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Institute of Clinical and
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ICTS Research Collaboration Survey Results

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INTRODUCTION

In September 2007, Washington University (WU) was awarded a Clinical and Translational Science Award (CTSA). To ensure the intent of the CTSA, WU created the Institute of Clinical and Translational Sciences (ICTS). The overall goal of the ICTS is to serve as the intellectual and physical home for clinical and translational research, clinical research training, and career development to help overcome the traditional boundaries between disciplines, departments and institutions.

The Tracking & Evaluation (T&E) Program was established to conduct the evaluation of the overall goals of the ICTS. The vision of the T&E Program is to utilize evidence-based and innovative evaluation methods to 1) inform ICTS strategic planning and program improvement activities, and 2) assess the impact of ICTS on clinical and translational science that results in clinical applications and meaningful community health outcomes.

Report Purpose

This report provides the results from the ICTS Research Collaboration Survey. The ICTS Research Collaboration Survey was developed to better understand the collaborative research partnerships of ICTS members. The survey included demographic, collaboration network, and general attitude and satisfaction questions. Established scales (Mâsse et al., Measuring Collaboration and Transdisciplinary Integration in Team Science, 2008) were used to assess satisfaction with collaboration, the impact of collaboration and attitudes about transdisciplinary research. Additional items were developed to assess change over the last three years and barriers encountered.

Report Organization

This report is divided into three main sections. First we provide a description of the respondents including general demographics, affiliation, discipline, and academic rank. The next section presents the characteristics of the collaboration networks, both by ICTS membership and by ICTS member discipline. Finally, this report outlines the general attitudes toward, satisfaction with, and barriers to collaborative research.

An Executive Summary of this report can be accessed at http://icts.wustl.edu/about/2011CollabES.pdf.

CHARACTERISTICS OF SURVEY RESPONDENTS

The first administration of the ICTS Research Collaboration Survey occurred between March-April 2011 to all ICTS members (n=1041). Seventy one percent of members (n=737) responded to the survey. While a 71% response rate is reasonable for the first administration of this survey, it is important to increase response rate for future administrations to better describe the ICTS collaboration network.

The majority of respondents (89.8%) listed their primary institution as Washington University (Table 1). When applicable, respondents also listed their school, department and division affiliations. Of those reporting a school affiliation, the Washington University School of Medicine was noted by 86.4% of respondents. The most frequently cited departments included Internal Medicine (27.0%), Pediatrics (7.9%) and Neurology (6.6%). Frequently cited divisions included Adult Neurology (9.5%), Cardiology (7.8%) and Oncology (6.4%). (See Appendices A-C for complete lists of all identified school, department and division affiliations.) Men made up 63.6% of the sample and women made up 36.4%.

For the first administration of this survey, a 71% response rate is reasonable. However, it is important to increase response rate for future administrations to better describe the ICTS collaboration network.

Table 1. Primary Institution Affiliation (n=737)

	Frequency	Percent (%)
Washington University in St. Louis	662	89.8
Saint Louis University	40	5.4
BJC HealthCare	11	1.5
University of Missouri at St. Louis	9	1.2
Southern Illinois University Edwardsville	3	.4
Community Health Organization	1	.1
Other	11	1.5

Respondents were also asked to report the discipline with which they most closely identified their current work. The list of disciplines they chose from came from the National Institutes of Health list of specialties. A total of 143 different disciplines were identified. The most frequently noted disciplines were Neurology (4.6%), Cardiovascular Diseases (4.3%) and Oncology (4.3%). (See Appendix D for the complete list of disciplines).

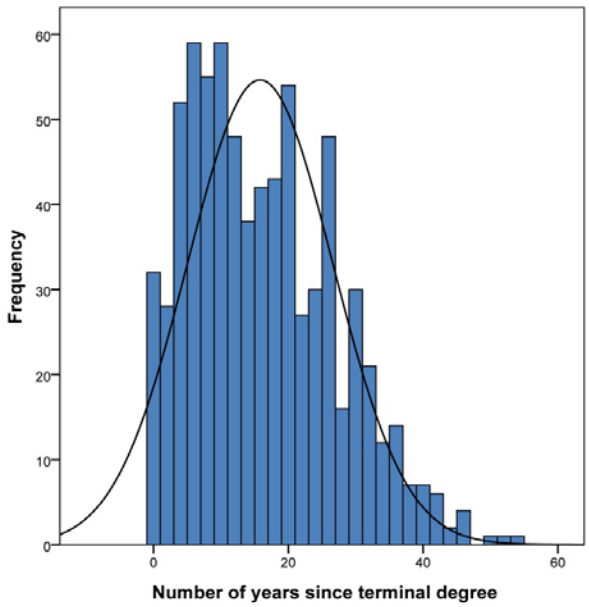
Table 2. Academic Rank

	Frequency	Percent (%)
Assistant Professor	228	30.9
Professor	213	28.9
Associate Professor	130	17.6
Instructor	66	9.0
Student	39	5.3
Fellow	26	3.5
Staff	14	1.9
Resident	10	1.4
Other	11	1.5
Total	737	100.0

Table 2 describes the academic rank among respondents. The greatest percentage identified themselves as Assistant Professors (30.9%) or Professors (28.9%). Associate Professors made up the next largest category (17.6%) and 5.3% of the sample identified themselves as students.

Respondents were also asked to report the number of years since obtaining their terminal degree. Figure 1 shows that the number of years since terminal degree responses were approximately normally distributed with a mean of 15.8 years and a standard deviation of 10.8 years.

Figure 1. Number of Years Since Terminal Degree



CHARACTERISTICS OF CURRENT COLLABORATION NETWORK

The survey included four items assessing the network of research collaborations. The first item asked respondents to identify their "most important research collaborations during the past 12 months." Respondents were able to name up to 10 collaborators. Respondents indicated level of direct contact, scientific products submitted (grants and/or publications), and the primary role (e.g. theory, data collection) for each collaborator they named. This report focuses on who respondents named and the connections between them throughout the ICTS network.

ICTS Collaboration Network

All but 33 of the 737 respondents identified collaborators, with respondents identifying an average of 2.18 collaborators. This resulted in a network of 2,234 individuals, 868 (39%) of whom were ICTS members. Figure 2 shows the network of individuals with collaborators, color-coded by whether or not they were ICTS members.

