Race and Ethnicity and NIH R01 Research Awards: AD2K—Administrative Data to Knowledge

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Acknowledgements

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How will changes in the diversity of the US population affect the pool of NIH investigators?

Raynard Kington,
President, Grinnell College,
Former Deputy Director, NIH
Starting in 2008, we wrote papers

Race, Ethnicity, and NIH Research Awards

Are Race, Ethnicity, and Medical School Affiliation Associated with NIH R01 Type Award Probability for Physician Investigators? *Academic Medicine* (November 2012)

Diversity in Academic Biomedicine: An Evaluation of Education and Career Outcomes with Implications for Policy

Publications as Predictors of Racial and Ethnic Differences in NIH Research Awards
Overview

- IMPAC II Data—AD2K
- Research Results
- Future Research Questions
- Impact of Research
- Conclusion: Administrative data such as IMPAC II are necessary for moving the Science of Science & Innovation Policy forward.
Research Question

- What factors explain these race/ethnicity differences in NIH R01 Funding?

- Economic Approach—There should be a rational explanation for the observed differences such as:
  - Education and Training
  - Academic Affiliation & Institutional Characteristics
  - NIH Experience
  - Research Productivity
To answer our research question, we combined NIH Administrative Data with multiple data sources resulting in—AD2K
Administrative Data to Knowledge
Administrative & Other Data Sources

- NIH IMPAC II (Information for Management, Planning, Analysis, and Coordination)
- Demographics, Education and Training Data
  - Survey of Earned Doctorates—57% of sample matched
  - AAMC Faculty Roster
- Education and Affiliation Information
  - IPEDS (Integrated Postsecondary Education Data System)
- Productivity
  - Thomson Reuters: *Web of Science* and *Journal Citation Reports*
Data Sample

- We used multivariate regression models to investigate award probability differences.
- The sample was restricted to Type 1 R01 applications submitted by PhD applicants between FY2000-06.
- Related or revised submissions received within 2 years of the original application were collapsed into one grant application.
- Information about an application was derived from the last funded or unfunded application.
STUDY GROUP—Includes both MDs and PhDs

R01 Type 1 Applications, FY2000-06, n=106,364

- White Males are half the applicants for R01 Type 1
- White Females are $\frac{1}{5}$th of applicants
- Fewer Hispanic and Asian Females than Males
- Black Women are .5% of sample
- Black Men are .9% of sample
There is a significant difference in R01 award probability by race and ethnicity.

Figure 1. Probability of NIH R01 award by race and ethnicity, FY 2000-2006 (n=83,188 applications). SOURCE: NIH IMPAC II, DRF, AAMC faculty roster.
MAJOR FINDING: AWARD PROBABILITY

There is a statistically significant difference in R01 award probability by race and ethnicity but not by gender or by gender within race categories (except for Asian PhD women v. men).

Figure 1. Probability of NIH R01 award by race and ethnicity, FY 2000-2006. SOURCE: NIH IMPAC II, DRF, AAMC faculty roster.
PROBIT MODELS: VARIABLES

<table>
<thead>
<tr>
<th>NIH R01 Applications FY2000-06 from PhDs (n=83,188)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODEL 1:</strong> Demographic Characteristics: Gender, Race, Ethnicity, Age, Foreign Born, Foreign PhD</td>
</tr>
<tr>
<td><strong>MODEL 2:</strong> Education and Training: <strong>MODEL 1</strong> + Degree Type, Previous NIH Training Support, PhD field, PhD Institution Funding Rank</td>
</tr>
<tr>
<td><strong>MODEL 3:</strong> Institutional Characteristics. <strong>MODEL 2</strong> + Employer Characteristics (organization type), Employer Region, NIH Funding Rank, Employer Carnegie Rank</td>
</tr>
<tr>
<td><strong>MODEL 4:</strong> NIH Resources. <strong>MODEL 3</strong> + NIH Institute, FY Funding, Human Subjects, Prior Grants, Review Committee</td>
</tr>
<tr>
<td><strong>MODEL 5:</strong> Research Record. <strong>MODEL 4</strong> + Prior Publications, % Last Author and Single Author Publications, Citations, Impact of Publications</td>
</tr>
</tbody>
</table>

