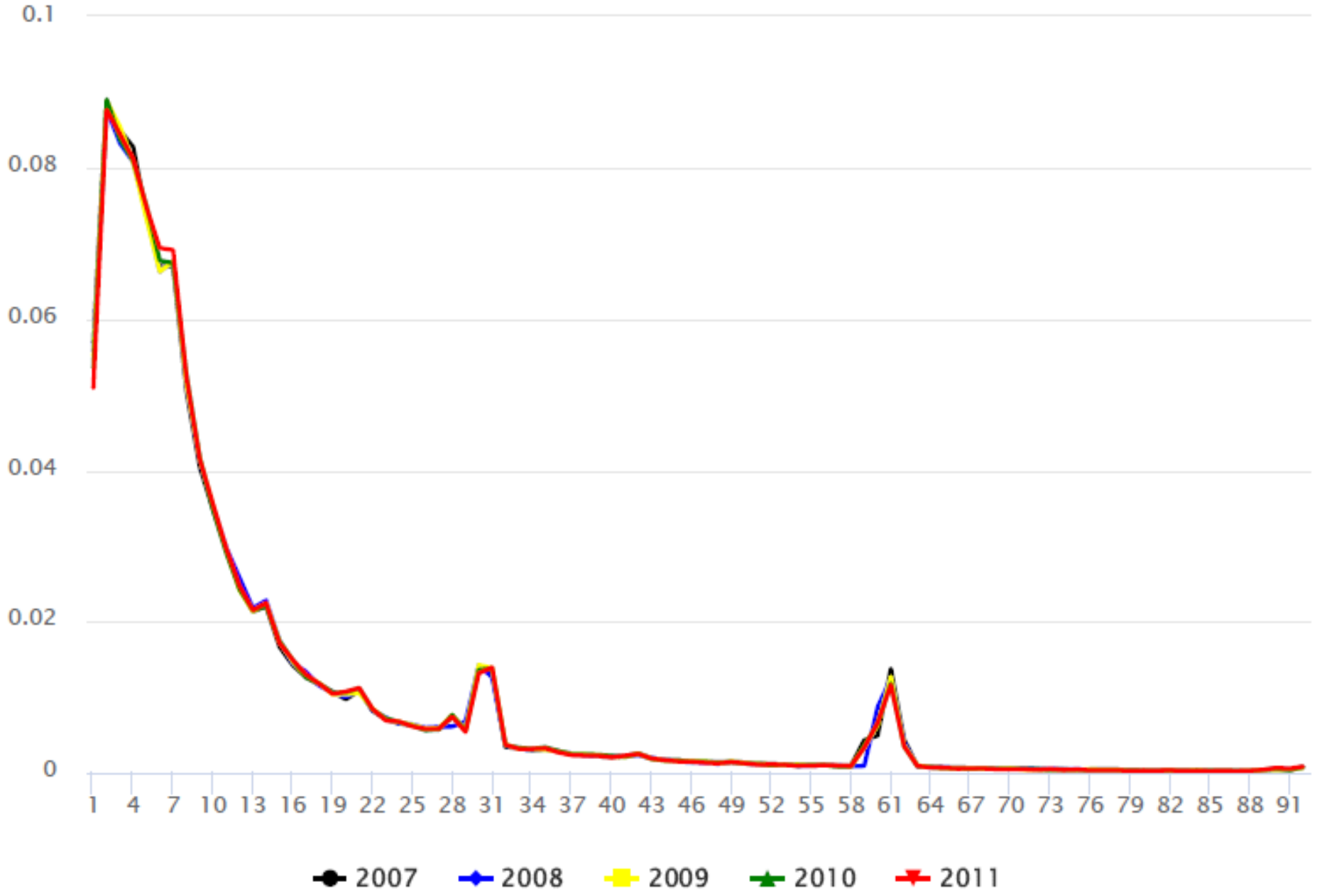
3 Inpatient Visit

→Incidence Rate

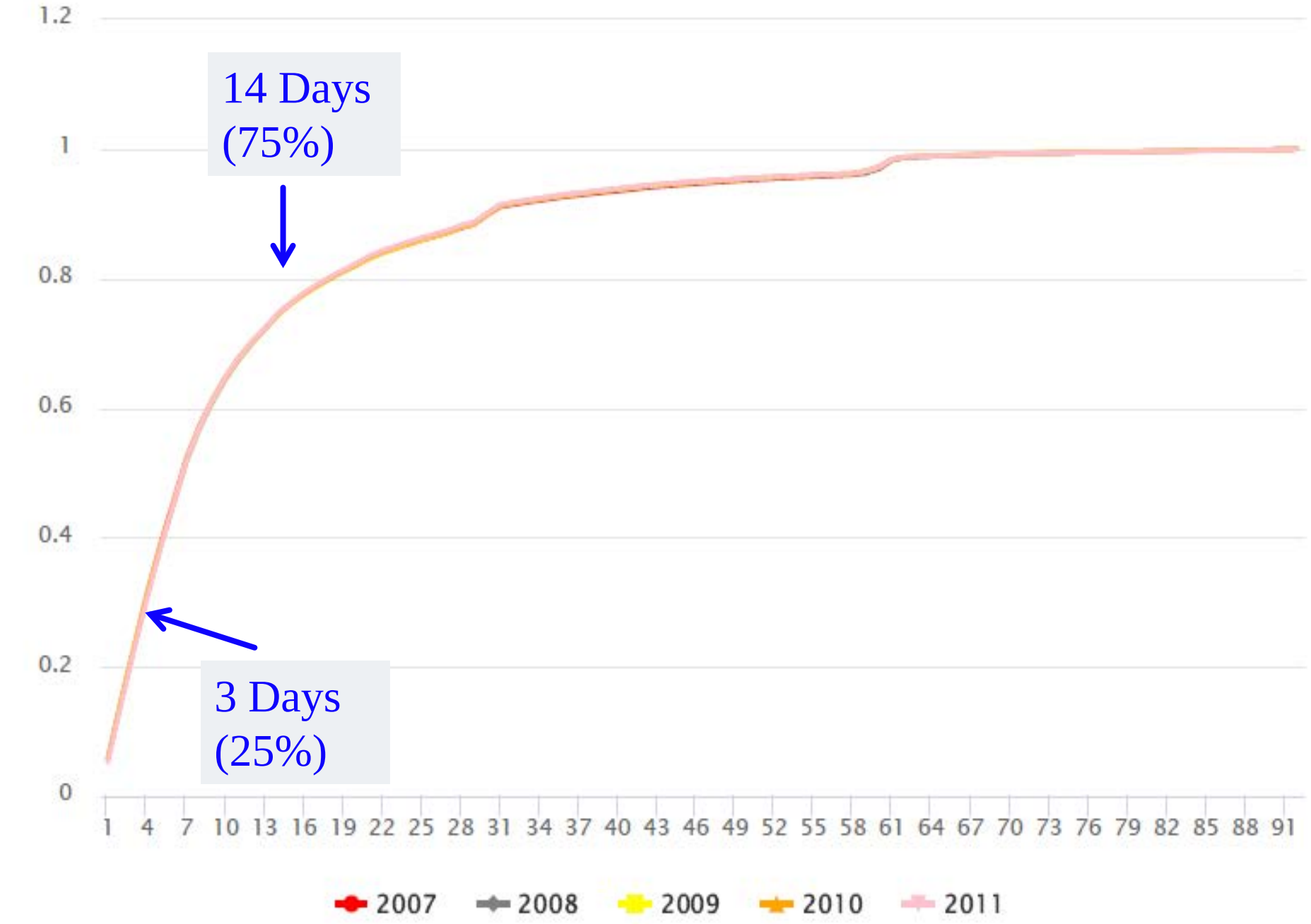
→Average Day

→Number of Visit

Days between Two Inpatient Visits



CDF of Days between Two Inpatient Visits



Days between Two Inpatient Visits

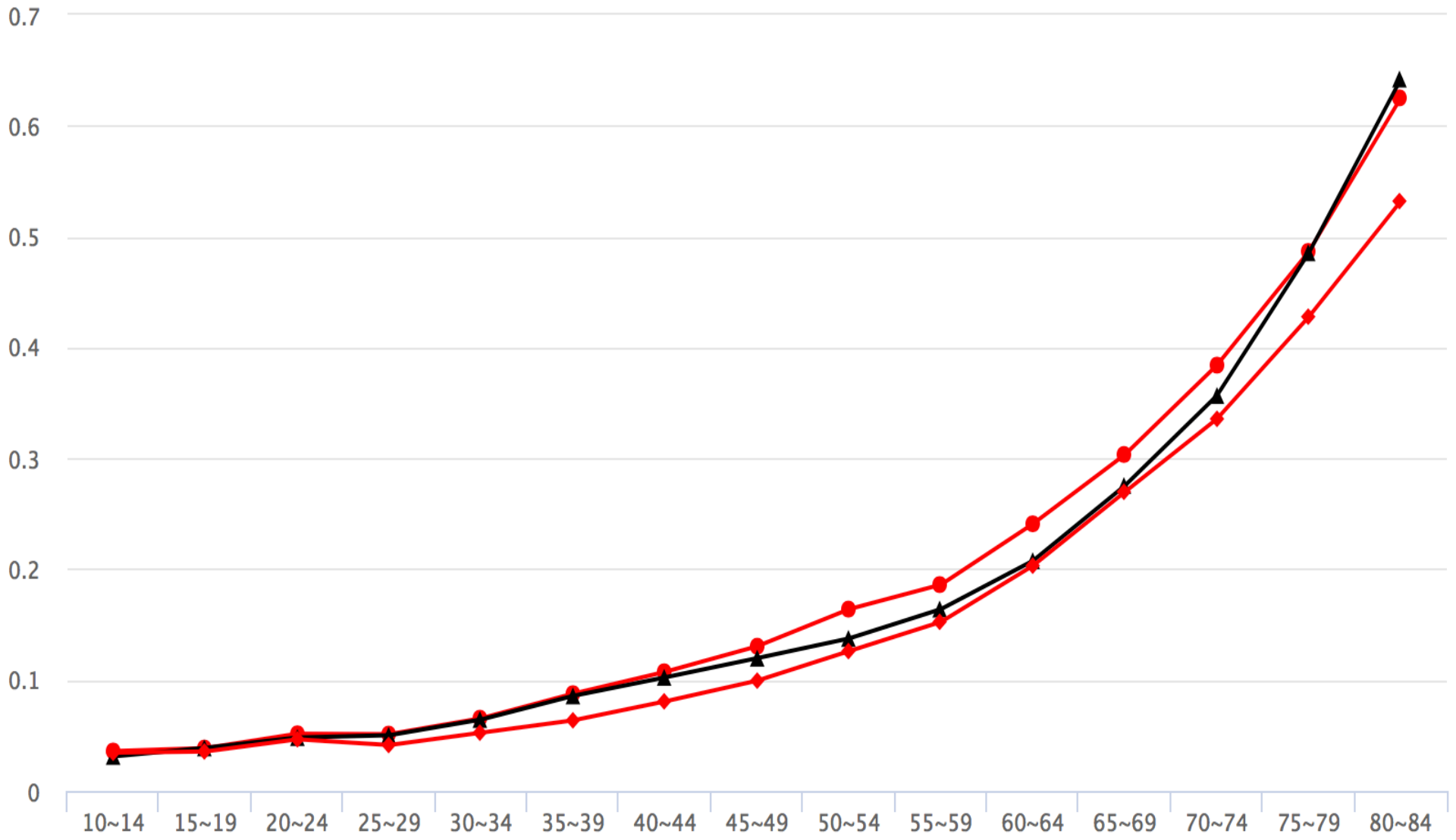
