

Appendix II – Multi-Criteria Decision Analysis Methods

Multi-criteria decision analysis can be utilized to assign weights to items by ranking all possible combinations in order of severity of toxicity. 1000Minds software facilitates the process by determining the point values of multi-attribute value models and has been used in studies in healthcare, corporate management, agriculture, and environmental management.¹ 1000Minds employs the “Potentially All Pairwise Rankings of all possible Alternatives” (PAPRIKA) method.² PAPRIKA is based on the principle that an overall ranking of items in a model can be achieved if all possible pairwise combinations of the included items can be ranked. Ranking in a pairwise manner carries less cognitive burden than ranking multiple criteria simultaneously. Because the total number of pairwise rankings can number in the thousands, 1000Minds limits the number of pairwise rankings using the property of transitivity (if $A > B$ and $B > C$, then $A > C$). Any pairwise decision in which one option clearly has a higher weight (in this case, greater toxicity) based upon the outcomes of previous comparisons is not presented for consideration, thereby creating an efficiency of comparisons and permitting hundreds of comparisons within a few hours.

Participants were asked to assess the relative weight (toxicity) of items by selecting the higher toxicity from a paired patient scenario differing in two toxicity items. Figure 1 shows examples of the types of comparisons the Scientific Committee was made asked to make in deciding which combinations of clinical GC complications of GC use constituted the higher degree of greater GC toxicity. Using Turning Point voting technology (Youngstown, Ohio), experts anonymously chose the scenario with higher GC toxicity. The results of each vote were immediately presented to the full Scientific Committee and reasons for disagreement, if present, were discussed. If there was significant disagreement, the group re-voted after discussion of disagreements. This step was repeated if necessary. Consensus was achieved when all participants reached agreement or could accept the majority decision.

Based on the number of domains and toxicity items, there were 62,208 possible paired patient scenarios differing in two toxicity items. The participants completed 103 scenarios, reaching agreement on all combinations. The remaining 62,105 scenarios were then implicitly resolved using the transitivity principle within the 1000Minds software. Through iterative discrete pairwise choices, 1000Minds assigned relative weights to the items.

Figure 1

Which patient shows greater steroid-related toxicity?
(given they're identical in all other respects)

<p>1. Change in Body Weight d Major increase</p> <p>6. Skin b Mild skin toxicity</p> <p>this one</p>	OR	<p>1. Change in Body Weight c Moderate increase</p> <p>6. Skin c Moderate skin toxicity</p> <p>this one</p>
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Screenshot from the exercise using 1000Minds

References

1. 1000Minds homepage. <https://www.1000minds.com>. Accessed June 1, 2015.
2. Hansen P, Ombler F. A new method for scoring multi-attribute value models using pairwise rankings of alternatives. *J Multi-Crit Decis Anal.* 2009;15:87-107.