



Appropriateness of healthcare decisionmaking: what multicriteria decision analysis (MCDA) can bring?

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EVIDEM Collaboration - Board of Directors

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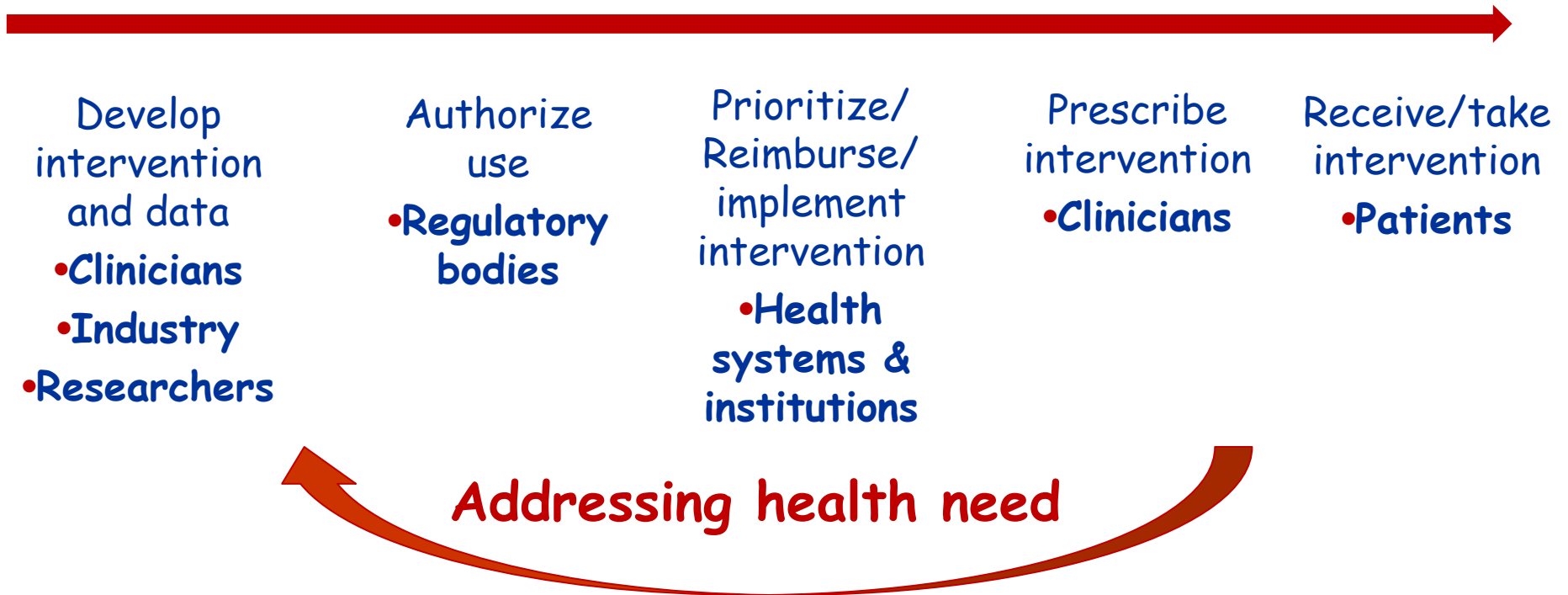
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Overview

Healthcare decisionmaking continuum



→ Appropriateness: Which interventions contribute the most to health and to an equitable, efficient and sustainable healthcare system?



Structuring the natural thinking process

→ Apply the principles of **Multicriteria decision analysis (MCDA)**

- Identify criteria
- Systematize their consideration
- Qualitative/quantitative approaches





Finding the evidence for each criteria
(scientific and colloquial)

→ Apply the principles of health
technology assessment (HTA)





