Editorial

Public health interventions: evaluating the economic evaluations

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Recent years have witnessed much progress in the incorporation of economic considerations into the evaluation of public health interventions. In England, the Centre for Public Health Excellence within the National Institute for Health and Care Excellence (NICE) works to develop guidance for preventing illness and assessing which public health interventions *are most effective and provide best value for money*.[1] Chapter 6 of the recent publication *Methods for the Development of NICE Public Health Guidance* considers in detail the role that health economics can play.[2] In the United States, the Centres for Disease Control and Prevention have produced a set of public health economics tools, including a highly readable summary of the relationship between economics and public health and a guide to assessing the cost-effectiveness of public health prevention initiatives.[3,4]

Value for money is a key tenet of the economic perspective: those charged with allocating spending to public health interventions should identify and fund those interventions which, evidence shows, offer the best value for money. The idea is that the benefits that are offered by an intervention should be worth the costs of providing it. The traditional economic approaches to evaluating such programmes include cost-effectiveness and cost-utility analysis, which focus on the gain to health for the individuals directly affected by the intervention. However, as noted by NICE, public health interventions may require a wider set of outcomes to be measured. In England, from March 2013, local government has taken over responsibility for implementing public health programmes. As such, NICE notes, cost-consequence and cost-benefit analysis, which have a wider remit in terms of the outcomes that they measure,[5] may sometimes be preferred.

Given these encouraging developments, it is worth trying to identify where future effort at the level of the design and implementation of economic evaluations of public health interventions could result in greater payoffs. Here we propose two areas: i) whether, in some situations, it is better to stop an evaluation early, because the evidence that has been collected to date is deemed to be *conclusive*; ii) how those charged with evaluating public health interventions from the economic perspective should deal with the problem of uncertainty surrounding estimates of cost-effectiveness. These two topics, though posed separately, are interlinked, since both concern questions of how to assess, and act upon, an evolving evidence-base as an evaluation progresses.

Economic evaluations of public health interventions have their own benefits and costs. On the cost side, there are the costs of paying a research team to undertake research, write up the results for publication, and so on. On the benefits side, the reduction in uncertainty surrounding the estimate of the cost-effectiveness of an intervention implies a lower probability of making the wrong decision and so allocating resources to interventions that do not offer good value for money. Other costs and benefits may be less apparent, however. For example, delaying to the wider public access to a new, cost-effective, approach to improving the public health while an evaluation progresses, perhaps in order to achieve a pre-determined level of *confidence* in results, can impose a cost on society.

Recent advances in the medical statistical literature permit the early termination of evaluations when evidence strongly suggests that a new intervention is more effective, or less effective, than its comparator. In *group sequential design*,[6,7] those assessing the intervention have the option to stop an evaluation early if the evidence that has accumulated is convincing enough to suggest that a new intervention should be adopted (or not, as the case may be). The savings in research costs can then be reallocated to other research projects, or to the interventions themselves. *Adaptive design* permits flexibility in the allocation of participants in an evaluation as it progresses, with more participants being allocated to the preferred intervention based according to the evidence which has accumulated to date.[8] Hendricks-Brown *et al.*[9] discuss a series of adaptive approaches which could be used in the public health arena, and assess the opportunities and threats posed by them.

The second area concerns the treatment of the uncertainty surrounding estimates of the cost-effectiveness of public health interventions. In its examples of evidence tables, NICE distinguishes between requirements for what it terms *quantitative studies* and economic evaluations.[10] The evidence table for quantitative studies requires the reporting of all measures of statistical uncertainty, including *confidence intervals, P-values, standard deviations* and *standard errors*. The evidence table for economic evaluations classifies analysis of uncertainty surrounding estimates of cost-effectiveness as *secondary*; the primary outcomes to be reported concern the point estimates of expected cost-effectiveness. Further, NICE's recommendations for whether or not a public health intervention is deemed *cost-effective* suggest that uncertainty only matters when the cost-per-QALY estimate exceeds £20,000: *in general, interventions with an ICER of less than £20,000 per QALY gained are considered to be cost effective*. For estimates that are greater than £20,000 per QALY gained, other factors should be taken into account, such as *the degree of uncertainty around the ICER*.[2] NICE therefore appears to treat the (quantitative) evidence arising from economic evaluations differently to quantitative evidence arising from other studies, such as clinical evaluations.

Why is uncertainty surrounding a cost-effectiveness estimate, regardless of any *threshold*, potentially important? First, estimates of cost-effectiveness can show large variability from one study to another and be sensitive to the methodology adopted. This is especially the case when decision modelling is used to obtain estimates of long-term health outcomes from a study with a short period of follow-up. Secondly, as noted by recent contributions to the literature,[11-13] the study of uncertainty allows investigators to carry out so-called *value of information* (VoI) analyses in order to define research priorities. These analyses compare the expected benefit from narrowing the uncertainty in a study with the expected cost of obtaining it by increasing the sample size. Attention paid to VoI in NICE documentation is relatively limited, but is likely to grow. Finally, uncertainty matters because of the existence of potentially irreversible consequences associated with making public health decisions. For example, there could exist costs of adopting a new intervention which, once spent,

cannot be recovered (examples include training staff and building new premises). In such cases, when an evidence base evolves over time, a decision concerning *whether* to carry out a new intervention to improve the public health cannot be separated from that about *when* it is best to do so.

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