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Addressing the disconnect between public health science and personalised health care: the potential role of cluster analysis in combination with multi-criteria decision analysis

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Abstract

Background Public health promotion and person-centred health care are being pursued simultaneously, with little attempt to resolve the conflict between them. One necessary step is to accept that health-care decisions involve multiple criteria and hence are preference sensitive. A second is to arrive at the necessary compromise between an individualised public policy (using each individual's preferences) and a deindividualised policy (using mean population preferences) in a more rigorous and transparent way. We show how cluster analysis can be combined with multi-criteria decision analysis (MCDA) to facilitate progression from variable-centred to person-centred public health, albeit at a subgroup level.

Methods Cluster analysis encompasses various techniques designed to detect patterns in the characteristics of individuals to establish the basis for policy decisions targeted at subgroups rather than the entire population. The characteristics can be objective health indicators or, as in our case, individual's preferences, expressed as importance weights for criteria. The techniques vary in their assumptions and procedures, and typically produce different results, although their common aim is to minimise intra-cluster differences and maximise the inter-cluster ones. In contrast to most previous studies that used only one clustering method, we compare the results from three techniques: a hierarchical agglomeration method (Ward's); partitioning around medoids; and latent class analysis. The data are from one arm of an Australian trial of online and interactive personalised decision aids for prostate cancer screening. Participants were 523 men aged 40–79 years, who assigned importance weights to five criteria: loss of lifetime, needless biopsy, and bowel, urinary, and sexual problems. The statistical quality of the cluster solutions produced was established and the results subjected to descriptive interpretation. Being interested in practical policy significance, the mean importance weights for each cluster were entered into a MCDA of the policy decision of whether or not to have a prostate-specific antigen (PSA) screening policy. MCDA is a technique designed to assess relevant options by combining the performance of each option on the decision criteria (outcomes, process attributes) with the weights assigned to those criteria by the decision owner, on the same 0–1 scale.

See Online for appendix

Findings The results presented (appendix) confirm that the different techniques, and alternative solutions within the techniques, produced different clusters. However, we could establish four meaningful preference-based subgroups, which we interpret as equals, very high lifers, moderate lifers, and very high sexers. Combining their mean importance weights with the performance ratings in the evidence base showed that no PSA screening emerged as optimum for all subgroups (results shown only for the Ward's method). By following the link in the appendix, the reader can interact with the underlying online program and establish the results and thresholds for all cluster solutions. We also calculated the threshold for improvement in the lifetime criterion that would be needed to flip the result for each of the subgroups to one where PSA screening is suggested (eg, 68% for very high sexers, 6% for very high lifers).

Interpretation Establishing interpretable preference-based subgroups and entering these into an MCDA formulation of a complex policy decision can be a major step towards person-centred rather than variable-centred public health policies.

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Contributors
MKK and JD conceived the study, undertook preliminary cluster analyses, entered the cluster results into MCDAs and are primarily responsible for the abstract. The final clustering analyses were undertaken by RT. JBN, GS, and MC commented on the analysis and the abstract. GS was principal investigator and MC and JD were co-investigators in the trial from which data come. All authors approved the final abstract.

Conflicts of interest
JD has a financial interest in the Annalisa software used in the trial but did not benefit from its use in it. The other authors declare they have no conflicts of interest.