

HTA within the nuclear medicine field: the Dutch Engineer perspective

Sietse van Mossel



Leiden University
Medical Center

**UNIVERSITY
OF TWENTE.**

Today's presentation

IMPORTANT NOTE: I won't show any nuclear medicine procedure

BUT: *We* will do some interactive care pathway engineering

KEY MESSAGE: Buy a bike
and join Vlaanderens Mooiste!



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Buy a bike or a PET/CT scanner?

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Sietse van Mossel • U

PhD candidate (HTA in nuclear medicine)

21 u • Bewerkt •

Every ride of 100 kilometres and more than 2,000 altimeters feels like a health technology assessment of (and tribute to) the non-electric "bike" ▶

Cycling prevents about 6,500 deaths a year in the Netherlands and Dutch people have a six-month longer life expectancy by cycling. Above all, cycling is fun and refreshing!

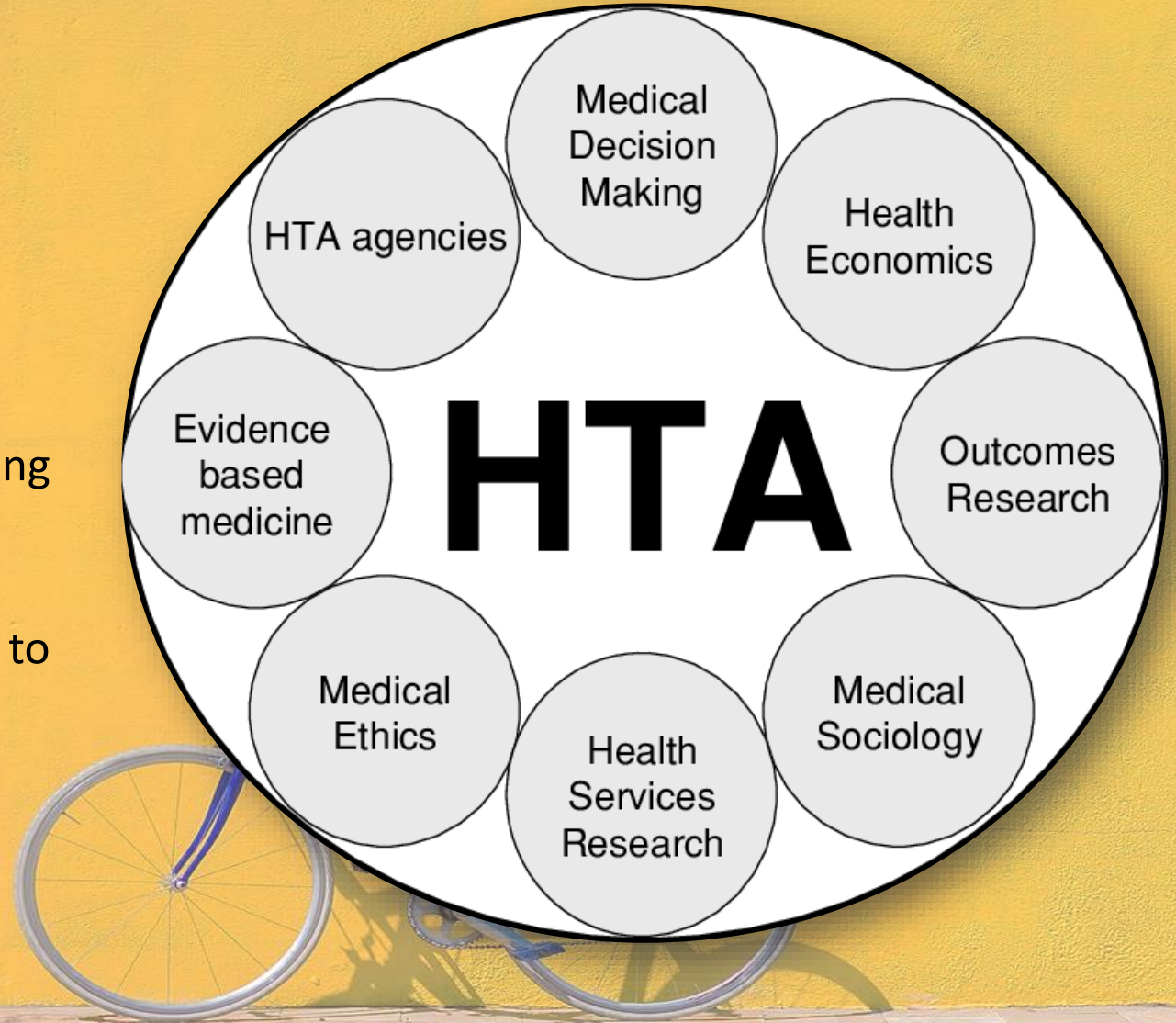
In terms of cost-effectiveness, I bet cycling "beats" any nuclear medicine procedure. [Lioe Fee De Geus-Oei](#), [Sopany Saing](#), [Dennis Vriens](#) Would you rather have a new PET/CT scanner or a new bike? Maybe both?

[#cycling](#) [#bike](#) [#cost_effectiveness](#) [#HTA](#) [#nuclear_medicine](#)



HTA framework

- The purpose is to inform decision-making to promote an equitable, efficient, and high-quality health system
- HTA can be applied to anything related to health care (prevention, diagnostics, medication, medical devices, etc.)



HTA in nuclear medicine in the Netherlands



Ministerie van Volksgezondheid,
Welzijn en Sport

Roadmap

Nucleaire
geneesmiddelenontwikkeling



Ambitie 2035 nucleaire geneesmiddelen

Coördinatie platform

- Bekend en erkend aanspreekpunt voor alle partners in de nucleaire geneeskunde
- Structurele samenwerking en gedragen keuzes
- Verbetering en versnelling van de toegang van patiënten tot innovaties



Kennis- en innovatie agenda

- Grondslag voor brede samenwerking
- Basis voor de identificatie van unmet clinical needs
- Leidend bij het maken keuzes en het kiezen van prioriteiten



Bekijk de online versie van de Roadmap:



Onze ambitie

Nederlandse ontwikkeling van nucleaire geneesmiddelen is wereldwijd toonaangevend en leidt tot een brede toegang van patiënten tot nieuwe behandelperspectieven.



Betere vertegenwoordiging in (subsidie)gremia

- Proactief vormgeven van de randvoorwaarden voor doorontwikkeling
- Actieve participatie in het ontwerpen van subsidieprogramma's en andere financieringsvormen



Communicatiestrategie

- Vergroten van de bekendheid en samenwerking buiten de nucleaire geneeskunde
- Vergroten van bekendheid bij politiek, beleidsmakers en publiek
- Verwerven van invloed op beleid en financieringsinstrumenten



Internationale samenwerking

- Versterken van de internationale positie
- Schaalvergroting
- Structurele toegang tot internationale ontwikkelingen en innovaties



Which HTA element got most attention?



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The image shows a blue landing page for Wooclap. At the top right, there is a 'Help' link with an information icon. The main text describes Wooclap as an online platform for interactive presentations. It explains that users can insert questions into their PowerPoint slides and have the audience participate via web or SMS. The results are displayed in real-time. Below this, it instructs users to sign into their account to select questions for their presentation. A large white button with the text 'Start' is centered on the page. At the bottom, it provides a link to sign up for free on the website.

Health economics within the nuclear medicine field:
the Dutch Engineer perspective



Why health economic evaluations?

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Budgets in healthcare systems are restricted

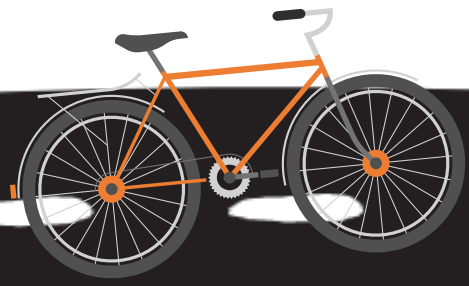


Every euro can only be spent once



How do we get the biggest health bang for our buck?



