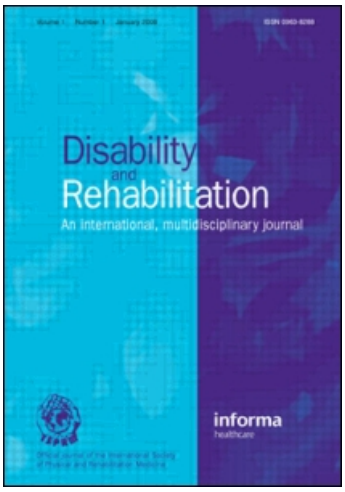

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Using the ICF in economic analyses of Assistive Technology systems: Methodological implications of a user standpoint

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Using the ICF in economic analyses of Assistive Technology systems: Methodological implications of a user standpoint

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Abstract

Purpose. This paper identifies key methodological issues for economic analyses of costs and effectiveness of Assistive Technology (AT) systems based on the International Classification of Functioning, Disability and Health (ICF). Following the biopsychosocial model of the ICF, the paper explores the consequences for cost-effectiveness analyses of AT systems when a user centred approach is taken. In so doing, the paper questions the fiction of neutrality in economic analyses and discusses the distinction between weak and strong objectivity.

Method. Costs are measured as all resources used when providing a particular level of environmental facilitators and reducing environmental barriers for an AT user, while effectiveness is measured in terms of the resulting increase in activities and participation of the AT user. The ICF's fourth qualifier for activities and participation, which denotes performance without assistance is used to identify the additional performance achieved due to the particular environmental factors in the current situation (first qualifier). A fifth qualifier for activities and participation is introduced to denote performance with optimal assistance, and the fourth qualifier is then again used to identify the increase in activities and participation due to the environmental factors in the situation with optimal assistance.

Results. The effectiveness that an AT user achieves in his or her current situation can be compared with the effectiveness he or she could achieve when provided with what is considered an optimal AT system based on current technologies and user priorities. This comparison throws into sharp relief the role of AT systems as well as of universal design (UD) in reducing environmental barriers for AT users in a way that is cost-effective for society as a whole.

Conclusion. Cost-effectiveness analysis based on the ICF can provide powerful economic evidence for how best to allocate existing funding for AT systems. We can identify three particular scenarios in which clear recommendations can be made. In addition, cost-effectiveness analysis provides a means to identify how society can comply with its obligation towards all its members in the most cost-effective way, using a combination of AT and UD.

Keywords: *Economics, ICF, cost-effectiveness analysis, Assistive Technology, universal design*

Introduction

This paper first introduces the way economists think about costs focusing on the fact that they consider the costs of all resources used for a particular purpose, not only those resources for which money is being paid. This implies that we will have to evaluate whole Assistive Technology (AT) systems, not only particular AT devices. Assistive Technology systems are defined by the authors as individually tailored combinations of devices, paid and unpaid care work. The paper then discusses the resulting need to clarify the perspective in which such AT systems and their costs are identified, and explains why the standpoint of the AT user is the most informative standpoint for society as a whole.

The second section of the paper investigates some key aspects of cost-effectiveness analyses in the context of the ICF and its coding system. It proposes a way how the effectiveness of a particular user's AT system can be measured, and how the relevant costs can be identified. This section also discusses how to

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accommodate the economists' requirement to compare two or more situations.

The third section uses the ICF's biopsychosocial model to critically examine some assumptions commonly shared by economists. In particular, it reviews the consequences for objectivity once a particular perspective or standpoint has been identified for a specific study. In our case the standpoint is that of the AT user.

The concluding section revisits the concepts of environmental facilitators and barriers for particular AT users and discusses the role of universal design (UD) as an important complement to a particular user's AT system. In so doing, the concluding section illustrates how the standpoint of the AT user allows us to develop the most comprehensive analysis for society.

Cost considerations by economists

Economic costs

Economic costs refer to the cost of all resources used for a particular purpose, not just to actual expenditures in monetary terms, as has been discussed in the context of assistive technology (AT) by Andrich and colleagues [1]. This can be illustrated by the case of a teenage user of a manual wheelchair, who has an attendant who pushes the chair whenever necessary. The economic costs of this AT system would include not only the cost of the manual wheelchair, but also the cost of the attendant – whether or not the attendant is paid.

If the attendant is a paid employee of an organization that provides care for people living with a disability, economists would normally use the attendant's pro-rata salary to calculate the costs of her services. However, if the attendant is a family member who is not paid for her care giving activities, how would economists assess the cost of the attendant? According to economic theory one would have to consider the caregiver's opportunity costs, which are defined as the next best use of the resources used, in our example the caregiver's time.

