



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

: Experiences and lessons learned in Taiwan

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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

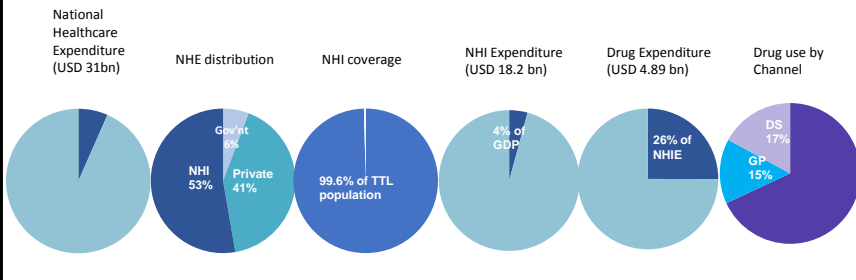


Geography and Population

- Area: 36,000 km square
- Population: 23 Mio.

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
- Administrated 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)

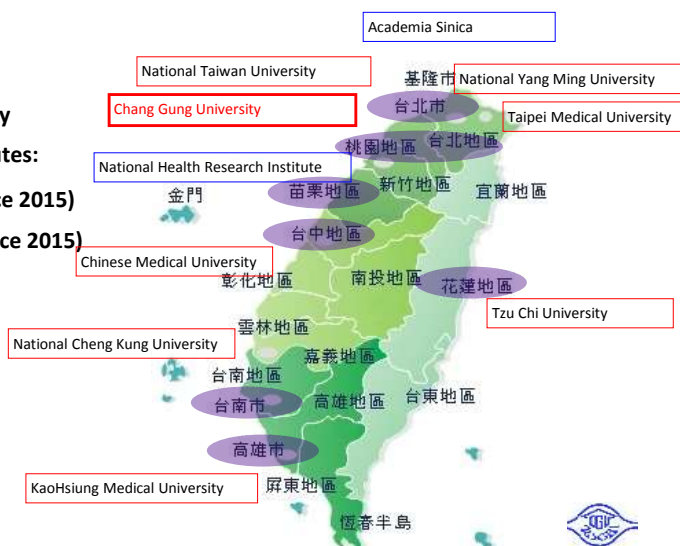
NTU, TMU

CGU, KMU

NYMU, TCU

– Academia Sinica

NHRI



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

Category of files	Data elements
outpatient/inpatient/ pharmacy service and expenditure	diagnosis, services charges (expenditures), date of inpatient visit, date of outpatients visit, date of hospital admission and discharge, etc.
outpatient/inpatient/ pharmacy orders	prescription drugs (drug name, strength, dose, quantity, date of dispensing), procedures, medical services, etc.
Registration files <ul style="list-style-type: none"> • registration of beneficiary • registry for contracted healthcare facilities • medical personnel • registry for catastrophic illness patients 	<ul style="list-style-type: none"> • age, sex, date of enrollment/withdrawal • hospital levels, provider specialty • diagnosis of catastrophic illness, date of registration

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
 - ▶ B1: Cohort 2005: 2000-2013; B2: Cohort 2005: 2005-2013
 - ▶ C1: Cohort 2010: 2000-2013; C2: Cohort 2010: 2010-2013



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





Database in HWDC, MoHW National Registries/Certificates

Data Source Name	Year of Data Available	Data Element Categories
Taiwan Death Certificate*	1971-2014	Causes and date of death, marital status, location of death (city/township), etc.
Taiwan Birth Certificate Registry*	2001-2014	Sociodemographic information (parental age and education), method of delivery, pregnancy outcomes (birthweight, gestational age, infant mortality, congenital defect), multiple births, APGAR score, etc.
Taiwan Cancer Registry	Short form 1979-2011; long form after 2002	Date of initial diagnosis, primary site, histology, grade/differentiation, and more details in long form

*mandatory to register

Taiwan Cancer Registry (TCR)

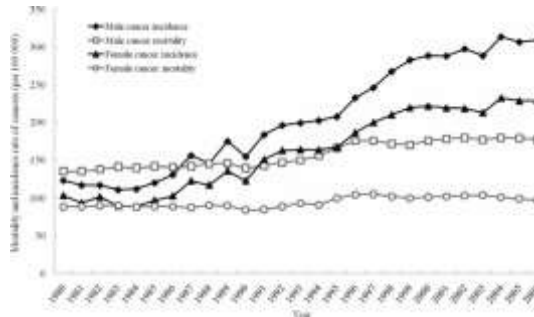
- Description
 - ▶ Population-based cancer registry founded in 1979. Hospitals with greater than 50-bed capacity are recruited to participate in reporting all newly diagnosed malignant neoplasms
- Population
 - ▶ The completeness of registry was estimated to be 92.8% in 2002, and has increased to 95.5% 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)

For more info: Chiang CJ, et al. Quality assessment and improvement of nationwide cancer registration system in Taiwan: a review. *Jpn J Clin Oncol.* 2015;45:291-6.

