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The HTA Core Model®—10 Years of Developing an International Framework to Share Multidimensional Value Assessment

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ABSTRACT

Background and Objectives: The HTA Core Model® as a science-based framework for assessing dimensions of value was developed as a part of the European network for Health Technology Assessment project in the period 2006 to 2008 to facilitate production and sharing of health technology assessment (HTA) information, such as evidence on efficacy and effectiveness and patient aspects, to inform decisions. **Methods:** It covers clinical value as well as organizational, economic, and patient aspects of technologies and has been field-tested in two consecutive joint actions in the period 2010 to 2016. A large number of HTA institutions were involved in the work. **Results:** The model has undergone revisions and improvement after iterations of piloting and can be used in a local, national, or international context to produce structured HTA information that can be taken forward by users into their own frameworks to fit their specific needs when informing decisions on technology. The model has a broad scope and offers a common ground to various stakeholders through offering a standard structure and a transparent set of proposed HTA questions. It consists of three main components: 1) the HTA ontology, 2) methodological guidance, and 3) a common reporting structure. It covers domains such as effectiveness, safety, and economics, and also includes domains covering organizational, patient, social, and legal aspects. There is a full model and a focused rapid relative effectiveness assessment model, and a third joint action is to continue till 2020. **Conclusion:** The HTA Core Model is now available for everyone around the world as a framework for assessing value.

Keywords: decision making, health care, health technology assessment, methodology.

Introduction

This article aimed to present the ideas behind the HTA Core Model® (hereafter referred to as "the model") and its development, piloting, and implementation as a framework for production and sharing of health technology assessment (HTA) information. We find that a scientific discussion on value frameworks should be informed about our network's experience. It is important to underline that the model, although developed in Europe, is generic and is thus for global use. This model comes from the European network for HTA (EUnetHTA), which involves more than 70 institutions in 32 European countries since 2006 and is supported by the European Union [1].

Value frameworks, explicit and nonexplicit, vary across health care decision contexts such as pricing and reimbursement of pharmaceuticals and the formulation of clinical pathways and practice guidelines. They involve varying compositions of decision makers and stakeholders. Nevertheless, a substantial amount of scientific evidence on health technologies (e.g., evidence of efficacy and effectiveness) is relevant and applicable across organizational and national contexts. There is therefore a great potential in sharing and reusing information (the "building bricks") if this can be done in a reliable way and through a shared repository.

Building on previous international work, the intention in developing the model was to enable transparent structures, procedures, and standards for handling evidence and information across various forms of HTAs, economic evaluations, and other forms of assessments of the value of interventions—and across institutions and countries [2].

In 2004, ministries of health in 25 European countries and the European Commission were developing policies regarding patient mobility across borders within the European Union. Researchers

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from 17 of these countries provided scientific considerations in this policy development on how a science-based policy-oriented cooperation could produce so-called common core information ("global evidence") on a technology to be combined with context-specific information for adaptation into national HTAs [3]. This led to the development of the model in the EUnetHTA project in the period 2006 to 2008 [2,4]. Subsequent development and testing of concept, applications, joint productions, and usability took place in two consecutive projects (Joint Actions 1 and 2 [JA1 and JA2]) from 2010 to 2016.

The Model

The model is built to enable broad-scoped, multidisciplinary HTA, be it comprehensive (broad scope) or rapid (limited scope), done early or late in the life cycle of a technology (Fig. 1). The aim of the model is to 1) improve the applicability of evidence and information for HTA across (e.g., national or regional) HTA projects; 2) enable actual collaboration between HTA agencies by providing a common framework for the production and reporting of HTA information; and 3) reduce unnecessary duplication of work.