Hence if the caregiver is a highly paid company executive who has given up her position to look after her son, the opportunity cost consists of the income she has forgone and is very high indeed. If, however, the caregiver is a retired bus driver who looks after his grandson, the opportunity cost of the grandfather's time is more difficult to measure in dollar terms, as it would consist of the monetary value of whatever else the grandfather would have done with his time.[1]

This brief introduction illustrates some of the issues that need to be addressed when estimating costs. Economists distinguish two kinds of problems with such estimations, those related to the measurement of the quantities of resources used, and those related to the value assigned to each unit of resource measured. However, the above example of caring for a teenage user of a manual wheelchair highlights the fact that when evaluating the cost of a particular AT device, say a powered wheelchair, we also need to consider potential cost savings due to a reduction in attendant costs that may result from using that AT device.

In other words, for a sensible economic analysis we will always need to consider the whole AT system of a particular user.[2] Consequently, the question of which economic costs to include becomes a key question for an economic analysis of AT. The answer to this question has to be found and justified in relation to another question – in whose perspective the investigation is undertaken.

Whose perspective?

In their 2003 article, 'Cost analyses in assistive technology research', Frances Harris and Stephen Sprigle [6] insist that identifying the viewpoint or perspective of a study is the first and most vital component of economic evaluations. Examples include the perspective of treating medical staff, allied health professionals, family carers, AT providers and funding institutions, government health authorities, insurers, and last but not least the perspective of the persons concerned, the AT users themselves. The illustration provided by Harris and Sprigle highlights travel costs, which are pertinent to patients responsible for attending medical treatment at a particular time and place, while health insurance companies are unlikely to see patients' travel costs as a health-related expense [6].

It is interesting to note that allied health professionals increasingly stress the need to take a client-centred approach in their own work [7,8]. Taken seriously, a client-centred approach means that the perspective of the client becomes the dominant perspective. Allied health professionals often suggest that the client's perspective should be considered the most informative one by all other groups involved, including medical staff, AT providers and funding institutions, government health authorities, and to some degree the AT user's family.

A systematic framework in which a client-centred perspective can be articulated in a comprehensive way is provided by the World Health Organization's International Classification of Functioning, Disability and Health (ICF) [9]. In addition, the ICF provides an internationally validated and used framework for a client-centred perspective, which with increasing use all over the world will allow international comparisons of research undertaken in this perspective.

The ICF has two parts, Part 1 called 'Functioning and Disability' with the two components 'Body Functions and Structures' and 'Activities and Participation', and Part 2, 'Contextual Factors' with the two components 'Environmental Factors' and 'Personal Factors'. Activities and Participation and the Contextual Factors are particularly important for an economic analysis of AT. The Personal Factors component, however, has not yet been developed.

In the ICF, activity is defined as 'the execution of a task or action by an individual' and coded with the letter 'a', while participation is defined as 'involvement in a life situation' and coded with the letter 'p' [9, p. 14]. While there may be situations where it is important to differentiate between 'a' and 'p', for our research this distinction is not relevant and we can follow the alternative coding rule proposed in the ICF and code activities and participation together as 'd'. Qualifiers are used to indicate the level of activity limitation or participation restriction. Environmental factors can be coded for each component of functioning, in our case for activities and participation, using the letter 'e', and qualifiers are used to indicate whether and to what degree a particular environmental factor acts as a facilitator or as a barrier for a particular AT user.

The ICF states that '[e]nvironmental factors are to be coded from the perspective of the person whose situation is being described. For example, kerb cuts without textured paving may be coded as a facilitator for a wheelchair user but as a barrier for a blind person' [9, p. 232]. This quote illustrates the implications of the ICF's approach, and how that will impact on an economic analysis in the perspective of the AT user.

AT devices, as well as paid and unpaid care work, comprise the assistance provided to a particular AT user, and hence they would be coded as environmental facilitators. However, for an economic analysis it is important to keep in mind that environmental barriers for a particular AT user can be overcome either with the help of assistance or by directly removing the environmental barrier in question. Notwithstanding the caveat illustrated above with the kerb cut example, in many cases it may prove cheaper to remove particular environmental barriers for everybody rather than provide each AT user with the necessary assistance to overcome these barriers. We will discuss this aspect further in the last section of this paper.

Economic analyses: can the ICF coding system cope?

