

# Mixed Methods Approaches for Assessing Transdisciplinary Collaborations: Evaluating a Center Grant Program of the National Cancer Institute

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The Sixth Annual International Mixed-Methods Conference

July 10, 2010

Baltimore, MD



# Overview

- About the NCI Science of Team Science (SciTS) Team
- About the TREC Initiative
- About the TREC Evaluation: Mixed Methods Approaches
- Lessons Learned

**About the NCI  
Science of Team Science (SciTS) Team**

# NCI SciTS Team

- Team Members
  - Kara Hall, PhD, Team Director
  - Annie Feng, EdD
  - Brooke Stipelman, PhD
  - Amanda Vogel, PhD MHS
  - Daniel Stokols, PhD, Scientific Consultant, Professor of Planning, Policy and Design, University of Calif., Irvine



*Division of*  
**Cancer Control and**  
**Population Sciences**  
NATIONAL CANCER INSTITUTE

# What is the “ Science of Team Science” Field?

The Science of Team Science (SciTS) is a rapidly emerging field concerned with understanding and managing circumstances that facilitate or hinder the effectiveness of large-scale research, training, and translational initiatives



# SciTS Team's Three Focus Areas

- 1 Studying Team Science**
- 2 Developing/Supporting the SciTS field  
(e.g. Team Science Toolkit; AJPM Special Issue)
- 3 Facilitating Team Science Programs and Projects  
(e.g. R13 grant)

<http://cancercontrol.cancer.gov/brp/scienceteam/index.html>

## About the TREC Initiative



# The TREC Initiative

## (Transdisciplinary Research in Energetics and Cancer)

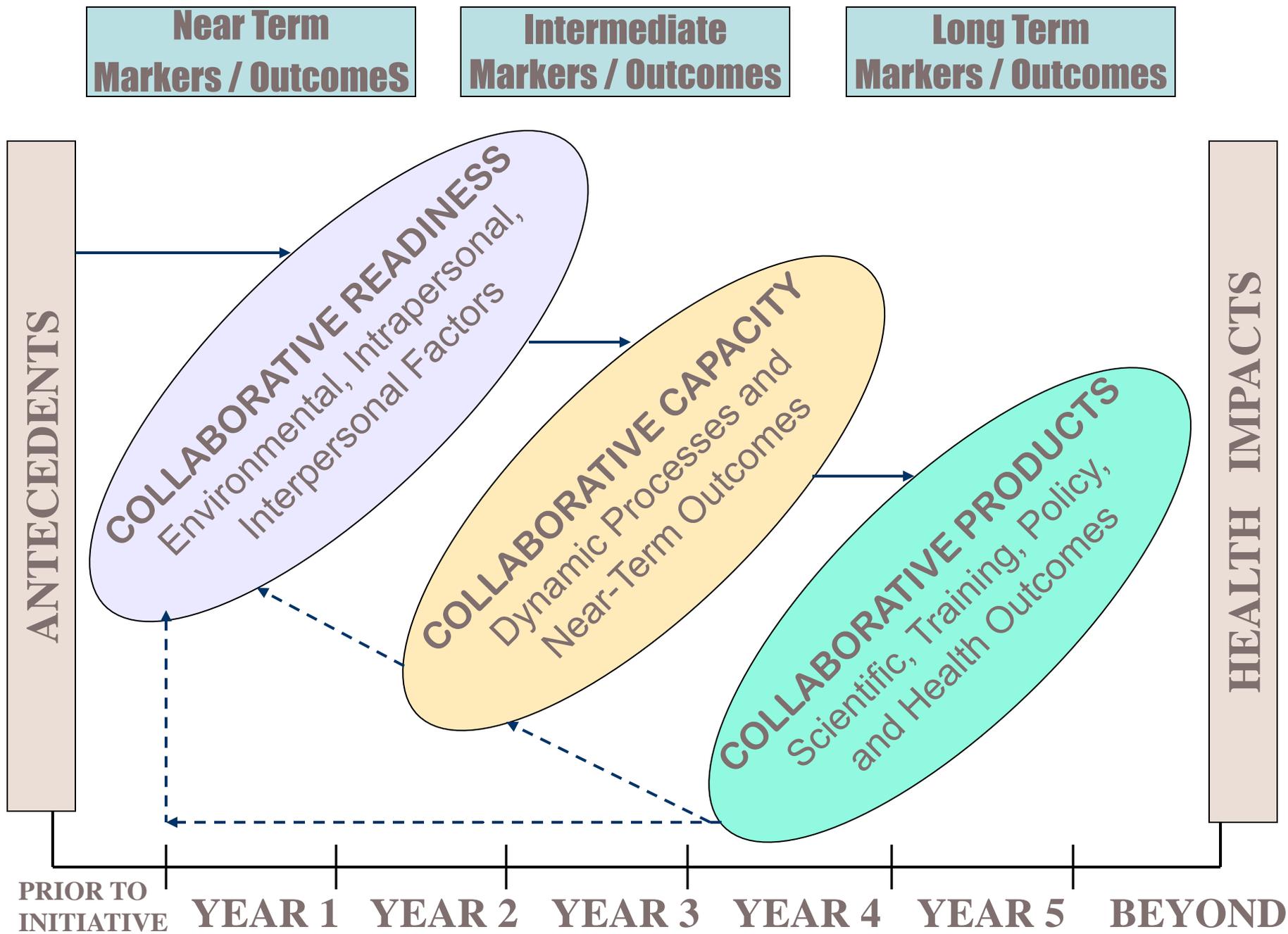
- **Purpose:** To foster the integration of social, behavioral, and biological sciences to address obesity, physical inactivity, and poor diet within a cancer prevention context.
- **Structure**
  - 5 year initiative (2005-2010)
  - \$54 million in total funding
  - 4 geographically dispersed research centers
  - 1 coordination center
- **Scientific Approach**
  - Within-center cross-disciplinary collaboration
  - Cross-center collaboration
  - Encourage transdisciplinarity: conceptual, methodological integration

