A DATA BASED ASSESSMENT OF RESEARCH DOCTORATE PROGRAMS
A Short History

- Data collection in 2007—using 2005-6 data for the most part
- 2008-reviewing and validating data and the methodology
- 2009—A Guide to the Methodology is published.
- 2010—The final report and accompanying spreadsheets will appear.
This Talk

• A little background
• The data that will become available and how they can be used.
• Thinking about quality of doctoral programs and program characteristics: How do we assess quality using data from programs?
• A variety of measures—overall and in different dimensions
• Study release—and after
CGS and the Study

• A special group who will be responsible for explaining and using the results.
• A great deal of information to absorb and interpret.
• NRC will try to give you early notice of the study release.
• Details of the release are not yet available.
Committee*

- Jeremiah P. Ostriker (NAS)  
  *Committee Chair*
  (Astrophysics)  
  Princeton University

- Virginia S. Hinshaw, *Vice-Chair*
  (Biology)  
  University of Hawai‘i Mano‘a

- Elton D. Aberle  
  (Agriculture)  
  University of Wisconsin-Madison

- Norman Bradburn  
  (Statistics)  
  University of Chicago

- John I. Brauman (NAS)  
  (Chemistry)  
  Stanford University

- Paul Holland  
  (Statistics)  
  Educational Testing Service

- Eric W. Kaler (NAE)  
  (Engineering)  
  SUNY-Stony Brook

- Earl Lewis *  
  (history)  
  Emory University

*Several members of Committee are present or former Deans of graduate schools.
Committee (2)

- **Joan F. Lorden***
  (Neuroscience)
  University of North Carolina, Charlotte

- **Carol B. Lynch***
  (Biology)
  University of Colorado, Boulder

- **Robert M. Nerem (NAE)**
  (Bioengineering)
  Georgia Institute of Technology

- **Suzanne Ortega***
  (Sociology)
  University of New Mexico

- **Catharine R. Stimpson***
  (English)
  New York University

- **Richard P. Wheeler***
  (English)
  University of Illinois
What will be released?

- The Report
  - A “slim volume” discussing what was done in the study, the data, and two *illustrative* methodologies for data based rankings.
- Online spreadsheets
  - Data for 4838 programs for the 20 variables used in the ratings calculation, and for 9 additional variables.
  - Range of rankings for 5 types of illustrative rankings: 2 overall and 3 dimensional
  - Ability to “click through” to get detail of ranking calculations
Release materials (cont’d)

• Demos to show how to query the spreadsheets
• Related effort on PhDs.com will permit calculations with user determined weights
• Press release and FAQ’s
• Press conference
• Revised Methodology Guide
Later

- Ranges of rankings for computer science
- Public use database
- Release of all questionnaire data (with individual identities masked) to researchers who request it and sign a confidentiality agreement

Six Months Later

- Conference on analytic uses of the data
What can you do with the spreadsheets?

• Pick out programs to compare with programs at your institution along many lines:
  – Research activity variables
  – Student support and outcomes variables
  – Diversity of students and faculty

• And, oh yes, ranges of *illustrative* rankings along those lines and across all 20 variables.
Key points

• It is helpful to compare programs that are doing similar things by collecting the same data from all the programs in a field.

• It is possible to compare data values by forming a ranking.

• There are many ways to develop rankings—the NRC did it in two ways—there are many others.

• It is important to know what goes into a ranking.
Some things that will change from the July 2009 Methodology Guide

• The rankings and their ranges
  – 1 overall ranking range ⇒ 2 separate ranking range calculations as *illustrations* of data-based ranking schemes
  – Change in length of range from covering 50% of a program’s rankings to covering 90%

• Emphasis
  – Ranges of rankings are *illustrative*. You could get different results with different assumptions.
What is the Assessment?

• Collection and dissemination of data on important aspects of doctoral programs
  – Programs
  – Students
  – Faculty
• Development of a benchmarking/rating methodology
  – Compare *doctoral programs* in a *single field* across universities
• 212 Universities, 59 fields with ratings
Audiences

1) Prospective graduate students. Give them better information about the various programs to make more informed decisions re where to apply.

2) Faculty in the programs to better evaluate their own strengths and weaknesses.

3) Those responsible for the health of graduate programs to enable them to better assess the programs under their charge and compare more objectively to those in other institutions.

4) Those with more global interests (legislators, boards of trustees, the US government, other nations) to provide more transparency in assessing a vital US national institutional resource.

5) During the “Recession of 2008-2010” Those responsible for resource allocation decisions.
Where do the data come from?