Two characteristics of economic analyses

In their seminal text on health economics, Michael Drummond and colleagues [10] identify two fundamental features of any economic analysis: first, that it deals with inputs *and* outputs, or costs *and* consequences, and second, that it is concerned with choices, with two or more alternatives.

Hence, studies that examine either only the costs or only the consequences of one alternative are called cost or outcome descriptions respectively. Similarly, studies that examine costs and consequences of one alternative only are called cost-outcome descriptions, while studies that examine only the costs or only the consequences of two or more alternatives are called cost analysis and efficacy or effectiveness evaluations, respectively.[3] Drummond and colleagues only speak of full economic evaluations once costs and consequences as well as two or more alternatives are considered.

These distinctions are consistent with the definition of economic evaluation given by Drummond and colleagues as 'the comparative analysis of alternative courses of action in terms of both their costs and consequences'. Accordingly, they hold that 'the basic tasks of any economic evaluation are to identify, measure, value, and compare the costs and consequences of the alternatives being considered' [10, p. 10]. Drummond and colleagues then distinguish between cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis, depending on whether the consequences are measured in terms of a common physical unit, in terms of physical outcome weighted by utility, or in terms of the monetary benefit attached to the physical outcome respectively.

In the case of our economic analysis of AT in the framework of the ICF, the inputs are the costs of an increase in the provision of environmental facilitators and of a reduction of environmental barriers, while the outputs or consequences can be identified as the additional activities and participation that can be achieved due to these changes. In terms of comparison of two or more alternatives, we compare both the costs and consequences in the *current situation* with the costs and consequences in a *situation with optimal assistance*. As we look at the activities and participation an AT user can achieve as the outcome measure, we undertake a cost-effectiveness analysis.

Economists' questions and consequences for coding

Economists are interested in the contribution of increased environmental facilitators and of decreased environmental barriers to the outcomes achieved in both cases, in the current situation and in the situation with optimal assistance. Hence, in terms of costs we measure the economic costs of everything that is needed to provide the additional environmental facilitators and to decrease existing barriers [11]. As long as we consider all the resources used in

the process, this does not present a particular problem, as the ICF provides a comprehensive framework that helps us to identify the relevant barriers and facilitators.

In terms of consequences however, the situation is slightly more complicated insofar as we need to identify the additional activities and participation achieved due to the facilitators provided and barriers overcome, both in the current situation and in a hypothetical situation with optimal assistance. Thus, we first have to identify the level of activities and participation in the current situation, which is done using the first qualifier for performance in the current situation.

However, in order to identify those activities and participation made possible by the facilitators provided and barriers removed in the current situation, we need another qualifier that indicates what the performance of a particular AT user would have been without any assistance. This can be done using the fourth qualifier provided in the ICF called 'performance qualifier without assistance' [9, p. 230].

This fourth qualifier is a theoretical construct insofar as potential users of assistive technology, in reality, receive some form of assistance to help them cope with their particular impairment. If they do not have access to particular AT devices or to formal care, family or friends are likely to find ways to provide care that makes up for the missing device to at least a level that allows survival. Comparing the activities and participation achieved in the current situation with those achieved without any assistance allows us to identify the *additional* activities and participation due to the environmental factors provided in the current situation – the efficiency measure that characterizes the current situation.

Yet for an economic analysis we also have to identify the level of activities and participation an AT user can achieve in a situation with optimal assistance, as we want to compare at least two alternatives. In order to do this we identify a fifth qualifier that we call 'performance with optimal assistance'. The ICF makes explicit provision for the development of an additional qualifier where needed [9, p. 231]. However, we again are interested in the *additional* activities and participation that have been made possible by the facilitators provided and barriers reduced in a situation with optimal assistance, and hence we will again have to compare 'performance with optimal assistance' (fifth qualifier) with 'performance without assistance' (fourth qualifier).

Thus we can see current performance as sitting either closer to performance without assistance or closer to performance with optimal assistance – depending on the environmental facilitators and barriers present in the particular current situation. This can be illustrated by Figure 1, where the boxes with dotted lines indicate possible other states of current performance.

For each of the three states characterised by the first, fourth and fifth qualifier respectively, the relevant environmental facilitators and barriers have to be coded separately, according to the third convention of the coding guidelines of the ICF [9, p. 226], which suggests that environmental factors be coded for each of the three performance qualifiers for every item in the activities and participation component.