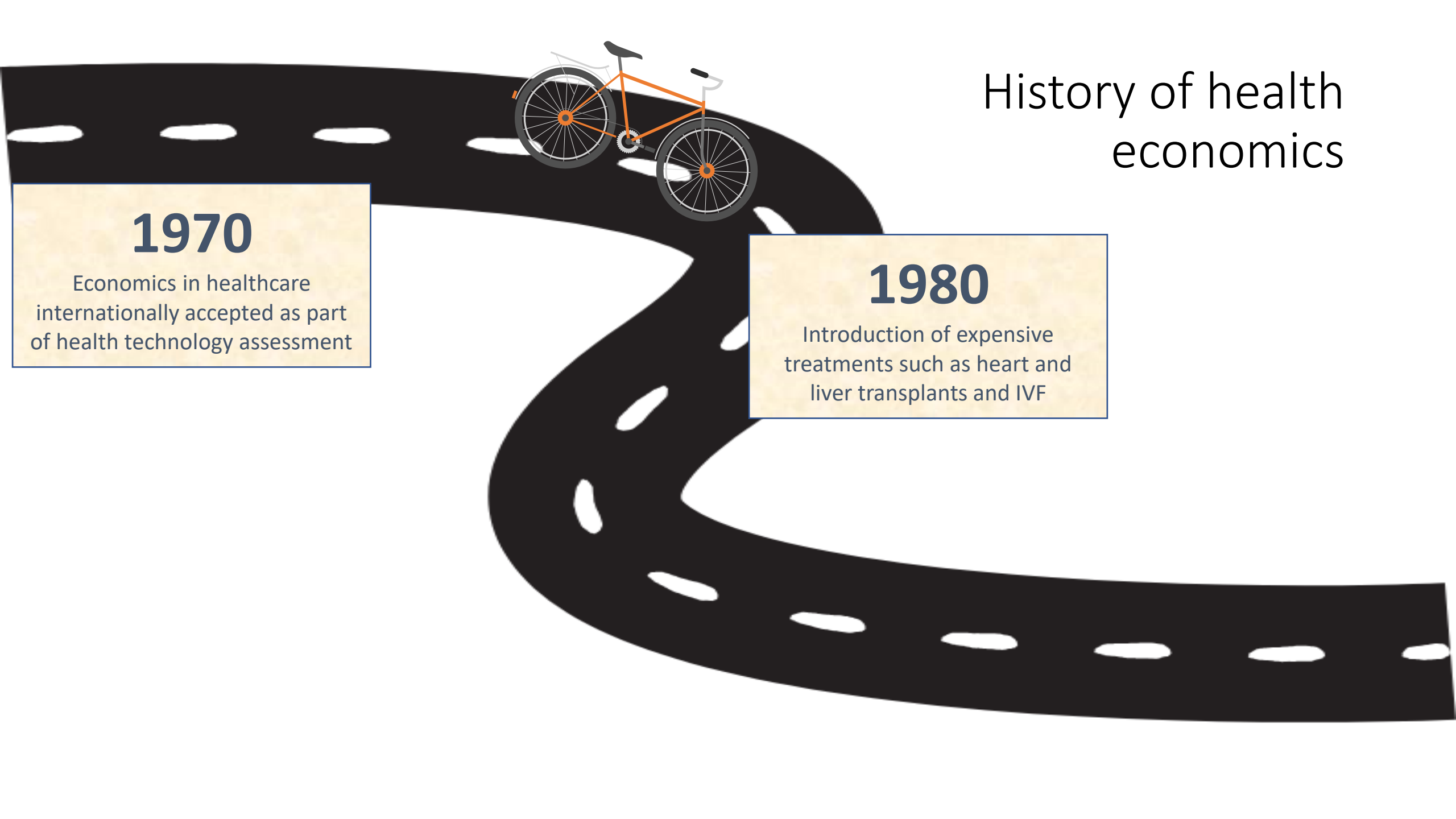


1970

Economics in healthcare
internationally accepted as part
of health technology assessment

History of health economics

History of health economics



1970

Economics in healthcare internationally accepted as part of health technology assessment

1980

Introduction of expensive treatments such as heart and liver transplants and IVF

History of health economics

1970

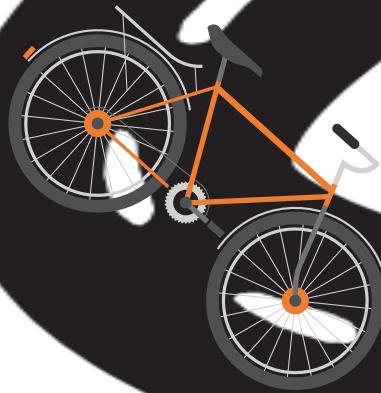
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Systematic studies into cost-effectiveness of expensive new medication



History of health economics

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Reimbursement of a new medication/technology only justified when it has 'sufficient additional value' for patients



History of health economics

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2017

Last Belgian winner of the Ronde van Vlaanderen (Philippe Gilbert)

1990

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2018

Niki Terpstra

2020

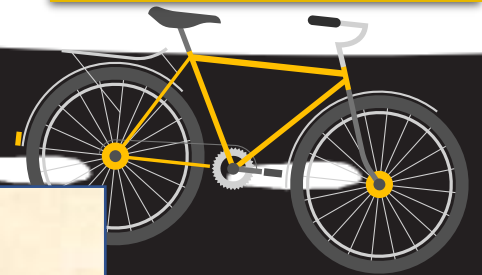
Mathieu van der Poel

2022

Mathieu van der Poel

2024

Mathieu van der Poel



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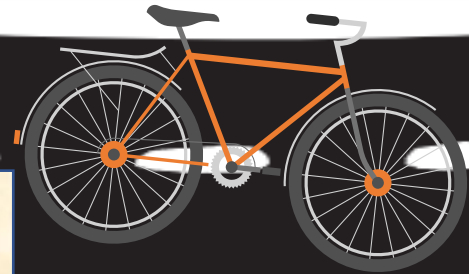
Systematic studies into cost-effectiveness of expensive new medication

Today

BELNUC HTA seminar

2005

Reimbursement of a new medication/technology only justified when it has 'sufficient additional value' for patients



Health economics history in nuclear medicine



Sanjiv Sam
Gambhir, MD,
PhD

Cost-Effectiveness Analysis in Nuclear Medicine

Cost-effectiveness analysis (CEA) is a method for evaluating the health outcomes and resource costs of various patient management algorithms or pathways (sets of tests and interventions that explicitly describe the full management of a patient). CEA remains underutilized by nuclear medicine researchers and also continues to be misunderstood by many health care personnel. This is due in part to the nature of our profession. As nuclear medicine physicians, we often do not understand how the result of a particular imaging study fully affects a particular patient's entire medical/surgical management. This is perhaps best exemplified by oncology management, which is complex, with rapidly changing management options. Yet management is key to understanding how a given nuclear medicine study may play a cost-effective role in patient care. As an example of how serious the rest of the medical profession is about starting to formalize patient management pathways, it is significant to note that the entire November 1996 issue of *Oncology* [1996;10 (suppl)] was devoted to patient management algorithms developed by National Comprehensive Cancer Network member institutions. Updates of these guidelines are expected to be published periodically. Many management guidelines are being developed by various organizations, and nuclear medicine professionals must be careful to ensure that nuclear medicine procedures are appropriately included.

But within nuclear medicine, articles dealing with the subject often continue to use the term *cost-effective* inappropriately. Most studies simply look at the cost components of procedures without considering effectiveness, and although it can be useful to look at cost alone, a study is not complete unless effectiveness is also fully considered. Another misunderstanding is not realizing that costs must include all costs incurred in patient management, not just the costs up to and including imaging. Certainly, if one were trying to optimize costs alone, the solution would be to perform no medical interventions (imaging or otherwise), even for palliative management! Alternately, if one were trying to maximize effectiveness alone, one would perform many tests and interventions that would otherwise be cost prohibitive, assuming the tests and interventions did not lead to any patient morbidity or mortality. In the case of limited health resources it is important to *balance* both costs and effectiveness. According to one commonly accepted definition of cost-effectiveness, it is necessary to determine if a given intervention produces benefits that are worth the additional costs incurred.