Figure 2. ICTS Collaboration Network

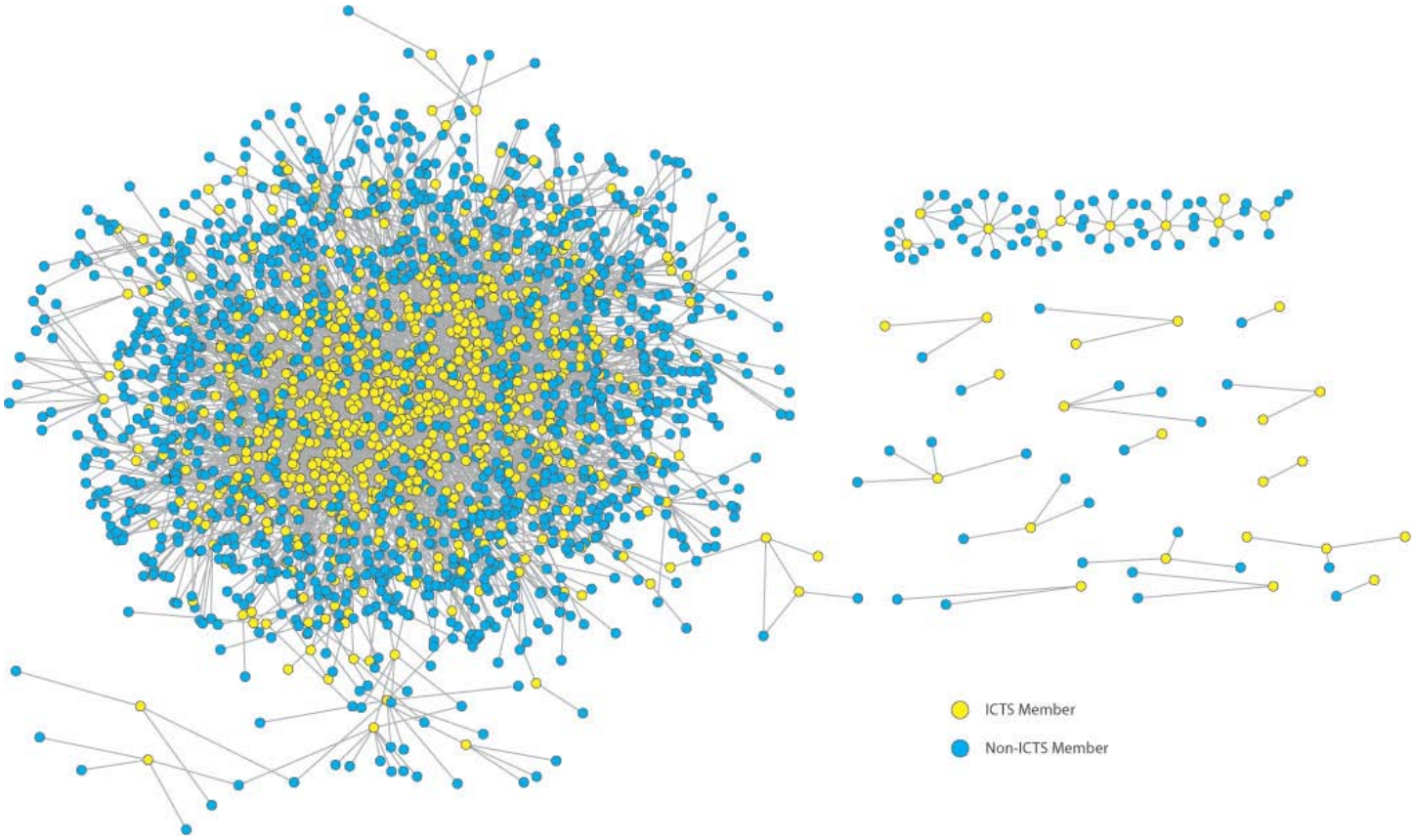


Table 3 displays the descriptive statistics for both the entire network as well as for ICTS members only. Density is the percentage of possible links in the network that actually exist. The density among ICTS members indicates that only .45% of the possible collaboration connections between members actually exist. With an average of only 3.91 collaborations among ICTS members in the network (average degree), there is room to expand the number of collaborators among members.

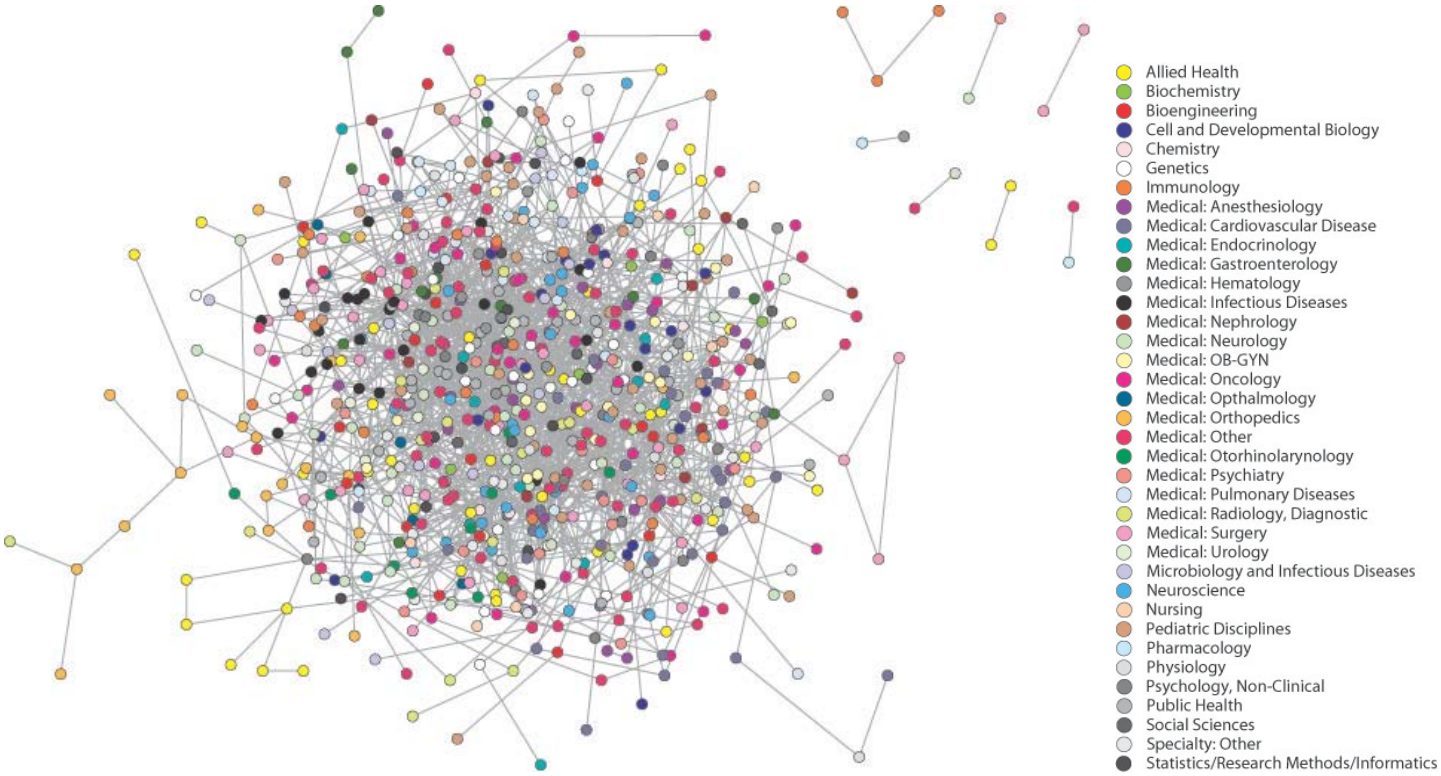
There is a strong tendency for ICTS members to collaborate with other ICTS investigators.

Table 3. Collaboration Network Descriptive Statistics

Network	# of nodes	Density	Average Degree	Size of Largest component	Diameter
Full network	2234	.0014	3.13	2092 (93.6%)	16
ICTS members only	868	.0045	3.91	783 (90.2%)	13

Figure 3 shows the network of ICTS members only, removing the 70 respondents with no ICTS collaborators, color coded according to a list of 37 disciplines (Table 4) collapsed from the initial 143 listed in Appendix D. In order to include discipline for members who did not participate in the survey, the disciplines that all ICTS members first chose when registering for ICTS were used.

Figure 3. Collaborations among ICTS Members Only



The ratio of inter-disciplinary to intra-disciplinary collaborations densities was .162, indicating that for every 1% of possible inter-disciplinary partnerships that actually exist, about 6% of the possible intra-disciplinary partnerships exist. Disciplines do not appear to be clumped together. For example, the yellow nodes (Allied Health) are spread throughout the entire network. This indicates that a fair amount of cross-discipline collaborations are occurring, though there is room for the ratio to shift towards more cross-disciplinary work.

There is a fair amount of interdisciplinary collaboration among ICTS members.

