

Statistical Trending with Application to the CAHPS Hospital Survey

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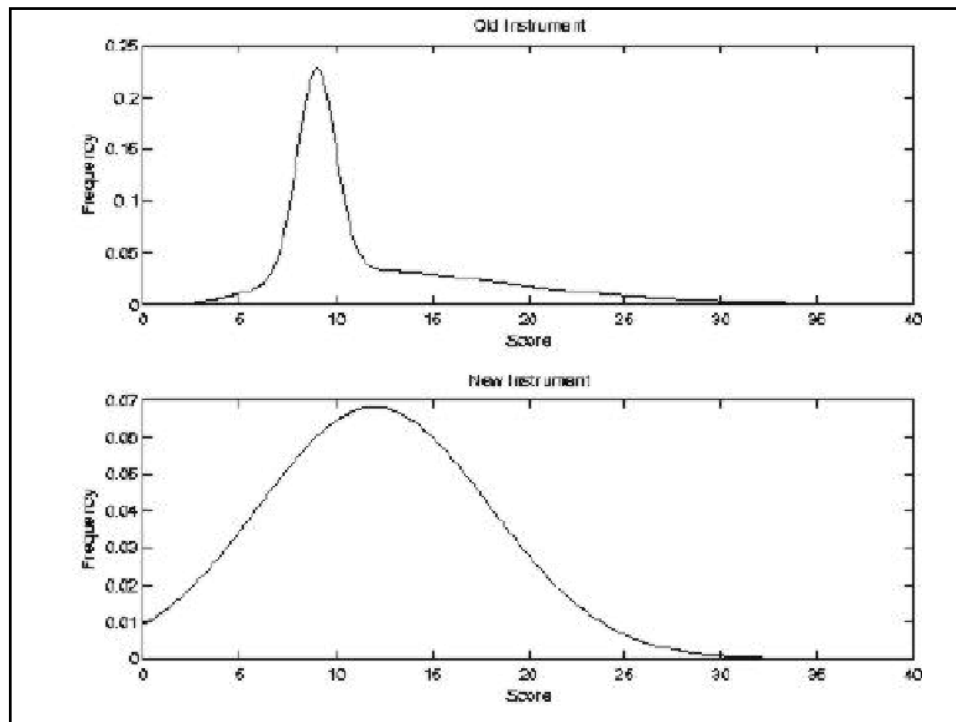
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The problem

- Trending or survey equating is the translation of a score across versions of a survey or across types of situations.
- Not regression!
- We do not want to estimate what score or value for an individual on an alternative survey, but rather want to know the equivalent score to that which they obtained.

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Equipercntile Equating

- Basic, well known method.
- Relates the percentiles of one distribution to those of another.
- Normal case: score of x on an old survey corresponds to a score of $y = e(x)$ on a new survey. Mathematically, given by:
$$e(x) = mn(y) + sd(y)(x - mn(x)) / sd(x).$$
- For continuously-valued items.
- Relies on form of the distributions of x and y .
- Need lots of data and homogeneous populations to estimate all parts of distributions well.

Discrete-valued items – What to do?

- Problem is that direct function from x to y not well defined.
- Could approximate the discrete distribution using a continuous distribution.
 - Makes sense when believe that there is an underlying continuous measurement.
- Item-response theory (IRT) models provide an alternative approach.

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IRT Models

- Model to all of the data from a survey simultaneous (for every item and every subject).
- For dichotomous items might fit the logistic regression model:
$$\Pr(Y_{ik}=1|\theta_k, a_i, b_i) = [1 + \exp(a_i(\theta_k - b_i))]^{-1}$$
where i denotes item and k denotes subject.
- θ_k is a latent variable that measures a general propensity to respond positively (e.g. to be happy with care).

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Equating with IRT Model

- Fit the IRT model separately to the data from each survey (to determine the scale of the latent variables the distribution of the θ_k across individuals is specified).
- Obtain the probability of a positive response on the new survey for every θ_k associated with the equated survey.
- Aggregate expected outcomes up to hospital or plan level for both surveys.
- Applies without any additional effort to items with different response categories across surveys.

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Issues

- Underlying assumption is that there is a “bridge” between surveys.
 - Some items remain unchanged. Enables adjustments for heterogeneous populations.
 - Samples of individuals drawn from a common population. Enables equating between non-overlapping surveys.
- If have heterogeneous populations can standardize all items using the common items (the anchors) prior to equating.
- Problem if have heterogeneous sample and no items in common.

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H-CAHPS Survey Applications

- Changing core survey items and altering the response scale of other items to be in line with H-CAHPS items.
 - Don't want change in a survey to inhibit ability to make longitudinal comparisons.
- Primarily interested preserving integrity of comparisons between composite items across surveys?
- Reasonable to assume surveys conducted on same population (performed one week a part).

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Potential Approaches for H-CAHPS Survey

- Equipercentile method problematic to implement on items at individual level.
 - Could apply directly to the composite items but then do not make full use of those items that have remained intact.
 - Could apply at hospital level but limited sample size.
- IRT best applied at individual level to individual items.
 - Neat and tidy, covers most situations.
 - Aggregate results up to whatever level you want.
 - Can generalize latent factor to allow for 2 or more underlying latent variables.
- Sometimes there is an intermediary survey, i.e. half of the items are changed first while the others are changed later.
 - The intermediary survey can be used as a bridge between the original and final versions.
 - Apply trending/equating method twice.

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