



**21st meeting of the International Network on Health
Expectancy (REVES)
Copenhagen, Denmark,
27-29 May 2009**

Multidimensional Profiles of Health Status: An Application of the Grade of Membership Model to the World Health Survey

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BACKGROUND

AIM OF OUR STUDY: to apply the Grade of Membership (GoM) model to the World Health Survey (WHS) data, in order to summarize the full set of health and health-related variables into a set of meaningful health profiles

WORLD HEALTH SURVEY (WHS):

- World Health Organization
- 70 countries
- between 2002 and 2004
- cross-population comparable data on health, health-related outcomes and risk factors

GRADE OF MEMBERSHIP (GoM) MODEL: summary health profiles from WHS self-reported health status and health conditions

WORLD HEALTH SURVEY

AIM OF THE WHS: to provide valid, reliable and comparable information about the World population health status

SAMPLING DESIGN: probability sampling using multi-stage, stratified, random cluster samples

POPULATION STUDIED: persons aged 18 years and older who lived in households



GoM model (1)

- Flexible, non-parametric, multivariate method
- Different from the other common classification methods
- **K** pure types, **I** individuals, **J** categorical variables, and **L_j** response levels

$$X_{ijl} = \begin{cases} 1 & \text{if the } i_{\text{th}} \text{ individual has the } l_{\text{th}} \text{ response to the } j_{\text{th}} \text{ variable} \\ 0 & \text{otherwise} \end{cases}$$

g_{ik} grade of similarity of the health features of the *i*th individual with the characteristics of each **K** pure types

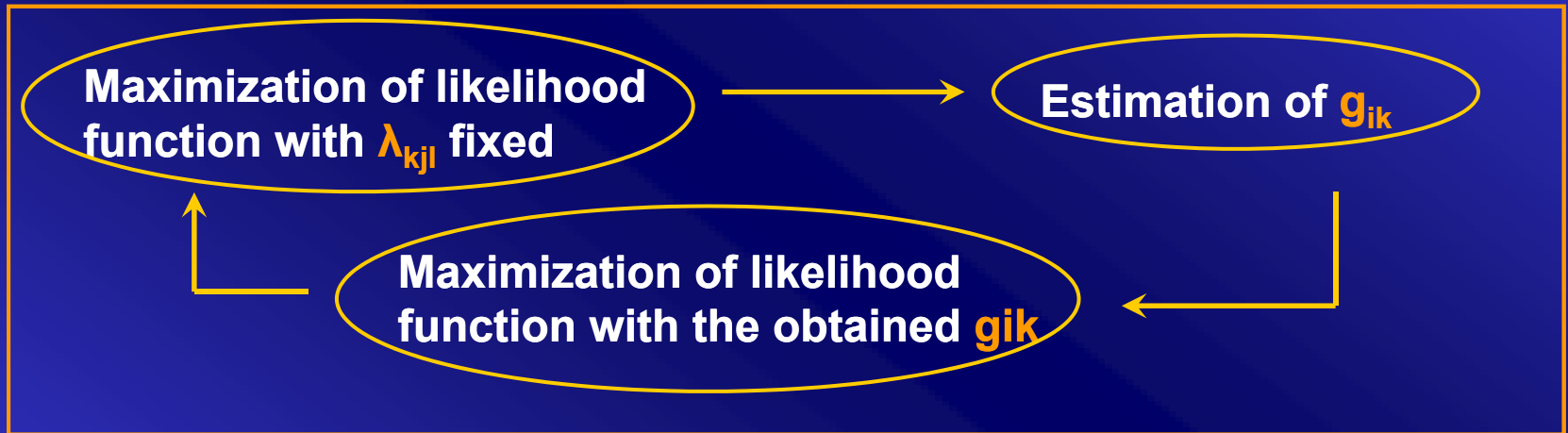
λ_{kjl} likelihood of a response *l* to the *j*th question by an individual belonging to the *k*_{th} pure type

GoM model (2)

DSIGoM software: to estimate the GoM parameters (g_{ik} and λ_{kjl})



The **likelihood function** of the GoM model is maximized



Optimal number of **K pure types**



Likelihood ratio test on the change in explanatory power between **K** and **K+1** model

DATA (1)

