

# Improving the Cost-Effectiveness of a Healthcare System for Depressive Disorders by Implementing Telemedicine: A Health Economic Modeling Study

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**Objectives:** *Depressive disorders are significant causes of disease burden and are associated with substantial economic costs. It is therefore important to design a healthcare system that can effectively manage depression at sustainable costs. This article computes the benefit-to-cost ratio of the current Dutch healthcare system for depression, and investigates whether offering more online preventive interventions improves the cost-effectiveness overall. Methods:* *A health economic (Markov) model was used to synthesize clinical and economic evidence and to compute population-level costs and effects of interventions. The model compared a base case scenario without preventive telemedicine and alternative scenarios with preventive telemedicine. The central outcome was the benefit-to-cost ratio, also known as return-on-investment (ROI). Results:* *In terms of ROI, a healthcare system with preventive telemedicine for depressive disorders offers better value for money than a healthcare system without Internet-based prevention. Overall, the ROI increases from €1.45 (\$1.72) in the base case scenario to €1.76 (\$2.09) in the alternative scenario in which preventive telemedicine is offered. In a scenario in which the costs of offering preventive telemedicine are balanced by reducing the expenditures for curative interventions, ROI increases to €1.77 (\$2.10), while keeping the healthcare budget constant. Conclusions:* *For a healthcare system for depressive disorders to remain economically sustainable, its cost-benefit ratio needs to be improved. Offering preventive telemedicine at a large scale is likely to introduce such an improvement. (Am J Geriatr Psychiatry 2014; 22:253–262)*

**Key Words:** Cost-benefit analysis, depressive disorder, e-health, prevention, health economic modeling

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Depression is the single leading cause of nonfatal disease burden<sup>1–3</sup> and has substantial economic consequences.<sup>4–7</sup> Reducing the disease burden due to depressive disorders at affordable costs is therefore of great significance to public health.

Cushioning the adverse effects of depression requires a healthcare system well equipped to manage the disorder. To that end, the interventions for depression that are offered need to be acceptable to both healthcare users and healthcare providers. In addition, the interventions must be effective in generating the required health gains and be economically sustainable over time. It is difficult to identify which particular combination of interventions will meet all these criteria within the extensive range of available options that are offered in multiple formats to different target groups.

The task of identifying an “optimal” healthcare system becomes even more daunting when the acceptability and cost-effectiveness of a newly designed healthcare system have to be compared with the cost-effectiveness of the current healthcare system. In particular, we need to know how a (hypothetical) healthcare system based on widespread implementation of preventive telemedicine would compare with the current healthcare regimen without preventive telemedicine. Would such a healthcare system produce larger health gains? In addition, how would the new system compare with the current healthcare regimen in terms of its benefit-to-cost ratio?

To facilitate decision making, we developed a health economic simulation model for depression called DEPMOD. This model assesses the population-level cost-benefit ratio of an alternative healthcare system relative to the current one. Although availability of data prompted us to apply DEPMOD to the population aged 18–65 years, we expect that DEPMOD is also relevant to older populations. This is especially true because the older population has an elevated risk for depression,<sup>8</sup> and the evidence suggests an increased risk of additional adverse outcomes for older people with depression.<sup>9</sup> The older population might be under pressure to be economically productive, even beyond the current age of retirement, due to the present-day economic downturn in “graying” societies. At the same time, increased life expectancy, common in high-income countries, is associated with an increase in the number of depressed older people.

In sum, graying societies, increased demand for mental healthcare, rising healthcare expenditure, and dwindling labor forces for mental health underscore the importance of the healthcare system being reassessed and geared toward offering more cost-effective interventions. Implementing interventions that can be offered over the Internet seems to be a promising approach because these interventions are likely to be scalable, effective, and cost-effective. DEPMOD simulates the possible consequences of offering Internet interventions for major depression.

Experience with the Australian Assessing Cost-Effectiveness models for heart disease, mental disorders, and prevention<sup>10–12</sup> and the WHO-CHOICE models (Choosing Interventions That Are Cost-Effective)<sup>13,14</sup> indicates that health economic models may have value for policy making. DEPMOD was specifically designed for the Dutch healthcare system, using Dutch population-based cohort data on depressive disorder<sup>15</sup> and standard cost prices pertinent to the Dutch healthcare system.<sup>16</sup> It also models the impact of several preventive e-health interventions that were recently developed, evaluated, and disseminated in The Netherlands. However, DEPMOD can be used for other countries and populations, provided that data requirements are met.

The aim of the current article was to briefly describe DEPMOD and then apply DEPMOD by modeling the current package of healthcare interventions and an extended package in which preventive telemedicine is added. The goal was to address the question of whether preventive telemedicine offers good value for money.

We define telemedicine (e-health) as psychological self-help interventions that are delivered over the Internet, either with or without minimal therapist support. Meta-analyses of randomized trials have demonstrated the effectiveness of both prevention of depressive disorder<sup>17,18</sup> and (preventive) e-health interventions.<sup>19,20</sup> In addition, telemedicine is very scalable because of the widespread usage of the Internet. It should be noted that older people are the fastest growing group of new Internet users, and one of the main reasons older individuals use the Internet is because they are seeking answers to health questions. By implication, there is a good match between older people’s Internet usage and e-mental health. Although not explicitly modeled here, evidence suggests that depression prevention is also effective in

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