The Atlas of Mental Health Care project:

*International development and applicability for DSS*

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NEW LINKS BETWEEN ORGANISATIONAL/BUSINESS RESEARCH AND HEALTH CARE RESEARCH (IHI)

Four Questions of leadership, quality and efficiency

- Do you know how good you are?
- Do you know where you stand relative to the best?
- Do you know where the variation exists?
- Do you know the rate of improvement over time?
“NOBODY KNEW THAT HEALTH CARE COULD BE SO COMPLICATED.”

— PRESIDENT DONALD TRUMP
HEALTH ECOSYSTEMS
(Nimo et al, Cascadia, 2016)
Complex health systems: TOOLS & ANALYTICAL TECH.

- Health ecosystems
  Systems, subsystems, nested systems
  Boundaries and Population determinants

- Jurisdictions
  Context analysis
  GIS
- Availability
  Capacity
  Use
- Interventions
  Packages
  Social Networks
- Logic models
  Conceptual maps
  Financial Flows
- DSS

- Frameworks & Drivers
  Values, goals, targets

- Agents
  Consumers
  Professionals
  Teams
  Organisations

- Connections
  Networks
  Interactions

- LOCAL ATLAS OF CARE

- CONCEPTUAL MAPS

- SOCIAL NETWORK ANALYSIS
Complex health systems: DECISION SUPPORT SYSTEMS

Context Analysis
- MACRO
- MESO
- MICRO

LOCAL ATLAS OF CARE
- Jurisdictions
- Context analysis
- GIS
- Availability
- Capacity
- Use

DSS
- Logic models
- Conceptual maps
- Financial Flows

Interventions
- Packages
- Social Networks

New Procedures
- Knowledge Discovery from Data (KDD)
- Expert-based Collaborative Analysis (EbCA)

New Tools
- Visualisation
- Simulation Modelling
- Data mining
- Social Network Analysis
- Neuronal Network Analysis
- Cluster based on Rules
- Monte Carlo DEA

Framing
- Scientific Knowledge (experts)
- Health ontology
- Research Synthesis
- Conceptual analysis

CONCEPTUAL MAPS
SOCIAL NETWORK ANALYSIS
Context analysis & Systems thinking
From EBM to System thinking:
The Greek Temple
Salvador-Carulla et al, Epid Psych Sciences, 2016
Decision support system

Methodologies: operational, statistical and artificial intelligence

- Spatial analysis (statistics)
- Geographical information systems (statistics)
- Relative technical efficiency assessment (operations)
- Simulation engines (statistics)
- Variable values interpretation (Artificial Intelligence)
Main Problems when Assessing Services

- **Commensurability:**
  Diff. units of analysis, lack of comparison like with like.
  We cannot merge:
  - Service Providers
  - Clinical teams
  - Interventions
  - Activities

MH Atlas Solutions

1st We identify the minimal unit of production or care (Basic Stable inputs of Care-BSIC) or TEAMS

Transferability and terminological variability:

- Names of the services do not always reflect their main activity (Hospital - Outreach services - Crisis houses-medical homes)
- Names of same services vary across jurisdictions (Day care)

2nd We label them according to their Main Type of Care (MTC) they provide
Main Type of Care: Main branches

**ACCESSIBILITY**: access to care WITHOUT direct provision of care related to needs (e.g. *access to employment*).

**OUTPATIENT**: contact with the person in a limited period of time (e.g. *visit with the GP*).

**DAY CARE**: the person spends the day at the facility (e.g. *day hospital or social club*).

**RESIDENTIAL**: the person sleeps at the facility (e.g. *acute unit -hostel*).

**SELF CARE/VOLUNTARY**: non-paid staff (e.g. *Alcoholic anonymous*).

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**INFORMATION**: guidance/ assessment/ information WITHOUT follow up (e.g. *information about availability of services*).

