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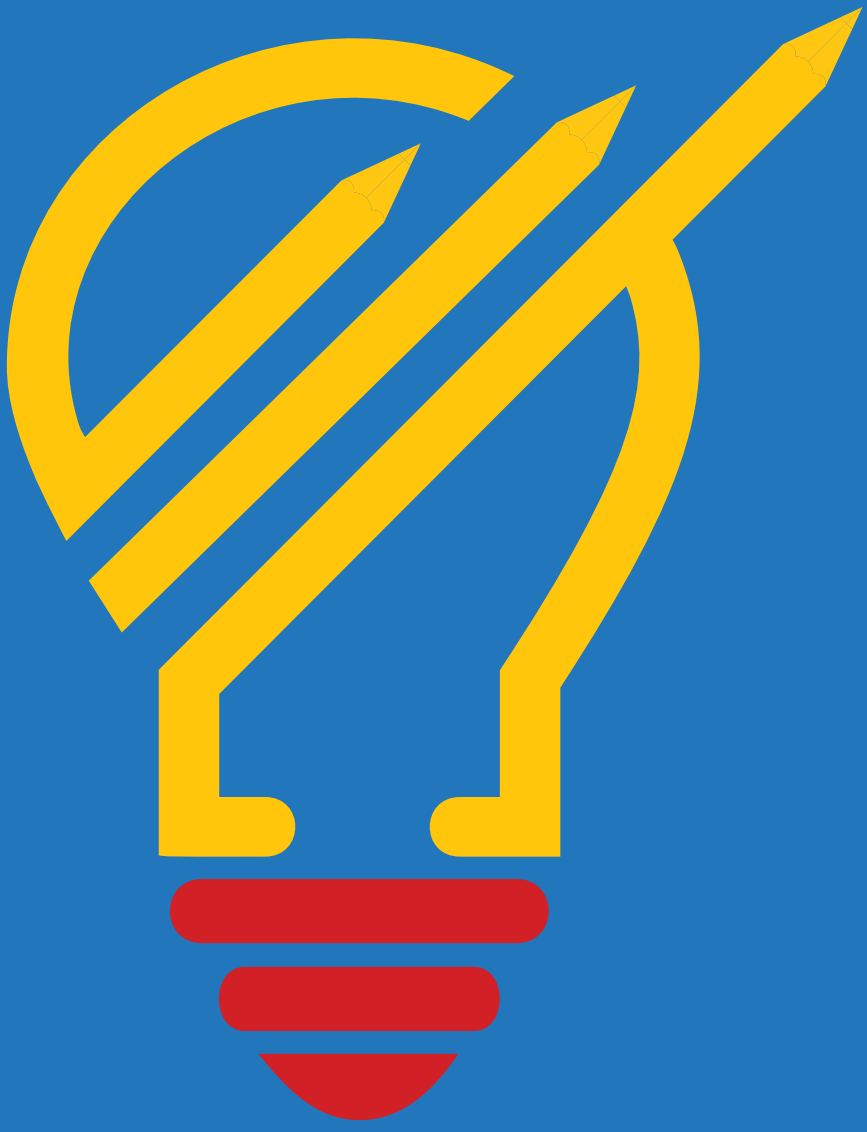

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SRA

FROM THE EDITOR'S DESK

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From the Editor's Desk

Nathan L. Vanderford
University of Kentucky

On behalf of the editorial board, I am pleased to present this issue of the J*ournal of Research Administration* (Journal). Having begun in 1969, the Journal will be celebrating its 50th anniversary next year. We will be officially commemorating this milestone next year and in anticipation of that, I would like to thank the Journal's past and present leadership as well as all the authors over the course of our publishing history. We look forward to continuing to serve as the premier research administration journal for our colleagues/peers who wish to continue to be or to become scholarly authors, and to bringing our readership timely resources addressing research administration and management.

In our previous issue, we welcomed Jennifer Taylor from the University of Arkansas as our new Deputy Editor. I am now happy to report that Holly Zink from Children's Mercy Hospital in Kansas City has accepted a role as Associate Editor for the Journal. In this role, Holly will focus on internal operational matters such as ensuring that the author guidelines and other author resources are up-to-date and that they are of maximum use to potential authors. Please join me in welcoming Holly to her new role.

Fall is an exciting time of the year. The changing season and, for many of us, the start of a new academic year, brings a sense of excitement and promise of new opportunities and possibilities. In this regard, we look forward to encouraging your efforts and facilitating your scholarly writing opportunities. As such, we hope to see many of you at the Society of Research Administrators International (SRAI) annual meeting in Orlando, Florida, on October 27-31, 2018. There will be several ways to interact with us at the annual meeting including participating in the free, Journal-provided learning lab, *Stepping Stones to Becoming a Peer-Reviewed Journal Author,* on Sunday, October 28, 1:30 – 5:00 pm. We look forward to meeting you, so please drop by the Journal information booth located in the exhibit hall. Particularly for those who have not previously written a scholarly article, these will be excellent opportunities for you to learn more about becoming a Journal author yourself! Please send an email to journal@srainternation.org if you would like more information.

In this issue, within our *Voice of Experience* article titled R*esponding to the FDA-OHRP Requirement for an IRB Contingency Plan*, Fanny and John Ennever describe their experience creating institutional IRB contingency plans as required by the Food and Drug Administration and the Office of Human Research Protection. In her article, *Research Administration Organizations: Results from an Investigation into the Five Disciplines*, Angela Silva presents results from a study that investigated whether research organizations are using Senge's Five Disciplines model as a means of being reflective, adaptive, and proactive in responding to changes. Of note, Angela is an alumnae of the Journal's Author Fellowship Program and she is the first fellow to publish an article as the result of the program. In *Development of a Pilot Grants Program in Social Determinants of Health in American Indian Health: A Program for Increasing the Representation*

of Underrepresented Groups in Funded Research, Alyson Becker and colleagues describe a pilot grant program that aims to increase the number of individuals from underrepresented groups that obtain extramural funding. In their article titled *Enhancing Institutional Research Capacity: Results and Lessons from a Pilot Project Program*, Leslie Bienen and colleagues describe a faculty-targeted pilot grant program that is a component of a more comprehensive National Institutes of Health-funded intervention which aims to build research capacity at primarily undergraduate institutions by having impact at the student, faculty, and institutional level. Julie Oestreich and Kimberly Heersche report on the creation of a customized database for managing the reporting of pre- and post-grant award activities within their article titled *Creation of a Grants Database Highly Customized for College Level Reporting*. In the article *Providing Administrative Research Training for Everyone! It's a PART-E! Taking the "They Don't Know What They Don't Know" Out of the Equation*, Rebecca DeMoss and colleagues describe a faculty-targeted research administration onboarding program that offers information and tools need for successfully navigating the research enterprise. And lastly, Holly Zink and Jack Curran in their article titled *Building a Research Onboarding Program in a Pediatric Hospital: Filling the Orientation Gap with Onboarding and Just-in-Time Education* describe their approach to creating a faculty onboarding program that covers research and research administration topics and has such goals as increasing faculty productivity and improving retention rates. As always, I hope that you enjoy reading these articles as much as we have enjoyed bringing them to you.

In closing, I would like to thank the Journal's Deputy Director, Jennifer Taylor, Associate Editor, Holly Zink, and the entire editorial board for their dedicated service to the Journal. We also thank our publisher, SRAI, and specifically, SRAI staff Dilyana Williams and Jim Mitchell for their support of the Journal and their efforts in facilitating the publishing of this and every issue. Finally, if you are a non-SRAI member and wish to have the Journal delivered to you via email, please sign up through the online system at http://www.journalra.org.

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Responding to the FDA-OHRP Requirement for an IRB Contingency Plan

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Keywords: *IRB; contingency plan; human subjects research*

Introduction

Since 2013, institutional animal research facilities have been required to have a contingency plan that covers care in the event of common emergencies such as electrical outages, fires, and natural disasters (Animal Plant Health Inspection Service, 2013; Donaho, 2014). In May, 2018, the Office of Human Research Protection (OHRP) and the Food and Drug Administration (FDA) finalized guidance (first issued in draft form in August, 2016) containing 55 recommendations for what should be included in written procedures for Institutional Review Boards (IRBs) that oversee human subjects research. The 51st recommendation is:

> 51. Contingency plans for transferring oversight of one or more studies to another institution or IRB in the event that the IRB is unable to continue oversight of the study (e.g., the IRB closes, suffers loss due to fire, natural disaster). (OHRP & FDA, 2018, p. 13)

No additional recommendations or discussion were provided on how IRBs should develop contingency plans, and the final guidance omitted any mention of FDA guidance on transferring oversight (FDA, 2014) that had been referenced in the draft guidance (OHRP & FDA, 2016).

The draft guidance was issued during a time that the joint Boston Medical Center and Boston University Medical Campus Human Research Protection Program (BMC/BU Medical Campus HRPP) was in the process of overhauling the IRB policies in preparation for accreditation by the Association for Accreditation of Human Research Protection Programs (AAHRPP). The Institutional Officials (the individuals with the overall responsibility for the IRB at BMC and BU Medical Campus, respectively) both recognized the wisdom of developing a contingency plan, in the hope, of course, that it would never be used.

The contingency plan was developed with separate consideration of disruptions to electronic records and to personnel. Responses are calibrated to the scope and severity of the disruption, including assuring that electronic records could be reconstructed within one week and incorporating the option of having an independent IRB perform reviews according to the BMC/BU Medical Campus policies. The important components of the contingency plan are summarized in Table 1. This publication reflects on the outcome of the development of the plan, notably the way that planning for the transfer of oversight was expanded to include developing processes to respond to disruptions that would not, in fact, require transfer of oversight.

IRB Operational Responsibilities

Investigators at institutions receiving Federal funding must obtain IRB approval before

Table 1. Components of the BMC/BU Medical Campus HRPP Contingency Plan

Issue	**Resolution**
Responsibility for implementation	IRB Director, with a specified hierarchy if IRB Director is unavailable.
Acceptable delay in resumption of IRB operations	One week
Records recovery	Electronic system backup is incorporated into institutional IT recovery plan
Personnel resources	Contract with independent IRBs or transfer oversight
Transfer of oversight	Invoked if IRB operations cannot resume in a reasonable time-frame; follows FDA guidance (FDA, 2014)
Return of transferred studies	IRB Director determines whether oversight of any transferred studies will be returned after disruption is resolved

conducting any activities that meet the definition of research with human subjects and that do not qualify as "exempt" [note, however that most institutions still require that IRBs perform an initial review even for exempt human subjects research (Loe, Winkelman, & Robertson, 2016)]. In addition, investigators may not make any changes in the approved research protocol without prior IRB approval, must report untoward events such as unanticipated problems and protocol deviations to the IRB, and must provide information for the IRB to re-approve the research protocol annually. [Note that this last requirement for annual review will only apply to research that poses risks that are greater than minimal under new Federal regulations that fully go into effect on January 21, 2019 (O'Rourke, 2017).]

Institutions may rely on an IRB other than their own to review research (called "ceding review") by entering into a reliance agreement with the reviewing IRB. BMC/BU Medical Campus has reliance agreements for industry-sponsored multi-center drug and device studies to be reviewed by independent IRBs, one of which has established access to BMC/BU Medical Campus's electronic system. Independent IRBs have taken over IRB functions for institutions in the past, either temporarily or permanently (Lis & Murray, 2008), and provide a key resource in contingency planning.

The consequences of disruptions to IRB functioning would be delays in the ability of investigators to start new research projects, to make changes to existing projects (including adding study staff),

to continue projects that are near the expiration date of annual re-approval, and/or to receive assistance in responding to unforeseen events.

OHRP and FDA Guidance

Included in the draft recommendation about contingency plans (OHRP & FDA, 2016) was a reference to a 17-page document (FDA, 2014) with guidance on how IRBs should handle the following 8 steps involved in transferring clinical investigation oversight to another IRB:

1. Identifying those studies for which IRB oversight is being transferred;
2. Ensuring the availability and retention of pertinent records;
3. Establishing an effective date for transfer of oversight, including records, for the clinical investigation(s);
4. Conducting a review of the study(ies) by the receiving IRB, where appropriate, before it accepts responsibility for the study(ies);
5. Confirming or establishing the date for the next continuing review;
6. Determining whether the consent form needs to be revised;
7. Notifying the key parties; and
8. Updating IRB registration information.

The process of developing the plan for BMC/BU Medical Campus identified several additional issues that should be addressed:

1. Specifying the criteria for deciding that transfer of oversight is necessary;
2. Identifying and contracting with the IRB(s) that will receive the transfer of oversight;
3. Determining whether the receiving IRB(s) will carry out reviews according to their own policies or according to the BMC/BU Medical Campus policies (i.e., acting as a panel for BMC/BU Medical Campus); and
4. Deciding whether to take back oversight at the end of the disruption.

Addressing the first point above was particularly useful, leading to the recognition that plans could be put in place for managing many kinds of disruptions without the need to transfer oversight.

Disruptions to IRB Functioning

IRB functioning is dependent on staff and IRB members who have access to the records of communications with investigators. Disruptions to IRB functioning can be characterized by their scope and severity. The scope of a disruption depends on whether and to what extent the disruption (1) reduces or prevents access to records and (2) makes some or all personnel unavailable to work. The severity of a disruption depends primarily on how long before operations return to normal. In addition to planning for the transfer of IRB oversight, the BMC/BU Medical Campus contingency plan prioritized developing ways of responding to disruptions quickly enough so

that no transfer would be necessary.

Identification of Responsibilities

The plan designates the IRB Director as the individual who will lead the response to a disruption. If the IRB Director is unavailable, the responsibilities transfer to the Institutional Officials, the IRB Chairs, and IRB Administrators, in that order. A key responsibility is communicating to investigators about the reasons for, responses to, and anticipated duration of the delays in IRB operations.

Response to Disruption of Access to Records

BMC/BU Medical Campus uses an electronic system to manage records concerning submission, review, and approval of research. In August, 2016, the electronic system (both the software and the data) were already being backed up on a daily basis on a BU server that is located in a different building than the server that holds the production version of the electronic system ("local backup"). However, it was recognized that both versions could be damaged or destroyed by a wide-spread event such as a hurricane or earthquake. Thus, implementation of the contingency plan included arranging for another backup of both the software and the database to be made on tape on a daily basis. This involved adding the IRB records to the backup procedures already in effect through the BU Information Technology (IT) disaster recovery agreement with SunGard, wherein the tape is stored in a location in a different State ("remote backup").

Recovery using the local backup is expected to take only a day or two to return to normal operations. The process is for the IRB Director make the determination that restoration from the local backup is required and for IRB staff coordinate with the BU IT department for the restoration of the electronic system and reconstruction of any records that were added to the system after the time of the backup.

For remote backup, incorporating the IRB records into the existing disaster recovery agreement involved choosing a timeframe for restoring the records. The decision was made to accept a period of one week after the date that disaster recovery was invoked for restoration of IRB records. The one-week goal was considered appropriate for IRB responsibilities because waiting an additional week for review of new protocols and amendments, while not ideal, would not be expected to significantly impede research. For annual renewal, investigators are expected to submit progress reports for continuing review to the IRB at least six weeks before the expiration date of the study. Thus, only investigators who had not met this expectation might be forced to cease study interventions (except for those required for the best interest of the already enrolled subjects) until records were restored. Investigators are also expected to submit initial applications well in advance of any need for IRB approval for funding purposes; again, a funding deadline might be missed if a submission was made less than a week before the funding deadline if records were unavailable. The one-week timeframe could potentially be problematic if an unforeseen event involving a fatal or life-threatening incident occurs during the disruption. However, the immediate response to such events could be accomplished without access to IRB records.

The process for remote backup is for the individual from BU responsible for disaster response to

make the determination that a disaster requiring recovery has occurred, and for the IRB Director and IRB staff to coordinate with SunGard and the BU IT department for restoration of the electronic system as well as reconstruct any records of IRB actions after the time of the backup.

Because IRB records will be restored within one week, a disruption of access to records would not require transfer of IRB oversight.

Response to Disruption of Availability of Personnel

An unexpected lack of availability of some or all IRB staff and/or IRB members can be caused by multiple resignations, pandemics, and interruptions in electricity and/or internet service to work and/or home. Note that the inability of IRB staff and IRB members to travel to the IRB office location would only constitute a personnel disruption if electricity and internet access were widely unavailable, because IRB staff and IRB members are able to use the electronic system from home and participate in convened meetings via teleconference. In the specific instance that the IRB becomes subject to administrative actions by FDA under 21 CFR 56.120 or 56.121 or by OHRP under 45 CFR 46.103(e) that include limitations on the IRB's authority to provide oversight, as has happened to other IRBs in the past (Lis & Murray, 2008), this would also be considered a personnel disruption for the purposes of the contingency plan, but would be likely to be known further in advance than other personnel disruptions.

To obtain external resources for responding to personnel disruptions, the contingency plan relies on the services of one or more independent IRBs which already provide oversight for some research at BMC/BU Medical Campus. The process for responding is for the IRB Director to decide whether or not a personnel disruption is likely to have a significant negative impact on IRB operations without external help, and to identify how soon the disruption is expected to be resolved (e.g., sick IRB members recover, additional staff are hired, new computers are purchased). If additional resources are needed, the IRB Director will initiate communication with one or more independent IRBs who are willing to perform reviews following the policies and procedures of the BMC/BU Medical Campus IRB. This would not constitute transfer of oversight to the independent IRB, because the independent IRB would be functioning as one of the panels for the BMC/BU Medical Campus IRB.

Some disruptions may be so severe that the IRB Director, in consultation with the Institutional Officials, will determine that investigators would be best served by transferring oversight to the independent IRB. In such a situation, the detailed FDA recommendations for transferring research oversight will be followed (FDA, 2014). The IRB Director will monitor the situation to determine when the disruption has been resolved and the services of the independent IRB are no longer required. If oversight of any studies has been transferred to the independent IRB, the IRB Director will decide whether or not to leave the studies with the independent IRB for the life of the study, taking into account the burden on investigators and the capacity of the IRB.

Reflection

The process of developing the contingency plan was a valuable exercise in identifying the steps that would need to be taken if IRB operations were disrupted. As it turned out, the planning process was particularly useful in thinking through responses to disruptions in ways that would minimize the situations where oversight would have to be transferred, including assuring that electronic records could be reconstructed within one week and incorporating the option of having an independent IRB perform reviews according to the BMC/BU Medical Campus policies. A similar process could be useful to other institutions as they incorporate this requirement into their IRB written procedures.

The hope is that none of the components of the plan will ever in fact have to be implemented, but thinking through the process certainly increased the sense of being prepared.

Authors' Note

The authors gratefully acknowledge the help in developing the contingency plan that was provided by the members of the HRPP Advisory Committee at BMC/BU Medical Campus.

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Angel Silva, DBA, MAOL, CRA, MultiCare Institute for Research and Innovation, participated in the First Cohort of the Author Fellowship program. Angela's peer advisor was Alicen Nickson, MA(hons), MBA, MSc. Deputy Director, Research Support and Development, Brunel University, London, UK

Research Administration Organizations: Results from an Investigation into the Five Disciplines

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Abstract: *Research organizations are dealing with impacts from shrinking funding, have limited means and are functioning in environments of constant change and pressure all while identifying resources to develop or sustain programs. This state of uncertainty presents a unique opportunity for organizations to expand their capacity and become adaptive, flexible, and productive learning organizations. The purpose of this study was to determine if research organizations use Senge's Five Disciplines model and how they integrated these disciplines into their organizational culture. Introduced in the 1990's, Senge's model includes key components such as personal mastery, mental models, team learning, shared vision, and systems thinking. Businesses and other organizations that adopt this model tend to be more reflective, adaptive and proactive in addressing changes. A two-phase survey project was conducted and qualitative and quantitative data were collected and analyzed. Results from this project indicate many research administrators had some familiarity with the components of the Five Disciplines model, while others were consciously applying specific components, especially shared vision and systems thinking. In addition, many respondents indicated that although there was strong leadership in their organizations, they were lacking on-the-job learning opportunities, education, and growth. Based on this investigation, recommendations are offered for performing a learning organization assessment, building a shared vision, promoting a culture of learning, and integrating systems thinking. Suggestions for areas of future research are also presented.*

Keywords: *Senge, Five Disciplines, Personal Mastery, Mental Models, Team Learning, Shared Vision, Systems Thinking, Learning Organization, Research Administration, Dimensions of Learning Organization Questionnaire*

Introduction

A variety of organizations conduct research including universities, academic medical centers, community hospitals, federal and state facilities, and for-profit and nonprofit institutions. In some institutions, research is the primary mission, while in others, it is only a part of the overall organizational goal. Underpinning this activity are individuals working in a wide range of positions providing specialized expertise in professional and administrative roles.

