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Assessing Participant Group Affiliation and Attitudes Towards CTSI Services

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Abstract

Analyzing open-ended survey text responses holds the capacity to yield greater insight about participants' perceptions of clinical translational science institute (CTSI) initiatives. Few translational research studies have explored their effectiveness. The aim of this mixed methods analysis was to assess participant perspectives of the impact and effectiveness of our CTSI program and services. We selected two open-ended survey question items (how CTSI benefitted research, and the most important impact of the research facilitated by the CTSI) from a larger set and compared responses by participant affiliations (clinical/non-clinical; lab/non-lab). We used a three-step analysis. First, nodes were generated using NVivo word frequency function. Next, with the aid of Python, we used sentiment analysis to classify each node (as positive, negative, or neutral) to indicate participant ratings toward their experiences with the CTSI and computed the average differences between groups. Third, we selected nodes that met pre-established criteria and report the qualitative distinctions. We recommend using precisely worded open-ended questions in future annual surveys or administering a survey using only open-ended questions every six months.

Keywords

Open-ended Responses, CTSI, Participant Attitudes, Evaluation

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Assessing Participant Group Affiliation and Attitudes Towards CTSI Services

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Analyzing open-ended survey text responses holds the capacity to yield greater insight about participants' perceptions of clinical translational science institute (CTSI) initiatives. Few translational research studies have explored their effectiveness. The aim of this mixed methods analysis was to assess participant perspectives of the impact and effectiveness of our CTSI program and services. We selected two open-ended survey question items (how CTSI benefitted research, and the most important impact of the research facilitated by the CTSI) from a larger set and compared responses by participant affiliations (clinical/non-clinical; lab/non-lab). We used a three-step analysis. First, nodes were generated using NVivo word frequency function. Next, with the aid of Python, we used sentiment analysis to classify each node (as positive, negative, or neutral) to indicate participant ratings toward their experiences with the CTSI and computed the average differences between groups. Third, we selected nodes that met pre-established criteria and report the qualitative distinctions. We recommend using precisely worded open-ended questions in future annual surveys or administering a survey using only open-ended questions every six months. Keywords: Open-ended Responses, CTSI, Participant Attitudes, Evaluation

Introduction

Translational science aims to identify methods that promote the transfer of fundamental research discoveries from laboratory into clinical practice. Decades ago, the National Institute of Health issued funding mechanisms, referred to as Clinical and Translational Science Awards (CTSAs) to support university development of a clinical translational science institute (CTSI). The primary purpose of these programs is to cultivate a cadre of physician-scientists whose research aims are directed at achieving translational science goals. Translational science institutes or CTSIs support faculty, researchers, and students through varied activities such as: research, developing and deploying new resources to support clinical trials, fostering stakeholder-engaged partnerships, and providing coursework in team science, responsible conduct of research, translational science models, and ethics (Allen, Ripley, Coe, & Clore, 2013; Institute of Medicine, 2013; Pincus, Abedin, Blank, & Mazmanian, 2013). The aim of our institutional CTSI is to develop novel venues in conducting research in real-world settings, community engagement, and informatics, and to support research collaborators in the discovery and implementation of new technologies and approaches aimed at improving health across the lifespan. Little is known about the effectiveness of CTSIs as it relates to its impact on institutional clinical researchers and basic scientists.

Assessing the impact of processes, procedures, resources, and outcomes is critical to the operation of any educational enterprise. Evaluation studies offer insight into the effectiveness of CTSI operations and progress towards intended outcomes (Dembe, Lynch, Gugiu, & Jackson, 2013; Feeney, Johnson, & Welch, 2013; Hogle & Moberg, 2013; Wooten, Rose, Ostir, Calhoun, Ameredes, & Brasier, 2013). Evaluation provides information to

stakeholders regarding whether programmatic activities should be maintained, modified, or discarded (Pincus, Abedin, Blank, & Mazmanian, 2013) and informs the CTSI leadership regarding how well they are meeting their intended goals. The strategic goals for our CTSI were:

1. Chart new pathways for developing the translational workforce and support mechanisms for translational research careers through novel competency-based training and professional development programs.
2. Embed translational science throughout the local CTSIs learning health system to support a continuous cycle of inquiry, innovation, and implementation.
3. Expand statewide collaborations and opportunities to advance a participant-centered research agenda that reflects the health priorities and diversity of the state.
4. Accelerate the collective impact of the CTSA network by collaborating with other hubs in multi-directional development, evaluation, dissemination, and implementation of new methods and processes for improving the quality and efficiency of translational research.