WWW



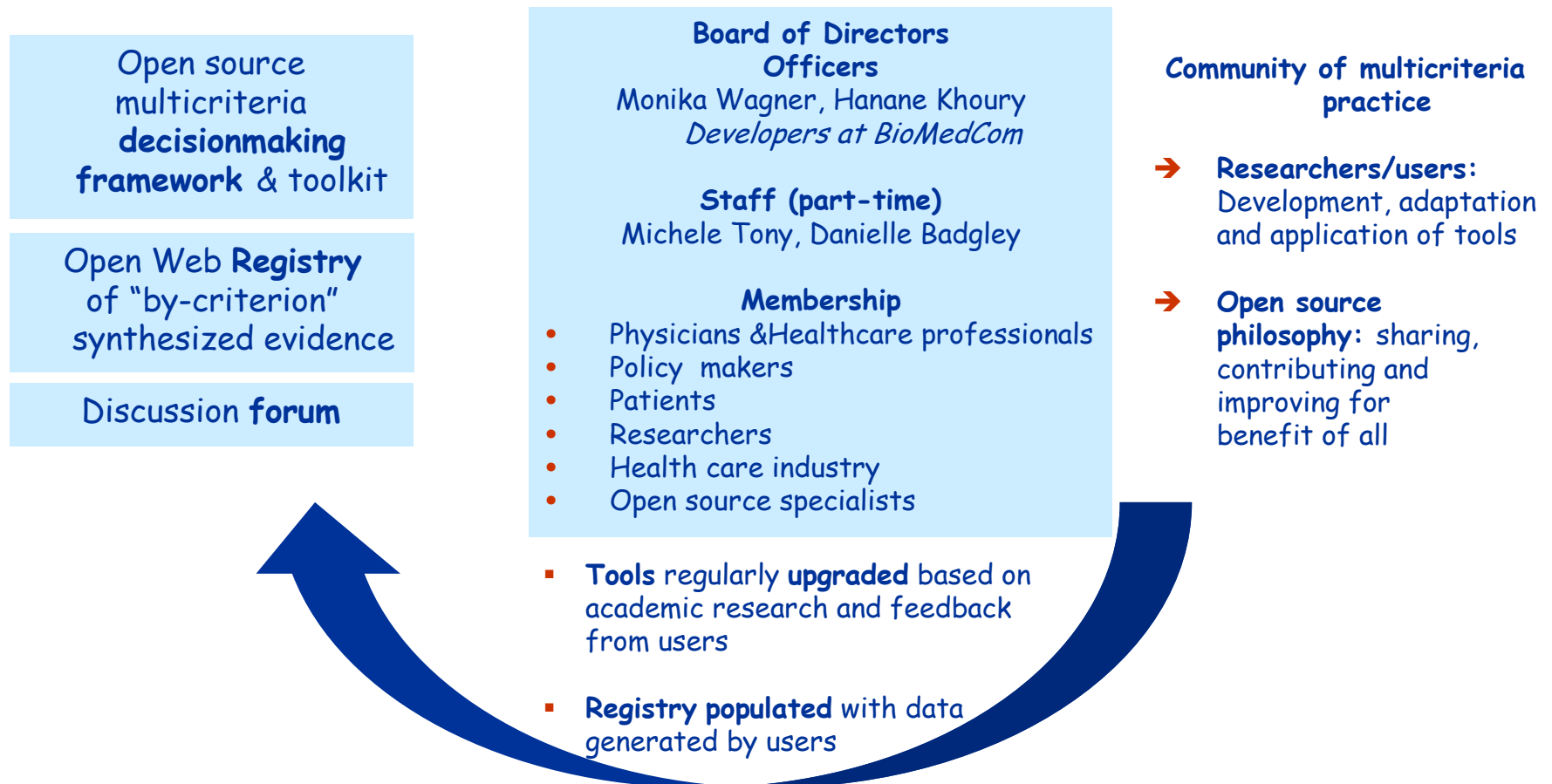
Bridging MCDA with HTA

→ **EVIDEM framework**

EVIDEM Collaboration*

A not-for-profit collaborative platform

Object: promote public health by developing efficient multicriteria-based solutions to healthcare decisionmaking



Criteria & tools

EVIDEM conceptual approach

Generic framework to facilitate reflection on all aspects of healthcare decision across all stakeholders to assess interventions

- ❖ **MCDA principles**
 - ❖ criteria should be complete
 - ❖ with minimum overlap
 - ❖ mutually independent
 - ❖ Operationalizable

- ❖ **Includes an adaptable set of criteria***
 - ❖ **MCDA Core Model** (universally normative criteria)
 - ❖ **Contextualization Tool** (normative contextual and feasibility criteria)

*Criteria identified from extensive analysis of literature and decisionmaking processes, feedback from users and selected to fulfill MCDA principles; categorized based on WHO normative and feasibility principles

EVIDEM MCDA Core Model

What should we do? Which interventions contribute the most to health and sustainable systems?