Once the situation of a particular AT user has been coded in the above framework, we can then identify *effectiveness in the* current *situation* as the difference in activities and participation achieved in the current situation as compared with activities and participation achieved without assistance. Similarly, *effectiveness in a situation with* optimal *assistance* can be identified as the difference in activities and participation achieved in the optimal situation as compared with activities and participation achieved without assistance.

As described above, in both the current and optimal situations, costs can be calculated as the costs of an increase in environmental facilitators and of a decrease in environmental barriers associated with the additional activities and participation achieved in both situations. On the cost side there may well be reductions in costs due to less care work needed, or due to reduced disability pension payments once the person has gained paid employment with the help of the AT system provided in the optimal situation. However, it is important to keep in mind that in economic terms these reductions in costs are cost savings, not benefits.

It is important to flag at this point that once all costs and cost savings are considered, there may be strong economic reasons to provide AT users with optimal assistance. This is particularly so in cases where the costs and cost savings of all environmental factors related to performance with optimal

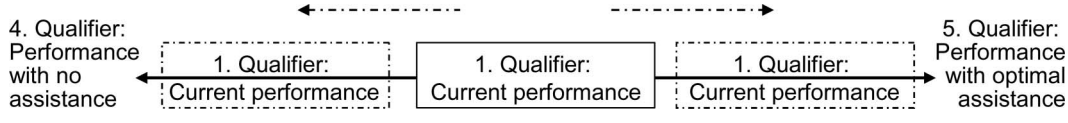

Figure 1. How current performance varies depending on assistance available.

assistance result in an overall cheaper solution than the costs of all environmental factors related to performance in current situation.

Cost-effectiveness analysis of a particular AT system

Our cost-effectiveness analysis proceeds in the following three steps:

Step 1: Identifying effectiveness in both situations. In the first step we identify the effectiveness in terms of activities and participation gained in the current situation and the effectiveness in terms of activities and participation gained with optimal assistance. This could be expressed in the two formulae (1a) and (1b):

$$E_{opt} = (d_{q5} - d_{q4});$$
Effectiveness achieved with optimal assistance (1a)

$$E_{cur} = (d_{q1} - d_{q4});$$
Effectiveness achieved in current situation (1b)

where E stands for effectiveness as measured in terms of additional activities and participation 'd' and the indices q5, q4 and q1 stand for the fifth, fourth and first qualifier respectively,[4] each of which indicates the level of activities and participation that can be achieved in the situation concerned, i.e., with optimal assistance, without assistance, in the current situation.

Step 2: Identifying costs in both situations. In the second step we identify the cost increase or decrease when comparing the current with the optimal situation. We first identify the costs related to increased environmental facilitators and decreased environmental barriers associated with the activities and participation achieved with optimal assistance and then compare them with the costs of increased environmental facilitators and of decreased environmental barriers associated with the activities and participation achieved in the current situation. This could be expressed in the two formulae (2a) and (2b):

$$C_{opt} = p_e(d_{q5} - d_{q4});$$
Cost of environmental factors with optimal assistance (2a)

$$C_{cur} = p_e(d_{q1} - d_{q4});$$
Costs of environmental factors in current situation (2b)

where 'C' stands for the costs resulting from the environmental factors that enable the effectiveness achieved as identified in the first step. 'p_e' stands for the prices of the relevant environmental factors – where an environmental factor does not have a market price, a price needs to be imputed in accordance with the concept of economic costs discussed earlier.

Step 3: Making recommendations based on comparing the two situations. The third step of our cost-effectiveness analysis consists of making recommendations in a number of different cases.

Case A: $E_{opt} > E_{cur}$ *and* $C_{opt} < C_{cur}$
(*increase in effectiveness*, *decrease in costs*)

The following vignette may help illustrating this case:

Vignette A:

A 30-year-old woman with paraplegia is discharged from rehabilitation with a standard issue manual wheelchair and a pressure cushion. She has limited community follow-up by a district nurse. Her rented apartment cannot be modified, and in order to manage at home she must perform multiple transfers per day such as onto bath seat and toilet, and these involve shoulder stress and shear force upon skin. In this situation she suffers pressure sores leading to further hospitalization, where she may lose functional capacity due to already compromised shoulder function and extensive bed rest. As a consequence the final outcome is a move to nursing home accommodation where most of her pension is consumed by fees and her activities and participation are very limited.