Our CTSI Evaluation and Tracking Committee has invited faculty to take an Annual Survey since 2011. The aim of the survey is to assess the use of and impact of the university's CTSI services and programs on the research environment. Item content in the annual survey focuses on acquiring participants' feedback related to (a) familiarity with the CTSI, (b) types of faculty activity (e.g., type of research, clinical care, teaching), (c) barriers to conducting research, (d) barriers to collaboration (e.g., the tenure and promotion system), (e) barriers to recruiting participants for clinical trials, (f) ease of use and benefits of CTSI services, (g) CTSI involvement with grants, publications and research activities, and (h) any comments or suggestions. However, the systematic analysis of responses to open-ended survey items has not been routinely undertaken. Analyzing open-ended survey responses can generate insights regarding participants' experiences or beliefs regarding organizational programs and activities (Jackson & Trochim, 2002; Leech & Onwuegbuzie, 2007; Popping, 2015).

The qualitative analysis of open-ended responses can present a level of understanding about context and yield complexities otherwise not discernable with close-ended survey items (Miles & Huberman, 1994). Varied approaches to analyzing open-ended comments include constant-comparison, content analysis, keywords in context (KIWC), word count, domain, taxonomic and componential analyses, and concept mapping; they have all been described in the literature (Hickey & Kipping, 1996; Hsieh & Shannon, 2005; Jackson & Trochim, 2002; Leech & Onwuegbuzie, 2007; Popping, 2015). New approaches to coding open text such as sentiment analysis have emerged. Sentiment analysis is used to categorize data as positive, negative, or neutral (Liu, 2012; Pang & Lee, 2008) by using pre-established dictionary word lists. Also, it has been used to classify people's attitudes, opinions, and emotions towards particular topics, such as customers' evaluations (Liu, 2012; Pang & Lee, 2008).

In this paper, we describe how qualitative and quantitative methods were used to evaluate CTSI services. The dataset comprised participant text responses to two open-ended questions from the annual CTSI faculty survey:

1. How has the CTSI benefitted your research, taken from the 2014-2015 survey?
2. What was the most important impact of the research facilitated by the CTSI, taken from the 2012-2013 survey?

We explored potential differences in the responses by (a) identifying the most frequent words, (b) conducting sentiment analysis to categorize each node and determine quantitative differences by group affiliations, and (c) explaining those differences qualitatively.

Evaluation Studies of CTSA Institutions

Previous researchers have evaluated CTSA services using surveys and interviews. Fagnan, Davis, Deyo, Werner, and Stange (2010) reported CTSA Community Engagement and Patient Based Research Network (PBRN) Directors' perceptions about existing relationships and their configurations. PBRN Directors emphasized the need for a stable infrastructure support to (a) assist with study proposals, (b) facilitate communication with clinicians and practice staff and, (c) support research initiated with and by community clinicians that was responsive to community-based patient health issues. Nagarajan, Peterson, Lowe, Wyatt, Tracy, and Kern (2015) reported how network analysis provided evidence of change in research collaborations.

Scott et al. (2014) reviewed results of the University of Washington's Institute for Translational Health Sciences (ITHS) new evaluation model that combined the Kellogg Logic Model (KLM) and World Health Organization's (WHO) Health Services Assessment Model (Kellogg Foundation, 2004; World Health Organization, 1981). Findings showed the new model overcame previous challenges and provided more details about the quality of their clinical translational science services. Following a review of their survey questions, the ITHS decided to include additional questions to assess the relevance of their services such as, "How directly are current CTSA resources and services focused on the translational needs of researchers? What modifications and/or actions would make CTSA resources and services more relevant?" (Scott et al., 2014, p. 93). Notably, other than Scott et al. (2014) few studies have focused directly on the processes and effectiveness of a local CTSI (Dilts, 2013).

