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Published in:

Exploring Complexity in Health: An Interdisciplinary Systems Approach

DOI (link to publication from Publisher):

[10.3233/978-1-61499-678-1-441](https://doi.org/10.3233/978-1-61499-678-1-441)

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Publication date:

2016

Document Version

Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Thiel, R., Birov, S., Piesche, K., Højen, A. R., Gøeg, K. R., Dewenter, H., Nejad, R. F., Volkert, P., Kufrin, V. K., & Stroetmann, V. (2016). The costs and benefits of SNOMED CT implementation: an economic assessment model. In *Exploring Complexity in Health: An Interdisciplinary Systems Approach: Proceedings of MIE2016 at HEC2016, 28 August-2 September 2016, Munich, Germany* (pp. 441-445). IOS Press. <https://doi.org/10.3233/978-1-61499-678-1-441>

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The Costs and Benefits of SNOMED CT Implementation: An Economic Assessment Model

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Abstract. As part of its investigations, the EU-funded ASSESS CT project developed an Economic Assessment Model for assessing SNOMED CT's and other terminologies' socio-economic impact in a systematic approach. Methodology and key elements of the model are presented: cost and benefit indicators for assessing deployment, and a cost-benefit analysis tool to collect, estimate, and evaluate data.

Keywords. Semantic interoperability, SNOMED CT, costs, benefits

1. Introduction

Considerable efforts have been invested into the development of standards for health information representation and communication, with an increasing focus on semantic interoperability. SNOMED CT (Systematized Nomenclature of Medicine-Clinical Terms) is increasingly seen as a unifying ontological standard, with the potential to solve many semantic interoperability issues. Yet adoption of SNOMED CT in Europe is slow, and only few countries have actual implementation experiences [1-3]. Consequently, the evidence is scarce on a) the benefits of SNOMED CT for semantic interoperability of eHealth services and b) the challenges associated with the adoption of a comprehensive clinical terminology.

The EU-funded ASSESS CT project investigates the fitness of SNOMED CT as a potential standard for EU-wide eHealth deployments. To cover core implementation aspects, the project analyzed SNOMED CT's impact from technical, business, organizational, governance and socio-economic viewpoints [4]. This paper presents the interim results of the socio-economic analysis of SNOMED CT. The main contribution is the development of an Economic Assessment Model that can be used to assess SNOMED CT and other terminologies' socio-economic impact systematically. Such

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economic assessments are valuable for public authorities when deciding on future investment in clinical terminologies, because they allow customization to different contexts, and help to forecast the likelihood of a reasonable return on investment.

2. Method

for each specific stakeholder are needed. Monetary values have to be assigned for the economic performance to be evaluated. This enables, in the aggregate, potential common patterns, trends and relationships to be identified. The method that supports the linking of these data is cost-benefit analysis (CBA). CBA allows different outcomes to be evaluated through common measures, and it can reflect a different allocation of resources before and after an investment. A key merit of CBA is that it allows for comparative, as well as single-option evaluation over time (e.g. comparing two terminologies, or observing the accruing costs and benefits for a specific terminology).

Costs and benefits are captured in indicators, which are central to the assessment. The cost and benefit indicators in Assess CT are measurable outputs comprised of variables incorporated into formulae. Combined, these indicators provide the socioeconomic data that allow assessing interventions, such as the regional or national adoption of SNOMED CT in Europe. The indicator development process is depicted below.

