



ARGOS: A Rigorous Global Observation System for burden of diseases

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Introduction

- Disease burden is the present expected sum of current and future DALYs resulting from all incident cases of disease.
- Global health institutions such as GBD, CONCORD-III, and WHO are monitoring burden of disease to quantify and compare the heterogeneity in disease burden and quality of health care system across the countries.
- We propose A Rigorous Global Observation System (ARGOS) based on OMOP-CDM, which is optimized for multi-center and -national comparison analysis.

ARGOS

Objective

- The goals of ARGOS is to calculate disease burden indicators and visualize the results.

Function

- ARGOS calculates and visualizes the following indicators :
 - Temporal trends in incidence of diseases, and incidence by age, gender, and birth year.
 - Mortality & survival rates
 - Medical expenses caused by the disease
 - Disability Adjusted Life Year (DALY) (Figure 1)

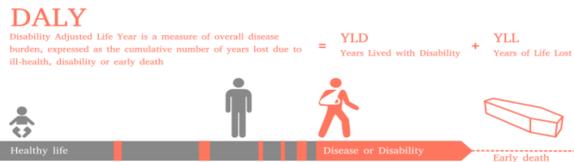


Figure 1. Concept of DALY (Wikipedia, 2019)

Method

Development of ARGOS

- ARGOS was developed with R and OHDSI tools, FeatureExtraction and PatientLevelPrediction packages.
- ARGOS is available at : 'https://github.com/ABMI/Argos'

Validation of ARGOS

- **Database**
 - NHIS-NSC : National Health Insurance Service-National Sample Cohort (1 million sample cohort from Korean national insurance data / 2003-2012)
- **Target disease**
 - 6 major cancers in Korea : colon/ lung/ stomach/ breast/ liver/ thyroid cancers
- **Measured epidemiological values**
 - Incidence rates, monthly and yearly medical expenses, and DALY
 - For incidence rates, we perform a further analysis:
 - ① Calculating Annual Percent Change (APC)
 - ② Comparing the results with the previous research (Jung et al, 2015)

Results

Incidence rates of each cancers

- Incidence rates of all cancers increased by 5.6% per year for 10 years (2003-2012)
- Notably, incidence of thyroid cancer increased by 19% per year in both sexes and has been the most common cancer since 2008. (Figure 3)

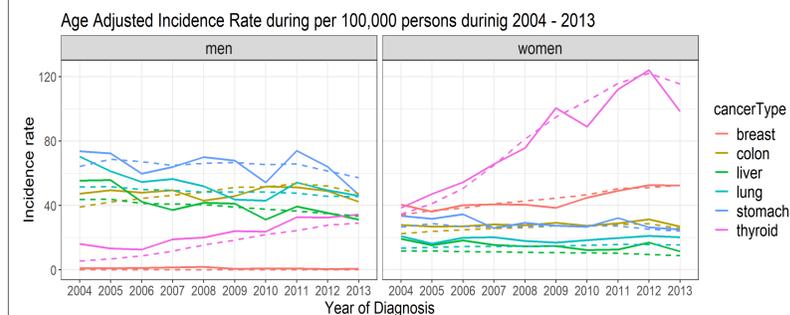


Figure 3. Comparison of age adjusted incidence rate between cancers in both sexes. (solid lines are the results from ARGOS, and dotted lines are from the previous research)

Trend in age standardized, and age specified incidence rates of breast cancer in women

- Age standardized incidence of breast cancer in women has increased. (Figure 4-a)
- While the incidence of breast cancer decreases in women of 30's and 80's to 100's, it increases in women of 50's to 70's. (Figure 4-b)

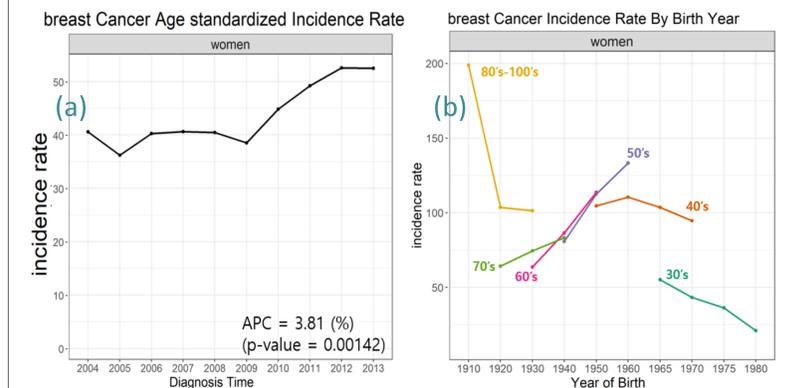


Figure 4. Age standardized incidence rate of breast cancer (a), and incidence rate of breast cancer by birth year (b)

