Bridging ‘theory’ and ‘practice’ for use of administrative data in program comparisons: data challenges and interpretability

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Center for Strategic Scientific Initiatives (CSSI)
Office of the Director, National Cancer Institute (NCI), National Institutes of Health (NIH)

NIH and the Science of Science and Innovation Policy: A Joint NIH-NSF Workshop

April 7th, 2016

On behalf of the team
• Jerry S.H. Lee (NCI)
• Frankie Philips (NCI)
• Natalie Abrams (NCI)
• Holly Wolcott (TR)
• Joshua Schnell (TR)
• Di Cross (TR)
**NCI Center for Strategic Scientific Initiatives (CSSI): Concept Shop**

**Mission**

“...to create and uniquely implement exploratory programs focused on the development and integration of advanced technologies, trans-disciplinary approaches, infrastructures, and standards, to accelerate the creation and broad deployment of data, knowledge, and tools to empower the entire cancer research continuum in better understanding and leveraging knowledge of the cancer biology space for patient benefit...”

Dates indicate approval(s) by NCI Board of Scientific Advisors; *Program moved to NCI Division of Cancer Biology
## CSSI Initiated Programs (FY99-FY15): Diverse Use of Funding Mechanisms

<table>
<thead>
<tr>
<th>Program</th>
<th>Grants</th>
<th>Cooperative Agreements</th>
<th>Contracts</th>
<th>FFRDC Resource</th>
<th>FFRDC R&amp;D Subs</th>
<th>Interagency Collaborations (Co-fund/joint pilot programs)</th>
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<tbody>
<tr>
<td>Unconventional Innovations Program</td>
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<td>FDA, NIST</td>
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<td>Innovative Molecular Analysis Technologies</td>
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<td>NCI Alliance for Nanotechnology</td>
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<td>FDA, NIST</td>
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<td>Clinical Proteomic Research Resource</td>
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<td>Cancer Genome Atlas</td>
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<td>caHUB The Cancer Human Biobank</td>
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<td>Preclinical Questions Initiative</td>
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<td>Anti-VEGF</td>
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</tbody>
</table>

**Legend:**
- ☑: Available
- ☐: Not Available

**Notes:**
- CSSI = Center for Scientific Innovation and Supercomputing Infrastructure
- FY = Fiscal Year
- FFRDC = Federally Funded Research and Development Center
- Interagency Collaborations: FDA = Food and Drug Administration, NIST = National Institute of Standards and Technology
CSSI Uses External Evaluations to Enhance Programs

**RFA Program Launched**
- Program Eval

**Program Renewed**
- 2 R21 (3 year)
- 2 R33

**Prospective Electronic Program Evaluation**
- U24
- Linked with TCGA

**Phase I Launched**
- U54
- R01
- R21/R33

**Phase II Launched**
- U54
- U01
- K99/R00
- R25

**Program Eval**

*Red Denotes Program Evals and Changes to Programs*
The Metric of Publication Number: Useful but Limited

NIH Research Portfolio Online Reporting Tools (RePORT)

NCI CSSI Science Day 2014
6/25/2014

NIH NATIONAL CANCER INSTITUTE
To generate **new knowledge** and catalyze **new fields of study** in cancer research by utilizing physical sciences/engineering principles to enable a better understanding of cancer and its behavior at all scales.

Not looking for new tools to do “better” science, but new perspectives and approaches to do **paradigm-shifting** science that will lead to exponential progress against cancer.

Build **trans-disciplinary teams** and infrastructure to better understand and control cancer through the convergence of physical sciences and cancer biology.
Unique Goals Require Unique Management and Evaluation: Information and Feedback to PIs

Semi-Annual
~70-80 pages
5 reports to date

Unique Program = Unique Evaluation

Database

Program Staff

Interdisciplinary Team Reporting, Analysis, and Query Resource (iTRAQR)

Thomson Reuters

MEMORANDUM TO THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Peter R. Orszag
    Director
Office of Management and Budget

John P. Holdren
    Director
Office of Science and Technology Policy

SUBJECT: Policy on Research Performance Progress Reports (RPPI)

Background: The National Science and Technology Council, through the Committee on Science (CoS), Research Business Models (RBM) Subcommittee, asked for public comments on federal policies and procedures related to business practices that could be changed to improve efficiency, effectiveness, and accountability of the nation’s research enterprise. One issue was the inappropriateness in current research progress reporting across Federal agencies. Given increasing complexity of international and emergency research, it is important for Federal agencies to develop reports that provide an accurate and comprehensive assessment of the research efforts. The need for such reports is apparent both at the individual (investigator) and institutional (department) levels.