Applicants missing >1 demographic variable, such as race and gender, were excluded from the analysis.
ESTIMATED EFFECTS FOR APPLICATIONS—PhD Full Sample

<table>
<thead>
<tr>
<th></th>
<th>PhD Sample</th>
<th>Model</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>58,124</td>
<td></td>
<td>-0.054‡</td>
<td>0.003</td>
<td>0.004</td>
<td>0.006</td>
<td>0.008*</td>
</tr>
<tr>
<td><strong>%</strong></td>
<td>69.9%</td>
<td></td>
<td>-0.054‡</td>
<td>-0.054‡</td>
<td>-0.051‡</td>
<td>-0.040‡</td>
<td>-0.042‡</td>
</tr>
<tr>
<td><strong>R01 Award Probability</strong></td>
<td>29.3%</td>
<td></td>
<td>-0.054‡</td>
<td>-0.054‡</td>
<td>-0.051‡</td>
<td>-0.040‡</td>
<td>-0.042‡</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>58,124</td>
<td></td>
<td>-0.054‡</td>
<td>-0.054‡</td>
<td>-0.051‡</td>
<td>-0.040‡</td>
<td>-0.042‡</td>
</tr>
<tr>
<td><strong>Asian</strong></td>
<td>13,481</td>
<td></td>
<td>-0.131‡</td>
<td>-0.131‡</td>
<td>-0.119‡</td>
<td>-0.110‡</td>
<td>-0.104‡</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>1,149</td>
<td></td>
<td>-0.131‡</td>
<td>-0.131‡</td>
<td>-0.119‡</td>
<td>-0.110‡</td>
<td>-0.104‡</td>
</tr>
<tr>
<td><strong>Hispanic</strong></td>
<td>2,657</td>
<td></td>
<td>-0.027*</td>
<td>-0.027*</td>
<td>-0.023</td>
<td>-0.014</td>
<td>-0.012</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>22,209</td>
<td></td>
<td>-0.027*</td>
<td>-0.027*</td>
<td>-0.023</td>
<td>-0.014</td>
<td>-0.012</td>
</tr>
</tbody>
</table>

- White women are not disadvantaged in the review process
- Once we control for all covariates in Model 5, women are 1 percentage point more likely to receive an R01 award.
## ESTIMATED EFFECTS FOR APPLICATIONS—Women PhDs Only

<table>
<thead>
<tr>
<th></th>
<th>PhD Sample</th>
<th>Model</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>R01 Award Probability</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>White</td>
<td>16,505</td>
<td>19.8%</td>
<td>29.1%</td>
<td>-0.040‡</td>
<td>-0.041‡</td>
<td>-0.041‡</td>
</tr>
<tr>
<td>Asian</td>
<td>2,671</td>
<td>3.2%</td>
<td>27.1%</td>
<td>-0.126‡</td>
<td>-0.124‡</td>
<td>-0.114‡</td>
</tr>
<tr>
<td>Black</td>
<td>397</td>
<td>0.5%</td>
<td>16.1%‡</td>
<td>-0.051**</td>
<td>-0.048**</td>
<td>-0.044**</td>
</tr>
<tr>
<td>Hispanic</td>
<td>787</td>
<td>1%</td>
<td>25.5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Female</td>
<td>22,209</td>
<td>26.7%</td>
<td>28.2%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, ‡ p<0.001, p-values corrected for multiple comparisons

- Compared to White women in Models 1-3 all non-White women are disadvantaged in receiving NIH awards.
- Including NIH variables and Publications explains the gap for Hispanics
- Black and Asian coefficients look very similar to men
- Race is more of a factor than gender for Women of Color
### ESTIMATED EFFECTS FOR APPLICATIONS—MD Full Sample