**About the TREC Evaluation:  
Mixed Methods Approaches**

# Goals of the TREC Evaluation

- **Grantees**
  - *Process evaluation* for continuous quality improvement, especially to enhance collaborations within and among TREC centers
- **NCI**
  - *Outcome evaluation* to assess the added value of large center grant initiatives with a transdisciplinary research approach
- **SciTS Team**
  - Develop new *methodological approaches* to assess the processes and outcomes of team science
  - Contribute to developing “*best practices*” for engaging in team science

# Conceptual Model for Evaluating Collaborative Initiatives



# Stage-Dependent Evaluation Activities

- **Start-up/Collaborative Readiness (2005-6)**
  - Appreciative inquiry/strategic planning to develop trust
  - Baseline survey
  - Qualitative appraisal of developmental project proposals
- **Mid-course/Collaborative Capacity Building (2007-8)**
  - Summer retreat reflections (group interviews and discussions)
  - Follow-up survey
  - Qualitative appraisal of developmental project proposals
- **Ending/Products, Lessons Learned (2009-ongoing)**
  - Survey on TD definitions
  - In-depth interviews, document analysis, re: lessons learned
  - Bibliometric analyses
  - Data visualizations
  - Delphi method

# Multiple Goals – Multiple Methods

Goal	Evaluation Method
<p>Assess collaboration antecedents, readiness factors, processes</p> <p>Assess training opportunities and impact</p>	<p>Baseline survey</p> <p>Mid-course follow-up surveys</p>
<p>Assess scope and level of cross-disciplinary collaborations and integration in science</p>	<p>Qualitative appraisal of developmental project proposals</p>
<p>Assess diffuse outcomes of TREC</p> <p>Gather lessons learned about engaging in team science</p>	<p>Network analysis</p> <p>Interviews</p> <p>Document analysis – briefing book, websites</p>
<p>Assess scientific productivity</p>	<p>Bibliometrics – # publications, etc</p>
<p>Impact of TREC on the scientific literature</p>	<p>Data visualizations</p> <p>Bibliometrics: Citation patterns</p> <p>Delphi method</p>

# Baseline Survey (Year 1)

## Goals

- To assess collaborative antecedents and readiness factors (e.g. collaboration history, attitudes, activities, processes and resources)
- To assess training resources and opportunities

## Methods

- Self-administered survey
- Closed- and open-ended questions
- Sample: TREC PIs, Co-PIs, professional research staff, (e.g. statisticians), postdocs
- N=56 (response rate 74%)
- Descriptive, inferential statistics, EFA

# Baseline Survey Dimensions

- **History of Collaboration**
  - Collaborators, inter/trans projects & centers
- **Researcher Orientation**
- **Semantic Differential**
  - Ratings of affective experiences
- **Collaborative Resources**
  - Institutional resources
  - Collaborative attitudes
- **Collaborative Processes**
  - Collaborative productivity, interpersonal collaboration
- **Collaborative Activities**
  - TREC, general
- **Fields of Training**
- **Training**
  - Attitudes, Activities

# Follow-up Survey (Year 3)

## Goals

- To assess change in collaborative antecedents, readiness, and collaboration processes
- To assess TD training impact
- To inform TREC investigators of findings, in order to improve collaborative processes and training