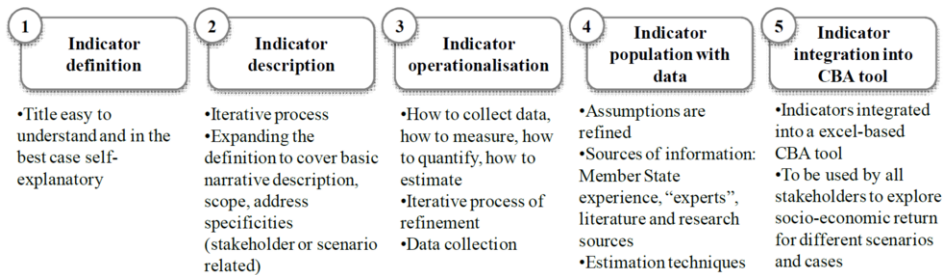


Figure 1. Approach to indicator development in the ASSESS CT project

2.1. Development of indicator definitions and indicator description

The following activities allowed us to identify and describe indicators

- *Documentation of methodological challenges in existing studies.* Through a systematic literature review we got an overview of the scarcely documented costs and benefits for clinical terminology implementation, and showed that especially existing benefit indicators were often speculative i.e. not based on real evidence.
- *Cost indicator development and validation.* Existing cost indicators were analyzed, and new ones added by the ASSESS CT socio-economic working group. The group, which are also the authors of this paper, was multidisciplinary with representatives from academia as well as eHealth authorities and health insurance and have experience within socio-economic analysis of eHealth solutions, and SNOMED CT implementation. The cost indicators were evaluated in terms of definition and relevance for national semantic interoperability strategies by European eHealth stakeholders at the

1stASSESS CT validation workshop both individually using questionnaires and through group work and discussions. Data analysis allowed a consolidated list of cost indicators to be developed.

- *Benefit indicator development and validation.* The socio-economic working group analyzed data collected in ASSESS CT through focus groups, questionnaires and case studies. We used the analysis of implementation experiences to confirm or reject theoretical benefit indicators. In addition, we discussed which benefit indicators were most important to stakeholders at the 2nd ASSESS CT validation workshop, still with focus on real implementation experiences. Data analysis allowed a consolidated list of benefit indicators to be developed. Contrary to cost indicators, benefits, at this stage of the analysis, can only be defined as measurable units in concrete use case or case studies.

2.2. Indicator operationalisation, population with data, and integration into CBA tool

Operationalization of indicators means that each indicator needs to be made quantifiable, and indicator population means finding these quantities. The socioeconomic working group established an initial operationalization. To validate the operationalization and populate indicators with data, a Danish-Swedish implementation cost-benefit study was performed including a dedicated focus group where key stakeholders from eHealth authorities and national implementation projects in Denmark and Sweden were asked to quantify cost and benefits of their projects, for example national translation projects and development of national terminology subsets. However, where actual evidence was not available, assumptions needed to be made. For the example Skills development and training, appropriate assumptions need to be made regarding: the average number of trainers needed; possible sources of information are country reports on implementation experience; average number of meetings needed. This is highly dependable on the scope of training as well as the number of trained staff, their level of understanding, etc.; and how much is lost in € when a professional spends time off work to be trained. The indicators were implemented in a Microsoft Excel-based CBA tool, based on earlier developments in the assessment and evaluation for e-service deployment in health, care and ageing [5].

3. Results

3.1. Indicator definitions and indicator description

When defining indicators, we aimed for short and precise definitions that are easy to understand without additional information. For example, “Legacy costs” carried a wide set of meanings, so we chose a more specific definition - “Legacy costs of administration”. As an overview, the set of cost indicators developed in the ASSESS CT project is presented in Table 1, and the provisional set of major benefit indicators is presented in Table 2. Notice that the latter is exclusive to the adoption of SNOMED CT.

