

Presentation of the disease model: WP5 Dr. Martin Brown

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This presentation arises from the project EConDA which has received funding from the European Union in the framework of the Health Programme



WP5: Development of the disease model

Develop an epidemiological disease model
Obesity and smoking to 2050
COPD, CHD, T2DM, CKD

 Test in 8 EU member states
Bulgaria, Finland, Greece, Netherlands, Lithuania, Poland, Portugal, UK

EConDA WP5: Brussels 2015 \ context

- →Continued development of UKHF Multiple Interacting Disease and Risk Factor simulation→(MIDRiFs)
- (MIDRiFs) → EConDA tool (not a microsimulation but otherwise the same structures and methods)
- Specific disease models (COPD, CHD,..) are implemented as instances of general disease structures
- Diseases can be **multi risk, multi state** and **interacting**

EConDA WP5: Brussels 2015 \ scope

- Short time to present a lot of detailed work so key features only
- MIDRiFs source code (text file) is ≈ 450 Mb
- EConDA Tool executable code (binary file) \approx 11 Mb
- War and Peace (text file) ≈ 3 Mb

EConDA Risk factor + Disease (Stage) Interactions



ECONDA (UKHF\MIDRiFS) System Architecture



Diagram of the microsimulation model (road map)



Population distributions









Diagram of the microsimulation model



BMI projections: UK males (14 data points)



BMI projections: 50-50yr old males



year

Netherlands 12 data points

BMI projections: 50-50yr old males



year

Bulgaria 4 data points

Obesity projections - 8 countries



Males 20-100years

Greece



100% 90% _____ 80% 70% _____ 60% _____

Lithuania

Portugal

2025

2035

2015



Netherlands



Females 20–100years

Greece

Lithuania



-BMI≤24.9 ---BMI≥25.0 to <30 -----BMI≥30

Female, UK 20-100, Income 1,2,3



67%, income 1

Female, UK 20-100, Income 1,2,3



39%, income 2

Female, UK 20-100, Income 1,2,3



43%, income 3

Projected smoker prevalence 40-49yr olds males



Projected smoker prevalence – 50-59yr old females



Smoking education group, Female, UK



2%, degree+

Smoking education group, Female, UK



year

4%, <degree

EConDA (+MIDRiFs) Multiple Relative Risk structure



Diagram of the microsimulation model



EConDA WP5: Risk factor + Disease (Stage) Interactions





EConDA multistate disease: risk architecture

EConDA Data collection

| Disaasas | DI | CP | CI | 17 | NII | Ы | рт | |
|------------------------|---|------|-----------|---------|------|------|------|------|
| Diseases | DL | GR | FL | LI | INL | FL. | FI | UK |
| CHD | | | | | | | | |
| incidence | | | 2011 | 2012 | 2007 | | _ | 2010 |
| prevalence | 2007 | 2006 | 2011 | 2010 | 2007 | 2009 | | 2010 |
| mortality | 2012 | 2008 | 2011 | 2012 | 2011 | 2008 | 2008 | 2010 |
| case fatality/survival | | | 2011 | mid 80s | 2007 | 2009 | 2008 | 2010 |
| IGT (pre diabetes) | | | | | | | | |
| incidence | | | | | | | | |
| prevalence | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 |
| Type 2 diabetes | | | | | | | | |
| incidence | | | | 2012 | 2000 | | | 2010 |
| prevalence | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 |
| mortality | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 |
| COPD | | | | | | | | |
| incidence | | | | 2012 | 2007 | | | 2005 |
| prevalence | 2008 | 2008 | 2011 | 2010 | 2007 | 2009 | 2008 | 2008 |
| mortality | 2012 | 2008 | 2008 | 2012 | 2008 | 2008 | 2008 | 2010 |
| case fatality/survival | can use aggregate data from meta-analyses | | | | | | | |
| Kidney disease (CKD) | | | | | | | | |
| incidence | | | | 2012 | 2008 | | | 1994 |
| prevalence | | | | | 2008 | 2009 | | 2010 |
| mortality | 2012 | | | 2012 | | | | |
| case fatality/survival | | | | | | | | |

Country/nr of data points

MIDRiFs Data Input Editor \3 Stage Diabetes



EConDA Multi-stage diseases, CHD and ... Interventions



Example: relative risks from PREVEND data PRE-DIABETES = Impaired Fasting Glucose (IFG) ≥6.1 and <7 mmol/L



EConDA Heart Disease & Stroke model ...



Multi (correlated) risk, multi-stage disease+cost model



Conclusion – Limitations - next steps

• We need more:

- Risk factor data by education, income, ... over time
- Stage dependent disease transition data (Diabetes, COPD, CKD, cancers, ...)
- Stage dependent relative risk data
- Longitudinal datasets and analyses
- ? Time lags between RF and disease
- Multiple risk correlation data
- EConDA is not over more data are available
- EConDa 2 ...





PREVEND a longitudinal study

- The PREVEND longitudinal study was used to approximate relative risks.
- Study contained ~4200 participants over four follow ups.
- The duration between a follow up varied for each individual between 1 and 5 years.
- Variables such as BMI, IFG, and the use of medication to regulate glucose levels were monitored.



Multi-stage diabetes & CHD

- BMI categories
 - Healthy weight
 - Overweight
 - Obese
- Diabetes disease stages
 - Normoglycaemia
 - Pre-diabetes
 - Diabetes



DIABETES RELATIVE RISKS defined as an impaired fasting glucose (IFG) ≥7 mmol/L



Finland –obesity projections by education, females



SES data by BMI

| Country | Education*BMI | Income*BMI |
|-------------|---------------|------------|
| Bulgaria | X | X |
| Finland | | X |
| Greece | | X |
| Lithuania | | X |
| Netherlands | | Х |
| Poland | | Х |
| Portugal | Х | Х |
| UK | | |





SES data by Smoker status

| Country | Education*Smk | Income*Smk |
|-------------|---------------|------------|
| Bulgaria | X | X |
| Finland | | X |
| Greece | \checkmark | X |
| Lithuania | | X |
| Netherlands | | X |
| Poland | | Х |
| Portugal | Х | Х |
| UK | | |