Includes 15 universal normative criteria and assumes that:

→ Interventions that contribute the most are:

- ❖ For severe disease (D1)
- ❖ For common disease (D2)
- ❖ For disease with many unmet needs (C2)
- ❖ Recommended by expert consensus (C1)
- ❖ Conferring major improvement in efficacy/effectiveness over standard of care (I1)
- ❖ Conferring major improvement in safety & tolerability over standard of care (I2)
- ❖ Conferring major improvement of patient perceived health over standard of care (I3)
- ❖ Either conferring major risk reduction (T1) or major alleviation of suffering (T2)
- ❖ That results in savings in healthcare intervention expenditures (E1) as well as other medical and non medical expenditures (E3); *cost-effective (E2)**
- ❖ For which there is sufficient data (Q1), that is fully reported (Q2) and valid and relevant (Q3)

10 *Cost-effectiveness is a composite of some elements of other criteria and does not comply with the non-redundancy design requirement of MCDA. It may be included in the framework since many decisionmaking processes currently rely on this composite measure.

EVIDEM Contextualization Tool

What is our context and what can be done?

Includes 6 criteria

→ Define objectives of healthcare system & population priorities – 2 contextual normative criteria

- ❖ Alignment with scope and mission of health care system/plan (Et1)
- ❖ Defining country/jurisdictional priorities for populations & access (Et2)

→ 4 Feasibility criteria

- ❖ Exploring opportunity costs (forgone interventions) and affordability (Et3)
(financial/budgeting exercise)
- ❖ Verifying system capacity (e.g., infrastructure, skills) and appropriate use of intervention (O1)
- ❖ Assessing political/historical context (e.g. cultural acceptability, precedence) (O2)
- ❖ Realizing pressures/barriers from healthcare stakeholders (O3)

EVIDEM framework

MCDA Core Model

Normative criteria

Disease impact

- Disease severity (D1)
- Size of population affected by disease

Context of intervention

- Clinical guidelines (C1)
- Comparative intervention limitations

Intervention outcomes

- Improvement of efficacy/effectiveness
- Improvement of safety and tolerance
- Improvement of patient reported outcomes

Type of benefit

- Public health interest (e.g., prevention)
- Type of medical service (e.g., symptomatic treatment)

Economics

- Budget impact on health plan (cost of intervention only) (E1)
- Impact on other spending (e.g., hospitalization, disability) (E2)
- Cost-effectiveness of intervention (E3)

Quality/uncertainty of evidence

- Adherence to requirements of decisionmaker (Q1)
- Completeness and consistency of reporting (Q2)
- Relevance and validity of evidence (Q3)

Contextualization tool

Feasibility & normative criteria

E2 - Possible sub-criteria

- Impact on primary care expenditures
- Impact on hospital care expenditures
- Impact on long-term care expenditures
- Impact on productivity
- Financial impact on patients
- Financial impact on caregivers

→ Adapt to context

Weights, scores & appraisal

Not all criterion are equal



Disease severity



Improvement of efficacy

Develop MCDA model

Weight elicitation technique*?

- ❖ Capture individual perspective on relative importance of criteria independently of healthcare interventions
- ❖ No gold standard

→ Simple techniques

❖ EVIDEM

Criteria	Weights				
	Low	←————→			High
Example Disease severity		□1	□2	□3	□4 □5

- ❖ Kepner -Tregoe Analysis (KTA)
 - ❖ Direct point allocation
- More complex
- ❖ Analytical hierarchy process (AHP)
 - ❖ Best/worst scaling
 - ❖ (Conjoint analysis)
- Adapt to user preference/context

Not all interventions are equal



Develop MCDA model

Scoring scale?