## Methods

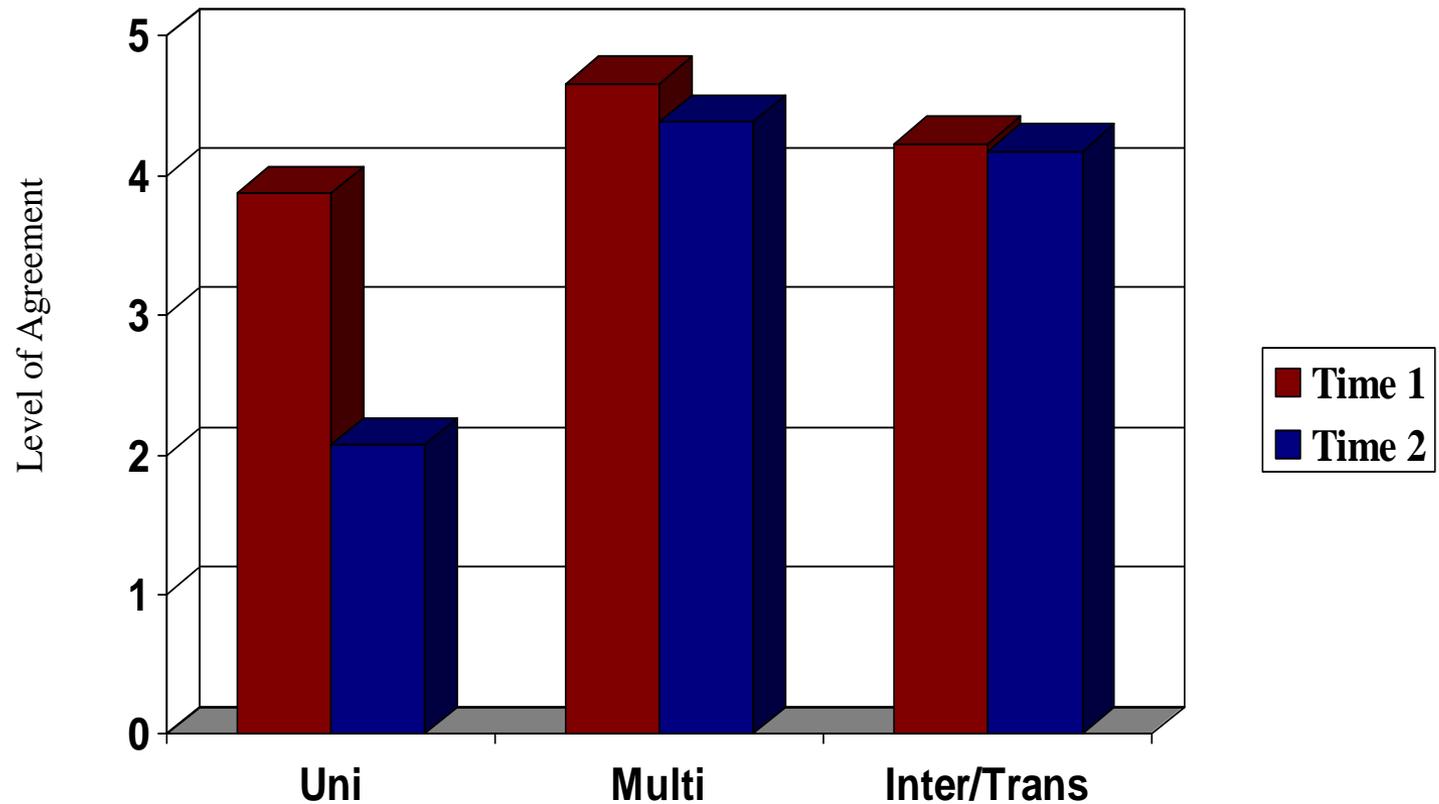
- Self-administered survey
- Closed- and open-ended questions
- Sample: TREC PIs, Co-PIs, professional research staff (e.g. statisticians), postdocs
- N= 103 (response rate 81%)
- Descriptive and inferential statistics, EFA and CFA.

# Follow-up Survey Dimensions

- **Scientific Collaboration**
  - Research Orientation
  - Collaborative Processes
  - Collaboration Activities
- **TD Training**
  - General attitudes about TD training
  - Training activities
  - Experiences with multi-mentoring program
  - Training impact
  - Strengths and areas for improvement