The model reflects the generic broad scope and multidisciplinary nature of HTA and consists of three main components:

1. The HTA *ontology* that encompasses 136 standardized questions called *assessment elements* within a framework with nine *domains* (such as effectiveness, safety, organizational, economic, patient, and social aspects) that comprise all aspects potentially relevant for HTA and thus value assessment (Fig. 1). The assessment elements are potentially relevant for the assessment of a health technology. Each element contains a question that researchers should consider to include and answer in a specific assessment project. Here are a few examples [2,5]:
   Topic: Features of the technology; Issue B0002: What is the claimed benefit of the technology in relation to the comparators?
   Topic: Health delivery process; Issue G0002: What kind of involvement has to be mobilized for patients/participants and important for others and/or caregivers?
   Topic: Resource utilization; Issue G0007: What are the likely budget impacts of implementing the technologies being compared?
2. *Methodological guidance* that foremost recommends the use of already existing, generally recognized methods guidance (e.g., EUnetHTA guidelines or Cochrane Handbook), along with other methodological recommendations.
3. A common *reporting structure* that provides a standard format for recording and displaying the results of a specific HTA in *collections*, in which the resulting information is displayed within so-called *result cards* containing the answers to the specific research questions defined by using the ontology [3,6]. The modular and hierarchical structure enables researchers to "scan" the ontology and focus on producing information relevant for decision making on the technology at hand. Transparent reporting enables review of the information at a highly detailed level.

Methods

During the initial years from 2006 to 2008, a general design team led the development together with a lead organization, the Finnish Office for HTA [2]. More detailed work was done in nine multidisciplinary "domain teams." Sixty researchers from 12 countries participated in the model development and piloting, and 34 reviewers commented on the work. Details are available in the EUnetHTA project technical report [7].

Since 2006, multidisciplinary teams of researchers and managers in EUnetHTA partner institutions; stakeholders including payers, patients, providers, and industry organized in a stakeholder forum; and the European Commission were involved in the development, field testing, and implementation of the model [5, 8]. Table 1 lists the partner organizations that participated in EUnetHTA JA2. The development and application of the model in joint piloting and production in EUnetHTA were rigorously defined in agreed research protocols, leading to publication of joint assessments intended for adaptation into national contexts. The EUnetHTA Web site has been live since 2006 and includes archived outputs [1].

Figure 2 describes the temporal relation between the publishing of the model versions, the HTA Core Model Handbook [6], joint assessments [9], and 14 methodological guidelines to help the assessors of evidence to process, analyze, and interpret the data [10]. The EUnetHTA output also includes a planned and ongoing projects database with standardized information reported by the partners [11], evidence submission templates for requesting evidence from companies [12], work on evidence generation (early scientific advice and additional evidence generation) [13,14], and a list of the national uptake of EUnetHTA joint assessments [15].

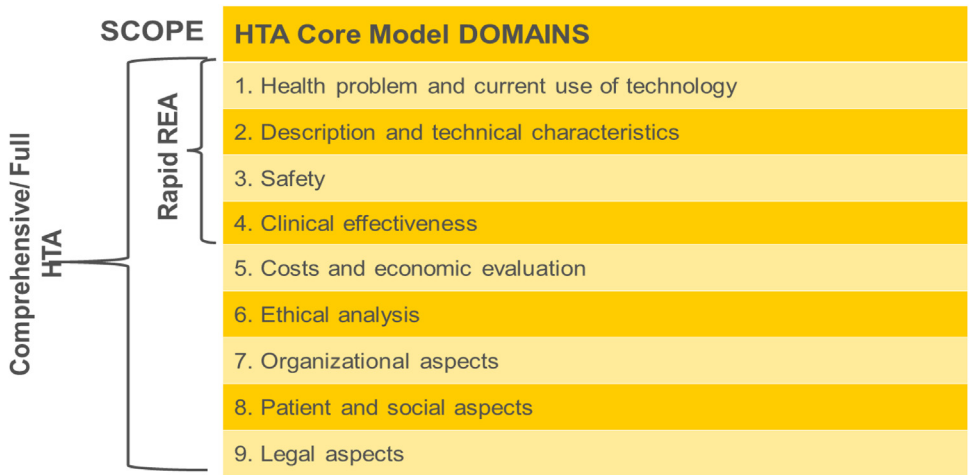

Fig. 1 – The domains of the HTA Core Model. HTA, health technology assessment; REA, relative effectiveness assessment.