Working with local CTSA evaluators, Kane, Alexander, Hogle, Parsons, and Phelps (2013) developed the National Evaluators Survey. Based on survey findings, they reported significant heterogeneity in staffing, organization, and methods across the CTSAs. Although these findings were characterized as both liabilities and strengths, the authors pointed out that a lack of standardization across CTSAs was an impediment to the meaningful use of common metrics. Using key informant interviews with 18 CTSA grantees, Morrato, Concannon, Meissner, Shah, and Turner (2013) identified five crucial barriers (a) lack of institutional awareness, (b) insufficient capacity, (c) lack of established dissemination and implementation methods, (d) confusion among stakeholders about what comparative effectiveness research actually is, and (e) limited funding opportunities.

Methods

Researchers' Perspectives

The research team included one faculty member and one doctoral student in school psychology. The first author is an experienced qualitative and educational researcher from the College of Education who studies outcomes that accrue from pedagogical interventions, and explores changes in faculty beliefs related to teaching, educational research, and assessment practices. Her research initiatives encompass faculty development, cultural competency, and the assessment of behavioral, cognitive, and attitudinal change. At the time of this study, she was the Director of the Office of Educational Development and Evaluation for the institution's CTSI and thus, responsible for evaluating this program and other grant supported educational initiatives. The second author was a research assistant for the first author. He has training and

expertise in school psychology. His experiences with qualitative research as an undergraduate, included studying how intimate partner violence influences children's values of marriage with grounded theory. From his studies in a master's degree program in counselor education, he became familiar with stages of change theory as it applies to substance abuse intervention. Our interest in this study emanated from a belief that an analysis of open-ended text responses potentially contained rich information.

This study, approved by the Institutional Review Board (#2014-U-0545), was conducted at a southeastern research-intensive university and its large satellite urban medical campus located more than 70 miles away.

Three-Step Analytical Process

First, we used NVivo Pro 11.4 to conduct the qualitative analyses. This software is helpful in logically organizing and exploring the insights and rules of the data (Fielding, Fielding, & Hughes, 2013; QSR International Pty Ltd, 2017). We imported the Excel files for each question into NVivo separately to enable organization and exploration. The most frequent word or node shared by each question, was identified and included in subsequent analyses as shown in Appendices 1 and 2 (Behar-Horenstein & Feng, 2018).

Second, using Python 3.5, we conducted sentiment analysis (Welcome to Python.org, 2018) to the classify the open-ended survey responses as positive, negative, and neutral. We calculated the average difference of the sentiment scores to show the distribution of participants' attitudes within each node by group affiliation. The average difference was 0.20. Thus, we set this as the criterion for the third step, qualitatively assessing quantitative differences by group affiliation. Group affiliation was designated by participant's primary research role as clinical/non-clinical or lab/non-lab. *Clinical research* refers to patient-oriented research. *Non-clinical research* refers to basic research, public or population health research, implementation research, health services research, policy research, community-based research or other. *Lab* refers to primary research with molecules, cells or tissues, devices or instruments, or animals. *Non-lab* refers to primary research with adult humans or children.

Results

How CTSI Benefitted Research

In this section, we report the qualitative findings for the following nodes, *clinical, funding, grant, program, project, research* and *service*. Regarding benefits of the CTSI, participants reported they received financial support, opportunities to network with others, biostatistics support, and access to personnel funding to employ a clinical research coordinator (CRC) who helped ensure adherence to research protocol. Participants reported receiving financial support in the form of CTSI pilot grant awards. Thirty six of 61 respondents indicated that they received pilot grant awards from CTSI. One respondent shared that, "The CTSI provided space and funding to support my research," while another participant explained that *funding* "laid the groundwork for a completely new avenue of research for me." A modest 7% (4 of 61 respondents) received grant support through collaborators.

