

***A multilevel approach to  
health systems analysis  
using RISS  
(Reporting-by-Intranet Statistical System)***

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Sydney, New South Wales, Australia

# e.health services research

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Clinical Epidemiology  
Modern Epidemiology  
Evidence-Based  
Medicine



Health Economics  
Quality of Care Research  
Public Health  
Health Services Research  
Outcomes Research

## Population-based Health Research

Internet  
Intranet  
CORBA  
GNU/Linux  
Distributed Computing  
Object Oriented Programming



Code reusability  
**Open Source Connectivity**

Biostatistics  
Machine learning  
Data Mining



Bayesian Statistics  
Neural Networks  
Computer-Intensive Methods  
Meta-learning

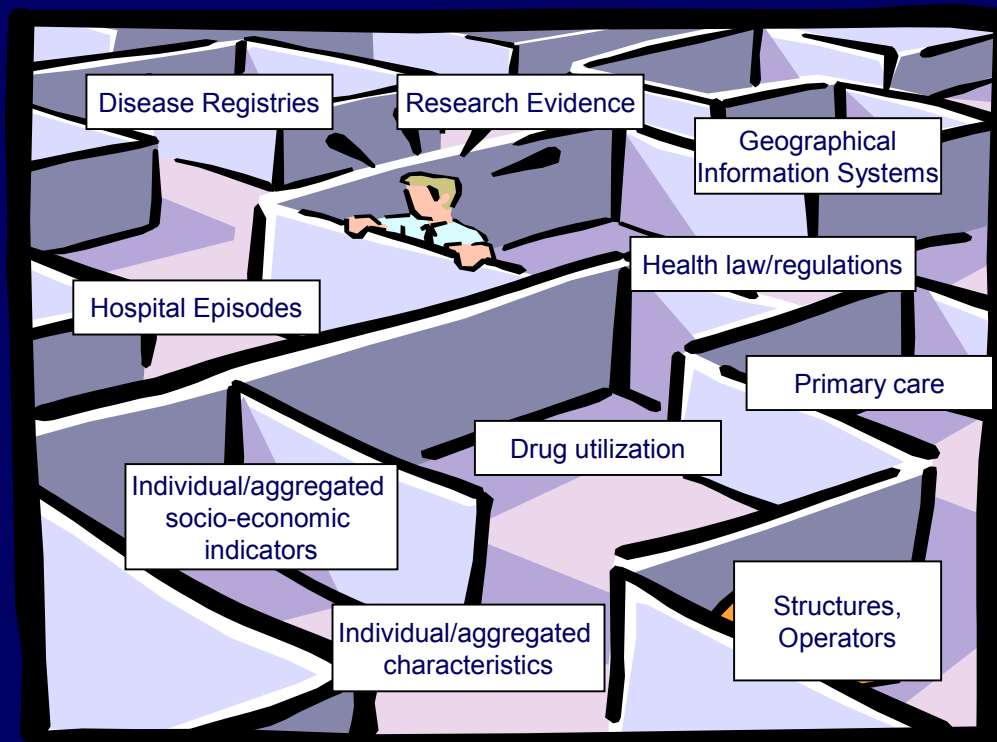
## Statistical Sciences

# Population-based health research

## Information from multiple sources

*Multidisciplinary and Multidimensional  
Cross-sectional and Longitudinal  
Experimental and Observational  
Administrative and Ad Hoc  
Systematic and Non-Systematic*

"Data-Warehouse"



# Statistical Sciences

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## Bias/Variance

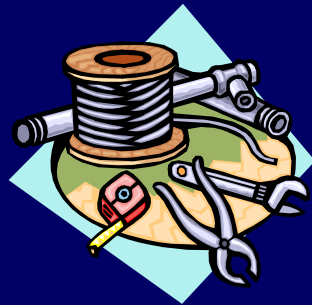
*Sampling techniques*

*Adjustment*

*Correlation*

*Subgroups analysis*

*Causal pathways*



## **Sampling Techniques**

*Markov Chains Monte Carlo*

*Gibbs sampling*

## **Random Effects Models**

*Generalized Mixed Models*

*Bayesian Mixed Models*

## **Multilevel models**

*Hierarchical Regression Models*

*Multilevel linear models*

## **Marginal models**

*Generalized Estimating Equations*

# Open source connectivity

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## Public Access to Re-usable sources

*Software engineering  
Developers' networks  
Standard browsing  
Remote access*



