Big Data in Asia-Pacific – A Valuable Resource For Better Health Care Decisions

: Experiences and lessons learned in Taiwan

Outline

- Taiwan’s Health Care Environment
- Reimbursement Data Base from National Health Insurance
- Big Data in Health Welfare Data Science Center (HWDC)
- Types of Health Databases
- Applications in HE & OR
Taiwan Healthcare Environment

Geography and Population
- Area: 36,000 km square

Healthcare System
- Taiwan’s National Health Insurance (NHI) system launched in 1995
- 2nd Generation NHI (2G NHI) Reform scheduled in Jan. 2013

NHIRD and HWDC
National Health Insurance Research Data Base (NHIRD): NHI program in Taiwan

- Started in 1995
- A single-player, government-run system
- Mandatory participation
  - Population of Taiwan: 23 million
  - Population covered by NHI: 96% in 2000, 99.9% in 2013
- Contracted majority of healthcare facilities
  - 97% of hospitals and 90% of clinics
- Comprehensive benefit package
  - Ambulatory care
  - Inpatient care
  - Prescription drugs
  - Dental service
  - Others
- Administered by NHRI
- Purchased database to keep after expiration of IRB approval
- Services stopped on Nov. 30, 2015

Health Welfare Data Science Center (HWDC)

- Operated by Department of Statistics, MoHW since 2012
- Database can not be released
- On-site use in HWDC, VPN usage estimated in late 2016
  - Data linkage must be accessed in HWDC.
  - Data analysis will be performed in HWDC except a few of survey data allowed to be exported by HWDC staff for use outside HWDC.
  - Personal identifying information is encrypted.

- Data Center in Academia
  - Number of Data centers: 8
  - 2 Million sampling data only

- Data service charges
  - Data cost
  - Fee for facility use

HWDC at CGU
HWDC Centers in Taiwan

- Established since 2012 in academic university and research institutes:
  - CMU (suspended since 2015)
  - NCKU (suspended since 2015)
  - NTU, TMU
  - CGU, KMU
  - NYMU, TCU
  - Academia Sinica
  - NHRI

HWDC Centers in Taiwan:NTU, TMU, CGU, KMU, NYMU, TCU, Academia Sinica, NHRI

Office and Analysis Venues in HWDC

- HWDC-CGU branch
- Research Service Center for Health Information
### NHIRD and related Data Base in HWDC

#### Content of NHIRD

- **byproduct of the NHI administrative system**

<table>
<thead>
<tr>
<th>Category of files</th>
<th>Data elements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>outpatient/inpatient/pharmacy service and expenditure</strong></td>
<td>diagnosis, services charges (expenditures), date of inpatient visit, date of outpatient visit, date of hospital admission and discharge, etc.</td>
</tr>
<tr>
<td><strong>outpatient/inpatient/pharmacy orders</strong></td>
<td>prescription drugs (drug name, strength, dose, quantity, date of dispensing), procedures, medical services, etc.</td>
</tr>
<tr>
<td><strong>Registration files</strong></td>
<td>• age, sex, date of enrollment/withdrawal</td>
</tr>
<tr>
<td>• registration of beneficiary</td>
<td>• hospital levels, provider specialty</td>
</tr>
<tr>
<td>• registry for contracted healthcare facilities</td>
<td>• diagnosis of catastrophic illness, date of registration</td>
</tr>
<tr>
<td>• medical personnel</td>
<td></td>
</tr>
<tr>
<td>• registry for catastrophic illness patients</td>
<td></td>
</tr>
</tbody>
</table>
Categories of NHIRD in HWDC, MoHW
Longitudinal Health Insurance Database (LHID)

• Population
  › All ages
  › 2 million people randomly selected (stratified sampling) from among the total Taiwan population (~8.7%) in 2000, 2005, and 2010

• Files included
  › NHIRD, Personal Attributes Data, Death registry, Taiwan Cancer Registry

• Year of data available
  › A: Cohort 2000: 2000-2013

Categories of NHIRD in HWDC, MoHW
per user request

• Population
  › All ages
  › All beneficiaries of National Health Insurance program (> 99% of total Taiwan population)