The incremental cost-effectiveness ratio (ICER) is one of the most general ways to compare a newly emerging strategy with an existing one. This ratio compares the difference in costs between the two strategies divided by the difference in their effectiveness. Using the ICER, one can arrive at the costs-per-year-of-life-saved for a newly emerging strategy. It is important to note that the exact costs that should be used (e.g., reimbursed costs) and the best

measures of effectiveness (e.g., quality of life) still continue to be highly debated. Nevertheless, many guidelines exist for performing CEA studies, many of which are discussed in articles in the *Journal of the American Medical Association* and the *Journal of Medical Decision Making*. Mathematical details of how to perform CEA are covered in various books and articles. A fairly extensive list of relevant resources (including articles and books on performing CEA) can be found on the Web site of the Decision Analysis Society (<http://www.fauqua.duke.edu/faculty/daweb/dafield.htm>).

Some software packages currently available for use in decision analysis include Data™ (TreeAge Software, Inc., Williamstown, MA) and DecisionPro (Vanguard Software Corp., Cary, NC). Some of the software tools available, such as PrecisionTree (Palisade Corp., Newfield, NY), are directly usable with spreadsheet packages such as Microsoft Excel (Microsoft Corp., Redmond, WA). My laboratory has also developed a physician-friendly decision analysis tool featured in the January 1998 issue of the medical informatics journal *M.D. Computing*. All of these software tools are powerful, but they must be used carefully to arrive at meaningful results. Although there are no reviews comparing all of the various software packages, the Decision Analysis Society has a listing of many of the tools available for various applications.

In the near future, especially in larger hospitals, hospital information systems will track patients through every aspect of their medical care. Such a system is already being tested at Memorial Sloan-Kettering Cancer Center. These systems should allow medical and hospital personnel to track almost every aspect of patient care (from simple blood tests to long-term follow-up). This in turn will allow us to understand many detailed management issues that are currently very difficult to track. Information access will continue to be key in the future of medical management. Decision analysis systems that will operate over the Internet are already under development and should help health care providers share information on patient management algorithms as well as simulate on-line CEA specific to a given hospital or HMO.

CEA is important from many different perspectives. These include the following: (1) helping nuclear medicine physicians understand how a given nuclear medicine study fits into the overall management of a patient, (2) providing objective data that justify the role of a particular study, (3) allowing physicians to understand how poorly a study can perform (e.g., how low can the sensitivity get?) and yet still be cost-effective, (4) allowing answers to "what if" questions (e.g., how expensive can a newly emerging technology be for it to remain cost-effective in a given set of applications?) and in this way help design future technologies, (5) helping nuclear medicine physicians understand what portion of the receiver-operator characteristic curve we should operate at to be most cost-effective (e.g., operate at high specificity to prevent a significant number of false positives that may lead to follow-up procedures with relatively high morbidity) and (6)

NEWSLINE

Invited Commentary

allowing nuclear medicine physicians to present objective evidence to hospitals, insurance companies and even federal regulatory agencies, leading to more rapid acceptance of and reimbursement for newly emerging technologies.

Carefully performed CEA involves collaboration between numerous clinicians, biomathematicians, statisticians and health economists, as well as patients affected by the disease. If the clinical problem is not well modeled, then no analysis can salvage the CEA. Alternatively, understanding the clinical problem is critical, but the mathematical modeling needs to be properly applied to arrive at useful conclusions. Many people are intrigued by the technique but fail to understand its real utility. We as physicians must be careful to provide the best quality of care possible to our patients, but we must also fight to objectively prove the utility of our imaging protocols for various management algorithms. More importantly, we must be willing to accept that some applications of our imaging studies are not cost-effective and should not be utilized purely for economic gains.

For newly emerging technologies (e.g., coincidence imaging with gamma cameras) as well as newly emerging clinical tracers, it is important that proper clinical trials and CEA be performed in conjunction with each other. One can always make a stronger case for a new imaging study if its role in patient management has been proven in a well-designed clinical trial. Many of the CEA studies available to date have been done by combining literature data with existing management algorithms, and they are therefore not as compelling as prospective trials. ADAC Corporation is currently performing a multicenter prospective study utilizing molecular coincidence detection technology for the evaluation of lung cancer staging and solitary pulmonary nodules with fluorodeoxyglucose. Similar studies, in which industry, university hospitals and community hospitals work together, should be encouraged.

Workshops at the Society of Nuclear Medicine (SNM) Annual Meeting in June 1997 presented various aspects of CEA. These

included a workshop in which Dr. David Markoff discussed CEA as it relates to breast cancer and scintimammography. There was also a workshop on the role of positron imaging in lung cancer in which I discussed CEA as it has been applied to non-small cell lung cancer staging and solitary pulmonary nodule diagnosis. A workshop that will cover CEA and lung cancer is planned for the June 1998 SNM Annual Meeting in Toronto. The Institute for Clinical PET also held a workshop on CEA in 1996 and several talks in October 1997.

I expect that there will be more workshops explaining the details of CEA with important new relevant areas of application over the next year. One of the best ways to understand CEA is to apply it to a nuclear medicine procedure of current interest. At the 1997 SNM Annual Meeting, there were 12 presentations and posters that applied CEA to various nuclear medicine procedures. Unfortunately, some of these did not model the effectiveness component, only the cost component. It is likely that articles addressing CEA will continue to increase in number and quality over the next few years. The *Quarterly Journal of Nuclear Medicine* has an issue devoted to nuclear medicine health economics and CEA planned for publication in early 1999. Guest editors for this issue include Professor Michael Maizey and Dr. Peter West (a health economist).

CEA is expected to continue to play a major role in the evaluation of current and future nuclear medicine studies. It is vital that we continue to perform CEA studies and apply the results from such studies with a proper understanding of their limitations. Nuclear medicine can be enhanced only if we continue to aggressively prove the cost-effective role of our procedures while providing the best quality care for our patients.

—Sanjiv Sam Gambhir, MD, PhD, is the director of the computational and communications sciences division at the Crump Institute for Biological Imaging and assistant professor, department of molecular and medical pharmacology, department of bio-mathematics, UCLA School of Medicine.



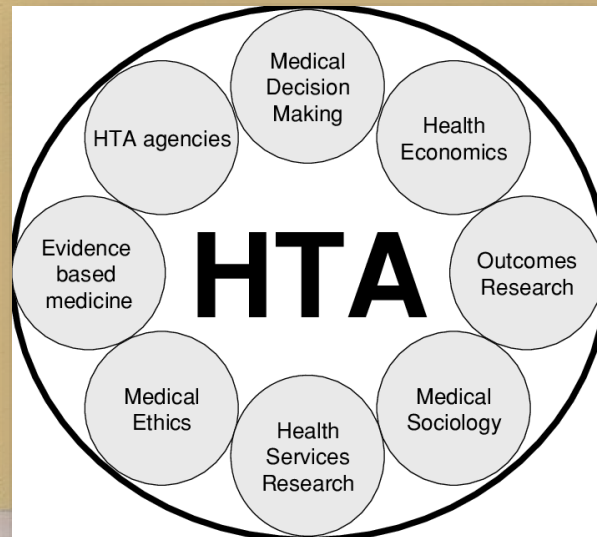
- Health economic studies are underutilised by nuclear medicine researchers and misunderstood by many clinicians
- Studies simply focused on cost components without accounting for clinical effectiveness
- Limited understanding of how the results of a specific imaging study could influence individual patient's treatment planning and outcomes

My background

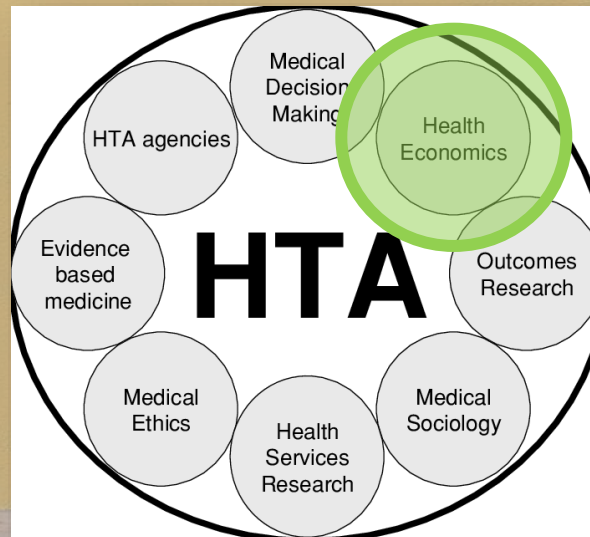


Position of the 'care pathway engineer'