Table 4. Collapsed Disciplines and Number of Partners (n = 868)

Discipline	#
ALLIED HEALTH	50
BIOCHEMISTRY	8
BIOENGINEERING	19
CELL AND DEVELOPMENTAL BIOLOGY	23
CHEMISTRY	11
GENETICS	32
IMMUNOLOGY	23
MEDICAL DISCIPLINES : Anesthesiology	23
MEDICAL DISCIPLINES : Cardiovascular Diseases	41
MEDICAL DISCIPLINES : Endocrinology	12
MEDICAL DISCIPLINES : Gastroenterology	14
MEDICAL DISCIPLINES : Hematology	12
MEDICAL DISCIPLINES : Infectious Diseases	24
MEDICAL DISCIPLINES : Nephrology	10
MEDICAL DISCIPLINES : Neurology	45
MEDICAL DISCIPLINES : OB-GYN	23
MEDICAL DISCIPLINES : Oncology	43
MEDICAL DISCIPLINES : Ophthalmology	5
MEDICAL DISCIPLINES : Orthopedics	24
MEDICAL DISCIPLINES : Other	80
MEDICAL DISCIPLINES : Otorhinolarynology	10
MEDICAL DISCIPLINES : Psychiatry	21
MEDICAL DISCIPLINES : Pulmonary Diseases	18
MEDICAL DISCIPLINES : Radiology, Diagnostic	18
MEDICAL DISCIPLINES : Surgery	39
MEDICAL DISCIPLINES : Urology	6
MICROBIOLOGY AND INFECTIOUS DISEASES	16
NEUROSCIENCE	32
NURSING	14
PEDIATRIC DISCIPLINES	49
PHARMACOLOGY	8
PHYSIOLOGY	12
PSYCHOLOGY, NON-CLINICAL	19
PUBLIC HEALTH	36
SOCIAL SCIENCES	10
Specialty: OTHER	22
STATISTICS AND/OR RESEARCH METHODS AND/OR INFORMATICS	16

Top Collaborators

Table 5 lists the top 22 research collaborators identified by respondents. These top collaborators are also important leaders in the Washington University and ICTS communities, with 18 of the 22 individuals serving some kind of director, chair, or dean role, indicating the importance of leadership in collaborative work.

Table 5. Top 22 ICTS Key Collaborators

Name	# of Collaborators	Discipline	ICTS/Institution Role
Graham A. Colditz	34	Epidemiology, Disease Prevention & Control	Deputy Director, Institute for Public Health; Director, Program for the Elimination of Cancer Disparities, Siteman Cancer Center; Associate Director, Prevention and Control, Siteman Cancer Center
R. Reid Townsend	26	Hematology	Associate Director, Translational Pathology and Biomarker Development
Samuel Klein	25	Physiology, Integrative Biology, Nutritional Sciences	Director, Center for Applied Research Sciences; Director, Lifestyle Intervention Research Core
John C. Morris	24	Neurology	Director, Alzheimer's Disease Research Center
Tammie Benzinger	23	Neuroscience, Radiology	Director, Magnetic Resonance Imaging and Advanced Imaging Techniques
Tamara Hershey	22	Cognitive Neuroscience	Brain Behavior and Performance Unit Faculty
Matthew C. Ellis	21	Oncology	Director, Human and Mouse Linked Evaluation of Tumors
Steven M. Kymes	21	Health Economics	Director, Center for Economic Evaluation in Medicine
Donna Jeffe	20	Education	co-Director, Tracking & Evaluation
Joel S. Perlmutter	20	Neurology	Director, Brain, Behavior and Performance Unit
Mario Schootman	19	Epidemiology	Associate Director, Clinical Research Training Center
Elaine R. Mardis	19	Genomics	The Genome Institute Director of Technology Development
Enola Proctor	18	Allied Health	Associate Dean for Faculty
Ross C. Brownson	18	Epidemiology, Disease Prevention & Control	Director, Prevention Research Center; Core Leader, Dissemination & Implementation Research Core
Margaret A. Olsen	18	Epidemiology	co-Director, Center for Administrative Data Research
Jeffrey Peipert	17	OB/GYN	Vice Chair: Clinical Research OB/GYN Department
Mario Castro	17	Pulmonary Diseases	co-Director, Center for Community Engaged Research
Robert McKinstry	17	Radiology: Diagnostic	Director, Center for Clinical Imaging Research
Bradley Schlaggar	17	Neuroscience	Director, Pediatric Neurology Residency Training Program
Kenneth B. Schechtman	17	Biostatistics, Clinical Trials Methodology	Investigator, Research Design and Biostatistics Group
Eric Lenze	17	Medical: Other	Investigator, Center for Mental Health Services Research
Rakesh Nagarajan	17	Statistics & Informatics	Chair, Center for Biomedical Informatics; Director, ICTS Biomedical Informatics

ICTS leadership collaborate at the highest degree.

SATISFACTION WITH COLLABORATION

The ICTS survey included eight items that assessed satisfaction with collaboration (Table 6). The scale was found to have high internal consistency (Cronbach α = .897).

Survey respondents reported high satisfaction with collaborative experiences. All of the mean scores for the Satisfaction with Collaboration Items (Table 6) were above 4 (out of 5), with overall opinions in the Good to Excellent range. The highest mean score was 4.60, with 64.5% of respondents reporting that the acceptance of new ideas among collaborators was Excellent. Additionally, a majority of respondents (65.8%) felt that collaboration was Excellent for capitalizing on the strengths of different researchers.

Table 6. Satisfaction with Collaboration Items (Cronbach α = .897)

	Inadequate n (%)	Poor n (%)	Satisfactory n (%)	Good n (%)	Excellent n (%)	Mean[1]
1. Acceptance of new ideas among collaborators *(n=707)*	0 (0.0)	0 (0.0)	31 (4.4)	220 (31.1)	456 (64.5)	4.60
2. Communication among collaborators *(n=710)*	0 (0.0)	8 (1.1)	70 (9.9)	281 (39.6)	351 (49.4)	4.37
3. Ability to capitalize on the strengths of different researchers *(n=707)*	0 (0.0)	1 (0.1)	52 (7.4)	189 (26.7)	465 (65.8)	4.58
4. Organization or structure of collaborative teams *(n=689)*	0 (0.0)	16 (2.3)	102 (14.8)	297 (43.1)	274 (39.8)	4.20
5. Resolution of conflicts among collaborators *(n=554)*	0 (0.0)	6 (1.1)	82 (14.8)	221 (39.9)	245 (44.2)	4.27
6. Ability to accommodate different working styles of collaborators *(n=683)*	0 (0.0)	5 (0.7)	100 (14.6)	306 (44.8)	272 (39.8)	4.24
7. Involvement of collaborators from outside Washington University *(n=542)*	5 (0.9)	19 (3.5)	74 (13.7)	176 (32.5)	268 (49.4)	4.26
8. Involvement of collaborators from diverse disciplines *(n=670)*	1 (0.1)	14 (2.1)	72 (10.7)	219 (32.7)	364 (54.3)	4.39

[1] These questions used Likert Scale from 1-5, 1= Inadequate, 5=Excellent

ICTS members reported high satisfaction with collaborative experiences.

IMPACT OF COLLABORATION

Six survey items assessed the impact of collaboration (Table 7, p.9). Respondents were asked to rate their views about their current research collaborations and to evaluate the overall quality of their research collaborations in terms of meeting productivity, product development, and overall productivity of collaboration. The scale had high internal consistency (Cronbach α = .789).*

Survey respondents felt strongly that collaboration has increased their productivity, as well as their quality of work.