# Change in Research Orientation from Baseline Survey to Follow-up Survey

## Research Orientation Scale



# Qualitative appraisals of the Developmental Project Proposals (Year 3)

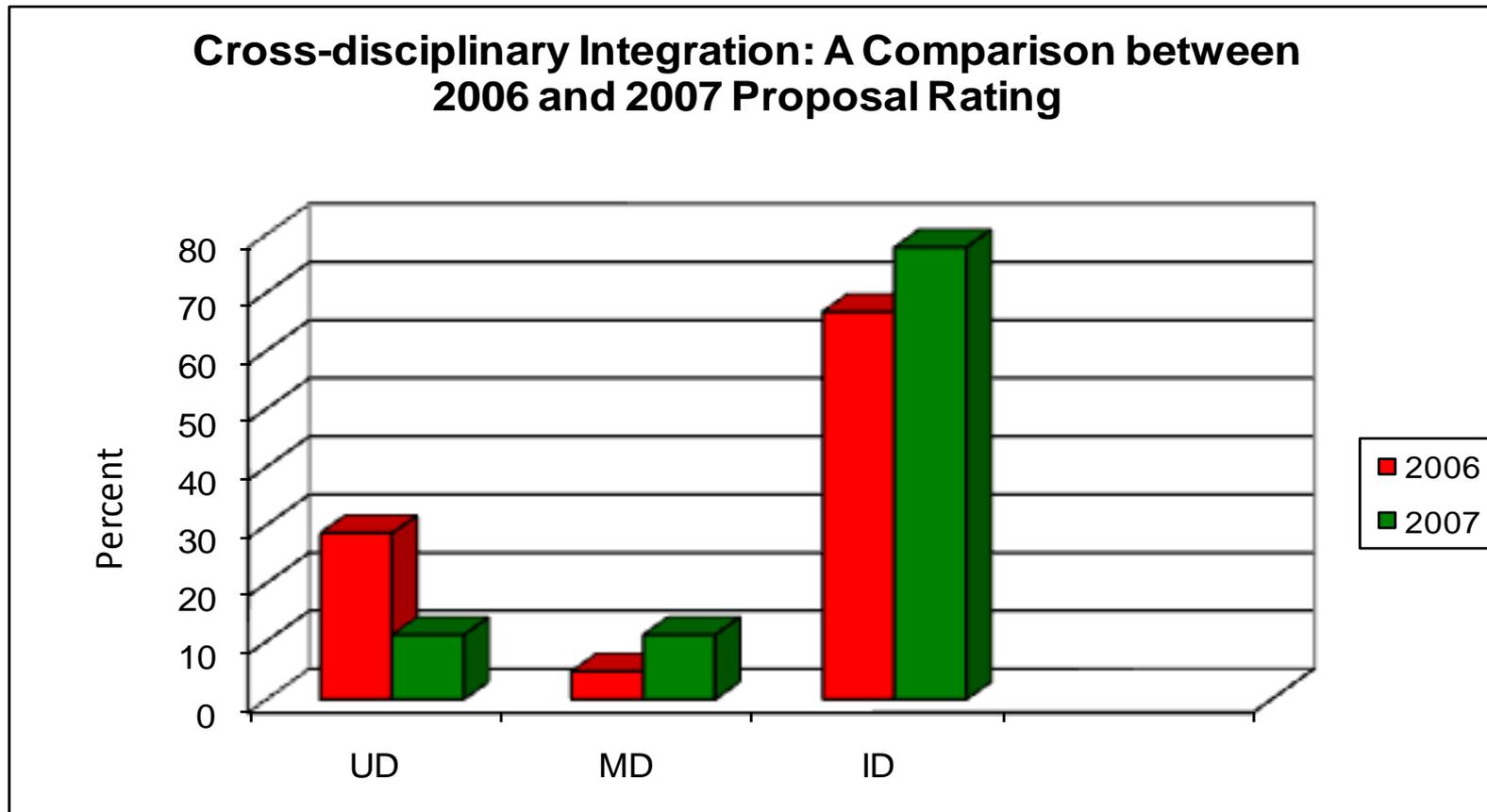
**Goals:** To assess collaborative orientation and scope and level of transdisciplinary integration of proposed developmental projects

**Variables of Interest:** Within and cross-center collaborations, disciplinary representations of researchers, levels of analysis and scope of TD integration of the proposal

**Methods:**

- Rating of developmental project proposals
- Applied preestablished criteria “written products protocol”
- Two independent reviewers for each proposal
- Sample Size (Proposals): N=21 (2006); N=27 (2007)

# Change in Cross-Disciplinary Integration from 2006 to 2007 Developmental Proposal Rating



From 2006 to 2007, there was an increase in the percentage of proposals using multi- or inter-disciplinary approaches

## Additional Key Findings

- There was a shift toward more integrated cross-disciplinary research, reflected in the predominant interdisciplinary orientation of the 2007 developmental project proposals
- There also was a shift toward using broader levels of analysis from 2006 to 2007
- Novel research topics emerged in the 2007 proposals, e.g. the role of sleep disturbances in the etiology of obesity, diabetes, and cancer
  - This provides evidence of cross-disciplinary synergy and integration by the mid-point of the initiative

# Survey on Defining TD (Year 5)

## **Goals**

- To gather more information about how to define TD research, particularly the role of the research process vs. research outcomes in this definition
- To compare the perspectives of TREC scientists and other scientists interested in TD team science approaches

## **Methods**

- Open-ended questions integrated into conference feedback form, Oct. 2009 TREC-FHCRC-NCI conference
- Sample: N=41
- Thematic analysis, NVIVO software

# Key Findings

## **Respondents defined TD as:**

- A research *process*, rather than a research *outcome*
- Incorporating methods, approaches from multiple disciplines across the entire research process
- Addressing multiple “levels” of science (e.g. laboratory science, clinical research, epidemiology)