Differences between lab and non-lab. Participants whose research was lab-related reported receiving financial and bio-statistical support, such as clinical research coordinators, more often than non-lab group participants. While perhaps unsurprising, this finding indicated that the CTSI's predominant support was for basic science research. With reference to collaboration, there was no noticeable difference between lab and non-lab groups regarding

perceived opportunities. However, the non-lab group reported their appreciation for opportunities to collaborate outside their own departments. Specifically, they used terms such as “across university” or “across campus.” However, non-lab group participants opined that the CTSI “obviously discourages international collaborations.”

Participants in the lab group referenced the node *clinical* more frequently than the non-lab group. More often, lab group participants appreciated the assistance of CRCs that they received from CTSI, while non-lab group participants believed that opportunities to collaborate was most helpful to them.

While discussing the nodes, *funding* and *grant*, more lab group participants reported obtaining financial support than did the non-laboratory group, although lab group participants also reported negative evaluations of the CTSI, (e.g., wasting resources and limited funding opportunity) more often. For instance, one participant believed that, “most researchers [were] losing funding.” However, this statement may reflect the current competitiveness in garnering federal funding.

While describing the nodes, *program*, and *project*, there was higher ratio of lab group participants reporting comments. Compared to the non-lab group, there was also a higher ratio among the lab group mentioning of personnel and neutral evaluations. When referring to the node, *service*, several lab group participants reported that the CTSI services were too expensive or that services available were “too difficult to determine.”

Differences between clinical and non-clinical. Compared to the non-clinical group, clinical group participants reported receiving financial support, collaboration opportunities, bio-statistical support and personnel help more often. When talking about the nodes, *funding*, *grant*, or *service*, most of the negative evaluations of CTSI emerged from the clinical group. One participant reported that construction of the new CTSI research facility, followed by moving offices and laboratories, disrupted his research. For instance, this participant said, “Most recently, with the CTSI transitioning to the new building, I will admit it has been more of a challenge to complete some research.”

For the node, *clinical*, the findings were similar to the lab/non-lab group. Participants in the clinical group appreciated access to personnel that the CTSI funded, while non-clinical group participants believed that collaboration opportunities were most helpful to them. Clinical group participants made statements that referenced the nodes, *funding* and *grant*, more often than the non-clinical group. A higher ratio of clinical group participants reported receiving financial support compared to the non-clinical group.

When talking about the node, *program*, most clinical group participants mentioned how programs such as the previous K30 award facilitated funding their research, while half of the non-clinical group participants pointed out that benefits were limited. When talking about the node, *research*, most clinical group participants described the kinds of personnel help or statistical support they received, while more than half of non-clinical group participants said they did not use CTSI services or that services were not applicable to their initiatives. For instance, one participant remarked that the “CISI has not been involved in my research very much.” Regarding the node, *services*, there was a higher ratio of negative and neutral evaluations within clinical group compared to the non-clinical group. For example, exemplifying a neutral evaluation, one clinical participant said, “I hope to be more actively leveraging CTSI resources in coming years.”

Most Important Impact of the Research Facilitated by the CTSI

In this section, we describe the qualitative findings for the following nodes: *clinical*, *funding*, *grant*, *program*, *project*, *pilot*, *providing*, *research*, and *service*. Participants’

responses showed that financial support and collaboration opportunities were the most important impacts of the research facilitated by CTSI. One participant believed CTSI services worked well at “fostering collaborations with new colleges/departments/investigators and facilitating my learning of new methods/disciplines.” Another participant said, “This has allowed for my continued funding through the KL2 as a transition to applying for an RO1.” About 17% (33 of 190 respondents) discussed the impact of their own research on patients rather than the impact received from the CTSI. For example, one participant said, “The research helps uncover factors responsible for pain and disability, which may have [an] important public health impact in the future.” Nearly 16% (31 of 190 respondents) stated they did not use any CTSI services or they did not know what they could get from CTSI, pointing out a need to ensure that information about the CTSI is readily accessible and broadly available to everyone across campuses.