- There is a co-payment for every inpatient visit: 10% first month, 20% second month, …

→Doctors tend to (temporarily) discharge patients at the end of first & second moths.

- It makes sense to combine inpatient visits within 24 hours.

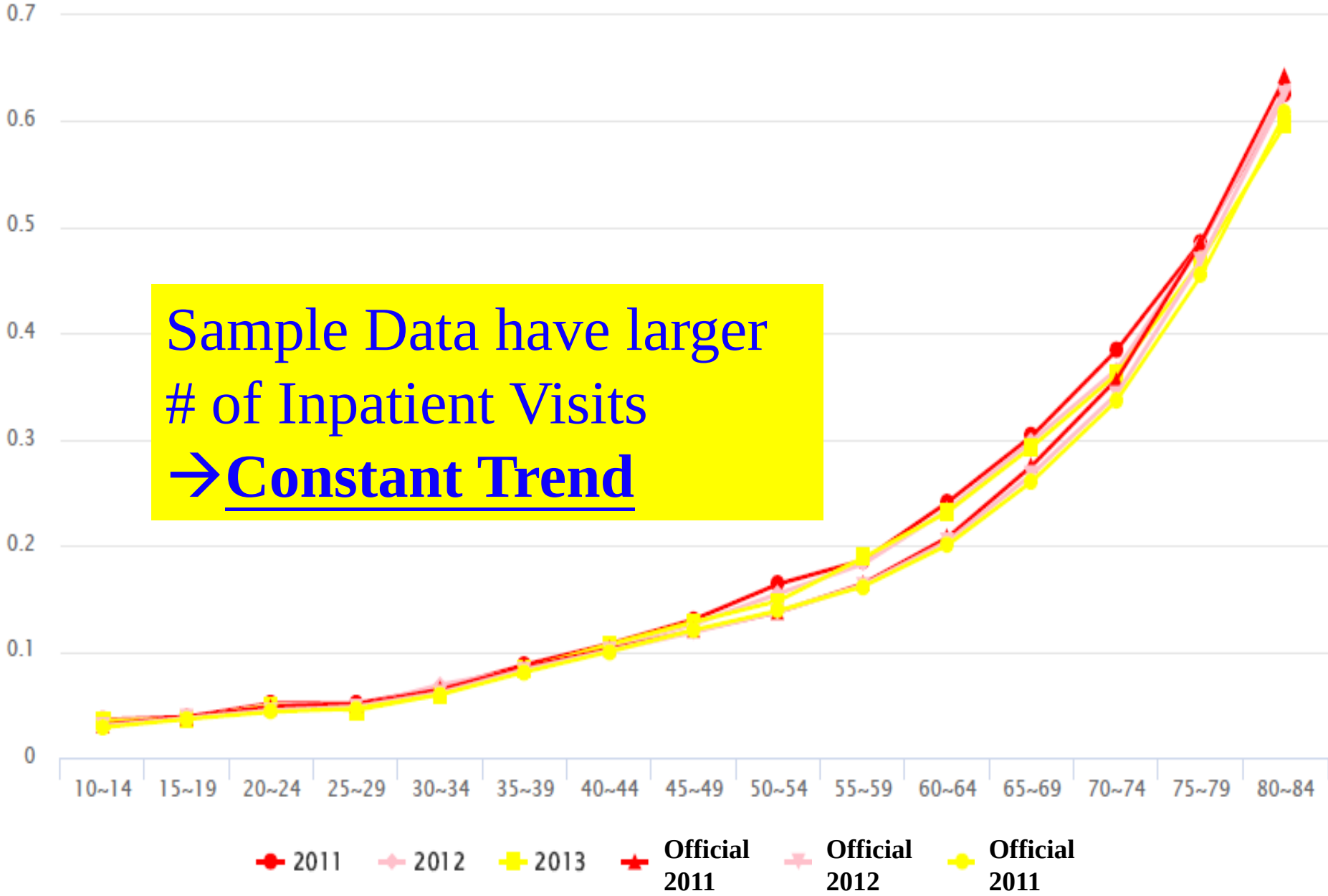
→Taiwan insurance companies combine visits within 14 days (same ICD code).