**Free Software Foundation/  
GNU's not Unix (GNU)**  
*Language Compilers-C, C++*  
**Linux**  
*Connectivity*  
*Web-server technology*  
**Java**  
*Browser technology*  
*Cross-platform applications*

# Population-based fallacies

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## Ecological fallacy

drawing inferences at the individual level based on group-level data

## Atomistic fallacy

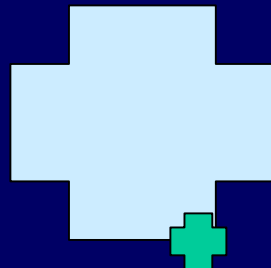
drawing inferences at the group level based on individual data

## Psychologistic fallacy

assuming that individual-level outcomes can be explained only in terms of individual-level characteristics (opposite:sociologistic)

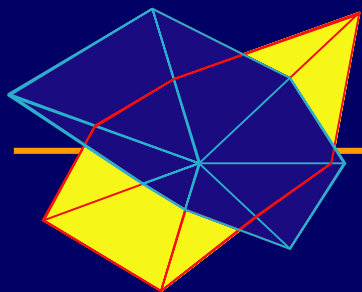


"Confounding"



**Micro-macro** level variables *interaction* !!

Real-time Information Distribution



# RISS

<http://statbone.cmns.mnegri.it>

## Reporting-by-Intranet Statistical System

### *Objective:*

- *Automating processes of data-warehousing and statistical analysis for complex and fragmented databases*
- *Delivering results in the form of widely accessible and interpretable reports*

### *Procedures:*

- **BROWSE**
  - **REPORT/LIST**
  - **REPORT/INDEX**
  - **STANDARD**
  - **MAPS**
  - **GENMOD**
- 
- *Supported by CMNS, Regione Puglia, SAS, SUN Microsystems*
  - *Version 6.12, modules AF, BASE, STAT, GRAPH*
  - *Standardized Browser Outputs (HTML+Javascript)*
  - *Designed for remote analysis through SAS/CONNECT*

# Open Source – Script “logic”

```

160003 1998 365
160; 003-97006201-1-16/06/94- . . 072028- . . 104-1-12/12/97-1-2-
160; |inizio:01/01/96
160; Ospedale:160078 OSPEDALE GENERALE REGIONALE MIULLI ACQUAVIVA DELLE FONTI
160; USL: File Name: RISS-H.ENU
160; ASL:103 Root Sub-Directory: \ENVIRONS\DATA\
160; GED:ACQUAVIVA DELLE FONTI Database Files Extension: .SDD
160; PUBLIC:4 Node Structure Extension: .OSP
160; Environment Files Extension: .502
160; *****No. Environmental Files: 13 **
160; Disciplina:08 Cardiologia
160; *****%if %bquote(&s_ri_tv1)^= %then %do; **
160; Reparto:08( IF (S_NCIJ,11-S_NAIJ,11-S_NCIJ,11)^=0 THEN **
160; IMNAIJ,11=((S_SIJ,11-S_SAIJ,11-S_SCIJ,11)/(S_NCIJ,11-S_NAIJ,11-S_NCIJ,11))
160; ***** (NNIJ,11-NAIJ,11-NCIJ,11); **
160; ELSE IMNAIJ,11=.;
160; Disciplina: IF (NNIJ,11-NAIJ,11-NCIJ,11)^=0 THEN **
160; ***** IPNAIJ,11=((S_SIJ,11-S_SAIJ,11-S_SCIJ,11)/(NNIJ,11-NAIJ,11-NCIJ,11))* **
160; Reparto:09( (S_NCIJ,11-S_NAIJ,11-S_NCIJ,11);
IF (DIM_DIA IN ('2506','3370','3371','3379','3659','3572','3579','3581',
'5360','5589','5910','5937','5964','5965','7135') OR
SUBSTR(LEFT(DIM_DIA),1,4) IN ('6078','6472') OR '3540'<=DIM_DIA<='3559' OR
PAT_CD1 IN ('2506','3370','3371','3379','3659','3572','3579','3581',
'5360','5589','5910','5937','5964','5965','7135') OR
SUBSTR(LEFT(PAT_CD1),1,4) IN ('6078','6472') OR '3540'<=PAT_CD1<='3559' OR
PAT_CD2 IN ('2506','3370','3371','3379','3659','3572','3579','3581',
'5360','5589','5910','5937','5964','5965','7135') OR
SUBSTR(LEFT(PAT_CD2),1,4) IN ('6078','6472') OR '3540'<=PAT_CD2<='3559' OR
PAT_CD3 IN ('2506','3370','3371','3379','3659','3572','3579','3581',
'5360','5589','5910','5937','5964','5965','7135') OR
SUBSTR(LEFT(PAT_CD3),1,4) IN ('6078','6472') OR '3540'<=PAT_CD3<='3559')
THEN NEURO=1;