Figure 4. ***In general, collaboration has improved your research productivity.***

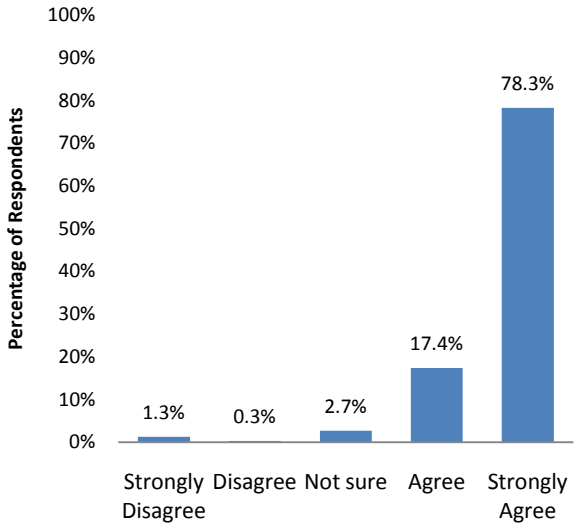


Figure 5. ***In general, collaboration has improved the quality of your research.***

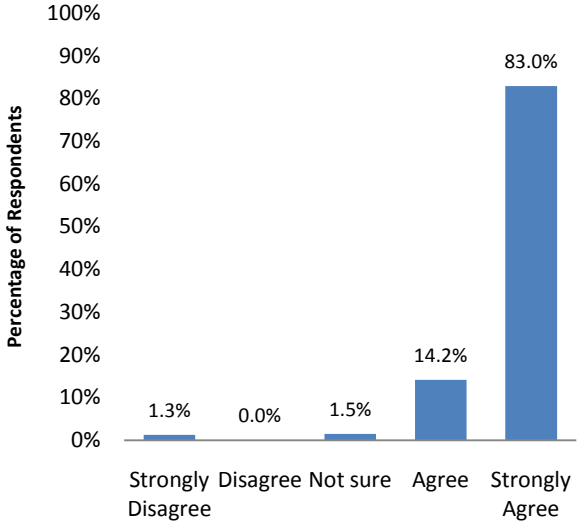
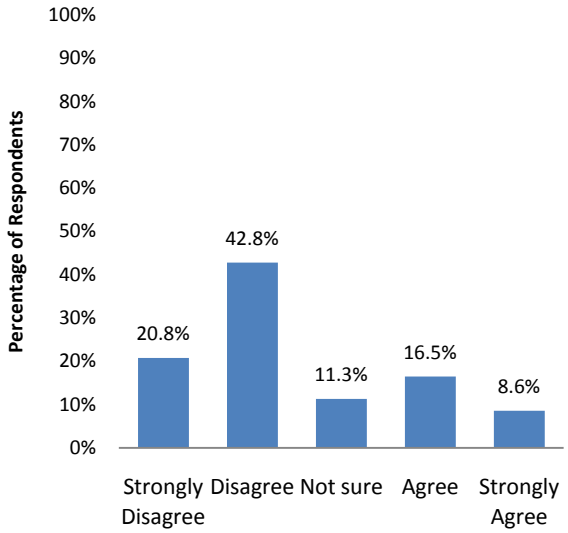


Figure 4 shows that the majority (78.3%) of respondents Strongly Agreed that collaboration has improved research productivity. Another 17.4% of respondents Agreed, for a total of 95.7% agreement with this statement. Figure 5 shows even stronger agreement (83.0% Strongly Agreed) with the statement that collaboration has improved the quality of research. Total agreement with this statement adds up to 97.2%.

Respondents also reported that collaboration had not posed a significant time burden, with a total of 63.6% disagreement with this statement (Figure 6).

Figure 6. ***Collaboration has posed a significant time burden in your research.***



*Cronbach α =.669 before removing "Collaboration has posed a significant time burden." Mâsse et al. (2008) also removed this item, noting that it did not load on the scale. However, the results for this item are still presented as they show a recognition of time burden.

Table 7. Impact of Collaboration Items (Cronbach α =.789)[1]

	Strongly Disagree n (%)	Disagree n (%)	Not Sure n (%)	Agree n (%)	Strongly Agree n (%)	Mean[2]
1. In general, collaboration has improved your research productivity. *(n=711)*	9 (1.3)	2 (0.3)	19 (2.7)	124 (17.4)	557 (78.3)	4.71
2. In general, collaboration has improved the quality of your research. *(n=712)*	9 (1.3)	0 (0.0)	11 (1.5)	101 (14.2)	591 (83.0)	4.78
3. Collaboration has posed a significant time burden in your research. *(n=701)*	146 (20.8)	300 (42.8)	79 (11.3)	116 (16.5)	60 (8.6)	2.49
	Inadequate n (%)	**Poor n (%)**	**Satisfactory n (%)**	**Good n (%)**	**Excellent n (%)**	**Mean[3]**
4. Productivity of collaboration meetings *(n=692)*	0 (0.0)	10 (1.4)	83 (12.0)	323 (46.7)	276 (39.9)	4.25
5. Productivity in developing new products (e.g., papers, proposals, courses) *(n=659)*	0 (0.0)	10 (1.5)	114 (17.3)	287 (43.6)	248 (37.6)	4.17
6. Overall productivity of collaboration *(n=709)*	0 (0.0)	3 (0.4)	59 (8.3)	291 (41.0)	356 (50.2)	4.41

[1] Cronbach α =.789 after removing "Collaboration has posed a significant time burden." Cronbach α =.669 for all six items.
[2]These questions used Likert Scale from 1-5, 1=Strongly Disagree, 5=Strongly Agree
[3]Likert Scale from 1-5, 1=Inadequate, 5=Excellent

There was consensus that collaboration increases productivity and quality of work.

TRANSDISCIPLINARY RESEARCH

The survey included 15 items that assessed attitudes about transdisciplinary research (Table 8, p. 11). The scale had high internal consistency (Cronbach α = .839).

Survey respondents expressed that they strongly valued transdisciplinary collaboration. While respondents recognized that a collaborative research article can take more time, overall, they felt that the benefits of transdisciplinary research outweighed the costs.

Figure 7 shows that a majority (83.2%) of respondents Strongly Agreed that they strongly value transdisciplinary collaboration. Total agreement with this statement was 97.6%.

There was some agreement that it takes more time to produce an article collaboratively with those of other disciplines, as shown in Figure 8. However, agreement with this statement was less strong, with total agreement adding up to a slim majority of 55.3%. Disagreement totaled 26.5% and 18.2% of respondents replied that they were Not Sure.

Figure 7. ***I would describe myself as someone who strongly values transdisciplinary collaboration.***

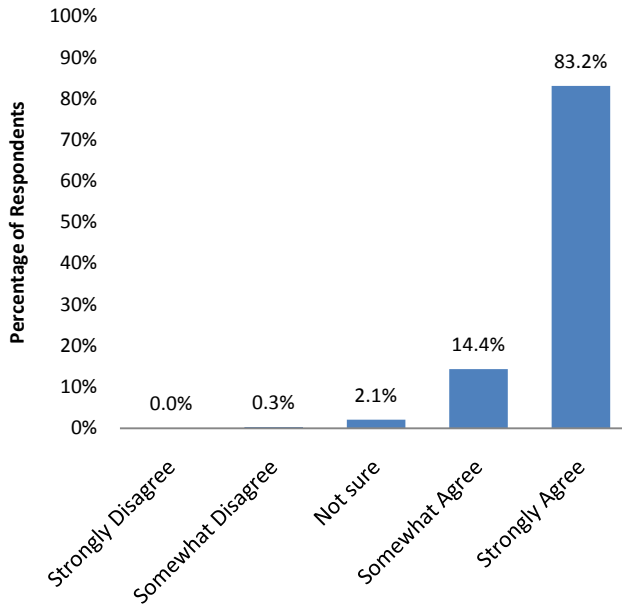


Figure 9 shows agreement among the respondents that the benefits of transdisciplinary collaboration outweigh the costs. A majority of respondents (67.1%) Strongly Agreed and 28.3% Somewhat Agreed, with overall agreement totaling to 95.4%

Figure 8. ***In transdisciplinary research, it takes more time to produce a research article.***

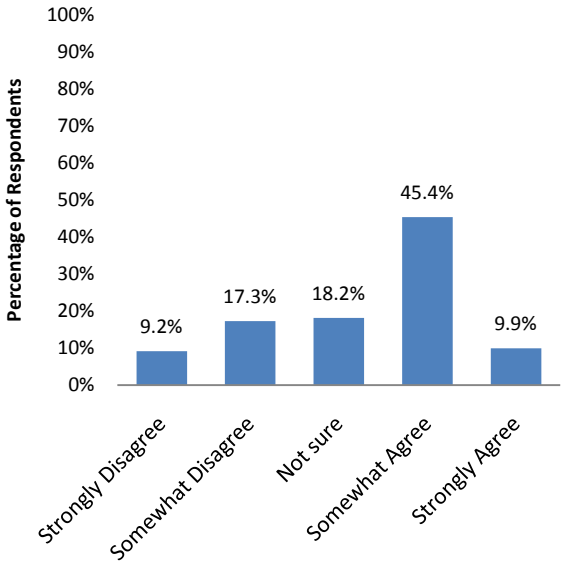


Figure 9. ***Generally speaking, I believe that the benefits of transdisciplinary scientific research outweigh the costs of such work.***