While total medical cost for cancers is increasing, cost paid by patients is decreasing

- The fact that economic burden of cancer in Korea has more than doubled over the period was identified in our results.
- Notably, total medical cost of breast cancer have increased by 11.4% per year during the period.
- Increasing rate of the cost paid by the insurer were prominent during the period, end up paying more than 90% of the total cost in 2013. (figure 5-a)
- On the other hand, the cost paid by patients decreases due to the health insurance system in Korea, and national policies to reduce the burden of cancer patients. (Figure.5-b)

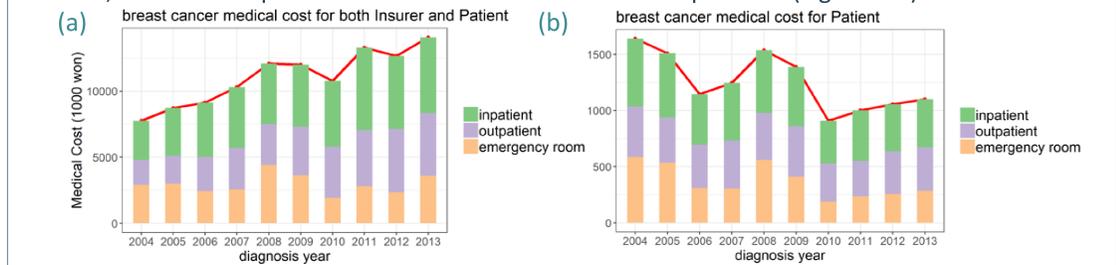


Figure 5. Total medical cost (a), and the cost paid by patients (b) for breast cancer

Monthly total medical cost for cancers shows similar pattern except breast cancer

- Since the breast cancer usually needs neoadjuvant chemotherapy after surgery, the graph showed another increasing pattern after the spike at the diagnosis date. (figure 6-a)
- All of the other cancers show a spike at the diagnosis date due to the surgery, followed by continuously decreasing pattern. (figure 6-b)
- Total medical costs are increasing as the year goes by.

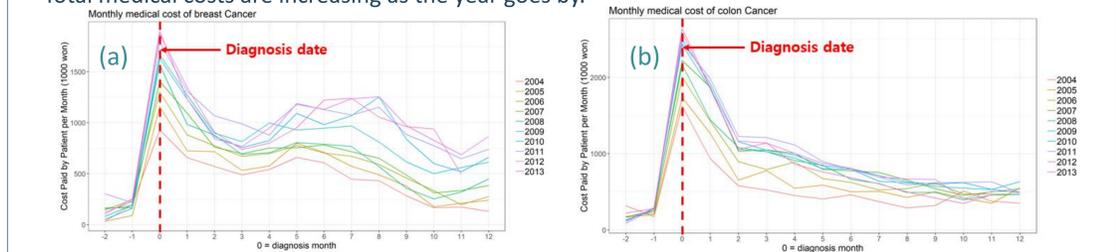


Figure 6. Monthly total Cost for Breast Cancer (a), and colon cancer (b)

Daily adjusted life years(DALY) of cancers

- Crude DALYs of cancers per 100,000 people maintain relatively constant values over the period (72.4 per 100,000 to 72.6 per 100,000).
- While the DALY of liver cancer falls the most to 86.2% in 2008, compared to 2004, it increases in breast cancer and colorectal cancer to 112%, and 120% respectively. (Figure 7)
- The highest average of DALY is stomach cancer (95.0), followed by lung cancer (76.5), and breast cancer (41.7) is the lowest.

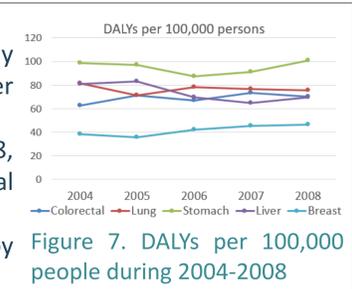


Figure 7. DALYs per 100,000 people during 2004-2008

Conclusions

ARGOS provides cross-country system to monitor burden of diseases from patient-level data in the format of OMOP-CDM. The validity and feasibility of ARGOS is demonstrated by POC study, assessing burden of cancers in Korea. We expect ARGOS to be widely used as an effective and rigorous surveillance system for burden of various diseases and contribute to the improvement of global healthcare system.