Differences between lab and non-lab. Most of participants who stated they did not use any CTSI services or were unaware of existing resources were from the non-lab group. There were no noticeable differences between the lab and non-lab groups in their references to who did or did not receive funding. Both lab and non-lab groups expressed negative attitudes regarding the CTSI. One participant said, “It seems [to be] extremely self-focused on a core group of people but yet [seeks] funds from other researcher to support CTSI activities.”

More non-lab participants reported receiving opportunities to collaborate than the lab group. The non-lab group appreciated opportunities to enter collaboration outside their own departments. They used terms such as “multidisciplinary” or “cross disciplines.” This is an important concept that speaks to the value of and emphasis on team science. Team science is characterized as collaborative working relationships that are used to address scientific challenges that maximize the cooperation among professionals trained in different fields. Team science may use coordinated teams of investigators with diverse skills and knowledge to study and resolve scientific problems that have multiple causes or are a byproduct of complex social problems (National Cancer Institute, 2017).

For the node, *clinical*, there was a higher ratio of neutral evaluations in the non-lab group, compared to the lab group. For instance, one participant said, “Human clinical trials will be conducted soon with our collaborators.” Non-lab group participants made more references to the node, *pilot* compared to the lab group. Also, there was a higher ratio of neutral evaluations among non-lab group participants.

When participants referenced the nodes, *program*, *project*, and *providing*, there was little difference in the ratio of neutral evaluations. However, there was a higher ratio of negative evaluations of CTSI among the non-lab groups. For instance, one participant said, “the CTSI support was minimal and much more of a cost than a benefit.” One participant stated, “the CTSI has not impacted my research.” Another participant shared, “CTSI hasn't been involved in any project in my department.”

For the node, *service*, there was a higher ratio of negative evaluations of CTSI among lab group participants. For example, one participant said, “I have not yet used CTSI services.” For the node, *study*, there was no negative evaluations in both groups. However, there was a higher ratio of neutral evaluations in non-lab group. One participant wrote, “I don't feel this survey is applicable to my job or maybe I just don't understand.”

Differences between clinical and non-clinical. There were no noticeable differences in the numbers of clinical and non-clinical group participants reporting that they received CTSI services or financial support. However, more non-clinical group participants reported receiving collaboration opportunities in comparison to the clinical group. There was a higher ratio of neutral evaluations in non-clinical group. For instance, one participant said, “I feel this is a

very important initiative and will take additional time to come to fruition.” Also, there was a higher ratio of negative evaluations of CTSI in clinical group for node, *grant*. One participant did not believe CTSI services were worthy and said, “The high cost of your service waste[s] my grant money.”

When talking about the node, *pilot*, there were no differences between clinical and non-clinical group participants. There was a slightly higher ratio of neutral evaluations in clinical group. When referencing about the node, *program*, both clinical and non-clinical groups held negative views of the CTSI. For instance, one clinical group participant said, “None of my research was facilitated by CTSI services or programs.” A non-clinical group participant said, “I have not used CTSI services or programs.” Also, there was a higher ratio of negative evaluations in clinical group.

Regarding the node, *providing*, there were no differences in the ratio of neutral evaluations for both two groups. However, there was a higher ratio of negative evaluations in non-clinical group. The findings were the same as the lab/non-lab groups reported.

Discussion

As shown in this study, participants reported CTSI support in the form of financial and personnel resources, networking opportunities, and collaboration opportunities. In response to how CTSI benefitted research, more lab/clinical group participants specifically reported receiving personnel support. In their response to the most important impact of the research facilitated by the CTSI, non-lab/non-clinical group participants more frequently reported having opportunities to collaborate. Some participants reported a reluctance to seek help from CTSI in their responses to the question item, the most important impact of the research facilitated by the CTSI. Perhaps this finding indicates their lack of awareness regarding the availability of CTSI resources (Morrato et al., 2013).

Also, it is important to consider the time period in which participants responded to the two survey questions. The question item, the most important impact of the research facilitated by the CTSI was asked during the 2012-2013 annual survey. The question item, how CTSI benefitted research was asked during the 2014-2015 annual survey. Given that the respondent group was similar, the findings suggests that that there has been a noticeable improvement in participants’ access to and receipt of services. To illustrate this point, in response to both survey items, participants mentioned financial support and collaboration opportunities. Over half of the respondents reported the value of pilot funding in fostering new research. Notably, there were no obvious differences among clinical and non-clinical or lab and non-lab groups who reported receiving funding.