Research administration (RA) has emerged as a relatively new professional field with primary emphases on proposal development, award management, and accounting. Professional development through training, certifications and networking opportunities is provided by a variety of research administration organizations such as the Society of Research Administrators International (SRAI), the National Council of University Research Administrators (NCURA), the National Organization of Research Development Professionals (NORDP), and the Research Administrators Certification Council (RACC). Universities such as Johns Hopkins and the University of Central Florida offer Master's degree programs in Research Administration.

Although their profession is becoming more established, research administrators are increasingly operating under conditions of change and uncertainty. Many research organizations are experiencing reductions in programs and staff due, in part, to shrinking sponsoring agency budgets and increased competition for diminishing resources. As scientific research continues to evolve, universities have tried to adapt, with varying degrees of success (Lintz, 2008). As a community, research administrators face increasing responsibilities and are expressing concerns related to work stress, number of hours worked, work/family conflict, and illness (Shambrook, 2012). Effectively managing change and positioning research organizations for success requires proven strategies to build resilience and deliver results.

There are a myriad of management theories and approaches in the organizational management literature. Some of these have been tried and tested, and others were only popular for a short time. Peter Senge's Five Disciplines model first emerged in the 1990's and was widely adopted within the business, higher education, and healthcare sectors. Components of the model include personal mastery, mental models, team learning, shared vision, and systems thinking. This model provides a matrix for organizations to enhance their performance and create vibrant, adaptive, healthy, team-focused environments. The model also presents a pathway for organizations to move from the status quo towards a learning organization that is better able to deal with uncertainty and change. The model is often presented as a framework for organizational development (Bui & Baruch, 2010).

The purpose of this study was to explore the level of awareness of the Five Disciplines model amongst RA communities, and the extent to which this model was being used as a management strategy by a diverse range of research organizations (universities, academic medical centers, community hospitals, federal and state facilities, and for-profit and nonprofit institutions). The two-phase study was driven by three research questions:

RQ 1: To what extent do research organizations use the Five Disciplines model in their development as learning organizations?
RQ 2: How do the key trends or themes mentioned by members of the research organizations help explain their views on the Five Disciplines model?
RQ 3: What attitudes or perceptions of the Five Disciplines model (as expressed by organization members) exist within these organizations?

In the pilot phase, a survey and two exploratory interviews were conducted to gather specific background information from research administrators. Phase II of the project was a thorough assessment of learning organization culture to identify organizational strengths and weaknesses. This more in-depth phase specifically targeted the Five Disciplines model and its application to research organizations.

This article highlights the results of the two-phased research project and, based on the findings, a number of recommendations that can be enacted within research organizations to improve performance are presented.

Literature Review

One of the first organizational management theories was the Great Man theory, introduced in the early 1900s. This theory suggested that great people, and only great people, possessed leadership traits with which they were born (Cawthron, 1996). In the early 20th century, as industrialization was sweeping the nation, Taylorism emerged as the popular management theory conceptualizing employees as machines to be managed within a production line model (Koumparoulis & Vlachopoulioto, 2012).

In the 1970s and 1980s, modern leadership theory was influenced by scholars including Drucker, Bennis, and Covey. There was a clear shift from the view of employees as machines, to the importance of organizational performance and culture, and employee productivity. Drucker's interests were related to organizational performance, creating an ideal environment, and developing a culture to support the creation of knowledge and the sharing and retention of this knowledge (Key, McCann, & Thompson, 2009). Bennis viewed organizations as organic systems and studied the intricacies and dynamics of successful leadership. According to Bennis (1999), "if there is one generalization we make about leadership and change, it is this: no change can occur without willing and committed followers." Covey was passionate about teaching leaders and employees how to be more effective in the workplace and may be best known for his book, *The Seven Habits of Highly Effective People*. Commentators have also sought to improve understanding of what successful leadership is and how it impacts organizations. The notion of servant-as-leader was introduced by Greenleaf in the 1970s. Servant leadership focuses on the leader as one who makes a deliberate choice to serve others and put the needs of others above their own (Sendjaya & Sarros, 2002).

In 1990, Senge introduced the concepts of the Five Disciplines. These concepts are central to creating a learning organization and encouraged groups of people to work together toward a common goal in order to excel and improve their individual and overall organizational

performance. They have been widely adopted by businesses and are still used today. The Five Disciplines concepts include:

1. Personal mastery (encourages personal growth and learning)
2. Mental models (our personal generalizations and assumptions)
3. Team learning (letting go of preconceived ideas and assumptions and working together)
4. Shared vision (building a shared picture of the future)
5. Systems thinking (encourages contemplating the whole, not the individual parts of a system)

Several researchers have sought to apply management theories relating to organizational leadership to the field of RA. Lintz (2008) recognized that research administrators tend to be reactive, rather than forward thinking, when they are responding to requests, reviewing proposals and contracts, and solving problems as they arise. Lintz presented a conceptual framework outlining effective management principals as a model for research administrators to adopt. This framework provides research administrators with strategic options to lead institutions in a highly competitive research environment. Gannon (2011) surveyed 121 research administrators on their perceptions of the academic medical center as a learning community. Results from the survey showed that an academic medical center is a learning organization but the learning environment could be strengthened. Campo (2014) described leadership as it relates to the field of RA, and claimed that every person in an organization is in a position to lead, regardless of job title or supervisory status. Gabriele & Caines (2014) explored servant leadership, leadership, and culture as related to RA, and presented the concept of "LeaderBeing." They challenged research administrators to avoid getting caught up in valuing only the work that needs to be done, and instead mature as a servant leader by becoming more involved in deepening one's personal and professional character.

While the literature clearly showed that management and leadership concepts were thriving in the business sector, there was little evidence that the Five Disciplines model has been used within research organizations. Given the benefits derived from the application of other management models to research administration, it was also clear that research organizations could benefit from these learning organization concepts.

Materials and Methods

The aim of this project was to determine the extent to which research organizations use the Five Disciplines model and how they adapt these disciplines into their organizational culture. There might be formal adoption of the model (employment of the five disciplines) or informal influence (incorporating components of the five disciplines into organizational culture).

The author received approval from the California Intercontinental University Institutional Review Board to conduct a two-phase study, collecting data from research administrators via survey and interviews. An exploratory sequential design was used for this project. This research design allowed the investigator to first explore participant's views (qualitative phase) and conclude with analyzing and interpreting the data from the surveys (quantitative phase). The pilot

phase evaluated research administrators' understanding of the Five Disciplines model through introductory survey questions and questions in the Dimensions of the Learning Organization Questionnaire (DLOQ) instrument. Two interviews were also conducted to identify use of the Five Disciplines components in research organizations (RQ 1). In phase II of the project, the short form of the DLOQ was used to identify key trends or themes and evaluate attitudes or perceptions of the Five Disciplines model (RQ 2 and RQ 3).

Pilot Phase

In the pilot phase of the study, data were collected through an online survey, two phone interviews, and the scientifically validated DLOQ questionnaire. The DLOQ was developed by Marsick and Watkins in 1993 and provides a thorough assessment of organizational learning culture and is available in both short and long form versions. It has been used with more than 200 companies (Marsick & Watkins, 2003). In this phase, the full DLOQ instrument was administered (55 questions) to gather information on organizational learning culture.

The pilot survey included questions about respondent demographics and captured information on research administrators' familiarity with the components of the Five Disciplines model and if they use this approach in their day-to-day work. The researcher developed these questions specifically for this study, and validity and reliability have not been tested. However, the questions were designed to be clear and direct to avoid ambiguity.

The pilot survey was distributed to a closed population of 3,858 research administrators who subscribed to the Research Administration Listserv. The survey was open from March 12, 2015 to May 19, 2015.

Two phone interviews were also conducted with staff from research organizations to explore their familiarity with the Five Disciplines model. A request for volunteers was posted during the pilot phase of this project. Interviewees were selected from those respondents that expressed interest. The first interviewee was a research administrator from a nonprofit with 14 years of experience, and the second was a research administrator from a university who had been in the field for 20 years.

Phase II

Phase II of the study involved the collection of data on research administrators' views related to organizational learning culture. To avoid survey fatigue and encourage more responses, an abbreviated version of the DLOQ was sent out to a broader audience of research administrators. Social media platforms were also utilized to further extend the reach to potential participants.

The phase II survey was open from May 3, 2015, to July 10, 2015 with 609 people participating. The abbreviated DLOQ survey was widely distributed through various listservs, discussion groups, emails, and social media. The estimated population at the time of the survey was 94,757 as represented in Table 1.

Table 1. Estimated Membership Counts of Research Administration Groups

Group	Distribution Methods	Phase	Estimated Members
RAL	Listserv	Pilot & Phase II	3,858
AUTM	Discussion group	Phase II	1,032
SRAI	Email, Linkedin, Facebook	Phase II	8,734
NCURA	Linkedin, Facebook	Phase II	5,450
RACC	Linkedin	Phase II	126
NORDP	Linkedin	Phase II	933
RAN	Linkedin	Phase II	1,314
ACRP	Linkedin	Phase II	54,768
GW	Linkedin	Phase II	16,291
InfoEd	Listserv, Email, Twitter	Phase II	1,052
OTHR	Facebook, Email	Phase II	1,199
Notes: The total pilot contained 3,858 members. Phase II contained 94,757 members			

The population was estimated from the social media and listserv membership counts. Duplicate memberships were not accounted for. Membership numbers and social media followers were used to estimate the population.

Data Collection and Analysis

For the pilot and phase II surveys, data were collected through SurveyMonkey and exported to Excel. After the conclusion of each phase of the project, data were extracted from the online survey database, de-identified, and quantified in aggregate.

In this two-phased project, both qualitative and quantitative data were analyzed. Qualitative data were based on research administrators' responses to the introductory section of the pilot survey, indicating their awareness of and familiarity with the Five Disciplines model. Thematic analysis was used to identify themes within their responses and to categorize these themes as related to the components of the Five Disciplines model. In the quantitative data analysis, responses to the DLOQ were tallied through Excel and scored according to the self-scoring instructions. If a response to a survey question was not answered or incomplete, the question was considered inconclusive and excluded from the analysis.

There were five questions in the pilot survey that evaluated research administrators' familiarity with the Five Disciplines model. These questions were developed by the researcher and participants

were encouraged to indicate their level of familiarity with the Five Disciplines concepts. For each of the Five Disciplines concepts, participants were asked to rate their familiarity. The options to select from were *No familiarity*; *Some familiarity*; or *Very Familiar*. They were also asked if they used these concepts in their day-to-day work. These initial questions provided a solid introduction to the DLOQ. To The DLOQ included questions related to individual, team, group, and organizational levels, with the following nine specific rating areas as referenced in Table 2.

Table 2. Question Range and Definitions of the DLOQ Dimensions

Question Range on DLOQ	Dimensions	Definition
1-7	Continuous Learning	• Learning is integrated into work • People can learn on the job • Ongoing education and growth are provided
8-13	Inquiry and Dialogue	• Productive reasoning skills are gained • People express their views. Increased capacity for listening and inquiry • Views of others are encouraged • Organizational culture supports questions, feedback and experimentation
14-19	Collaboration and Team Learning	• At work, groups access different modes of thinking and learn together • Collaboration is appreciated and rewarded
20-25	Systems to Capture Learning	• Hi-tech and low-tech systems are used to share learning and integrate work
26-31	Empower People	• People work together to develop, own, and implement a joint vision • People are motivated to learn and are accountable for what they do

32-37	Connect the Organization	• People see the effect of their work on the entire organization and use information to adapt work practices. The organization is linked to the community
38-43	Provide Strategic Leadership for Learning	• Leaders model and champion learning. Learning is used strategically for business results
44-49	Financial Performance	• Indicates financial health and available resources
50-55	Knowledge Performance	• Products and services are enhanced because of learning and knowledge capacity • Indicates intellectual capital
Note: Table adapted from Leufvén, M., et al. (2015).		

An analysis was then conducted to show the distinction between the responses to each of the nine DLOQ Dimensions.

Exploratory interviews occurred by phone in the pilot phase. The purpose of these 15-minute interviews was to get a sense of how research administrators used one or more of the Five Disciplines model components in their organizations to develop a learning organization culture. This helped to inform the overall results of the study by providing examples of how the components of the Five Disciplines were used in a RA setting.

In order to increase the response rate and lessen the time survey respondents needed to take the survey, the short form of the DLOQ was used. The short form is a validated tool that has been used successfully with other organizations. In phase II, the short form of the DLOQ was administered through SurveyMonkey. The shortened survey contains 21 questions and represents the areas of *Continuous Learning, Inquiry and Dialogue, Collaboration and Team Learning, Systems to Capture Learning, Empower People, Connect the Organization, and Provide Strategic Leadership for Learning*. Responses were exported to Excel and the univariate frequency of distributions was also measured to show the distinction between the responses to each of these areas. Unclear or incomplete survey responses were excluded from the data analysis.

Fisher's Exact Test and the Cochran-Armitage statistical tests were used to identify the association between responses to the demographic questions from the pilot and phase II surveys. These tests were completed using an online statistical calculator and XLSTAT. XLSTAT is an easy to use Excel add-in and provides basic statistical analysis (Deal, 2001).

Validity and Reliability

The DLOQ was the primary instrument used in this investigation. This tool has been determined to be valid and consistently reliable above the recommended .70 rating (Marsick & Watkins, 2003). The short form of the DLOQ survey has also proven to be reliable with an overall reliability estimate of .93 (Yang, 2003).

Sample Size

The pilot survey was open for just over three months and was distributed to 3,858 subscribers to the Research Administration Listserv. Only 168 people consented to take this survey, falling far short of the sample size of 350 recommended by Raosoft's online sample size calculator. RAO provides many online tools to support questionnaire design, graphics and data analysis an integrated questionnaire (Arora, 1994). The population pool was expanded significantly for the phase II survey, with a recommended sample size of 383 respondents using Raosoft's online calculator.

Results

Pilot Phase

In the pilot phase, 168 responses were received from the surveyed population (3,858), which indicated a 4% response rate. Most respondents were female (92.2%), white (88%) and had a graduate-level education (47.24%). Most responses were received from participants aged 35-44 (35.5%). The reported areas of highest general responsibility included pre-award (33.1%) and pre- and post-award management (33.7%). Most respondents worked in a university setting (68.32%) with 1,001 to 10,000 employees (47.9%) and were in the area of middle management (35.2%). They also spent 1-10 hours per month outside of work on work-related learning (77.9%).

Most participants had some familiarity with components of the Five Disciplines model but were least familiar with mental models. This is represented in Table 3.

Table 3. Familiarity with Senge's Five Disciplines Questions

Question	Response	n	%
Familiarity w/systems thinking	None	39	25.50
	Some	80	52.30
	Very	18	11.80
	Use day to day	16	10.50
Familiarity w/personal mastery	None	37	24.30
	Some	79	52.00
	Very	26	17.10
	Use day to day	190	6.60
Familiarity w/mental models	None	74	48.40
	Some	60	39.20
	Very	16	10.50
	Use day to day	3	2.00
Familiarity w/shared vision	None	27	17.80
	Some	82	53.90
	Very	37	24.30
	Use day to day	6	3.90
Familiarity w/team learning	None	39	25.50
	Some	72	47.10
	Very	35	22.90
	Use day to day	7	4.6

DLOQ

In addition, 120 participants responded to the full DLOQ survey. The highest rated value was *Knowledge Performance* and the lowest rated value was *Systems to Capture Learning* (rating scale 1-6) with (1) being Almost Never and (6) being Almost Always.

1. Continuous Learning = 3.38
2. Inquiry and Dialogue = 3.44
3. Collaboration and Team Learning = 3.06
4. Systems to Capture Learning = 2.16
5. Empower People = 2.97
6. Connect the Organization = 3.37
7. Provide Strategic Leadership for Learning = 3.26
8. Financial Performance = 3.39
9. Knowledge Performance = 3.45

Exploratory Interviews

Two interviews were conducted during the pilot phase of this study. Interviewees shared their familiarity with each of the five disciplines in the model (team learning, shared vision, systems thinking, personal mastery, and mental models). These interviews were short and exploratory and intended to highlight respondent's familiarity with the five disciplines concepts. One question from each of these Five Disciplines areas was posed during the phone interviews: team learning, shared vision and systems thinking.

In the first interview, team learning was highlighted. The interviewee shared that it was important for their small team to be flexible in their approach to their job responsibilities, as downsizing had impacted the organization. It was no longer possible to have a rigid division of responsibilities. Staff needed to assume more responsibilities and complete tasks outside of their usual areas of responsibility. It was important for the team to work together, and they accomplished this through a shared vision. The vision they shared was to work together and make sure the organization was sustainable even though the team was smaller. In addition, systems thinking was valued as the team needed to see the whole picture and be innovative to make things work.

In the second interview, the disciplines of personal mastery and growth were clearly evident when the professional development of department team members was discussed. Team learning was also in practice and was used when a committee with many department and other team members needed to draft a standard operating procedure (SOP) for document management. Overcoming pre-established mental models was also evident during the process of developing this SOP, as no one had a clear idea of what the other team members did. Any preconceived ideas were dismantled as members of this team learned to work together to accomplish this task. Because the team was diverse and committee members had various skills and knowledge, a successful SOP was developed. The organizational culture also supported building a shared vision and connecting team members to the big picture. Team members knew the work that they accomplished helped the faculty get the research done. Team members were asked to consider how they fit within the team and how their work made an impact in the day-to-day tasks that needed to be accomplished.

Phase II Study

The phase II survey was distributed to a broader population of research administrators. In addition to members of the Research Administration listserv, research administrators from the following groups were invited to participate: the Association of University Technology Managers (AUTM), the Society of Research Administrators International (SRAI), the National Council of University Research Administrators (NCURA), the Research Administrators Certification Council (RACC), the National Organization of Research Development Professionals (NORDP), the Research Administrators Network (RAN), the Association of Clinical Research Professionals (ACRP), Grants Writers/Grant Writing (GW), and the InfoEd group. The SurveyMonkey link was distributed through various listservs, discussion groups, emails and social media. The phase II survey started on May 3, 2015 and concluded on July 10, 2015 with 609 responses received,

yielding a 0.6% response rate.

Respondent demographics were similar to those from the pilot survey. The short form of the DLOQ was used and 520 responses were received. The highest-rated area was in Strategic Leadership for Learning and the lowest area was in Continuous Learning.

Of the 609 people who participated in this survey, respondents were predominantly female (84.9%), a result consistent with the field (Shambrook & Roberts, 2011). Most respondents were white (79%) and had graduate-level education (42.18%). Most responses were received from participants aged 45-54 (30.21%). The reported areas of highest general responsibility included pre-award (24.57%) and pre- and post-award management (31.09%). Most participants worked in a university (59.11%) with 1,001 – 10,000 employees (44.25%), and were in the areas of middle management (37.5%). The majority of these respondents also spent 1-10 hours per month outside of work on work-related learning (72.08%).

Overall Results

There were many consistencies between the data collected in the pilot and phase II studies. Overall, the results of the pilot and phase II surveys indicated that participants had some familiarity with the Five Disciplines model and some of these learning organization concepts were evident in their organizational culture.

One key item to note is that respondents were participants in various listservs and email groups and therefore survey responses were limited to this community. The survey was not directed toward particular organizations or groups of research administrators except for those previously referenced. Demographic factors were compared using the Fisher's Exact Test through an online calculator and the Cochran-Armitage Trend test using XLSTAT through an Excel add-in. Areas of significance between data sets include ethnic background and area of general responsibility. There was no significant difference in the areas of gender, education level, age, organizational role, work-related learning, organization type, and number of organizational employees. This is represented in Table 4.