Optimal assistance for this woman includes the provision of a lightweight manual wheelchair and a pressure cushion that can be pulled into her modified car, allowing her to achieve independent mobility. In the optimal situation her apartment is modified with a level access shower, a padded shower commode, accessible bench tops, wide doorways, as well as a tailored package of attendant care. Over time, this assistance allows her to build endurance at home until she can reduce attendant care significantly. At this stage she would also be able to take up again her previous occupation full-time and to engage in leisure activities like wheelchair basketball and archery as well as to rejoin her camera club. Her activities and participation are greatly increased.

While the initial costs for the optimal solution sketched here are significant, the cost savings due to reduced reliance on attendant care, return to work full-time and paying income tax rather than receiving a pension, are even more significant and result in an overall reduction in costs. When compared with the expenses expected in the future scenario based on the current assistance, namely repeated hospitalization and permanent reliance on a public pension, the overall cost savings that accrue to society as a whole become obvious.

In the case where more activities and participation can be achieved with optimal assistance and where the costs of the environmental facilitators provided and barriers reduced are less than the costs incurred in the current situation, the recommendation would be to ensure the AT user can access the optimal assistance.

Case B: $E_{opt} > E_{cur}$ *and* $C_{opt} > C_{cur}$ *and* $C_{opt} <$ *funds available* (*increase in effectiveness, increase in costs within existing overall budget constraints*)

This case can be illustrated by the following vignette.

Vignette B:

A 30-year-old man in a similar situation to the woman in Vignette A but with a higher level lesion is issued with a comparable AT system. However, his trauma results in all activities being more effortful, and hence even with optimal assistance he returns to work only part-time, and requires daily attendant care. He cannot participate in wheelchair basketball, but he also enjoys archery and serves as the treasurer of the camera club.

While the costs for the optimal solution are roughly the same as in Vignette A, the cost savings related to relying on less attendant care over time and to eventually being able to return to part-time work are still significant, but less so than in Vignette A. Hence while the man is paying some income tax and does not receive a pension, the optimal assistance results overall in a slight increase in costs, yet one that is still within the limitations of the overall budget. When compared with the expenses expected in the future scenario based on the current assistance, namely repeated hospitalization and permanent reliance on a public pension, the slight cost increase appears easily justifiable, particularly in light of the significant increase in activities and participation.

If we have an increase in effectiveness combined with an increase in costs that still falls within the overall funding available, the recommendation would also be to ensure that the AT user can access the optimal assistance. However, this case highlights the need to ensure that the delivery processes for AT systems are flexible enough to accommodate the realisation of the optimal assistance. While this also holds true for Case A above, Case B is more likely to push the flexibility envelope of the delivery process, because more resources than in the current situation are needed, increasing the risk that the system is too rigid to deliver the particular resources needed.

Case C: $E_{opt} > E_{cur}$ *and* $C_{opt} > C_{cur}$ *and* $C_{opt} >$ *funds available* (*increase in effectiveness, increase in costs beyond existing overall budget constraints*)

This case can be illustrated by the third vignette.

Vignette C:

A 55-year-old man who used to be a construction worker finds himself in the same situation as the woman in Vignette A, however, his paraplegia results from a tumour on his spine.

While the optimal assistance for this man would be the same as for the woman in Vignette A, he is unable to find work again. Hence the cost savings will be limited to the eventual reduction in attendant care, and thus the costs of optimal assistance are significantly higher than the costs in the current situation and beyond the existing budget restrictions.

If the increase in effectiveness is combined with an increase in costs beyond the existing overall budget constraints, there are two possible solutions:

(1) The overall budget will be increased to accommodate the increase in effectiveness, or
(2) the AT user prioritises the activities and participation she or he wants to achieve, and

as many environmental factors as fall within the overall budget are made available following the priorities established.

While the first solution to Case C is likely to require a significant amount of political lobbying, the second solution also makes a number of assumptions that require political will to be realized.

Firstly, the prioritization is done by the AT user. While a lot of lip service has been paid to this in principle, the actual constraints of delivery processes for AT systems often limit the influence AT users have on decisions taken.

Secondly, the determining factor is not a particular AT device or system for which the AT user expresses a preference, but the activities and participation he or she wants to achieve. This requires much more flexibility in the delivery process – and a true partnership between the AT user and those involved in the decision process.

Thirdly, the environmental factors comprise environmental facilitators that are provided to an individual AT user as well as environmental barriers that, once they are removed, will benefit other AT users as well as the community in general. This poses particular problems not only for the costing of a removal of environmental barriers, but also for the regulatory framework that ensures they are indeed removed. Universal design (UD) is a case in point, which we will discuss later.

