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Easier said than done: Overcoming challenges in the economic evaluation of Internet-based lifestyle interventions

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An unhealthy lifestyle is often represented by a variety of health behaviours like physical inactivity, an unhealthy diet, excessive drinking and smoking. As a consequence, it is a major cause of chronic diseases and related to reduced quality of life, productivity losses and substantial health care costs. Interventions that can effectively stimulate a healthy lifestyle will thus yield important societal benefits.

A landmark systematic review has shown that Internet-based health behaviour change interventions can effectively promote a healthy lifestyle (Webb, Joseph, Yardley, & Michie, 2010). In particular Internet-based interventions that are tailored to the specific characteristics of the individual participant – using online computer-tailoring strategies – have been found to be effective in enhancing various health behaviours (Lustria et al., 2013). Compared to more static health communication tools, computer-tailored interventions provide individuals with more personally relevant information. Consequently, this information is more likely to be read, thoroughly processed and remembered (de Vries & Brug, 1999; Kreuter, Farrell, Olevitch, & Brennan, 1999). Besides, using the Internet to deliver these interventions has several advantages: it is highly accessible for people with different backgrounds, it offers participants the possibility to use it at any convenient time, and it has the potential to reach a large audience at minimal cost – an attribute making it likely to result in favourable cost-effectiveness (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006).

In healthcare, especially given the current economic climate, limited resources are generally available to implement effective lifestyle interventions on a large scale. Therefore, health care decision-makers should prioritize interventions that produce most value for money and should make evidence-based decisions about which interventions to implement. Valid and reliable information regarding the cost-effectiveness of Internet-based lifestyle interventions is therefore crucial.

Economic evaluations to date

In economic evaluations, the costs and effects of an intervention are determined and compared with the costs and effects of current practice and/or other interventions (Drummond, O'Brien, Sculpher, Thorrance, & Stoddart, 2005). Economic evaluations usually consist of 5 steps: 1) Identification of relevant costs and effects based on a chosen perspective (e.g. the health care or societal perspective); 2) Measurement of costs and effects; 3) Valuation of measured costs and effects; 4) Calculation of an incremental cost-effectiveness ratio (ICER) to indicate the additional costs required for an additional measure of effect, based on the formula ICER = $(Cost_{intervention} - Cost_{control}) / (Effect_{intervention} - Effect_{control})$; and 5) Uncertainty analysis to test the robustness of the results. These steps can easily be embedded within the context of a randomised controlled trial. Whereas step 1 requires some thought before the initiation of the trial, step 2 can take place during regular measurements of the trial

and mainly entails including a resource use measurement instrument, such as a cost questionnaire (Thorn et al., 2013), and a generic health-related quality of life instrument, such as the EuroQol (EuroQol Group, 1990). Steps 3 to 5 could be conducted in collaboration with a health economics expert once data have been collected – similar to analyses to investigate an intervention's effectiveness. The five steps are described in more detail elsewhere (Smit, Evers, de Vries, & Hoving, 2013, multimedia appendix 1).

In 2006, a call was published to more regularly investigate the cost-effectiveness of Internet-based interventions aimed to improve health (Ahern, Kreslake, & Phalen, 2006). Since then, a number of cost-effectiveness studies have been conducted of Internet-based interventions aimed at, for example, alcohol reduction (Smit et al., 2011), decreasing depressive symptoms (Warmerdam, Smit, van Straten, Riper, & Cuijpers, 2010), smoking cessation (Smit et al., 2013; Stanczyk et al., 2014), and reducing lifestyle associated risk factors (Schulz et al., 2014). Without exception, these economic evaluations showed a high probability of Internet-based interventions being cost-effective in improving lifestyle related outcomes when compared to current practice (Smit et al., 2013; Smit et al., 2011), brief and/or non-tailored interventions (Schulz et al., 2014; Stanczyk et al., 2014) or a waiting list control group (Warmerdam et al., 2010). Together, these findings thus suggest that Internet-based lifestyle interventions are not only effective, but also cost-effective.