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
<th>R01 Award Probability</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>White</td>
<td>19,697</td>
<td>64.0%</td>
<td>30.9%</td>
<td>-0.061† -0.047† -0.043† -0.022* -0.025**</td>
</tr>
<tr>
<td>Asian</td>
<td>4,372</td>
<td>14.2%</td>
<td>27.7%†</td>
<td>-0.115† -0.116† -0.102† -0.101† -0.092‡</td>
</tr>
<tr>
<td>Black</td>
<td>474</td>
<td>1.5%</td>
<td>20.0%‡</td>
<td>-0.028     -0.027 -0.021 -0.006 -0.004</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1,252</td>
<td>4.1%</td>
<td>29.7%</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5,846</td>
<td>19.0%</td>
<td>28.7%</td>
<td>-0.014 -0.017* -0.015* 0.008 0.005</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, † p<0.001, p-values corrected for multiple comparisons

- Women MDs are not disadvantaged in the review process
- Black and Asian gaps look similar to PhD Sample
### ESTIMATED EFFECTS FOR APPLICATIONS—Women MDs Only

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
<th>R01 Award Probability</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>White</td>
<td>3,568</td>
<td>11.6%</td>
<td>30.9%</td>
<td>-0.056**</td>
</tr>
<tr>
<td>Asian</td>
<td>794</td>
<td>2.6%</td>
<td>28.0%</td>
<td>-0.140‡</td>
</tr>
<tr>
<td>Black</td>
<td>147</td>
<td>.5%</td>
<td>16.3%‡</td>
<td>-0.073**</td>
</tr>
<tr>
<td>Hispanic</td>
<td>292</td>
<td>1%</td>
<td>25.7%</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5,846</td>
<td>19.0%</td>
<td>28.8%</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, ‡ p<0.001, p-values corrected for multiple comparisons

- Compared to White women in Models 1-3 all non-White women are disadvantaged in receiving NIH awards
- Including NIH variables and Publications explains the gap for Hispanics and Asians
- Black women are worse off relative to Black men
- Race is more of a factor than gender for Women of Color
Summary of Main Results

- Blacks are significantly less likely to receive NIH awards than whites
  - Only 1/3\(^{rd}\) of difference explained by covariates

- MDs at medical schools are more likely to be funded
  - After controlling for human subjects, no race differences for MDs at medical schools
Summary of Main Results

- Limited evidence of a double-bind
  - White women do slightly better than white men in Type 1 R01 awards
  - Disadvantage for women of color is related to race differences.
  - Women submit fewer proposals
  - Women of color more likely to leave the applicant pool (evidence of double-bind)
Additional, Preliminary Analysis

• Previous studies limited by:
  • Limited information on undergraduate background
  • No information on:
    • Postdoctoral experience
    • Academic rank
    • Scholarly Awards
    • Funding from other organizations
  • Publications were not the same as those listed on the biosketch (measured with error)
Additional, Preliminary Analysis

- Sampled 2400 Biosketches from PhD sample (~600 each of Black, White, Hispanic and Asian proposals)
- Hand coded information on:
  - Undergraduate, graduate and postdoctoral training
  - Academic Rank and Scholarly Awards
  - Prior Grants
  - All Publications listed on Biosketch—matched to bibliometrics in *Web of Science*
    - Over 50,000 publications matched to applications
    - Publications more precisely measured than in previous studies
Blacks publish significantly fewer articles and have fewer citations

NOTE: PRELIMINARY DO NOT CITE OR QUOTE

Do applicants report all publications on biosketch? We plan to normalize these by field of study
Next Steps

NOTE: PRELIMINARY DO NOT CITE OR QUOTE

- Control for rank of postdoctoral institution
- Control for timing of publications
- Do more-recent publications have a larger impact than those published pre-doc or postdoc?
- Do co-authorship networks matter?
- Other suggestions?
Diversity Research Questions

