Session Number: 1379
How to Build a Research Evaluation Team in the Era of Big Data

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Office of Public Health Scientific Services
Centers for Disease Control and Prevention
Goals of Presentation

- Provide strategies on how to identify, recruit, train and retain a highly talented staff with appropriate skills to evaluate big (and smaller) data in the 21st century
- Offer lessons learned on how big (and smaller) data used for evaluation can be best presented to agency leadership to build support for such activities
Growth of Big Data Poses New Opportunities and Challenges for Research Evaluation

“Analytics” & “Big Data” Google Searches Have Risen over Time

Source: Google Trends analysis conducted 10/16/2015
Big Data Analytics Are Relevant to Many Fields and Require Workforce with New Skills

http://www.nature.com/nature/journal/v455/n7209/full/455028a.html
http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation

http://www.hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century/ar/1
http://content.healthaffairs.org/content/33/7/1123.full.pdf+html
Recruit Evaluation Staff from Multiple Disciplines that Share Common Core Competencies

**CORE COMPETENCIES**
- Advanced Statistics & Visualizations
- Research Design & Implementation
- Exceptional Oral & Written Communication Skills
- Policy Analysis
- Emotional Intelligence
- Collaborative Team Player
- Creativity
- Resiliency under Pressure

- Epidemiology
- Econometrics
- Informatics & Computer Science
- Quantitative Sociology
- Finance
- Geography & GIS
Potential Hires with Advanced Analytical Skills Are Rare and Expensive!

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Total U.S. Employees</th>
<th>Mean Annual Salary</th>
<th>Median Annual Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Occupations</td>
<td>135,128,260</td>
<td>$47,230</td>
<td>$35,540</td>
</tr>
<tr>
<td>Actuaries</td>
<td>21,490</td>
<td>$110,090</td>
<td>$96,700</td>
</tr>
<tr>
<td>Computer Programmers</td>
<td>302,150</td>
<td>$82,690</td>
<td>$77,550</td>
</tr>
<tr>
<td>Computer and Information Research Scientists</td>
<td>24,210</td>
<td>$113,190</td>
<td>$108,360</td>
</tr>
<tr>
<td>Economists</td>
<td>18,680</td>
<td>$105,290</td>
<td>$95,710</td>
</tr>
<tr>
<td>Epidemiologists</td>
<td>5,420</td>
<td>$74,120</td>
<td>$67,420</td>
</tr>
<tr>
<td>Financial Analysts</td>
<td>262,610</td>
<td>$92,250</td>
<td>$78,620</td>
</tr>
<tr>
<td>Geographers</td>
<td>1,260</td>
<td>$75,610</td>
<td>$76,420</td>
</tr>
<tr>
<td>Operations Research Analysts</td>
<td>86,950</td>
<td>$82,940</td>
<td>$76,660</td>
</tr>
<tr>
<td>Political Scientists</td>
<td>5,640</td>
<td>$104,000</td>
<td>$104,920</td>
</tr>
<tr>
<td>Sociologists</td>
<td>2,240</td>
<td>$78,810</td>
<td>$72,810</td>
</tr>
<tr>
<td>Statisticians</td>
<td>26,970</td>
<td>$84,010</td>
<td>$79,990</td>
</tr>
<tr>
<td>Survey Researchers</td>
<td>15,410</td>
<td>$54,730</td>
<td>$49,760</td>
</tr>
</tbody>
</table>

How to Recruit the Best and Brightest

Before You Recruit

- Master your agency’s human resources (HR) authorities and policies
  - Learn full range of available employee benefits
  - Understand HR policies for building a unit as well as hiring individuals
- Create career ladders so recruits don’t have to leave to be promoted
- Understand your competition and what it takes to be successful

During Recruitment

- Seek diversity in levels of work experience, job sector experience, disciplinary training, culture and backgrounds
- Use active recruitment methods, e.g., former and current staff, social networks and social media
- Screen as many potential candidates as possible from a wide range of disciplines – hundreds if necessary!
How to **Recruit the Best and Brightest**

### Communicating with Potential Hires
- Stress strategic impact of their work, e.g. “saving lives”
- Be concrete about their work and how they will fit into the agency
- Introduce them to agency leaders who will use their work
- Ask standardized questions of all candidates

### Making your Final Hiring Decisions
- Have finalists meet with your staff, peers and managers and seek their input on hiring
- Always check at least 3 references
- Give as much weight to emotional intelligence as other skills and experience
- Don’t hire if you don’t find suitable candidates (try again!)
- Trust your instincts!
How to **Retain** the Best and Brightest