Table 1. List of cost indicators for potential large scale clinical terminology implementation

Nr	Cost indicator
Costs related to organisational infrastructure	
C1	License costs
C2	Decision making costs for adoption of terminologies
C3	Release management costs
C4	National Release Centre (NRC) costs
C5	Legacy costs of administration
C6	Promoting Implementations
Costs related to technical infrastructure	
C7	Translation costs
C8	Mapping costs
C9	Customisation costs
C10	Implementation testing costs (user pilots, user interface)
C11	Integration into software products
C12	Terminology Binding Costs
Cost related to capacity-building	
C13	Skills Development and Training costs
C14	Educational material costs
Cost related to tools	
C15	Terminology management system (TMS) costs

Table 2. List of benefit indicators for potential large scale clinical terminology implementation

Nr	Benefit indicator
B1	Terminology across professional boundaries
B2	Enhancing clinical decision support systems and medication procedures
B3	Patient-friendly terms for complex medical language
B4	Capture clinical details and reporting for administration purposes
B5	Useful analytics for clinical audits, population health management and research
B6	Interlingua standard supporting vendors and users; Enhancement to vendor systems
B7	Enabling cross-border interoperability
B8	Up-to-date terminology supporting open-ended needs

The description of each indicator includes scope, specificities, and assumptions about the size and form of the indicator across the different scenarios. For example, the description of the indicator “Skills development and training” is presented in Figure 2.

Description	Skills development and training costs covers all existing training costs. This indicator subsumes costs related to: <ul style="list-style-type: none">• instructors training costs,• user skills development costs,• provider skills development costs, and• NRC skills development.
Scope	The costs for the NRC skills development concerns IHTSDO membership commitments (like IHTSDO organisation and management, financing, participation in groups etc.) and are also included here. A separate cost indicator is used for NRC costs associated with establishing the organisation and recruiting the people of the NRC.
Specificities (scenario related)	ADOPT: The costs are relatively low because of support from the IHTSDO (partly included in the license fee). ALTERNATIVE: substantial costs due to a greater number of terminologies that need to be managed. ABSTAIN: substantial costs because countries have to define their own “documentation standard”, such decentralisation requires more resources.
Assumptions	<i>Assumption 1: Applying SNOMED CT compared to other terminologies will require more and other skills than those need for other systems, e.g. statistical classifications. However, managing and knowing a variety (as opposed to just one) of terminologies in detail may be more costly.</i> <i>Assumption 2: ...</i>

Figure 2. Elements of the indicator description

3.2. Indicator operationalization and indicator population with data

The data collected from the Danish-Swedish case study meant that for each indicator, the appropriate variables and metrics could be identified. In the indicator example “Skills development and training” the variables form the following equation:

$$\text{Skills development and training costs} \quad \Sigma = \frac{\text{Costs for trainers} + \text{Materials, meetings, consumables costs} + \text{Labour costs}}{\quad} \quad (1)$$

The assessment framework allowed for cost items (within indicators) to be assigned to different stakeholders, as the underlying CBA tool is stakeholder-centric.

We populated the CBA tool using the data from the Danish-Swedish case study, as well as most appropriate assumptions. The indicators were implemented in the Microsoft Excel-based CBA tool, to become part of a public project deliverable available to the community. Interested parties can use the tool to perform their own analyses for a specific case. Comprehensive information based on the indicator descriptions, available figures and assumptions are incorporated to guide them through the assessment process.

4. Discussion

The ASSESS CT project has developed the first draft of an economic assessment model to base any impact assessment on scientific methodologies, real observations, and actual data. Several methodological challenges exist, e.g. a key step towards assessing SNOMED CT is to fill the indicators with real data, i.e. figures and monetary values. We based our analysis on the Danish-Swedish case study, but still rely heavily on “best guesses”. However, similar projects have also had difficulties finding such data. For example, the IHTSDO commissioned report on ‘Building the Business Case for SNOMED CT’ offers some extensive analysis of costs and benefits that may arise from the adoption of SNOMED CT, but does not provide a single case study or example where actual costs or benefits were quantified [6]. The strength of our approach is that indicators and assumptions are implemented in a customizable CBA tool, which can be refined whenever better data becomes available. The next step is to a) finalise the CBA method and b) produce a toolkit for general use by practitioners, scientists, and policy-makers alike.

Acknowledgments

ASSESS CT has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 643818.

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