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Ranking medical innovations according to perceived health benefit

Jilles M. Fermont[a,b,*], Karla H.P. Douw[a], Hindrik Vondeling[a], Maarten J. IJzerman[a]

[a]*Department of Health Technology and Services Research, MIRA institute for Biomedical Technology & Technical Medicine, University of Twente, The Netherlands*
[b]*Health Economics Research Centre, Nuffield Department of Population Health, University of Oxford, Old Road Campus, Headington, Oxford OX3 7LF, UK*

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Abstract
Objectives: In 2001, Fuchs and Sox published a landmark study on the relative importance for patients of thirty preselected medical innovations in the United States. About a decade later, we replicated the study in the Netherlands in response to the continuing debate on rising healthcare costs. The aims were to provide an updated list of medical innovations, categorise these according to their impact and novelty, provide a ranking according to the perceived health benefit by Dutch clinical and health technology experts, and draw conclusions for health technology policy making at a macro-level.
Methods: A search to identify medical innovations introduced in healthcare systems between 1990 and 2010 was performed in Medline. The authors categorised the innovations and disagreement was resolved by majority vote. Dutch health technology- and clinical experts from national agencies and medical societies ranked the innovations by means of best-worst scaling experiments in an online survey.
Results: Forty-one technologies (16 pharmaceuticals and 25 non-pharmaceuticals) were included. Of these, nine were categorised as big ticket technology, 24 as add-on and ten as new. Sixty-six clinical and health technology experts ranked these technologies. Self-monitoring of blood glucose and biological therapies for autoimmune diseases ranked highest.
Conclusions: Study limitations prevent making robust conclusions, however, results indicate that many of the identified innovations are add-on technologies, increasing health care cost at only marginal health benefit. If add-on technologies are the trend and healthcare systems aim to provide value for money, policies might need to be adjusted and research and development strategies should be informed at an earlier stage of technological development.

*Corresponding author at: Health Economics Research Centre, Nuffield Department of Population Health, University of Oxford, Old Road Campus, Headington, Oxford OX3 7LF, UK. Tel.: +44 1865 289275.
E-mail addresses: jilles.fermont@dph.ox.ac.uk (J.M. Fermont), kdouw@health.sdu.dk (K.H.P. Douw), hvondeling@health.sdu.dk (H. Vondeling), m.j.ijzerman@utwente.nl (M.J. IJzerman).

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Introduction

The added value of medical innovations in terms of health benefit and their impact on spending has been an issue since the late 1970s among health care providers, patients, hospitals, insurers and policy-makers. Technological change in health care has not only led to vast improvements in health services and the health status of populations, it is also a major driver and perhaps even the most important contributor to increasing health care expenditure [1,2]. In the Netherlands, the contribution of health technology to rising health care costs is a recurrent topic of debate. The National Institute for Public Health and the Environment (RIVM) states that, infused by the global financial crisis, cost reductions will be a primary motive for innovation in the fields of public health and the environment. This financial aspect represents an indispensable part of a strategic research programme within the institute; aiming to produce a balanced assessment of the significance of technological innovations [3]. This is the first study in the research programme, primarily aiming to provide input to support the discussion about the value for money of medical innovations.

In 2001, Fuchs and Sox [4] addressed the issue of the added value of medical innovations and reported on their relative importance for patients. Their study included thirty innovations that had been introduced in the United States during the previous twenty-five years. In 2010, a similar study was conducted by Athanasakis and colleagues in Greece [5]. They identified forty-two relevant innovations over the past thirty years and differentiated between technological and pharmaceutical innovations. In both studies the respondents were physicians. The highest ranked medical innovations in terms of relative importance were imaging techniques and technologies related to cardiovascular disease such as balloon angioplasty. About a decade later, we replicated the study in the Netherlands in response to the continuing debate on rising health care costs. Building onto the two previous studies [4,5], this study aimed to provide (i) an updated list of medical innovations introduced in the past two decades, (ii) categorise these according to their impact on resource use and novelty, (iii) rank the innovations according to the perceived health benefit by Dutch clinical and health technology experts with a broad overview of pharmaceutical and/or non-pharmaceutical innovations (i.e. devices and procedures) and draw policy conclusions. Pharmaceuticals are defined as "any chemical or biological substance that may be applied to, ingested by or injected into humans", a device as "any physical item, excluding drugs, used in health care", and a procedure as "a combination of provider skills or abilities with drugs, devices or both" [6].

Methods

Identifying medical innovations

Informed by experts from the Health Technology Assessment International (HTAi) Special Interest Group on Information Resources, a systematic search was carried out in Medline to identify medical innovations in the period between 1990 and 2010. Between 10 and 17 October 2011, a search for full-abstract articles was carried out in the four most cited general medical journals: the Journal of the American Medical Association (JAMA), British Medical Journal (BMJ), the Lancet, and the New England Journal of Medicine (NEJM).

The following terms were used with the expectation of capturing the most relevant innovations: highlight*, trends*, impact*, breakthrough*, milestone* and discovery*, with the following medical subject heading qualifiers: surgery, rehabilitation, trends, diagnostic use, genetics, prevention control, radiotherapy, instrumentation, therapeutic use, therapy, drug therapy, diagnosis and diet therapy. Only articles in English related to humans were included. The search included 'journal articles', 'meta-analysis' and 'reviews'. A secondary search was conducted through Google Books and Google Scholar to identify books and grey literature, which used the following search terms: medical breakthrough, pharmaceutical innovation, healthcare innovation, medical innovation, breakthrough technologies, and medical discoveries.

Filtering medical innovations

To reduce the extensive list of identified innovations, an initial selection was made based on the following three criteria: (i) the citation frequency of the innovation had to be >100, as recorded by Medline, (ii) the innovation had to be a medical intervention or diagnostic procedure, and (iii) the innovation had to be successfully applied to humans in the period between 1990 and 2010 and granted market approval in healthcare.

Categorising medical innovations

Different ways to categorise medical innovations are used within the scientific literature and in healthcare systems to support the understanding of the impact of medical innovations on health and health care costs. Ways to categorise innovations used by for example EuroScan, the National Institute for Health and Clinical Excellence, the International Network of Agencies in Health Technology Assessment, HTAi, Food and Drug Administration, and the European Medicines Agency were reviewed. The identified categorisations were described and a final selection was made by the commissioners of the study (RIVM) to select systems that were supportive in explaining the relation between technology and health care cost. The innovations were categorised individually into the selected categories by the authors. Detailed descriptions of the different categorisation systems are included in a report that can be obtained from the authors [7].

Ranking of medical innovations

Best-worst scaling (BWS) object case (case 1) was used to rank medical innovations based on their perceived health benefit. With the absence of attribute levels (profiles), bounded to just single objects, case 1 BWS was the most appropriate type [8]. BWS is an increasingly used method in health services research and health technology assessment (HTA) to elicit preferences [9]. It is a choice-based method grounded in random utility theory in which respondents are presented with series of choice-sets [8]. From these choice-sets, respondents have to choose the best (most preferred)