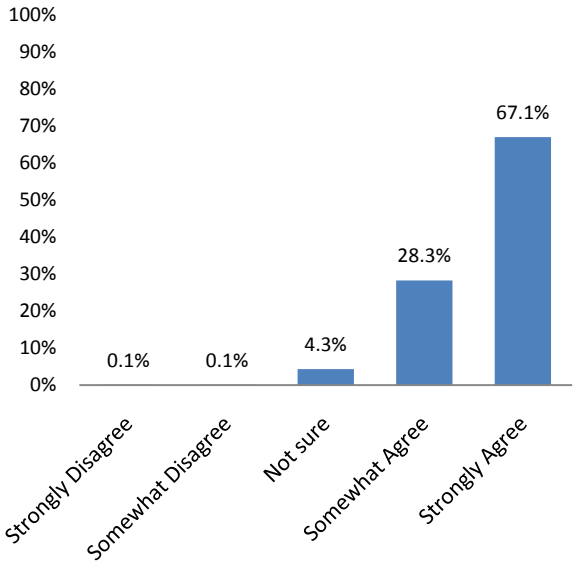


Table 8. Transdisciplinary Integration Items (Cronbach α =.839)

	Strongly Disagree n (%)	Somewhat Disagree n (%)	Not Sure n (%)	Somewhat Agree n (%)	Strongly Agree n (%)	Mean[1]
1. I would describe myself as someone who strongly values transdisciplinary collaboration. ***(n=720)***	0 (0.0)	2 (0.3)	15 (2.1)	104 (14.4)	599 (83.2)	4.81
2. Transdisciplinary research interferes with my ability to maintain knowledge in my primary area. ***(n=706)***	351 (49.7)	220 (31.2)	52 (7.4)	40 (5.7)	43 (6.1)	1.87
3. I tend to be more productive working on my own rather than working as a member of a transdisciplinary research team. ***(n=710)***	208 (29.3)	284 (40.0)	112 (15.8)	86 (12.1)	20 (2.8)	2.19
4. In a transdisciplinary research group, it takes more time to produce a research article. ***(n=707)***	65 (9.2)	122 (17.3)	129 (18.2)	321 (45.4)	70 (9.9)	3.30
5. Transdisciplinary research stimulates me to change my thinking. ***(n=713)***	0 (0.0)	5 (0.7)	32 (4.5)	280 (38.0)	396 (53.7)	4.50
6. I have changed the way I pursue a research idea because of my involvement in transdisciplinary research. ***(n=691)***	4 (0.5)	28 (4.1)	74 (10.7)	255 (36.9)	330 (47.8)	4.27
7. Transdisciplinary research has improved how I conduct research. ***(n=696)***	2 (0.3)	11 (1.6)	61 (8.8)	228 (32.8)	394 (56.6)	4.44
8. I am optimistic that transdisciplinary research among ICTS collaborators will lead to valuable scientific outcomes that could not have occurred without that kind of collaboration. ***(n=708)***	3 (0.4)	6 (0.8)	50 (7.1)	192 (27.1)	457 (64.5)	4.55
9. Participating in a transdisciplinary team improves the interventions that are developed. ***(n=677)***	0 (0.0)	1 (0.1)	59 (8.7)	224 (33.1)	393 (58.1)	4.49
10. Because of my involvement in transdisciplinary research, I have an increased understanding of what my own discipline brings to others. ***(n=698)***	2 (0.3)	9 (1.2)	52 (7.4)	239 (34.2)	396 (56.7)	4.46
11. My transdisciplinary collaborations are sustainable over the long haul. ***(n=691)***	1 (0.1)	10 (1.4)	90 (13.0)	241 (34.9)	349 (50.5)	4.34
12. Generally speaking, I believe that the benefits of transdisciplinary scientific research outweigh the inconveniences and costs of such work. ***(n=714)***	1 (0.1)	1 (0.1)	31 (4.3)	202 (28.3)	479 (67.1)	4.62
13. I am comfortable working in a transdisciplinary environment. ***(n=711)***	0 (0.0)	3 (0.4)	22 (3.1)	189 (26.6)	497 (69.9)	4.66
14. Overall, I am pleased with the effort I have made to engage in transdisciplinary research. ***(n=706)***	2 (0.3)	18 (2.5)	40 (5.7)	232 (32.9)	414 (58.6)	4.47
15. ICTS investigators as a group are open-minded about considering research perspectives from fields other than their own. ***(n=686)***	4 (0.6)	14 (2.0)	124 (18.1)	226 (32.9)	318 (46.4)	4.22

[1] These questions used Likert Scale from 1-5, 1=Strongly Disagree, 5=Strongly Agree

Transdisciplinary research is highly valued and the benefits of transdisciplinary research outweigh the costs.

CHANGE OVER THE PAST THREE YEARS

The survey included four items asking respondents to evaluate how their collaborative efforts have changed over the past three years (Table 9). The scale had high internal consistency (Cronbach α = .845).

The survey responses indicated that ICTS may have helped increase collaboration over the last three years. The majority of respondents (85.5%) Agreed that they are more aware of collaborative opportunities (44.6% Somewhat Agreed and 40.9% Strongly Agreed). Additionally, Figure 10 shows that a majority (80.7%) Agreed that it is easier to engage in collaborative activities. This suggests that ICTS might not only be promoting awareness but also facilitating collaboration.

There also appears to be an opportunity for respondents to participate in new types of collaborative partnerships in the future. Although 58.0% of respondents Agreed that they are engaged in new types of collaborative partnerships, 16.5% Somewhat Disagreed and 5.3% Strongly Disagreed.

Figure 10. ***It is easier for me to engage in collaborative activities.***

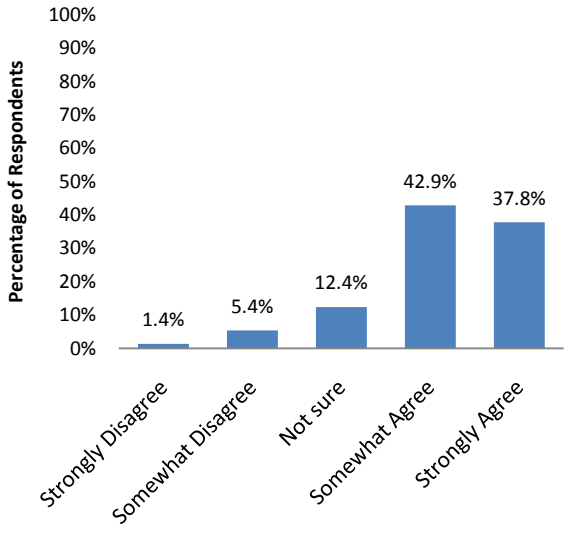


Table 9. Change Over Past Three Years Items (Cronbach α =.845)

	Strongly Disagree n (%)	Somewhat Disagree n (%)	Not Sure n (%)	Somewhat Agree n (%)	Strongly Agree n (%)	Mean[1]
1. I am more aware of collaborative opportunities. ***(n=706)***	11 (1.6)	34 (4.8)	57 (8.1)	315 (44.6)	289 (40.9)	4.19
2. It is easier for me to engage in collaborative activities. ***(n=701)***	10 (1.4)	38 (5.4)	87 (12.4)	301 (42.9)	265 (37.8)	4.10
3. I am more engaged in research with collaborators from a discipline or area of study that I would not have otherwise considered. ***(n=688)***	16 (2.3)	47 (6.8)	74 (10.8)	252 (36.6)	299 (43.5)	4.12
4. I am engaged in new types of collaborative partnerships (e.g., industry, community, private, public, government) that I would not have otherwise considered. ***(n=624)***	33 (5.3)	103 (16.5)	95 (15.2)	193 (30.9)	200 (27.1)	3.68

[1] These questions used Likert Scale from 1-5, 1=Strongly Disagree, 5=Strongly Agree

ICTS may have played a role in increasing collaboration over the past three years.