The proposed ESR should be seen as a single-paged, easy-to-read, comprehensive tool that is easy to prepare and review. It should be a critical component of research management that goes beyond the traditional annual status reports. Each ESR should be a complete representation of the scientific progress made during the reporting period. The ESR should be a management tool that is easy to prepare and review. It should be a critical component of research management that goes beyond the traditional annual status reports. Each ESR should be a single-paged, easy-to-read, comprehensive tool that is easy to prepare and review. It should be a critical component of research management that goes beyond the traditional annual status reports.

3. Policy:
   a. Use of the Report:
      i. The RPPI will be used by agencies and awarding officials that support research and research-related activities for use in submission of required annual and other status reports, performance reporting on grants and cooperative agreement awards. The uniform RPPI format will replace other performance reporting formats currently in use by agencies supporting research and research-related activities. The RPPI addresses progress for the most recently completed period, at the frequency required or designated by the agency. If an agency has implemented an electronic solution for submission of progress reports, information, once reported, should be automatically updated. The RPPI is a component of subsequent reports. However, agencies may use this format in either printed or electronic form.
      ii. Each category in the RPPI is a separate reporting component. Agencies will require award recipients to report on “Accomplishments.” As needed, agencies may also use optional components of the format to request additional information. Within a particular component, agencies should direct recipients to complete only those questions that are relevant to the award or agency. If a recipient has nothing significant to report during the reporting period on a question or item, they will be asked to state “Nothing to Report.”
      iii. Agencies will utilize the standard instructions that have been developed for each category, but may provide additional program-specific instructions necessary to clarify a requirement for a particular program.

Research Performance Progress Report
Implementation Plan for NIH and Other PHS Agencies
January 21, 2011

In accordance with the April 21, 2010 memorandum to the heads of executive departments and agencies from the Office of Management and Budget and Office of Science and Technology Policy, the National Institutes of Health (NIH) hereby provides its implementation plan for the Research Performance Progress Report (RPPI). The RPPI is a federal-wide uniform format for use by agencies and awarding offices that support research and research-related activities.

NIH implementation of the RPPI will replace the following existing OMB approved information collections and associated burdens:

- Public Health Service (PHS) Non-Competing Continuation Progress Report (PHS 2590), OMB no. 0925-0001, currently approved for use through 06/30/2012. 15 burden hours. The PHS 2590 is used by approximately 57,000 grantees each year; total annual burden hours is 555,000. Note that OMB approval number 0925-0001 includes other information collections, which are not affected by the RPPI, including the PHS Grant Application (PHS 398).
Rich iTRAQER Data Support Evidence-based Decision Making by Program Officials AND PIs

Examples from 3 year report

Growth of the PS-OC Network

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<thead>
<tr>
<th>Month</th>
<th>Jan12</th>
<th>Feb12</th>
<th>Mar12</th>
<th>Apr12</th>
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<td>Other</td>
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<td>20</td>
<td>20</td>
<td>20</td>
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<td>20</td>
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</tbody>
</table>

Landscape and Number of Collaborations

Year '01

Year '03

Impact on Program

- Direct feedback for investigators
  - 17% of projects have undergone PI initiated changes
- Increased reporting quality
- Increased Center connectivity

- Direct feedback for Program Officials
  - Ongoing comparison of Centers
  - Change program elements (ex. Outreach pilot projects)
  - More emphasis on cancer researchers applying physical sciences principles

Effectiveness of PS-OC Program Elements on Collaboration Outputs

<table>
<thead>
<tr>
<th>Program Element</th>
<th>Average Participation</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Projects</td>
<td>0.85</td>
<td>20%</td>
</tr>
<tr>
<td>Cares</td>
<td>0.79</td>
<td>30%</td>
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<tr>
<td>Team Network Projects</td>
<td>1.33</td>
<td>50%</td>
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<tr>
<td>Pilot Projects</td>
<td>0.25</td>
<td>75%</td>
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<tr>
<td>Outreach</td>
<td>0</td>
<td>100%</td>
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</table>

Range of Training Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courses</td>
<td>20</td>
</tr>
<tr>
<td>Hands-on Training</td>
<td>15</td>
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<tr>
<td>Lynx</td>
<td>5</td>
</tr>
</tbody>
</table>

JHU PS-OC: How do you interact with the Center?