In response to the survey item, how CTSI benefitted research, participants described the benefits of having access to bio-statistical support and funding to hire additional personnel. This finding supports Fagnan et al. (2010) in the observation that stable infrastructure support and access to personnel are necessary to building collaboration with colleagues and to conducting their clinical tasks. It also indicates that our CTSI has made progress in this regard.

For the survey item, how CTSI benefitted research, more lab and clinical group participants reported receiving benefits from CTSI compared to the non-lab and non-clinical groups. Discovering that clinical faculty reported greater accessibility to CTSI support suggests that group affiliation influences participants’ attitudes towards and experience with CTSI services. Learning about non-clinical participant experiences offers important insight as well. Although non-clinical faculty do not deliver direct patient care, they still may be conducting or hold interest in engaging in translational research. Perhaps the CTSI should consider offering services that are more nearly aligned with their needs and research interests. Developing CTSI resources inclusive and supportive of patient-centered research may also be warranted.

In response to the survey item, most important impact of the research facilitated by the CTSI, non-lab or non-clinical groups participants more frequently reported engaging in collaboration opportunities. Since a third of the participants reported no direct benefit from the CTSI, perhaps additional outreach to these participant groups is warranted.

As evidenced by previous researchers there are myriad ways to evaluate the effectiveness of CTSAs (Fagnan et al., 2010; Kane et al., 2013; Morrato et al., 2013; Nagarajan et al., 2015). Researchers have focused on (a) conducting local evaluations studies of IRB duration, (b) identifying perceived bottlenecks in moving from proposals to the actual research, (c) assessing the retention of trainees in translational science, and (d) assessing the impact of the CTSI activities on the overall university research environment.

The National Center for Advancing Translational Sciences (NCATS) has advocated for implementing common metrics to report systematic outcomes across CTSAs. Given the uniqueness of each CTSAs, we suggest that the studies of local effectiveness are vital and essential. As evidenced by the findings reported, this study provides insight into participants' perceptions regarding the ways that local CTSI activities have impacted their research initiatives across a three-year period, 2012-2015.

Our methodological approach and findings align with the National Academy of Medicine recommendations, that the next steps for the clinical translational science awards should, "Formalize and standardize evaluation processes for individual CTSAs ... [and] use clear, consistent, and innovative metrics that align with the program's mission and goals and that go beyond standard academic benchmarks of publications and number of grant awards to assess the CTSAs program and the individual CTSAs" (Institute of Medicine, 2013, p. 14). Our study also addresses the Kane et al. (2013) recommendation that evaluation processes be aligned with CTSI strategic goals. Our study offers an approach towards standardizing the assessment of open-ended question responses. Through mixed methods, we also acquired insight into the utility of our local CTSI questionnaire. By comparing our results with previous studies (e.g., Fagnan et al., 2010; Morrato et al., 2013; Nagarajan et al., 2015; Scott et al., 2014) this study illustrates the relevance and practicality of a mixed method approach.

Our findings provide innate awareness into participants' perceptions of services and resources beyond traditional productivity metrics shown by social network analyses or studies of economic activity. The use mixed methods analysis to assess the effectiveness of our local CTSI services and program delivery has not been previously reported. Regarding services and resource improvements, the study finding support the continuation of pilot funding. The finding also suggests a need to provide resources that are more judiciously aligned with non-clinical faculty.

Nuanced differences that are attributable to respondent's primary research emerged from this study. Thus, we suggest that other hubs seek to differentiate results using these or similar classifications. As the findings demonstrate, it is important to investigate how respondent groups differ in their perceptions of CTSI-related experiences. This information in turn can be used to ensure that individual CTSIs and collective CTSAs are meeting organizational needs. The development of evaluation processes must be carefully undertaken to ensure that they are aligned with the grant's strategies goals. Evaluation is central to determining how well a CTSI is meeting its intended goals.