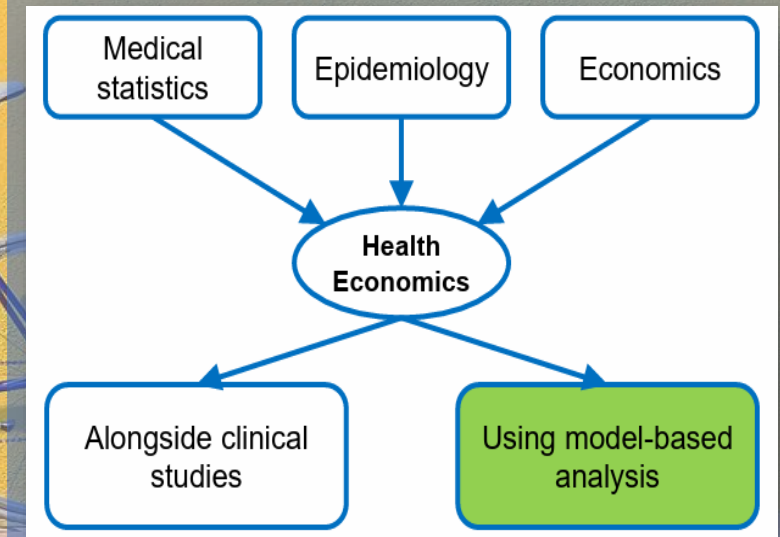
Health technology assessment



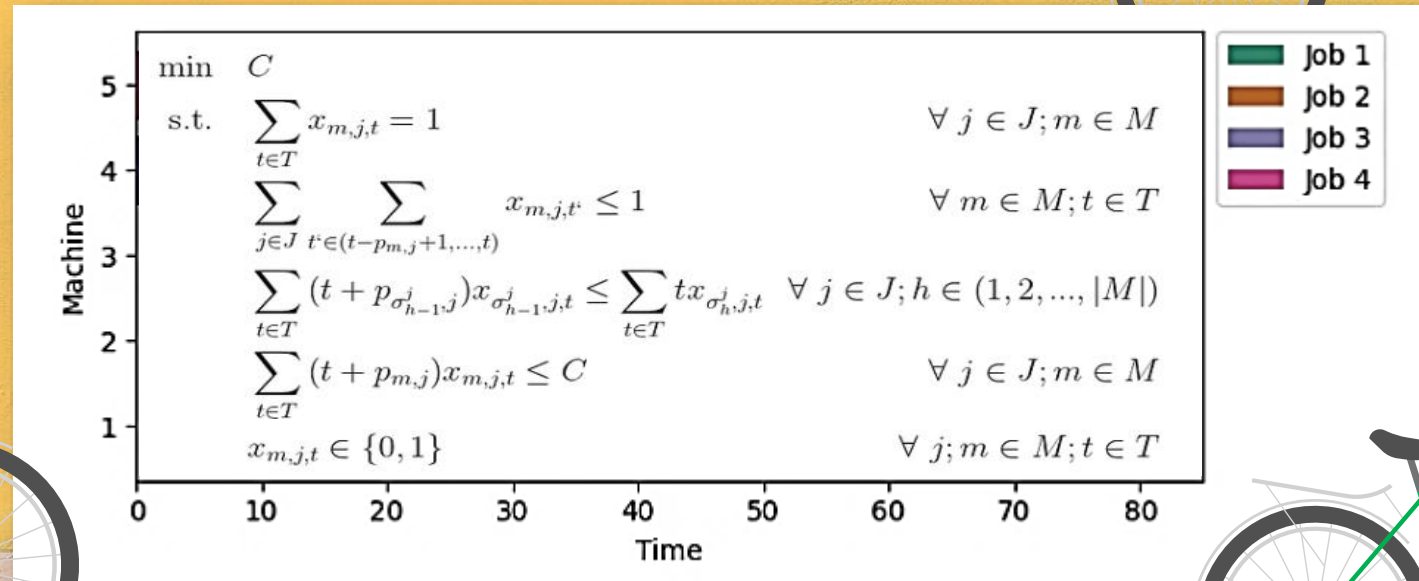
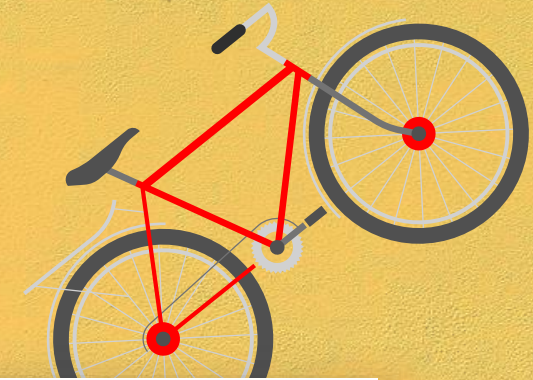
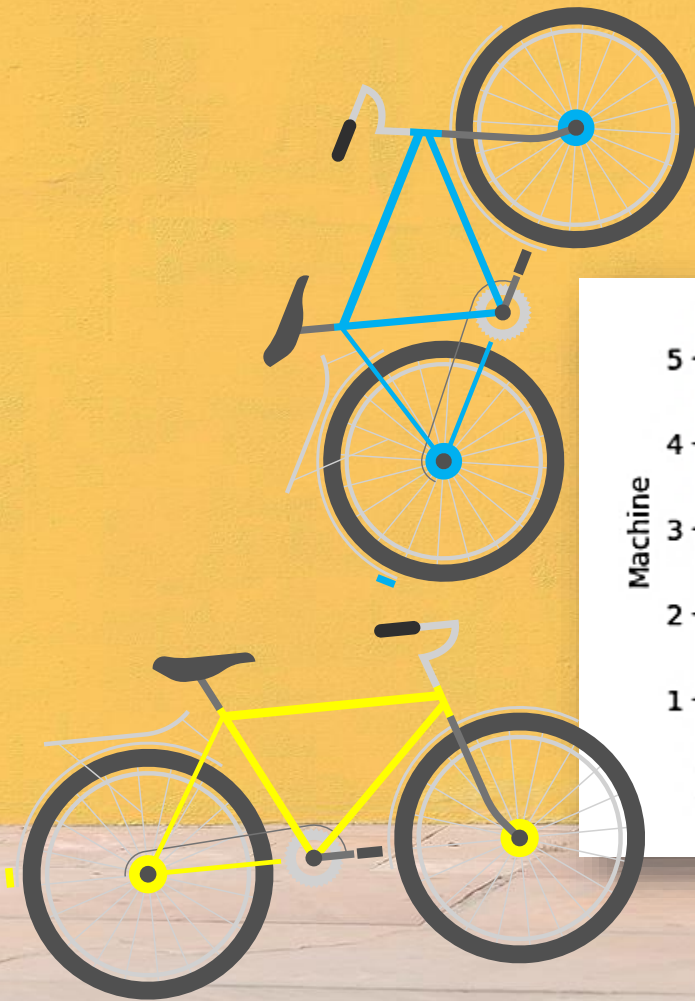
Health economics is an element of HTA