Male Inpatient Incidence Rate (Official vs. Sample)



2011 Official ▲, 2011 Sample ●, ■(combining discharge within 1 day)

of Male Inpatient Visits (Official vs. Sample)



Sample Data have larger # of Inpatient Visits

→**Constant Trend**

Results of Inpatient Visits

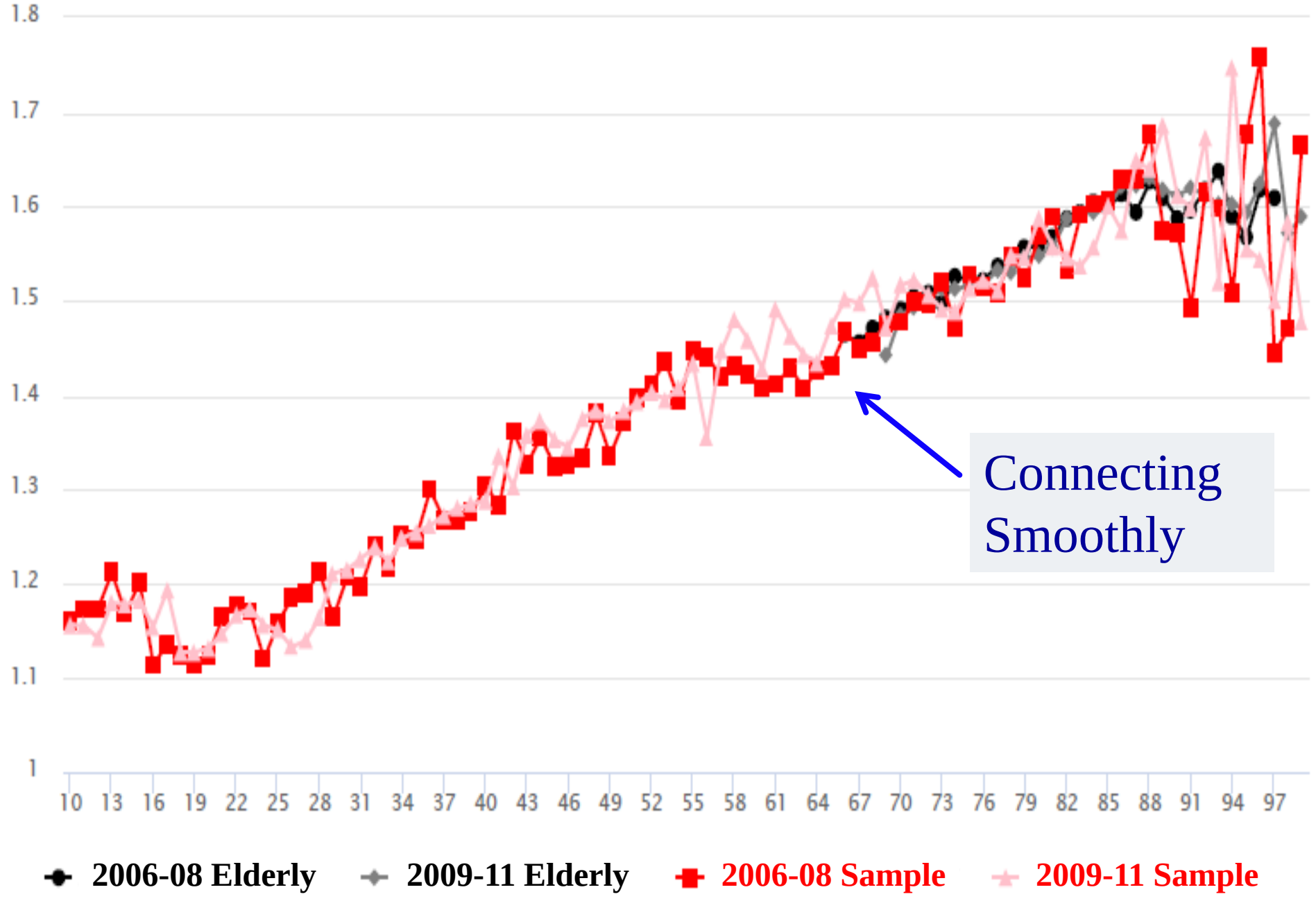
- Incidence rates of inpatient visits are very similar for sample data & official records.

→Usually results of sample data are higher.

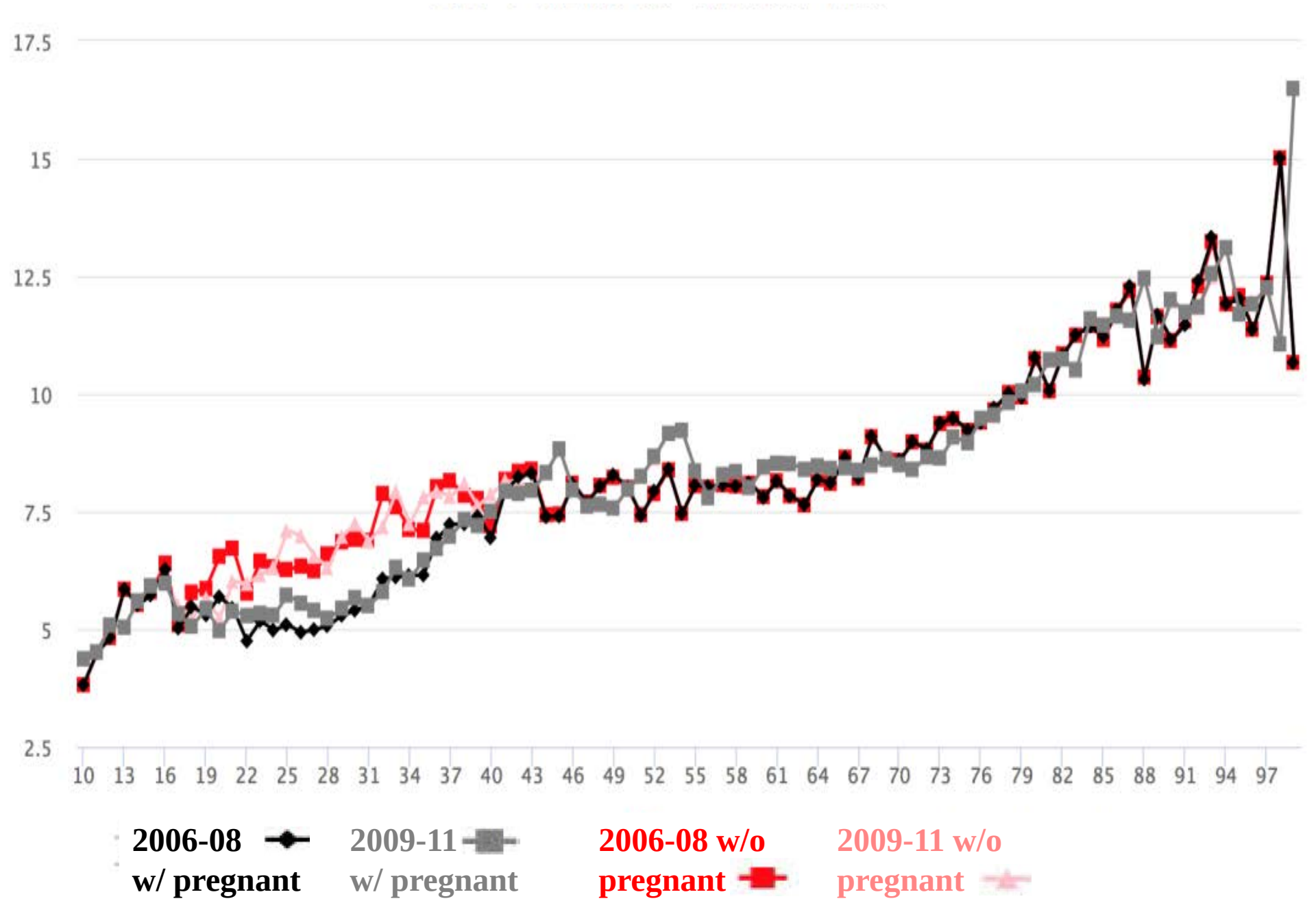
- Results of incidence rates, # of visits, and average days per visit are quite stable.

→Both data sets show similar patterns and we can combine the estimates from two data sets.

