**Box 1. Summary of key methodological guidance**

Modelling co-dependency between the components of the refractive outcome

* Combining the three components (sphere, cylinder and axis) into a univariate outcome or modelling the components independently will lead to a loss of information and may introduce a systematic error.
* To account for co-dependencies between the sphere, cylinder and axis components, and avoid loss of information and introduction of systematic error, transform the refractive outcome into components of the dioptric power matrix and simultaneously analyse these components using a multivariate normal model.

Accounting for the data’s dependence structure

* Ignoring the data’s dependence structure can lead to incorrect inference.
* Multilevel models account for dependencies between observations to obtain appropriate standard errors.
* The data may have a non-nested data structure (such as a cross-classified structure due to two surgeons operating on different eyes of a patient) which requires a specialised multilevel model.
* Multilevel models have been extended to multivariate outcomes.
* For continuous outcomes, the multilevel model can be used to make inferences at the population level, to make predictions at the operation level and to examine the data’s dependence structure (e.g. comparison of within-operation variability to between-patient and between-surgeon variability).

Estimation of a multivariate cross-classified model

* Markov chain Monte Carlo (MCMC) methods enable estimation of complex models that may be difficult to estimate using maximum likelihood methods.
* Applying MCMC methods with diffuse priors approximates maximum likelihood estimation.