- ❖ Measure performance of intervention
- ❖ Need to define:
 - ❖ Type of scale/number of options
 - ❖ Scale anchors for each criteria
- ➔ Simple approach
 - ❖ EVIDEM

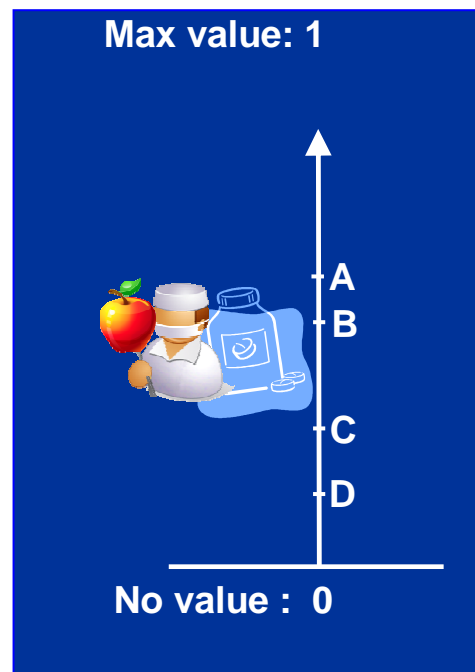
Criteria	Scoring scale
Example Disease severity	<input type="checkbox"/> 0 - not severe <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 - very severe

- ➔ More complex (e.g., more scale options, boolean operators for each option)
- ➔ Adapt to user preference/context

Applying the tools: appraise & rank interventions

Adapted MCDA Core Model Quantitative criteria

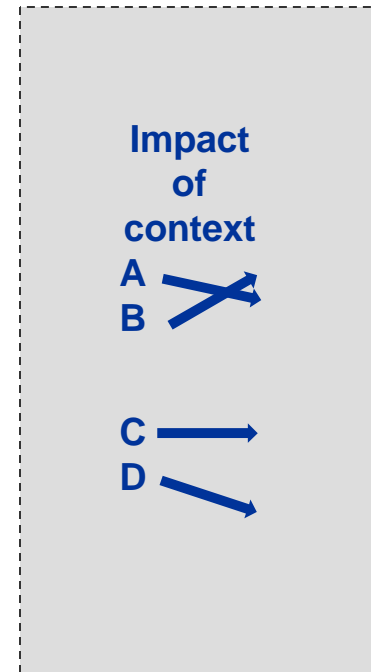
$$\sum N \text{Weights} \times \text{Scores} = \text{Value}$$



What should we do?
Normative criteria

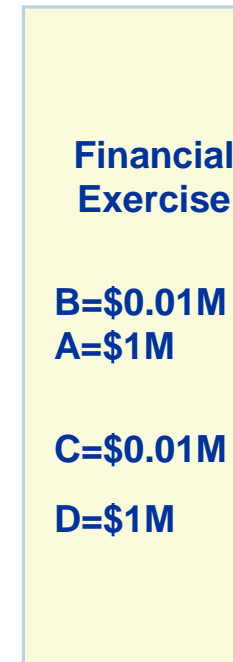
Recommendation

Adapted Contextualization tool Qualitative criteria



What can we do?
Feasibility criteria

Decision



Invest
AND
Disinvest

"By-criterion" HTA web report

Web registry

<http://www.evidem.org/evidem-collaborative.php>

Demo: Interactive prototype

<https://www.evidem.org/tiki/?page=DEMO-main>



Overview of intervention

Last Update: April 2009

Disease: Turner syndrome (TS)

Intervention: Growth Hormone (GH)

Setting: Canada

Drug class: Polypeptide hormone

Indication: treatment of short stature in girls with Turner Syndrome

Administration: subcutaneous injection 3 to 7 days a week

Intervention duration: Needs to be established. Initiate as soon as growth failure demonstrated until satisfactory height reached (6 years of treatment starting at 10 years)

Comparator(s): No treatment

Economic burden of illness: No data available

Interactive by-criterion HTA report – high level synthesis - excerpt

	Intrinsic criteria	Highly synthesized information	Score	Comments
	Disease impact			
D1	Disease severity	Female-specific genetic disorder characterized by short stature, cardiovascular defects, absence of puberty, infertility, increased risk of diabetes, defects in visuo-spatial organization and nonverbal problem-solving, and decreased life expectancy. [see details]	<input type="radio"/> 0 Not severe (minor inconvenience) <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 Very Severe	<input type="checkbox"/> Low Score due to data - specify
D2	Size of population	Prevalence: 40/100,000 female adults.	<input type="radio"/> 0 Very rare disease <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 Common disease	<input type="checkbox"/> Low Score due to data - specify
	Context of intervention			
C1	Clinical guidelines	International guidelines (no Canadian Guidelines): Consider GH treatment as soon as	<input type="radio"/> 0 No recommendation	