```

Label:  
Codice  
Numero  
Numero

CODICE	LABEL
160000	MOBILITA'
160001	OSPEDALE C
160002	OSPEDALE F
160003	CENTRO TR
160004	OSPEDALE C
160005	OSPEDALE L
160006	OSPEDALE L
160007	OSPEDALE Un
160008	OSPEDALE L. BONOMO ANDRIA

8	001008	0	3	1	95 01	001	Alipignano
9	001009	0	3	1	95 01	001	Andezeno
10	001010	0	1	1	95 01	001	Andrate
11	001011	0	1	1	95 01	001	Angrogna
12	001012	0	3	1	95 01	001	Arignano
13	001013	0	3	1	95 01	001	Avigliana
14	001014	0	3	1	95 01	001	Azeglio
15	001015	0	3	1	95 01	001	Bairo
16	001016	0	3	1	95 01	001	Balagnero

Version spec

SAS datasets:

Population and geographical data

Network Script:  
.net file

Operational Database  
.db file

Structure Database  
.st file

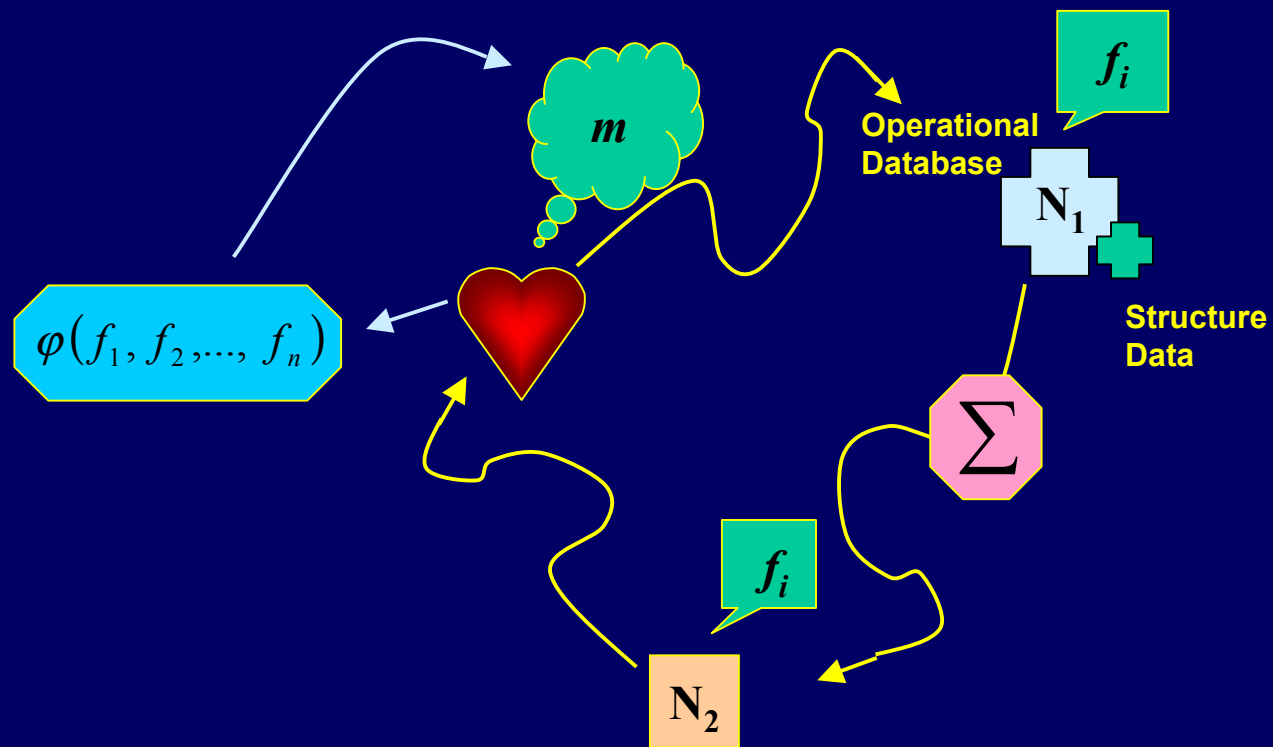
Environment databases  
.env file

SAS programs  
.mak file (main)  
.mak file (custom)