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91 different codes- taxonomy tree
Use of an integrated Atlas of Mental Health Care for evidence informed policy in Catalonia (Spain)

A. Fernandez1,2, J. A. Salinas-Perez3, M. R. Gutierrez-Colosia4, B. Prat-Pubill5, A. Serrano-Blanco5, C. Molina5, E. Jorda5, C. R. Garcia-Alonso3 and L. Salvador-Carulla4, on behalf of the GEOCAT-SM group
Data Collection
- Listing of the services
- Assessment of the services

Identification of available databases with local data

Analysis of the local data (mapping of socio and demographic indicators)

Regular meetings with PIR steering committee to validate findings

Mapping of the services in relation to indicators

Coding of the services

Analysis of the Pattern of Care

Integration of the Information
- Report released for public comment
- Final report

Full Survey

Mixed

Automated
How to read an integrated mental health atlas


**OBJECTIVE:** Complementary information to available reports and documents, description of the specialised system of public MH care using an international gold-standard, comparisons with other regions in NSW, other cities in Australia, other cities in the World, other models of community MH care. Combine with health indicators for modeling, benchmarking, efficiency and management.

**STRUCTURE:** Executive summary, Introduction, Method, Results, Discussion, Recommendations

**METHOD:** Classification/taxonomy, glossary of terms, procedure, training material, practical examples, usability

http://www.edesdeproject.eu/

**RESULTS:** Tables and spider graphs with information on: KEY SOCIAL AND DEMOGRAPHIC INDICATORS, MAPS, CARE AVAILABILITY, BALANCE OF CARE, PLACEMENT CAPACITY, WORKFORCE CAPACITY by target population and care subsystems (General MH, (Child and Adolescent), Older adults, (Drug & Alcohol), Transition, etc.
Psychological distress:
age standardized ratio of people 
with high or very high levels of psychological distress according to the Kessler psychological distress scale (K10) - prior four weeks - in PHA areas (PHIDU database)

Social Fragmentation Index: an index of social fragmentation developed using principal component analysis technique at statistical area level 1 (SA1) for whole Australia. This index includes percentage of lone people, home ownership, non-family household and school age children in each SA1.
Balance of Care: distribution of the MTCs according to sector

**CESPHN**
- Health: 35.2%
- FACS: 5.7%
- NGO: 4.4%
- Justice: 54.7%

**CHN**
- Health: 31.1%
- NGO: 64.8%
- Justice: 4.1%
## Partners in Recovery

### Semantic variability

<table>
<thead>
<tr>
<th>Provider</th>
<th>Name</th>
<th>Main Desde Code</th>
<th>FTE</th>
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<tr>
<td>Capital Health Network PIR</td>
<td>PIR-CHN</td>
<td>A4.2v</td>
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<tr>
<td>CatholicCare</td>
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<td>Woden Community Service</td>
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<td>O5.2</td>
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<td>3.0</td>
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<tr>
<td>PIR ES</td>
<td>O5.2</td>
<td>Randwick</td>
<td>5.0</td>
</tr>
<tr>
<td>PIR IWS</td>
<td>O5.2</td>
<td>Pagewood</td>
<td>10.5</td>
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<td>PIR ES</td>
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<td>PIR IWS</td>
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<td>PIR IWS</td>
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<table>
<thead>
<tr>
<th>Total</th>
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<tbody>
<tr>
<td>Rate per 100,000 residents (&gt;17 years old)</td>
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</table>

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**CHN-ACT**

**CESPHN NSW**
Mapping of MH Care in Montreal (Lessage et al 2002)
SERVICES AMBULATOIRES ET COMMUNAUTAIRES

NOMBRE DE CONTACTS OU USAGERS / 100 000 HABITANTS / MOIS

<table>
<thead>
<tr>
<th>Code</th>
<th>AMSTERDAM</th>
<th>COPENHAGUE</th>
<th>LONDRES</th>
<th>SANTANDER</th>
<th>VERONE</th>
<th>MONTRÉAL*</th>
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<td>42,0</td>
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<tr>
<td>Total</td>
<td>45,8</td>
<td>270,6</td>
<td>18,9</td>
<td>42,0</td>
<td>56,9</td>
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<td></td>
<td>736,0</td>
<td>1 247,6</td>
<td>1 104,6</td>
<td>2 716,0</td>
<td>558,0</td>
<td>1 600,0</td>
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<td>30,0</td>
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<td>O10</td>
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</tbody>
</table>

| Total| 736,0 | 1 258,3 | 1 104,6 | 2 716,0 | 558,0 | 1 780,0 |

Données estimées pour Montréal
Atlas on the Primary Care of Adults with Developmental Disabilities in Ontario

