Faculty Involvement in Translational Research and Interdisciplinary Collaboration at a US Academic Medical Center

Christine M. Weston, PhD,* Eric B. Bass, MD, MPH,**† Daniel E. Ford, MD, MPH,**† and Jodi B. Segal, MD, MPH*†

In 2006, the National Institutes of Health (NIH) launched the Clinical and Translational Science Awards (CTSAs) to spearhead the transformation of clinical and translational research in medical institutions across the country. Since that time, 46 academic medical centers have been awarded a CTSA grant and have begun to address the myriad of challenges that accompany the mission of moving science from the basic stages of discovery to improved patient care. The primary goals of every CTSA-funded institution are to identify and remove barriers to conducting clinical and translational research, to develop methods to improve the training and career development of clinical and translational scientists, to find more meaningful ways for engaging the community in research, and to foster interdisciplinary collaborations.1-5

The Johns Hopkins University was awarded a CTSA in the fall of 2007, at which time it created the Institute for Clinical and Translation Research (ICTR). In planning for the use of our award, we realized that little is known about the investigators who identify themselves as translational researchers within academic medical centers. Additionally, while there are presumed barriers to translational research,6-10 there is scant published information about barriers from the perspective of investigators themselves. Some anecdotal accounts have been published,11-14 but little systematic study of attitudes about translational research and its perceived costs and benefits. Furthermore, despite the importance of interdisciplinary collaboration to clinical and translational research,15-20 little has been done to quantify interdisciplinary collaborations.

In response to this fundamental knowledge gap, we surveyed our faculty to determine (1) the prevalence of clinical and translational research, (2) barriers to conducting translational research, (3) attitudes about translational research, (4) involvement in interdisciplinary collaboration; and (5) barriers to collaboration.

Survey Design

We designed an Internet-based survey to examine factors related to translational research and interdisciplinary collaboration at our institution. The survey asked questions about demographic and professional characteristics, type of research conducted, involvement in translational research, barriers to and attitudes about translational research, number and types of collaborators, and barriers to collaboration. At our institution, individuals with less than 30% of their time committed to research are likely to be clinician-educators rather than clinician-researchers.

MATERIALS AND METHODS

Survey Design

From the *Department of Health Policy and Management, Johns Hopkins University Bloomberg School of Public Health; and †Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, MD.

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Reprints: Christine M. Weston, PhD, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, 624 N Broadway, Room 631, Baltimore, MD 21205.

E-mail: cweston@jhbsph.edu.

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Drs. Weston and Segal had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Background: Forty-six academic health centers have been awarded Clinical and Translational Science Awards by the National Institutes of Health to enhance health by advancing translational research.

Objective: As a recipient of a Clinical and Translational Science Award, we aimed to determine the prevalence of translational and interdisciplinary collaboration at our institution.

Design, Setting, and Participants: We surveyed all full-time faculty and postdoctoral fellows (n = 3870) in the Johns Hopkins Schools of Medicine, Public Health, Nursing and Engineering, in late 2008.

Main Outcome Measures: Outcomes included (1) the proportion of investigators involved in early (T1), late (T2), and reverse translational (RT) research; (2) barriers to translational research; (3) attitudes about translational research; (4) involvement in interdisciplinary collaboration; and (5) barriers to collaboration.

Results: With 1800 respondents, the response rate was 55% for faculty and 40% for postdoctoral fellows. Of the 1314 investigators with more than 30% of their time committed to research, 69% reported conducting 1 or more types of translational research (T1 = 79%, T2 = 36%, RT = 36%). Attitudes about translational research revealed both concern and uncertainty. Fifty-four percent of respondents described translational research as having complex regulatory requirements; 42% felt that an individual’s contributions suffer from underrecognition, 39% described it as high risk, and 35% consider funding less secure for translational researchers. Collaboration across school and types of research was common. Forty-seven percent of basic scientists collaborated with a clinical investigator in the last year, and 56% of clinical investigators collaborated with a basic scientist.

Conclusions: Overall, investigators who did translational research reported a greater number of collaborators than those who did not.