# Key Findings

**Respondents identified challenges as a unique feature of the TD research process. These included:**

- Challenges of team research (e.g. coordinating activities, lack of recognition if not the PI)
- Challenges of cross-disciplinary work (e.g. scientific “language” barriers, more time consuming)

**TREC respondents did not identify these challenges**

- Suggests there are concrete strategies available to address these challenges (e.g. funding, leadership, infrastructure)

# Interviews and Document Review (Ongoing, years 5-6)

## **Goals:**

- Document lessons learned about engaging in team science, TD approaches
- Document diffuse impacts of TREC (e.g. impact on trainees, faculty careers, scientific innovations)

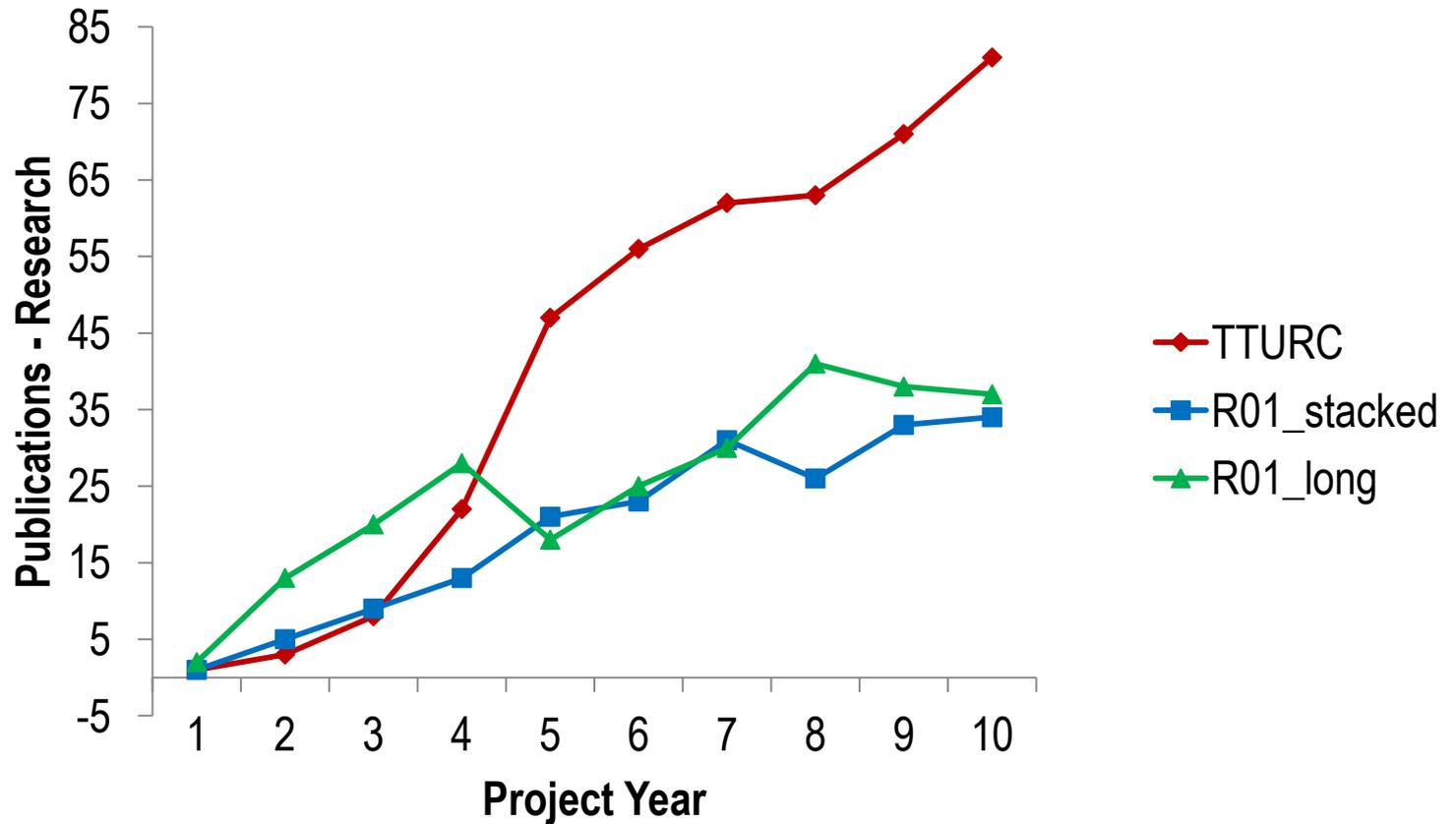
## **Methods:**

- In-depth qualitative interviews with ~40 TREC grantees and NCI program staff
- Document review: briefing book, websites
- Thematic analysis, NVIVO software
- Findings will be interpreted with input from TREC Evaluation WG and NCI program staff