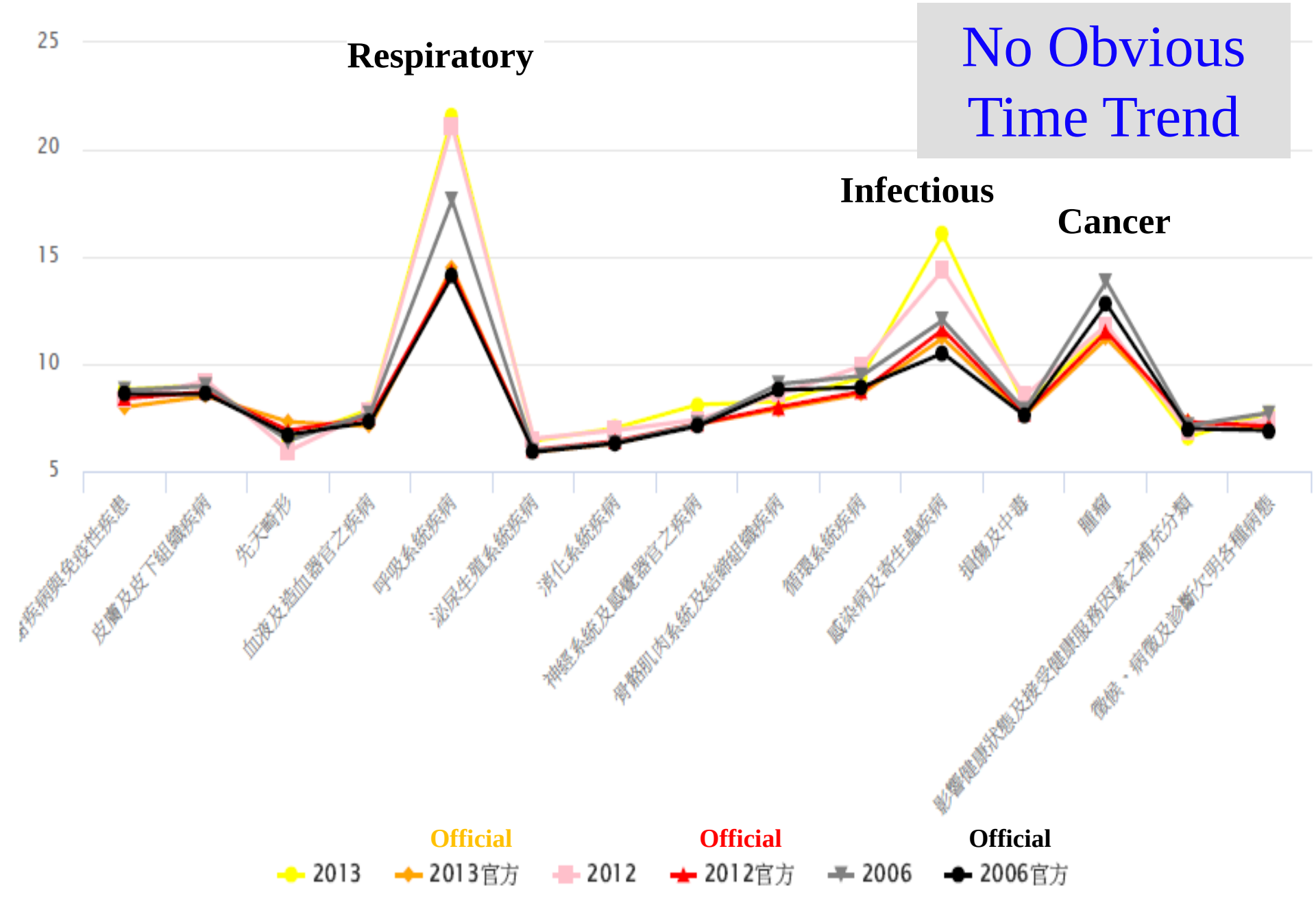
of Male Inpatient Visits (2 data sets: 0~99 vs. 65+)



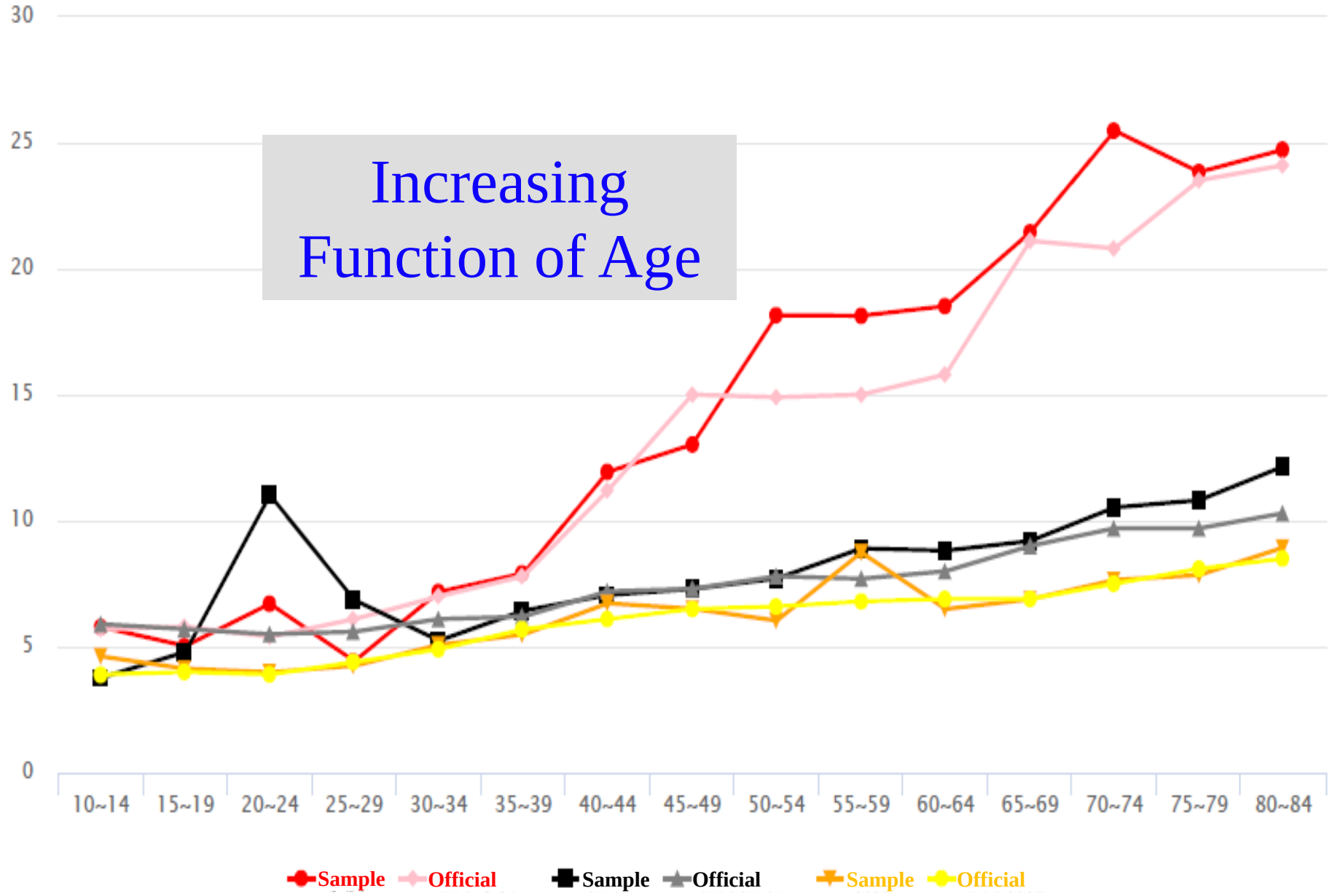
Female Inpatient Days (Pregnant or not, Below 30 days)



Top 3 Male Inpatient Days (Official vs. Sample)



Male Age-specific Inpatient Days (2013)