Table 4. Pilot Survey and Phase II Survey Demographics Comparison

Question	Distribution	Pilot n	%	Phase II n	%	P Value
Gender	All	168	100	609	100	0.0179a
	Male	13	7.80	79	15.10	0.053b
	Female	153	92.20	445	84.90	
Ethnic Background	White	146	88	412	79	0.246b
	African American	4	2.40	31	6.00	
	Asian American	4	2.40	19	3.70	
	Latino American	7	4.20	17	3.30	
	Native American	1	0.60	2	0.40	
	Other	4	2.40	22	4.20	
	N/A	0	0	17	3.30	

Education level	High School	0	0	3	0.57	0.006b
	Some College	5	3.07	31	5.92	
	College Degree	57	34.97	176	33.59	
	Graduate	77	47.24	221	42.18	
	Post Graduate	24	14.72	83	15.84	
	Other	11	6.75	10	1.91	
Age	18-24	0	0	0	0.00	0.246b
	25-34	21	12.70	63	12.05	
	35-44	59	35.50	148	28.29	
	45-54	38	22.90	158	30.21	
	55-64	42	25.30	125	23.90	
	65-74	6	3.60	26	4.97	
	75+	0	0	3	0.57	
General Responsibility	Gen Mgt	12	7.40	67	12.86	0.0062b
	Oper	7	4.30	35	6.72	
	Fin/Acct	12	7.40	49	9.40	
	Admin/HR	3	1.80	14	2.69	
	Mark/BD/Comm	1	0.60	6	1.15	
	Technical/R&D	1	0.60	12	2.30	
	Legal	3	1.80	13	2.50	
	Pre	54	33.10	128	24.57	
	Post	15	9.20	35	6.72	
	Pre & Post	55	33.70	162	31.09	
Role	Sr Mgr	31	19.10	91	17.50	0.9146b
	Middle Mgt	57	35.20	195	37.50	
	Supervisory	12	7.40	44	8.46	
	Tech/Prof	55	34	171	32.88	
	Hourly	7	4.30	19	3.65	
Work Related Learning	0 hrs	10	6.10	30	5.74	0.127b
	1-10 hrs	127	77.90	377	72.08	
	11-20 hrs	21	12.90	85	16.25	
	21-35 hrs	1	0.60	17	3.25	
	36 hrs	4	2.50	14	2.68	
Organization Type	University	110	68.32	305	59.11	0.097b
	Academic Med Ctr	14	8.70	52	10.08	
	State	3	1.86	11	2.13	
	Fed	2	1.24	11	2.13	
	Hospital	10	6.21	55	10.66	
	Non-profit	22	13.66	72	13.95	
	For Profit	0	0.00	10	1.94	
	Other	7	4.35	23	4.46	

Number of Organization Employees	0-500	29	17.80	90	17.24	0.321b
	501-1000	18	11.00	51	9.77	
	1,001-10,000	78	47.90	231	44.25	
	10,001-50,000	33	20.20	124	23.75	
	Over 50,000	5	3.10	26	4.98	

Notes: a. Test performed using online Fisher Exact Test calculator (www.socscistatistics.com).
b. Cochran-Armitage Tests performed using XLSTAT

The DLOQ results from the pilot and phase II surveys showed that Continuous Learning (3.38) and Inquiry and Dialogue (3.44) rated highest in the pilot survey while Strategic Leadership (3.86) and Inquiry and Dialogue (3.78) were the highest-rated in the phase II survey. The only similarity in results was in the Inquiry and Dialogue section. This information is presented in Figure 1.

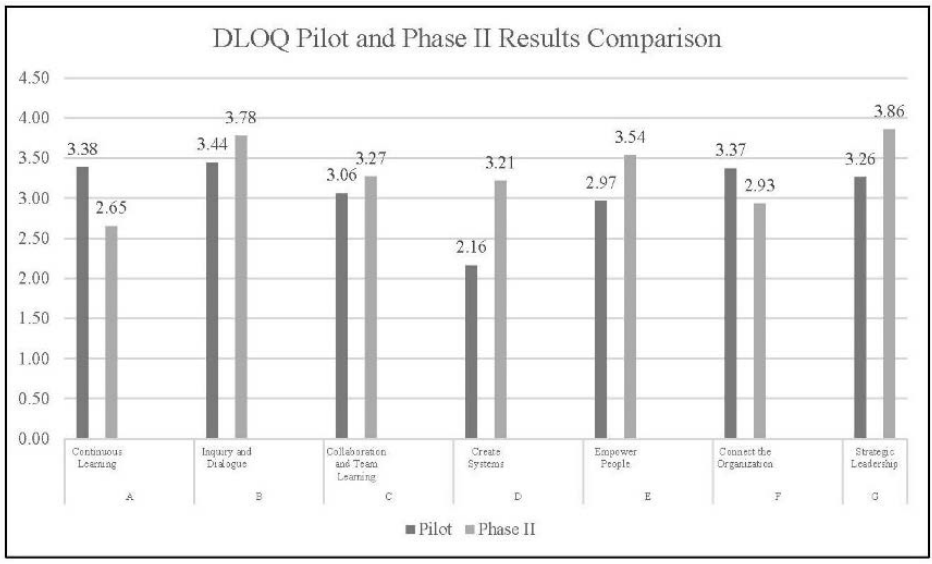

Figure 1. DLOQ Pilot and Phase II Results Comparison

Discussion

The first research question was explored in-depth in the pilot phase and focused on the extent to which research organizations use the Five Disciplines model in their development as learning organizations. For each of the components of the model, respondents could select from the following options: "None" (no familiarity); "Some" (some familiarity); "Very" (very familiar with the specific component); and "Use Day to Day" (daily use of the specific component). Most respondents indicated familiarity with the five disciplines. Overall results include:

1. Systems thinking: Some familiarity = 52.3%
2. Personal mastery: Some familiarity = 52%
3. Mental models: No familiarity = 48.4%
4. Shared vision: Some familiarity = 53.9%
5. Team learning: Some familiarity = 47.1%

The second research question focused on key themes and trends mentioned by research organizations that helped explain their views on the five disciplines model. Results from the DLOQ indicated that Knowledge Performance (rating at 3.45) and Strategic Leadership for Learning (rating at 3.86) were the most highly-rated dimensions.

The third research question was related to the attitudes and perceptions of the Five Disciplines model that exist within research organizations. Cumulative results from the DLOQ indicate that learning is highly valued. The DLOQ was used in the pilot and phase II surveys. To determine overall responses of the RA population, ratings were averaged between the pilot and phase II surveys with Strategic Leadership at 3.56, Collaboration and Team Learning at 3.16 and Continuous Learning at 3.01.

A review of the overall DLOQ scores shows participants indicated that their organizations had strong leadership but were lacking in on-the-job learning opportunities, education, and growth.

Conclusion

This study was the first inquiry related to the Five Disciplines model and the DLOQ instrument in relation to research organizations. This investigation gathered both qualitative and quantitative data. Results from the pilot survey revealed that most participants had some familiarity with each component of the Five Disciplines model, especially shared vision and systems thinking; this was also evident in the case study interviews. Results from the DLOQ surveys identified specific areas of organizational strength and weakness.

Recommendations

Research administration is a constantly evolving profession that is vulnerable to external and internal pressures with research organizations functioning in an environment of constant change and continually shrinking resources. It is clear that effectively managing change will be a constant challenge for research organizations. However, while change can be challenging, there is also opportunity for these organizations to become more adaptive, flexible, and productive learning organizations. Becoming a learning organization is an evolutionary process that begins with engaging employees at every level in the process.

Key recommendations arising from this study include performing a learning organization assessment, building capacity for shared vision, promoting a culture of learning, and integrating systems thinking approaches to develop the Five Disciplines model and promote a learning organization culture. Rationale for these recommendations is based on responses to the DLOQ.

Recommendation 1 - Perform a Learning Organizational Assessment

Research organizations must deal with issues associated with limited funding, increased competition and increased regulatory oversight in a constantly changing and evolving environment. Consequently, there needs to be a method to manage this efficiently and effectively.

Performing a learning organizational assessment is one of the first steps to determine organizational performance and what can be improved. In the literature, it is evident that there is concern that managers may lack practical tools and guidelines to reference when developing a learning organization (Goh, 1998). Adopting a tool to perform an organizational assessment on a team, department, or organization is the first step in identifying strengths and weaknesses in organizational learning culture. Practicing RA leaders and senior administrators can position themselves as champions for an organizational assessment. Determining the "lay of the land" is a critical first step in evaluating past and current practice and identifying gaps that prevent the RA team from achieving synergy and effective overall operations as a learning organization. Those newer to the RA profession can also be effective advocates for an organizational assessment and should ask questions. The five W's (who, what, where, why, when) are simple basic questions that can really flesh out a practice or procedure and help the team get back to basics.

From responses to the DLOQ, Knowledge Performance and Strategic Leadership for Learning were the most highly-rated learning dimensions. Knowledge performance is an indicator of the knowledge capacity of an organization (intellectual capital). A high rating in strategic leadership indicates solid organizational leadership where leaders model and are champions of learning. This is consistent with the literature emphasizing research administrators as thought leaders (Atkinson, Barrett, & Gilleland, 2007) and showing the value of successful leaders (Campo, 2014; Willenberg, 2014). In addition, Campo (2014) advocates that each individual is in a position of leadership in an Office of Sponsored Programs. Results from the DLOQ also highlighted areas of potential improvement include Create Systems and Connect the Organization. Creating systems involves using high and low technology systems to share learnings and integrate work. Connecting the organization relates to people realizing the effect of their work on the organization and environment and adapting as necessary. Cumulative scores were averaged from the pilot and phase II surveys and were 2.68 and 2.73 respectively (see Figure 1).

In summary, the results indicate that research organizations have a strong intellectual capital and leaders that champion learning. But there is a disconnect in using technology to create and integrate work and connecting people to the organizational environment. Adopting an inquisitive approach and conducting a learning organization assessment will help identify what's working well and areas of potential improvement.

Recommendation 2 - Build a Shared Vision

Research administration is a constantly evolving profession and sometimes RAs may experience an identity crisis (Trindale & Agostinho, 2014). The second recommendation based on the findings from this study is to build capacity for shared vision. Participants in the pilot survey indicated that they had the most familiarity with shared vision, rating this component of the Five Disciplines model at 53.9%. Building capacity for shared vision includes providing training for

leaders to learn leadership skills (Campo, 2014), encouraging an environment of dialogue and innovation, and supporting personal growth and development. Leaders and senior administrators should be mindful that building a shared vision is not a top-down strategy and leadership is not exclusive to management level positions. A shared vision should be built with the involvement of the RA community regardless of job title or position. Many RAs demonstrate leadership in their day-to-day work and have gained valuable expertise in their roles. Promoting a culture of inquiry and dialogue will encourage transparency and build trust as the vision is developed. This will also ensure everyone has input and that there is buy-in to put the shared vision into practice.

Building capacity for a shared vision and developing the vision may seem overwhelming or daunting at first. It is important to remember that this is a process with many components and it could take months or even years to complete. One of the advantages of the RA profession is that it is comprised of communities of learners and there are resources available. Professional organizations such as SRAI and NCURA offer advanced leadership training. There is a growing body of RA literature that depicts how other organizations have approached development. Further, there are colleagues at other institutions that may be subject matter experts that could share resources they have developed. An email to one of the many RA listservs could produce some intriguing resources.

Recommendation 3 - Promote a Culture of Learning

A learning organization champions the collective learning process for employees at every level of the organization. Research organizations value learning and encourage continued education. Many research administrators hold a Bachelor's or higher-level degrees (Shambrook & Roberts, 2011). Demographic findings indicate that most participants had graduate-level education. Cumulative results from the DLOQ reflect that learning is highly valued. Building a learning community involves identifying gaps in knowledge, sharing and developing ideas, and learning from mistakes and reflection (Gannon, 2011). Three specific learning dimensions were measured and overall values from the pilot and phase II surveys show that Strategic Leadership was the highest-rated area at 3.56, Collaboration and Team Learning rated at 3.16, and Continuous Learning at 3.01. Continuous Learning is related to on-the-job learning to promote education and growth for individuals. This area was rated high in the pilot phase but was the lowest-rated area in the phase II survey. This seems to suggest some conflicting views among participants and could be an overall area of improvement. This outcome is consistent with over 72% of respondents indicating that they spent 1-10 hours outside of work on work-related learning. To better promote a culture of learning, research organizations should also include on-the-job learning opportunities.

Research administrators are learners. With changing regulations, updated sponsor guidelines, and a flurry of new opportunities to pursue, there is a constant stream of new information to learn and process. Organization and department budgets are shrinking and this often limits resources available to pursue conferences and other professional development opportunities. Leaders and practicing administrators should therefore seek opportunities to promote onsite training and development and also look for local (chapter and regional) training and education opportunities as offered through SRAI and NCURA. In addition, many RA training and education organizations

are in desperate need of volunteers. Volunteering with one of these groups would benefit the individual research administrator and also the organization, as this individual can share what they learned with the RA team.

Recommendation 4 – Integrate Systems Thinking

The last recommendation from this study is for research organizations to better integrate a systems thinking approach. Systems thinking integrates all of the Five Disciplines into the learning organization model. Research administration from a systems perspective involves many interdependent components to include sponsors, people, and processes working together and can promote cooperation, shared responsibility, and improved performance (Kirby, 1996). The results of this study add to the body of research knowledge by validating that systems thinking is one of the most familiar learning organization concepts. In the pilot survey, the highest rated area from the DLOQ was Knowledge Performance, suggesting that most respondents thought their organization had systems to capture and share knowledge. In addition, pilot survey respondents indicated a 52.3% familiarity with systems thinking. While Systems Thinking was highly rated, results from the DLOQ also reflected areas of potential improvement to include Create Systems and Connect the Organization. Cumulative scores from these learning dimensions were averaged from the pilot and phase II surveys and scored 2.68 and 2.73, respectively. Creating Systems involves maintaining and utilizing both high and low technology to share and integrate learning with work while Connecting the Organization is related to connecting people to their environment, adjusting work practices based on information, and linking the organization to communities (Marsick & Watkins, 2003). Improving technology sharing and integration, and ensuring connections between people, their environment, and communities, will improve the systems approach for research organizations. One of the basic first steps for leaders and research administrators to consider when integrating a systems thinking approach is to view the issue, problem, or process from a holistic perspective. Involve the RA team as well as other departments, teams, and individuals in the process. Differing perspectives will help flesh out an issue in-depth and ensure there is investment from all parties for a resolution. Some basic approaches that can be used to facilitate the planning process and problem solving include creating a process map or using a fishbone diagram (Madison, 2005).

Suggestions for Future Research

Directions for future research could involve many other studies. For example, a similar study could be conducted evaluating leadership styles and behavior by type of research organization and how this influences learning organization culture. Additionally, future studies could evaluate if the type of research organization influences how the Five Disciplines model is used. It would also be interesting to evaluate if gender, age, or organizational role influences outcomes. An additional phase of the study could be conducted and include these variables as additional outcomes. Follow-on studies could be conducted to evaluate the rate of success of various research organizations' use of the Five Disciplines model.

Author's Note

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Development of a Pilot Grants Program in Social Determinants of Health in American Indian Health: A Program for Increasing the Representation of Underrepresented Groups in Funded Research

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Abstract: *The problem statement for this manuscript is to describe the literature on grant funding for underrepresented investigators, particularly American Indians, and detail the CRCAIH Pilot Grant Program and its success in developing underrepresented researchers (e.g. American Indian, early stage investigators). Grant funding is increasingly difficult to receive and the demographics of NIH grant awardees have shifted in recent decades to funding investigators that are more experienced. Additionally, racial disparities in awardees exist, particularly among American Indian (AI) researchers. Pilot grant funding mechanisms can be used by early stage investigators to collect preliminary data, which is beneficial for applying for NIH grants. The Collaborative Research Center for American Indian Health (CRCAIH) Pilot Grant Program (PGP) was aimed to increase research on the topic of social determinants of health in AI population health. Since there are no existing procedures for creating a PGP, CRCAIH created a PGP, and the processes are detailed here. Over four years, the CRCAIH PGP funded 15 projects with 47% of PIs or Co-PIs self-reporting as AI. Future directions for the CRCAIH PGP, including a mentoring program to provide more guidance and capacity building to the investigators, are also detailed.*

Keywords: *Pilot grant program, American Indian, racial disparities.*

Introduction

NIH Research Funding

Funding and grants are becoming increasingly difficult to obtain (Daniels, 2015; National Institutes of Health, 2017d). NIH funding for studies and projects have evolved over the years to promote and encourage different types of researchers to apply. The NIH alone has 240 distinctive funding mechanisms through the organization (National Institutes of Health, 2016). However, in the research community, the recognized standard of an independent researcher is receiving an

NIH R01 grant (Daniels, 2015; Levine, 2007; Tragesser, 2011), which is NIH's earliest and oldest funding mechanism (National Institutes of Health, 2016a). This increasingly competitive grant (and its grant equivalents) only had a 20% success rate for those who applied in 2016 (National Institutes of Health, 2015c). Therefore, it is imperative to have a quality study and accompanying preliminary data to apply for an R01 grant, particularly for first-time R01 applicants.

As a part of their "Next Generation Researchers Initiative," which was implemented in 2017 to encourage independent research careers, the National Institutes of Health (NIH) modified the definitions of the stages of career researchers (National Institutes of Health, 2017d). One area of interest to the NIH, and a main focus of the "Next Generation Researchers Initiative" (National Institutes of Health, 2017d) is the development of early stage investigators, which the NIH defines as,

> A Program Director / Principal Investigator (PD/PI) who has completed their terminal research degree or end of post-graduate clinical training, whichever date is later, within the past 10 years and who has not previously competed successfully as PD/PI for a substantial NIH independent research award. (National Institutes of Health, 2017c).

Disparities of NIH Grant Awardees

Early stage investigators can be of any age, race, and gender, but it is increasingly difficult for any early stage investigators to secure significant funding, such as an R01-equivalent grant, from the NIH. In 2016, for applications where the contact Principal Investigator (PI) was a first-time investigator, the success rate was only at 16%; this is down from 23% in 1998 (National Institutes of Health, 2015b). Of NIH R01-equivalent grant applicants in 2016, only 32% were applying for the first time, which is down from 39% in 1998 (National Institutes of Health, 2015b).

The NIH has tried to lessen the disparity between first-time and established researchers through several methods. One attempt by the NIH suggested imposing a funding limit for those with labs that have the equivalent of three R01 grants (Kaiser, 2017b; National Institutes of Health, 2017b). That policy, however, came with backlash as some viewed it as limiting productive labs (Kaiser, 2017a). Another recent effort aimed to assist with the development of early-stage and early-established investigators is the "Next Generation Research Initiative," launched by the NIH at the end of August in 2017, which aims to support an additional 400 researchers by restructuring classifications and adopting policies to promote diversity (National Institutes of Health, 2017d).

The majority of NIH R01 and equivalent grant recipients are white, above 40 years old, and male (Daniels, 2015; National Institutes of Health, 2015a, 2017c). Similar to early stage investigators, underrepresented researchers (e.g. racial minorities) experience struggles in obtaining funding, but there is less research about the distribution of race/ethnicity and NIH R01-equivalent grants. Hayden (2015) reported in Nature that every year from 1985 to 2013, underrepresented racial minorities received NIH funding at 78-90% the rate of other races. NIH award rates have been on the downward trend overall, but the disparity still exists. In 1985, the NIH award rate for R01 and equivalent grants was at 48.6% for Whites and 42.1% for non-Whites, while that decreased to 23.3% for Whites and 19.3% for non-Whites in 2013 (Oh et al., 2015).

The NIH readily provides age and gender data in the NIH Data Book (2018), but recent racial and ethnicity data is more difficult to find; there is a degree of opacity from the NIH in regard to race and ethnicity data of NIH grant awardees compared to age and gender. The racial and ethnicity data available about R01-equivalent grant applicants and awardees was found from 2000–2006 (Ginther et al., 2011; Kaiser, 2011). Of those years, there were a total of 83,188 applicants and of those, 58,124 (69.9%) where self-identified as White (Kaiser, 2011). A recent publication detailed the racial disparity of NIH R01-equivalent applicants and awards, which failed to address the significant disparity of American Indian (AI) researchers (Ginther et al., 2011). While Asian applicants represented 16.2%, Black applicants represented 1.4%, and Hispanic applicants represented 3.2% for NIH research grants between 2000-2006, AI applicants represented less than 1%, at 0.05% (Ginther et al., 2011).

Sadly, although Ginther et al. (2011) may be dated, it is a widely referenced source of NIH grant awardee race and ethnicity data, including specific race and ethnicity data from 2000–2006. It is disheartening to find that AI researchers are not well represented among the pool applying for R01-equivalent grants, and warrants a focus on identifying those potential applicants, awardees, and the overall research pipeline that develops AI investigators.

AI researchers represented 0.1% of employees in the science field in 2015 (National Science Foundation, 2017), so it is evident that the underrepresentation not only exists for NIH funding but throughout the industry (National Science Foundation, 2017). Minority researchers (racial minorities and women) face several barriers in building successful science careers, including receiving funding (Kameny et al., 2014). Four common barriers, as identified by Kameny et al. (2014), are institutional, cultural, skills and personal. Institutional barriers can be significant in stifling successful careers as they consist of lacking in research support, insufficient mentoring, and work politics (Kameny et al., 2014). Institutional barriers, combined with cultural barriers minority researchers experience, can place additional burdens on developing minority researchers (Kameny et al., 2014).

The NIH is working on addressing those barriers and increasing workforce diversity through several mechanisms. A national effort by the NIH is the Scientific Workforce Diversity Toolkit (n.d.) which provides guidance on how to increase workforce diversity through diversifying the talent pool, performing unbiased talent searches, outreach and networking, and mentoring relationships. Other efforts, not on a national level, include specific programs, such as The Native Investigator Development Program, which aims to assist AI/AN investigators in career development (Manson, Goins, & Buchwald, 2006).