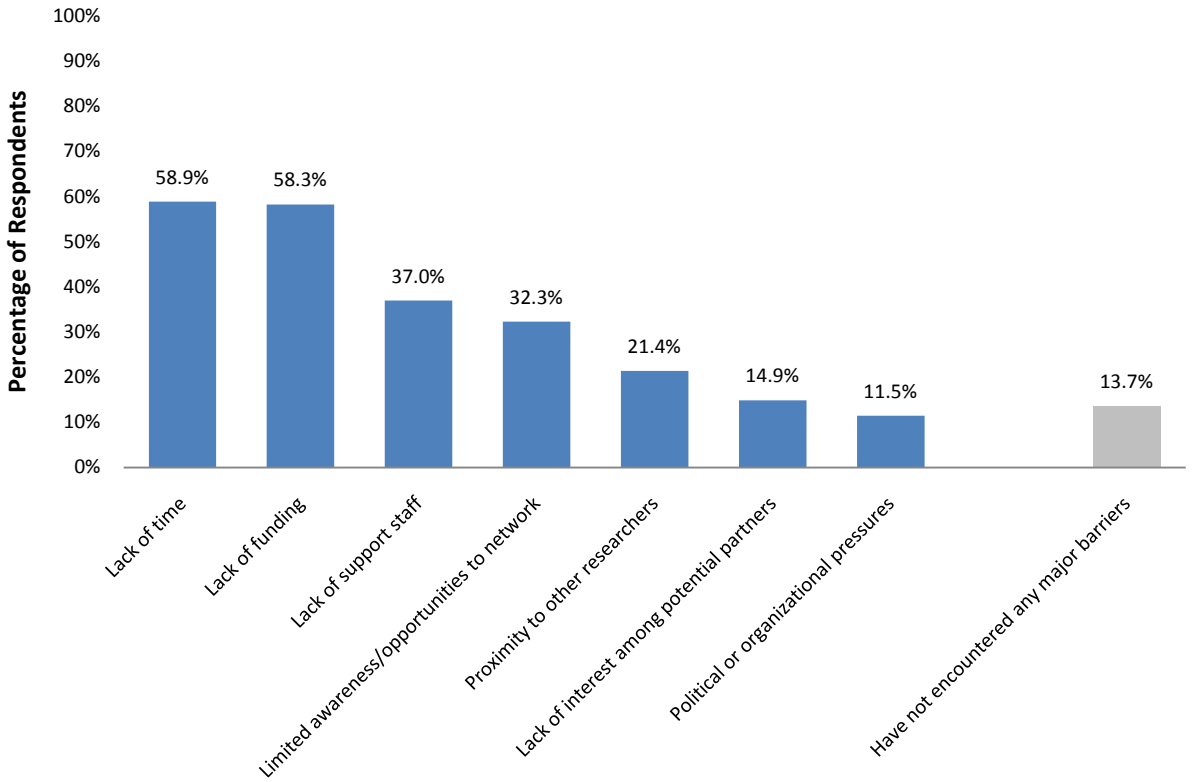
BARRIERS

The survey also asked respondents what barriers they have encountered when trying to establish research collaborations with investigators from other departments, institutions, and organizations. Lack of time and lack of funding were the most frequently cited barriers (58.9% and 58.3%, respectively). See Table 10 and Figure 11 below for all responses.

Table 10. Barriers Encountered When Trying to Establish Research Collaborations (n=737)

	Frequency	Percentage (%)
Lack of time	434	58.9
Lack of funding	430	58.3
Lack of support staff to assist with collaborative research efforts	273	37.0
Limited awareness or opportunities to network with people outside my discipline	238	32.3
Proximity to other researchers	158	21.4
Lack of interest among potential partners	110	14.9
Political or organizational pressures	85	11.5
Have not encountered any major barriers	101	13.7

Figure 11. Barriers encountered when trying to establish research collaborations with investigators from other departments, institutions, and organizations.



Lack of time and funding are barriers to establishing research collaborations with investigators from other departments, institutions, and organizations.

ADDITIONAL FEEDBACK

The final survey question asked respondents to provide any additional feedback about their collaborative research partnerships that would be helpful for ICTS leadership to consider in their program planning. Responses largely centered on praise for the information and resources provided by ICTS and the essential role that collaboration played in an individual's research. Many suggestions for future ICTS program planning were also provided. Increasing awareness of various forums (e.g., blogs, websites, and seminars) to identify potential collaborators was frequently mentioned.

SUMMARY

Overall, the ICTS survey provides valuable information about ICTS members' current research collaborations and their views regarding transdisciplinary research. Findings of particular interest include:

- Survey respondents reported high satisfaction with their current collaborative experiences. Across a scale of eight items, more than 80% of respondents viewed their experiences as Good to Excellent.

- Respondents reported that collaboration has improved both their research productivity and quality of work. Ninety-six percent agreed that collaboration has improved their productivity and 97.2% reported that collaboration has improved the quality of their research.

- Respondents strongly value transdisciplinary collaboration. 83.2% Strongly Agreed with the statement "I would describe myself as someone who strongly values transdisciplinary collaboration." An additional 14.4% Agreed with the statement.

- While respondents did recognize that it can take more time to produce a transdisciplinary research article, they also reported that collaboration has not posed a significant time burden in their research.

- Overall, the respondents feel that the benefits of transdisciplinary research outweigh the costs.

- Lack of time and lack of funding were identified as frequent barriers to establishing research collaborations with investigators from other departments, institutions, and organizations.

APPENDIX A: AFFILIATED SCHOOL, COLLEGE OR ENTITY

Primary School Affiliation (n=712)

	Frequency	Percent (%)
School of Medicine (WU)	615	86.4
School of Medicine (SLU)	28	3.9
George Warren Brown School of Social Work (WU)	19	2.7
College of Arts and Sciences (WU)	9	1.3
School of Engineering (WU)	9	1.3
College of Nursing (UMSL)	8	1.1
Albert Gnaegi Center for Health Care Ethics (SLU)	4	.6
Barnes Jewish Hospital (BJC)	4	.6
Doisy College of Health Care Ethics (SLU)	4	.6
Goldfarb School of Nursing (BJC)	3	.4
School of Nursing (SIUE)	3	.4
School of Public Health (SLU)	3	.4
St. Louis Children's Hospital (BJC)	2	.3
School of Law (WU)	1	.1

APPENDIX B: AFFILIATED DEPARTMENT, PROGRAM OR CENTER

Primary Affiliated Department, Program or Center (n=682)

Department	School	Frequency	Percent
Internal Medicine (John T. Milliken Department of Medicine)	WU School of Medicine	184	27.0%
Pediatrics	WU School of Medicine	54	7.9%
Neurology	WU School of Medicine	45	6.6%
Surgery	WU School of Medicine	35	5.1%
Psychiatry	WU School of Medicine	33	4.8%
Radiology	WU School of Medicine	33	4.8%
Anesthesiology	WU School of Medicine	26	3.8%
Pathology & Immunology	WU School of Medicine	26	3.8%
Obstetrics & Gynecology	WU School of Medicine	21	3.1%
Orthopaedic Surgery	WU School of Medicine	20	2.9%
Occupational Therapy	WU School of Medicine	17	2.5%
Physical Therapy	WU School of Medicine	17	2.5%
Otolaryngology	WU School of Medicine	13	1.9%
Biostatistics	WU School of Medicine	11	1.6%
Radiation Oncology	WU School of Medicine	10	1.5%
Neurology & Psychiatry	SLU School of Medicine	10	1.5%
Ophthalmology and Visual Sciences	WU School of Medicine	9	1.3%
Emergency Medicine	WU School of Medicine	8	1.2%
Psychology	WU College of Arts and Sciences	7	1.0%
Molecular Microbiology	WU School of Medicine	7	1.0%
Pediatrics	SLU School of Medicine	7	1.0%
Developmental Biology	WU School of Medicine	6	0.9%
Genetics	WU School of Medicine	6	0.9%
Other	WU School of Medicine	6	0.9%
Health Communication Research Laboratory	GWB School of Social Work	5	0.7%
Cell Biology & Physiology	WU School of Medicine	5	0.7%
Neurological Surgery	WU School of Medicine	5	0.7%
Mental Health Services Research, Center for	GWB School of Social Work	4	0.6%
Biomedical Engineering	WU School of Engineering	4	0.6%
Other	SLU School of Medicine	4	0.6%
Institute for Public Health	GWB School of Social Work	3	0.4%
Other	GWB School of Social Work	3	0.4%
Anatomy & Neurobiology	WU School of Medicine	3	0.4%
Audiology and Communication Sciences	WU School of Medicine	3	0.4%
Biochemistry & Molecular Biophysics	WU School of Medicine	3	0.4%
Physical Therapy and Athletic Training	SLU Doisy	3	0.4%
Violence and Injury Prevention, Center for	GWB School of Social Work	2	0.3%
Computer Science & Engineering	WU School of Engineering	2	0.3%
Population Health Sciences	WU School of Medicine	2	0.3%
Biochemistry & Molecular Biology	SLU School of Medicine	2	0.3%
Internal Medicine	SLU School of Medicine	2	0.3%
Community Health	SLU School of Public Health	2	0.3%