- Cross-train staff on core competencies
- Assign work to teams with different disciplinary training, skills, and experience levels
- Provide challenging work projects/opportunities for growth
- Learn from rather than punish mistakes
- Carve out time for staff to learn new skills and analytical methods, e.g., 80/20 rule
- Provide multiple mentoring avenues for staff
- Encourage conflict of ideas (not people)
How to **Retain** the Best and Brightest

- **Reward team performance and success**
  - Celebrate individuals but not at the expense of the team
  - Use non-monetary as well as monetary rewards

- **Deliver outstanding results to build support from leadership for team resources**

- **Apply workforce policies to maximum benefit for staff, e.g., promotions, retention bonuses, telework**

- **Showcase work of subordinates to senior leadership**

- **Ask -- and listen!**
Learn and Respect Generational Differences

The "Millennials" Are Coming
Morley Safer On The New Generation Of American Workers
Communicating Data-Driven Evaluations Effectively to Leadership

- While all evaluations should be well designed/communicated, those based on complex analyses pose special challenges

- Most organizational leaders
  - Are not experts in statistics
  - Would benefit from explanatory and predictive models to inform policy development and management decisions
  - Need to understand the analyses
  - Want to see alternative results based on modifying assumptions
  - Are most interested in strategic implications of analyses
  - Want data and analyses quickly (sometimes in 1 hour!)

Practice-based strategies for effective communications: Overall goal is to tell clear story to inform strategic decisions
Begin with High Level “Tutorial” on Methods and How to Interpret Results Especially for Novel Methods

Social Network Statistics (cont.)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>What is it?</th>
<th>How does it look on a graph?</th>
<th>What does it mean?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>Number of actual co-authorships divided by the maximum possible co-authorships for a network of that size</td>
<td>Nearly all authors (nodes) are connected to each other in dense networks</td>
<td>High density means lots of collaboration</td>
</tr>
<tr>
<td>Component</td>
<td>Sub-network in which at least one path exists between all pairs of authors in the sub-network</td>
<td>A distinct cluster of authors (nodes) totally separate from other cluster</td>
<td>Groups of authors are working separately</td>
</tr>
<tr>
<td>Diameter</td>
<td>Length of the longest geodesic between any pair of authors</td>
<td>Longer diameter will make graphs fat</td>
<td>Longer diameter -&gt; slower speed of info/idea transmission between authors</td>
</tr>
<tr>
<td>Centralization (Betweenness)</td>
<td>Mathematical technique for summarizing individual author centrality scores for entire network</td>
<td>High centralization graphs look like collections of spokes and hubs</td>
<td>High centralization -&gt; hierarchical and potentially compartmentalized</td>
</tr>
</tbody>
</table>

Tutorials: Show Them As Well as Tell Them

"We examined total and direct costs of NIH research project grants from 1998 through the last full fiscal year, and graphed the distribution of research funding by age group. The full data is posted on RePORT, and since the patterns are similar, I’ll post the graph of direct cost funding distribution"
Challenge: Identifying CDC’s Surveillance Systems

Functional Classification of CDC Surveillance Systems

- Public Health Surveillance
- Clinical Epi Research & Studies
- Statistical Analysis & Modeling
- Health Surveys
- Research Synthesis
- Vital Statistics
- Hazardous Substances Assessments
- Miscellaneous (13 categories)
- Missing

Only 50% of surveillance systems are classed to a surveillance function

Source: CDC Enterprise Systems Catalogue, accessed 3/15/2015
Keep Analyses Based on New Methods Under Wraps Until Ready for Sharing

“A lot of times, people don't know what they want until you show it to them.”*

“New always becomes the new normal”**

Sources:  
** [https://www.linkedin.com/pulse/7-steve-jobs-quotes-could-change-your-life-jeff-haden](https://www.linkedin.com/pulse/7-steve-jobs-quotes-could-change-your-life-jeff-haden)
Evaluate Complexity, Present Simplicity

- Conduct descriptive and stratified analyses, followed by modeling to control for potential bias and confounding **BUT**
- Show the simplest data to make your points
  - Pick the fewest graphs needed to inform policy or management decisions
  - Present stratified analyses instead of regression parameters if they tell the same story
  - If directed, present familiar rather than best statistic if both convey same story (e.g., means over medians; % over rates)
- Show how results change by modifying inputs and assumptions (sensitivity analyses)
- Keep complex analyses and estimates of uncertainty in your back pocket for questions
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Note: The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.