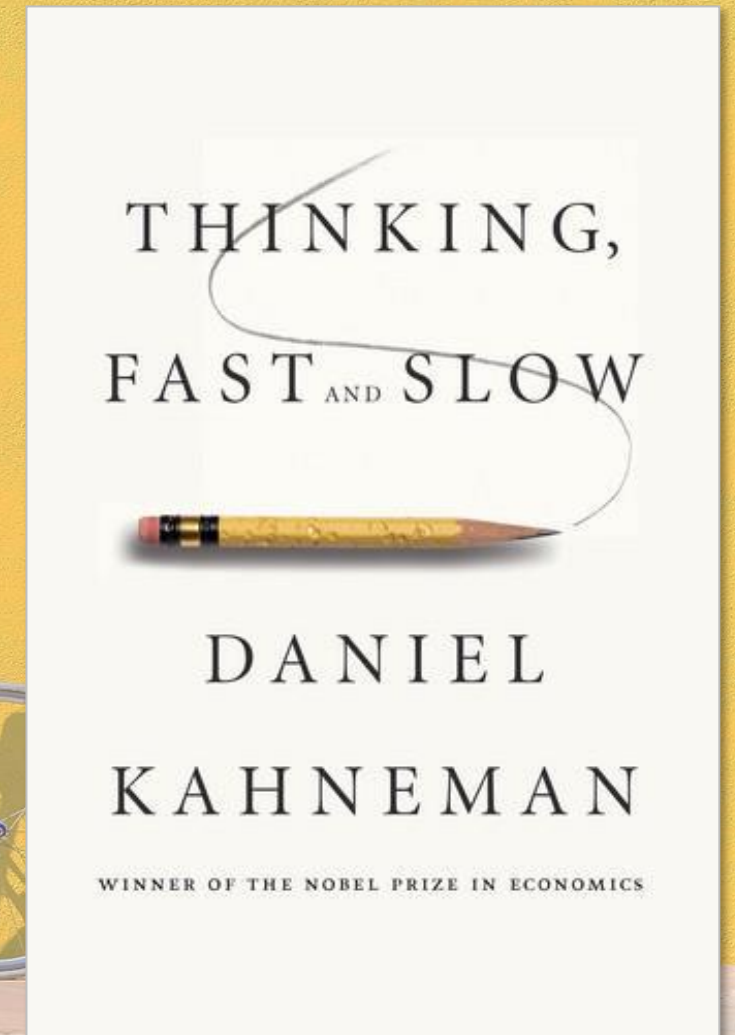
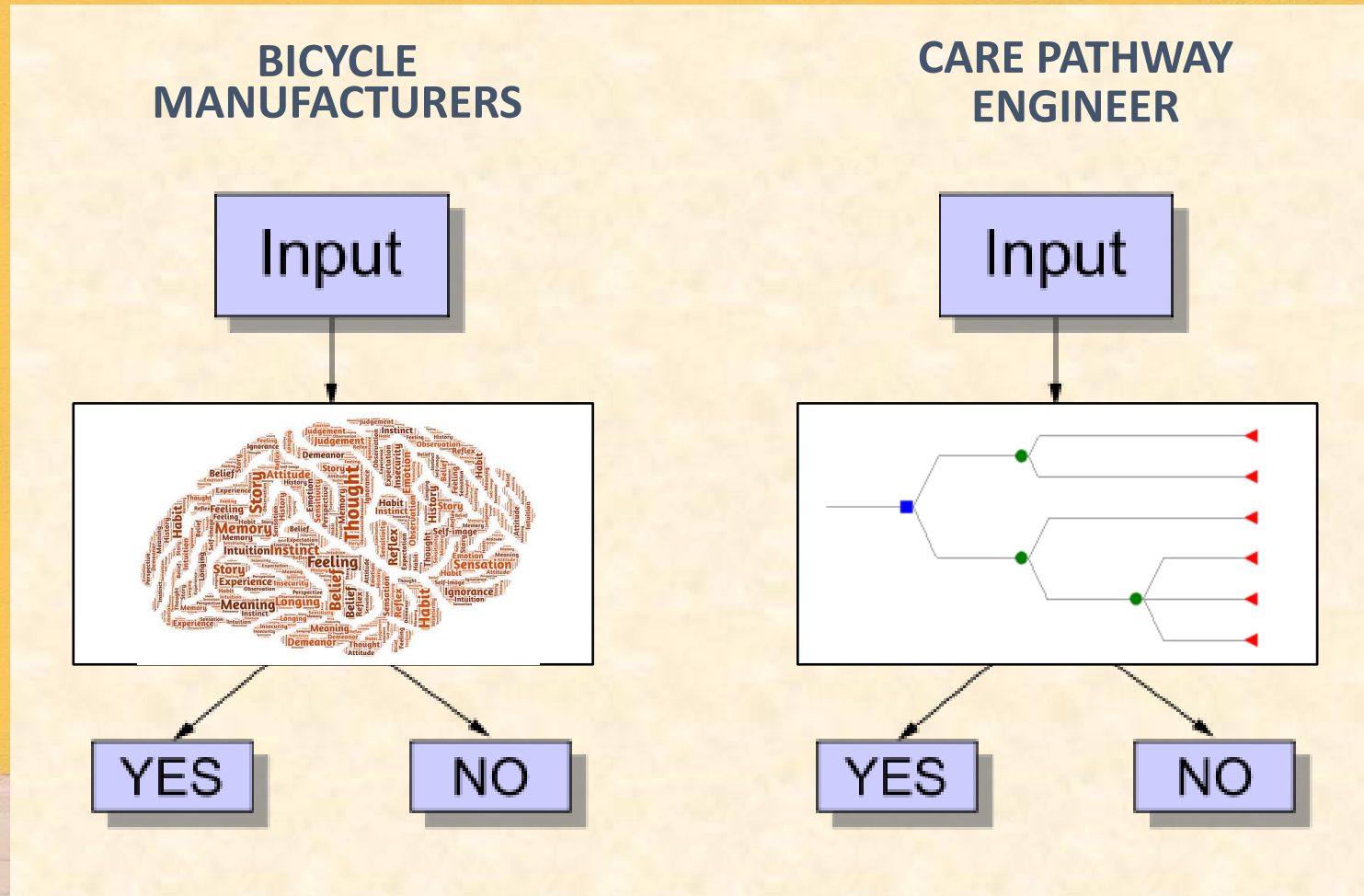
Care pathway engineering