Interactive by-criterion HTA report

Details on evidence - example

D1 - Disease severity

Turner syndrome is a female-specific genetic disorder (complete or partial loss of one of the X chromosome) characterized by short stature and presenting a wide spectrum of abnormalities, including cardiovascular defects (17-45%), lymphedema, gonadal dysgenesis (90% requiring hormone replacement therapy to induce puberty), infertility, miscarriage, hypothyroidism (15-30%), risk of obesity, ophthalmic defects, hearing problems and ear malformations, gastrointestinal and renal manifestations (Bondy 2007, Sybert et al. 2004). Patients are at increased risk of impaired glucose tolerance and diabetes (Hjerrild 2008, Holl 1994). Overall, cancer risk appeared not to be significantly increased; increased risks were reported in some studies for brain and nervous system tumors, and for colon and rectal cancer (Stochholm 2006, Schoemaker 2008, Hjerrild 2008). Defects in visuo-spatial organization and nonverbal problem-solving affect most patients with TS; in addition, impaired psychomotor and social functioning have been reported (Bondy 2007, Sybert et al. 2004).

In young patients, psychosocial issues arise: impaired peer relationship, teasing, social isolation, anxiety, shyness, and poor self-esteem (Bondy 2007, Sybert et al. 2004, Schmidt et al, Busschbach et al. 1998). In audiotaped interviews, Turner Syndrome patients reported infertility as their biggest concern (range: 36% of girls aged 7-13 yrs to 74% of adults aged 20-39 yrs; Sutton et al. 2007). However, many Turner Syndrome patients of all ages reported to be bothered by short stature (36% girls, 44% adolescents and adults, 55% mature adults 40-59 yrs; Sutton et al. 2007); 44% of 25 adult Turner Syndrome patients reported to be bothered by short stature (Busschbach et al. 1998). Short stature is

Life expectancy is decreased in women with Turner anomalies (Stochholm et al. 2006; Sybert et al. 2007) (number of deaths / expected number of deaths =

[Return to DEMO Scoring intervention \(MCDA Ma](#)
[Return to DEMO Menu](#)

The screenshot shows a web browser window displaying a PubMed search result. The browser's address bar shows the URL: <http://www.ncbi.nlm.nih.gov/pubmed/17047017?opt=Citation>. The page title is "Care of girls and women with Turner syndrome: A guideline of the Turner Syndrome Study Group." The author is listed as "Bondy CA; Turner Syndrome Study Group." The journal is "J Clin Endocrinol Metab." The abstract is visible, starting with "OBJECTIVES: The objective of this work is to provide updated guidelines for the evaluation and treatment of girls and women with Turner syndrome (TS)." The page also includes a "Related citations" section with several links to other articles, and a "Cited by 9 PubMed Central articles" section. The browser's search bar is visible at the top, and the NCBI logo is in the top left corner of the page.