Comments on Inpatient Visits

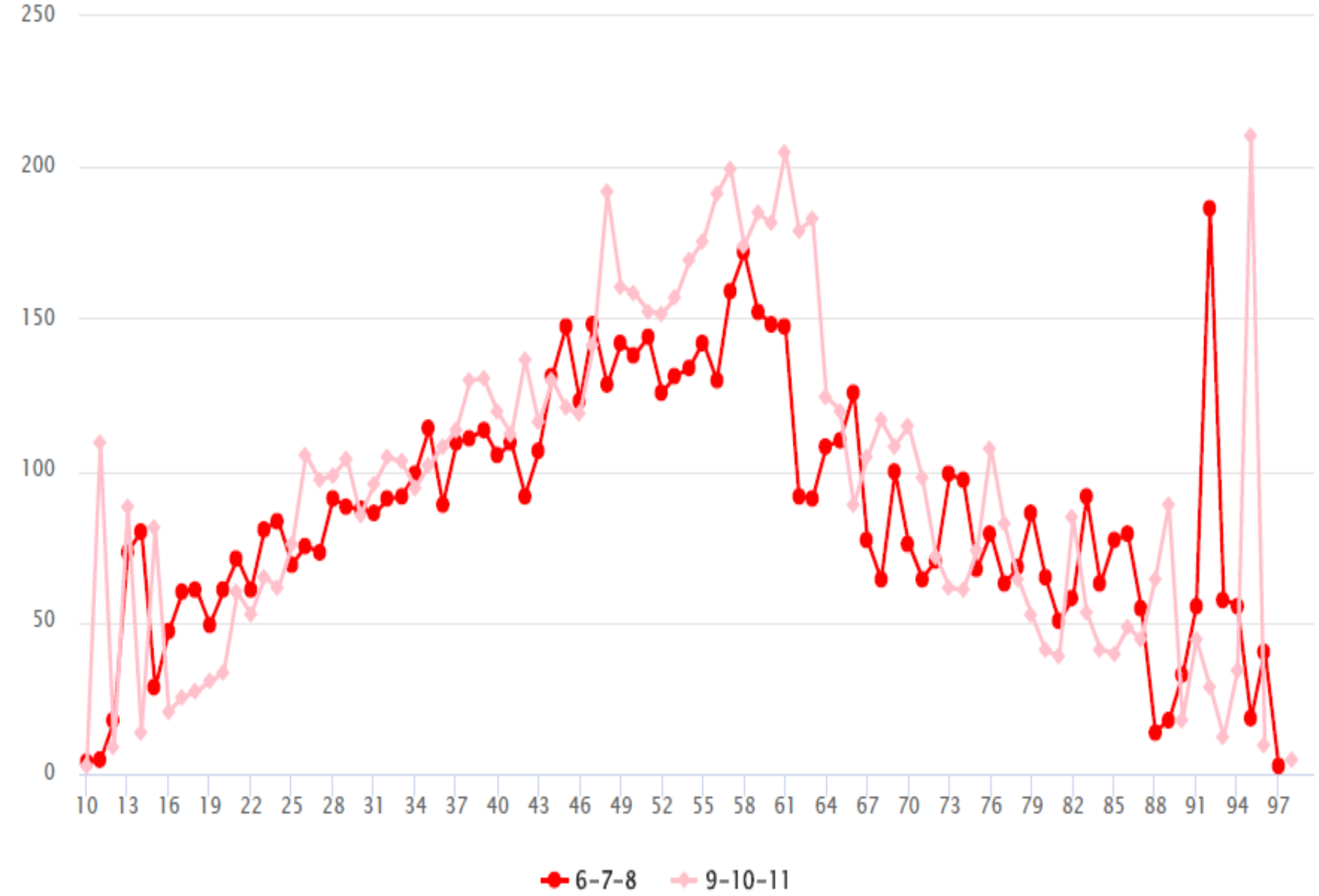
- Results of incidence rates, # of visits and average days are stable (No Time Trend!)

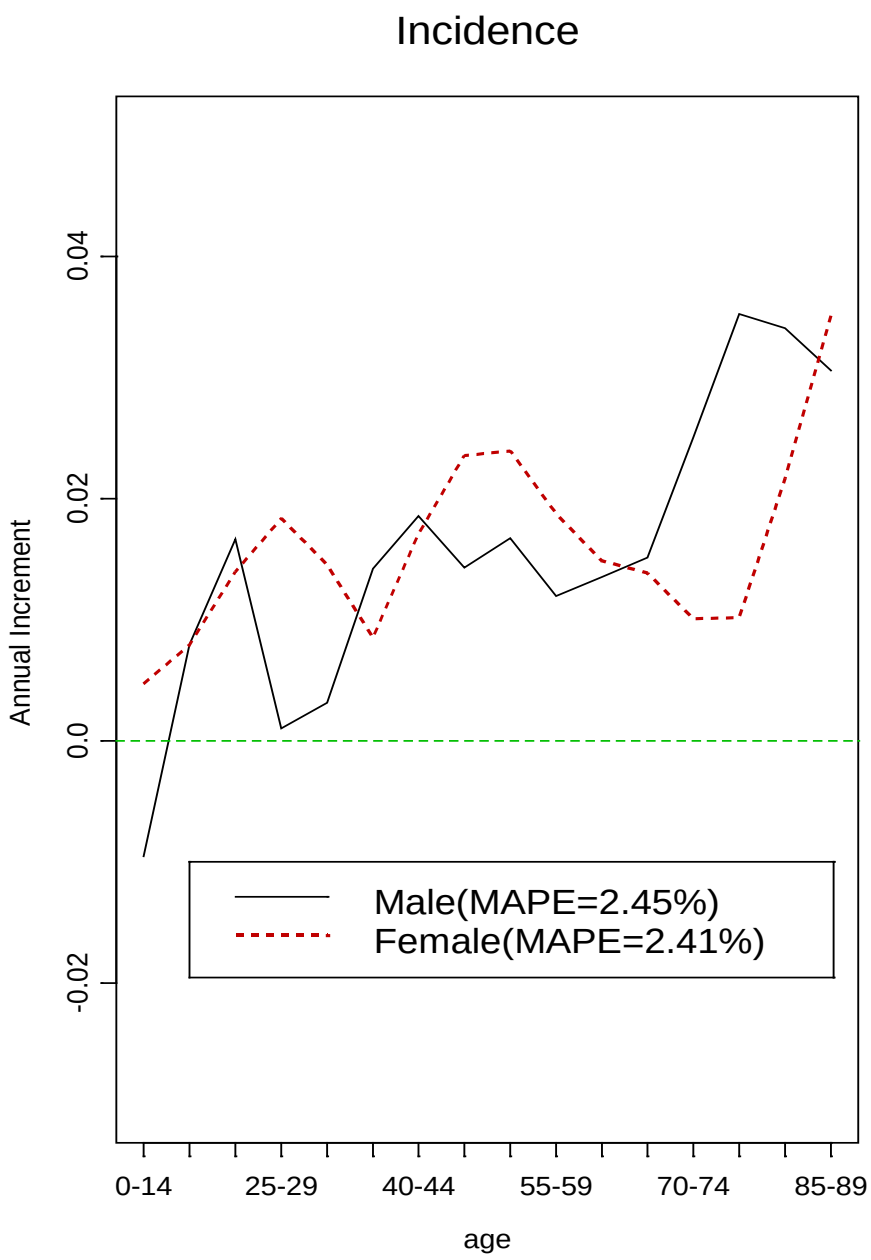
→Sample data and Official records are similar.

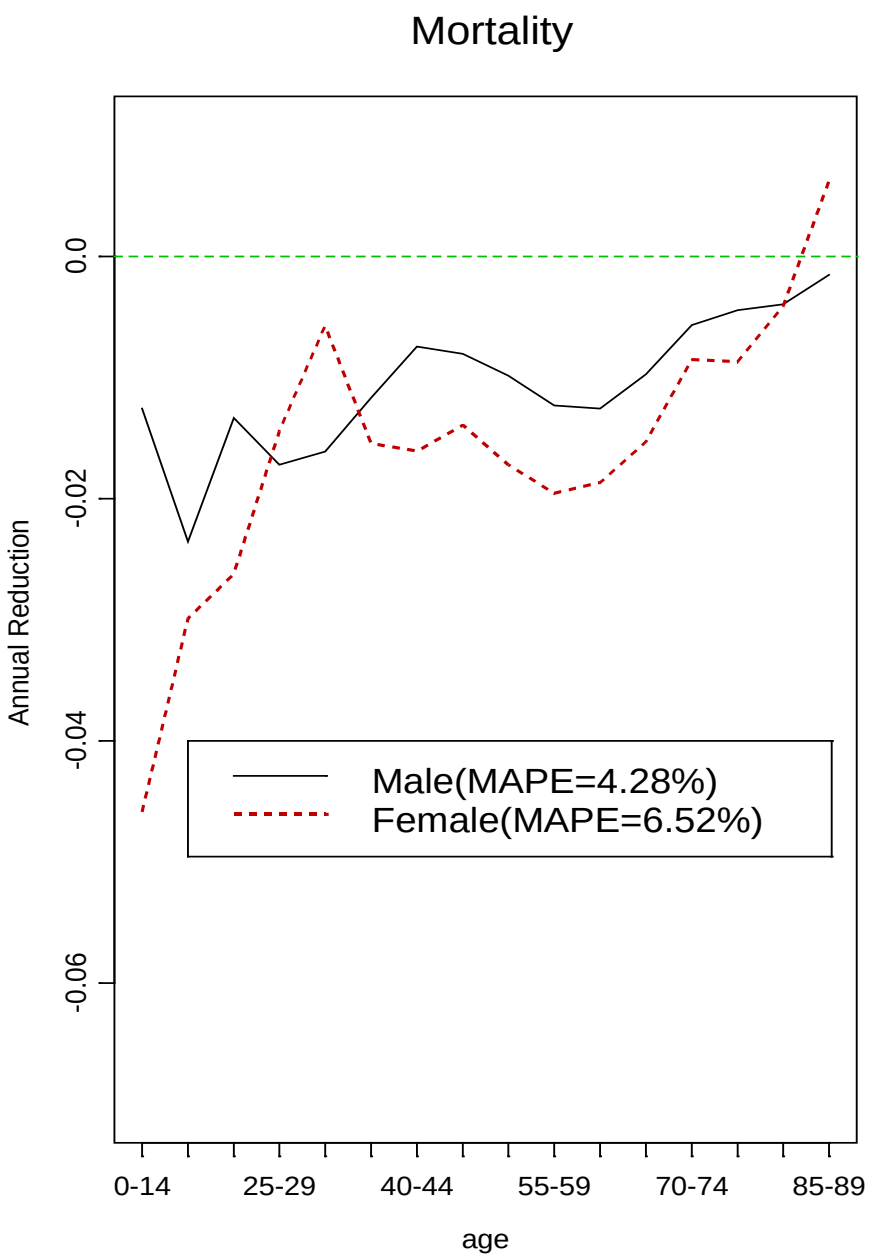
- All results increasing function of age, except mental illness.

