

Identification and Expert Panel Rating of Key Structural Approaches applied in Health Economic Obesity Models

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Background



- Obesity is a **multifactorial, chronic disorder** that has, according to the WHO, reached **epidemic proportions** globally and is a major contributor to the global burden of chronic disease and disability
- **Overweight and obesity are leading risks for global deaths and morbidities**
- **Decision analytic modelling has increasingly been used to assess the long-term health economic impact of prevention and therapy for obesity**
- However **variable quality and heterogeneity in methods could limit the use of these evaluations by decision makers**

Objective



- The objective of our research was
 - **to assess the key structural modelling approaches applied in published health economic obesity models**
 - **and to provide guidance in order to improve the validity of the outcomes, their comparability and methodological standards**



Published Systematic Literature Search

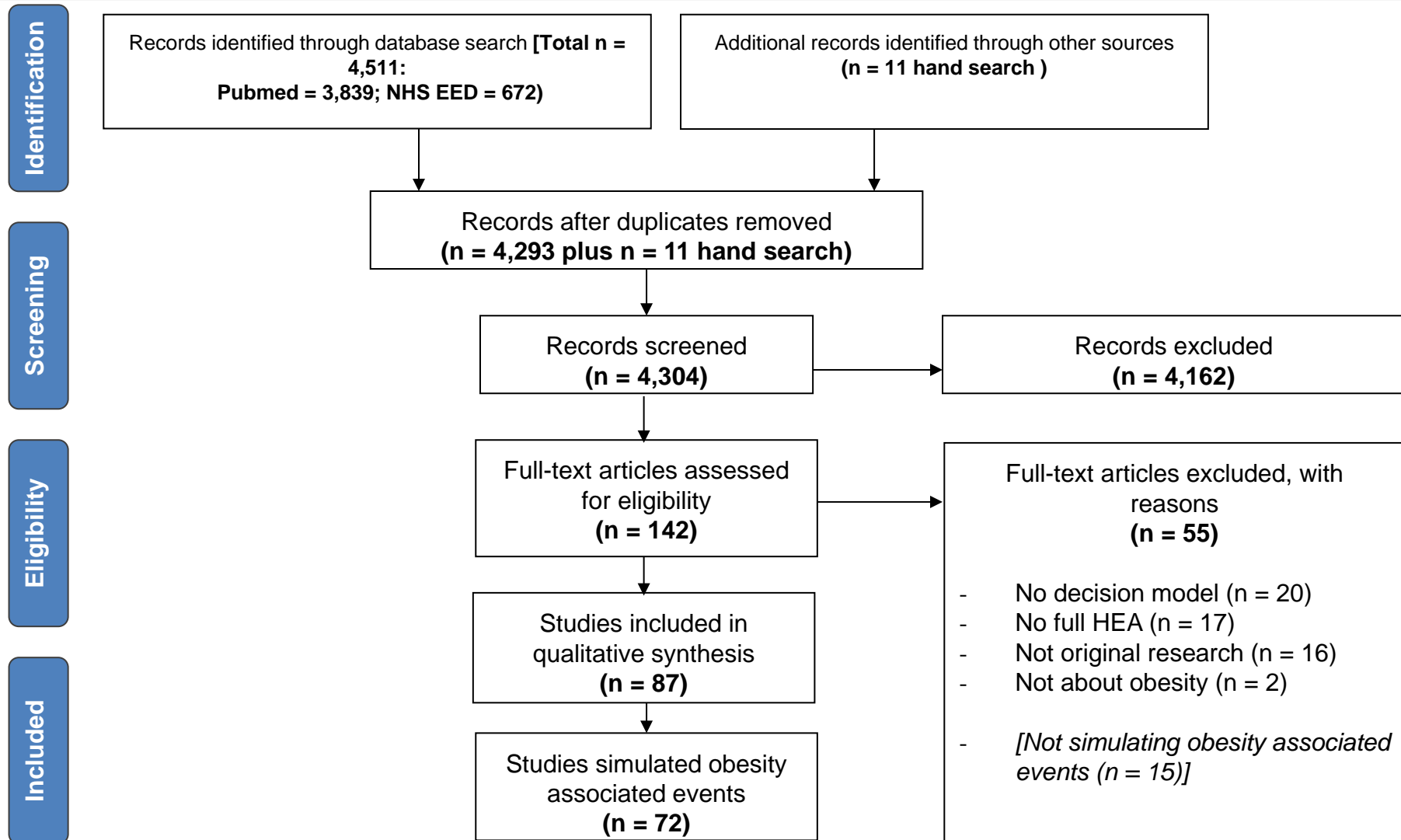
Ten One-to-one Expert Interviews

Expert Panel Meeting
(with the ten experts)