Includes: Reported Collaborations, Publication Co-Autors, Project Co-Investigators

January 2010 – January 2011

January 2010 – June 2013

NIH NATIONAL CANCER INSTITUTE
CSSI Program Evaluations and Outcomes Highlights (as of 6/10/2014)

Phase I (May 2014)
- $32.7M per year for 5 years (over $100M leveraged)
- 70+ startup companies
- 17 clinical trials testing Alliance therapeutics
- 5 diagnostic devices being tested under clinical protocol
- 39 patents awarded citing Phase I awards and over 100 patent applications filed during Phase II

Phase I (Fall 2012)
- $30M per year for 5 years (over $100M leveraged)
- 600+ trainees
- 500 self-reported new collaborations
- 5 PS-OC advances tested in clinical settings
- 23 patent applications

Phase II (March 2013)
- $30M per year for 3 years
- 1,500+ applications in 2 years
- ~150 awards overall
- Enabled analysis and evaluation of applicants pre-review

- ~$30M per year for 3 years
- 1,500+ applications in 2 years
- ~150 awards overall
- Enabled analysis and evaluation of applicants pre-review
Challenges for the Practice of Evidence-Based Decision-Making as Data Proliferate

There is an increasing awareness and accessibility of data for decision making; however, there remains a need to:

- Continue to access data that is nuanced enough to support program-level decision making; and
- Consider the context of individual programs when making policy-level decisions.
Developing a Framework to Qualify the Appropriateness of Comparisons Across Programs

- Determine whether appropriate comparative analysis can be conducted if one provides **context, rationale for approach**, and any **caveats** or **limitations**

- Project components include
  - Working Group
  - Framework for assessing appropriateness
  - Software application potentially supporting communication and assessment

**Working Group:**
- Natalie Abrams, NCI
- L. Michelle Bennett, NCI
- James Corrigan, NCI
- Elizabeth Hsu, NCI
- Meredith Fox, NIMH
- Mindy Chai, NIMH
- Christie Drew, NIEHS
- Yvette Seger, FASEB
- Brian Zuckerman, STPI
- Joshua Schnell, Thomson Reuters
## Full Consideration of Program-Specific Logic Models to Inform Qualification of Comparisons

### Single-Outcome Comparison Framework

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Activities</th>
<th>Outputs, Short-term Outcomes (&lt;5 years), and Long-term Outcomes (&gt;5 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who program funds</td>
<td>How program supports it</td>
<td>What are the outputs and resulting impact of translational and technological productivity? Examples include clinical trials, patent applications and awards, technologies and prototypes, regulatory contributions, etc.</td>
</tr>
<tr>
<td>What program funds</td>
<td>What are the training and outreach activities? Examples include workshops, trainee mentorship and exchanges, career development, conference presentations/posters, web-based communication, patient advocacy, etc.</td>
<td></td>
</tr>
<tr>
<td>How program funds it</td>
<td>What are the individual and collaborative activities of each program component?</td>
<td>What are the outputs and resulting impact of grant productivity? Examples include new topically related investigator-level grants, trainee grants, set-aside program funded grants, innovative science awards, etc.</td>
</tr>
<tr>
<td>What Awardees do</td>
<td>What are the program scientist’s management and organizing activities?</td>
<td>What are the outputs and resulting impact of literature-related productivity? Examples include publications, conference proceedings, books, etc.</td>
</tr>
<tr>
<td>How are the funding mechanisms utilized by the program? Do they correspond to specific infrastructure?</td>
<td>What are the shared resource produced? Examples include within network and community core resources, reference materials, benchmark datasets, software tools, Standard Operating Procedures, community accessible resources, etc.</td>
<td>What are the outputs and resulting impact of collaborative productivity? Collaborations including multidisciplinary teams within network, inter-institutional, interagency, industrial, international, etc.?</td>
</tr>
</tbody>
</table>

### Questions

- **Who program funds**: Does the program fund individuals, centers, teams, other?
- **What program funds**: What are the funding mechanisms utilized by the program? Do they correspond to specific infrastructure?
- **How program funds it**: Who are the target grantees of the funding opportunity?
- **What Awardees do**: What are the individual and collaborative activities of each program component?
- **How program supports it**: What are the training and outreach activities?
- **What are the funding mechanisms utilized by the program? Do they correspond to specific infrastructure?**: How are the funding mechanisms utilized by the program? Do they correspond to specific infrastructure?
The Intersection of Theory and Practice: Considerations for the SciSIP Community

- How do we ensure that policy decisions are made on appropriate cross-program comparisons?
  - Data may allow both when comparisons are and are not appropriate
  - Suboptimal comparisons may lead to suboptimal policy decisions