Population Datasets  
.sd2 file

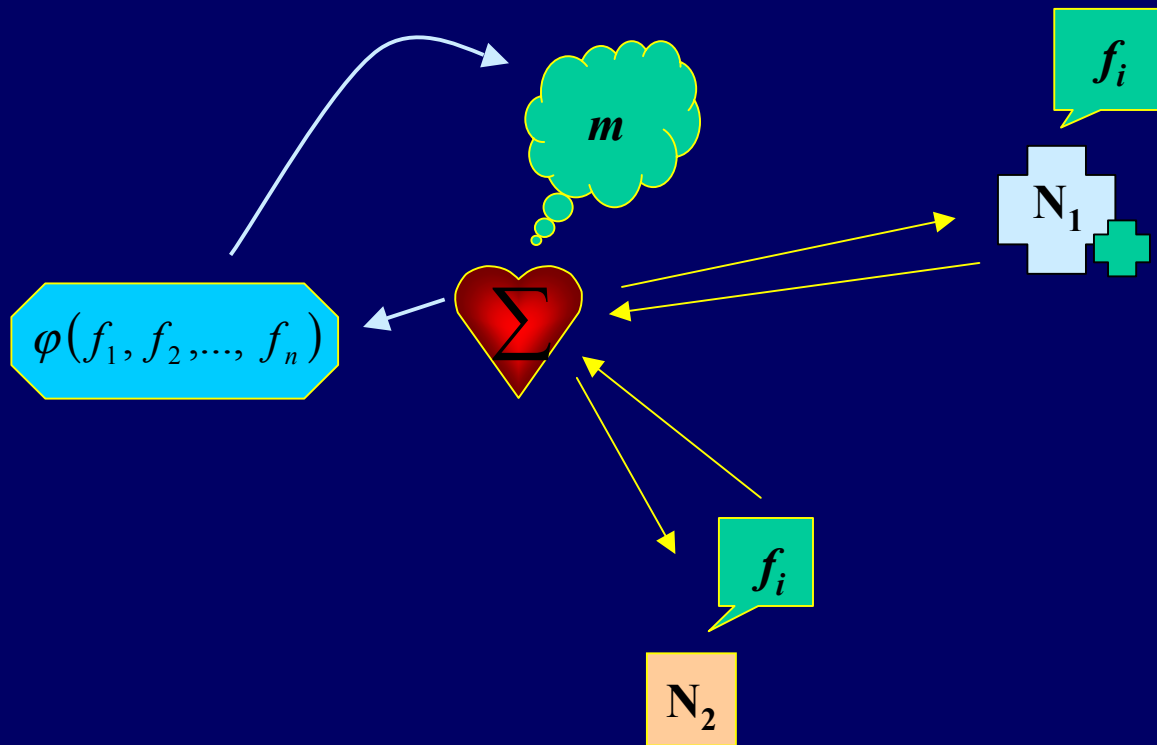


# Cumulative meta-analysis



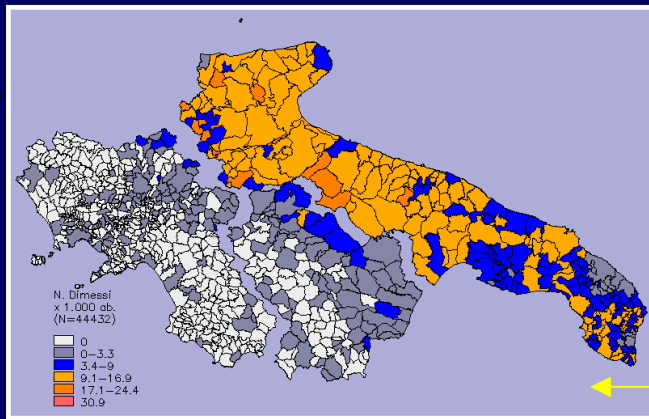
Touch+Pile-Up+Meta-Analyze (TPA)  
Distributed/Fragmented, Multilevel Hierarchical Network