Future studies should integrate quantitative and qualitative methods to discern if the results of the quantitative assessments are supported by the qualitative findings and vice versa. According to Ginsburg, van der Vleuten, and Eva (2017) finding non-concordance with quantitative findings may illustrate weaknesses not otherwise shown in the scores. In previous studies, we found that it critical to maintain a certain degree of skepticism about quantitative findings that rely solely on closed ended items. For example, in a study designed to assess the effectiveness of an academic health center mentor program at a CTSI, Behar-Horenstein, Feng

Prikhidko, Su, Kuang, and Fillingim (in press) found that reflective writings supported some survey findings yet refuted others. We stress the importance of reporting outcomes that is based on a complete analysis of available data. Thus, when researchers construct surveys comprised of both close- and open-ended questions, they are beholden to share the results of all questions, not just the close-ended items. Otherwise they risk conveying incomplete summaries of assessment findings. Moreover, research reporting ought to match the methodologies undertaken.

Prior to this study, our organization did not investigate attitudes towards CTSI services or compare responses by participant group affiliation. We stress the need to standardize survey analysis so that all CTSA conduct and report the findings from both quantitative and qualitative analyses. We recommend that the practice of analyzing group differences qualitatively become a standard in CTSA evaluation studies. Owing to the findings that we have offered, our internal CTSI reports now include this information. In our opinion, one reason that this practice has not previously implemented may be due to a lack of awareness and expertise. Qualitative analyses are labor intensive, necessitate team work, and may not always generate useful insight. Also, this type of analysis is not expedient. For those who wish to have the type of prompt output that quantitative analyses promise, engaging in qualitative research may be perceived as unwieldy.

Another crucial consideration relates to the wording of open-ended questions. Fazekas, Wall, and Krouwel, (2014) found that how open-ended questions are worded impacts the amount and type of responses. The type of open-ended question items reported in this study were quite general in nature and did not attempt to identify the ways in which engagement with the CTSI impacted individual research. In other words, the questions could have been more precise in seeking information such as: How did funding impact your ability to obtain data for grant proposals? How did other personnel facilitate the integrity of clinical trials? How did bio-statistical help facilitate getting your research published? It is possible that the wording of the research questions influenced the responses. The open-ended survey items were non-directive and suggests that perhaps that they should be written in relationship to local CTSI strategic research goals as articulated in the grant proposal. Below, we list the strategic goals and present sample revised versions of these questions that are aligned with each goal.

Strategic Goal 1: Chart new pathways for developing the translational workforce and support mechanisms for translational research careers through novel competency-based training and professional development programs. A revised version of these questions aligned to this strategic goal are:

1. How has your CTSI supported research benefitted the goal of charting new pathways for developing the translational workforce?
2. What was the most important impact of your CTSI facilitated research in supporting translational research career development?

Strategic Goal 2: Embed translational science throughout the local CTSIs learning health system to support a continuous cycle of inquiry, innovation, and implementation. A revised version of these questions aligned to this strategic goal are:

1. How has your CTSI supported research supported a continuous cycle of inquiry, innovation, and implementation?
2. What was the most important impact of your CTSI facilitated research in supporting a continuous cycle of inquiry, innovation, and implementation?

Strategic Goal 3: Expand statewide collaborations and opportunities to advance a participant-centered research agenda that reflects the health priorities and diversity of the state. A revised version of these questions aligned to this strategic goal are:

1. How has your CTSI supported research promoted a participant-centered research agenda that reflects the state's health priorities and diversity?
2. What was the most important impact of your CTSI facilitated research in advancing a participant-centered research agenda that reflects the state's health priorities and diversity?

Strategic Goal 4: Accelerate the collective impact of the CTSA network by collaborating with other hubs in multi-directional development, evaluation, dissemination, and implementation of new methods and processes for improving the quality and efficiency of translational research. A revised version of these questions aligned to this strategic goal are:

1. How has your CTSI supported research promoted the multi-directional development, evaluation, dissemination, and implementation of new methods and processes for improving the quality and efficiency of translational research?
2. What was the most important impact of your CTSI facilitated research in supporting the multi-directional development, evaluation, dissemination, and implementation of new methods and processes for improving the quality and efficiency of translational research?

