Burden of Disease Assessments: the BCoDE project experience

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Overview

- An introduction to BCoDE project
- What is burden and what is needed for burden assessments
- Preliminary results from pilot study
- WP2b: Preliminary work on TBE
- Summary and questions
What is the BCoDE project?

- **Burden of Communicable Diseases in Europe (BCoDE)**

- A project funded by ECDC, coordinated by RIVM (NL), and involving several collaborating institutes in Europe

- The primary aim of the BCoDE project is to quantify the burden of communicable diseases in Europe in a consistent manner in order to compare the relative burden of each CD.

- 41 CDs and 30 countries
Purpose of estimating burden

- To understand specific health needs of different countries
- To best allocate limited services and healthcare resources to achieve maximum results
- To improve evidence-based health policy decision making and promote transparency and accountability
What do we mean by ‘health burden’?

- Morbidity?
- Mortality?
- Composite measure?
  - HALYs
  - QALYs
  - DALYs
What do we mean by ‘health burden’?

- Morbidity?
- Mortality?
- Composite measure?
  - HALYs
  - QALYs
  - DALYs

The BCoDE consortium has chosen Disability Adjusted Life Years (DALYs) to express the burden of disease.
Mortality: Years of life lost due to early death

\[ \text{YLL} = N \times L \]

- \( N \) = Number of deaths
- \( L \) = Standard life expectancy at age of death in years

Morbidity: Years of healthy life lost due to disability

\[ \text{YLD} = I \times W \times L \]

- \( I \) = Number of cases
- \( W \) = Disability weight
- \( L \) = Average duration of the case until remission or death (years)

\[ \text{DALY} = \text{YLL} + \text{YLD} \]
What is needed to make DALY estimates?

For each disease or condition and each country:

- All notified cases (morbidity)
- All notified deaths (mortality)
- Information on duration of disease outcome
- An outcome tree (showing all possible disease outcomes following infection)
- Disability weights for all disease outcomes
- Correction factors to adjust for underreporting
An **outcome tree** is a qualitative representation of the progression of a disease in time.

To build a tree, we need to know:
- All **health states** resulting from infection
- The **percentage** that develop each health state.
Disability weights

A disability weight is a factor that reflects the severity of a disease or condition on a scale from 0 (perfect health) to 1 (equivalent to death).

- Examples from GBD 2004
  - Dengue
    - Dengue fever 0.197 (0.172 - 0.211) varies with age
    - Dengue haemorrhagic fever 0.545 (0.475 - 0.583)
  - Malaria
    - Episodes 0.191 (0.172 - 0.211) varies with age and treatment
    - Neurological sequelae 0.471 (0.443 - 0.471), varies with age and treatment
    - Anaemia 0.012 (0.012 - 0.013), varies with age
Under-reporting

- Under-reporting is a major issue affecting most (if not all) morbidity and mortality datasets.
All infections in population (asymptomatic + symptomatic)

Under-ascertained cases concealed

Case seeks healthcare

Specimen requested

Specimen provided

Laboratory confirmed case

Correctly diagnosed case

Correct + full notification

Cases reported to national health statistics authority

Under-reported cases concealed

Incidences before adjustment
Under-reporting

- It is **vital and justified** to correct for under-reporting in order to;
  - Produce the best possible disease estimates that are closer to the true burden
  - Improve comparability between countries (because underestimation heterogeneity between diseases and countries)
  - Produce better, more informed estimates (with a degree of uncertainty) for policy-makers
How to correct under-reporting?

- Better surveillance
- Multiplication factors
- Mathematical and statistical modelling
- Community-based studies (including serological surveys)
How to correct under-reporting?

The BCoDE project has chosen to correct for under-reporting by using multiplication factors.

These factors needed to be disease- and country-specific and sometimes age – and gender-specific.
The pilot study

- Following completion of WP1 (development of methodology protocol), BCoDE is now in the pilot field study phase (WP2).

WP2: The pilot
- WP2a - 4 diseases in 4 countries
  - Measles
  - Influenza
  - Hepatitis B
  - Salmonellosis
  - in Estonia, Germany, Italy and Netherlands
- WP2b – all 41 diseases in 4 countries
Preliminary results – DALYs per year

The Netherlands - DALY per year

- Salmonella
- Influenza
- Measles
- HBV
Preliminary results – DALYs per case

The Netherlands

- Salmonella
- Influenza
- Measles
- HBV
WP2b: preliminary work on tick-borne encephalitis (TBE)

- Certain geographic distribution
- Two subtypes of TBEV, Eastern and Western
- Transmitted by ticks
- Rodents are main reservoir of infection, humans are accidental host
- Vaccination is available
Infection with TBE virus