Table 1 – EUnetHTA JA2 participating institutions.

Country	Participating institution
	Associated partners (organizations nominated by a ministry of health to participate in EUnetHTA JA2)
Austria	Hauptverband der Österreichischen Sozialversicherungsträger
	Gesundheit Österreich GmbH/Geschäftsbereich
	Ludwig Boltzmann Institut für Health Technology Assessment
Belgium	Belgian Health Care Knowledge Centre
Bulgaria	National Centre of Public Health Protection
Croatia	Agency for Quality and Accreditation in Health Care and Social Welfare
Cyprus	Ministry of Health, Department of Pharmaceutical Services, Ministry of Health Cyprus
Czech Republic	Ministry of Health of the Czech Republic
Denmark	Danish Health and Medicines Authority
	HTA and Health Services Research, Public Health and Quality Improvement, Central Denmark Region
Estonia	Tartu University Department for Public Health
Finland	National Institute for Health and Welfare
	Finnish Medicines Agency
France	Direction générale de Santé/Haute Autorité de Santé
Germany	Deutsches Institut für Medizinische Dokumentation und Information
	Institute for Quality and Efficiency in Health Care
Greece	National School of Public Health
Hungary	National Institute of Pharmacy and Nutrition (former: National Institute for Quality and Organisational Development in Healthcare and Medicines)
Ireland	Health Information and Quality Authority
Italy	Agenzia Nazionale per i Servizi Sanitari Regionali
	Agenzia Italiana Del Farmaco
	Regional Agency for Health and Social Care—Emilia Romagna
	Regione Veneto
Latvia	National Health Service
Lithuania	State Health Care Accreditation Agency
Malta	Directorate for Pharmaceutical Affairs, Ministry for Health, the Elderly and Community Care
The Netherlands	Zorginstituut Nederland
Norway	Norwegian Knowledge Centre for the Health Services
Poland	Agency for Health Technology Assessment and Tariff System (former: Agency for HTA in Poland)
Portugal	National Authority of Medicines and Health Products
Romania	National School of Public Health, Management and Professional Development
Slovakia	Ministry of Health
Slovenia	National Institute of Public Health
	Institute of Economic Research
Spain	Instituto de Salud Carlos III
Sweden	Swedish Council on Health Technology Assessment
United Kingdom	National Institute for Health and Care Excellence
	NIHR Health Technology Assessment Programme, NIHR Evaluation, Trials and Studies Coordinating Centre
	Collaborating partners (organizations not nominated by a ministry of health that contributed in kind)
Austria	University for Health Sciences, Medical Informatics and Technology
	Donau Universität Krems
Belgium	Rijksinstituut voor Ziekteen Invaliditeitsverzekering
Bulgaria	Medical University of Sofia
	National Council for Pricing and Reimbursement of the Medicinal Products (joined July 31, 2013)
Croatia	Croatian Health Insurance Fund (joined April 24, 2014)
Denmark	Danish Institute for Local and Regional Government Research
Germany	National Cluster of Excellence, Health Technologies—Medical Valley EMN, University of Erlangen-Nuremberg, Interdisciplinary Centre for Health Technology Assessment and Public Health, Medical Valley EMN
	Gemeinsamer Bundesausschuss
Ireland	National Centre for Pharmacoeconomics, St. James Hospital
Italy	Department of Economics, Law and Institutions, University of Roma Tor Vergata
	University Hospital "A. Gemelli"
Lithuania	State Medicines Control Agency– (joined May 19, 2014)
Luxembourg	Inspection générale de la sécurité sociale, Cellule d'expertise médicale
	Administration du Controle Médical de la Securité Sociale (joined May 14, 2013)
Russia	National Center for Health Technology Assessment
Spain	AVALIA-T, Galician Agency for Health Technology Assessment
	The Andalusian Agency for Health Technology Assessment
	Spanish Ministry of Health, Social Services and Equality
	Directorate General for Pharmacy and Health Care Products (Spanish Ministry of Health, Social Policy and Equality)