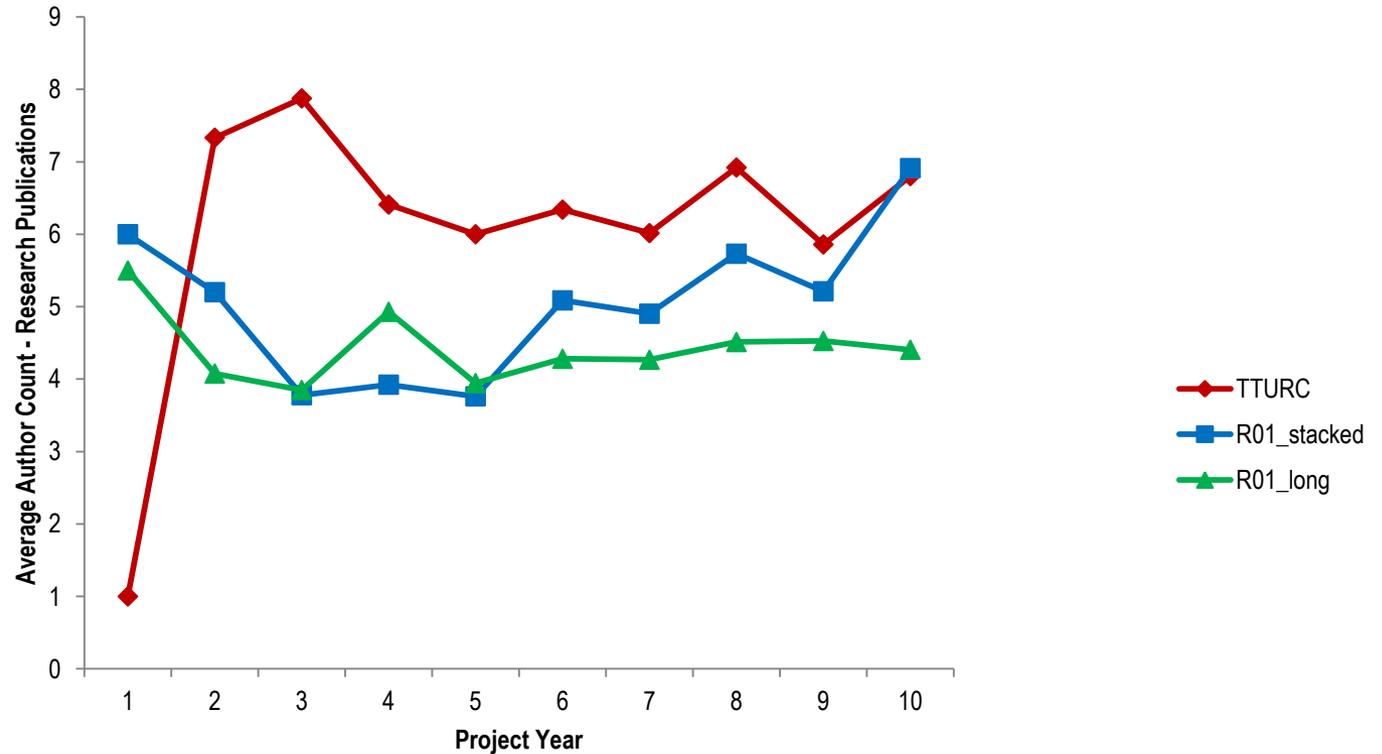
# Bibliometric Analysis (Ongoing, years 5-6)

- Bibliometrics
  - Assessment of the **quantity** and **quality** of scientific publications
- Applications
  - Can be linked to other outcome data and process data to help determine what factors are important in determining general research productivity and TD outcomes
  - Can be used in combination with the Delphi method to track the **originality** of scientific advances and long-term and **broad-ranged program impact**

# Example of Bibliometric Analysis: Number of Publication by Year



# Example of Bibliometric Analysis: Average Author Count



# Bibliometric Analysis, Preliminary Study

## Goals

- Assess whether baseline measures of collaboration readiness are associated with research productivity and collaboration
- Assess whether there are specific aspects of collaboration readiness that are particularly influential on research productivity and collaboration