- **Five inter-related topics of interest were assessed** (structural aspects of the Phillips checklist not related to quality of reporting):
 - **time horizon,**
 - **model type,**
 - **obesity-related clinical events simulated**
 - **event simulation approaches**
 - **external event validation**

(More information on the detailed methods can be provided on request)

Published Systematic Review: We identified 87 papers & 83% (72 of 87) simulated obesity-associated events



Time Horizon – Systematic Literature Search, Expert Interview Outcome and Expert Panel Outcomes



Time Horizon	Literature Review (n=87 models)	Expert Interviews (n=10 experts)	
		Minimum	Optimal
< 20 years	23%	20%	10%*
≥ 20 & < lifetime	14%	20%	10%*
Lifetime	63%	60%	100%*

** 2 experts provided 2 different answers: ≥ 20 years in adults / lifetime in younger subjects; ≥ 10 years / lifetime optimal*

In the expert panel meeting it was agreed on

- that a lifetime horizon is the optimal time horizon for a health economic obesity model (100% agreement)
- that both short-term and long-term results should be presented (100% agreement)
- No alignment was possible on the topic minimum time horizon

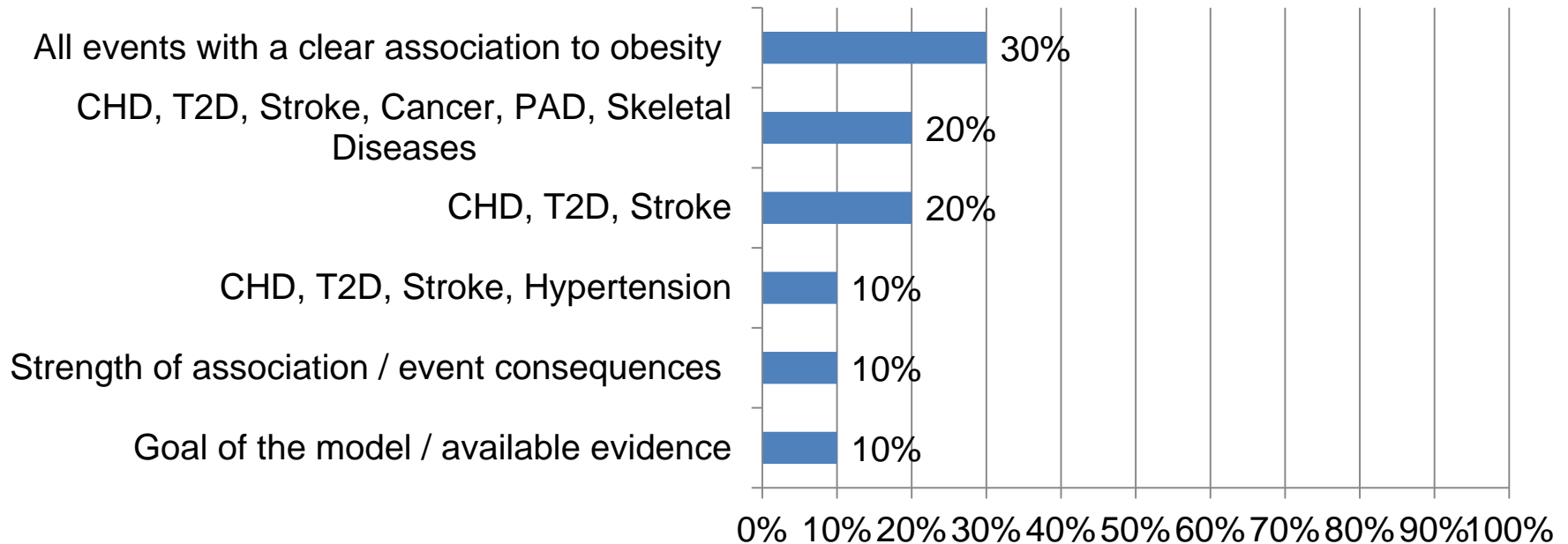
Minimum Acceptable Obesity Associated Events – Systematic Literature Search & Expert Interview Outcomes