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Table 1 – *continued*

Country	Participating institution
	Basque Office for Health Technology Assessment
	Agency for Health Quality and Assessment of Catalonia
	Health Technology Assessments Unit, Subdirección General de Tecnología e Innovación Sanitarias. Consejería de Sanidad
	Evaluation AND Planning Unit—Directorate of the Canary Islands Health Service (joined December 4, 2013)
	Instituto Aragonés de Ciencias de la Salud (joined December 4, 2013)
Sweden	Dental and Pharmaceutical Benefits Agency
Switzerland	Swiss Federal Office for Public Health
Turkey	Turkish Evidence Based Medicine Association
	Republic of Turkey, Ministry of Health, General Directorate of Health Researches
	The Scientific and Technological Research Council of Turkey-Industrial Management InstituteHealth Economics and Management Research and Development Division, TÜBİTAK-TÜSSİDE
United Kingdom	Healthcare Improvement Scotland

Note. The Danish Health and Medicines Authority was the JA2 coordinator.
EUnetHTA, European network for Health Technology Assessment; JA2, Joint Action 2; NIHR, National Institute for Health Research.

Results

Model Applications (Full or Rapid) for Different Types of Technologies

Distinct *applications* were developed by the EUnetHTA to contain tailored subsets of the full model to be used for the assessment of four different types of technologies: pharmaceuticals, medical and surgical interventions, diagnostic technologies, and screening. The full model applications contain assessment elements distributed in all nine domains. An application was also developed for rapid relative effectiveness assessment (REA) to cover a more limited range of research questions, allowing a swifter, focused HTA information production.

The nine domains in the model are interconnected in numerous ways. For example, the costs and economic evaluation domain includes the possibility of using existing economic information as well as conducting de novo evaluations. Hence, it typically uses information from other domains, such as the organizational aspects domain or the patients and social aspects domain, to provide information on costs and affordability, as well as information from economic evaluation(s). Information from the costs and economic evaluation domain and other domains can be useful when constructing and populating clinical condition or jurisdiction-specific decision models.