As noted in previous literature (Manson et al., 2006), meaningful and reliable information on AI researchers is lacking. This was evident in that finding research literature outlining the lack of minority researchers in itself was not difficult; however, finding research that explicitly discussed AI researchers, particularly those who have received NIH grant funding, was next to impossible. Therefore, it is evident additional workforce development funding should be invested in building a cadre of AI researchers.

Purpose of Pilot Grants

One type of funding that is commonly used for the development of early stage investigators are pilot grants. PGPs are a unique funding mechanism that can help provide a research development opportunity to early stage investigators by providing funding to collect initial data for applying for a larger, future research project (National Institutes of Health, 2016b). The NIH provides funding for a Pilot Research Project (2016b), but many other organizations and universities have their own pilot grant programs (PGPs) that provide funding opportunities to research specific interests to that institution, leading PGPs to cover a myriad of subjects, from biomedical to social and behavioral research.

PGPs provide funding to diverse areas of research to assist investigators in testing out new and innovative methods while collecting preliminary data to use for further grant funding and research (Doody & Doody, 2015; van Teijlingen & Hundley, 2001). The process of writing, applying, and receiving a pilot grant leads to an increased, competitive experience in future applications (Moore, Carter, Nietert, & Stewart, 2011). The eventual goal is to guide the research trajectory of early stage investigators into empowering them to do non-pilot project studies and gain independence as a researcher. PGPs also provide capacity-building opportunities to further develop the researcher's skills necessary for performing future studies, and therefore displaying the scientific rigor of the investigator (Moore et al., 2011).

As other funding mechanisms, such as corporate funding or organizational pilot grants, are becoming an attractive source of funding for early-stage and underrepresented investigators (Jahnke, 2015), the Collaborative Research Center for American Indian Health (CRCAIH) decided to dedicate funds to starting an organizational PGP. Motive for incorporating the PGP in CRCAIH included providing experience with grant writing and overall building confidence about the grant process for underrepresented investigators. The process outlining the CRCAIH PGP is described below.

Collaborative Research Center for American Indian Health

Compared to the rest of the country, South Dakota (SD) has a higher percentage of the population that identify as AI; approximately 9.0% of the population in SD are self-identified as AI, compared with 1.3% in the United States (United States Census Bureau, n.d.). This led Sanford Health, the largest employer and health care provider in the Dakotas, to try to address the issue from an organized and collaborative state and regional effort. In 2012 Sanford Research, a non-profit research organization within Sanford Health, applied for and received a five-year, $13.5 million grant from the NIMHD to start CRCAIH, (pronounced "KIRK-uh"), or the Collaborative Research Center for American Indian Health, which at the time was the largest grant ever received by Sanford Research (Elliott et al., 2016).

CRCAIH's overall goal is "to build tribal research infrastructure and transdisciplinary research teams to improve American Indian health through examination of social and environmental influences on health" (CRCAIH, 2017a). The organizational structure of CRCAIH (see Figure 1) supported that goal in many different ways: the cores and divisions, the three large research

projects, and the PGP.

Figure 1. Organizational structure of CRCAIH..

CRCAIH funded several regional tribal partners to build their infrastructure for research in various ways, mainly focusing on building their research regulation capacity through tribal codes, establishment and growth of research review boards, and related policies and procedures.

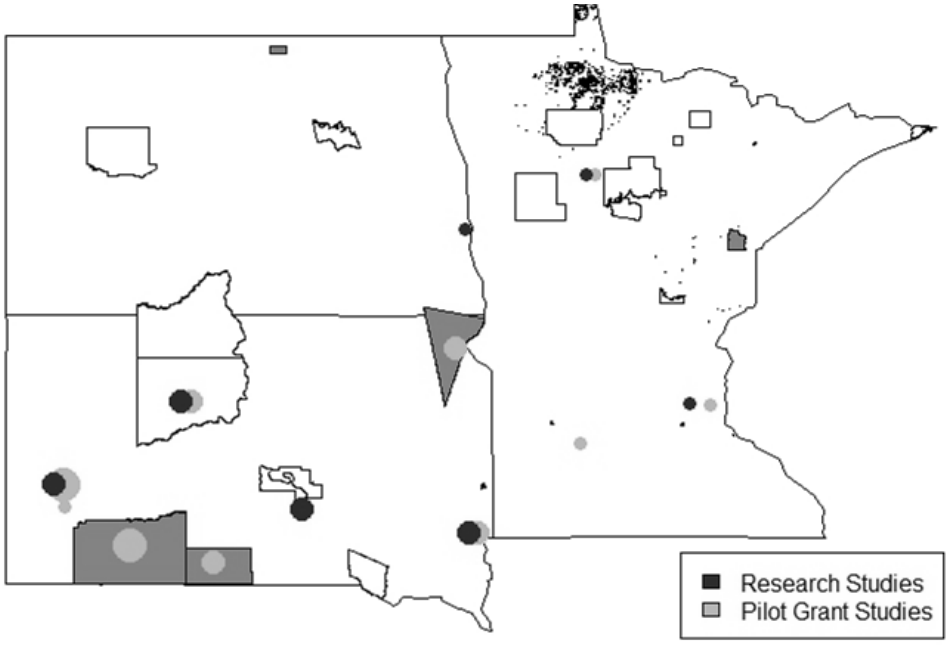

Figure 2. Research and pilot grant study locations of CRCAIH projects.

CRCAIH is comprised of three cores (Culture, Science, & Bioethics; Regulatory Knowledge; and Methodology) and two divisions (Administrative and Community Engagement & Innovation). The creation of CRCAIH was not to be a single effort to expand the research knowledge of AI health disparities, but rather to be a common platform to provide communication and infrastructure to unify efforts through partner tribal nationals, research institutions, and healthcare organizations (Elliott et al., 2016).

The original aims of CRCAIH were to: (1) establish strong relationships needed for tribal research on AI health disparities; (2) provide capacity-building assistance to help tribes create and manage research in the future; (3) perform three studies on regional AI health issues; and (4) fund and maintain a PGP to research health disparities among AIs (CRCAIH, 2017a). CRCAIH was successfully able to address each aim during the initial funding period, including the PGP, which lasted for the duration of initial five years of CRCAIH funding (CRCAIH, 2017d).

However, through the NIH/NIMHD Transdisciplinary Collaborative Center grant (National Institute on Minority Health and Health Disparities, n.d.) that funded CRCAIH, there are no pre-established procedures to follow for creating a NIH-funded pilot grant program. Therefore, CRCAIH supported research projects, cores, divisions, and developed the PGP collectively, from the beginning.

This paper aims to describe the CRCAIH PGP and its role in developing underrepresented

investigators, including AI researchers and early-stage investigators, and adding literature to the knowledge gap of AI health research. The process of developing the CRCAIH PGP and sharing lessons for other organizations considering starting a PGP will also be discussed.

CRCAIH Pilot Grant Program Process

As a part of the Administrative division, the PGP was a significant undertaking of CRCAIH. The CRCAIH PGP had two specific aims: (1) provide a funding mechanism for the formation of transdisciplinary research teams within North Dakota, South Dakota, and Minnesota, to initiate research on significant health issues for AIs in the Northern Plains, and; (2) create a rigorous independent peer review process to provide the selection of quality pilot projects in line with CRCAIH goals and identified priority areas and to provide useful feedback to all submitting investigators to help improve future grant submissions (CRCAIH, 2017d).

It took less than a year to plan the PGP as the first Request for Applications (RFA) had a 2013 Spring release date, after funding started in September 2012. There were four separate rounds of funding pilot grant projects, each for a maximum of one year and $100,000 in direct funds per project. The CRCAIH PGP process followed a fairly standard order that took approximately one year to complete for each round of funding. Table 1 outlines the PGP process and the amount of time allotted for each step for applications from release RFA to the beginning of the pilot grant funding.

Table 1. CRCAIH Pilot Grants Program Process Timeline for Each Round of Funding.

Fall	**CRCAIH Pilot Grant Subcommittee Meetings** • Review and revise RFA, application package, scoring criteria; & review timeline and set deadlines **CRCAIH Pilot Grants RFA Released** **CRCAIH Cores and Divisions Technical Assistance & Trainings**
Winter	**CRCAIH Pilot Grant Applications Received** **Triage (*1 week*)** **Pilot Grants Sent for External Review (*4 weeks*)** • Applications reviewed and funding recommendations made to CRCAIH Pilot Grants Program Subcommittee
Spring	**CRCAIH Pilot Grants Approved by Subcommittee (*2 weeks*)** • Funding recommendations from External Review Committee reviewed and Pilot Grants selected to move forward to NIH **Pre-Award RGO & Regulatory Knowledge Core Notified of Funding Decisions** • IRB, FWA, and CITI Certifications requested from selected applicants **Awardees Notified - Just-In-Time - Phase I (*2 weeks*)** • Selected applicants notified of potential award; other support, eCOI, and, if needed, budget and narrative modifications collected **Applications Reviewed for IRB, FWA & CITI Certifications** **Selected Pilot Grants Submitted to NIH for Approval**

Summer	**Just-In-Time – Phase II** • IRB, FWA, and CITI Certifications finalized from selected applicants; documents collated by project and provided to Post-Award RGO upon completion for each project **IRB, FWA & CITI Certifications Submitted to NIH** **CRCAIH Pilot Grants Reviewed by NIH** • Applications reviewed and either approved or denied **Just-In-Time – Phase III** • If requested, additional information is collated and returned promptly to NIH **CRCAIH Pilot Grants Approved by NIH** **CRCAIH Pilot Grants Awarded** • NOGAs sent to Pilot Grant PIs and institutional representatives

Release of RFA. CRCAIH released an RFA for each round of funding that detailed the specific sections and requirements in submitting an application for the PGP. The RFA was not a rigid document, but rather fluid to outline changing priorities and feedback. Significant changes in RFA include, from round 1 to round 2, expanding the application period from 8 to 14 weeks, due to feedback about potential applicants wanting additional time for grant preparation. Often, NIH (2017a) and other federal grants release the funding announcement only 6-8 weeks before the deadline, so CRCAIH Administrative division and the Pilot Grants Subcommittee felt this time period was acceptable.

Other changes in the RFA throughout the CRCAIH PGP highlighted the increased importance of community-based participatory research (CBPR) and Tribal Research Priorities. For example, in the RFA from round 1 to round 2, Letters of Support went from "Recommended" to "Required" for any collaborating or tribal partner included in the CRCAIH PGP application. The importance of changing CBPR from "Recommended" to "Required" stemmed from the commitment of CRCAIH to not only add knowledge to AI health disparities research, but to ensure that the researchers were building strong relationships with the tribes involved in their pilot studies, relating back to Aim 1 of CRCAIH.

Another significant change in the RFA occurred between 2014 and 2015. In order to show CRCAIH's dedication to AI health and health disparities, and entire section called "Tribal Health Research Priorities" was added along with examples of what those types of projects might look like. Tribal priorities were also highlighted in the 2015 RFA (round 3) by the addition of the "Tribal Approvals" subheading in the Human Subjects section that outlined how appropriate Tribal Approvals would be required before any funding would be received.

Other updates may not have been as direct as adding the sections on tribal health, but nonetheless were important in evolving the RFA to provide as much relevant information as possible. The resources were updated every year to provide relevant information, and between round 1 and round 2, applicants were required to submit the narrative of their application in a Microsoft

Word™ document to make sure it fit the page requirements.

Letter of Intent. The Letter of Intent (LOI) was not a required document when submitting for PGP funds, but strongly recommended in the RFA. LOIs are a common practice when applying for grant funds. Specifically, for the CRCAIH PGP, it was encouraged as a way to draw in investigators in order to follow up and encourage them to connect with the CRCAIH cores and divisions for assistance in designing their study and preparing their application.

Application Due. During the first round of funding for 2013, an application form was available from the CRCAIH website as a fillable Microsoft Word™ document. That application was due by 5:00 pm CST to the Sanford Research Grants Office. Besides the Technical Assistance webinar held by the grants office, applicants did not require much other guidance when submitting the application.

Internal Grant Office Triage. The internal grants office (analogous to a sponsored projects office) conducted the first step of the application review with a checklist for completeness of the grant, adherence to the instructions, and eligibility of the organization and Principal Investigator. Only three submitted applications were triaged over the years and not sent on for external review due to reasons such as lateness in submission and research strategy extending past the page limit.

External Review. An important aspect to developing the CRCAIH PGP was the decision to have a rigorous review process. This was created to be similar to NIH review process to prepare CRCAIH PGP applicants for an NIH grant application and review process after their experience with the CRCAIH PGP.

To maintain objectivity, the external reviewers were not affiliated with CRCAIH or the applicant institutions. They were recruited by the lead of the PGP, and included colleagues from conferences and previous university affiliations, as well as referrals from several CRCAIH staff from their previous universities. Reviewers came from organizations spanning three time zones and two countries (e.g., Alaska, British Columbia, Arizona, and Alabama). To help bring a transdisciplinary perspective, various disciplines in community-based and minority health were represented, with at least half focusing on American Indian health. The reviewers were split evenly between early stage and senior investigators. The group benefited from stability across the years, with ten reviewers covering the eight slots over time, and with five reviewers involved all four years. Reviewers were paid a $1000 honorarium as a "thank you" for their time and commitment to a thorough review.

After reviewers had committed to the review, they were sent their assigned applications and a conflict of interest statement, which they signed and returned after confirming they were not in conflict with their assigned applications. After the first year, the date of review was chosen and reviewers confirmed they could attend before applications were sent out for review.

The first year of the program had the largest number of applications, and only a primary and secondary reviewer were assigned for each application. For the following years, CRCAIH moved to having three (Primary/Secondary/Tertiary) reviews of each application. The benefit of taking an average of three scores per application versus two was so there is less chance of positively or

negatively skewed reviews. Reviewers' scoresheets were due a week before the teleconference review so the combined scores could be calculated and rank ordered. After receiving reviewer feedback, the second year onwards, a private online file sharing space was used to upload files, and the other reviews were posted. Reviewers were encouraged to read other reviews before the teleconference to understand the other assigned reviewers' perspectives and why their scores may differ.

The review was via teleconference and led by the Program Director/Chair of Pilot Grants Subcommittee. Each year, the meeting took no longer than 2 hours, with at least the top half of the applications discussed, with a vote at the top and bottom of the meeting to discuss any of the bottom applications. Additional comments that arose during the review were added to the detailed comment sheets from the reviewers and sent to the applicants to aid in improving their project for implementation or grant resubmission.

Funding Decisions. Shortly after the External Review, a PGP Subcommittee meeting was held. Although the details of the applications and reviews were not released to the members, they received the project abstracts and relative ranking of the top scoring projects. CRCAIH Administration discussed the aspects highlighted by the reviewers, including concerns. This lively discussion resulted many times in confirmation of the top scoring applications being funded, however also brought about change in funding an additional project the first year at a 6-month delay because the benefits of the project were strong, but to give the Project Lead more time to prepare revisions and for budgetary reasons. It was in the first year post-review subcommittee meeting where a concern about a proposed project's buy-in/commitment from the tribal community was questioned, and the idea in future years to make the letter of commitment mandatory was established.

The applications were scored according to Figure 3 and the applications with the highest scores were funded. There were no preferences given to investigators based on their career stage. Proposed budgets could range from $25,000 to $100,000 for direct costs with indirect costs allowed at the applicant institution's approved negotiated rate. With $1.2 million available to fund the PGP, the total number of projects supported depended on the budgets of the awardees. Most project proposed budgets were closer to the maximum amount (average proposed direct costs = $77,268; average total proposed budget = $103,744), leading to a varying amount of awardees for each round, as there was only a limited amount of funding available for the CRCAIH PGP.

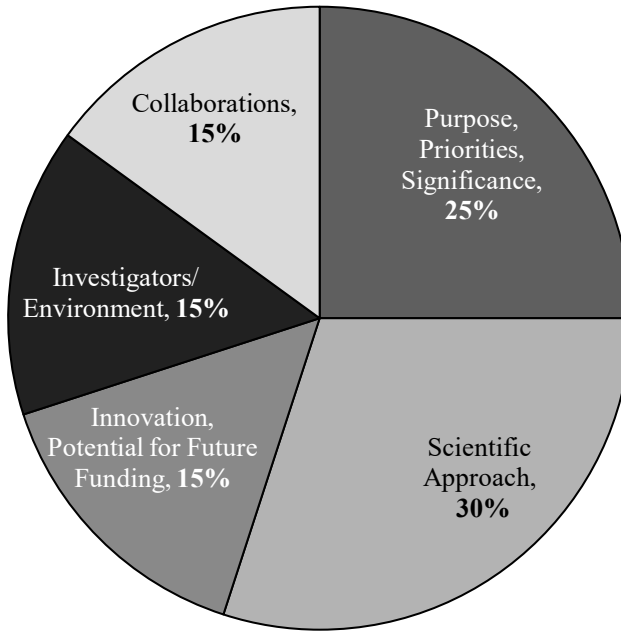

Figure 3. The breakdown of scoring categories1 of the CRCAIH PGP application (Rounds 2-4). Note: 1The NIH scoring categories are Significance, Investigator(s), Innovation, Approach, and Environment.

Request for Just in Time. Emails were sent by the grants office to the selected applicants and their organizations, asking for items such as revised budget, Institutional Review Board Approvals, human subjects training certificates, photos for publicizing, FWA information, and "other support" documentation. After the project funding decisions were made, budgets were closely examined for items that could be trimmed, and often a reduced budget amount was offered to the applicants. Recipients were given approximately 2 weeks to return the materials back to the grants office.

NIH Review. Each year, after the complete materials were received by the grants office for all the recipients, the complete packages were sent to CRCAIH NIH Project Officer and Fiscal Contact for approval. The length of this review varied, and could extend to several weeks, therefore for subsequent years of the pilot grants program the application deadline was pushed earlier to account for the final approvals and to give awardees more time to secure IRB approvals.

Funding Begins. The amount that CRCAIH offered for each pilot grant is significantly larger than traditional pilot grants due to the community involvement and the FTE involved with employing a community liaison. Approximately 68% of CRCAIH funds went outside of CRCAIH core and division services to support community partners and projects, which includes the funds dedicated to the PGP. Although awarded as a one-year project, CRCAIH permitted awardees to carry over unspent funds into a second year if requested.

CRCAIH Resources

Support from Cores and Divisions. In order for CRCAIH to achieve their aims and to assist in the development of researchers, the cores and divisions of CRCAIH were available to the applicants as resources during the application process. CRCAIH advertised three modes of communication: email, phone number, and website. Applicants were encouraged to contact the core or division relevant to their question on the RFAs. General applicant questions went to the program director and were forwarded to the appropriate core or division. The questions and responses were documented and organized by round of funding (see Table 3, right-hand column).

Website. The website was not only a communication tool, but also a resource. Along with webinar recordings, the CRCAIH website housed the CRCAIH Frequently Asked Questions, or FAQs page (CRCAIH, 2017b). The page was developed through documentation of what questions potential applicants had when contacting the cores and divisions. The CRCAIH FAQ page addressed questions from several topics including general questions, application questions, approvals, partners, principal investigators, funding/budgets, and indirect costs/facilities & administrative costs (2017b). Providing these kind of thorough resources to the applicants led to greater capacity building for the researcher and their community partner, and to stronger applications.

Webinars. After the RFA was released, CRCAIH held webinars that were directly related to the PGP. The first year of the PGP, a webinar was held/recorded with representatives from the cores and divisions to focus on what types of assistance they could provide. Each following year, a Pilot Grant Pre-Application Technical Assistance webinar was held with the Program Director and representation from the Internal Grants' Office. Those webinars were:

1. 2014 Core Division Resources
2. 2014 Pilot Grants Program Pre-Applications Technical Assistance
3. 2014 Tips on Writing a Pilot Grant
4. 2015 Pilot Grants Program – Building relationships in Community-based Research
5. 2015 CRCAIH Pilot Grants Program Pre-Application Technical Assistance
6. 2016 Pilot Grant Pre-Application Technical Assistance. (CRCAIH, 2017f)

Targeted Outreach. During the subsequent rounds of the application time periods, after the first round of pilot grant awardees, CRCAIH made targeted outreach a priority to encourage particular people to apply. This included previous applicants who were unfunded, particularly those who were close to the funding line, those applicants from tribally-based organizations, and AI investigators. This outreach was sometimes an email of encouragement, but oftentimes an in-person or phone meeting with representatives from the cores and divisions to discuss weaknesses raised by reviewers and recommendations for addressing the concerns. This targeted outreach may account for the rising percentages of applications from AI PIs, which ranged from 32% AI PI/Co-PI applicants the first year to 100% AI PI/Co-PI applicants the fourth year of the CRCAIH PGP.