→No obvious time trend and the longevity risk is not as severe as cancer.

Male Age-specific Inpatient Days (Mental Illness)







Annual increment/reduction of cancer data (LC Model)

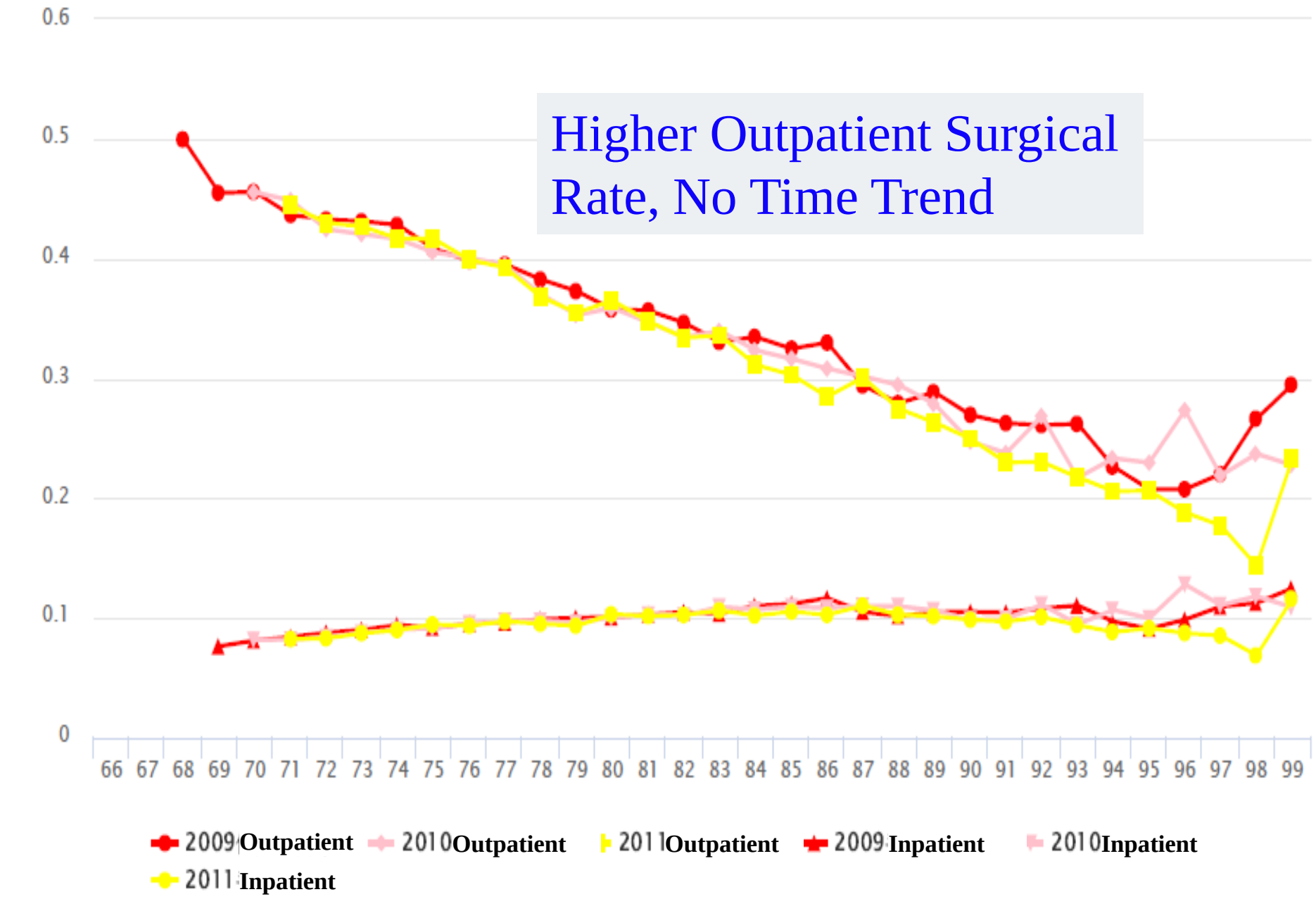
4 Surgical Procedures

→Inpatient Surgery