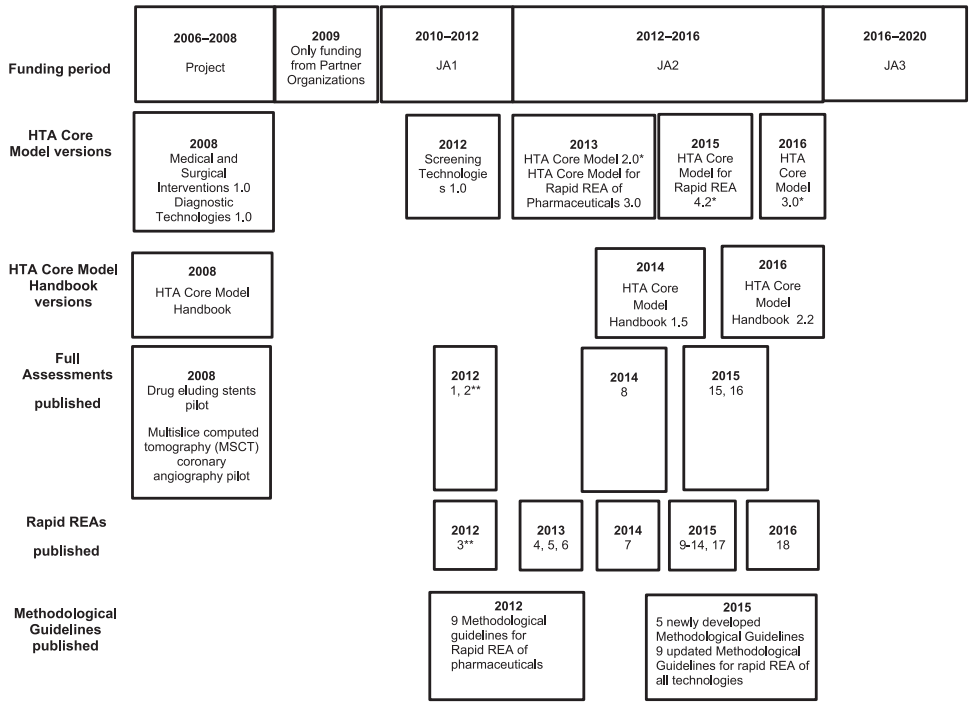

Fig. 2 – The timelines of funding and publishing HTA Core Model versions, handbook versions, and joint assessments. HTA, health technology assessment; REA, relative effectiveness assessment.

Piloting and Using the Model Applications in Practice

Table 2 presents the assessments done with the model (full or rapid), published by the EUnetHTA in JA1 and JA2 between 2012 and 2016. These are all available on the EUnetHTA homepage [16].

Two joint assessments were produced in JA1 by using one of the applications of the full model with all nine domains with 7 to 22 partners participating per pilot assessment, and in JA2 with three more domains with 6 to 8 partners each. In JA1, an REA of a pharmaceutical was done with 22 partners. JA2 produced 6 REAs on drugs and 6 REAs on other technologies (5–9 partners, of which 2 were the main authors).

HTA Core Model for Full Assessment

Two forms of collaboration were tested during JA1. In one of the collaborative forms, each domain was managed by researchers from different agencies, and in the other each domain was managed by one agency. JA2 was dedicated to testing the capacity of national HTA bodies to produce structured core HTA information together and apply it in national context. Figure 3 shows the procedure of topic selection in JA2. Three full assessments were produced by adopting a mixed form of collaboration (some domains were managed by one agency and others by mixed teams) [9]. More experience is needed in applying the full model before a best structure of project management can be verified [1].

Table 2 – Joint assessments in EUnetHTA JA1 and JA2.

EUnetHTA JA1
Full/comprehensive assessments
Abdominal aorta aneurysm screening [1]
Prognostic tests for breast cancer recurrence [2]*
Rapid REA of pharmaceuticals
Pazopanib for the treatment of advanced renal cell cancer [3]
EUnetHTA JA2
Full/comprehensive assessments
Fecal immunochemical test vs. guaiac-based fecal occult blood test (for colorectal cancer screening) [8]
Use of intravenous immunoglobulins for Alzheimer disease including mild cognitive impairment [15]
Structured telephone support for adult patients with chronic heart failure [16]
Rapid REA of pharmaceuticals
Canagliflozin for the treatment of type 2 diabetes mellitus [7]
Sorafenib and its use for the treatment of progressive, locally advanced or metastatic, differentiated (papillary/follicular/ Hürthle cell) thyroid carcinoma refractory to radioactive iodine [10]
Rapid REA of new pharmaceuticals for the treatment of chronic hepatitis C [17]
Ramucirumab in combination with paclitaxel as second-line treatment for adult patients with advanced gastric or gastroesophageal junction adenocarcinoma [11]
Vorapaxar for the reduction of thrombotic cardiovascular events in patients with a history of myocardial infarction [13]
Zostavax for the prevention of herpes zoster and postherpetic neuralgia [5]
Rapid REA of other technologies
Balloon eustachian tuboplasty for the treatment of eustachian tube dysfunction [9]
Biodegradable stents for the treatment of refractory or recurrent benign esophageal stenosis [12]
Duodenal-jejunal bypass sleeve for the treatment of obesity with or without type II diabetes mellitus [4]
Endovascular therapy using mechanical thrombectomy devices for acute ischemic stroke [18]
Renal denervation systems for treatment-resistant hypertension [6]
Transcatheter implantable devices for mitral valve repair in adults with chronic mitral valve regurgitation [14]

EUnetHTA, European network for Health Technology Assessment; JA1 and JA2, Joint Actions 1 and 2; REA, relative effectiveness assessment.
* Numbers correspond with numbering in Fig. 2.

