Building Bridges between the VR-12 and SF-36®
Patient Reported Outcomes in the SEER-MHOS Data Resource

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Topics to be covered in this presentation

• Medicare Health Outcomes Survey (MHOS)
• SF-36® and VR-12 health surveys
• Matching scales of the VR-12 to the SF-36®
• Extensibility Values - Definition and Applications
• Clinical Applications
• Conclusions
SEER-MHOS Description

• Linkage of cancer registry data (SEER) to patient-reported measures from the Centers for Medicare Medicare & Medicaid Services Health Outcome Survey (MHOS)

• MHOS is an annual quality improvement survey of Medicare Advantage participants, with beneficiaries sampled/surveyed/resurveyed 2 years later on health-related quality of life and other PROs

• Linked data are the records of individuals in both the SEER (1973-2011) and MHOS data sets, plus all additional MHOS data for the years 1998-2013
Description of the MHOS

- Sponsored by Centers for Medicare and Medicaid Services (CMS)
- Tracks functional health and well-being (HRQoL)
- Members of Medicare Advantage Plans
- Baseline random sample each year, 1998-present
- Follow-ups after 2 years must be alive and in plan
- Three eras in the type of instruments used to assess HRQoL

<table>
<thead>
<tr>
<th>Era</th>
<th>Cohort</th>
<th>Baseline survey year</th>
<th>Baseline survey instrument</th>
<th>Follow-up survey year</th>
<th>Follow-up survey instrument</th>
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</thead>
<tbody>
<tr>
<td>VR-12 era</td>
<td>9 to present</td>
<td>2006 to present</td>
<td>VR-12</td>
<td>2008 to present</td>
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<tr>
<td>Year</td>
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<td>Follow-up</td>
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</tbody>
</table>

**SF-36**

**VR-12**
SEER-MHOS linked dataset

- The Surveillance, Epidemiology, and End Results (SEER) program is a national registry of cancer patients that contains clinical and demographic information as well as causes of death. Data from a subset of individuals in the SEER program have been linked to the MHOS data resource, creating a combined SEER-MHOS data resource.
Use of the MHOS

• Assesses changes in physical and mental health status
  • Outcomes are PCS same or better, and MCS better
  • Baseline to follow-up (including death)
• The SEER-MHOS data resource tracks respondents across multiple cohorts where possible
• The SEER-MHOS data resource allows longer-term follow-up
• CMS uses the MHOS as a quality improvement tool, however, researchers can use the MHOS and by extension the SEER-MHOS data resource for research purposes considering the rich robust clinical and PRO measures available
Objective of the Bridging Study

Create an algorithm to match the scale scores between the SF-36® and the VR-12 and that can be applied across a broad range of potential subsamples in both SEER-MHOS and the MHOS.
SF-36® version 1.0 and VR-12

• Both are derived from Medical Outcomes Study Rand-36 questionnaire

• SF-36®
  ▪ 8 scales: physical functioning (PF), vitality (VT), bodily pain (BP), general health perceptions (GH), role limitations due to physical functioning (RP), role limitations due to emotional functioning (RE), social functioning (SF) and mental health (MH)
  ▪ 2-10 items per scale
  ▪ Physical and Mental Component Summary scores (PCS and MCS)

• VR-12
  ▪ 12 representative items from the above 8 scales taken from the VR-36 (longer form counterpart originally derived from the SF-36)
  ▪ Modifications to 4 “role functioning” items: 5 response choices in place of yes/no choices
  ▪ 8 scales can be calculated but only 1-2 items per scale
  ▪ PCS and MCS
Development of a bridging algorithm

Goal: Compare scores across samples of respondents that may differ
- Across survey versions
- Across time
- In demographics or health status
- By an external characteristic in the SEER framework
Extensibility

- Derived from generalizability theory
- Concept: Modified item matches original scale across clusters
- Mathematical definition:
  - Mean square error of modified item vs. original scale
- Implication:
  - Match is never perfect
  - But much better than it might have been
The bridging algorithm in more detail

• Create MHOS subsamples (clusters) that
  • Differ in health status
  • Are fairly homogeneous within each cluster
• For each cluster, compute:
  1) Average of complete scale using standard SF-36 methods
  2) Average for specific items using modified scoring
• Modify the scoring to make complete scale and modified scoring match
Results: Comparison of original to rescored scales*