Content of the Collaborative

Interactive by-criterion HTA report

Links to quality assessments - example clinical data

	interventions limitations	syndrome.	limitations ○ 1 ○ 2 ○ 3 Major	<input type="checkbox"/> Low - specif
	Intervention outcomes			
11	Improvement of efficacy/ effectiveness	<p>4 placebo controlled RCTs(2-year (toddlers) to 11-year treatments; N=42 to 104, 1 in Canada, 3 in USA): Final height of treated patients = 147 cm to 150 cm; difference with untreated = 7 cm</p> <p>Observational studies(2-year to 8-year treatments, N=26 to 123, 1 in Germany, 1 in Greece, 1 in Israel, 3 in Italy): : Final height of treated patients = 148 cm to 151 cm; difference with controls = 2.1 to 6.8 cm. Example of critical analysis</p>	<p>○ 0 Lower efficacy/ effectiveness than comparators presented</p> <p>○ 1</p> <p>○ 2</p> <p>○ 3 Major improvement in efficacy/ effectiveness</p>	<input type="checkbox"/> Low - specif
12	Improvement of safety & tolerability	<p>Common AEs(from RCTs -frequency at least twice of placebo): Surgeries (50%), ear problems (6 % to 47 %), joint (13.5%) and respiratory (11%) disorders, sinusitis (18.9%)</p> <p>Serious AEs(from registries, no control data): Intracranial hypertension (0.2%), slipped capital femoral epiphysis (0.2 - 0.3%), scoliosis (0.7%), pancreatitis (0.1%), diabetes mellitus (0.2 to 0.3%), cardiac/aortic events (0.3%), malignancies (0.2%)</p> <p>Warnings: Scoliosis, slipped capital femoral epiphysis, intracranial hypertension, ear disorders, cardiovascular disorders, autoimmune thyroid disease, insulin resistance.</p>	<p>○ 0 Lower safety / tolerability than comparators presented</p> <p>○ 1</p> <p>○ 2</p> <p>○ 3 Major improvement in safety / tolerability</p>	<input type="checkbox"/> Low - specif
13	Improvement of patient reported outcomes	<p>Inconclusive data:</p> <p>1 RCT(2-year treatment data, N=28, Canada): higher rating on questionnaire by GH treated patients versus untreated for some domains but not for others</p> <p>2 observational studies: no significant differences on SF-36 dimensions in one study (5-year treatment, N=568, France) and significant differences in another (7-year treatment, N=29, Holland); other questionnaires, non significant differences</p> <p>Convenience: Subcutaneous injection 3 days a week or daily.</p>	<p>○ 0 Worse patient reported outcomes than comparators</p> <p>○ 1</p> <p>○ 2</p> <p>○ 3 Major improvement</p>	<input type="checkbox"/> Low - specif
	Type of benefit			
T1	Public health interest	No data on risk reduction with GH treatment.	○ 0 No risk reduction	

Interactive by-criterion HTA report

Quality of evidence assessment - overall clinical data

Relevance and validity – clinical data			
Disease: Turner Syndrome (TS) Intervention: recombinant human growth hormone (GH) Setting: Canada	Series of key studies Stephure et al, 2005 : Canada – See full assessment Rosenfeld et al 1998 : US - See full assessment Quigley et al 2002 : US - See full assessment Davenport et al 2007 : US – See full assessment		
Type of evidence	Question(s)	Rationale	
Efficacy/safety data	How relevant is the research program with regard to efficacy and safety? Are conclusions valid over the range of studies (conclusions across studies consistent or conflicting)? Are individual trials relevant and valid? <i>See assessment of individual studies below</i>	Overall, randomized controlled trials consistently demonstrate that GH treatment promotes height gain in girls with Turner Syndrome. Some uncertainty remains on extent to which GH may affect final height. High attrition rates were noted in the Canadian clinical trial (Stephure 2005); 2 multiphase trials were missing a control arm (no GH treatment) and chose GH administration mode (frequency of injections) that did not correspond to current practice (Rosenfeld et al. 1998 ; Quigley et al. 2002). Safety data monitoring is generally limited, despite the numerous warnings and AEs associated with GH treatment in Turner Syndrome populations. (Humatrope PM. 2007 ; Saizen PM. 2007 ; Nutropin PM. 2006).	1 [] Low relevance/validity 2 [] 3 [X] 4 [] High relevance/validity