## Methods

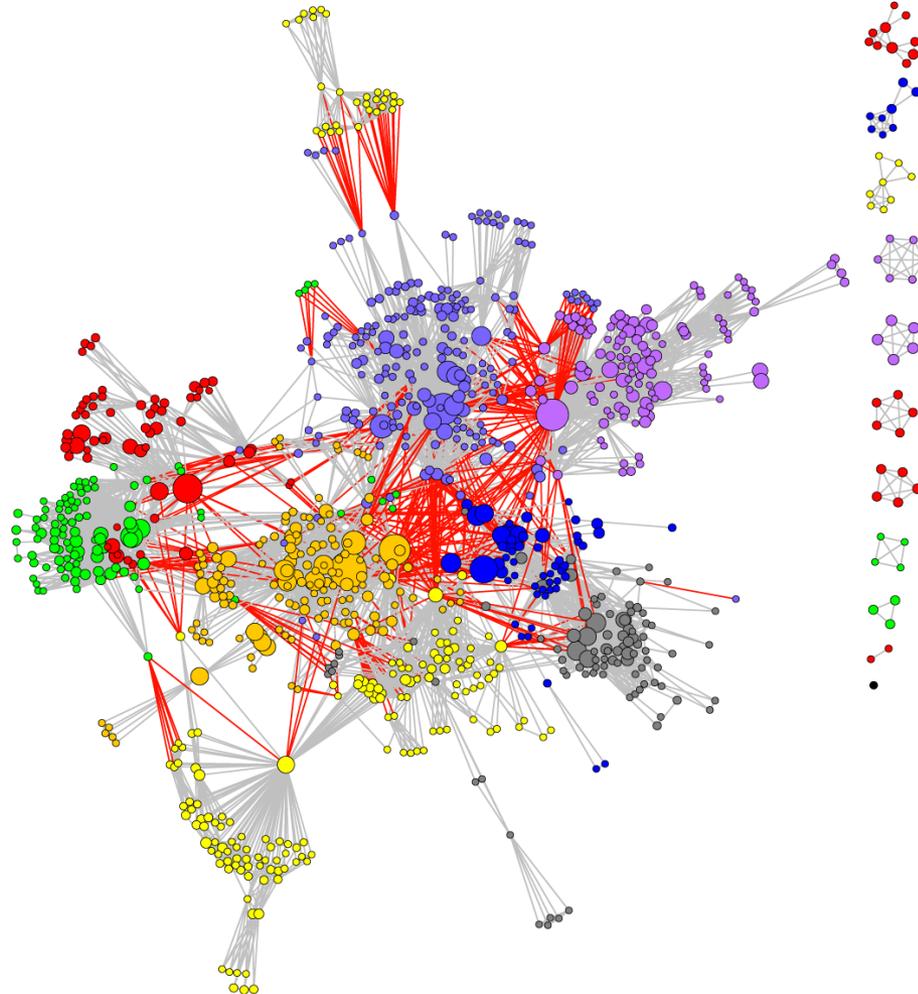
- TREC baseline survey results were linked to basic bibliometric data (publication & author counts)
  - Baseline survey data from 47 scientists who remained with TREC  $\geq 2$  years
  - Bibliometric data from the publication list available on the TREC website
- Regression analysis

# Key Findings

- Perceived interpersonal collaboration at baseline was significantly related to increased number of publications, presentations, and coauthors
- The MD ROS Factor at baseline was significantly related to number of presentations
- Measures of contextual-environmental conditions at baseline (Institutional Resources, Collaborative Productivity, and General Collaborative Activities) were not significantly related to number of publications

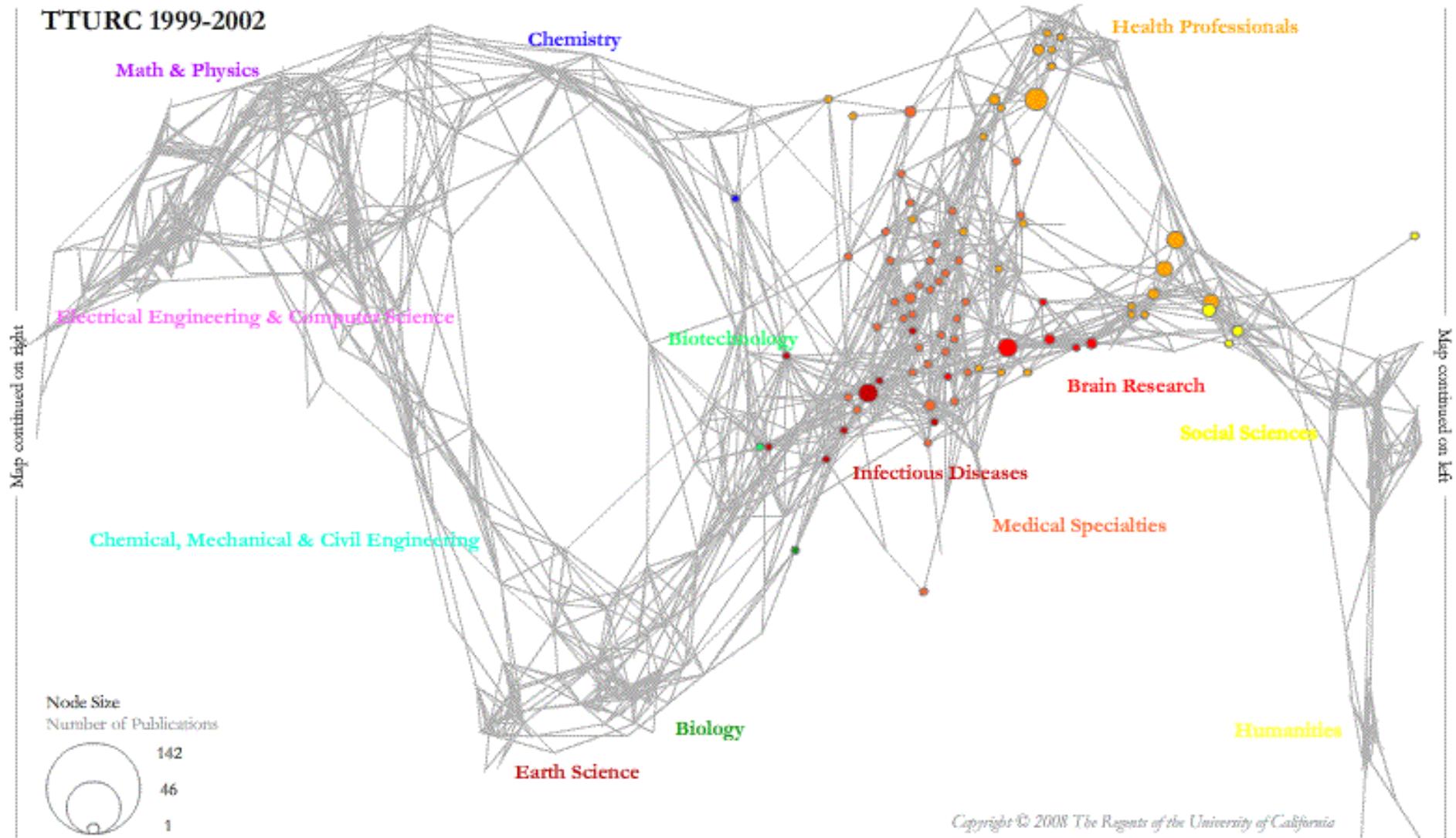
# Example of Future Bibliometric Analysis: Network Analysis