HTA Core Model for Rapid REA

The model application for REA was initially developed for pharmaceuticals with the intent to produce HTA information within a limited time frame (90–180 days, European Transparency Directive 89/105/EEC) [17]. The focus is on only the four "clinical" domains of the model (Fig. 1). Nevertheless, aspects in other domains that may need to be addressed in-depth can be screened with a checklist. Even though strict time frames do not apply to nonpharmaceutical technologies, the rationale for rapid assessments can be justified by the need for producing timely information for pending (e.g., reimbursement) decisions in national settings. Thus, the model application for REA was expanded to nonpharmaceutical technologies encompassing devices, diagnostics, surgical interventions, and screening.

The results of several rounds of joint assessments and revisions of the rapid REA model (Fig. 2) led to changes over time in three areas:

1. Focus on strict project and time management procedures facilitated collaboration on assessments, and responsibility for leading the large number of partners was placed with one agency (first author) supported by a second main contributor (second author).
2. Scientific coordination across EUnetHTA's activities (which also includes scientific advice to manufacturers on evidence generation prelaunch and postlaunch) has led to a shared understanding that the model can be used as a framework at any stage and for any applied scientific purpose in a technology's life cycle.
3. To increase the usability of the rapid REA model, the reporting structure for rapid REA was modified to contain domain reports instead of collection of result cards.

Further key learnings are that despite differences from and between national reports, the joint assessments included nearly all comparators, end points, trial designs, and methods of analysis that were used in national/local reports on the same technologies [18]. This means that individual organizations would be able to find the key results for their national reporting.

The application for REA of pharmaceuticals was used in five single-technology assessments and in one dealing with several pharmaceuticals (for hepatitis C) [9]. Except for the latter, the topics for REA of pharmaceuticals depended on volunteering manufacturers. Of the six REAs of "other technologies" (clinical procedures, diagnostics, and devices), four were dealing with several devices and two with single technologies [9].

Continuous Development

The model is continuously under evaluation taking into consideration feedback from users and critical quality reviews by partners, stakeholders, and public consultation. Methodological standards and procedures for full HTA and for rapid REA production are now available as a part of the HTA Core Model Handbook and as separate documents [16,19,20].

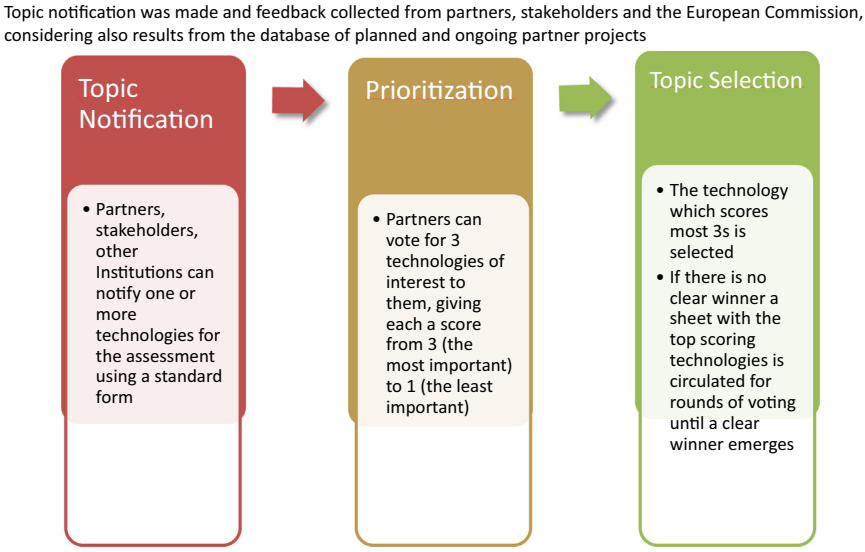

Fig. 3 – Topic selection procedure for full HTAs. HTAs, health technology assessments.