Key Words: clinical and translational research, interdisciplinary research, barriers, attitudes, collaboration

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For the purposes of this survey, we wanted to avoid burdening faculty whose primary commitment is not research with a research-focused survey. Therefore, respondents who reported spending 30% or less of their time were only required to complete an abbreviated form of the survey. By doing so, we also hoped to avoid nonresponse bias, by sending the survey to faculty who would not find the topic relevant.

We provided survey respondents with the definition of translational research as described by the NIH: T1—the process of applying discoveries generated during research in the laboratory and in preclinical studies, to the development of trials and studies in humans (as well as the process of applying bedside observations to inform laboratory discoveries); and T2—research aimed at enhancing the adoption of best practices in the community.21

Furthermore, we provided a list of T1, T2, and reverse translational activities and asked respondents to indicate their involvement in each. The T1 activities included (1) the translation of basic discovery into mechanistic studies in cell lines or animals, (2) the translation of mechanistic studies into initial human testing, and (3) the translation of initial human testing into proof of efficacy. The T2 activities included (1) the translation of proof of efficacy into proof of effectiveness in a usual care setting and (2) research aimed at enhancing the adoption of best practices in the community. Examples of these included improving access to care, reorganizing and coordinating systems of care, helping physicians and patients to change behavior and make more informed choices, providing reminders and point-of-care decision support tools, and strengthening the patient-clinician relationship (as recently described by Woolf22). Reverse translation activities were defined as the translation of clinical observations to basic research. Multiple responses were permitted, and investigators were invited to supply their own descriptions of translational research, as well.

If respondents reported no involvement in translational research, they were asked to choose from a list of possible barriers to translational research. Again, multiple responses were permitted and write-in answers were allowed.

We also asked respondents to indicate their agreement, disagreement, or uncertainty with 10 statements associated with involvement in translational research. These statements were based on items we identified in the literature and others that were suggested by local leadership.

Finally, respondents were asked to identify, by school and department, with whom they collaborated on grants or manuscripts in the last year. We used this information to assess collaboration in 3 different ways: (1) the prevalence of cross-school collaborations (the extent to which investigators from one school (ie, the School of Medicine, Public Health, Nursing, or Engineering) reported collaborating with investigators from another), (2) the prevalence of collaborations by research type (the extent to which investigators conducting one type of research (ie, basic research) collaborated with investigators conducting a different type of research (ie, clinical research), and (3) the total number of collaborators.

Sampling Frame
As the ICTR is designed to serve faculty within our Schools of Medicine, Public Health, Nursing and Engineering, we targeted all full-time faculty and fellows within each of these 4 schools. Part-time, adjunct, and nontenure track faculty were not included.

Survey Administration
We obtained institutional board review approval for this survey. Responses were deidentified at the time of data analysis but remained linkable. The survey was pilot tested for clarity and ease of use by investigators from different schools and ranks and was reviewed by the director of the ICTR as well as the directors of key programs within the ICTR. We administered this as a Web-based survey using SurveyMonkey (SurveyMonkey, Portland, OR) and distributed the link to this survey by e-mail. The survey was sent from the office of the vice dean for research. Data collection ran from mid-November 2008 to mid-January 2009. Respondents were sent 2 reminders at regularly spaced intervals during the data collection period.

### Statistical Methods
We used descriptive statistics to report results and tested for differences between groups with χ² tests. We used multivariable logistic regression to explore associations between engagement...
in translational research and investigators’ sex, academic ranks, and highest degrees.

RESULTS

Response Rate

The survey was sent to 3870 individuals (2270 faculty members and 1600 postdoctoral fellows). Of these, 136 (5%) were ineligible for having left the institution or having undeliverable e-mail addresses. Of the remaining 3684 eligible participants, we received responses from 1800, a 55% response rate for faculty and a 40% response rate for fellows. It was later determined that 28 respondents (1.5%) were not full-time faculty members or fellows, and their data were excluded. To rule out potential systematic differences between faculty respondents and nonrespondents, we compared respondents with nonrespondents by their sex, rank, and department within each of the 4 schools and found no significant differences. Of the 1772 respondents, 1314 reported spending more than 30% of their time in research, and only this subset was included in the analysis.