Obesity Associated Events	Literature Review* (n=72 models)	Expert Interviews (n=10 experts) (Minimum acceptable events)*		
		CHD, T2D, Stroke	CHD, T2D, Stroke, Cancer	CHD, T2D, Stroke, Cancer, HT
Coronary heart disease (CHD)	83%	50%*	20%*	10%*
Type 2 Diabetes (T2D)	74%			
Stroke	67%			
Cancer	35%			
Hypertension (HT)	11%			
Osteoarthritis	27%			
Hyperlipidaemia	11%			
Peripheral arterial disease	10%			

**no definite answer was provided by 2 experts (n=20%) - in general those events with strongest association / causal relationship to obesity should be included*

Obesity Associated Events – Optimal Case – Systematic Literature Search & Expert Interview Outcomes



- During the expert panel, it was not possible to achieve consensus on the events to be included in an obesity model
- However, there was general alignment that those events with a strong statistical association to obesity combined with a clear clinical causal relationship to obesity should be included in the optimal case

Model Type – Systematic Literature Search, Expert Interview Outcomes and Expert Panel Outcomes



Model Type	Literature Review (n=87 models)	Expert Interviews (n=10 experts)
State Transition Model (STM)	85%	60%
Discrete Event Simulation (DES)	2%	10%
Decision Tree Model	13%	--
STM or DES (expert rating)	--	30%

** 3 experts rated both STM and DES as suitable - depending on the data availability (for the DES model)*

Within the expert panel meeting the following consensus was reached:

- An individual patient / microsimulation STM is regarded an adequate approach for an obesity model
- DES is regarded as the most flexible approach for building a health economic obesity model but DES is complex, difficult to build, to inform and to explain (to stakeholders)

Definition of Key Event Simulation Approaches



- **Risk Equation / Change in Risk Factors:** E.g. Framingham / UKPDS equations – the base risk is calculated as an equation of risk factors and the intervention effect is simulated by the change of risk factors
- **Disease Incidence Estimate / BMI related relative risk (RR):** Any kind of incidence estimate (e.g. age-specific; gender-specific incidence etc.) is used as base risk and the intervention effect is simulated by applying a BMI related relative risk to the base risk
- **BMI Function / Change in BMI:** Base risk is calculated as function of the BMI which is directly influenced by the intervention effect on the BMI
- **Other Event Simulation Approaches :**
 - Disease Incidence Estimate / Obesity related RR
 - BMI Group Function / Change in BMI Group
 - Disease Incidence Estimate / BMI Group related RR