Observations: Applications and Awardees

The number of awardees varied per year due to the quality of the application and the amount requested. A total of 58 applications were received and 15 projects were funded through all four rounds of the CRCAIH PGP, which is an overall success rate of 26%. The success rate varied by year, ranging from 20-40%. Although the overall success rate for CRCAIH was slightly higher than the NIH success rate of 18.8% for R01-equivalent grants during the same timeframe (2013-2016), CRCAIH did have a notable difference on race/ethnicity of Principal Investigators (National Institutes of Health, 2015c). There was no data found on race/ethnicity of NIH applicants found for the years 2013-2016, but previous numbers (Ginther et al., 2011; Kaiser, 2011) indicate that the number of AI PIs who apply and receive NIH R01-equivalent grants is incredibly low. In 2006, a total of 41 AIs were PIs on R01-equivalent grant applications, or merely 0.05% (Ginther et al., 2011). In the CRCAIH PGP, 29 AIs were listed as PIs on applications out of 58, or 50%. Table 2 outlines the demographics of the applicants over each of the four rounds of CRCAIH PGP funding, with the awardees in parentheses. Of the awardee PIs and Co-PIs, nine were AI (47%) and of the PI organizations, 27% were Tribal/Tribal Academic (CRCAIH, 2017d).

Table 2. Demographic Information of CRCAIH PGP Applicants and Awardees.

		2013	2014	2015	2016
Indicactor	**Applicant Awardees**	**Year 1 n=25 (n=5)**	**Year 2 n=15 (n=5)**	**Year 3 n=13 (n=3)**	**Year4 n=5 (n=2)**
American Indian PI[1]		**8 (2)**	**7 (1)**	**9 (2)**	**5 (2)**
Tribal Partners Lead Org/PI[2]		**3 (1)**	**1**	**2 (1)**	**1**
Tribal Partners a Site3		**13 (4)**	**9 (3)**	**6 (2)**	**5 (2)**
Early Stage Investigator PIs		**16 (4)**	**10 (3)**	**10 (1)**	**3 (1)**
PIs Organization					
Academic (non-tribal)		**15 (3)**	**5 (3)**	**6 (1)**	**2 (1)**
Research		**4 (1)**	**3 (1)**		
Healthcare		**1**	**3 (1)**		
Tribal Organization		**4 (1)**	**2**	**3**	**1**
Community non-profit				**1**	
Tribal/Academic				**3 (2)**	**2**
Tribal/Research		**1**			**1 (1)**
Academic/Healthcare			**2**		

State Project In					
South Dakota		**17 (4)**	**11 (4)**	**7 (2)**	**5 (2)**
North Dakota		**3**	**1**	**1**	
Minnesota		**4 (1)**	**2 (1)**	**4 (1)**	
South Dakota & North Dakota		**1**			
North Dakota & Minnesota				**1**	
SD, ND, & MN			**1**		
Social Determinant of Health					
Health Care		**4 (1)**	**4**	**2**	**1**
Health Behaviors		**15 (4)**	**6 (3)**	**6 (1)**	**1 (1)**
Demographics & Social Environment		**5**	**5 (2)**	**4 (1)**	**3 (1)**
Physical Environment		**1**		**1 (1)**	

Notes: Includes applications forwarded on for review (triaged: Y2 = 2; Y3 = 1); parentheses designate awarded; 1One of PIs known AI identified; 2Tribal partners (past/present/future); 3Tribal partner site involved (e.g., staff, LOI)

Table 3 lists the funded CRCAIH pilot studies by year (round), title, social determinant of health studied, and number of contacts the PI, Co-PI, or supporting staff made to CRCAIH on behalf of the grant application. Although contacting CRCAIH resources was not required for applying and receiving funding, with the amount of time and effort that went into developing the cores and divisions and their various resources, some individuals did choose to utilize those services to improve their applications. Out of the 15 awardees, 11 (73%) contacted CRCAIH about their PGP project for a total of 27 contacts cataloged for all awardees.

Table 3. List of Funded CRCAIH Pilot Grants Studies by Year/Round, Title of Project, Social Determinant of Health Studied, and How Many Contacts the Pi or Supporting Staff Made To CRCAIH During That Round of Funding About That Project.

Year	Project Title	Social Determinant of Health Addressed	PI Contacts to CRCAIH During Application Process
2013 (Year One)	Is my health care making me sick? Microaggressions in American Indian healthcare	Health Care	4
	Reliability and validity in a prevention program for Native American women	Health Behaviors	4
	Using mindfulness to reduce risky behaviors among American Indian youth	Health Behaviors	3
	Determinants of care and life quality in American Indian women with cancer	Health Behaviors	2
	Assessing the impact of lay patient advocate training in tribal communities	Health Behaviors	1
2014 (Year Two)	Impact of residential treatment on American Indian maternal-child health outcomes	Demographics & Social Environment	**2**
	American Indian pilot study on caregiving attachment and health of young children	Health Behaviors	**2**
	Walking forward American Indian survivorship physical activity pilot	Health Behaviors	**-**
	Culturally based curriculum, wicozani and suicidal ideation in Dakota youth	Health Behaviors	**3**
	Multilevel context of health-related quality of life in northern plains tribes	Demographics & Social Environment	**1**
2015 (Year Three)	Pregnancy health survey for parents of newborns on the Lake Traverse Indian reservation	Demographics & Social Environment	-
	Healthy foods healthy families feasibility study	Physical Environment	**1**
	East-Metro American Indian diabetes initiative: An evaluation of innovative community-based programs to improve the health of Native men and youth	Health Behaviors	-
2016 (Year Four)	Wac'in Yeya: The Hope Project	Health Behaviors	**5**
	We RISE (Raising Income, Supporting Education) project on the Cheyenne River Sioux reservation	Demographics & Social Environment	-

Continued Interactions

During the entire PGP process, pilot grant awardees were encouraged to continue utilizing the cores and divisions' assistance. Subcontracts were established and awardees submitted quarterly reports detailing their project's progress. Awardees were included in panel presentations and encouraged to present posters at the Annual CRCAIH Summit (CRCAIH, 2017c, 2017f). Because the panel presentations were only a snapshot of their project and findings, CRCAIH held an Annual Pilot Grant Program Seminar Series where awardees from each round were brought to Sanford Research to give a full one-hour presentation. Presentations were livestreamed and recorded for later archiving on the CRCAIH website (2017c). This presentation took place approximately 24 months after funding was officially received by the awardee. This allowed for sufficient time in analyzing data from their participation in the CRCAIH PGP. Advertisements for these presentations went out through the CRCAIH bi-weekly email newsletter. During these visits, CRCAIH arranged meetings with additional investigators to encourage collaboration, and with the cores and divisions to reignite ideas for utilization of their resources. This resulted in several new interactions, particularly in assistance with new quantitative and qualitative analyses with the Methodology Core and follow-up from CRCAIH's NIH Project Scientist to encourage applications for specific mechanisms.

Dissemination/Return on Investment

Dissemination is an important part of any type of research and CRCAIH encouraged dissemination from all parts of the organization, including those who received funding from the CRCAIH PGP. Through the Annual Summit and Pilot Grant Program Seminar Series, CRCAIH provided a venue for formal academic presentation of pilot study findings reaching a broad audience. As for peer-reviewed scholarly output, awardees currently have nine manuscripts published or in press resulting from their CRCAIH pilot grants. Additionally, there are four more manuscripts under review or revise and resubmit with several more in preparation. CRCAIH shares links to recent publications (2017e) with our listserv as well as archiving them on our website.

Despite much emphasis placed on the necessity of dissemination of research results through peer-reviewed publications, the importance of getting research results and project-generated resources back to the community should not be overlooked. Community-based participatory research (CBPR) approaches, like those undertaken by CRCAIH pilot grant PIs, seek to involve the community as equitable partners in all aspects of the research process. One of the key principles of CBPR partnerships is the dissemination of findings to all partners and involving them in the dissemination process (Israel, Schulz, Parker, & Becker, 2008). A majority of PIs indicated they provided informal presentations or reports of pilot study results to the community in which they were working. Through collaboration with the Research Ethics And Dissemination (READ) Core of Sanford Research, one awardee is creating infographics for use in social media and print campaigns to disseminate findings to the community, taking into account cultural context.

A follow-up survey was administered to the PI of the 13 projects in the first three funding cycles. Eleven PIs responded to the survey, allowing further exploration of the impact of the CRCAIH PGP. Since their participation in the CRCAIH PGP, 82% (n=9) have submitted additional grants,

including federal, state, and foundation grants. Forty-nine grant applications were reported by PIs in the years following their CRCAIH pilot grant. Some were reported more than once, reflecting a proposal which was resubmitted to a different funder or in multiple cycles. Applications for federal funding accounted for 73% (n=36) of those reported, with NIH funding mechanisms (n=24), reported most often. Other federal funding agencies targeted include: DHHS Office of Adolescent Health, SAMHSA, HRSA, CDC, and the Department of Justice. Nine grant applications (18%) were submitted to national and regional foundations (e.g. American Cancer Society, Bush Foundation, and Robert Wood Johnson Foundation). Although not always related to the topic of their particular pilot study, over 30 of these grant submissions were in the area of American Indian health research. Five (45%) indicated that they have submitted additional grants which utilized their pilot grant findings. The applicants' roles on these grants ranged from PI, to evaluation director, to consultant. Overall, 17 of the 49 reported applications were funded.

Recently, a CRCAIH PGP awardee received sizable SAMHSA funding to build on the PGP study that was conducted in that community. Three awardees, two of which were early stage investigators, also submitted NIH R01 applications. One early stage investigator's R01 was recently funded to continue her pilot grant work in that community; the other resubmitted her application in the next funding cycle. Another awardee submitted for a NIH U19 grant (unfunded). Two pilot grant awardees are currently Project Leads under the Center for Health Outcomes and Population Research CoBRE, awarded to Sanford Research in 2017. It is not just the CRCAIH PGP PIs using the CRCAIH pilot study as a springboard for additional funding applications. Four (36%) of CRCAIH pilot grant PIs reported that their partner organizations or members of their research team have submitted additional grants as a result of their involvement with the CRCAIH PGP.

Although not all awardees have peer-reviewed publications from their CRCAIH pilot grant, it must be taken into consideration that the success of a pilot study utilizing a CBPR approach with AI communities cannot be measured solely on the basis of peer-reviewed scholarly output. Employing community members from their study sites, as approximately three-quarters did, fosters a deeper connection to the community and provides a wealth of knowledge otherwise unattainable. Half included undergraduate and graduate students as members of their research team, which provides potential future researchers valuable experience. Six (55%) of PIs indicated that their CRCAIH pilot grant led to additional collaborations with members of their research team, including tribal/community organizations or additional research projects at their study sites. The CRCAIH PGP contributions to research in tribal communities and the development of future investigators will be of lasting impact.

Evaluation

Evaluation was critical to continuous improvement of the PGP processes. CRCAIH conducted surveys of potential (everyone who contacted CRCAIH for assistance) and actual applicants. For example, this is where the suggestion to extend the amount of writing time in year 1 was mentioned by several people, and changed for future years. Likewise, CRCAIH also conducted surveys among the pilot grant reviewers in years 1 and 2 to determine if improvements should be made in the reviewing process. An example of those improvements detailed above were sharing reviewers' critiques ahead of time.

2013-2014 Pilot Grant Cohort

Feedback from the 2014 Pilot Grant Completion survey on how assistance pilot grant awardees received was most helpful included: "just good to know that I had a support system there to help submit the grant, ask questions about gaining IRB approval, and analyzing the data;" "assistance with the IRB and reports;" "that everyone was very eager and willing to help me answer my questions;" and "I feel I had great support and had my questions answered quickly and in a timely manner."

CRCAIH Pilot Grant Program Follow-up

Though not as structured as the evaluation of the 2013-2014 cohort, the Administrative division of CRCAIH has kept contact with the PGP awardees over the years. This has primarily been done through a survey using SurveyMonkey® on an annual basis. Overall, the CRCAIH PGP awardees have answered with positive responses of their experience in the CRCAIH PGP. Out of the 11 pilot grant awardee responses, many said it was crucial for submitting other grants, for example: "[The PGP] gave us the opportunity to collect pilot data necessary for R01 grant submission;" and "...the CRCAIH pilot was the perfect opportunity to gather pilot data. I think if I had tried to write this into a larger NIH grant, I would have gotten dinged because it wasn't a methodology I had done yet. But now I can say I have done it and can cite these efforts via the manuscript we produced."

Other respondents mentioned the PGP was helpful to relationship building, which is especially critical for early stage investigators. For example, "[The PGP] Increased visibility / credibility for our University-Community partnership; this is situating us as more competitive for further funding", and "the pilot program gave us the opportunity to build collaborations with the community that has led to the formation of 3 new project ideas".

Reflection and Recommended Solutions

Challenges/Lessons Learned

In establishing the CRCAIH PGP and running it for four years, many lessons were learned and corresponding improvements were made in the process along the way. For example, although the CRCAIH PGP found success with simplified application materials and scoring rubric (see Figure 3), one applicant and one reviewer over the years mentioned in the survey evaluation wanting CRCAIH to utilize the standard NIH application and scoring materials, respectively. After much internal discussion, the PGP Subcommittee decided to continue using the simplified materials because the pilot grant was often an entry point for obtaining funding, and CRCAIH wanted to create a process that was easy to navigate for research novices. However, it is important to weigh the potential benefits of utilizing the NIH forms and scoring system, because that would give both applicants and reviewers more exposure to NIH standards for their future work. In this way, it would be easier for applicants to turn their applications into submissions to the NIH.

Additionally, as shown in Table 2, the number of applications received over the four years decreased, starting at 25 in year 1 and reducing to five in year 4. While specific reasons for why

this occurred are not known, a few reasons were hypothesized. One optimistic view is that once applicants were funded, the pool of available investigators was reduced. In addition, it could be argued in subsequent years, applicants had the benefit of seeing the types of previously funded grants which helped tighten the field of applications, and the information posted on the FAQ page may have helped investigators determine their project was not a close fit for CRCAIH's purpose. In addition, previous applicants who were unfunded may have been discouraged from applying again, judging their chances of funding on resubmission not worth the time investment. It would be impossible to calculate the number of possible investigators who were interested in CRCAIH PGP funding over the course of the CRCAIH grant.

Future Directions

The CRCAIH PGP was an overall success that would continue funding projects if funding was available. Awardees who participated in the follow up provided specific suggestions and ideas for improvement of the CRCAIH PGP were it to be reinstated in the future, including "It would have been great if I could have applied for additional funding to buy me out of teaching a class so I would have had the time to submit this work for publication." Although CRCAIH continually encouraged the utilization of the core and division resources to the awardees, very few took advantage of the services after their pilot grant was funded. One idea for future PGPs would be to make the use of the cores mandatory. Similarly, another awardee recommended pilot grant trainings by cohort before funding was slated to begin, "... This could help with implementing innovative angles / ideas along the way that we might not have thought of beforehand."

If CRCAIH were to redesign a funding program in the future, it would also include a formal mentoring component. Mentoring can encourage success and is an essential part of increasing diversity in the scientific workforce (Kameny et al., 2014; National Institutes of Health, n.d.). One awardee suggested a similar idea, "Potentially providing a peer or senior mentor at some point throughout the program." Due to limitations of time and resources, much of the input for this program went into capacity-building assistance for potential pilot grant applicants. However, to better serve those awardees, more focus could be given to mentoring them throughout the project startup period, data analysis, publication writing, and future grant writing.

Another idea similar to other mentoring programs (Manson et al., 2006) is to establish ongoing group and individual mentoring meetings to establish mentorship, identify and support applications for further funding, and continue to use of CRCAIH cores and divisions for capacity-building assistance beyond the one-year pilot grant program. After notification of the pilot grant award, this would entail developing a mentorship plan to identify their strengths and weaknesses in research skills and identify one or two areas (statistics, interviewing, analyzing focus group data) to improve professional development and develop a research agenda that expands beyond the pilot grant year.

The mentorship plan would be used as a guide to match a mentorship team with the awardee, work with the grants management office to identify funding announcements and sources throughout the year, such as Career Development K-awards, and help set a timeline that includes a grant application and pilot grant publications. Mentors would provide support through activities such

as reviewing and commenting on research studies, publication drafts, and discussion on specific aims for grant applications.

The CRCAIH PGP shows the promise of investment in underrepresented investigators in AI health. There is a clear need for additional scientific workforce development funding, which should be invested in building a cadre of AI researchers.

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Enhancing Institutional Research Capacity: Results and Lessons from a Pilot Project Program

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Abstract: *The National Institutes of Health (NIH) established the Building University Infrastructure Leading to Diversity (BUILD) initiative to increase engagement and retention of undergraduates from diverse backgrounds in biomedical research. Portland State University, in partnership with ten other academic institutions, received a BUILD award and developed the BUILD EXITO (Enhancing Cross-Disciplinary Infrastructure and Training at Oregon) project. The EXITO program offers a three-year research and mentorship experience for undergraduates in biomedical, behavioral, social science, clinical, and bioengineering disciplines. The BUILD initiative also emphasizes enhancing research capacity and infrastructure through institutional change and faculty development. A key piece of EXITO's program to enhance research capacity is offering faculty an opportunity to apply for up to $50,000 of funding to carry out a one-year pilot study. We conducted two separate RFAs for this purpose, closely modeled on NIH's Small Grant Program (R03), over two years. Principal Investigators of pilot projects were encouraged to include EXITO students, or other undergraduate students, on their research teams. Students then worked on these research projects as part of EXITO's intensive mentored research program. This paper reports on methods to conduct and implement a pilot project program intended to train primarily junior faculty members to write and submit an NIH proposal and fund successful applicants to gather pilot project data to aid in applying for future proposals. We provided a step-by-step rigorous submission and review process. We provided proposal writing and revising workshops, technical support, and helped pilot project Principal Investigators (PIs) with biosketches, IRB applications, IUCUC documents, budgets, and other proposal sections. We secured at least three external (not at any BUILD EXITO institution) reviewers for*

each proposal. PIs revised proposals before resubmitting and receiving their final scores. Across two RFAs, we provided funds to twenty PIs to conduct pilot projects; these projects included at least 21 students working on them who received mentoring in research methods and in disseminating results. This paper describes important lessons learned, including the importance of: allotting sufficient time to recruit reviewers; recruiting reviewers through a variety of sources and methods; and assisting PIs in engaging with research administration staff at Portland State University and partner institutions. Challenges included: finding an optimal timeline that was neither too compressed nor too stretched out; encouraging applicants from distant partner institutions to apply and keeping them engaged and retained through the entire process; and assisting PIs from partner institutions to efficiently utilize Portland State University's sponsored projects department if similar resources were not available at their home institutions. Our goal is to provide guidance and insights to faculty and research-administration staff at other institutions interested in replicating or adapting EXITO's program to enhance institutional research capacity.

Keywords: *Pilot projects; stimulating faculty research; grant writing; faculty development; research infrastructure; research administration; faculty mentoring; BUILD initiative; diversity in research; student mentoring*

Background on BUILD Initiative

The National Institutes of Health (NIH) considers increasing diversity of the U.S. biomedical workforce to be of such paramount importance that, in 2013, NIH leadership allocated 240 million dollars from the Common Fund to establish the BUILD (Building University Infrastructure Leading to Diversity) Initiative ("Building University Infrastructure Leading to Diversity", n.d; "RFA-RM-13-016", n.d). The major aim of the BUILD initiative, which is ongoing as of October 2018, is to encourage development and evaluation of innovative approaches for effectively engaging and retaining undergraduate students from diverse backgrounds in biomedical research (Valantine & Collins, 2015). In 2013, universities that met two criteria could apply for the first round of BUILD funding: 1) received less than 7.5 million dollars of NIH funding annually, averaged over the previous three years; and 2) enrolled a high percentage of low-income students. BUILD had the goal of identifying institutions that educate traditionally underrepresented student populations and substantially enhancing research and training capacity at those institutions ("RFA-RM-13-016", n.d). Ten BUILD applicants were ultimately awarded five-year grants, at varying levels of funding, with the possibility of renewal for another five years. (For a full description of BUILD and to learn about the ten successful round one BUILD sites, see https://www.nigms.nih.gov/training/dpc/pages/build.aspx.)

