An appropriate methodology for handling monotonicity when given only summary data should:

1. Never produce an inconsistent draw, i.e. a draw that crosses over the assumed monotonic relationship between variables.
2. Not produce biased or inaccurate estimates of quantities already known. E.g. the mean value of either of the distributions.
3. Not involve discarding available and usable information (i.e. information about either the mean or standard error of any of the component distributions), as with the lock-step approaches
4. Not involve making up information, and assumptions about the association between variables, just in order to satisfy the first condition.
5. Not require more information than is already available to the modeller from the summary data. I.e. requiring clinicians to define a between variable covariance structure may be a bit excessive.
6. Not require far more time and effort to perform than existing methods.

Possible relaxations of above conditions:

1. Could say that some minimal violation of monotonicity is acceptable, e.g. if below, say, 1% of draws. In effect when distributions are far apart then simply drawing distributions independently may be sufficient.
2. Again, small amounts of bias may be acceptable if the trade off is a much simpler method.
3. Don’t think there should be an exception to this.
4. Can be a fine line between making information up and incorporating knowledge and making inferences. E.g. knowing that two variables are strictly monotonic and that they each have a given mean and variance could be seen to imply the covariance structure, or limits on covariance structure, so in this sense this additional quantity is inferred rather than purely fabricated.
5. If clinicians are on hand to provide this information then it wouldn’t be too much of a demand.
6. If a method is more time consuming initially that may simply be due to the learning curve of the new method. Once how to do something properly is learned, the new method may be around about as quick and simple as the existing method.