Effectiveness and cost-effectiveness of blood pressure screening in adolescents in the United States

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study examined the cost-effectiveness of various approaches to managing high blood pressure in adolescents. The authors concluded that routine blood pressure screening in adolescents was moderately effective, but blood pressure reduction interventions for the whole adolescent population could be cheaper and more effective in preventing cardiovascular disease. There were a few limitations to the reporting, but the authors’ conclusions appear to be reasonable.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of various approaches to managing high blood pressure in adolescents.

Interventions
Seventeen strategies were evaluated. The three main approaches were no intervention, screening then treatment, and strategies to reduce blood pressure for the whole population. Screening then treatment consisted of six strategies to screen all 15-year-olds and three to screen only those who were overweight, with treatment for those with high blood pressure. The population strategies were five active individual-based behavioural programmes aimed at all or overweight 15-year-olds, without screening, and two passive policy or environmental programmes. Treatments and programmes aimed to reduce weight (if overweight), increase exercise, or reduce salt intake. Medication or surgery was considered for hypertension secondary to treatable conditions.

Location/setting
USA/primary care.

Methods
Analytical approach:
Modelling involved two phases. Phase 1 simulated a cohort of 2,065,127 boys and 1,952,694 girls aged 15 years. Long-term tracking correlations, the blood pressure distribution (three categories) at age 15 years, and treatment effectiveness were used to estimate the blood pressure distribution at age 35 years for Phase 2. Phase 2 was a Markov model, the Coronary Heart Disease (CHD) Policy Model, that used risk equations to estimate the effectiveness of reduced blood pressure for various outcomes (CHD events, and CHD and non-CHD deaths). The risk equations were stratified by age, gender, and other risk factors, such as blood pressure and smoking status, along with the costs for various blood pressure management strategies. A lifetime horizon (up to 85 years old) was used and the authors stated that a societal perspective was adopted.

Effectiveness data:
The clinical evidence came from a selection of relevant studies. The main inputs were the reduction in blood pressure and its effect on the risk of CHD events. The effectiveness of the behavioural interventions for individuals was from published meta-analyses, authors’ assumptions, and expert opinion. The effectiveness of policy programmes was from a published study and authors’ assumptions. Most of the epidemiological and screening estimates, such as the prevalence of high blood pressure at one screen, were from published literature. The incidence of CHD (myocardial infarction, cardiac arrest, or angina), the CHD and non-CHD mortality, and the revascularisation rates (percutaneous coronary
intervention or coronary artery bypass graft), for different risk factors were from several published studies.

Monetary benefit and utility valuations:
Each model health state and event was assigned a health-related quality of life adjustment. These utility values were from a US observational study.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure. They were discounted at an annual rate of 3%. Life-years were reported.

Cost data:
The direct medical costs included paediatrician visits, diagnostic tests for secondary causes and comorbidities, the treatment of secondary hypertension, medications, individual-based behavioural interventions (weight reduction, exercise, salt reduction), additional exercise classes in school, and policy changes. The resource use and costs came from published US sources, such as Medicare and Medicaid payments, except for the costs of the policy to reduce salt in food and educate via the media, which were from upper-to-middle income countries. All costs were in US dollars ($) and the price year was 2006. Future costs were discounted at an annual rate of 3%.

Analysis of uncertainty:
A deterministic one-way sensitivity analysis was undertaken to investigate the parameter uncertainty and its impact on the results. Modified scenarios were created to include the potential non-blood pressure cardiovascular benefits from weight reduction, and to assess changes to systolic blood pressure instead of diastolic blood pressure. The results were presented on an incremental cost-effectiveness plane (using efficiency frontiers) and in tornado diagrams.

Results
An incremental cost-effectiveness analysis was performed and dominated strategies, which were more expensive and less effective than another option, were excluded.

The cheapest non-dominated strategy was the population salt reduction policy. Compared with the next less expensive strategy, the population policy to increase exercise in school had an incremental cost-effectiveness ratio (ICER) of $11,605 for boys and $34,698 for girls. The exercise programme for all adolescents had an ICER of $55,538 for boys and $121,126 for girls.

In the scenario assuming that weight loss improved cholesterol and diabetes risk, the policy to increase exercise in school was dominated by a weight loss programme for overweight adolescents. The exercise programme for all had an ICER of $201,239 for boys and was dominated for girls.

Authors' conclusions
The authors concluded that routine blood pressure screening in adolescents was moderately effective, but blood pressure reduction interventions for the whole adolescent population could be cheaper and more effective in preventing cardiovascular disease.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear; they were the available options for managing high blood pressure in adolescents. They might be relevant options in other settings. The interventions were not described in detail, but references were given and these reflected the authors' setting.

Effectiveness/benefits:
The methods used to identify and select the most relevant sources of clinical evidence were not reported, but these sources were generally well cited. They seem to have been of high quality, for example published meta-analyses, but their key methods were not given. The approach used to elicit the utility values, the values used, and the health states that they applied to were not stated. These factors might limit the generalisability and transferability of the results and the sources should be consulted for more information. QALYs were an appropriate measure of benefit as they capture the impact of the blood pressure reduction strategies on the patients' quality of life, and they allow comparisons with
other programmes and diseases.

Costs:
The stated perspective was societal, but only the direct medical costs appear to have been analysed. In general, these costs were presented as category totals, without a breakdown of cost items and without the resource use estimates. This reduces the transparency of the analysis and might hinder the ability to reproduce the analysis for other settings. The discount rate, currency, and price year were reported.

Analysis and results:
The approach and modelling assumptions were generally well described, with details in an appendix, and a diagram of the model was presented. The absolute costs and benefits were not reported for each strategy; the incremental results were given. The uncertainty was partly investigated by varying each parameter individually; the results were reported for some, but not all strategies, which limits the transparency of the analysis. Alternative scenarios were investigated. The authors acknowledged some limitations to their analysis, such as the assumption of no synergy between blood pressure interventions, for example exercise and weight loss.

Concluding remarks:
There were a few limitations to the reporting, but the authors’ conclusions appear to be reasonable.

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