# Parallel processing



# An 'admin' RISS version: RISS-H

Regione Puglia – Southern Italy, 114 Hospitals



## Diabetes

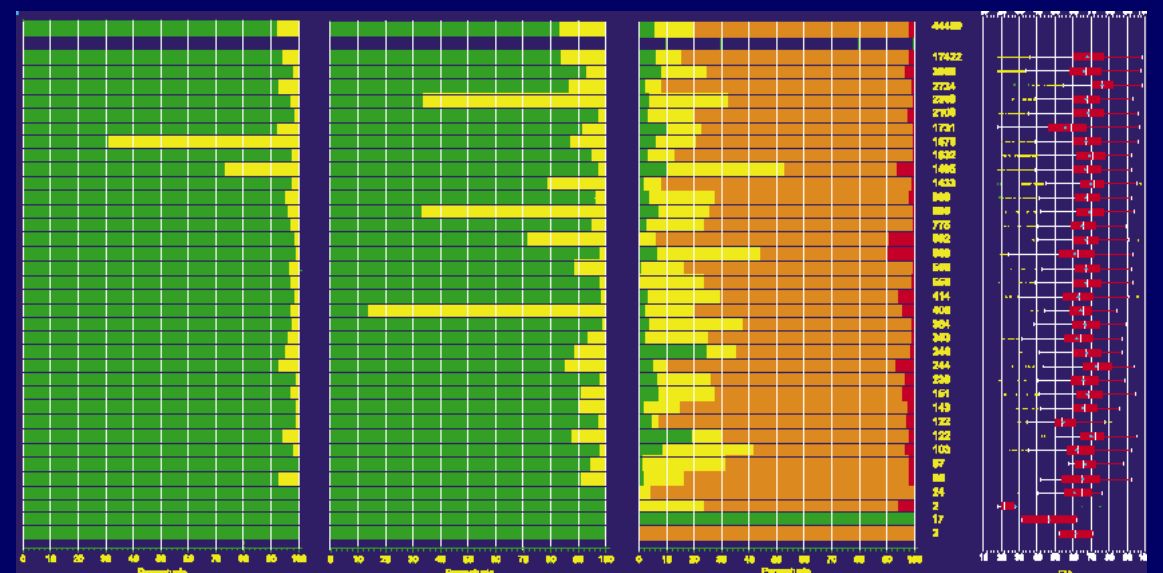
- List Hospitals x Diabetes
- List Hospitals x Complications

Complications Yes/No  
(Binary Variables)

LOS classes  
(Categorical Variables)

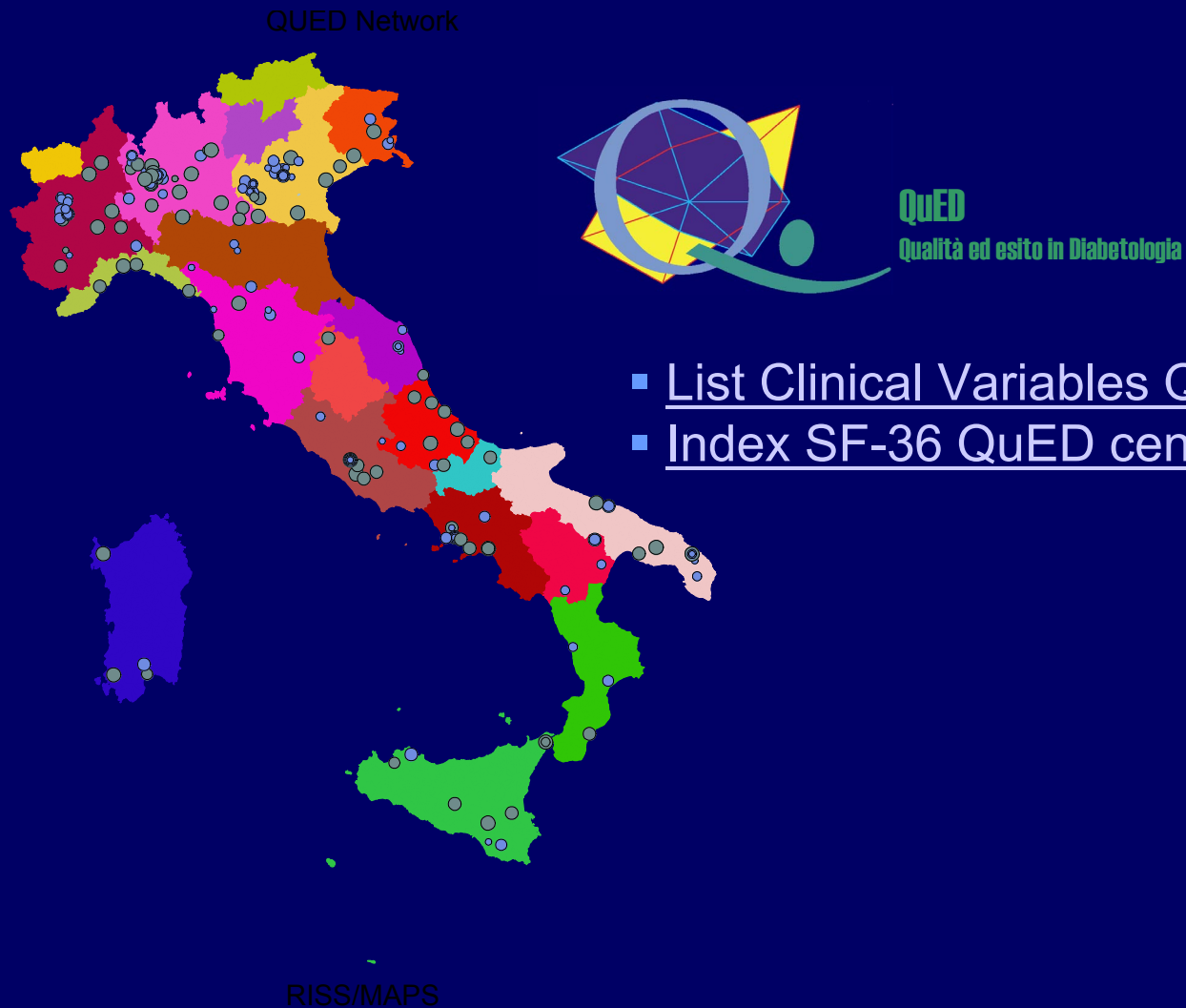
AGE  
(Continuous)