- Standardized source providers (e.g. citations from ISI, NSF for post-graduate student plans)
- New surveys (e.g. faculty & students)
- **US institutions of higher education:**
  - A HUGE TASK
## What Data will become Available?

### Research Activity
- Publications per faculty member going back to 1981
- Citations per publication (except for humanities fields) in 2005-6 with pubs going back to 1981
- Percent of faculty with grants (from NRC faculty questionnaire)
- Honors and awards per faculty member (from honorary and scholarly societies)

### Student Support and Outcomes
- Number of PhDs
- Percent receiving financial support in first year
- Median time to degree
- Percent of entering cohort(s) completing within six years (eight for the humanities)
- Percent of graduates with definite employment or postdoc plans (from NSF)
Summary Descriptive Information for Each Program

**Program Diversity**

- **Faculty:**
  - Gender diversity
  - Racial/ethnic diversity

- **Students**
  - Gender diversity
  - Racial/ethnic diversity
  - International diversity

**Program Interdisciplinarity**

- Percent of faculty associated with other programs
- Identification of “umbrella” programs
Questions

• A prospective student
  – What do I want to do when I finish and does the program seem to support that aim?
  – Am I likely to get funding?
  – How long will it take to complete?
  – How likely is it that if I start in a program that I will complete in a reasonable amount of time?
  – Will I be the only (woman, minority)?
More questions

• A department chair
  – What are the strengths and weaknesses of the program?
  – How does my program compare to peer programs?

• A provost
  – Where can additional resources result in the most improvement?
  – What programs could benefit from being combined with similar programs?
And Yet More Questions

- A state board of higher education
  - Do we have too many doctoral programs in a given field?
  - Which programs are strong nationally and deserve more support?
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Program A</th>
<th>Program B</th>
<th>Program C</th>
<th>Program D</th>
<th>Program E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publications per Allocated Faculty</td>
<td>4.993</td>
<td>4.328</td>
<td>4.448</td>
<td>2.937</td>
<td>2.379</td>
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<td>Cites per Publication</td>
<td>3.573</td>
<td>3.401</td>
<td>2.782</td>
<td>2.819</td>
<td>2.386</td>
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<td>Percent Faculty with Grants</td>
<td>88.6%</td>
<td>100.0%</td>
<td>95.5%</td>
<td>90.5%</td>
<td>73.4%</td>
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<tr>
<td>Percent Faculty Interdisciplinary</td>
<td>71.4%</td>
<td>0.0%</td>
<td>38.1%</td>
<td>18.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percent Non-Asian Minority Faculty</td>
<td>0.0%</td>
<td>5.0%</td>
<td>0.0%</td>
<td>2.9%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Percent Female Faculty</td>
<td>16.2%</td>
<td>13.6%</td>
<td>8.0%</td>
<td>17.9%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Awards per Allocated Faculty</td>
<td>1.929</td>
<td>7.291</td>
<td>1.896</td>
<td>0.640</td>
<td>0.424</td>
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<tr>
<td>Average GRE-Q</td>
<td>712</td>
<td>772</td>
<td>767</td>
<td>703</td>
<td>673</td>
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<tr>
<td>Percent 1st yr. Students w/Full Support</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>86.0%</td>
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<tr>
<td>Percent 1st yr Students with External Funding</td>
<td>0.0%</td>
<td>0.0%</td>
<td>22.2%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percent Non-Asian Minority Students</td>
<td>2.8%</td>
<td>1.9%</td>
<td>3.2%</td>
<td>8.0%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Percent Female Students</td>
<td>39.3%</td>
<td>39.1%</td>
<td>39.8%</td>
<td>42.2%</td>
<td>37.3%</td>
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<tr>
<td>Percent International Students</td>
<td>23.0%</td>
<td>42.7%</td>
<td>37.2%</td>
<td>45.1%</td>
<td>31.3%</td>
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<tr>
<td>Average PhDs 2002 to 2006</td>
<td>31.6</td>
<td>17.4</td>
<td>20.2</td>
<td>11.400</td>
<td>19.800</td>
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<td>Percent Completing within 6 years</td>
<td>49.3%</td>
<td>77.8%</td>
<td>67.6%</td>
<td>41.6%</td>
<td>54.0%</td>
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<tr>
<td>Time to Degree Full and Part Time</td>
<td>5.7</td>
<td>5</td>
<td>4.9</td>
<td>4.3</td>
<td>5.000</td>
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<tr>
<td>Percent students in Academic Positions</td>
<td>17.2%</td>
<td>32.1%</td>
<td>25.6%</td>
<td>20.0%</td>
<td>12.2%</td>
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<tr>
<td>Student Work Space</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Health Insurance</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine
How will the ratings/rankings work?