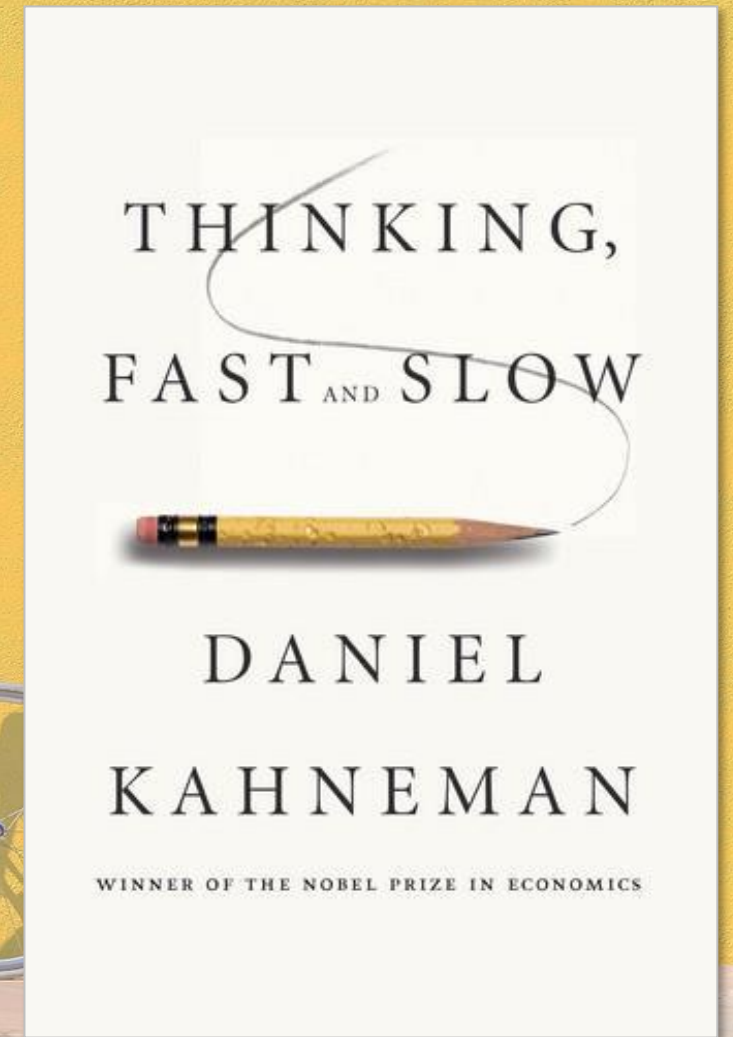
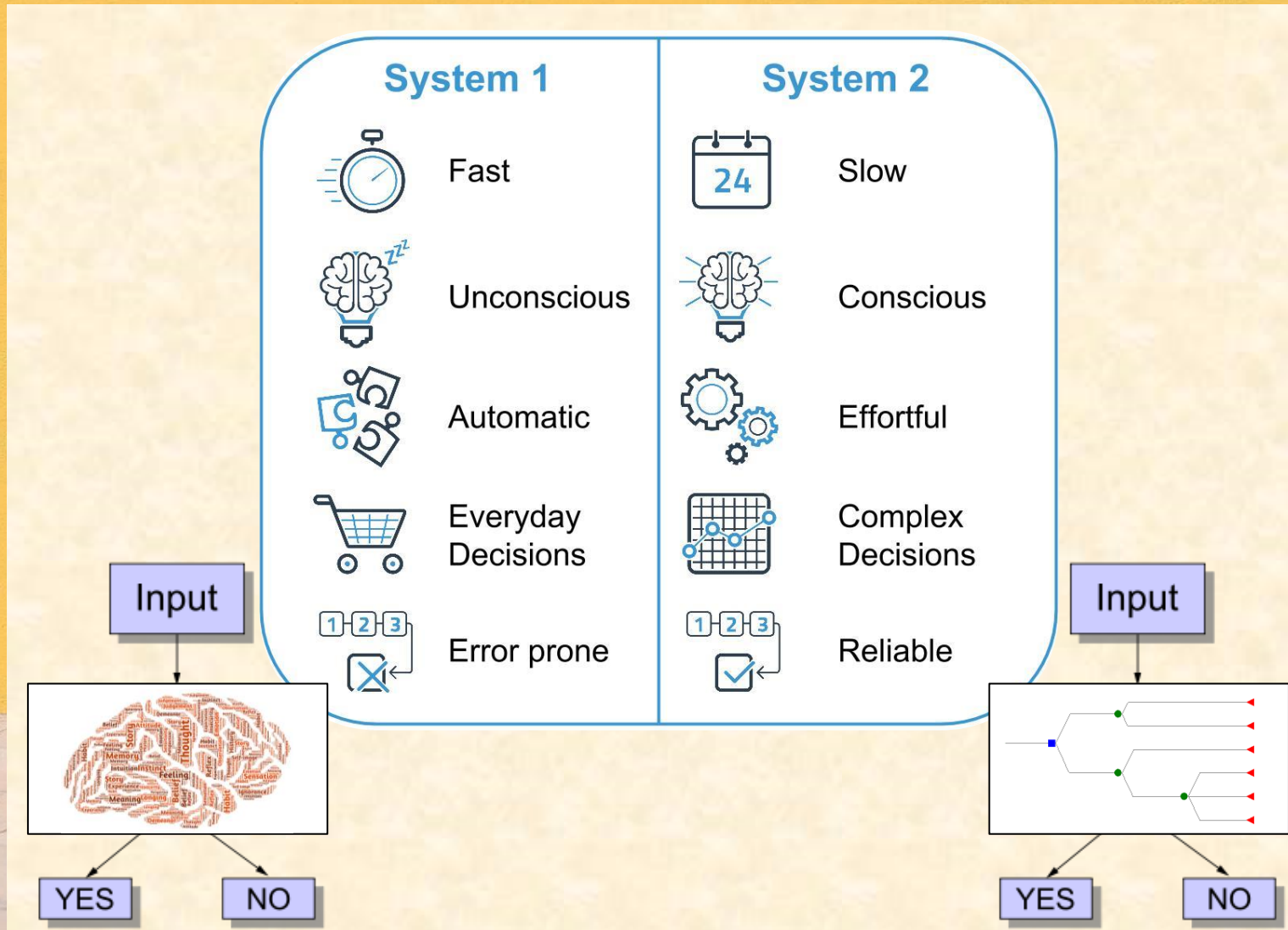
Bike repair shop engineering



Thinking fast and slow (1/2)



Thinking fast and slow (2/2)





Buy a bike or a PET/CT scanner? A fair question?

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#cycling #bike #cost_effectiveness #HTA #nuclear_medicine



The costs of the PET scanner are very different from those of the bike



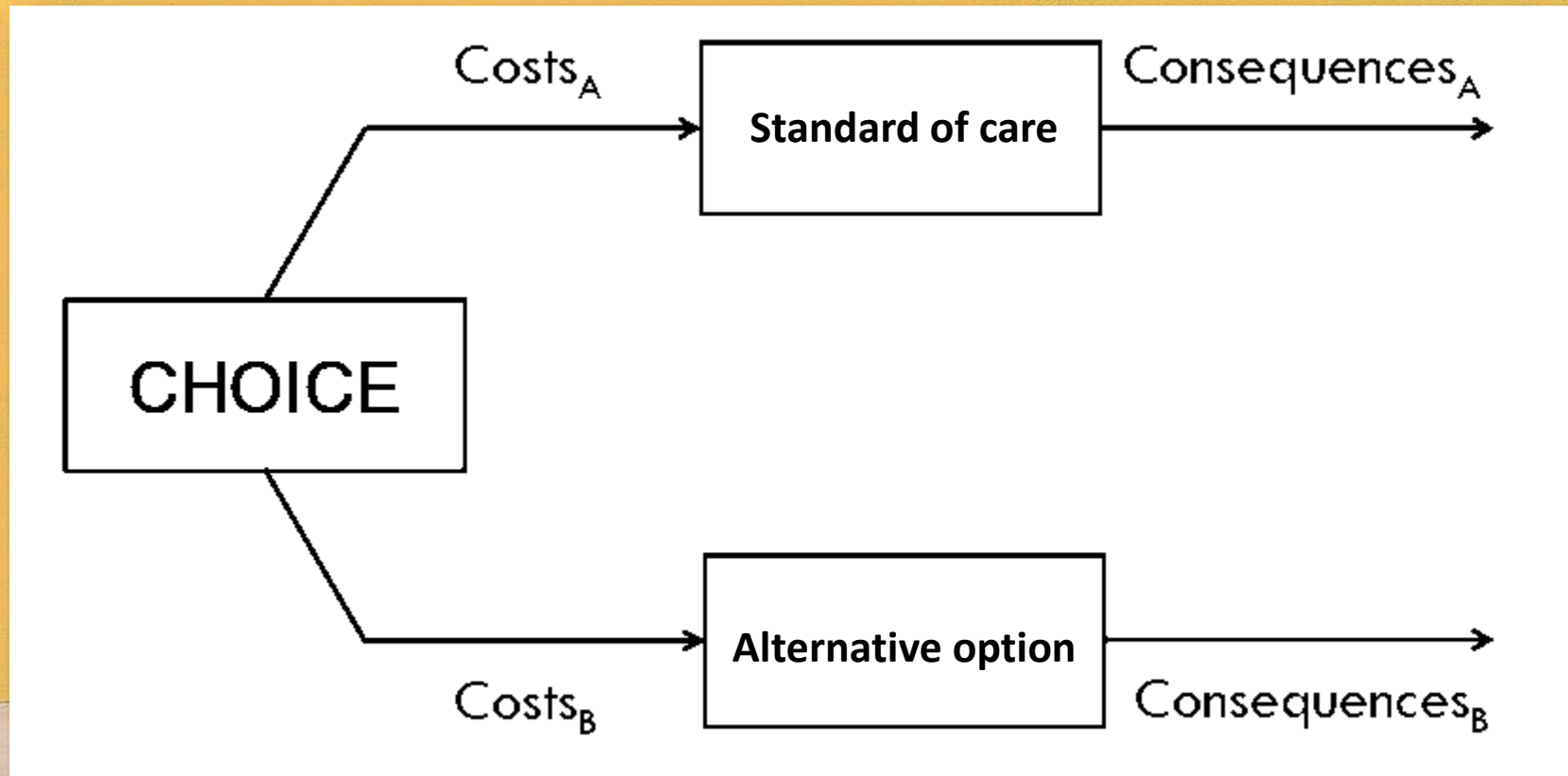
The health effects of the PET scanner are very different from those of the bike