*For the 100 clusters, association between the SF-36® Mental Health (MH) scale score calculated in the original way (with all 5 MH items present) and the VR-12 MH scale score calculated by two different methods, original (prorated) and rescored (proposed).
Mean of baseline age by cohort in MHOS database (N=1,880,765)
Results: Baseline PF scores across MHOS cohorts 1-12
Results: 2-year follow-up PF scores across MHOS cohorts 1-12
Results: 2-year change in PF scores across MHOS cohorts 1-12

New and original scale PF change between baseline and follow up by cohort
Application of SEER Data Set with MHOS: Patients with localized prostate cancer who underwent surgical treatment N=907

<table>
<thead>
<tr>
<th>Time intervals between the date of treatment to the date of the baseline survey</th>
<th>Patients with only localized prostate cancer who underwent surgical treatment (N=907)</th>
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<tr>
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<td>SF-36 era (cohorts 3-8)</td>
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<tr>
<td>7-12m</td>
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<tr>
<td>13-18m</td>
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<tr>
<td>19-24m</td>
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<tr>
<td>&gt;24m</td>
<td>63</td>
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</table>
Prostate Cancer, General Health scale
Original VR12 scale vs. Original SF36 scale

Adjusted baseline scores of General Health by time difference group in patients with only localized prostate cancer who underwent surgical treatment.
Prostate Cancer, General Health scale
Recoded VR12 scale vs. Original SF36 scale

Adjusted baseline scores of General Health by time difference group in patients with only localized prostate cancer who underwent surgical treatment
Application of SEER Data Set with MHOS: Patients with localized colon cancer who underwent surgical treatment N=1938

<table>
<thead>
<tr>
<th>Time intervals between the date of treatment to the date of the baseline survey</th>
<th>Patients with only localized colon cancer who underwent surgical treatment (N=1938)</th>
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<tr>
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<td>SF-36 era (cohorts 3-8)</td>
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<td>13-18m</td>
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<tr>
<td>&gt;24m</td>
<td>209</td>
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</tbody>
</table>
Colon Cancer with General Health scale
Original VR12 scale vs. Original SF36 scale

Adjusted baseline scores of General Health by time difference group in patients with localized or regional colon cancer who underwent surgical treatment
Adjusted baseline scores of General Health by time difference group in patients with localized or regional colon cancer who underwent surgical treatment.
Guidance for using extensibility values

• Extensibility is an additional error component
  • Applies where comparisons are unbalanced by survey version
  • Similar to a standard error
  • Non statistical error dominates in large samples
  • Sampling error dominates in small samples (<1000)
  • Typically 1-2 points on a 0-100 scale
    • But larger for the role scales, where responses changed
Other Sample Evolution Issues

• Ideas change about who has disease and symptoms
• Health care or plan membership has an impact
Limitations

• Extensibility is not perfect
  • Items in a scale differ slightly in content
  • Non-zero extensibility limits analysis of very large samples

• Extensions
  • The algorithm was developed from the MHOS in those 65 years of age or greater
  • Phone respondents are sicker but more positive
  • Proxy response, language also affects responses

• Sample evolution not fully understood
  • Secular trends in health, health knowledge, and Medicare Advantage
Conclusions

- Novel methodology (extensibility) enabled more accurate rescoring of the items from the VR-12 to numerically match scales of the SF-36®
- Other “obvious” methods of rescoring failed
- The new algorithm allows for more aggressive use of data, even when many items are missing
- Sample evolution problems are complex and could impact SEER analysis
Future research

• Development of algorithms to match individual items between the VR-12 and SF-36®, which may improve extensibility further

• Development of algorithms to address “sample evolution” problems that should improve upon the use of indicator variables to adjust for differences among MHOS cohorts
Suggested References:

Website: About the VR-36/VR-12/VR-6D, How to use the instruments... A website devoted to the suite of VR measures giving the history and applications with a comprehensive bibliography and the process for obtaining the documentation and scoring algorithms. http://www.bu.edu/sph/research/research-landing-page/vr-36-vr-12-and-vr-6d (last accessed 3/22/16)


Suggested References (continued)


Questions?