- online resources and reports



More info:
1. <http://tcr.cph.ntu.edu.tw/main.php?Page=N1>
2. [Jpn J Clin Oncol.](#) 2010;40:897-904.



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**

National Health Interview Study, NHIS

~online resource and publications

Publication	
1. "A Population Study of the Self-care Beliefs and their Associated Factors of Diabetes in Taiwan: Results From the 2001 National Health Interview Survey in Taiwan", Hong-Yi Chang ¹ , Chi-wei Chiu, Hsin-Chu Lin, Tung-Yuan Tai, <i>Preventive Medicine</i> , 2010 Mar; 48(3):344-6.	(Abstract) (Full)
2. "Health-related quality of life and health utility for the institutional elderly in Taiwan", Lai KL, Yang RL, Wang BL, Tan HL, Anstee AL, Bao S., <i>Qual Life Res</i> , 2005 May; 14(4):1189-95.	(Abstract) (Full)
3. "Total fat, cholesterol and other risk factors associated with obesity among Taiwan men adults", Chang W-C, Hsiao S-L, Chang W-Y, Lai Y-H, Hsiang C-H, Shu Y-T, Tai T-H, <i>Int J Obes (Lond)</i> , 2004 Feb; 28(2):179-83.	(Abstract) (Full)
4. "Do the BP, TG and WHR/OGTT/MBP Measure the Same Constructs? Evidence from the Taiwan Population", J-Chen Hoang, Albert W. Wu, <i>Composites (Biopolym)</i> , Quality of Life Research, 2008 Feb; 13(1):17-24.	(Abstract) (Full)
5. "Demographic Characteristics and Perceived Health Status of Users of Hot Therapies in Taiwan", HSI-GHAY TSEH, PH.D., TAN-KU KE, PH.D., CHEN-JIN WANG, PH.D., PH.D., HSI-GHAY TSEH, PH.D., HSI-YEN WANG, PH.D., and YEN-HSY CHENG, B.S.	(Abstract) (Full)



More info: <http://nhis.nhri.org.tw/thesise.html>



BIOBANK • 健康世代

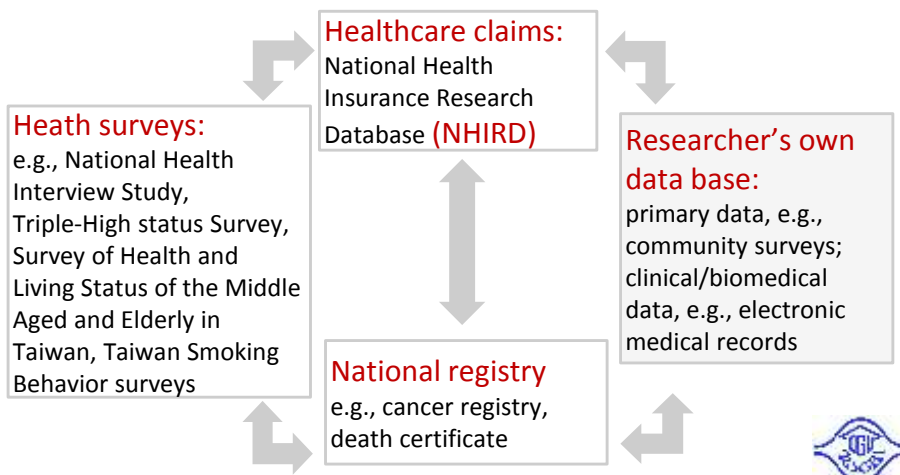
中央研究院 • 臺灣人體生物資料庫

- 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

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Opportunity for Data Base Linkage

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



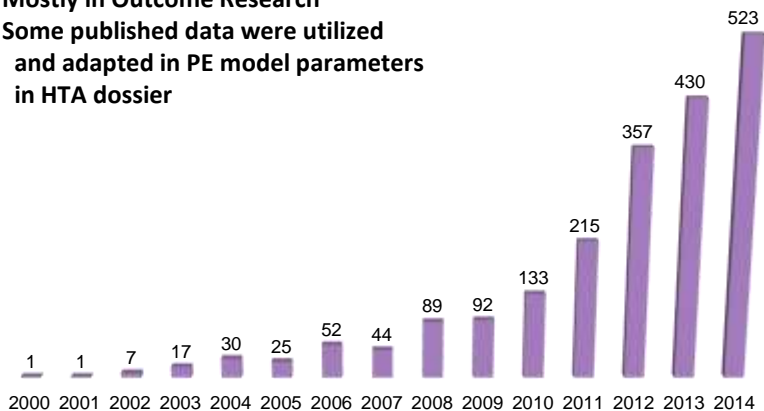
Publications in Health Care



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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





THANK YOU FOR YOUR ATTENTION!

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