Respondent Characteristics

The majority of the 1772 respondents were from the School of Medicine, followed by the Schools of Public Health, Engineering, and Nursing. Fifty-nine percent of respondents were male. There was identical representation of researchers with MD degrees (n = 727) and with PhD degrees (n = 727), with an additional 208 individuals having MD/PhD degrees. Many of the respondents had additional degrees, including 349 with master’s degrees in public health, science, or health sciences (Table 1).

Involvement in Translational Research

Among the 1314 individuals devoting 31% or more of their time to research, 905 (69%) indicated involvement in some type of translational research. Multiple responses were permitted, and many investigators declared participation in more than 1 type of translational research (T1, T2, or reverse translation). A majority doing translational work reported doing early translation or translation of mechanistic information into early human trials (714/905, 79%). These researchers were often also engaged in reverse translational activities. Thirty-six percent of respondents (324/905) described themselves as translating the proof of efficacy into effectiveness information in a usual care setting, or doing research aimed at enhancing the adoption of best practices in the community. Another 36% reported taking human observations back to the laboratory for investigation (311/905).

As shown in Table 2, sex had no bearing on overall participation in translational research, although men were more likely to be involved in T1 research, and women in T2. Fellows were significantly less involved in all types of translational research than faculty. Respondents from the School of Medicine reported the most involvement in T1 research and reverse translation when compared with the faculty of other schools, and the respondents from the School of Nursing and School of Public Health were more involved in T2 research than those in the School of Medicine. Basic scientists and clinical investigators were almost equally involved in T1 research, but clinical investigators were more involved in T2 and reverse translation than basic scientists. Furthermore, public health researchers were more involved in T2 research than any of the other types of researchers.

In the multivariate analysis, sex was not an independent predictor of participation in any translational research. Faculty with PhDs were significantly less likely than MDs to participate in translational research (odds ratio [OR] = 0.53, P < 0.0001), but there was no significant difference between MDs and MD/PhDs. Instructors and assistant professors were almost 5 times more likely to engage in translational research than fellows (OR, 4.8; P < 0.0001), whereas associate and full professors were almost 8 times as likely (OR, 7.8; P < 0.0001). Similarly, faculty in the School of Medicine were more likely than those in the

<table>
<thead>
<tr>
<th>Category of Respondent</th>
<th>n (%) In Category</th>
<th>T1 (n = 714)</th>
<th>T2 (n = 324)</th>
<th>RT (n = 311)</th>
<th>Any Translation (n = 905)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>781 (60)</td>
<td>465 (60)</td>
<td>174 (22)</td>
<td>195 (25)*</td>
<td>544 (70)*</td>
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<td>Female</td>
<td>515 (40)</td>
<td>241 (47)</td>
<td>147 (29)</td>
<td>114 (22)</td>
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<tr>
<td>MD</td>
<td>402 (32)</td>
<td>246 (61)</td>
<td>144 (36)</td>
<td>132 (33)</td>
<td>315 (78)</td>
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<td>PhD</td>
<td>677 (54)</td>
<td>318 (47)</td>
<td>119 (18)</td>
<td>106 (16)</td>
<td>400 (59)</td>
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<tr>
<td>MD/PhD</td>
<td>179 (14)</td>
<td>131 (73)</td>
<td>30 (17)</td>
<td>64 (36)</td>
<td>148 (83)</td>
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<tr>
<td>Fellow</td>
<td>501 (38)</td>
<td>193 (39)</td>
<td>43 (9)</td>
<td>68 (14)</td>
<td>235 (47)</td>
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<tr>
<td>Instructor/assistant professor</td>
<td>350 (27)</td>
<td>205 (59)</td>
<td>112 (32)</td>
<td>90 (26)</td>
<td>280 (80)</td>
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<tr>
<td>Associate/full professor</td>
<td>463 (35)</td>
<td>316 (68)</td>
<td>169 (37)</td>
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<td>221 (22)</td>
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<td>9 (60)</td>
<td>1 (7)</td>
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<td>8 (9)</td>
<td>8 (9)</td>
<td>31 (33)</td>
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</table>

The χ² test was performed to test for differences between respondent categories within translation type. All P < 0.01 or greater, unless otherwise noted.

*No significant difference.