- Asymptomatic infection (70-98%)
  - Virus cleared

- Symptomatic infection (2-30%)
  - Mild
    - R
    - Neurological involvement (33.3%)
      - R

  - Death (33.3%)
  - Paresis (10-40% of symptomatic)

  - Sequelae Post-encephalitis Syndrome (36%)
    - Paresis (2-10% - 5-30%)
      - R
      - D
Table - Number of reported cases in Europe and Russia

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* preliminary data
m = mandatory
Under-reporting of TBE

- Believed to be very high
- Lack of a common TBE case definition
- Lack of common diagnostic criteria for Europe
- Incomplete mandatory reporting
- Most TBE infections mild or subclinical
- Western TBE subtype milder in children – higher UR

EU/EEA countries with mandatory TBE reporting: Austria, the Czech Republic, Estonia, Finland, Germany, Greece, Hungary, Latvia, Lithuania, Norway, Poland, the Slovak Republic, Slovenia, and Sweden, Norway, Switzerland.
TBE expected results

- Under-reporting high and variable between countries
- DALYs per case to be high (even in countries with high vaccine coverage)
- DALYs per 100,000 and DALYs per year for Estonia and Germany to be very high

TBE contributes considerably to the burden of infectious disease in Europe, and to certain countries.
Main challenges for BCoDE

- Getting access to all data
- Missing data
- Under-reporting
- Creating accurate outcome trees – rare outcomes?
- Creating new DW
- Budget and time
- HUGE task
- Dealing with a political issue
- Estimate not exact numbers
Further work

- WP2b: Completion of pilot study by August 2011
- WP3a: Creation of toolkit
- November – ECDC-led workshop open to all member states to explain project and introduce toolkit
- WP3b: Roll out of full project
- WP4: Dissemination of results
  = Completion of project by end of 2013

- CD/European tailored disability weights
- Economic studies based on cost-effectiveness analysis of intervention and prevention strategies
- Study of risk factors based on DALY results

- Ongoing work: Update methodology and results
Summary

- Introduced BCoDE project, what burden is and what is needed for burden assessments
- The BCoDE project aims to quantify the burden of 41 communicable diseases in Europe in terms of DALYs
- The DALY is a composite health measure taking into consideration short term and long term morbidity and mortality
- Preliminary results from pilot study and shown some preliminary work on TBE
- Huge task with many challenges
Wp2 participants

- **RIVM, the Netherlands**: Arie Havelaar, Alies van Lier, Mirjam Kretzschmar
- **UMCU, the Netherlands**: Marie-Josee Mangen, Juanita Haagsma, John Brooke, Ardine de Wit
- **University of Bielefeld, Germany**: Paulo Pinheiro, Dietrich Plaß, Alexander Krämer
- **University of Edinburgh, Scotland, UK**: Eric Fèvre, Cheryl Gibbons
- **University of the Sacred Heart, Rome, Italy**: Silvia Longhi, Chiara Waure, Walter Ricciardi, Elisabetta Franco
- **UMIT, Hall, Austria**: Beate Jahn, Nikolai Mühlberger, Uwe Siebert
- **National Institute of Public Health, Tallinn, Estonia**: Taavi Lai, Kristi Rüütel, Ardo Matsi
- **ECDC**: Alessandro Cassini, Piotr Kramarz

- **Project lead**: Mirjam Kretzschmar
- **ECDC representatives and advisors**: Piotr Kramarz, Alessandro Cassini
Respiratory tract infections
- Seasonal influenza
- Legionellosis
- Tuberculosis

STI, including HIV and blood-borne viruses
- Chlamydia
- Gonococcal infections
- Hepatitis B
- Hepatitis C
- HIV
- Syphilis

Food- and waterborne diseases and zoonoses
- Campylobacteriosis
- Cryptosporidiosis
- Infection with VTEC/STEC
- Giardiasis
- Hepatitis A
- Leptospirosis
- Listeriosis
- Salmonellosis
- Shigellosis
- Toxoplasmosis
- Variant Creutzfeldt-Jakob disease

Diseases consequences of infections
- Primary liver cancer (due to HBV and HCV)
- Cervical cancer (due to HPV)
- Gastric cancer (due to H. pylori)
- End stage liver diseases (due to HBV and HCV)

Emerging and vector-borne diseases
- Q fever
- Tick-borne encephalitis

Vaccine-preventable diseases
- Diphtheria
- Invasive Haemophilus influenza disease
- Invasive pneumococcal infections
- Measles
- Invasive meningococcal disease
- Mumps
- Pertussis
- Poliomyelitis
- Rabies
- Rubella
- Tetanus

Nosocomial infections
- UTI
- SSI
- (LRTI) Pneumonia
- BSI
- (GII) Clostridium difficile
Questions please..

BCoDE@ecdc.europa.eu

The experience of BCoDE project - VBornet AGM 2011