- How can we effectively consider individual program goals when making cross-program comparisons?
  - Readily accessed data for individual programs makes it easy to generate many comparisons at multiple levels.
  - Unclear that all such comparisons are meaningful given differing program goals, challenges, etc.
The Center for Research Strategy responsibilities are to:

- Synthesize input from NCI leadership and external stakeholders to inform priority initiatives
- Identify scientific opportunities within priority initiatives
- Coordinate development of programs across the NCI to address opportunities
- Conduct portfolio analysis to support priority setting and scientific strategic planning
- Collect and analyze data to identify research accomplishments
- Recommend strategies for allocating resources effectively

Projects

The NCI Annual Plan and Budget Proposal

Commonly called the “Bypass Budget,” this document is sent to the President and Congress for each fiscal year to inform them of the NCI’s best professional judgment on the funding needed to make the most rapid progress against cancer. CRS convenes internal stakeholders, gathers ideas, builds a vision, and composes the plan. CRS collaborates with OMB, OGC, and OCPL to formulate a budget and communicate the plan to the public.

Cancer Research Health Disparities

The CRS works across the NCI Divisions, Offices, and Centers to identify scientific research opportunities and coordinate initiatives to reduce cancer health disparities through basic and applied research.

NCI Firewood Sessions

CRS convenes a series of discussions with NCI staff that allow NCI leadership to hear their best ideas. This is an opportunity for the community to share ideas about the work NCI is doing, how efforts are organized and funded, how decisions are made, and how to communicate internally and externally.

Portfolio and Asset Analysis

CRS conducts portfolio and asset analysis for priority initiatives and provides consultation and other support to the NCI for concept development and program assessment.

International Cancer Research Partnership

CRS leads NIH participation in the International Cancer Research Partnership, a consortium of worldwide cancer funding organizations dedicated to enhancing cancer funding information. This increases knowledge of the array of research that international cancer research organizations are supporting.

Program Evaluation

CRS consults with the Office of the Director and other Divisions, Offices, and Centers on evaluation-related projects, analyses, and requests. In addition, CRS conducts evaluation tasks for a limited number of high priority areas. CRS represents NCI in trans-NIH planning and evaluation-focused efforts.

http://www.cancer.gov/about-nci/organization/crs

L. Michelle Bennet, Ph.D.
Director
Center for Research Strategy, NCI

Revised: March 29, 2016
Acknowledgements/Thanks to the “Secret Ingredients”

Clinical Sciences

Life Sciences

Physical Sciences
The Intersection of Theory and Practice: Considerations for the SciSIP Community

- How do we ensure that policy decisions are made on appropriate cross-program comparisons?
  - Data may allow both when comparisons are and *are not* appropriate
  - Suboptimal comparisons may lead to suboptimal policy decisions

- How can we effectively consider individual program goals when making cross-program comparisons?
  - Readily accessed data for individual programs makes it easy to generate many comparisons at multiple levels.
  - Unclear that all such comparisons are meaningful given differing program goals, challenges, etc.
Additional Background
CSSI Recent Evaluations Presentations to NCI Board of Scientific Advisors

Are we making progress?

- Are we making progress?
- Are we on target?
- Are we making our impact?
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**Overall Goals**

**Publications**

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<thead>
<tr>
<th>Publications</th>
<th>7 complete (5 in-progress)</th>
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**Publications**

<table>
<thead>
<tr>
<th>Publications</th>
<th>9 complete (3 in-progress)</th>
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CSSI Program 2 (Year 4)

RPPR Submission

Training

B.4 WHAT OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT HAS THE PROJECT PROVIDED?

NOTHING TO REPORT

ESR for iTRAQR

Training

C. Training: Please identify the individuals (students, undergraduate/graduate, post-docs, etc.) being trained or have trained in your laboratory during this reporting period working on related projects or task.

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<th>Title</th>
<th>Position (ex. Student, Post Doc, Visiting Scientist, etc)</th>
<th>Period (start/end)</th>
<th>Current Location (Institution Name)</th>
<th>Did training occur in another laboratory during this period? (Yes or No; which laboratory if applicable)</th>
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<tr>
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<td>Post Doc</td>
<td>2/17/14 - present</td>
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<td>Post Doc</td>
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Other Products and Resource Sharing

C.5 OTHER PRODUCTS AND RESOURCE SHARING

C.5a Other products

NOTHING TO REPORT

C.5b Resource sharing

NOTHING TO REPORT

Other Products and Resource Sharing