Biology	WU College of Arts and Sciences	1	0.1%
Chemistry	WU College of Arts and Sciences	1	0.1%
Obesity Prevention and Policy Research, Center for	GWB School of Social Work	1	0.1%
Prevention Research Center in St. Louis	GWB School of Social Work	1	0.1%
Electrical & Systems Engineering, Preston M. Green Department of	WU School of Engineering	1	0.1%
Energy, Environmental & Chemical Engineering	WU School of Engineering	1	0.1%
Mechanical Engineering & Materials Science	WU School of Engineering	1	0.1%
Biology & Biomedical Sciences	WU School of Medicine	1	0.1%
Clinical Investigation	WU School of Medicine	1	0.1%
Siteman Cancer Center	WU School of Medicine	1	0.1%
Clinical Laboratory Science	SLU Doisy	1	0.1%
Family and Community Medicine	SLU School of Medicine	1	0.1%
Center for Outcomes Research (SLUCOR)	SLU School of Medicine	1	0.1%
Health Management and Policy	SLU School of Public Health	1	0.1%

APPENDIX C: AFFILIATED DIVISION

Primary Affiliated Division (n=422)

Division	Department	Institution and School	Frequency	Percent
Adult Neurology	Neurology	WU SOM	40	9.5%
Cardiology/Cardiovascular Diseases	Internal Medicine	WU SOM	33	7.8%
Oncology	Internal Medicine	WU SOM	27	6.4%
Division of General Surgery	Surgery	WU SOM	22	5.2%
Infectious Diseases (Clinical)	Internal Medicine	WU SOM	19	4.5%
Division of Radiological Sciences	Radiology	WU SOM	18	4.3%
Gastroenterology	Internal Medicine	WU SOM	15	3.6%
Geriatrics and Nutritional Science	Internal Medicine	WU SOM	15	3.6%
Pulmonary and Critical Care Medicine	Internal Medicine	WU SOM	15	3.6%
Division of Diagnostic Radiology	Radiology	WU SOM	14	3.3%
Endocrinology/Metabolism/Lipid Research	Internal Medicine	WU SOM	11	2.6%
Laboratory and Genomic Medicine	Pathology & Immunology	WU SOM	11	2.6%
General Medical Sciences	Internal Medicine	WU SOM	9	2.1%
Renal Diseases	Internal Medicine	WU SOM	9	2.1%
Immunobiology	Pathology & Immunology	WU SOM	9	2.1%
Newborn Medicine	Pediatrics	WU SOM	9	2.1%
Clinical & Translational Research, Division of (DoCTR)	Anesthesiology	WU SOM	7	1.7%
Allergy, Immunology & Pulmonary Medicine	Pediatrics	WU SOM	7	1.7%
Maternal-Fetal Medicine and Ultrasound	Obstetrics and Gynecology	WU SOM	6	1.4%
Health Behavior Research	Internal Medicine	WU SOM	5	1.2%
Cardiology	Pediatrics	WU SOM	5	1.2%
Critical Care Medicine	Pediatrics	WU SOM	5	1.2%
Endocrinology and Diabetes	Pediatrics	WU SOM	5	1.2%
Clinical Radiation Oncology	Radiation Oncology	WU SOM	5	1.2%
Cardiothoracic Division	Anesthesiology	WU SOM	4	0.9%
Critical Care Division	Anesthesiology	WU SOM	4	0.9%
Infectious Diseases (Basic Science)	Internal Medicine	WU SOM	4	0.9%
Medical Education	Internal Medicine	WU SOM	4	0.9%
Rheumatology	Internal Medicine	WU SOM	4	0.9%
Pediatric and Developmental Neurology	Neurology	WU SOM	4	0.9%
General Obstetrics and Gynecology	Obstetrics and Gynecology	WU SOM	4	0.9%
Gynecologic Oncology	Obstetrics and Gynecology	WU SOM	4	0.9%
Anatomic and Molecular Pathology	Pathology & Immunology	WU SOM	4	0.9%
Emergency Medicine	Pediatrics	WU SOM	4	0.9%
Gastroenterology and Nutrition	Pediatrics	WU SOM	4	0.9%
Hematology and Oncology	Pediatrics	WU SOM	4	0.9%
Nephrology	Pediatrics	WU SOM	4	0.9%
Bone and Mineral Diseases	Internal Medicine	WU SOM	3	0.7%
Hematology	Internal Medicine	WU SOM	3	0.7%
Reproductive Endocrinology and Infertility	Obstetrics and Gynecology	WU SOM	3	0.7%
Infectious Diseases	Pediatrics	WU SOM	3	0.7%

Division of Urology	Surgery	WU SOM	3	0.7%
Basic Research, Division of (DBR)	Anesthesiology	WU SOM	2	0.5%
Obstetrics	Anesthesiology	WU SOM	2	0.5%
Pain Center, Washington University (WUPC)	Anesthesiology	WU SOM	2	0.5%
Dermatology	Internal Medicine	WU SOM	2	0.5%
Pediatric Neurosurgery	Neurological Surgery	WU SOM	2	0.5%
Neuropathology	Pathology & Immunology	WU SOM	2	0.5%
Cancer Biology	Radiation Oncology	WU SOM	2	0.5%
Medical Physics	Radiation Oncology	WU SOM	2	0.5%
Division of Plastic and Reconstructive Surgery	Surgery	WU SOM	2	0.5%
Pediatric Anesthesiology and Pain Medicine, Division of	Anesthesiology	WU SOM	1	0.2%
Bioorganic Chemistry and Molecular Pharmacology	Internal Medicine	WU SOM	1	0.2%
Adolescent and Pediatric Gynecology	Obstetrics and Gynecology	WU SOM	1	0.2%
Urogynecology	Obstetrics and Gynecology	WU SOM	1	0.2%
Genetics and Genomic Medicine	Pediatrics	WU SOM	1	0.2%
Hospitalist Medicine	Pediatrics	WU SOM	1	0.2%
Laboratory Medicine	Pediatrics	WU SOM	1	0.2%
Rheumatology	Pediatrics	WU SOM	1	0.2%
Bioinformatics and Outcomes	Radiation Oncology	WU SOM	1	0.2%
Division of Cardiothoracic Surgery	Surgery	WU SOM	1	0.2%
Division of Pediatric Surgery	Surgery	WU SOM	1	0.2%
Cardiology	Internal Medicine	SLU SOM	1	0.2%
Infectious Diseases	Internal Medicine	SLU SOM	1	0.2%
Health Policy	Health Management and Policy	SLU SPH	1	0.2%
Biostatistics	Community Health	SLU SPH	1	0.2%
Epidemiology	Community Health	SLU SPH	1	0.2%