However, the UN Convention on the Rights of Persons With Disabilities [12] adopted on 13 December 2006 does include environmental accessibility and support measures such as personal assistance and assistive technologies that facilitate communication, mobility, independent living etc. among the measures that each signatory state is obliged to ensure. In addition, the preamble recognizes in point (n) the 'individual autonomy and independence [of persons with disabilities], including the freedom to make their own choices', and considers under point (o) that 'persons with disabilities should have the opportunity to be actively involved in decision-making processes about policies and programmes, including those directly concerning them' [12]. Hence this convention could prove a rather strong support for a lasting change in political attitudes that will allow following the approach to decision making outlined here.

The ICF perspective: Can economists cope?

Research in the perspective of the AT user – the true end of a false claim for neutrality

The ICF as a classification of functioning, disability and health deliberately takes a stand between two competing paradigms of disability [6, p. 20]. On the one hand there is the 'medical model', which sees disability as directly caused by disease, trauma or other health conditions for which the individual requires medical treatment by medical professionals. On the other hand there is the 'social model', which focuses on disability mainly as a socially created problem, with disability seen as a complex collection of conditions, many of which are created by the social environment, which thus require social action and environmental modifications.[5]

The ICF attempts to integrate these two opposing models in what it calls its own biopsychosocial model, in which it attempts a coherent view of different health perspectives from a biological, individual and social perspective, hence the ICF's division into the two parts of 'Functioning and Disability' with the two components 'Body Functions and Structures' and 'Activities and Participation' on the one hand, and 'Contextual Factors' with 'Environmental' and 'Personal Factors' on the other hand.

A broad-brush picture could show the various actors aligned in the following way: medical practitioners are primarily interested in body structures and to some degree in body functions, while allied health professionals are interested primarily in body functions and to some degree in activities and participation. Disability advocates focus on the environmental factors and the activities and participation that they either facilitate or restrict.

While this is a very rough picture indeed, it helps us seeing more clearly the traditional position of health economists in so far as such a picture highlights the fact that health economists in the main have been enlisted by medical practitioners and thus have shared their interest in body structures and medical interventions. However, there is no economic reason why economists should not work with disability advocacy groups and hence share their focus on activities and participation and on environmental factors.

As Harris and Sprigle [5] have highlighted, the clear identification of the perspective of an economic study has been declared by health economists the first and most important component of evaluating any study in health economics. However, as a discipline, economics has been incredibly 'successful' at insulating itself against critical examinations of the perspectives under which economic analyses in general are undertaken, clinging to an outdated concept of objectivity.

This concept of objectivity has long been discredited in other social sciences, because it confuses objectivity with neutrality. As will be shown below, economic research, like any other research, does not need to be neutral in order to be objective. In fact, economic research that is self-reflective, able to

reflect or critically think about itself, recognizes that economic research in general is always and as a matter of principle undertaken in a particular perspective – as has been outlined by many health economists for health economics in general [10].

Thus, in order for health economics to keep pace with the paradigm shift the WHO and its ICF have adopted, a more critical self-reflection of the economic side of health economics is needed. The ICF clearly and explicitly requires that any coding be undertaken in the perspective of the person concerned – which has particular consequences for an economic analysis that wants to keep up with the level of critical reflection required to successfully utilise a biopsychosocial approach.

If Harris and Sprigle have correctly represented the important components of economic evaluations, then it is not controversial amongst health economists that there are different perspectives in which economic evaluations can and should be undertaken. The ICF's biopsychosocial approach not only requires us to reflect on the impact, which the focus of a particular study has on the study as a whole, it also requires us to consider Part 1 and its components 'Body Functions and Structures' and 'Activities and Participation' in conjunction with Part 2 and its components 'Environmental' and 'Personal Factors'. In so doing, the ICF directly questions the unreflected alliance between health economists and medical practitioners and the resulting uncritical priority given to health economic investigations related to body functions and structures and the related medical interventions.

Moreover, the ICF also reflects back to economists the opportunity cost of an unreflected alliance between health economists and medical practitioners, i.e., the very real risk that health economics might miss out on being involved in economic evaluations embracing the focus of disability advocates. This means that health economics chooses not investigate issues related to half of Part 1 (Activities and Participation) as well as the whole of Part 2 ('Environmental Factors' as well as 'Personal Factors') of the ICF – without a critical discussion of this choice. By highlighting in a very practical way the choices economists do indeed make when they design their studies, the ICF renders untenable the illusion of a position of neutrality in economic evaluations.