December 2013

<table>
<thead>
<tr>
<th>Visited family physician</th>
<th>Visited emergency department</th>
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<tr>
<td>Developmental disabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td></td>
<td>76.1</td>
</tr>
<tr>
<td>Local Health Integration Network</td>
<td></td>
</tr>
<tr>
<td>1. Erie St. Clair</td>
<td>75.7</td>
</tr>
<tr>
<td>2. South West</td>
<td>74.1</td>
</tr>
<tr>
<td>3. Waterloo Wellington</td>
<td>75.7</td>
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<tr>
<td>4. Hamilton Niagara Haldimand Brant</td>
<td>77.7</td>
</tr>
<tr>
<td>5. Central West</td>
<td>82.8</td>
</tr>
<tr>
<td>6. Mississauga Halton</td>
<td>81.7</td>
</tr>
<tr>
<td>7. Toronto Central</td>
<td>77.1</td>
</tr>
<tr>
<td>8. Central</td>
<td>82.2</td>
</tr>
<tr>
<td>9. Central East</td>
<td>79.3</td>
</tr>
<tr>
<td>10. South East</td>
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</tr>
</tbody>
</table>
Pattern of availability of MTCs for adults > 17 years with lived experience of mental illness. Comparison between CHN and Helsinkin and Uusimaa.
Needs profile of WSPIR participants at entry

Integrated Atlas of local Mental Health

- Classification of ALL Services
- Mapping services related to indicators

CONTEXT ANALYSIS

Integrated Atlas of MH

We detected gaps, duplications, and potential barriers compared with...

NEED ANALYSIS (made by PIR WS)

Consumer rated unmet need (n=487) SF rated unmet need (n=559)
REsearch on the FINancial Systems’ Effect on the Quality of MENTal Health Care

REMAST: Local Atlases (mapping)
FINCENTO: Financing
REQUALIT: Quality of care
REPATO: Pathways of care

Glossary of Terms
Fig. 1. Acute, non-acute and community residential care per 100000 inhabitants.

Fig. 2. Health- and non-health-related day care per 100000 inhabitants.

Fig. 3. Acute and non-acute outpatient care per 100000 inhabitants.
### Mental health care: HOSPITAL

<table>
<thead>
<tr>
<th></th>
<th>AT (G)</th>
<th>EN (G)</th>
<th>SP (G)</th>
<th>FI (G)</th>
<th>FR (G)</th>
<th>IT (G)</th>
<th>NO (G)</th>
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<tbody>
<tr>
<td>Average Length of Stay (LoS)</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Readmission rate after 1st Admission</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Involuntary admission</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Acute psychiatric hospitalizations with discharge against medical advice</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Patient turnover at psychiatric wards</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Outpatient aftercare by a community mental health center or other outpatient carein the first month after discharge</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Acute referral to services outside the local area (better low)</td>
<td>+</td>
<td>-</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td><strong>Overall rating</strong></td>
<td>6</td>
<td>2</td>
<td>12</td>
<td>-3</td>
<td>1</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

a) Romania – is not arranged in sectorised catchment areas and part of hospital care is institutionalised.

### Average length of stay on acute psychiatric wards in the REFINEment countries

- **AUT**: 11.2 days
- **ENG**: 51.0 days
- **FIN**: 37.2 days
- **FRA**: 27.7 days
- **ITA**: 15.5 days
- **NOR**: 14.0 days
- **ROM**: 11.0 days
- **SPA**: 15.0 days

![Graph showing average length of stay on acute psychiatric wards in REFINEment countries](image)
REFINEMENT: POLICY AND PLANNING IMPACT OF THE STUDY

- key to reactivate the funding for mental health care
- Strengthen mental health management
- Development of an integrated, community-oriented MHS
- Info from Remast + Requalit ➔ benchmark area in Spain