APPENDIX D: DISCIPLINE

	Frequency	Percent
Medical Disciplines: Neurology	34	4.6
Medical Disciplines: Cardiovascular Diseases	32	4.3
Medical Disciplines: Oncology	32	4.3
Medical Disciplines: Orthopedics	18	2.4
Nursing	18	2.4
Public Health: Epidemiology	18	2.4
Medical Disciplines: General	17	2.3
Medical Disciplines: Infectious Diseases	17	2.3
Medical Disciplines: OB-GYN	17	2.3
Pediatric Disciplines: General	16	2.2
Medical Disciplines: Pulmonary Diseases	15	2
Medical Disciplines: Surgery	15	2
Cell and Developmental Biology: Cell Biology	14	1.9
Neuroscience: Systems/Integrative Neuroscience	12	1.6
Allied Health: Rehabilitation	11	1.5
Genetics: Genetic Epidemiology	11	1.5
Neuroscience: General	11	1.5
Allied Health: Physical Therapy	10	1.4
Medical Disciplines: Gastroenterology	10	1.4
Medical Disciplines: Nephrology	10	1.4
Genetics: Molecular Genetics	9	1.2
Medical Disciplines: Anesthesiology	9	1.2
Medical Disciplines: Radiology, Diagnostic	9	1.2
Genetics: Genomics	8	1.1
Molecular Biology	8	1.1
Neuroscience: Neurodegeneration	8	1.1
Bioengineering: Imaging	7	0.9
Immunology: General	7	0.9
Medical Disciplines: Otorhinolarynology	7	0.9
Medical Disciplines: Psychiatry	7	0.9
Microbiology and Infectious Diseases: Pathogenesis of Infectious Diseases	7	0.9
Neuroscience: Cognitive Neuroscience	7	0.9
Pediatric Disciplines: Pediatric, Prematurity and Newborn	7	0.9
Public Health: General	7	0.9
Public Health: Disease Prevention and Control	7	0.9
Public Health: Health Services Research	7	0.9
Statistics and/or Research Methods and/or Informatics: Biostatistics and/or Biometry	7	0.9
Allied Health: Audiology	6	0.8
Allied Health: Social Work	6	0.8
Cell and Developmental Biology: Developmental Biology	6	0.8
Genetics: Developmental Genetics	6	0.8
Immunology: Inflammation	6	0.8

Medical Disciplines: Clinical Psychology	6	0.8
Medical Disciplines: Diabetes	6	0.8
Pharmacology: General	6	0.8
Genetics: Human Genetics	5	0.7
Medical Disciplines: Endocrinology	5	0.7
Medical Disciplines: Geriatrics	5	0.7
Medical Disciplines: Hematology	5	0.7
Medical Disciplines: HIV/AIDS	5	0.7
Medical Disciplines: Ophthalmology	5	0.7
Microbiology and Infectious Diseases: Virology	5	0.7
Neuroscience: Behavioral Neuroscience	5	0.7
Nutritional Sciences	5	0.7
Social Sciences: Bioethics	5	0.7
Statistics and/or Research Methods and/or Informatics:	5	0.7
Allied Health: General	4	0.5
Biophysics: General	4	0.5
Medical Disciplines: Clinical Laboratory Medicine	4	0.5
Medical Disciplines: Liver Diseases	4	0.5
Neuroscience: Developmental Neuroscience	4	0.5
Neuroscience: Neuropharmacology	4	0.5
Physiology: Integrative Biology	4	0.5
Psychology, Non-Clinical: Behavioral Medicine (non-clinical)	4	0.5
Allied Health: Pharmacy	3	0.4
Biochemistry: Metabolism	3	0.4
Bioengineering: Biomechanical Engineering	3	0.4
Cell and Developmental Biology:	3	0.4
Genetics: General	3	0.4
Immunology: Immunopathology	3	0.4
Immunology: Transplantation Biology	3	0.4
Medical Disciplines: Behavioral Medicine (clinical)	3	0.4
Neuroscience: Cellular Neuroscience	3	0.4
Pediatric Disciplines: Pediatric Endocrinology	3	0.4
Pediatric Disciplines: Pediatric Oncology	3	0.4
Public Health: Health Economics	3	0.4
Allied Health: Exercise Physiology (clinical)	2	0.3
Allied Health: Speech-language Pathology	2	0.3
Biochemistry: General	2	0.3
Biochemistry: Biological Chemistry	2	0.3
Bioengineering: Biomaterials	2	0.3
Bioengineering: Nanotechnology	2	0.3
Bioengineering: Rehabilitation Engineering	2	0.3
Chemistry: Medicinal Chemistry	2	0.3
Immunology: Asthma and Allergic Mechanisms	2	0.3
Immunology: Vaccine Development	2	0.3
Medical Disciplines: Immunology	2	0.3
Medical Disciplines: Metabolic Diseases	2	0.3
Medical Disciplines: Nuclear Medicine	2	0.3

Medical Disciplines: Rehabilitation Medicine	2	0.3
Medical Disciplines: Trauma	2	0.3
Medical Disciplines: Urology	2	0.3
Microbiology and Infectious Diseases	2	0.3
Microbiology and Infectious Diseases: Bacteriology	2	0.3
Neuroscience: Molecular Neuroscience	2	0.3
Pediatric Disciplines: Pediatric Hematology	2	0.3
Pharmacology: Molecular Pharmacology	2	0.3
Pharmacology: Pharmacogenetics	2	0.3
Physiology: General	2	0.3
Physiology: Aging	2	0.3
Physiology: Endocrinology (basic science)	2	0.3
Physiology: Molecular Medicine	2	0.3
Psychology, Non-Clinical: Personality and Emotion	2	0.3
Psychology, Non-Clinical: Social Psychology	2	0.3
Public Health: Health Education	2	0.3
Public Health: Occupational and Environmental Health	2	0.3
Social Sciences: General	2	0.3
Social Sciences: Education	2	0.3
Statistics and/or Research Methods and/or Informatics: Bioinformatics	2	0.3
Allied Health: Medical Genetics	1	0.1
Allied Health: Occupational Health	1	0.1
Bioengineering: Bioelectric/Biomagnetic	1	0.1
Bioengineering: Mathematical Modeling	1	0.1
Biophysics: Spectroscopy	1	0.1
Chemistry: Analytical Chemistry	1	0.1
Chemistry: Bioorganic Chemistry	1	0.1
Chemistry: Physical Chemistry	1	0.1
Genetics: Behavioral Genetics	1	0.1
Immunology: Autoimmunity	1	0.1
Immunology: Immunogenetics	1	0.1
Immunology: Immunoregulation	1	0.1
Medical Disciplines: Allergy	1	0.1
Medical Disciplines: Clinical Nutrition	1	0.1
Medical Disciplines: Connective Tissue Diseases	1	0.1
Medical Disciplines: Preventive Medicine	1	0.1
Medical Disciplines: Radiation, Interventional	1	0.1
Microbiology and Infectious Diseases: Mycology	1	0.1
Microbiology and Infectious Diseases: Parasitology	1	0.1
Neuroscience: Communication Neuroscience	1	0.1
Pharmacology: Pharmacodynamics	1	0.1
Psychology, Non-Clinical: Behavioral Communication Sciences	1	0.1
Psychology, Non-Clinical: Cognitive Psychology	1	0.1
Psychology, Non-Clinical: Neuropsychology	1	0.1
Psychology, Non-Clinical: Psychology of Aging	1	0.1
Radiation, Non-Clinical	1	0.1
Radiation, Non-Clinical: Nuclear Chemistry	1	0.1

Radiation, Non-Clinical: Radiation Physics	1	0.1
Radiation, Non-Clinical: Radiobiology	1	0.1
Social Sciences: Economics	1	0.1
Statistics and/or Research Methods and/or Informatics: Clinical Trials Methodology	1	0.1
Statistics and/or Research Methods and/or Informatics: Computational Science	1	0.1
Statistics and/or Research Methods and/or Informatics: Information Science	1	0.1
Trauma, Non-Clinical	1	0.1