Weak and strong objectivity – insights from philosophy of science

However, as philosopher of science Sandra Harding outlined in various contexts over the last quarter of the previous century, there is no need to equate neutrality with objectivity. In her seminal 1995 article in the journal *Feminist Economics* [13] Harding demonstrates that objectivity does not need to be linked to neutrality and further, that neutrality is not a requirement of good science.

Harding shows in detail how what she calls 'weak objectivity' refers only to questions of method and thus is unable to identify the unreflected assumptions shared by the whole scientific community. In other words, as long as health economists only engage with the work of medical practitioners who are mainly interested in body functions and structures, and as long as the scrutiny of the economists' work is limited to questions of methods, economists continue to limit themselves to analysing a small part of what is or ought to be of interest to health economists.

Yet once the ICF has highlighted the choices health economists are actually making when they choose what they investigate and how they investigate it, the weakness of their concept of objectivity becomes obvious, a concept of objectivity that by claiming neutrality ultimately negates the very concept of opportunity costs so central to economic evaluations.

However, it is the same ICF that can provide economists with a framework to develop what Harding calls strong objectivity, objectivity that comes from openly discussing one's own perspective or standpoint and its contribution to gaining knowledge.[6] Using the ICF, health economists are forced to declare which aspects of the reality of persons living with a disability they are prepared to include in their analysis, and which ones they exclude – and why. Once these questions are openly raised, economists must ensure their methods and methodologies can encompass the complexities and contradictions in the actual lives of AT users.

Economists taking the ICF seriously

Economists analysing all costs of providing or not providing AT

Once economists frame their analysis of AT systems in the context of the ICF, they gain a systematic framework to include the costs of all kinds of assistance that can complement and substitute for AT devices. And once the economic analysis is undertaken in the perspective of the AT user, economists will be able to identify cost savings to one party that result in an even bigger cost increase to another party, which overall result in a total cost increase to society as a whole. Hence it could be argued that it is in fact the perspective of the interested AT user that provides society with the most comprehensive understanding of the costs and gains in effectiveness that result from particular interventions.

There are several issues arising from the perspective of the AT user that defy some key assumptions made in mainstream economics. To begin with, are the wants for AT really unlimited? How many wheelchairs might one person with a mobility impairment want? And: would anyone, let alone everyone, who does not need a wheelchair, want one? Could funds be saved if we eliminated the bureaucratic process of establishing and maintaining funding priorities between AT users, and made available whatever AT is required to all persons living with a disability so they could participate in all desired activities?

These questions illustrate some of the different questions that arise when economic investigations are developed from and implemented in the perspective of AT users – and how such an approach can benefit the understanding not only of costs and effectiveness in the health sector and other sectors of the economy, but also of economic analysis in general.

Economists taking a closer look at environmental barriers

AT aims to overcome activity limitations and participation restrictions that are due to individuals' impairments. Yet many environmental barriers also cause activity limitations and participation restrictions, some of which can be overcome by AT. Consequently, economists need to raise the question whether in the latter cases it would be more effective for society as a whole not to erect such barriers in the first place – not without acknowledging that what is a barrier for one person can be a facilitator for another person, as has been illustrated in the example of kerb cuts.

Yet once we shift our attention away from overcoming the problems of a particular person or a group of persons living with a disability and focus on the benefits for society as a whole, we can see that there are various environmental barriers for many people that need not be erected and environmental facilitators that can be provided for everybody. These can be provided at no or very little extra cost – provided the needs of all people are considered from the beginning, at the design stage of the production of goods and services. This approach has been championed in Europe by the movement 'Design for All' and in the USA by the movement for 'Universal Design'.

The Banner for the Center for Universal Design at North Carolina State University, for example, reads 'Environments and Products for All People', and under the heading 'About Universal Design (UD)' their website quotes a definition from their founder, the late Ron Mace: 'Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design'. The site goes on to say: 'The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities' [15].

If the principles of UD are widely applied, this will result in an increase in environmental facilitators and a decrease in environmental barriers for the benefit of all without or with minimal additional costs. In some instances, the provision of AT to overcome environmental barriers would be rendered unnecessary, and in these cases UD represents a huge saving for society.

Economists clearly identify unrealised savings as costs. Hence not widely applying universal design principles imposes a cost on society. Economists then have to ask who pays this bill? Who pays for the costs of not providing environmental facilitators and for the costs of erecting environmental barriers? It would appear that those who pay are not the ones who buy and sell the goods and services in question. For economists this represents one of the classical cases of market failure, the case of externalities. Externalities have been broadly defined as situations in which the actions of one individual affect the well-being of another individual in ways that need not be paid for according to the existing definition of property rights in the society in question.