- Two psychiatric hospitals redesigned to provide specialized care with psychiatrists on-site 24 hours
- Acute residential care for mental disorders provided in small acute units located at general hospitals, supported by community care teams
- Three psychiatric hospitals were closed
HEALTH ECOSYSTEMS: Atlas of MH for DSS: Barcelona (Catalonia, Basque Country)

- 3.- Cost of Illness - Salvador-Carulla et al, 2011
- 4. Financing (Financing of Illness) - Salvador -Carulla et al, 2010
- 5.- Spatial analysis (hot and cold-spots) - Rodero-Cosano ML et al, 2016
- 6- Smart and relational indicators - Salvador-Carulla L, Salinas-Pérez JA, et al, 2010
- 7.- Technical efficiency analysis - Torres-Jimenez et al, 2016
- 8.- Analysis of management interventions (micro meso y macro management) - Garcia-Alonso et al, submitted

MAPPING OF SERVICES IN EUROPE: [http://www.refinementproject.eu/](http://www.refinementproject.eu/)
Spatial Economic Analysis

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rsea20

Applying an Evolutionary Algorithm for the Analysis of Mental Disorders in Macro-urban Areas: The Case of Barcelona
José Alberto Salinas-Pérez, Maria Luisa Rodero-Cosano, Carlos Ramon García-Alonso & Luis Salvador-Carulla
Published online: 11 Aug 2015.

Use of an integrated Atlas of Mental Health Care for evidence informed policy in Catalonia (Spain)


Decision Support
Evaluation of system efficiency using the Monte Carlo DEA: The case of small health areas
Mercedes Torres-Jiménez a,*, Carlos R. García-Alonso b, Luis Salvador-Carulla c, Vicente Fernández-Rodríguez d
Applying an Evolutionary Algorithm for the Analysis of Mental Disorders in Macro-urban Areas: The Case of Barcelona

José Alberto Salinas-Pérez, María Luisa Rodero-Cosano, Carlos Ramon García-Alonso & Luis Salvador-Caballé
Published online: 11 Aug 2015.

Spatial distribution of local coefficients (elasticities) of Geographical Weighted Regression analysis in the Barcelona Metropolitan Area and Health Region.
MENTAL HEALTH CARE IN THE BASQUE COUNTRY

<table>
<thead>
<tr>
<th>Data</th>
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<th>Data</th>
<th>Area Name</th>
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<td>G20</td>
<td>Alto Deba-Arrasate</td>
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<tr>
<td>B2</td>
<td>Barakaldo</td>
<td>G21</td>
<td>Amara</td>
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<td>Basauri</td>
<td>G22</td>
<td>Andoain</td>
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<td>Bermeo</td>
<td>G23</td>
<td>Azpeitia</td>
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<td>B5</td>
<td>Derio</td>
<td>G24</td>
<td>Beasain</td>
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<td>B6</td>
<td>Durango</td>
<td>G25</td>
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<td>B17</td>
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<td>B18</td>
<td>Zalla</td>
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<tr>
<td>B19</td>
<td>Rekalde</td>
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</table>
MENTAL HEALTH ATLAS

2004 GUIPUZKOA (ESMS)
2013 GUIPUZKOA & BIZKAIA
2017 GUIPUZKOA, BIZKAIA, ARABA

2013 MH NETWORK (OSAKIDETZA) INFORMED THE HEALTH PLANNING AGENCY OF GAPS and PROVISION DRIVEN NEEDS: **Placement capacity:**
- Increase of places in day care, community residential care, employment for SMI
- Decrease of long-stay beds

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**COMMENTARY**

Epidemiology and Psychiatric Sciences (2015), 24, 42-44. © Cambridge University Press 2014
doi:10.1017/s2045796014000596

**The role of geographic context on mental health: lessons from the implementation of mental health atlases in the Basque Country (Spain)**

A. Iruin-Sanz, C. Pereira-Rodriguez and R. Nuño-Solín
RELATIVE TECHNICAL EFFICIENCY (Input-oriented)
What is the aim of the project?

We want to design and develop a Decision Support System (DSS) for helping decision makers (in Mental Health Care) to understand the system where they operate.