The most recent version of the HTA Core Model (version 3.0) was published in 2016 and was based on feedback from the teams that piloted the model and used it in joint production and a comprehensive protocolled work to produce recommendations for improvement. This took into account the needs of the EUnetHTA internal users as well as external potential users of the model (e.g., results of a project with an industry stakeholder organization [21]). This updated version will be applied and further developed in JA3 (2016–2020) [22].

A set of guiding principles on use was published by the EUnetHTA in January 2016, laying out basic principles of the model's use [23]. They offer a common ground to various stakeholders to fit their specific needs at all stages of the development of health technologies, be it for assessment frameworks, clinical development and market access planning, decision support systems, or statistical and economic models. Users in general may choose which model application best fits their needs and whether they use the whole application or only parts of it, or create their own collection of issues from the model. In fact, flexibility in choice and order allows researchers to select questions from the generic model and build them into a structure of reporting, tailored to the needs of the user [19].

Discussion

During EUnetHTA JA2, the value of the model and the capacity of HTA agencies to use the model and collaborate on production were shown. Experience from piloting the standardized structure, format, and methods shows that to realize added value for national (or regional) health authorities and manufacturers, some critical success factors for cross-border assessments are essential [24–27]. The most important issues that also increase the national uptake are selection of relevant topics and timing of assessments. Equally important is finding the right dimensions and expertise of research teams, and improving standardization of procedures across agencies in the EUnetHTA [28]. This will be central in JA3. Equally central will be the national uptake and adaptation of joint work, which was not satisfactory by the end of JA2, with only 68 examples in the quarterly updated list of national uptake [15]. At present, the minimum requirement for recognizing that a national adaptation has taken place is only the inclusion of an explicit reference to a EUnetHTA joint assessment on which the local report was based.

Although pharmaceuticals enter the European market at one time, medical devices and procedures enter the European health care market in a time span of 1 to 5 (and even more) years after European conformity marking [29,30]. The time taken for the diffusion of medical devices across countries has an important impact on the aim to reduce redundancy. A shared electronic repository of HTA information provided as an information technology tool is currently available for EUnetHTA partners through the HTA Core Model Online [19,31]. For pharmaceuticals, JA2 has shown that the REA production process is approaching optimal timelines (i.e., timeliness in relation to the publication of the European public assessment reports by the European Medicines Agency) and this way the impact and usability of the joint assessments are increasing.

Although two of the three technologies that underwent a comprehensive HTA during the JA2 were relatively new with limited real-world evidence available, the piloting of the comprehensive HTAs provided valuable experience on both the management and the scientific sides [28]. In particular, the ability to recognize the value of a technology beyond its effectiveness and cost-effectiveness through a methodologically sound analysis of, for example, organizational, patient, and social aspects enhanced the utility of assessment and its suitability for decision makers [32]. Because this broad approach requires more resources and time, it should be adopted at the European level for selected technologies (e.g., potentially disruptive or very high-cost technologies) and for re-assessment of technologies already in use that entered the market early with little evidence of effectiveness [33].

The systematic and transparent structure of the model has proved to be especially valuable when "late assessors" of medical procedures and devices can build on the work of "early assessors," when scarce, often noncomparative clinical evidence available shortly after European conformity marking advances toward more mature evidence (e.g., randomized controlled trials and clinical databases) along the life cycle of the technologies [28].

The commitment of so many organizations and countries in EUnetHTA's development of tools for HTA collaboration shows that there is a clear need for standardized HTA information, ultimately resulting in assessments with better quality and less duplication of effort. The HTA Core Model is now available for everyone around the world as a framework for assessing value.

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