Challenges in the economic evaluation of Internet-based lifestyle interventions

We highly recommend economic evaluations to be conducted to enable evidence-based decision-making. To facilitate this, we would like to address some of the major challenges in economically evaluating Internet-based lifestyle interventions that need to be anticipated upon, and provide suggestions to overcome these challenges (for an overview, see table 1).

The first challenge in performing economic evaluations is how to choose an outcome measure that can compare interventions across health behaviours, but is also sensitive to behaviour-specific changes resulting from the intervention. Health care decision-makers often need to compare the cost-effectiveness of interventions targeting different health behaviours; the use of a generic measure like quality adjusted life years (QALYs) as a study outcome facilitates this comparison. A recommended QALY measure that has been used frequently is the EuroQol (EuroQol Group, 1990). Although the EuroQol is able to compare interventions aimed at different health behaviours, the EuroQol has also been criticized for assessing quality of life from a limited health perspective. The majority of Internet-based lifestyle interventions aims to prevent the development of chronic diseases, rather than treating them. Consequently, most participants do not (yet) suffer from any health related complaints (i.e. they do not experience any limitations in daily life resulting from impaired health) and will not experience any major improvements in health due to their participation in the intervention. In fact, people may initially experience adverse effects of their lifestyle change, such as withdrawal symptoms (i.e. when quitting smoking) and aching muscles (i.e. when increasing physical activity levels). Recent research has therefore suggested to take a broader perspective in the economic evaluation of lifestyle interventions and to additionally focus on non-health related outcomes (Weatherly et al., 2009). In line with this suggestion, next to health related quality of life measures, we recommend using outcome measures that go beyond health, such as the ICECAP questionnaire measuring quality of life by assessing capabilities that are non-health related, such as achievement (Keeley, Al-Janabi, Lorgelly, & Coast, 2013).

Table 1

Overview of the challenges in the economic evaluation of Internet-based lifestyle interventions and their possible solutions

Challenge	Possible solution(s)
#1 How to choose an outcome measure that can compare interventions across health behaviours, but is also sensitive to behaviour-specific changes	Use measures of non-health related quality of life as (additional) outcome measures
#2 How to determine whether the effects of an intervention on lifestyle related outcomes outweigh its costs – taking into account society's willingness to pay	Transform changes in lifestyle improvements into metrics that are comparable across health behaviours
#3 How to predict long-term costs and effects accurately	Use data from trials and longitudinal research to inform modelling techniques to predict long-term costs and effects
#4 How to value the leisure time people spend on participation	Value leisure time using several methods (i.e. as paid and unpaid labour time) in a sensitivity analysis
#5 How to finance Internet-based lifestyle interventions – also in the long run – to ensure their financial sustainability	Mobilize governmental bodies to ensure long-term financial possibilities

A second challenge is how to determine whether the effects of an intervention on lifestyle outweigh its costs. New interventions often bring about additional effects, but also additional costs, which is reflected in the ICER calculated in step 3 of an economic evaluation. Whether the ICER is acceptable, however, depends on society's willingness to pay (WTP) per additional measure of effect. The ICER should be lower than the WTP for the intervention to be considered as having sufficient value for money. Often €18,000/QALY has been set as the Dutch WTP for preventive interventions, though this cut-off point is still contested (Raad voor de Volksgezondheid en Zorg, 2006). Besides, no information on the WTP for lifestyle improvements, e.g. for each additional non-smoker or health norm met, is available. This hinders the interpretation of the results from economic evaluations using lifestyle related outcomes. This became especially apparent in three studies in which the cost-effectiveness (i.e. using lifestyle related outcome measures) and cost-utility (i.e. using QALYs as outcome measure) of three different Internet-based interventions were determined. In all three studies, both types of analyses suggested different treatments to be most efficient (Schulz et al., 2014; Smit et al., 2013; Stanczyk et al., 2014). To overcome this problem, WTP cut-off points could be defined for improvements in different lifestyle related outcomes. However, given the range of lifestyle related health behaviors, a better alternative might be to transform lifestyle improvements into metrics that can be compared across behaviours and for which WTP cut-off points are known (e.g. transforming lifestyle improvements into QALYs) (Schulz et al., 2014; Tate, Finkelstein, Khavjou, & Gustafson, 2009). Yet, recent research efforts indicate the potential but also the challenges that accompany the development of such metrics (Versteegh, Leunis, Groot, & Stolk, 2012), indicating that more research is needed before reliable metrics can be recommended.