Specialties  
(Nominal variables)



# An 'epi' RISS version: RISS-Q

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# e.health systems

**LAYER 3**  
**(MICRO-LEVEL)**

**Implementation**  
Population-based Approach  
Vs  
Disease Management

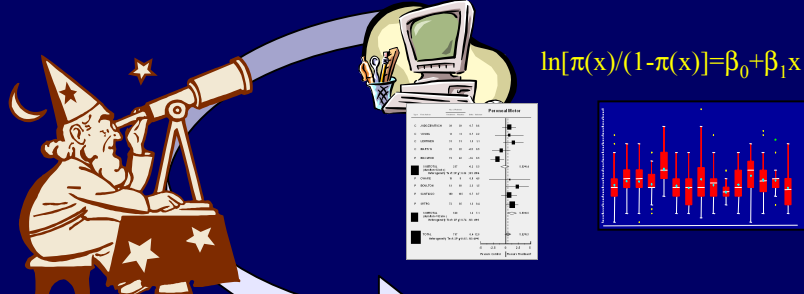


- Service Mapping*  
Provider resources
- Medical databases*  
CARDIAB
- Ambulatory Data*  
Diabetes Centres
- Educational programs*  
Diabetes Australia
- Surveys*  
PRE: AusDiab - POST: Ad-hoc  
Quality of Life in Diabetes (SF-36)

Diabetes Register

**LAYER 2**  
**(META-LEVEL)**

**Research**  
Evidence-based Medicine  
Vs  
Clinical Practice



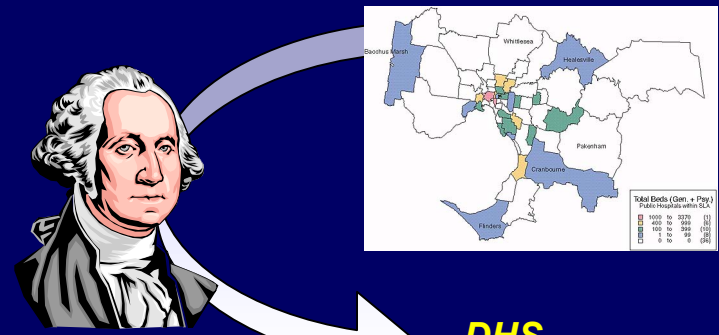
**DHS**  
**SHCN**

**NHMRC**  
**SHCN**

- Clinical guidelines*  
Scientific Associations  
Cochrane Library
- Patient outcomes*  
Medical records
- Clinical Variability*  
Intranet Shared Information System  
Multilevel models

**LAYER 1**  
**(MACRO LEVEL)**

**Governance**  
Health needs  
Vs  
Health services



**DHS**  
**SHCN**

- Public Health Data*  
Burden of Disease  
Census data, AusDiab
- Operational Databases*  
Hospital Databases  
Pharmaceutical prescriptions
- Regulations*  
Case-Mix/DRG
- Geographical data*  
Census, Boundaries