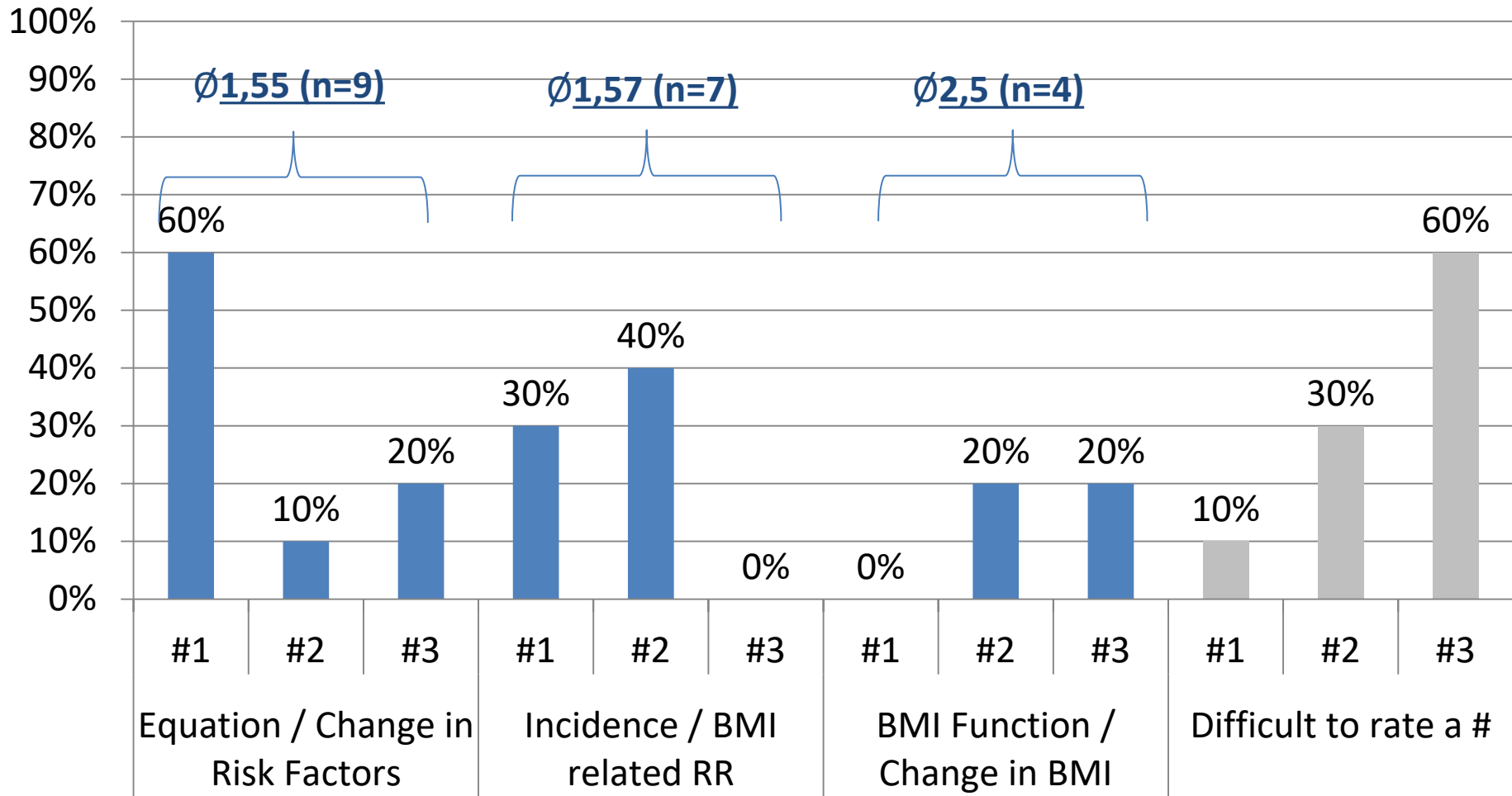
Expert Ranking of the modelling approaches observed on the basis of the systematic review from 1 to 3



Event Simulation Approach	Literature Review (n=72 models)	Expert Interviews (n=10 experts) – Ranking (#1, #2, #3)
Risk Equation / Change in Risk Factors	32%	#1 (60%): #2 (10%); #3 (20%)
Disease Incidence Estimate / BMI related relative risk (RR)	21%	#1 (30%): #2 (40%); #3 (0%)
BMI Function / Change in BMI	12%	#1 (0%): #2 (20%); #3 (20%)
Disease Incidence Estimate / Obesity related RR	12%	
BMI Group Function / Change in BMI Group	9%	
Disease Incidence Estimate / BMI Group related RR	7%	
Others / Others	7%	

* 3 experts rated both STM and DES as suitable - depending on the data availability (for the DES model)

Outcomes of the interview question: Which event simulation approach would you prefer for a health economic obesity model? (Rank 1-3)