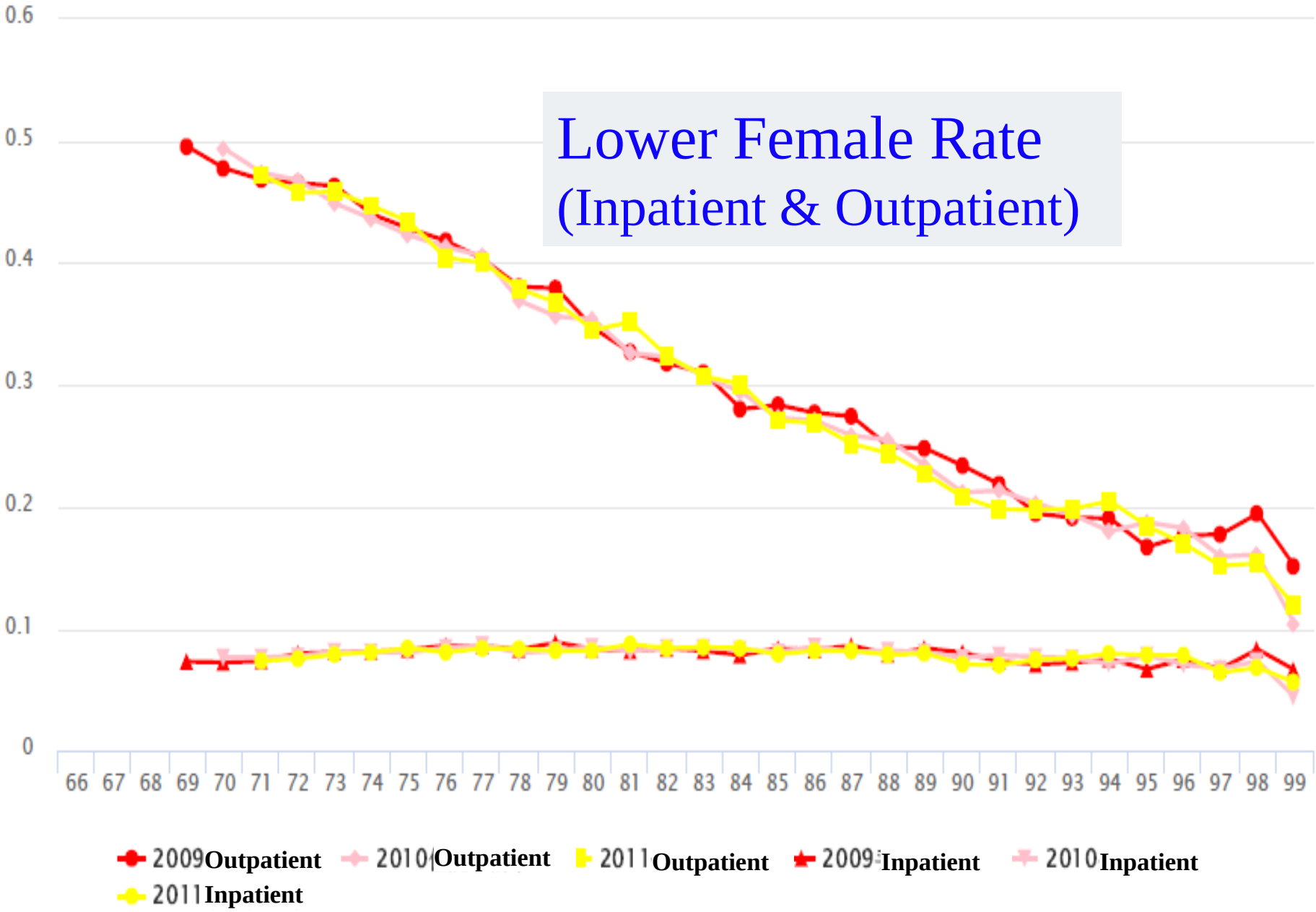
→Outpatient Surgery

→Surgery related Mortality

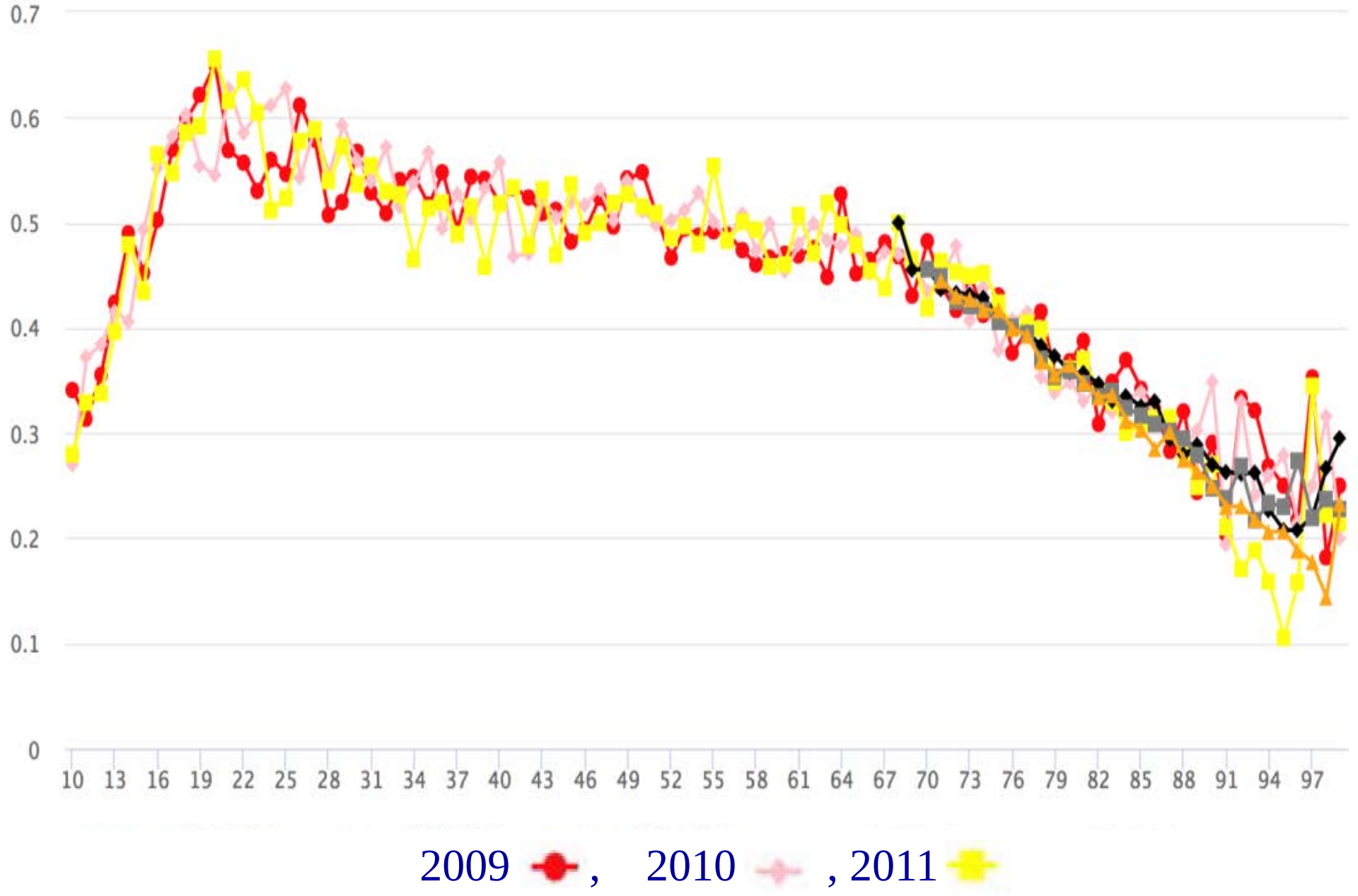
Male Age-specific Surgical Rates



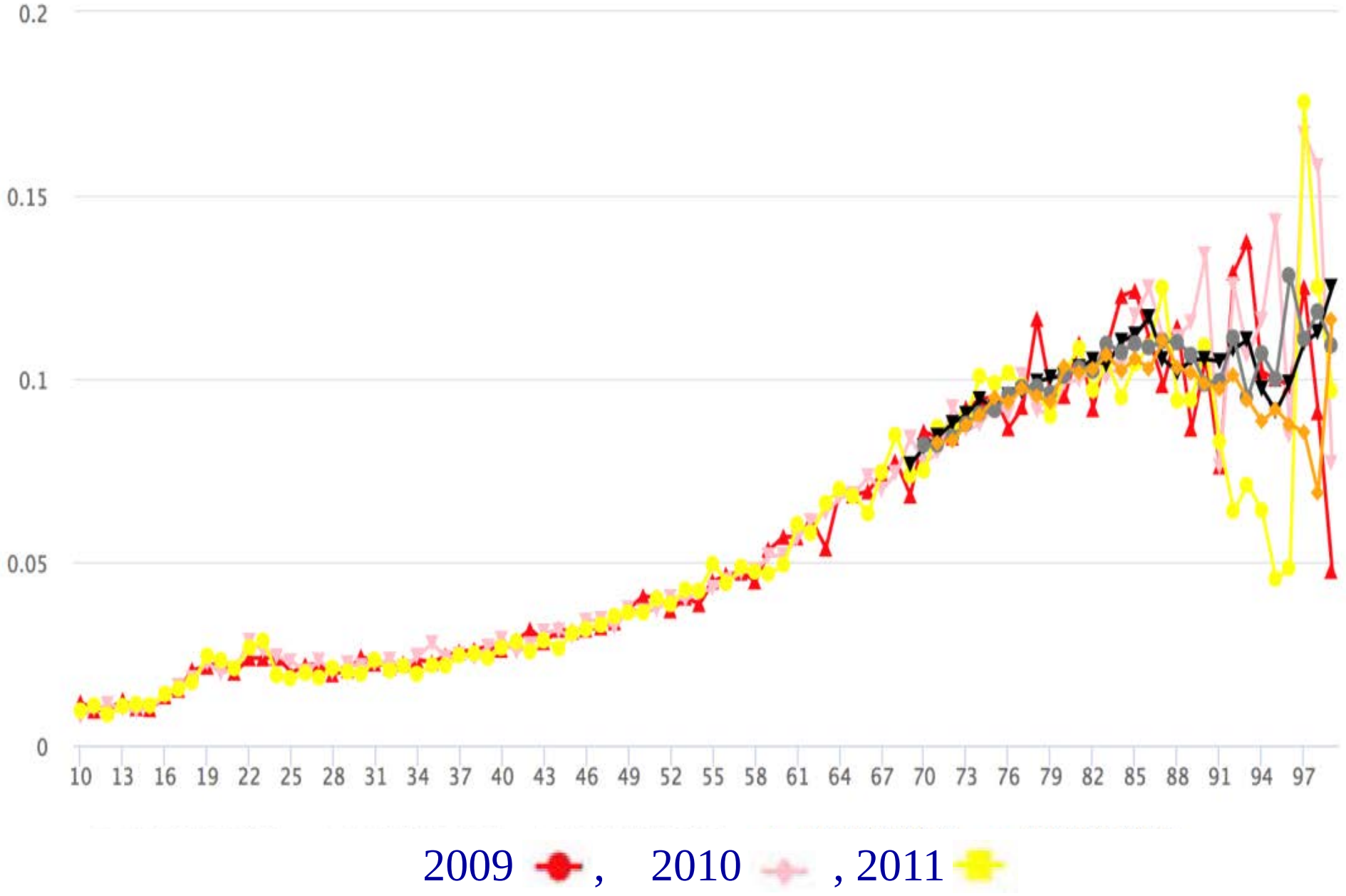
Female Age-specific Surgical Rates (2009-11)



