Using Matched Controls to Evaluate Team Assembly and Effectiveness

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Harvard 2009 Pilot Grant Competition

- Internal competition for \$50,000 research pilot grants
 - Funded by NIH Clinical & Translational Award program
- Review process
 - 37,266 people (all Harvard faculty) could apply
 - 458 teams (1,460 faculty) submitted proposals
 - 65 teams (249 faculty) were awarded funding
- NIH required reporting metrics
 - How many teams were funded?
 - How many teams published results?
- Additional goals of the pilot grants
 - Encourage cross institutional/disciplinary collaboration
 - Match junior investigators with mentors

• How do you know what would have happened anyway?

- Theoretical model of team assembly
- Matched controls that did not apply for funding (data from EFS)

Multi-theoretical Multilevel (MTML) Model

Integrated explanatory framework to understand collaboration

• Individual (actor) level

Academic rank, expertise, gender

- Relational (dyad) level
 - Common interests, past collaboration
- Higher order (ecosystem)
 - Connections between teams



Team as a collection of individuals



Team as individuals and relations



Ecosystem of teams

Defining Comparison Groups of Teams



Comparing Team Characteristics



Variables

Attributes (<u>Applicant</u>, <u>R</u>eviewer)

- Biomedical School *
- Has Publications *
- Senior Faculty *
- Trainee *
- MD-PhD Degree *
- Is Female
- C.T. Research
- Proposal Expertise
- Is Also Reviewer
- Is Also Applicant

Proposal

- Priority Topic
- MeSH Uniqueness
- * Variables used to match teams

Relationships (AA, AR, RR)

- Have CoAuthored *
- Have Cited *
- Same Institution *
- Same Field *
- Same Gender

Team Level Variables

- PI is Female
- Local Ecosystem Density
- C.T. Research Range
- Total Proposal Expertise

Review Committee

- C.T. Research Range
- Total Proposal Expertise

Profiles Research Networking Software (RNS)

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Interactive Network Visualizations



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Phases of Analysis

• Team Assembly Phase

- How did investigators choose collaborators?
- Were new collaborations formed?

Peer Review Phase

- Were there biases in the review process?
- What were the characteristics of awarded proposals?

Post-Award Phase

- What was the impact of funding on awarded teams?
- What impact did applying have on un-funded teams?

Results: Team Assembly

		Virtual Teams	5	Actual Teams			
	Non-Ap	plicants	Appli	cants	Public	ations	
	Random	Matched	Regrouped	Proposals	0 Applicants	1+ Applicant	
Cohort Characteristics							
Matches Per Proposal	1,000	442.2	1,000	1	434.4	214.0	
Distinct People	35,797	31,460	1,469	1,469	4,285	2,071	
People Per Team	3.860	3.860	3.860	3.860	3.670	3.748	
Publications Per Person	23.7	88.4	81.6	77.0	78.9	101.2	
Total Proposal Expertise	0.138	0.277	0.300	0.635	0.207	0.272	
Applicant Attributes							
Biomedical School	0.651	0.901	0.905	0.901	0.791	0.943	
Has Publications	0.615	0.949	0.952	0.949	0.948	0.960	
Senior Faculty	0.155	0.378	0.405	0.378	0.340	0.407	
Trainee	0.379	0.126	0.104	0.137	0.334	0.241	
MD-PhD Degree	0.050	0.161	0.164	0.161	0.084	0.143	
Is Female	0.410	0.316	0.307	0.317	0.297	0.302	
C.T. Research	0.321	0.610	0.630	0.609	0.526	0.678	
Applicant Relationships							
Have CoAuthored	0.000	0.148	0.005	0.199	0.509	0.560	
Have Cited	0.001	0.251	0.029	0.302	0.502	0.572	
Same Institution	0.112	0.481	0.160	0.435	0.807	0.758	
Same Field	0.013	0.327	0.049	0.315	0.563	0.554	
Same Gender	0.688	0.721	0.715	0.747	0.751	0.746	
Team Level Variables							
PI Is Female	0.377	0.333	0.291	0.345	0.250	0.252	
C.T. Research Range	0.415	0.454	0.468	0.388	0.256	0.287	
Local Ecosystem Density	0.699	0.566	0.530	0.561	0.671	0.645	