TTURC Co-Authorship Network



# Example of Future Bibliometric Analysis: TTURC Group: Map of Science - Publication Counts

TTURC 1999-2002



# Delphi Approach and Visualization Method: Future Directions

## Goals

- To identify the most impactful ideas in the field of energetics and cancer during the TREC grant
- To assess the relative contribution of TREC to these most impactful ideas

## A True Mixed Methods Study: Combining Delphi Approach, Automated Thesaurus, and Global Map Visualizations

- Create a global map of NIH funded energetics balance research literature to reveal patterns in the structure of the energetics balance and cancer research literature, processes of knowledge dissemination

# Delphi Approach and Visualization

## Method: Future Directions

### **Methods, Continued:**

- Use Delphi approach to survey a panel of energetics balance experts to identify “most influential ideas” driving energetics and cancer research , policy and practice during TREC grant
- Use automated thesaurus to link Delphi results to literature (in Scopus)
- Identify which of these publications produced by TREC
- Overlay results onto the global map, and use citation patterns to identify patterns of knowledge dissemination, and influence of TREC within these patterns

**Lessons Learned  
from the TREC Evaluation**

# Strengths of the TREC Evaluation

- Multi-method approach provides a more comprehensive understanding of antecedent factors, processes, and outcomes – and their relationships to one another – than a single-method approach
- Data collection across the various stages of the initiative provides an opportunity to look at how process variables change, and how process and outcome variables influence one another over time

# Challenges in the TREC Evaluation

- Evaluation by team housed within funding agency (NCI) led grantees to (incorrectly) perceive the evaluation as impacting funding/renewal
  - Led to possible reporting bias (baseline and follow-up surveys)
  - Grantees dissatisfaction with findings that demonstrated room for improvement (qualitative appraisal of developmental project proposals)

# Challenges in the TREC Evaluation

- Immediate burden to grantees to participate in data collection yet unclear how it directly benefits them
  - There is a delay in producing findings regarding outcomes, as well as what antecedent factors are associated with better outcomes
- Institutional pressure to demonstrate grant outcomes
  - Cannot be adequately assessed until after grant ends (5-10 years)

# Responses to Challenges

- **Establish partnership** with and provide feedback to grantees (from the start)
- **Minimize burden** on grantees, especially at the start, by selecting low-burden data collection methods
- Results should be well **disseminated & utilized**, particularly for quality improvement
- **Use cutting-edge methods** (e.g. bibliometrics, global maps, expert panel approaches) to assess program impact with least burden

# NCI SciTS Resources

- Science of Team Science Information:  
<http://cancercontrol.cancer.gov/brp/scienceteam/index.html>
- Evaluation of Large Initiatives (ELI):  
<http://cancercontrol.cancer.gov/brp/eli.html>
- Presentations from NCI Science of Team Science Conference October, 2006:  
[http://cancercontrol.cancer.gov/brp/presentations\\_day1.html](http://cancercontrol.cancer.gov/brp/presentations_day1.html)
- Special Issue of Nicotine Tobacco and Control:  
Volume 5, December, 2003