Interactive by-criterion HTA report

Quality of evidence assessment - excerpt single study

Relevance and validity – clinical data - study 1			
Disease: Turner Syndrome (TS) Intervention: recombinant human growth hormone (GH) Setting: Canada			Study: Stephure et al Canada 2005
Type of evidence	Question	Rationale	Score
Efficacy/safety data	Is the study question relevant (choice of comparator, time horizon, patient population, and outcome)? Is the design appropriate (setting & design, sample size, patient allocation, analyses, statistics)? <i>See dimensions below</i>	This is the only study reporting final height (standard measure of GH effect; (Baxter et al. 2007) as the primary outcome. Although differences between GH treatment and no treatment are meaningful, high attrition rates, especially in the control arm (45%) might bias the study conclusions (Baxter et al. 2007). Authors report that supportive intent-to-treat analysis with conservative assumptions on missing data confirmed significance but no details are provided.	1 <input type="checkbox"/> Low relevance/validity 2 <input type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input type="checkbox"/> High relevance/validity
Dimension	Question	Comment	
1 Target population	Is the target population relevant (age, gender, disease stage, comorbidities, inclusion criteria/exclusion criteria, setting etc)? Does it correspond to the actual population in which the intervention is envisioned to be used?	Target population is relevant and corresponds to the actual population in which the intervention is indicated: prepubertal Turner Syndrome girls (mean age: 10.3 ± 1.8 yrs; range: 7–13 yrs) with evidence of growth failure (height < 10th percentile) (Bondy 2007). Canadian setting but there is no mention of number and location of centers involved.	
2 Intervention & comparators	Is the intervention in agreement with expected use? Does the choice of comparators reflect standard of care?	GH dose and schedule are in agreement with indication to treat short stature in Turner Syndrome girls (Humatrope PM. 2007; Saizen PM. 2007; Nutropin PM. 2006). Comparator is no treatment (standard of care).	
3 Outcome measures	Are the selected outcomes measures (efficacy, safety and PRO) relevant? Are rationales for outcomes selection valid? Are the instruments/methods/units used to measure outcomes (efficacy, safety and PRO) valid?	The primary outcome is final height (cm), which is the gold standard measure of GH effectiveness (Baxter et al. 2007). Other efficacy analyses are relevant to the assessment of short-term growth, and instruments/units used are valid: height age-specific Turner Syndrome standard deviation score (SDS; allows comparison to same population height) height adult Turner Syndrome	

Users & applications

Users	Applications
❖ Decisionmakers	
Policy (macro/meso)	<ul style="list-style-type: none"> ➤ Priority setting ➤ Regulatory ➤ Reimbursement ➤ Implementation
Physicians & healthcare professionals	<ul style="list-style-type: none"> ➤ Clinical practice guidelines (CPGs) ➤ Seamless access to evidence
Patients	<ul style="list-style-type: none"> ➤ Access to clear, digested & validated information
❖ HTA developers	<ul style="list-style-type: none"> ➤ By-criterion HTA report ➤ Web-based multilevel evidence
❖ Research	<ul style="list-style-type: none"> ➤ Identify research questions/data needs ➤ Research planning ➤ Explore the decisionmaking process
❖ Developers of new healthcare interventions/ programs	<ul style="list-style-type: none"> ➤ Development ➤ Positioning ➤ Data gap analysis
❖ All	<ul style="list-style-type: none"> ➤ Communication (evidence and values) ➤ Knowledge translation

Strengths and challenges

Strengths	Challenges
Utility to decisionmakers	
<ul style="list-style-type: none"> • Adaptable to local context • Systematize decision process • Quantitative and qualitative aspects combined • Identify criteria and perspectives at play in decisionmaking • Appraisal and priority setting based on wide range of criteria • Transparency 	<ul style="list-style-type: none"> • Perception of complexity • Integration into existing processes • Degree of quantification • Risk of using MCDA as a formula rather than as a support to decisionmaking/priority setting
Methodology	
<ul style="list-style-type: none"> • Pragmatic, user-oriented and modular • Open source development (benefit from others' experience) 	<ul style="list-style-type: none"> • Criteria selection • Weighting process
Data requirements	
<ul style="list-style-type: none"> • Comprehensive but modular • Open web registry (benefit from others' work) 	<ul style="list-style-type: none"> • Data synthesis by criteria • Web registry in its infancy
Capacity/training requirements	
<ul style="list-style-type: none"> • Testing package available in the toolkit • Community of users and developers building up 	<ul style="list-style-type: none"> • Limited MCDA expertise in healthcare

On the agenda

- ✓ Methodological development (e.g., sub-criteria, weighting elicitation techniques, data synthesis)
- ✓ Field adaptation and implementation
- ✓ Discussion forum - community of multicriteria practice
 - Collaboratively optimize open source framework & toolkit
 - Optimize resources, decisions, priority-setting and patient health

Acknowledgments

- ✓ Colleagues at BioMedCom
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Thank you

www.evidem.org

Back-up slides

EVIDEM framework - overview

Applications

Framework structure adaptation