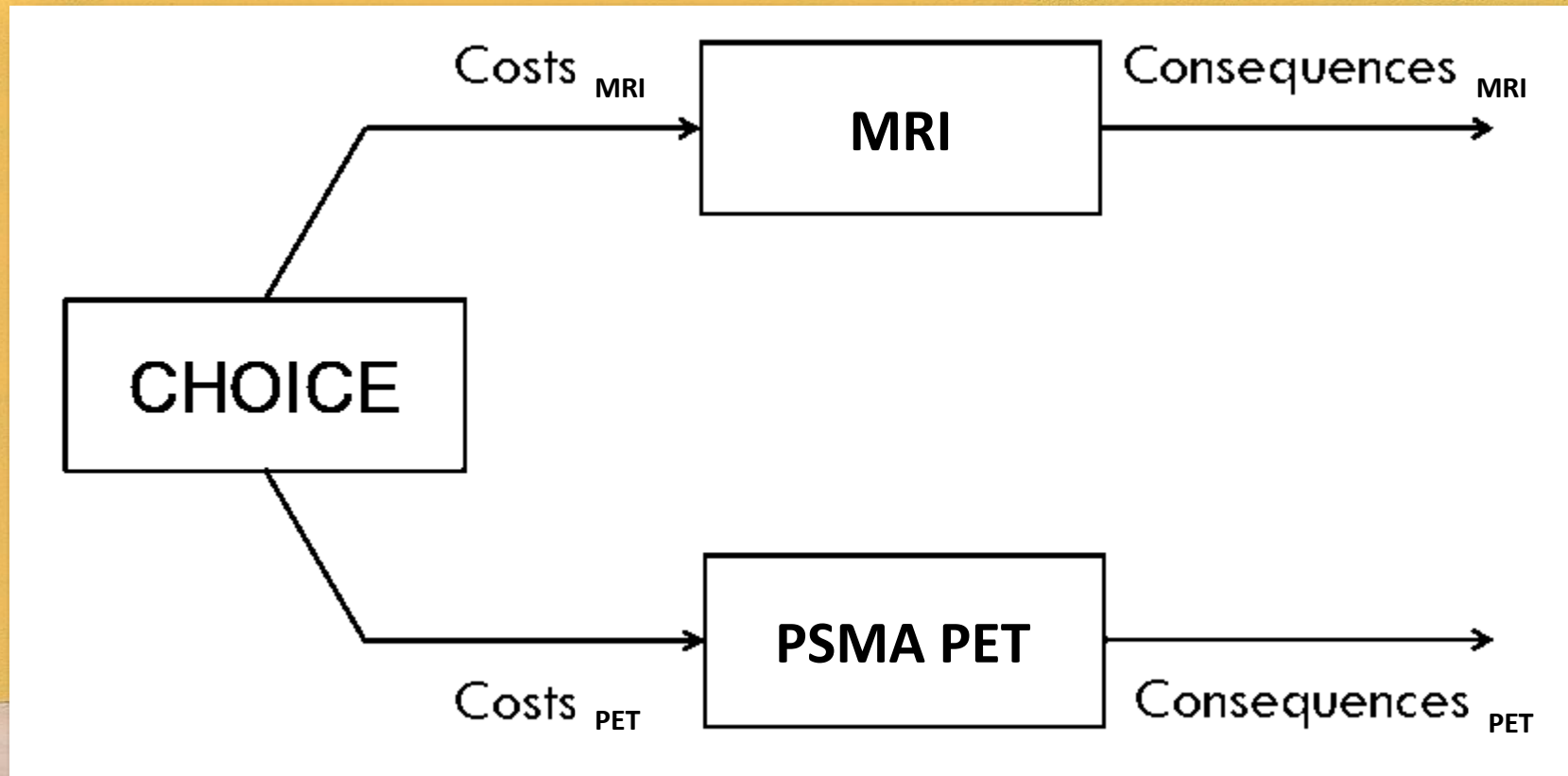
You cannot simply replace a PET scanner with a bike.
Why not take both or none of them?



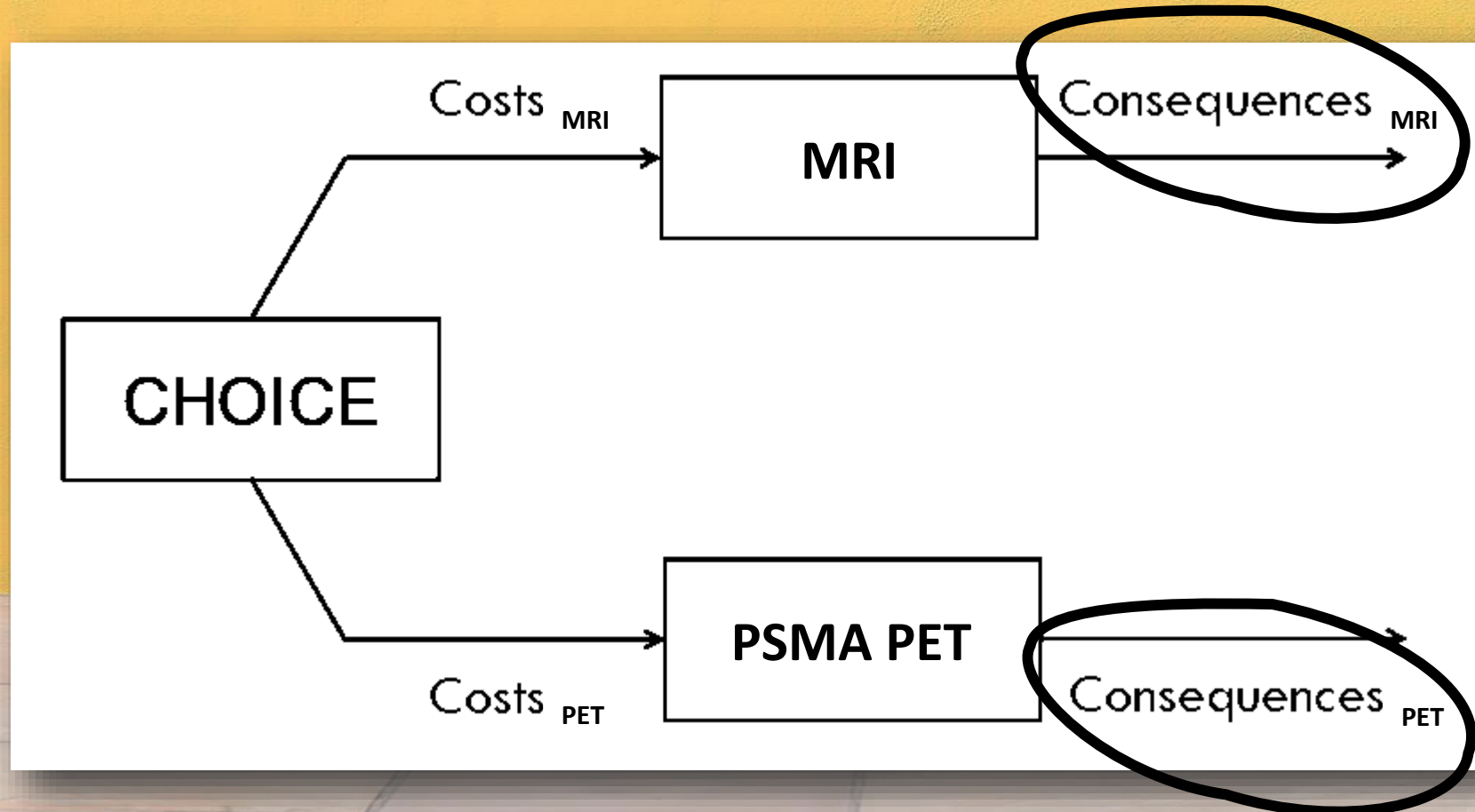
Analysis of comparative alternatives



Prostate cancer staging with MRI or PSMA PET



Limited understanding of how the results of a specific imaging study could influence individual patient's treatment planning and outcomes



Why health economic modelling?