• Files included
  › NHIRD
  › Data linkage with optional national health databases after approval of IRB and HWDC, MoHW

• Year of data available
  › 2000-2014, additional outpatient/inpatient service and expenditure are from 1998
<table>
<thead>
<tr>
<th>Data Source Name</th>
<th>Year of Data Available</th>
<th>Data Element Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan Death Certificate*</td>
<td>1971-2014</td>
<td>Causes and date of death, marital status, location of death (city/township), etc.</td>
</tr>
<tr>
<td>Taiwan Birth Certificate Registry*</td>
<td>2001-2014</td>
<td>Sociodemographic information (parental age and education), method of delivery, pregnancy outcomes (birthweight, gestational age, infant mortality, congenital defect), multiple births, APGAR score, etc.</td>
</tr>
<tr>
<td>Taiwan Cancer Registry</td>
<td>Short form 1979-2011; long form after 2002</td>
<td>Date of initial diagnosis, primary site, histology, grade/differentiation, and more details in long form</td>
</tr>
</tbody>
</table>

*mandatory to register

Taiwan Cancer Registry (TCR)

- **Description**
  - Population-based cancer registry founded in 1979. Hospitals with greater than 50-bed capacity are recruited to participate in reporting all newly diagnosed malignant neoplasms

- **Population**
  - The completeness of registry was estimated to be 92.8% in 2002, and has increased to 95.5% after the Cancer Control Act was announced in 2003, and has reached 97.7% in 2011

- **Content**
  - Short form (1979~, all cancer sites): date of initial diagnosis, primary site, histology, grade/differentiation, etc.
  - Long form (2002~, major cancers): more detailed information of the stage at diagnosis and the first course of treatment, and more required items in 2011 to include cancer site-specific factors (e.g., laboratory values, tumor markers, etc)

Taiwan Cancer Registry
- online resources and reports

More info:

Health Surveys Data in HWDC, MOHW

- Population
  - National representative survey (all ages) on health behaviors, health conditions, etc.
  - Survey on specific issues in subgroups such as elderly, adolescents, etc.
- Other Data Bases: some examples
  - National Health Interview Study, Triple-High Status Survey (high blood pressure, hyperglycemia and high blood lipid profile), Survey of Health and Living Status of the Middle Aged and Elderly in Taiwan, Taiwan Smoking Behavior Surveys, Family and Fertility Survey, Adolescent Health Survey, etc.
National Health Survey Data in HWDC, MOHW

~ National Health Interview Study, NHIS

- **Population**
  - All ages (adult & children), ~25,000 subjects in each survey
  - Nationally representative: multistage stratified systematic sampling design, probability Proportional to Size

- **Method of Data collection**
  - Face to face questionnaire interview
  - Self-reported questionnaire

- **Content**
  - Demographics, personal health and disease histories, health behaviors, utilization of healthcare services, lifestyle, food pattern, nutrition knowledge, economic status and body weight and height, etc.
  - Contents may differ by age, e.g. quality of life in 20-65 yrs

- **Year of Data Available**
  - Cross-sectional surveys in 2001, 2005

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Taiwan BioBank is operated by Academia Sinica since 2010
Total number of samples collected from ~70,000 individual
To provide a centralized sample and data center for all scientific research usage
To be merged with Biosignatures project

Opportunity for Data Base Linkage

39 databases in HWDC, MOHW, as of Sep 10th, 2015

Healthcare claims:
National Health Insurance Research Database (NHIRD)

Health surveys:
e.g., National Health Interview Study,
Triple-High status Survey,
Survey of Health and Living Status of the Middle Aged and Elderly in Taiwan, Taiwan Smoking Behavior surveys

National registry
e.g., cancer registry, death certificate

Researcher’s own data base:
primary data, e.g., community surveys;
clinical/biomedical data, e.g., electronic medical records
Publications in Health Care

NHIRD Publications since 2000

- Mostly in Outcome Research
  Some published data were utilized and adapted in PE model parameters in HTA dossier

A total of 2016 articles had been published as of mid-2014
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