



<b>Title</b>	<b>A Review and Critique of Modeling in Prioritizing and Designing Screening Programs</b>
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## Aim

To undertake a structured review and critical appraisal of methods for model-based, cost-utility analysis of screening programs. Informed by the review, study aims include development of guidelines and an assessment checklist of good practice in screening models.

## Conclusions and results

Few relevant methodological studies were identified, and no studies reporting direct empirical comparisons on the relative merits of alternative methodologies. Hence, the defined guidelines and assessment checklist are based on theoretical interpretations of the impact of alternative approaches to different components of the modeling process when applied to the cost-utility analysis of screening programs. The review identified many alternative modeling methods that had been applied in cost-utility analyses of screening programs, including some relatively new approaches that had not been widely disseminated. The natural history modeling approach was identified as the preferred general method of evaluation for screening programs. Alternative modeling approaches were generally used only to extrapolate the observed effects of screening and were unsuitable for evaluating unobserved screening options.

State transition models have generally been used to represent disease natural histories, though individual sampling models are more prevalent than in treatment intervention evaluations. Structural aspects that were not well handled by screening models include post-diagnosis disease progression and screening uptake. Calibration is common and important in screening models, and models are fitted to observed data describing outputs of the model to populate unobserved input parameters. In most cases, calibration was limited to identifying best fitting parameter values. See Executive Summary link at [www.hta.ac.uk/project/1567.asp](http://www.hta.ac.uk/project/1567.asp).

## Recommendations

The review of methods for the model-based, cost-utility

analysis of screening programs identified the natural history modeling approach as the preferred general method of evaluation for screening programs. More complex model structures may incorporate important additional aspects of the disease natural history, although any benefits should outweigh the consequences of additional unobservable input parameters and increased complexity in implementing the model. Preferred approaches to handling post-diagnosis disease progression and screening uptake would incorporate treatment models representing current treatment patterns, while available evidence might inform links between screening uptake rates and disease incidence or progression. Model calibration should predict output parameters for many input parameter sets, with the accuracy of each set's predictions represented as a weight. The main analysis of the model then samples many input parameter sets according to the weights attached, from which mean values and probability distributions of cost-effectiveness can be derived. Further research should address methods with the potential to improve accuracy in screening models and to respond to the needs of model users.

## Methods

Literature searches identified applied and methodological studies of economic evaluations of healthcare screening programs. In addition, applied screening models in antenatal screening and 3 broad disease areas (cancer, cardiovascular disease, and diabetes) were reviewed. See Executive Summary link at [www.hta.ac.uk/project/1567.asp](http://www.hta.ac.uk/project/1567.asp).

## Further research/reviews required

More complex mathematical modeling approaches have great potential as alternatives or adjuncts to state-based modeling techniques in evaluating the cost utility of screening programs. See Executive Summary link at [www.hta.ac.uk/project/1567.asp](http://www.hta.ac.uk/project/1567.asp).