Portland State University (PSU), in Portland, OR, received a BUILD award and named our initiative BUILD EXITO (Enhancing Cross-Disciplinary Infrastructure and Training at Oregon). PSU is the primary institution. We have ten partner institutions: Oregon Health & Science University (OHSU), a research-intensive academic health center in Portland; four community colleges in Oregon and Washington that contribute a large number of transfer

students to PSU; and six other partners, both two-year and four-year institutions, that span the Pacific Rim, with locations in Alaska, Hawaii, Guam, American Samoa, and the Northern Mariana Islands (see Table 1). Renewal applications were due in June 2018 and BUILD EXITO applied to renew our funding.

Table 1. Partner Institutions and Research Learning Communities.

Institution	Location	# of Research Learning Communities
American Samoa Community College[1]	Malaeimi, American Samoa	**N/A**
Chemeketa Community College[2]	Salem, Oregon	**N/A**
Clackamas Community College[2]	Oregon City, Oregon	**N/A**
Clark College[2]	Vancouver, Washington	**N/A**
Northern Marianas College	Saipan, Commonwealth of Northern Mariana Islands	**N/A**
Oregon Health and Science University[3]	Portland, Oregon	**42**
Portland Community College[2]	Portland, Oregon	**N/A**
Portland State University	Portland, Oregon	**34**
University of Alaska Anchorage[1]	Anchorage, Alaska	**14**
University of Hawaii Manoa[1]	Honolulu, Hawaii	**11**
University of Guam[1]	Mangilao, Guam	**3**

[1] Pacific Rim partner
[2] Local community college partners. A community college is a two-year institution that primarily grants associate's degrees and prepares students to transfer to four-year institutions that offer bachelor's degrees
[3] Research-intensive partner

BUILD EXITO's model and importance of pilot project program

To increase capacity for externally funded research, BUILD sites could include funding for pilot-project awards in their budgets. The primary goal of EXITO's pilot project program was to stimulate faculty research and to provide additional opportunities for research faculty to mentor students in intensive research placements. The aim of this paper is to share our insights and methods for implementing a rigorous pilot project program at a non-research-intensive university that has a high number of underserved and diverse undergraduate students. As Richardson et al. (2017) explain, the EXITO model "is guided by socio-ecological theory [and offers] a three-year research training pathway for scholars in the biomedical, behavioral, social, clinical and bioengineering disciplines" (p. 133). BUILD EXITO's model has at least seven fundamental components: student outreach and engagement; integrated curricular enhancements; intensive research experiences; multifaceted developmental mentoring; supportive community services; rigorous

evaluation and quality improvement; and faculty and institutional development (Richardson et al., 2017). Research and faculty development occurs through multiple mechanisms, including: holding curriculum development conferences; research learning communities; the pilot project mechanism; ongoing mentor training and support; and developing campus infrastructure and services to support scholars with diverse backgrounds. (EXITO's website has more details about our partners, evaluation, mentoring activities, and how scholars are recruited, trained, and retained in the program, at https://www.pdx.edu/exito/program-model.)

Our paper presents a detailed description of how we implemented a comprehensive pilot project program that featured a competitive proposal process. We incorporated strategies described and recommended by others who have implemented similar pilot project programs elsewhere, including: development of a cohort of researchers who participated in pre-award workshops on writing, revising, and submitting grants (Banta et al., 2004; Godreau et al., 2015; Rust et al., 2006); offering individualized and group coaching and consultation (Brutkiewicz, 2012; Feldman & Acord, 2002; Huenneke, Stearns, Martinez, & Laurila, 2017; Rice et al., 2014); and furnishing PI applicants with two rounds of proposal reviews conducted by external experts so that PIs had an opportunity to do an extended revision of their proposal based on expert feedback (Gordin, 2004). Post-award, we also supported grantees in writing papers to disseminate their results (this work is ongoing as of this writing) and in writing proposals to other funders, including a workshop specifically on applying for mentored career awards. PIs' dissemination efforts and proposal submissions are outcomes of the main EXITO intervention and, as such, are not discussed in detail here. The workshops were key program elements that supported faculty in achieving EXITO outcomes. Faculty applying for a pilot project grant, as well as students working with them, could participate in all or any of the workshops.

Pilot project PIs were also encouraged to join or establish an EXITO Research Learning Community (RLC). An RLC is a research team typically headed by an established investigator who already has external funding. EXITO Scholars are embedded within these mentor-rich communities in supported research placements that allow them to spend concentrated time working during the summer and academic year to learn about, and contribute to, real-life research projects. BUILD EXITO now supports 116 RLCs, mostly at PSU and OHSU, with an additional 14 at the University of Alaska Anchorage, 10 at University of Hawaii, and three at University of Guam. The pilot project program, therefore, creates additional placements in which students work on actual research projects and learn about conceptualizing a study, investigating a hypothesis, presenting a poster, writing a manuscript, attending a conference, and participating in other research activities. The pilot project program also provides a pathway for junior faculty to learn from a team of more senior researchers, through RLCs and in other fora, as we explain in detail in the Methods section (see also full RFA in Appendix I).

We provide extensive detail about our methods here, because when we first devised the model for our pilot project program, which involved recruiting large numbers of external expert reviewers, we heard repeatedly that "it couldn't be done." We report here that it can be done and explain in detail our methods for finding a large number of qualified external reviewers and for supporting PIs through the proposal process. However, in order for others to replicate, improve upon, or build off EXITO's pilot project program, they need to know precisely what we did and what

the rationales were for our decisions. In the Discussion we explain elements of the pilot project program that are significantly different from other programs seeking to place students into research settings and why they are important. We also discuss lessons learned from our program, both from successes and mistakes, as well as challenges to success.

Methods

Overview of the pilot project RFA

BUILD EXITO has released and funded two pilot project Requests for Applications (RFA), RFA1 and RFA2. The RFAs for these two rounds of funding were nearly identical and, for the sake of brevity, wherever possible we treat them here as a single RFA. One notable difference between RFA1 and RFA2 involved the timing of deadlines. All deadlines for RFA2 were more spread out, so that PIs had more time to revise their proposals between the first and second submission, and we had more time to secure outside expert reviewers (see Figures 1 and 2).

Applications had to adhere to all requirements and materials pertaining to submission of an R03, with one major difference: we required inclusion of a mentoring plan. The mentoring plan was a scorable section, giving it similar weight to an innovation or environment section. The mentoring plan had to include information about how the PI would mentor an undergraduate student working on the project, and it could include a proposal for the PI to be mentored him/herself by one or more senior researchers. In RFA1 we did not specify a page limit for the mentoring plan; in RFA2, we limited the mentoring plan to a single page and also provided sample mentoring plans to give the plans more consistency in structure across applications.

After release of the RFA, applicants submitted a one-page Letter of Intent (LOI), with a hard deadline. Because one of the goals of the pilot projects is to put PIs through a mentored dress rehearsal for applying to NIH, we treated all deadlines as firm. First submissions of proposals were due about six weeks after LOIs.

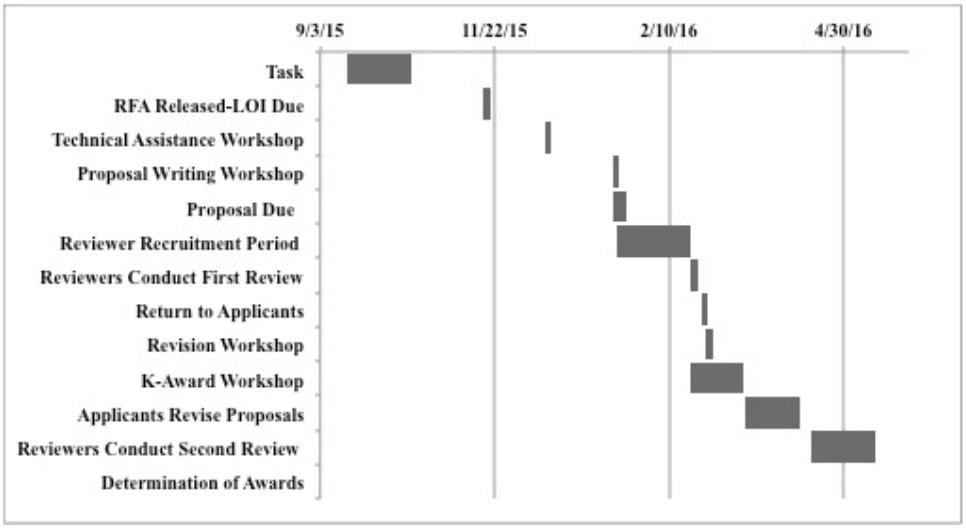

Figure 1. Timeline of RFA 1. Thinnest bars signify a one-day event.

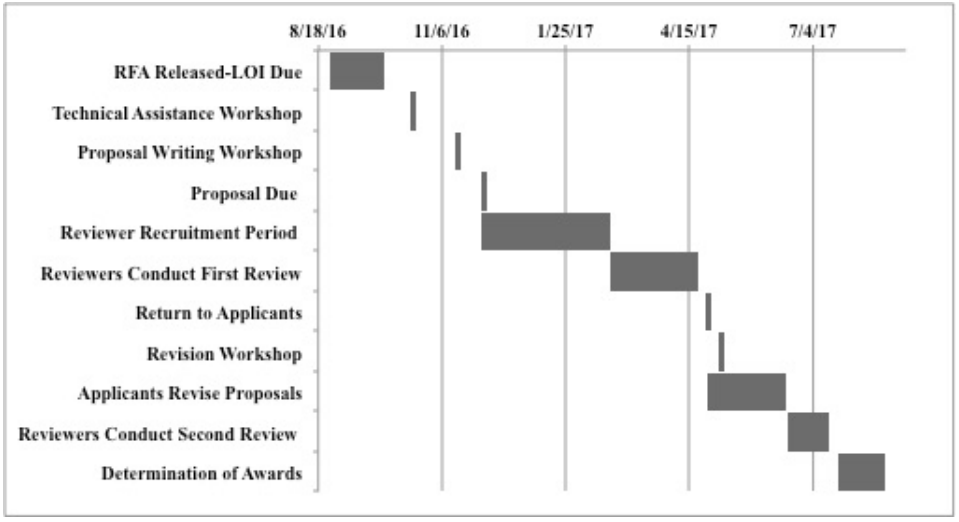

Figure 2. Timeline of RFA 2. Thinnest bars signify a one-day event.

PI eligibility and outreach to faculty

Full-time faculty at any BUILD EXITO partner institution were eligible to apply for up to $50,000 of funding for pilot-project research that had to be completed within a one-year funding cycle. We recruited faculty at PSU and our partner institutions using five outreach methods. First, at PSU, we sent targeted e-mails to faculty through department chairs in all relevant biomedical departments, including social work, arts and sciences, public health, engineering, and others.

Second, we used social media available at PSU. Third, we made announcements in an institution-wide "Funding Opportunities" list that is maintained and shared weekly at PSU. Fourth, we featured the announcement in the weekly faculty newsletter (we used similar funding newsletters at OHSU). Fifth, at our partner institutions for RFA1, we relied on EXITO newsletters and emails to EXITO faculty leads.

For RFA2, we made a concerted effort to reach faculty at our partner institutions and encourage them to apply. To increase applications from our partner institutions, some of which do not have established infrastructure for publicizing funding opportunities, we asked key contacts at those institutions how each institution communicates with faculty regularly (social media, faculty newsletter, internal bulletin board, etc.). We then reached out to the Communications Office at each college or university and made a detailed request to have the Pilot Project Funding opportunity included in the most appropriate communication platform. We created target communications based on the platform, unique institutional factors (such as location or school focus), and space available. Additionally, we asked our EXITO faculty and leadership at partner institutions to share targeted emails with colleagues. To encourage applications from partner institution faculty, we also hosted a brown bag information-sharing lunch during the EXITO summer curriculum conference and in advance of the RFA2 deadline, when we knew many EXITO faculty from our partner institutions would be at PSU. At the lunch, the pilot project coordinator gave a presentation on the RFA and we answered questions from participants about the application process, the mechanics of the program, and how to get paired with EXITO scholars. At the lunch we also gathered email addresses from potential PIs and later reached out to them individually to encourage them to apply and to share upcoming deadlines.

Support for pilot project applicants

Workshops

To support PIs in preparing their proposals, we held four workshops. Workshops were conducted in-person at PSU and were simultaneously live-streamed to partner institutions. We also made video of workshops available to be watched at any time through a link on our website, using the capture software Echo360. We scheduled workshops to account for time differences at partner institutions and posted a Frequently Asked Questions page on our website for PIs.

The first workshop was a technical workshop, led by the EXITO PI and the pilot project coordinator. This workshop described the purpose of the RFA and important details such as how applications should be submitted, various deadlines, the review process, requirements around inter-institutional collaboration, and eligibility criteria. The second workshop, led by the pilot project coordinator, was on proposal writing and grantsmanship, focusing on the NIH R03 mechanism. The third workshop, also led by the pilot project coordinator, was held after the PIs received their first set of reviews and focused on techniques for revising proposals and writing resubmission letters. The fourth workshop, led by one of the OHSU EXITO PIs, was on K Awards and other mentored career awards.

Other support

Throughout the application and review period the pilot project coordinator answered questions via email and met individually in person or by telephone with PIs who needed support in writing or had technical questions (e.g. about budgeting, biosketches, research plan strategies, etc.) Applicants could also receive help as needed from research administrators at their home institutions, or via PSU if they were at an institution that did not have research support staff. In addition, one of the EXITO PIs attended an institutional Departmental Research Administrators meeting to explain the RFA and reaffirmed the need to adhere to NIH standard protocol even though this was an internal pilot project program. The presentation highlighted that one of the ultimate goals is to increase institutional capacity to submit grants to NIH at PSU and at our four-year partner institutions.

Compliance with NIH requirements and protocols

PIs had to comply with all NIH requirements in trainings and protocols since the funding came from NIH. At PSU, this meant doing CITI training and working with PSU IRB and IUCUC departments as necessary. If PIs were at non-PSU institutions, they worked with their respective departments and completed whatever trainings their universities required. Pilot project staff and/or administrative staff supported PIs if they needed help working with IUCUC or with the IRB process, when necessary. If staff at other partner institutions were not available, PSU staff were available to help. NIH/NIGMS BUILD officers and program directors reviewed the pilot projects carefully to make sure all ethics requirements, human subjects, and animal use requirements were properly met.

Evaluation

After each workshop, we asked participants to fill out a brief survey on whether the workshops were helpful and to suggest information that might be useful in future workshops. Attendance was not mandatory but we tracked attendance for each one. BUILD EXITO Scholars were welcome to attend any workshop with or without their mentors.

Structure of review process

Our primary objective was to follow closely the NIH R03 submission and scoring process. We asked applicants to format and compile all documentation in accordance with NIH requirements. Applicants submitted proposals to research administrators at their own institutions, or at PSU if their institution did not have such staff, who reviewed them for compliance with NIH standard submission requirements and informed applicants of necessary corrections.

All submitted proposals were reviewed and scored by at least three external reviewers. Four proposals in each RFA had four reviewers. Proposals occasionally ended up with four reviewers because we always emailed more reviewers than we were looking for to guarantee we had at least three. Reviewers knew the PIs' names and were asked to identify potential conflicts of interest with PIs, but PIs did not know names of their specific reviewers. We shared the names of all of the reviewers on the EXITO website after the ranking process was completed so PIs could see the entire list and identify any reviewers with whom they may have had a conflict.

Distributing and recovering reviews

We emailed each proposal, along with a scoring worksheet (a modifiable Word document) and guidelines for review to the appropriate reviewers. We entered all reviewers and PIs into color-coded spreadsheets so we could track who had returned reviews and who had not, a complex process for hundreds of reviewers. We sent timed reminders to reviewers throughout the course of the review process to urge them to return their feedback before the due date. For the first reminder, emails were general in tone. The next set of reminders was more targeted and addressed the reviewer by name. Finally, reviewers who had not returned their reviews by the deadline received up to three phone calls, using the phone number published on their departmental page, requesting that they submit their materials (see Discussion for lessons learned about recovering reviews). We uploaded all returned reviews to a password-protected Google Drive folder. We did not return reviews to PIs piecemeal, as we wanted all applicants to get their reviews back at the same time to prevent some from having a competitive advantage over others. Instead, we waited until every PI had three reviews returned, and then we sent all reviews to the applicants within a 24-hour period.

Quality control and consistency of reviews

Whenever we received a review, we checked it within two days of receiving it for adherence to NIH's scoring guidelines and for quality. If reviewers made errors, such as providing lengthy comments but no numeric score for a particular section or forgetting that the mentoring plan needed a separate score, we sent the review back and requested the error be fixed. In RFA2, we changed our scoring template to add a dropdown menu for numeric scores.

Mechanics of revising and resubmitting

After PIs received their first round of reviews, they had about six weeks to revise and resubmit (see Figures 1 and 2). We encouraged all PIs, regardless of scores received, to revise and resubmit. To provide support at this stage, the pilot project coordinator held a proposal revision workshop which was live-streamed to individuals at partner institutions so they could participate remotely via chat. PIs then revised and resubmitted to their research administrators, using the same process as for their initial submission. Proposals were sent back to the same reviewers for a second round of scoring, with an accompanying one-page resubmission letter from the applicants responding to reviewer comments and detailing how the proposal had been strengthened.

Opportunity for reviewers to change scores in RFA2

For RFA2 only, we gave reviewers the opportunity to change their scores based on other written reviewers' scores and comments, so that our review process would more closely mimic a Study Section at NIH, where reviewers can alter their scores based on others' feedback. Once we had received all three reviews, we sent them all to each reviewer for a given proposal and communicated to reviewers that if we did not hear from them in a week's time, we would assume that they wished their scores to be left unaltered.

Reviewer identification, recruitment, and demographics

Our goal was to recruit at least three experts to review each proposal, and for the same reviewers to review the initial and revised proposals. Reviewers had to be from a non-EXITO institution and could not have published or worked with pilot project PIs previously.

Reviewer identification

We used five primary methods to identify reviewers.

1. **NIH RePORTer**: We used the NIH RePORTer, an online database of all research funded by NIH, to find names of people who had received NIH funding in fields closely related to the proposed projects, using keywords derived from applicants' LOIs. We preferentially contacted researchers whose work had been funded recently and whose work closely resembled the proposed research of the applicants. We selected reviewers who were more established in their fields over junior faculty or post-doctoral fellows, using credentials and information furnished through individuals' academic and/or departmental webpages.
2. **PubMed**: We searched PubMed for key terms related to each proposal to find experts in specific research areas.
3. **NIH Study Sections**: We asked PIs to list at least two NIH Study Sections appropriate for their pilot project were they to submit the same project to NIH for review. We then used Study Section rosters to identify reviewers. We also investigated whether Study Section participants had expertise that overlapped with the particular proposal in question. We primarily assessed expertise in the relevant area by looking at potential reviewers' own funded research, and by searching PubMed for their publications.
4. **Project Scientist**: Every BUILD site is assigned an NIH Project Scientist, separate from the Project Officer. Our Project Scientist assisted us in the implementation of EXITO activities and was instrumental in identifying a small number of NIH-funded external reviewers for projects where we encountered barriers securing reviewers.
5. **Colleague recommendations**: We recruited a small portion of reviewers through recommendations from other reviewers. We used this method as a last resort and always verified through PubMed and/or NIH RePORTer that the suggested person was an expert in the topic area.

Before we used any reviewer, we verified with him or her that the PI and the reviewer did not know each other.

Reviewer recruitment

We sent individual emails to every potential reviewer outlining the overall mission of EXITO and the pilot project mechanism and asking them to participate in EXITO as an external reviewer. This email also included the title of the project and its PI, the timeline of the requested review, and a description of the honorarium (one hundred dollars per review). We also asked about conflicts of interest. Since we were aiming for three reviewers per proposal, we initially contacted between four and six reviewers per proposal, depending on the topic, before we had any acceptances or

refusals. Potential reviewers who declined our request would sometimes refer us to a colleague they thought would be better suited for the project, whom we would subsequently contact if we thought the reviewer was a good fit based on the same criteria we used to identify our initial reviewers. If an email received no answer, we sent the same email one more time. We limited any nonresponder to two emails for the initial recruitment. In no case did we send bulk emails.

In RFA2 only, we recruited from NIH Study Sections. We did not do this in RFA1, but it is likely that many reviewers from RFA1 had also participated in NIH Study Sections. For RFA2, we also re-recruited some reviewers who had done outstanding jobs in RFA1, if we had RFA2 proposals that were in similar areas as proposals from RFA1.

Reviewer demographics (RFA2 only)

We did not have a scientific method of balancing gender and ethnicity of reviewers, nor would it have been possible to do so as making sure we simply had three qualified reviewers was a significant challenge. However, we made a concerted effort when compiling our initial list of names to have at least half female-associated names, and to solicit reviewers when indicators of potential racial/ethnic diversity were apparent.