The management of information under uncertainty is based on probability and possibility theories (Klir 2006).

\[ A \text{ priori uncertainty } U_1 \]  
\[ \rightarrow \text{ Intervention} \]  
\[ A \text{ posteriori uncertainty } U_2 \]  
\[ \rightarrow \text{ Information: } U_2 - U_1 \]

The only way to reduce UNCERTAINTY is to increase KNOWLEDGE.

The Generalized Information Theory is based on the concept of uncertainty and INFORMATION. Information is defined in terms of uncertainty decrease.
What could happen if we move a psychologist from an acute service in a MHC to another acute service in other MHC? ... with a small increase of beds in acute services in other MHC.

This intervention involves 6 variables (we have 57)

The DSS shows us that the psychologist rate should be reduced in MHC 6 and we need an additional bed in MHC 4

We have changed the current situation into a simulated one, but ...

Is this correct/adequate/appropriate?
Is this feasible?
MODELLING MICRO-MANAGEMENT INTERVENTIONS IN BIZKAIA: CHANGES IN THE WORKFORCE IN SMALL CATCHMENT AREAS

Intervention 1: Move a psychologist in Ambulatory care in Uribe to Day Hospital in Durango

Intervention 2: Move a psychiatrist in Ambulatory care from Uribe to Sestao.

Intervention 3: Move a psychiatrist in Ambulatory care from Ercilla to Barakaldo.
MICROMANAGEMENT: SHIFT OF PLACEMENT CAPACITY (BEDS) ACROSS CATCHMENT AREAS
Micromanagement Intervention (shift staff and beds across catchment areas in Basque Country)

Effects on system’s efficiency and stability of care in the small MH areas

<table>
<thead>
<tr>
<th>Small health areas (mental health centres)</th>
<th>Input management (Input oriented DEA)</th>
<th>Output management (Output oriented DEA)</th>
<th>Small health areas (mental health centres)</th>
<th>Input management (Input oriented DEA)</th>
<th>Output management (Output oriented DEA)</th>
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<tbody>
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Mostly positive/neutral ... ... positive/neutral.
Self-Organising Map Network (SOMNet) for Evidence-informed Decision Making in MH care

**INPUT (WOF SOM)**

Individual W1

**OUTPUT (USE SOM)**

U3 = 10 is given

---

Psychiatrists value W1

Original MIN 0.16

Original MAX 5.23

Estimated MIN 1.37

Estimated Max 2.49

Estimated AVE 1.94

* Low-Medium value (W1 = 1.94) is most likely related to the ideal value of U3 = 10.

Chung et al, submitted
Where next?

Ehealth and Health ecosystems (general)

Accountability and transparency

Automated coding systems and registries

Improved semantic interoperability

Linking digital to tangible care – eH - IoT

Linking provision, use and financing

Navigation Charts

Real-time dashboards

Smart DSS

Kitchin et al. Knowing & Governing Cities through Urban Indicators. *Regional studies, regional science, 2*: 6-28, 2015
SYSTEMS THINKING vs LINEAR HEALTH CARE PLANNING: MIND THE GAP!

The role of geographic context on mental health: lessons from the implementation of mental health atlases in the Basque Country (Spain)

A. Iruin-Sanz¹, C. Pereira-Rodriguez²

Evaluación de la eficiencia técnica de la atención primaria pública en el País Vasco, 2010–2013

Complexity and whole-system change programmes

Brice Dattée, James Barlow


Place-based systems of care
A way forward for the NHS in England

Deming’s systems thinking and quality of healthcare services: a case study

Leadership in Health Services Vol. 26 No. 3, 2013

NHS arm’s length bodies and regulatory networks in England: quantitative analysis

BASQUE COUNTRY (SPAIN) / SCOTLAND NHS (UK)  ALBERTA / ENGLAND (CQC)
Urban MH
citiesRISE
I-CIRCLE
Visual tools should provide meaningful information that improves organisational learning and decreases ambiguity to support decision making.
Thanks

luis.salvador-carulla@anu.edu.au
• Service provision & use in local areas:
  • ATLAS OF MH CARE (2002-2017)
• Financing of health care
• Cost of Illness studies (Schiz., Depression, Anxiety, BPD)
• Technical efficiency of small catchment areas
• Hot-spot and cold-spot analysis
• Micro and Meso Interventions in Health care management