As an example, the stairs at the entry of an office block would cause additional costs to an employee using a wheelchair, if she needs to have her carer accompany her to work only to push her wheelchair up the stairs, a cost for which neither the builder or developer as the seller of the building nor the future owner as the buyer of the building have to pay. As in other cases of market failure, government intervention has redistributed the costs through the legal requirement that every public building must have a wheelchair accessible entry. Once the regulation is in place, every building designer will think about the issue of accessibility from the beginning and will design the building in such a way that no or minimal additional costs result. Hence society as a whole benefits from reduced costs overall, while everybody can access the building more easily, including users of wheelchairs, prams, trolleys or walking aids.

Concluding remarks

This paper followed the ICF in its call for a systematic use of the perspective of the person concerned, in our case the perspective of the AT user. Undertaking an economic analysis in a particular,

openly declared and discussed perspective is on the one hand accepted practice in Health Economics, at least as long as the same kind of analysis is undertaken as has been common in the past. But on the other hand, and in particular when analyses are undertaken in novel perspectives, such an approach raises a number of interesting questions about how economists understand themselves and their discipline.

Using the ICF and its focus on the person concerned has also allowed us to shed a new light on the relationship between listening to a particular person living with a disability and analysing economic problems considering society as a whole. In our economic cost-effectiveness analysis we kept our focus on the effectiveness side, on the activities and participation particular persons living with a disability want to achieve. On the cost side we focused on the costs of the environmental facilitators that need to be provided and environmental barriers that need to be removed to achieve these activities and participation. In doing so we were able to show that the perspective of the persons concerned can encompass cost-effectiveness considerations for the whole society, once the principles of design for all or universal design are considered.

Such an economic cost-effectiveness analysis can thus show that the economically interesting question is not 'How much does the provision of assistive technology and the use of universal design cost society?' but rather, that the interesting question is 'How much has society wasted by not providing assistive technology to those who need it and by not applying the principles of universal design in the first place?'

The consequences in terms of public policy then would have to be two-fold: *As a society we can neither afford the wastage from not applying universal design, nor the illusion that universal design would replace the necessary expenses for assistive technology and for care work*.

In other words, economic analyses can learn from using the ICF that there will always be people with impairments that lead to activity limitations and participation restrictions, for which they will need environmental facilitators in the form of assistive technology and care work, and that not providing such assistance can amount to a significant economic cost to society. Yet not using the principles of universal design in the first place is certain to impose economic costs on society overall.

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Notes

1. In the context of housework in general and of care work in particular economists are rather quick in making exceptions to the rule of considering opportunity costs as the economically relevant costs. In these contexts economists often either assume that family members use their 'own time', which is then assumed to be leisure time with no monetary value, or they assume housework and care work to be unskilled work and thus to be paid at the minimum wage. Such inconsistencies in economic theory have been discussed extensively in the journal *Feminist Economics* and elsewhere in the context of the invisibility of what traditionally has been considered as women's work.
2. The need to consider whole AT systems has been discussed in a variety of contexts by a number of authors, not least in the context of abandonment of AT devices, which is obviously of particular relevance to any economic analysis [2,3]. Various models have been developed from a psycho-social perspective, e.g., the Matching Person and Technology model by Marcia Scherer [4] or the Human Activity and Assistive Technology model by Al Cook and Susan Hussey [5].
3. Most randomized controlled trials fall into this category.
4. At this stage the reader may recall that as 'd' stands for activities and participation, we are here dealing with a number of dimensions, depending on the level of the ICF classification, to which we want to take our analysis. There are nine chapters of activities and participation and each chapter has one or several blocks. So if we were to do our analysis at the level of blocks, we would already have 21 dimensions for activities and participation. While the level of detail depends on the purpose of the analysis, 21 dimensions is already a sizeable number in terms of complexity. Yet in terms of the level of detail occupational therapists for example are used to in their case descriptions, it is still a rather aggregated view with all the shortcomings of aggregation.
5. This brief characterisation does by no means claim to do the two positions justice, it only serves as an illustration of key differences relevant to the ICF's own position.
6. In the context of philosophy of science Harding explains how this includes addressing not only questions of method (questions regarding the techniques for gathering evidence), but also questions of methodology (questions related to how research should proceed) and of epistemology (questions about an adequate theory of knowledge or justificatory strategy) [14].

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