- What are the determinants of receiving a score on an NIH proposal?
  - Is there race bias in receiving a score?
- Women are less likely to receive Type 2 R01 proposals.
  - Is this related to differences in productivity?
- Early Career Investigators are less likely to be funded.
  - What are the career impacts of funding early career investigators?
Big Picture Research Questions

• Scientific research funding is a public good.
  • What is the impact of funding research on rare biomedical conditions?
• NIH Mission is to enhance health.
  • What is the effect of research funding on health outcomes and innovation? (Lichtenberg 2013)
• Publications are important for funding.
  • Which bibliometric measures are associated with higher probabilities of funding?
Implications and Conclusions

• NIH Policy Changes

• AD2K-- Administrative Data to Knowledge

• AD2K & Future of Social Science Research
NIH Policy Changes

Advisory Committee to the Director Working Group on Diversity in the Biomedical Research Workforce in June, 2012 made recommendations. In December, 2012 NIH Announced $500 Million, 10 Year Program:

1: NIH ACD Committee on Diversity
2: NIH BUILD: Building Infrastructure Leading to Diversity
   —Increased support for biomedical undergraduates
3: National Research Mentoring Network
   —connects students, postdocs and faculty to experienced mentors.
4: Ensuring Fairness in Peer Review
   —Conduct An Anonymizing Experiment with Review Process
   Implicit Bias Training for review panels
5: Increase NIH Leadership Engagement
   —Chief Diversity Officer
   —Internal NIH Steering Committee on Diversity
Why Did this Research Change Policy?

This research changed policy because it was built on a foundation of high-quality, administrative data—a case study in AD2K.

- Had the backing of key individuals at NIH.
- By combining several data sources we were able to address most of the potential explanations for the funding gap.
- There was an internal and external vetting process that bolstered the credibility of the findings.
Administrative Data to Knowledge: AD2K

- The future of economic and social science research will be built on administrative data.

- Strengths of Administrative data
  - No missing data or attrition
  - Very large sample sizes
  - Less expensive to collect than survey data
Percent of applied microeconomics articles in top Economics Journals using existing survey data (e.g. CPS, SIPP, etc.)

Source: Raj Chetty
AD2K: The Future is Now

Percent of applied microeconomics articles in top Economics Journals using administrative data e.g. scanner data, social security records etc.

Source: Raj Chetty
AD2K Considerations

• Access & Security

• Science Policy

• Methods

• Data Science
Access to Administrative Data is ad hoc at best.


- Centers for Medicare and Medicaid Services provides a model of secure access to administrative data.
- Census RDC Model is suboptimal
  - Not enough RDCs to accommodate researchers
  - Screening requirements delay research
  - Expensive
- Universities know how to secure FERPA & HIPPA Data

NSF and NIH should work with the research community to facilitate access to administrative data.
AD2K: Science Policy

• Several Administrative Data efforts to link scientists to federal funding and research output
  • STAR Metrics
  • ORCID
  • SciENCV
• No single data set will be sufficient to answer research and policy questions of interest
  • Data infrastructure should be developed
  • Permission to access and link data sets is critical to furthering research
AD2K: Methods

• Revolution in Applied Microeconometrics: Econometric techniques are being supplanted by
  • Research Design that emphasizes causal relationships
  • High quality data
• Federal Funding Agencies, Federal Statistical Agencies, and the overall economy will benefit by using Big / Administrative Data:
  • We can’t answer important policy questions without access to the data.
AD2K: Conclusions

- Administrative Data is a critical input for social science and science policy research
- No single data set is sufficient to answer research questions
  - In the past economists made assumptions, appealed to theory or resorted to complicated estimation techniques to do their research
  - Now and in the future careful research designs and linked data sets will be used to do research
- Big Data and Administrative Data require empirical skills and data literacy
AD2K: Conclusions

• Access to administrative data in the future will yield new insights and inform policy

• AD2K:
  It’s all about Data