Two Approaches

• Asked faculty what they thought was important to the quality of a doctoral program and developed weights (S-weights).

• Asked a sample of faculty in each field how they would rate a sample of programs. Related those ratings to 20 program characteristics through a regression (R-weights)

• Calculated ratings using each approach for all programs in a field, based on program values for the 20 characteristics.

• The rankings will be *illustrative*. 
Overall Rating AND Dimensional Measures

• Student Treatment and Outcomes
• Diversity of the Academic Environment
• Research Activity of Program Faculty
The Twenty Key Variables used in the Rankings

- Publications per allocated faculty
- Citations (exc. Humanities) per publication
- Percent faculty with grants
- Awards per faculty
- Percent 1st Yr. Full Support
- Percent Completing in 6 yrs. or less (8 yrs. for humanities)
- Median Time to degree
- Students with Academic Plans
- Collects Outcomes data

- Percent Faculty Minority
- Percent Faculty Female
- Percent Students Minority
- Percent Students Female
- Percent Students International
- Percent Interdisciplinary
- Average GRE-Q
- Number of PhDs 2002-2006
- Student Workspace
- Student Health Insurance
- Student Activities
Ratings: What measures “Quality of PhD Program”? 

• Usual Approaches: 
  Those who design the study construct measures on an ad hoc basis. 
  • Based on reputation 
  • Based on refinements of scholarly productivity measures

• NRC Approach: 
  Faculty input on a field by field basis determines the measures. Two estimators of faculty values to estimate best measures: direct (S) and regression-derived (R).
Sources of uncertainty for any rating

- Differences among raters
- Year-to-year variation in the data
- Range of error in any statistical estimation

Every rating has a range, and so do the rankings derived from the ratings

- We settled on a broad range—one that covers 90% of the estimated rankings for a program
- Unincluded and unquantifiable factors may also matter—but the committee focussed on what could be quantified.
Changes to Encourage Use of the Study Data

• Make data easily available via web
• Disseminate through professional societies
• Permit customized comparisons by users
• Provide analytical tools and associated essays (later)
Does it matter that it’s “late?”

• There is a trade-off between speed and accuracy
  – We spent a lot of time trying to get universities to provide comparable data and developing our model.

• In most fields, and especially now, doctoral faculty change relatively slowly, as do patterns of publication

• We would like to update the study in the next two years
  – Now that we have developed the statistical machinery, it is a data updating task, which could be carried out online.
  – But, we will need to obtain funding
Looking at the Rankings based on R’s and S’s

- How are the R’s different from the S’s?
  - R’s are regression-based. Look at how ratings depend on the program characteristics.
    - More technically, carry out a backwards regression on the characteristics that have been transformed with a principle components transformation.
    - R’s based on relatively small samples of faculty
  - S’s are survey-based weights derived from an idealized question
Looking at the Rankings based on R’s and S’s (2)

- Why might rankings based on R’s be different from those based on S’s?
  - R’s have a reputational component
    - What can go into reputation? Program visibility, age of program, halo effects
      - Example: size of program may be very important, even though faculty don’t think that size matters to quality
    - S’s reflect normative judgments by faculty of the components of perceived quality
What do we make from this?

- Median R-rankings and S-rankings are close but nowhere near perfectly correlated.
- S-rankings show more programs with a broad range
- Need to look at the coefficients that go into the calculation and ask what the purpose of the ranking is.
## A Sample Comparison

### R and S-based Rankings for 5 Programs in a Field

<table>
<thead>
<tr>
<th>Institution Name</th>
<th>R5</th>
<th>R95</th>
<th>S5</th>
<th>S95</th>
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</thead>
<tbody>
<tr>
<td>Institution A</td>
<td>4</td>
<td>17</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Institution B</td>
<td>4</td>
<td>27</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Institution C</td>
<td>13</td>
<td>37</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Institution D</td>
<td>31</td>
<td>79</td>
<td>31</td>
<td>86</td>
</tr>
<tr>
<td>Institution E</td>
<td>52</td>
<td>102</td>
<td>91</td>
<td>150</td>
</tr>
</tbody>
</table>
## Dimensional Rankings for the Same Programs