<0.01 Positive Coefficient

< 0.05

< 0.05

P-Values:

< 0.001

<0.01
Negative Coefficient</pre>

< 0.001

Results: Team Assembly



Fraction of Individuals (Attributes) or Dyads (Relationships/Teams)

Results: Peer Review

	All Not Funded	Proposal Not Submitted	Scored Not Interviewed	Interviewed Not Funded	Funded
Cohort Characteristics					
Proposals	393	78	271	34	65
Distinct People	1276	241	955	146	249
People Per Team	3.845	3.192	4.018	4.382	3.954
Applicant Attributes					
Biomedical School	0.899	0.911	0.897	0.913	0.913
Has Publications	0.946	0.950	0.949	0.907	0.972
Senior Faculty	0.368	0.358	0.376	0.382	0.439
Trainee	0.139	0.127	0.132	0.129	0.126
MD-PhD Degree	0.156	0.169	0.155	0.153	0.192
Is Female	0.321	0.353	0.322	0.294	0.294
ls Reviewer	0.054	0.093	0.044	0.047	0.064
Reviewer Attributes					
Biomedical School			0.952	0.963	0.956
C.T. Research			0.641	0.637	0.660
A-A Relationships					
Have CoAuthored	0.199	0.226	0.203	0.156	0.198
Same Institution	0.446	0.423	0.466	0.375	0.369
A-R Relationships					
Have CoAuthored			0.014	0.024	0.025
Have Cited			0.070	0.084	0.098
Same Gender			0.056	0.054	0.059
R-R Relationships					
Have CoAuthored			0.087	0.083	0.085
Same Field			0.322	0.379	0.352
Team Level Variables					
Total Proposal Expertise	0.628	0.572	0.647	0.641	0.678
Team Size 3	0.270	0.218	0.280	0.353	0.200
Review Committee					
C.T. Research Range			0.404	0.388	0.402
Proposal Variables					
Priority Topic	0.369	0.308	0.384	0.382	0.462
MeSH Uniqueness	0.268	0.259	0.271	0.262	0.269

There were several small differences between funded teams and unfunded teams, but the p-values are weak.

Note that the quality of the science in the proposals is not measured by any of these variables!

P-Values:

< 0.05

Positive Coefficient Negative Coefficient

< 0.1

< 0.05

< 0.1

Results: 5-Year Post-Award Outcomes

	New Publications		New Collaborations			CoAuthor	
	All	Cites Grant	Total	From Grant		Density	
				Partially	Entirely	2009	2014
Proposal Teams							
All Proposals	143.8	3.11	1.799	0.301	0.159	0.199	0.443
All Not Funded	143.6	3.19	1.692	0.132	0.061	0.199	0.415
Proposal Not Submitted	125.3	2.24	1.462	0.051	0.000	0.226	0.405
Scored Not Interviewed	149.7	3.49	1.771	0.159	0.085	0.203	0.421
Interviewed Not Funded	154.4	3.88	1.853	0.147	0.029	0.156	0.415
Funded	145.3	2.63	2.446	1.323	0.754	0.198	0.612
Virtual Teams							
Random	35.4	0.27	0.001	0.000	0.000	0.000	0.000
Matched	111.8	1.08	0.028	0.000	0.000	0.148	0.152
Regrouped	160.5	3.78	0.028	0.002	0.002	0.005	0.009
Published Teams							
0 Applicants	115.9	0.69	3.053	0.013	0.001	0.509	1.000
1+ Applicants	169.2	2.48	3.189	0.098	0.039	0.560	1.000

Results: 5-Year Post-Award Outcomes



New Publications (Cites Grant)



Funded teams published 1.55 more grant-citing articles than Matched teams

New CoAuthors (All)



New CoAuthors (Cites Grant)



New collaborations resulted from Non-Funded teams, but not through grant-citing articles

Conclusions

- Proposal teams have more <u>diversity</u> than typical teams that write publications. However, there is still far more <u>familiarity</u> than by random chance.
- New lasting collaborations formed even in teams that were <u>not funded</u>. (Indirect effects of the program.)
- Evaluating the formation and effectiveness of teams requires appropriate matched controls to correct for baseline activity