FINAL DATASET: 217,472 respondents from 69 countries

High Income Countries	Upper-middle Income Countries	Lower-middle Income Countries	Low Income Countries
Australia	Croatia	Bosnia and Herzegovina	Bangladesh
Austria	Brazil	China	Burkina Faso
Belgium	Hungary	Congo	Chad
Czech Republic	Kazakhstan	Dominican Republic	Comoros
Denmark	Latvia	Ecuador	Côte d'Ivoire
Estonia	Malaysia	Georgia	Ethiopia
Finland	Mauritius	Guatemala	Ghana
France	Mexico	Morocco	India
Germany	Russian Federation	Namibia	Kenya
Greece	Slovakia	Paraguay	Lao People's Democratic Republic
Ireland	South Africa	Philippines	Malawi
Israel	Uruguay	Sri Lanka	Mali
Italy		Swaziland	Mauritania
Luxembourg		Tunisia	Myanmar
Netherlands		Ukraine	Nepal
Norway			Pakistan
Portugal			Senegal
Slovenia			Vietnam
Spain			Zambia
Sweden			Zimbabwe
United Arab Emirates			
United Kingdom			
22	12	15	20

DATA (2)

18 categorical variables

- **5 socio-demographic characteristics**
(sex, age, marital status, education and employment)
- **1 self-reported overall health status question**
- **difficulties in functioning in 8 health domains**
(mobility, self-care, pain and discomfort, cognition, interpersonal relationships, vision, sleeping, and feeling sad or depressed)
- **self-reported diagnosis of 3 physical and 1 mental health condition**
(arthritis, angina pectoris, asthma and depression)

GoM application

VARIABLES

INTERNAL

- 1 self-reported overall health status
- 8 health domains
- 4 self-reported diagnoses

EXTERNAL

- 5 socio-demographic variables

4 economic areas



1 GoM analysis in each area



3 pure types for each area

RESULTS (1)

- For **each economic area**, the GoM model produced **three health multidimensional profiles**, each of which captures different aspects of **physical and mental conditions**

In order to better understand the obtained pure types, **two summary tables** will be shown

- **external variables** results for each economic area
- **internal variables** results for each economic area

Health Profiles	Internal Variables	High Income	Upper Middle Income	Lower Middle Income	Low Income
HEALTH PROFILE I (ROBUST)	SRH*	Good ($\lambda=55\%$)	Good	Good	Good
	HS**	None	None	None	None
	CC***	None	None	None	None
HEALTH PROFILE II (INTERMEDIATE)	SRH*	Good	Moderate	Moderate	Moderate
	HS**	Mild	Mild	Mild	Mild
	CC***	None	None	None	None
HEALTH PROFILE III (FRAIL)	SRH*	Moderate	Moderate	Moderate	Moderate
	HS**	Moderate	Moderate	Moderate	Moderate
	CC***	Arthritis, Depression	Arthritis	None	Arthritis

*SRH = self-reported overall health status

**HS = health state determined by level of difficulty with each of the eight health domains

***CC = reported physical and mental health conditions: arthritis, angina pectoris, asthma and depression

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HEALTH PROFILE I (ROBUST)	Sex	Female / Male	Male	Male	Male
	Age group	Adult	Adult	Adult	Young / Adult
	Marital status	Married	Married	Married	Married
	Education	High	Intermediate	Low	None
	Current job	Private sector	Self-employed	Self-employed	Self-employed
HEALTH PROFILE II (INTERMEDIATE)	Sex	Female	Female	Female	Female
	Age group	Adult	Adult	Adult	Adult
	Marital status	Married	Married	Married	Married
	Education	High	Intermediate	Low	None
	Current job	Private sector	Self-employed	Homemaker	Self-employed
HEALTH PROFILE III (FRAIL)	Sex	Female	Female	Female	Female
	Age group	Older	Older	Older	Adult
	Marital status	Married	Married	Married	Married
	Education	Low	Low / Intermediate	None	None
	Current job	Retired	Retired	Homemaker	Self-employed

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RESULTS (2)

Age-standardized prevalence estimates (%) for the g_{ik} scores distribution

Economic areas	HEALTH PROFILES		
	ROBUST	INTERMEDIATE	FRAIL
High Income	62.4	21.8	15.8
Upper Middle income	62.3	22.1	15.6
Lower Middle Income	58.2	20.0	21.8
Low Income	58.4	22.4	19.2

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CONCLUSIONS

- Robust method to **reduce** and **summarize** health variables from health surveys
- Concrete **levels of health** and characteristics of **healthy** and **non-healthy** individuals
- Set of profile which are easier to interpret and use for **decision-making** in **health policy**

Next steps

- Investigate **changes** between **health profiles** and the impact of the **health-wealth**

**Thank you very much for your
attention!**