T1 indicates early translation; T2, later translation; RT, reverse translation research.
School of Engineering (OR, 0.19; P < 0.0001) and Public Health (OR, 0.6; P < 0.0001) to be involved in translation. Although it may seem that the engineers are less involved in translation than other types of researchers, this may be due to the fact that faculty from all departments in the School of Engineering were included in the survey, including departments that may have little or no connection to medicine and public health. Future studies might consider restricting analyses to the divisions of engineering that are most relevant.

Barriers to Conducting Translational Research

Among the 409 investigators who did not report involvement in any type of translational research, 205 (50%) answered questions about the barriers to translational research (Fig. 1). The most common reason provided for not pursuing translational research was because it is not central to the researchers’ goals. Other reasons included a lack of resources, collaborators, or mentors or a lack of direction about how to proceed.

Attitudes About Translational Research

Most respondents agreed that translational research is necessary for improving health outcomes and is professionally fulfilling. More than two thirds also believed that scientists who can cross the laboratory/clinic divide are in demand. On the other hand, many of the respondents expressed concerns about the regulatory complexity of translational research and the perceived high-risk nature of these projects. Most notably, many respondents were uncertain about the security of funding for translational research.

FIGURE 1. Barriers to translational research (n = 205).

FIGURE 2. Investigators’ attitudes about translational research (n = 1039).
research projects and how translational research is viewed by study sections and promotion committees (Fig. 2).

Interdisciplinary Collaboration

Cross-School Collaboration

Among respondents who reported submitting a grant or publishing a manuscript in the last year (n = 1124), nearly all (96%) reported having collaborators. Most collaborated with investigators from their own schools; however, there was also extensive cross-school collaboration. Whereas more than 40% of the investigators from the School of Medicine were collaborating with investigators from the School of Public Health, 63% of investigators from the School of Public Health were collaborating with those in Medicine. Most researchers in the School of Nursing were collaborating with investigators from the School of Medicine (69%) and the School of Public Health (61%), and investigators from the School of Engineering also reported having collaborators in the School of Medicine (38%) and in the School of Public Health (27%).

Collaboration by Research Type

Whereas most basic scientists partnered with other basic scientists (93%), 47% said they collaborated with a clinical investigator in the last year. Similarly, whereas 91% of clinical researchers partnered with other clinical researchers, 56% said they collaborated with a basic scientist in the last year (Fig. 3).

Total Number of Collaborators

The number of active collaborators reported by investigators ranged from 0 to 15. After stratifying investigators by involvement in translational research, we saw that translational researchers (n = 905) had consistently more collaborators than those not involved in translational research (n = 409). For example, 22% of translational researchers had 5 or more collaborators compared with only 1% of nontranslational researchers; 29% of translational researchers had 3 or 4 collaborators compared with 10% of nontranslational researchers; and 45% of translational researchers had 1 or 2 collaborators compared with 34% of nontranslational researchers. Most remarkable is the fact that only 2% of translational researchers reported having no collaborators, whereas 53% of nontranslational researchers reported having no collaborators.

Barriers to Collaboration

With respect to barriers to collaborating, more than half of the respondents (58%, 53%, and 54%, respectively) reported having had no problems with (1) identifying experts with whom to collaborate, (2) finding collaborators with the necessary skills, or (3) initiating collaborations with other investigators. However, an additional 20% reported slight problems with collaboration (21%, 21%, and 19%, respectively); roughly a quarter of the respondents (22%–27%) described these issues as moderate to significant. Additional barriers described in free text included a lack of time for developing collaborations, the lack of funding or salary support for collaborators, and an individualistic environment that does not foster collaboration.

DISCUSSION

We assessed the prevalence of translational research and collaboration at our institution so that we can document change over time that may be attributable to the CTSA funding and provide insight into the barriers and attitudes surrounding translational research. We found that a significant proportion of investigators at this institution consider their work to be translational. Sixty-nine percent of researchers identified some aspect of their research as T1, T2, or reverse translational research—with the preponderance of these researchers involved in some aspect of T1 research (79%). Because early definitions of translational research focused on the translation of basic discovery
into human testing, we suspect that many investigators doing T2 research may not yet define their research as being translational. Given the current increased emphasis on the importance of T2 research,22 including comparative effectiveness research, we anticipate we will see an increase in investigators describing T2 research activities as translational at the time of our follow-up survey.