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There is a knowledge gap

Diagnostics or treatments need to be compared
that were never evaluated head-to-head



Evidence is incomplete but clinical decision-making
needs to be made



Long-term outcomes are lacking

Evidence needs to be extrapolated beyond the trial horizon



Intermediate clinical outcomes need to be linked to clinical endpoints



Clinical trials are costly and time-consuming

It is relevant to know if further research is useful to
make a better decision with less chance of
incorrect decisions



Health economic modelling in nuclear medicine:
It is an unavoidable fact of life



Disadvantages of health economic modelling?

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Disadvantages of model building

Model construction may be error-prone

Model construction may not be easily replicable

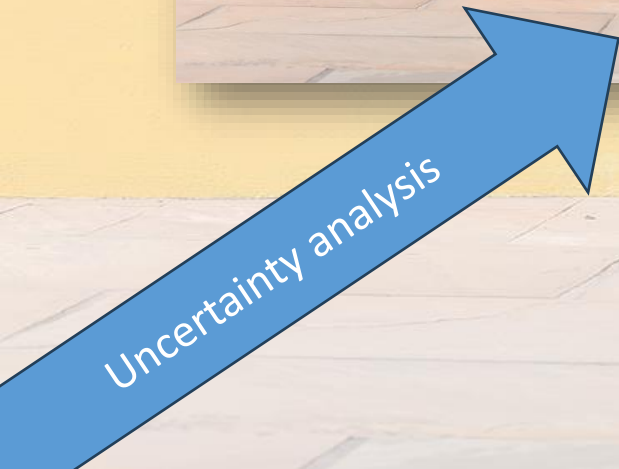
Validation efforts

Transparency

Disadvantages of simulation results

Interpretations of modelling outcomes may be difficult

Modelling results may not be deemed sufficiently strong for decision-making (high-grade evidence)



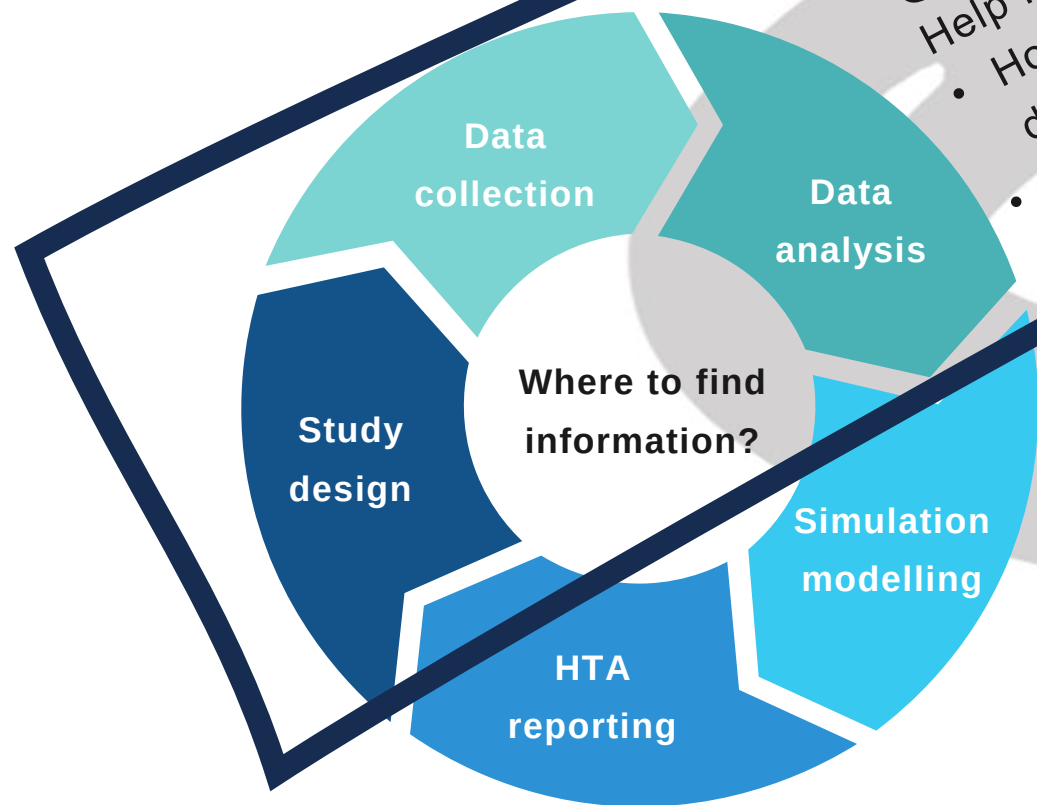
An interdisciplinary collaboration:
It is an unavoidable fact of life



Together with Belgian expertise, we are writing an editorial...

HTA cycle for nuclear medicine procedures

Interdisciplinary collaboration is key

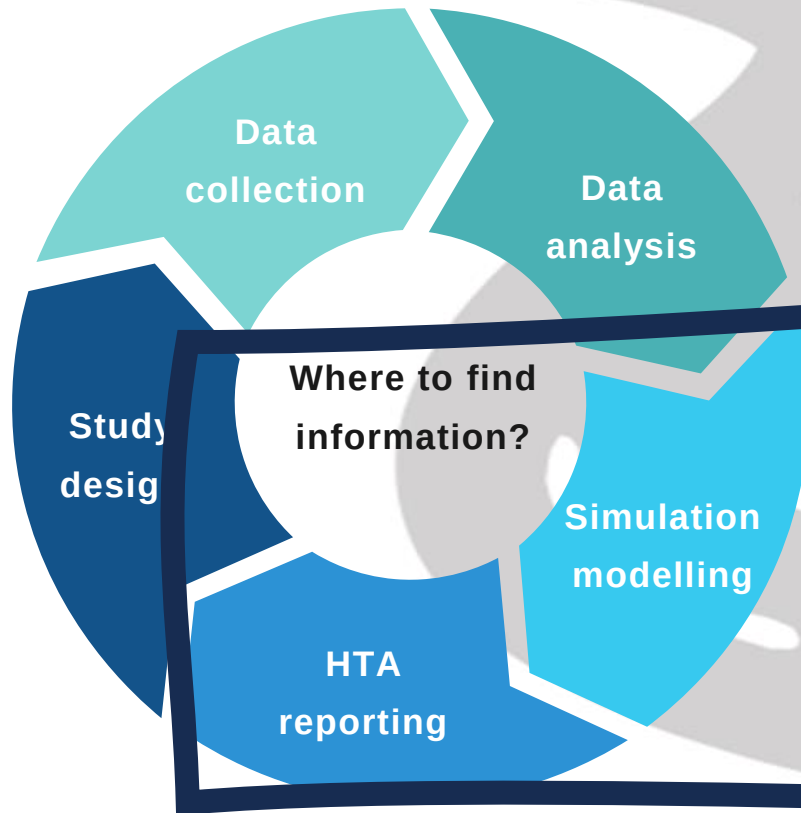


@Nuclear medicine community
Help HTA/HE specialists and policy-makers!!

- How is nuclear medicine improving downstream patient management and outcomes?
- Think of tumour targeting, patient selection, etc.

HTA cycle for nuclear medicine procedures

Interdisciplinary collaboration is key



An interdisciplinary collaboration is key

- As understanding the clinical problem is critical but appropriate simulation modelling requires specific expertise, a collaboration between medical professionals and HTA/HE professionals
- By working together, we ensure that innovations in nuclear medicine are not only clinically beneficial but also affordable for health systems



Take home messages

We must agree with Sam Gambhir that nuclear medicine can be strengthened if and only if we are clinically beneficial and economically affordable

Health economic modelling in nuclear medicine:
It is an unavoidable fact of life



An interdisciplinary collaboration:
It is an unavoidable fact of life



Buy a bike and join
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HTA/HE within the nuclear medicine field: the Dutch Engineer perspective

Sietse van Mossel



Leiden University
Medical Center

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