Proposal ranking and selection for funding

Once proposals had received a final review and a final score, all proposals and reviews were read by and discussed with the NIH Project Scientist assigned to EXITO. BUILD awards are cooperative agreements with NIH that entail active involvement by NIH program officers and project scientists. The Project Scientist is different from the Project Officer and has a role similar to a Co-Investigator. We ranked all proposals numerically by averaging all reviewers' Overall Impact scores for that proposal, in addition to the Approach and Mentoring scores. For RFA1, we used the Mentoring score to help differentiate proposals where the Impact average score was identical or nearly identical. Mentoring scores were assigned by reviewers as a separate score, similar to an innovation or environment score, based on the PI's plan to mentor an undergraduate embedded in the project, and potentially a plan for the PI him/herself to receive mentoring by a senior scientist in their field. For RFA2, nearly all the mentoring plans received very high scores and thus were not useful for differentiating projects, likely because we provided sample mentoring plans to applicants. Therefore, we used the Approach score for RFA2, as it offered more variability, a change with which our NIH Project Scientist agreed. When proposal scores were too closely clustered to differentiate them based on numeric scores, we took into consideration faculty status of the PI (junior faculty received more weight), whether the PI was at a partner institution with less research capacity (affirmative received more weight) and diversity of the funding portfolio. Our NIH Project Scientist provided input in the ranking process described above.

After all the proposals were ranked, a six-person committee (the pilot project coordinator, EXITO supporting staff, key EXITO investigators with external grant review experience, and our assigned NIH Project Scientist) met to discuss the ranking criteria and to adjust proposal rankings if necessary. This committee then submitted the top fifteen proposals for discussion and final selection to the EXITO Steering Committee. The EXITO Steering Committee is

comprised of Presidents from several EXITO institutions, Provosts, Vice Presidents for Research, Chief Diversity Officers, the NIH Project Officer and two external community representatives. The EXITO Steering Committee and our NIH program officers had access to the secure Google Drive where the proposals, abstracts, and scores were stored. The Steering Committee approved and forwarded the top ten proposals from RFA1 and the top eleven from RFA2 to NIH for final approval. NIH BUILD staff made the final funding decision after a thorough review.

Post-award management

One of the EXITO project coordinators conducted the majority of post-award management, in coordination with other EXITO staff. For RFA1, we held quarterly meetings to check in with PIs. At the last meeting, the PIs presented their findings and made suggestions for improving the pilot project process and discussed the types of support they might need going forward after the funding period ended. EXITO Scholars were welcome to attend all meetings. We also asked PIs to submit quarterly reports that tracked progress on their scientific aims, career development (whether they had submitted other proposals for funding), project dissemination (whether they had submitted posters, papers, and attended conferences), scheduled meetings with EXITO students, whether they were spending the money on schedule, and on any barriers to completing their work. Appendix II is the quarterly report form. RFA2 PIs received their funds in March 2018 so their post-award management began in April 2018.

Results

Number of faculty researchers participating in pilot projects

Table 2 shows the number of applicants that went through the pilot project process for RFA1 and RFA2. Sixty-six applicants applied across the two RFAs. Attrition rates were similar for RFAs 1 and 2. As noted before, we had a higher number of applicants from our partner institutions in RFA2. In RFA1 we had one applicant not from OHSU or PSU, and in RFA2, we had five applicants not from OHSU or PSU. This difference is not reflected in the table because we combined data for the two RFAs. The higher number of applicants from partners resulted in two funded projects from non-Portland partners among the final ten funded projects for RFA2.

Table 2. Partner institution participation across two Pilot Project RFAs*

	Portland State University	Oregon Health and Science University	U. Guam	U. Hawaii	U. Alaska
LOI	74 (43, 31)	27 (9, 18)	5 (3,2)	5 (3,2)	10 (6,4)
First Submission	46 (24,22)	12 (5,7)	2 (2,0)	2 (2,0)	4 (1,3)
Resubmission	41 (22, 19)	12 (5,7)	1 (1,0)	1 (1,0)	4 (1,3)
Funded	13 (6,7)	5 (1,4)	0	0	2 (0,2)
% Funded of Resubmissions	31.71%	41.67%	0.00%	0.00%	50.00%

Note: Participation is characterized by the home institution of the PI. Numbers in parenthesis denote (social science applications, bench science applications)
*Two-year college faculty were not eligible to submit as PIs

Participation in workshops

Because Echo360 does not show how many people are logged on remotely, we may have incomplete records of how many people attended the workshops. However, via the chat mechanism of Echo 360 we could roughly ascertain the numbers of people attending remotely. On average, 30-45 people attended each workshop, inclusive of both online and in-person attendees.

Attrition rate of PIs

Despite the varied challenges the longer and shorter timing provided, attrition of PIs between the first and second proposal submission was the same in both RFAs—6%, or two from each RFA. In each of these cases but one, extenuating circumstances applied such as a health issue or the timing of field work making it impossible to complete the second submission. In one case, no reason was given.

Outcome of reviewer recruitment process

We had asked PIs to list three suggested reviewers in their LOIs in case we could not find three reviewers through the above methods. However, we did not use any of the PIs' suggested reviewers, except in one case where we noticed after the fact that one of the reviewers we recruited was also listed by the PI as a suggested reviewer. Therefore, all of the reviewers were recruited using one or more of the methods outlined in the methods section. We disqualified approximately three reviewers for each RFA who knew the PI of the project we were asking them to review. For RFA1 we did not track acceptance rate of reviewers as we had a short timeline for finding reviewers. In addition, since in RFA1 we had a greater number of reviewers who reviewed more than one proposal, the recruitment percentages are not strictly comparable. We also relied more heavily

on the program staff's professional networks to facilitate recruitment in RFA1. While we did not track the sources from which we drew reviewers for RFA1, we collected this information for RFA2, presented in Figure 3.

For RFA1, we recruited 89 reviewers to review 33 applications. Although every proposal had three or more reviewers, several reviewers reviewed more than one proposal in RFA1. For RFA2, with more time to recruit reviewers, we had only two reviewers who reviewed more than one proposal.

For RFA2, we recruited 103 reviewers to review 33 applications. Overall, 32% of the individuals we contacted agreed to serve as reviewers. Nine of the reviewers for RFA2 had reviewed for us in RFA1. The stipend was very small, only one hundred dollars, and was likely not a major incentive to participate. Several reviewers turned down the stipend, either because they could not accept the money if they worked for NIH, the Veteran's Administration, or other federal departments, or because the paperwork was not worth the small fee.

For those who agreed to review, for both RFAs, we had very high retention from first submission to final submission and only had to replace one reviewer due to drop out.

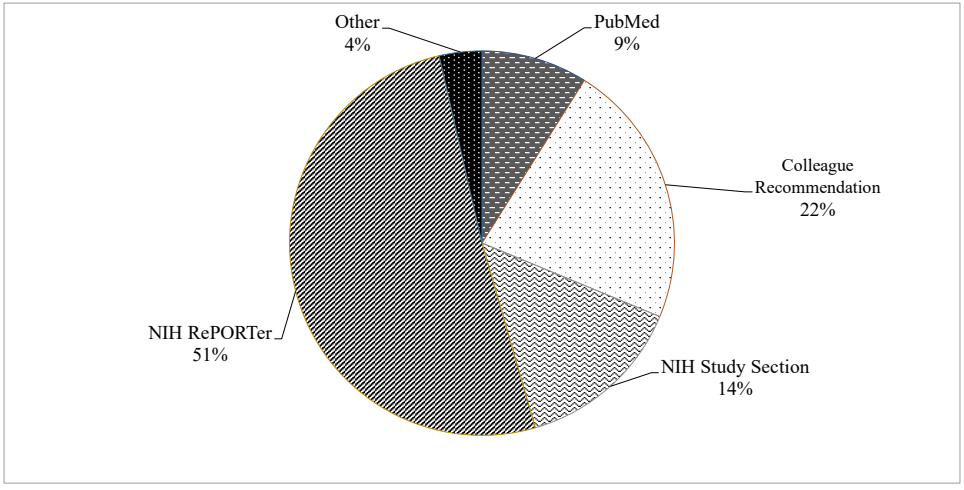

Figure 3. Sources of External Reviewers for RFA2.
'Other' category represents reviewers re-recruited from RFA1 and individuals recruited through committee members' professional networks. While 14% of reviewers were recruited through current NIH Study Section membership, 49% of reviewers self-reported prior experience serving on a NIH Study Section.

Quality control of reviews

Consistency and adherence to NIH scoring metrics improved from RFA1 to RFA2, likely because of the addition of a drop-down menu for score entries. In RFA1, fifteen reviewers returned reviews with minor errors, compared to only three reviewers in RFA2. In addition, the rushed timeline for RFA1 may have contributed to reviewers having less time to error-check their work. On approximately five occasions, including both RFAs, we also asked reviewers to correlate their comments and their numerical scores more closely in accordance with NIH's scoring guidelines, which they did.

Opportunity to change scores in RFA2

As explained previously, we gave RFA2 reviewers the opportunity to change their scores after seeing other reviewers' scores. Only two reviewers out of 103 elected to adjust their scoring of the proposal after seeing their colleagues' feedback and no one changed a section score by more than one point (e.g., from a three to a four on Innovation, etc.). This may have been because reviewers only had one week to notify us if they wished to change a score. However, many reviewers (at least ten) communicated to us that they were pleased to see that other reviewers were in agreement with their own scores.

Reviewer demographics

We did not collect racial, ethnic, or gender data from reviewers in RFA1. For RFA2, after all reviews had been returned, we asked reviewers to self-report their race and/or ethnicity using NIH's categories. Reviewers were mostly white, and Asian was the largest non-white category. We oversampled individuals with female-associated names in reviewer recruitment, trying to populate half our reviewer list with women, and we were relatively successful in this regard, with 39% of reviewers being women. Nevertheless, our reviewer demographics reflect the non-diverse demographics of biomedical researchers in general. This skew was likely exacerbated because we aimed for more accomplished researchers with strong records of funding to review the proposals (Ginther et al., 2011). Last, we do not necessarily have a completely accurate picture of our reviewer demographics, as 54% (56/103) of reviewers did not answer our email query about their race/ethnicity.

Number and diversity of students participating in pilot projects

As of this writing, students are still being matched with RFA2 projects. For RFA1, 17 students participated: 9 EXITO students, 7 non-EXITO undergraduates, and 1 graduate student. Although we collect survey data from EXITO students about their self-reported demographics (first-generation college goers, race/ethnicity, experience in foster care, disability, and other metrics that would qualify them as underrepresented in biomedical research) we did not collect these data from pilot project student participants specifically. However, the EXITO program evaluators report that, out of 285 EXITO students who returned surveys, only 26 students did not put "yes" for at least one category from the above list (M. Honore, personal communication,

May 29, 2018.). If pilot project students are reflective of EXITO students generally, then ~90% of them would fall into the category of underrepresented in biomedical research fields. In addition, the 7 non-EXITO students were recruited from programs at PSU that focus on first-generation college goers, from the Louis Stokes Alliance for Minority Participation (LSAMP), a program at PSU dedicated to supporting the success of students underrepresented in STEM majors, or from programs run by faculty at PSU dedicated to underrepresented groups such as advancing women of color in science, or students from disadvantaged backgrounds. We do not have final outcome data yet, such as enrollment in graduate biomedical research programs, as the first full cohort of EXITO students graduated in June 2018.

Table 3. Gender and Self-reported Race/ethnicity of Reviewers, RFA2

Gender	**# of Reviewers**
Male	63
Female	40
Race/ethnicity	
Black or African American	2
Asian	9
Hispanic or Latino	5
White	31
Race Not Reported*	56
Total Reviewers (RFA2)	103
Note:· Gender was determined through analysis of the names of reviewers· where reviewers with names conventionally associated with women were presumed to be female·	

Evaluation of program success

Defining success for conducting the pilot project program is complex and is different than defining success of the pilot project program outcomes, which are related to achieving the overall aims of BUILD EXITO. Therefore, we focus here on four elements of the pilot project program that we evaluated as best we could, given variations across RFA1 and RFA2. Some of the variations across the two RFAs occurred as we evaluated RFA1 and tried to improve the experience for PIs in RFA2. We also actively tried to increase the number of PIs from our partners, which necessitated changes to our outreach to partners, for example. The four questions that guided our evaluation were: 1) Were all proposals matched with appropriate reviewers and did all PIs receive an initial and a final set of reviews from the same three reviewers? 2) Were reviews constructive and relevant? 3) Did PIs attend the workshops and did they find them helpful? 4) Was feedback from our NIH program officers positive, and what did they want to see changed if they had criticisms? We present evidence pertaining to each of these questions in Table 4.

Table 4. Benchmarks of Success and Assessment of Whether Benchmark Was Met for BUILD EXITO Pilot Project Program

Benchmark of Success	**Assessment of Benchmark**
1. Were all proposals matched with appropriate reviewers and did all PIs receive an initial and a final set of reviews from the same three reviewers?	A. One hundred percent of proposals from RFA1 and RFA2 successfully matched with three or more reviewers. B. For both RFA1 and RFA2, out of approximately 170 discrete individual reviewers, we replaced only two reviewers between initial and final reviews.
2. Were reviews constructive and relevant?	A. Of PIs who expressed an opinion on surveys, in person, or via email, 90+ % expressed that reviews were helpful and stimulated them to rethink their proposals during the revision period. Two PIs who received lower scores than they expected expressed that the reviewers did not adequately understand their proposals. In both cases where PIs voiced this perception, all of the reviewers were exceptionally well qualified to review the proposal.
3. Did PIs attend the workshops and did they find them helpful?	A. Not all PIs returned the surveys, so our data may be skewed by people who found the workshops helpful and thus responded at a higher rate. Workshop feedback was overwhelmingly positive. When PIs returned negative comments about workshops, most of the comments clustered around the first technical workshop, which some PIs said was redundant with the RFA. Others, however, found it extremely helpful, particularly for the first RFA, which had less clear instructions around the mentoring plan. B. Average attendance was about 20 attendees (some as high as 40, but others closer to 15) with the exception of the K Award workshop, which had six attendees. C. A representative comment from a post-workshop survey: "Discussion about writing the Introduction letter was particularly helpful. Though I have done this a number of time[s] under the guidance of senior researchers, it's great to have some more insight. It was also helpful to learn about how you selected reviewers. By the way, these are the most thorough reviews I have ever received." Workshop surveys revealed that attendees found revision/resubmission workshop most helpful, as this topic is not generally touched on in typical grant writing workshops and was designed to instill persistence, a critical component to success for new investigators. Other aspects of the workshops that received positive feedback were time spent outlining a detailed plan for proposal writing and processes, providing sample mentoring plans, and explaining reviewer recruitment processes. More critical comments included that the workshops were too focused on PSU's structure and that questions from PIs about their specific proposal topics were not of general interest.

4. Was feedback from our NIH program officers positive, and what did they want to see changed if they had criticisms?	A. All pilot project proposals were packaged together after the ten (or 11 in RFA2) projects were recommended for funding and were sent together to NIH. We received feedback from our Project Scientist and our Program Officers at NIH about our pilot mechanism and program at the end of each RFA. The NIH Project Scientist and Program Officers reviewed the projects carefully for scientific merit as well as for human subjects violations, conflicts with other funded work, whether the projects were relevant to biomedical research, and for other parameters. After completion of review of RFA1, selection and award phases of the pilot projects, a senior NIH program officer communicated that "the pilot packages are outstanding and reflect a rigorous and very thoughtful solicitation, peer-review and resubmission process. The science involved is also interesting and in many case, quite novel. Superb job…The mentoring plans are stellar, notable for use as a consortium example as is the entire process." We have not received detailed comments yet from RFA2. B. No substantial criticisms were raised, though we are in discussions with our Project Scientist about how to continue supporting all PIs, funded and not, after the pilot program funding ends.
5. Did all projects have at least one student working with the PI and did the students actively engage in papers and presentations?	A. RFA2 PIs are in the process of being matched with students. For RFA1, all funded projects had at least one student and several had two. The total number of undergraduate students was 16, with nine being EXITO students. There was one graduate student. All RFA1 students had either presented at a conference, and/or co-authored a paper, or were scheduled to present at a conference at the time of writing.

Discussion

Although literature exists on engaging traditionally underrepresented students in research as a way to increase diversity in the biomedical workforce, less has been published about using such programs to enhance faculty research capacity at educational institutions that serve those students. We describe here in detail our pilot project program because we designed and tested its feasibility as part of a large long-term project, BUILD EXITO, that will also collect significant amounts of data on its success in at least two dimensions. First, we will examine the program's ability to enhance capacity for research by faculty at low-resource universities. Second, we will determine whether the program is successful as a vehicle for increasing numbers of underserved students entering in and staying in biomedical fields by exposing them to mentored research projects. We do not yet have enough data on PIs who participated in the pilot project process to report on the outcomes described above, or on students who participated, as the first full cohort of EXITO students will graduate in spring 2018. Therefore, we report here on the lessons, challenges, and successes of our program model at creating a framework to support these important goals of building research support at low-resource institutions with diverse faculty and students. This framework will ultimately both increase diversity of faculty who engage in research and provide more opportunities for underrepresented minorities at those institutions to undergo mentored research experiences, potentially from faculty who are also from underrepresented

groups (Fakayode, S. O. et al., 2014). The biomedical workforce still is overwhelmingly non-Hispanic white. The National Science Foundation and the NIH reported that only 5% of PIs on funded projects are from underrepresented minorities, as of 2012 (Coalition for Urban Serving Universities, Association of Public and Land-Grant Universities, Association of American Medical Colleges, 2016). Universities with high ethnic and racial diversity and high numbers of first-generation college attenders, such as PSU and our EXITO partners, can serve as important pools from which to draw students into research (Allen-Ramdial & Campbell, 2014; Auchincloss, L. C., et al. , 2014). Additionally, our pilot project program specifically sought to increase capacity at our partner institutions, which were originally selected because of their diverse student and faculty populations and their locations around the Pacific Rim. One of our goals for the second round of BUILD funding, if EXITO is refunded, is to engage a higher number of diverse faculty in the pilot project process and thus create a true cohort of faculty who can support each other and create the benefit of a cohort.

The pilot project program built institutional capacity for faculty through the following ten mechanisms: 1) providing seed money for future research projects; 2) providing experience in grant writing and grantsmanship through workshops; 3) strengthening future research proposal submissions by supplying research faculty with two sets of NIH-like reviews and giving PIs support and methods for responding to them; 4) providing opportunities for faculty who may not be experienced in proposal submission to put together an entire proposal, including budgets, biosketches, IRB and other supporting documents, and generating these documents in NIH format; 5) providing opportunities for faculty to work with research staff at their home institutions, so in the future when they submit proposals they will already know the research support team and what to expect from working with them; 6) providing an opportunity for faculty to produce first authored publications and posters to support future funding proposals; 7) finding collaborators at their home or other institutions who work in their fields; 8) learning about other mechanisms such as K awards; 9) learning how to conduct research and adjust to unplanned data-gathering hitches on a one-year timeline; and 10) gathering pilot data to support future larger research efforts.

Through the above mechanisms, the pilot project program helped build institutional capacity for externally-funded research at PSU and EXITO partner institutions and, in turn, created more research training opportunities for undergraduate scholars. Although the pilot project program provided a mechanism for students to be embedded in research projects, the pilot project program was not the primary means of placing students in research opportunities through BUILD EXITO. Our primary, and more cost-effective mechanism for providing research placements is through RLCs, and pilot projects can help to foster the growth of these communities (see Build EXITO model website).

The pilot project process, by closely mirroring an NIH R03 mechanism, helped demystify the NIH and other grant-writing processes (Porter, 2004), and provided a finished product that has gone through a rigorous review, thereby instilling confidence and allowing for practice of actionable skills and behaviors related specifically to grant submission (Rust et al., 2006). In addition, as Godreau and colleagues (2015) pointed out, connecting faculty with research administration for support with grant preparation, and for overcoming IRB and IACUC hurdles, lowers barriers for

faculty in submitting future proposals.

Finally, a series of four workshops supported faculty in achieving or working toward the above goals. The pilot project program workshops provided detailed instructions for junior faculty on proposal writing, grantsmanship, methods to respond to reviewer comments, and applying for mentored career awards. Faculty applying for a pilot project grant, as well as students working with them, could participate in all or any of the workshops.

Successes versus outcomes and how we defined "success"

We specifically did not include in this paper evaluations that, for example, compare successful applications to external funders between junior faculty who went through the program and those who did not. This metric is more correctly an outcome of the entire EXITO intervention and here we wanted to report on our methods and results of the pilot project program per se, not of EXITO as a larger intervention. We will conduct these analyses when RFA2 PIs have had time to gather their pilot data and apply for other funding, and as an explicit outcome of BUILD EXITO's overall model. Our preliminary data on outcomes such as funding success are pointing to a high rate of success of applications for PIs funded under RFA1—around 31% success rate one year after RFA1 is complete (unpublished data). However, data collection is ongoing and we are working on establishing analytical methods for these complex data.