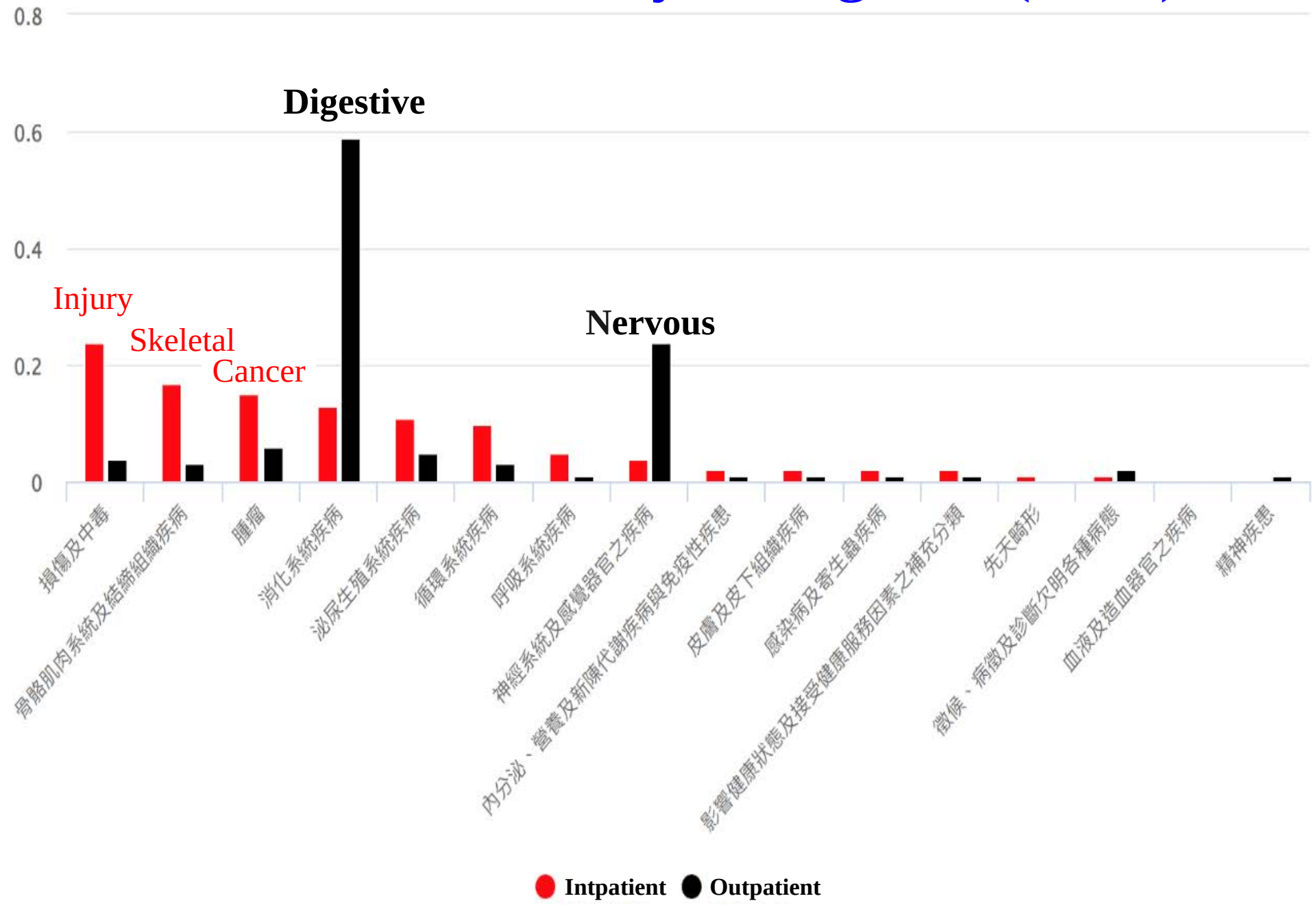
Male Age-specific Outpatient Surgical Rates (2009-11)



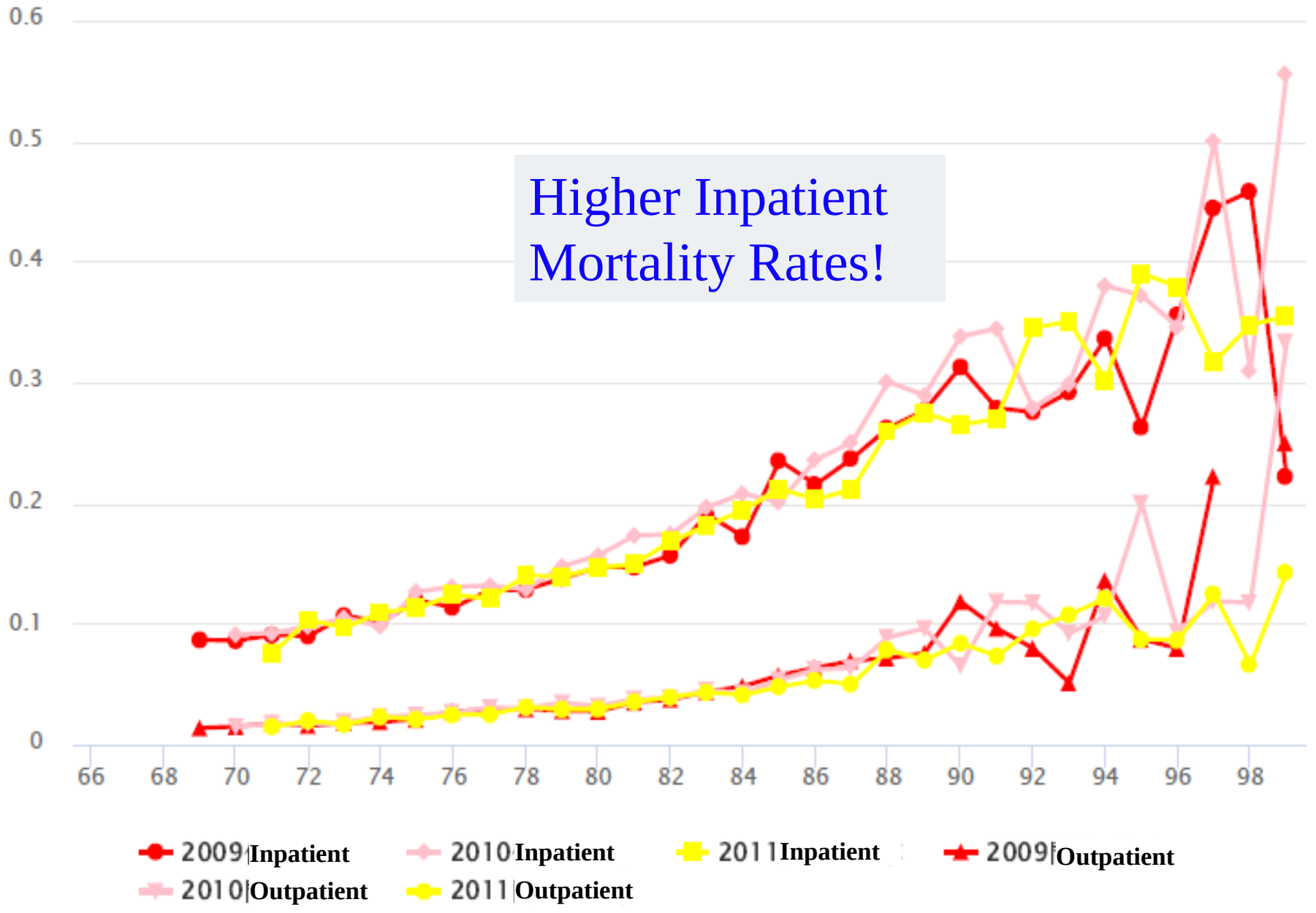
Male Age-specific Inpatient Surgical Rates (2009-11)



Causes of Elderly's Surgeries (2011)



Mortality Rates of Male Surgeries



Comments on Surgical Procedures

- Results of surgical procedure rates are consistent in time and age.

→No obvious time trend.

→Outpatient surgical rates are higher.

→Outpatient surgical rates increase with age.

- Inpatient surgical mortality rates are higher than those of outpatient surgeries.

Conclusions

- It takes lots of efforts to handle **big data** & apply them into insurance **(Domain knowledge)**.

→Knowledge in application fields (e.g., ICD codes) and experience accumulation in handling data are important.

- Inpatient and surgical results do not change with time.

→The longevity still exists since the mortality rates decrease with time (not as severe).

Discussions

- Accumulate more data (small population issue) and be careful about the data quality.

→Sensitivity analysis and survival analysis.

- Incidence rates of inpatient visit are more than 20% for the elderly.

→A potential market for Inpatient visits.

- Big data and data scientist

→Insurance companies also need experts in big data (& information technology).

Thank you for your attention!