Based on the study's findings, we recommend that other CTSA's seek to use annual longitudinal survey as a method to assess their own effectiveness. Beyond that, we recommend using open-ended questions that are more precise in seeking information. Drawing upon Scott et al. (2014) study the researchers recommend developing open-ended questions that are more specific to evaluating the CTSI's contextual effectiveness, process and impact. Suggested questions for future surveys include the following:

1. How is the CTSI facilitating movement of projects from discovery to application?
2. What would make the CTSI services and resources more effective?
3. How is the CTSI improving the process of translational research?
4. How are CTSI education and training improving the next generation of translational researchers? (p. 93)

We also recommend either placing these questions into future annual surveys or implementing subsequent surveys using only open-ended questions every six months.

Implications and Limitations

The findings of this study were based on single survey administrations that occurred at one point in time each year. The survey responses revealed that CRC services in particular, played an important role of helping participants assist their patients. However, there were still many participants who had no idea how to get access to those resources. Without an analysis of open-ended text, this observation would likely remain unknown. Thus, the CTSI needs to improve the limitations in service provision to ensure that they are more widely available to faculty.

The study does not differentiate respondents by career level. Future studies should consider comparing Early Stage Investigators' (ESI) and Early Established Investigator's (EEI) responses.

No comparison surveys were administered during any given year. Thus, the findings reported in this study represent snapshots of participant beliefs. They are, therefore, limited to those individuals who took the survey and elected to answer open-ended questions. The findings are not generalizable to others who were non-respondents. Also, the findings cannot be used to understand issues or experiences that were not expressed in this study. Another limitation of this study relates to the density of data that were available for any given node.

The type of analysis described in this study is complex and labor intensive. The processes described requires a specialized skill sets, familiarity and expertise in qualitative research methods, and an ability to handle ambiguity and fluidity. Those trained in the hypo-deductive theoretical framework may find this approach antithetical and too unwieldy. Thus, training and philosophical ascriptions, as well as beliefs about epistemology regarding what knowledge and how it can be known are influential in motivations to conduct this type of research. These matters aside, neglect of open text analysis is disadvantageous to researchers, funding agencies and public readership. An analysis of open text responses holds the capacity to yield deep and meaningful insights regarding participants' experiences. Notably, the research questions that served as the focus of this study are consistent with priorities of the National Center for Clinical and Translational Science (NCATS).

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Appendix 1: Frequency of Words Used as Nodes to Code the Data

1 : 2-clinical	29
2 : 2-collaborators	58
3 : 2-funding	49
4 : 2-grant	29
5 : 2-pilot	27
6 : 2-program	27
7 : 2-projects	26
8 : 2-providing	55
9 : 2-research	81
10 : 2-services	35
11 : 2-study	26
12 : 2-support	57

Appendix 2: Coded Content

Reference 10 - 0.02% Coverage
More sharing of resources across departments and colleges. Hiring <u>more senior level</u> <u>funded</u> investigators who can provide opportunities to mid an junior faculty for collaborations.
Reference 11 - 0.02% Coverage
The problem is always <u>funding</u> . Lots of idea, little money.
Reference 12 - 0.02% Coverage
Protected time to do research. Other faculty have same problem - they say they do not have time to devote unless there is <u>funding</u> for their FTE
Reference 13 - 0.02% Coverage
Larger investments in seed <u>funding</u> or joint research projects and perhaps a mechanism to defray the costs of publications that result from collaborations that cross department, college, and institutional boundaries.
Reference 14 - 0.02% Coverage
<u>funding</u> to do so
Reference 15 - 0.02% Coverage
The pressure from the upper administration to secure NIH dollars <u>inhibits</u> people from wanting to collaborate because we are all competing for the same thing. Also, the fear of someone "staking claim" to your work from another department to bump up their research <u>funds</u> line is <u>concerning</u> .

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