<table>
<thead>
<tr>
<th>Institution Name</th>
<th>RA5</th>
<th>RA95</th>
<th>SS5</th>
<th>SS95</th>
<th>D5</th>
<th>D95</th>
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<tbody>
<tr>
<td>Institution A</td>
<td>7</td>
<td>29</td>
<td>9</td>
<td>66</td>
<td>81</td>
<td>131</td>
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<tr>
<td>Institution B</td>
<td>3</td>
<td>12</td>
<td>31</td>
<td>110</td>
<td>97</td>
<td>147</td>
</tr>
<tr>
<td>Institution C</td>
<td>9</td>
<td>39</td>
<td>6</td>
<td>42</td>
<td>101</td>
<td>151</td>
</tr>
<tr>
<td>Institution D</td>
<td>21</td>
<td>85</td>
<td>21</td>
<td>93</td>
<td>42</td>
<td>97</td>
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<tr>
<td>Institution E</td>
<td>53</td>
<td>124</td>
<td>53</td>
<td>133</td>
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<td>128</td>
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<td>R95</td>
<td>S5</td>
<td>S95</td>
<td></td>
<td></td>
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<tr>
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<td>Publications per Allocated Faculty</td>
<td>-0.011</td>
<td>0.144</td>
<td>0.146</td>
<td>0.151</td>
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<tr>
<td>Cites per Publication</td>
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<td>0.086</td>
<td>0.125</td>
<td>0.130</td>
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<tr>
<td>Percent Faculty with Grants</td>
<td>0.066</td>
<td>0.118</td>
<td>0.163</td>
<td>0.167</td>
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<td>Percent Faculty Interdisciplinary</td>
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<td>0.033</td>
<td>0.036</td>
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<tr>
<td>Percent Non-Asian Minority Faculty</td>
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<td>0.049</td>
<td>0.007</td>
<td>0.009</td>
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<tr>
<td>Percent Female Faculty</td>
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<td>0.011</td>
<td>0.013</td>
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<td>Awards per Allocated Faculty</td>
<td>0.015</td>
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<td>Average GRE-Q</td>
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<td>0.066</td>
<td>0.070</td>
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<td>Percent 1st yr. Students w/ Full Support</td>
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<td>0.101</td>
<td>0.053</td>
<td>0.057</td>
<td></td>
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<td>Percent 1st yr Students with External Funding</td>
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<td>0.043</td>
<td>0.047</td>
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<td></td>
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<tr>
<td>Percent Non-Asian Minority Students</td>
<td>-0.062</td>
<td>-0.007</td>
<td>0.015</td>
<td>0.017</td>
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<tr>
<td>Percent Female Students</td>
<td>-0.023</td>
<td>0.037</td>
<td>0.016</td>
<td>0.018</td>
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<tr>
<td>Percent International Students</td>
<td>-0.068</td>
<td>-0.022</td>
<td>0.007</td>
<td>0.009</td>
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<td></td>
</tr>
<tr>
<td>Average PhDs 2002 to 2006</td>
<td>0.101</td>
<td>0.181</td>
<td>0.038</td>
<td>0.041</td>
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<td>Percent Completing within 6 years</td>
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<td>0.045</td>
<td>0.048</td>
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<td>-0.025</td>
<td>-0.023</td>
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<td>Percent students in Academic Positions</td>
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<td>0.055</td>
<td>0.067</td>
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<td>0.005</td>
<td>0.006</td>
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<td>Health Insurance</td>
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<td>0.082</td>
<td>0.003</td>
<td>0.004</td>
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<td></td>
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<td>Number of Student Activities Offered</td>
<td>0.062</td>
<td>0.117</td>
<td>0.022</td>
<td>0.024</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Big Points

• Data-based ranking is not a simple task
• Rankings depend on the values of measures used and the weight that is put on them.
• The NRC is not endorsing any method as “best”
• The NRC study will be complex. We will try to make it useful—but that is also up to you.
Things to Remember

• The rankings come from the ratings of the programs arranged in numerical order.

• The ratings are calculated 500 times with the different half samples of raters and variation (in a small range) of the data values.

• The database will show the rankings for the 5th and 95th percentile values on R, S, and three dimensional measures.
More things to remember

• You will be able to access the values that went into the calculation of the 5\textsuperscript{th} and 95\textsuperscript{th} percentile values.
  – Note: the calculation uses standardized values. We will also show the actual values for the program and the standardized value in the rating calculation

• The dimensional rankings spotlight program characteristics not prominent in the overall rankings
To Learn More About the Study

http://sites.nationalacademies.org/pga/Resdoc/index.htm

Or contact

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Or

jvoytuk@nas.edu