A third challenge is how to predict long-term costs and effects accurately. Many economic evaluations are trial-based, i.e. conducted using data collected

alongside a randomised controlled trial (e.g. Schulz et al., 2014; Smit et al., 2013; Stanczyk et al., 2014; Warmerdam et al., 2010). This often implies that follow-up periods are relatively short and limited to 12 or 24 months. However, assessing the effects of lifestyle interventions on health related outcomes (e.g. a reduced risk of cardiovascular diseases due to smoking cessation) often requires a longer follow-up period. A potential solution to this problem may be to complement trial-based economic evaluations with modelling techniques to predict long-term costs and effects. A major drawback of modelling though is that a model is only as good as the available evidence. If the evidence-base is limited, it is hard to model long-term costs and consequences accurately, resulting in uncertainty in the results presented (Drummond et al., 2005). To optimise model-based economic evaluations, longitudinal research is required in which long-term costs and effects associated with lifestyle related risk factors are investigated. Moreover, for model-based economic evaluations of Internet-based lifestyle interventions, the choice of a discount rate is particularly important as these interventions often generate benefits in the distant future, while costs have to be invested in the short-term. This poses additional challenges, as we know that the use of a certain discount rate will have an influence on the results (Evers, Hiligsmann, & Adarkwah, 2014) and there has been considerable methodological debate about the most appropriate discount rate that should be applied to costs and health benefits being modelled (Weatherly et al., 2009).

The fourth challenge is how to value participant time. Whereas the costs associated with the time spent by a health professional are often well documented in guidelines (Tan, Bouwmans, Rutten, & Hakkaart-van Roijen, 2012), in many Internet-based lifestyle interventions no health professional is involved (Webb et al., 2010). Consequently, the only time that needs to be valued in terms of costs is the time people spend participating in these interventions. However, people often participate in their leisure time and the question remains how this should be valued. It has been suggested to value it as labour time, using wages, or to value it as unpaid work (Tan et al., 2012). Yet, a comparison of the different methods to value patient time revealed that the method of valuation greatly influenced economic evaluation results (Guerriere, Tranmer, Ungar, Manoharan, & Coyte, 2008). To deal with this uncertainty, we recommend that patient time is valued using different methods in a sensitivity analysis (see also step 5 of economic evaluations as described in Smit et al., 2013).

A final challenge concerns how Internet-based lifestyle interventions can be financed – also in the long run – to ensure their financial sustainability. When published on the Internet, many Internet-based interventions become publicly accessible. Yet, not everything that is publicly accessible is for free and often there are costs associated with the permanent availability of these interventions (e.g. costs associated with hosting a website or keeping an intervention up-to-date). However, after an Internet-based intervention has been studied for its (cost-)effectiveness, research funds are often no longer available and new funding needs to be found for the intervention's dissemination. Although this is not in the heart of the economic evaluation itself, financial and organisational sustainability of these interventions is a major challenge. While some intervention developers or researchers might have the resources and/or enthusiasm to pursue long-term funding, a more sustainable option might be for governmental bodies to play a role in this respect.

Conclusion

Given the current economic climate and resulting limited resources for large-scale implementation, economic evaluations of Internet-based lifestyle interventions are becoming increasingly important. The few economic evaluations carried out to date show a great potential for these types of

interventions in terms of value for money. Nonetheless, many challenges remain for conducting rigorous economic evaluations, as well as for the interpretation and the use of their results. We therefore encourage researchers in the field not only to conduct economic evaluations alongside their randomised controlled trials, but also to investigate novel ways of overcoming the challenges presented in this paper.

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