The results of a pharmacoeconomic study: incremental cost-effectiveness ratio versus net monetary benefit

To the Editor

The article by Wouters and colleagues presents an exhaustive overview on how quality-adjusted life years (QALYs) can be used in cost-effectiveness analysis. In this framework, the authors also mention the incremental cost-effectiveness ratio (ICER), which is the parameter typically used to express the results of a cost-effectiveness study. The article, however, does not discuss the net monetary benefit (NMB), which is another parameter used to express the results of a cost-effectiveness study.

The incremental cost (ΔC) and the incremental effectiveness (ΔE) are the two main parameters of pharmacoeconomics and cost-effectiveness analysis, along with the willingness-to-pay threshold (λ). The decision rule (eg, in the case of a favourable pharmacoeconomic result) is ΔC/ΔE < λ (equation 1), if based on the ICER, or (ΔE x λ – ΔC) > 0 (equation 2), if based on the NMB. Likewise, an unfavourable pharmacoeconomic result is when ΔC/ΔE > λ or when (ΔE x λ – ΔC) < 0; NMB is defined as ΔE x λ – ΔC, while ICER is defined as ΔC/ΔE.

Despite its apparent complexity, most part of the pharmacoeconomic methodology is described by the two simple equations reported above (ie, equations 1 and 2), but whether the ICER or the NMB is the best parameter for the purposes of pharmacoeconomic decision-making remains on open question.

The study by Cowper et al evaluating new versus old oral anticoagulants in patients with atrial fibrillation is a typical ICER-based cost-effectiveness analysis in which the ICER of apixaban versus warfarin is compared against a willingness-to-pay threshold. This analysis can be taken as an example for comparing ICER with NMB.

In one of the base-case analyses of the study by Cowper et al, QALYs per patient were 7.94 for apixaban and 7.54 for warfarin, while pharmacological costs per patient were US$22,934 and US$4392, respectively. These data yielded, for apixaban versus warfarin, an ICER of US$46,355 per QALY gained, a value that remains within the willingness-to-pay threshold of US$50,000 per QALY gained and is therefore considered favourable (or ‘high value care’). As pointed out by Hlatky, in interpreting a specific ICER value, more than a single willingness-to-pay threshold is frequently considered (eg, the threshold between US$50,000 and US$150,000 or the threshold above US$150,000), and this allows us to better understand a pharmacoeconomic result expressed on the basis of an ICER.

In the methodology of pharmacoeconomics, the NMB plays a role similar to that of ICER, but some differences are important.

First, the ICER—by definition—always has an incremental nature and consequently the absolute cost-effectiveness ratio (calculated for a single treatment in the absence of any comparison) makes little sense and, for this reason, is rarely used. In contrast, the NMB can be calculated for a single treatment in the absence of any comparison (absolute NMB) or can conversely be calculated as an incremental parameter (according to the equation: (incremental NMB) = (incremental QALYs per patient) x λ – (incremental cost per patient)). Another feature of NMB is that the incremental NMB for the comparison of A versus B can be estimated as the absolute NMB calculated for A minus the absolute NMB calculated for B. In this sequence of calculations, calculating the absolute NMB makes sense because the absolute NMB (separately calculated for the experimental treatment and for the control treatment) represents an intermediate step in the calculation of the incremental NMB (box 1).

The values of absolute NMB for apixaban and warfarin (box 1) are, respectively, US$374,066 and US$372,608 per patient (calculated according to equation 2). Hence, the incremental NMB for apixaban versus warfarin is simply the difference of the above two values, ie, US$1,458 per patient.

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