The response rate for our faculty was 55%, which is about average for studies of physicians.23,24 As with any survey, there is always the possibility of response bias; however, having access to the demographics of our nonrespondents allowed us to rule out any systematic difference between our respondents and nonrespondents on the basis of sex, rank, or department. To encourage candidness, survey respondents were not asked to provide their name or any other personal identification anywhere on the survey. Although surveys were linked to e-mail addresses for the purpose of tracking respondents and nonrespondents, all data were deidentified at the level of data analysis. Although it is possible that respondents may have felt constrained by the choices of responses that were offered, we provided the opportunity for free-text comments.

Zinner and Campbell25 recently published the results of a survey of 50 US academic medical centers to document the state of academic research. They, too, were interested in identifying the proportion of researchers engaged in translational research. They defined “translational researchers” as researchers who reported involvement in exclusively phase 1 research, Phase 1/phase 2, basic/phase 1, or basic/phase 1/phase 2. We defined translational research much more broadly, as does the NIH. Because of these differences in definition, our faculty reported far more engagement in translational research (69%) than did those in the sample of Zinner and Campbell (9.1%). This example demonstrates that standard definitions of translational research would facilitate comparisons across academic medical centers.

Despite the importance of translational research, we do not expect all investigators to be engaged in translational research. No formula exists for determining whether an institution has enough translational research, and the amount of translational research at different institutions is likely to vary. In some institutions, it may be important to increase the amount of translational research, whereas in others it may be more important to focus on the effectiveness of existing translational research. Ultimately, the success of an institution’s commitment to translational research will depend on demonstration of the effects of translational research on health outcomes.

Our multivariate analysis demonstrated that faculty with PhD degrees are significantly less likely to be conducting translational research than those with MD or MD/PhD degrees. This raises questions about the preparation of basic scientists to do translational research as well as the availability of resources to facilitate this. We also found that both junior and senior faculty were far more likely to be engaged in translational research than were fellows. This suggests that the training of fellows is still focused primarily on nontranslational projects. It may be that fellows are directed to master a narrowly focused area of investigation during their training, or there may be lack of appropriate mentors to expose fellows to translational projects.

We aimed to learn why investigators may not be doing translational research. Among investigators who said they were not doing translational research, the most frequently stated reason was because it is not central to their research agenda. This is not surprising, given the broad variety of researchers at our institution for whom translation research may not be a primary aim. After that, respondents mentioned a variety of obstacles to conducting translational research, which included not knowing what the next step would be or what the appropriate translational question is, a lack of training or expertise, an inability to find the right collaborators, a lack of resources and mentorship, or methodological obstacles. However, the number of investigators reporting these barriers was relatively small compared with those who reported active engagement in translational research. One the easiest ways to promote translational research institutionally may be to pair researchers with limited translational experience with those who are more active.

Most of our respondents agreed that, in the abstract, translational research is attractive in certain ways. However, when it comes to evaluating the professional impact of conducting translational research on one’s own career, there is significant concern and uncertainty. Through this lens, it would appear that the costs of conducting translational research may outweigh the benefits. These types of concerns have been voiced elsewhere in the scientific community. Are these concerns valid? Is funding less secure for translational research than for more traditional research? If not, misperceptions need to be corrected. Clarifying whether these beliefs are misperceptions or truth is an appropriate next step.

One of the major goals of the CTSA is to bridge the chasm between basic and clinical research by improving communication and increasing collaboration between scientists and clinicians. According to Heller and de Melo-Martin,26 well-formulated plans for fostering dialogue and collaboration between basic scientists and clinicians have fallen short, yet adequate attention to this barrier is critical for accelerating the speed of clinical and translational research. We found substantial cross-school collaboration at our institution, as well as basic and clinical scientist interaction, but the need to continue to monitor the growth of interdisciplinary collaborations at CTSA sites cannot be overemphasized.

This survey provides an important first step in assessing the culture surrounding translational research from the perspective of investigators. The observations from this research may allow institutional leaders to focus efforts that may include correcting misconceptions, reducing barriers to translational research, or altering the system that provides rewards for involvement in translational science. We think that many of these results should be generalizable to other major research institutions and suspect that the attitudes toward translational research are broadly held.

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