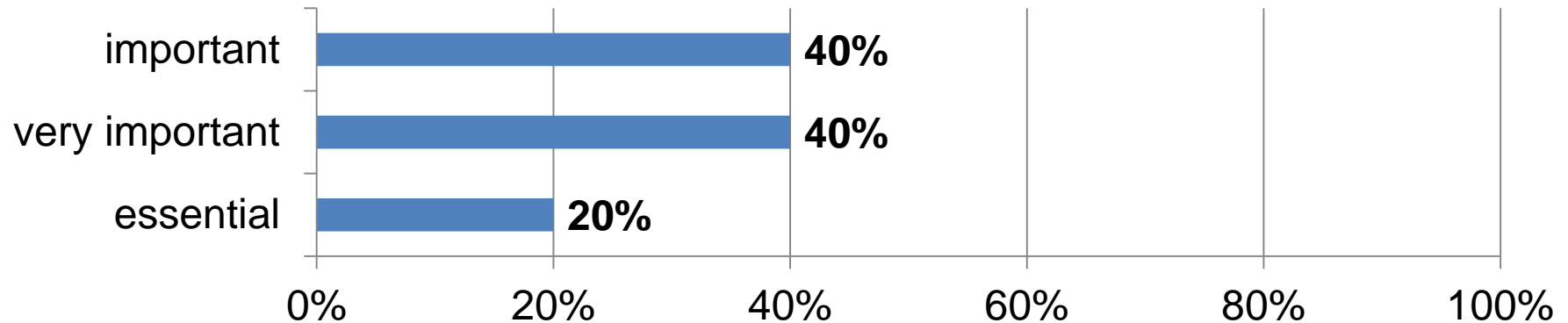


External validation - Systematic Literature Search, Expert Interview Outcomes and Expert Panel Outcomes



- External validation was defined as comparing a model's results with actual event data (ISPOR / SMDM guidelines)
- According to the systematic review, only for ten published model-based health economic assessments in obesity an external event validation was performed (14%; 10 of 72)

Interview Question: How important do you rate an external validation for health economic obesity model?



- **100% of experts rated the external validation at least important**

Overview of Expert Panel Recommendations



Key Aspect	Structural	Expert panel recommendations
Time Horizon		Simulating a lifetime horizon was regarded as optimal for an obesity model (100% agreement)
		Ideally, both short and long-term results should be presented (100% agreement)
Obesity Associated Events		No consensus was possible on which clinical events to be included in a health economic obesity model
		There was general alignment that those events with a strong association to obesity combined with a clear causal relationship to obesity should be included in the optimal case
Model Type		An individual patient/microsimulation state transition model was regarded an adequate modelling approach (90% agreement)
		Discrete event simulation (DES) was regarded as the most flexible approach for building an obesity model but DES was recognised as complex, as more difficult to build, populate and to disseminate (to stakeholders)
Event Simulation Approach		Using a risk equation approach for simulating the clinical events was the most preferred approach (60%) followed by applying a body mass index (BMI) related relative risk to a base risk estimate (30%)
		Continuous BMI approaches were preferred (relative to categorical ones) (100% agreement)
External Validation		100% of experts rated the external validation at least important

Limitations



- **Only European experts included:** For the expert panel, we focused on experts that were going to visit the EuHEA meeting in Maastricht (2018)
- **Only quantitative methods used:** In the expert interviews and in the expert panel we have only used quantitative methods in order to obtain an expert rating and an expert consensus, as the kind of the questions were not rated to require qualitative techniques such as the Delphi method or discrete choice experiments
- **Focus on health economists:** Furthermore the focus on health economists is a limitation related to the composition of the panel. The rationale for selecting health economists was that modelling is primarily driven by this discipline, but as a consequence it was not possible to get a clear expert rating on purely clinical aspects, such as the obesity associated event selection

Conclusion



- While the working group acknowledged some challenges and difficulty to achieve consensus, **several recommendations for the key structural approaches for a health economic obesity model were developed**
- The **obtained insights, discussion and consensus** (on the key structural aspects) **can provide valuable guidance** for all decision makers, health economists and modelers **for rating and developing decision-analytic models applied in the context of obesity**



Many Thanks to the Members of the Expert Panel

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