Challenges and lessons learned

We learned a great deal from RFA1, and again from RFA2, and we summarize some important lessons below.

Challenges of reviewer recruitment

The biggest challenge of both RFA1 and RFA2 was recruiting all the reviewers we needed and retrieving both sets of reviews from the reviewers within specific timelines. Because we did not want some PIs to get their reviews before others, as that would have allowed some PIs longer to work on their proposals, we had to get all the reviews sent out and back in a very narrow window of time. This task was much harder for RFA1 because we had less time and because we had not yet developed a comprehensive system for recruiting reviewers, such as using NIH Study Sections. As a result, for RFA2 we were able to find reviewers, even for very technical proposals, by using Study Sections. This technique enabled us to more easily and quickly find reviewers whose expertise was an excellent fit for the proposal in question. During RFA1, we sometimes emailed fifteen or twenty reviewers before finding three who were a good fit for the proposal, particularly for highly technical proposals. For RFA2, typically we emailed between six and eight people to find three reviewers because we had refined our recruitment methods.

Lessons learned: 1) Having multiple methods of recruiting reviewers was key. 2) Recruiting reviewers from NIH study sections was a particularly efficient method of finding highly qualified reviewers who were well matched with topics, particularly for highly technical proposals which can be challenging to match with reviewers.

Challenges of timing

Timing the RFA events was challenging, and potentially affects the quality of the experience for reviewers, for PIs, and for the coordinator and project staff charged with running the program. During RFA1, the entire schedule was compressed because of the timing of the BUILD funds release, leaving the pilot project program team with little time to recruit reviewers (see Figure 2). This put stress on the program staff who had to find a substantial number of reviewers (more than eighty) in only a few weeks, and on reviewers by requiring them to get their reviews back very quickly, which in turn made reviewer recruitment more difficult as the short timeline was off-putting for potential reviewers. In response to the compressed timing of RFA1, we constructed a longer timeline for RFA2. This longer timeline, though it operated more smoothly overall than RFA1, led to the unintended consequence of difficulty recovering the reviews. The longer timeline extended into the summer, when academics are often on vacation, out conducting field work, or traveling to conferences. This made getting the reviews back challenging as reviewers were away from their emails. A happy medium between the short timeline of RFA1 (three months) and the longer timeline of RFA2 (eight months), would be ideal. In addition, with so much time to complete their second review in RFA2, several of the reviewers forgot about them completely which created hurdles to communicating with reviewers and recovering the reviews in a timely manner.

Lesson learned: A six-month timeline for the entire process would be ideal, as it would eliminate disadvantages of both the too-short and the too-long timeline.

Challenges around reviewer scoring

We quality-checked every review that came in for adherence to NIH's scoring standards, to make sure that every section had a score, and to check that the numerical scores and comments matched. We returned more reviews in RFA1 to be corrected, likely because of the short timeline and the lack of a pull-down menu for numeric scores. The most common error was forgetting to score the mentoring section. For two reviews over both RFAs, we asked the reviewer to rescore a particular section because the comments indicated more minor concerns than were reflected in the numerical score.

We also found it challenging at times to get reviewers to understand the mentoring component of the mechanism, particularly for RFA1. This confusion was aggravated by the fact that the investigators themselves did not necessarily understand how to write a mentoring plan in RFA1. Some reviewers expected to see a mentoring plan in place for the applicant in addition to the EXITO scholar, whereas other reviewers scored such mentoring plans harshly, and said that the plan for mentorship of the faculty member was unnecessary. By the second round of submission in RFA1 this problem had largely been resolved, and for RFA2 it was not an issue as we had clarified the instructions for the mentoring plan in the RFA and provided the PIs with sample mentoring plans. Another struggle was to get reviewers not to score the investigators poorly for lacking publications and research experience, as the goal of the mechanism was to help PIs gain this experience. When this was reflected in reviews, the pilot project coordinator coached PIs in

responding to the reviewers in their resubmission letters, and this became a non-issue for the final set of reviews.

Lessons learned: 1) A longer total time line reduced errors by reviewers. 2) A sample mentoring plan given to PIs reduced confusion and inconsistency about what a mentoring plan was, and thus reduced reviewer confusion as well. 3) Sending materials to reviewers about how to score the proposals did not eliminate common mistakes by reviewers, and reviewers had to be coached individually about unusual elements of our RFA such as the mentoring plan. 4) A pull-down menu to select a score from 1-9 seemed to greatly reduce the number of reviewer errors around inadvertently leaving a section unscored.

Challenges of the ranking process

We found it challenging to rank projects from multiple disciplines against one another. In standard NIH ranking, projects are judged against other projects in the same Study Section within one institute. Here, all projects from various disciplines were ranked against one another. While we cannot make a generalization that applies to every project, we noticed that PIs from the bench sciences tended to have more training in proposal writing and to produce more traditionally organized and hypothesis-driven proposals, which in turn received more favorable scores. This may have placed social science proposals at a disadvantage when ranking them against traditional biomedical proposals. Nonetheless, more RFA1 awards went to applicants in social work than any other academic unit, and the first pilot project that became an independent NIH-funded grant was from an investigator from the School of Social Work at PSU. In addition, the Steering Committee recognized the need for a balanced portfolio of social and bench science grants when establishing the final recommendation. This is important because some studies on student persistence in STEM fields that have looked at the importance of research experiences have concluded that opportunities to conduct and participate in social science research may be particularly relevant for retaining underrepresented minorities in research (Martin, Marcus, Curtis, Eichenbaum, & Drucker, 2016).

Lessons learned: 1) PIs from social science disciplines may need more support in proposal preparation and writing. 2) It is important to weight the overall portfolio and account for diversity of projects when ranking proposals, not simply numeric scores, in order to provide a diversity of projects for students to engage in.

Challenges around engaging PIs from partner institutions

We increased our engagement efforts with partner PIs because in RFA1 the vast majority of applications were from PSU and OHSU. With few applications from four-year partner-institution faculty (two-year faculty were not eligible to apply), no projects from our partner institutions in RFA1 received funding. During RFA2, we changed our methods for communicating about the pilot projects by engaging more staff on site at our partner institutions and figuring out what faculty newsletters were available at our partner institutions. Importantly, we also held a face-to-face lunch session with many junior faculty, who subsequently completed applications, during a time when we knew many of our partner faculty would be on site at PSU. In this way

we were able to encourage PIs who might lack confidence to apply and give them a chance to sign up with their individual emails to receive information about upcoming deadlines. The pilot project coordinator then reached out to these PIs individually, rather than relying solely on faculty newsletters or campus-wide outlets. We also managed to retain PIs from our partners at high rates, as we did for all PIs. We attribute this high retention rate to the fact that all PIs were encouraged to revise and resubmit a final proposal, regardless of the strength of their score on the first round. We emphasized that the process was as important as the final funding, and that initially low scoring proposals could still be funded as only the final score counted in proposal ranking. Several proposals that received low scores on the first round of scoring received high scores for the final review and at least one such proposal was funded in each RFA.

Lessons learned: 1) Using information outlets specific to our partner campuses seemed to increase applications from partner PIs. 2) Holding an in-person information session to gather individual emails, as well as reassure PIs who might not feel confident in their ability to write a proposal, likely increased the pool of PIs from our partners considerably. 3) More partner PI applications greatly increased likelihood of funded PIs at partner institutions. 4) Individual outreach to PIs who scored low on the first submission likely increased retention of PIs, as did the process of only counting the final score in the ranking system. 5) Future pilot projects RFAs will likely limit PI eligibility to PSU and our four-year partners, excluding OHSU, in order to maximize funds for universities and faculty that can benefit more from the resources.

Future iterations of the pilot project program

As we consider what we will do if BUILD EXITO is renewed for five more years after the initial funding period ends in 2019, we must consider how best to assess and maintain the effects of our pilot project program on participating faculty. We are tracking proposal submissions, success rates of submissions, and numbers of publications and posters by PIs who were awarded funding related to their pilot projects. We will also include data for analyses from faculty who participated in the pilot project program but were not funded. We must figure out how to compare these two groups, however, as they are not exactly the same because the unfunded participants were not able to gather data from their pilot project. However, as recipients of most of the intervention, via receiving reviews, attending workshops, and gaining support to interact with university research administrators, these PIs should also have bolstered their capacity to engage in research at their institutions. This is particularly true for unfunded PIs who went through RFA1 and RFA2, of which there were at least four. One PI from RFA1 was subsequently funded in RFA2. We have begun collecting data on successful submissions from funded RFA1 PIs and are very pleased with our initial results. We plan to publish these analyses in a separate paper when we have collected data from both RFAs.

Conclusion

Our methods and lessons can be used to help disseminate a model to enhance institutional research capacity through a pilot project program. Our participants were predominantly junior faculty from a wide variety of biomedical, behavioral, social, clinical, and bioengineering disciplines. This

diversity in disciplines created challenges for the program, particularly for recruiting reviewers. Diversity in disciplines of PIs also creates some ranking challenges when weighing scores, but these challenges can be addressed by deliberately seeking to create a diverse portfolio of funded projects and not necessarily only funding the top ten numerically scored projects. We sought to overcome these challenges with our targeted and multi-sourced recruitment methods; with individualized support for program participants; and through workshops that addressed both basic and sophisticated challenges of proposal writing. Our experience demonstrates that it is possible to use and adhere to a rigorous process to recruit external reviewers and to support faculty in the submission process. Universities planning to invest funds to support new faculty in research can benefit from our experiences and from the strategies we used to overcome hurdles we faced in this process. In future iterations of the pilot project program, we will aim to recruit a more diverse pool of reviewers; continue to enhance and expand our efforts to recruit PIs from our partner institutions; and continue to find ways to permanently institutionalize the support for junior faculty that the pilot program provided. We also will investigate the possibility of actively recruiting a more diverse pool of faculty researchers and providing support for them to engage in the process as a true cohort, rather than as individual researchers scattered across multiple institutions, both so they can support each other and so they can better support diverse students (Salto, L. M. et al. 2014; Villarejo, M. et al. 2008).

As we implement the second stage of RFA2, we are refining our methods to keep these unfunded PIs engaged in the pilot project program and encouraging them to use the resources the program expended on them. Many of the proposed projects were meritorious, above and beyond the ten or elevan we could fund in each cycle. Armed with two sets og three reviews of their projects and support for writing proposals, many of the PIs should be able to increase their success at gaining funding even though they were not funded through EXITO. If our BUILD EXITO funding is renewed, we will apply the lessons learned from our first two RFAs to RFA3 so that we can further refine and improve our pilot project program, and permanently institutionalize it at PSU and at our partner institutions.

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Creation of a Grants Database Highly Customized for College Level Reporting

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Abstract: *To handle wide-ranging reports and increasingly collaborative projects, our college research office developed and implemented a relational database. Department level tracking requests for research administration activities exceeded the capabilities of existing tools. Our desired solution aligned between multiple spreadsheets and cloud-based commercial products. In consultation with an internal specialist, we created a highly customized system that connects proposals, submissions, awards, and expenditures with an additional feature for managing multiple investigator participation. Avoiding the expense of marketed products, we improved the efficiency of reporting with our budget neutral solution.*

Keywords: *Departmental research administration, tracking and reporting, database*

Project Context

The University of Kentucky—a public, land grant university with around 30,000 students and 2,000 faculty—receives over $300 million per year in extramural research funding. The College of Pharmacy supports over 60 faculty who submit to diverse sponsors including the National Institutes of Health (NIH), Department of Defense, National Science Foundation (NSF), state agencies, non-profit foundations, and industry. The research office handles pre-award activities at the college level separate from, yet integrated with, centralized research administration on campus. Personnel consists of two faculty administrators (associate and assistant deans), one director, one college grants officer, and an administrative coordinator.

For reporting requests, the office previously collected data from multiple sources requiring significant effort to integrate and analyze. Examples of requests that proved complicated to fulfill included: 1) proportional award credit for collaborative research, 2) sponsor success rates at the college level, and 3) funding partnerships with other departments, universities, foundations, and industry. University systems supported internal approval and award management, but did not integrate all grant-related information in an efficient and convenient way for department level needs.

Similar to the University of Kentucky, many other universities prioritize information technology (IT) resources for the critical compliance requirements associated with post-award financial management. Specifically, 64% of research-intensive universities leverage the same enterprise

system for post-award and general ledger activities (Saas & Kemp, 2017). In the pre-award setting, however, only 8% of the same institutions possess systems that combine general ledger and pre-award activities. To bridge this gap, a majority of institutions purchased a commercial product specific for pre-award needs, 8% built in-house systems, and 13% still process manually (Saas & Kemp, 2017). Nonetheless, few of these technology solutions fully integrate all information, which impedes efficiency and hinders operations when research administrators encounter complicated requests (Saas & Kemp, 2017).

Furthermore, research administration needs vary at the university and department levels (Hughes, 2004), and available systems do not capture all of the department-level preferences for pre-award tracking and reporting. The lack of broad and integrated resources creates difficulties for colleges and units interested in compiling data for fine-tuned, faculty-level metrics that assign proportional credit for collaborations. As interdisciplinary research constitutes a major goal for universities and sponsors, the emphasis on quantifying multiple principal investigator (MPI) and co-investigator contributions continues to increase in importance (Joiner, 2009). The percentage of MPI proposals submitted to NIH increased by 50% from 2010 to 2013 (Rockey, 2014), and the number of collaborative projects at NSF matches those from single investigators (NSF, 2017). Thus, the quantity of reporting requests for complex research metrics likely will continue.

New System Considerations

To accommodate reporting challenges, the office pursued a more sophisticated system. To meet this objective the following priorities were identified: 1) low cost, 2) customized to internal processes, and 3) optimized for reporting. Furthermore, the office preferred to own and manage the solution to ensure time sensitive requests did not require dependence on outside support.

Based on these criteria, the group weighed several options. At first, the office hoped to improve their system of numerous spreadsheets because Excel® is easy to manipulate and has flexible calculations. They also considered commercial products with strong user interfaces and customer support. However, both of these options possessed substantial limitations or cost constraints, leading the office to review the advantages and disadvantages of Microsoft Access®.

At the University of Kentucky, building an Access® database added no further costs as the university already supported the Microsoft Office® Suite and a database consultant with relevant expertise. The college IT unit provided a stable, on-site server capable of hosting the database. The office also valued the ability to create a highly customized and inexpensive system.

As described by Snyder and colleagues, most Access® databases lack technical controls to enforce data management best practices such as security, audit trails, and uniform quality control. In addition, specialized functionality such as automated processing, integration of external data, and management of metadata is often absent (Snyder et al., 2012). Based on the small size of the office, the team considered many of the missing features non-essential and expected a highly customized product would balance the lengthy development process. After considering these factors, the group selected an Access® relational database as the best solution and pursued development (see Figure 1).

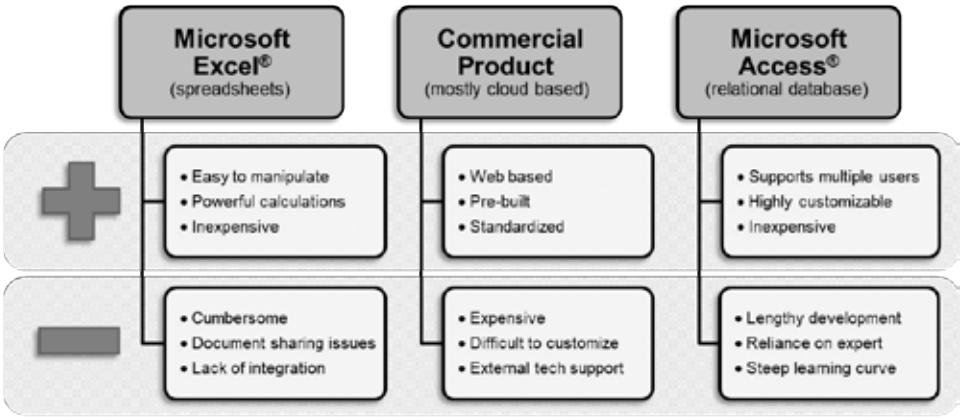


Figure 1. Advantages and disadvantages for options considered.

Product Development

The database was constructed collaboratively with three primary parties: 1) the college research office director, 2) a database consultant from campus Technology Training (part of Human Resources Training and Development), and 3) other members of the research office team, including a college grants officer and administrative support (see Figure 2).

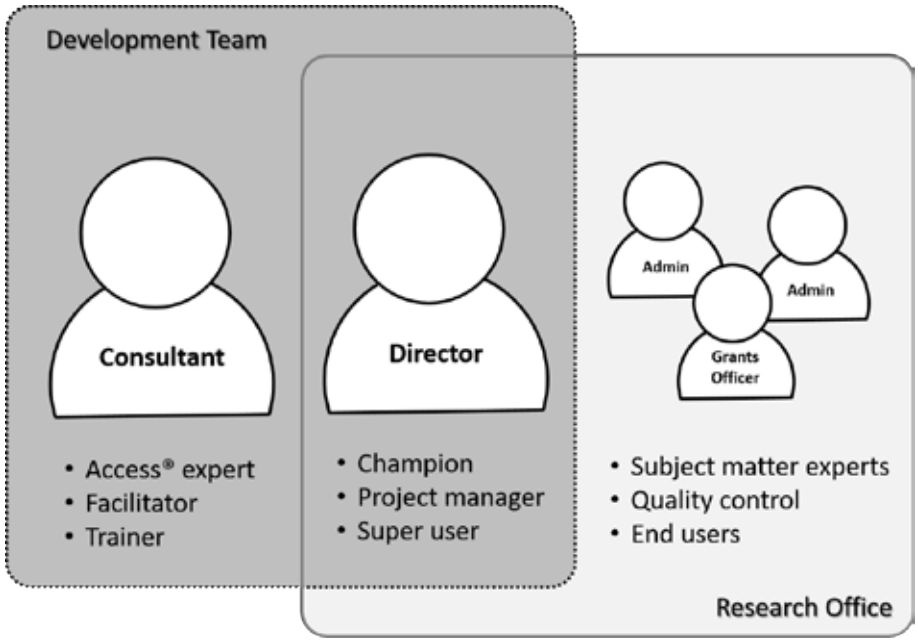


Figure 2. Project personnel and roles.

The research office accomplished project milestones through a series of meetings with the database consultant and assigned work on their own. The initial planning phase of the process involved the input of the full group to gather all relevant perspectives, while the development team—consisting of the director and consultant—built the majority of the product. The consultant employed a coaching approach, so the office actively learned Access® functionality throughout the project. Therefore, knowledge transferred to the department, which ultimately reduced long-term reliance on the database consultant.

Pre-Build

In order to maximize the flexibility and efficiency of reports, the group engaged in extensive process mapping to detail the grant process from application to award to closeout. The team considered all necessary data fields from existing systems, relationships between components, input and output needs, as well as user interface requirements. The meetings involved long, detailed discussions that benefited from the consultant's pointed inquiries and translation of database best practices to the team. The pre-build process (approximately 10 hours in five meetings over a four-month period) proved critical to the overall design and completeness of the final product.

Build

After carefully considering the system requirements, the group constructed the first build of the database over the next three months. Process workflow was translated into Access® logic through the creation of database objects, including 35 data storage tables and over two dozen relationships connecting these tables. The initial user interface for data entry was developed and then beta-tested by entering a handful of grants. Following the trial, the team finalized the user interface and proceeded with the live system at the beginning of the 2016 fiscal year.

The development team then expanded the user interface to include an advanced search feature and quick links to common reports. Over the next 10 months, they built over 50 queries and reports for fast retrieval of high priority data related to 1) upcoming proposals, 2) submissions, 3) awarded proposals, 4) study section status, 5) budget forecasting, and 6) current and pending support.

In the last major build phase, the development team dedicated two months to a new expenditure component. The group successfully created import and append features to integrate data from the financial portion of the university enterprise system (SAP HANA). The additions allowed advanced tracking of primary accounts and subaccounts, simplified reporting, and predicted indirect costs allocated to the unit.

Database Specifications

The completed database accommodated the complicated aspects of grants management through specific features including a split database format, customized forms, and standard queries and reports.

Split Database

The database was divided into two parts, defined by Access® programmers as the "back end" and "front end". The back end stored all the data on a server with restricted access, while the front end housed the user interface on office desktops for optimized performance. The split database supported multiple concurrent users, decreased chances of corruption, and allowed all users to view and work with data in real time.

Another benefit of the split database was the opportunity to create different versions of the front end that all connect to the same back end data. For example, the development team created a read-only version, so interested parties could review grant information without inadvertently changing data. The office also incorporated new functionality and improvements through development

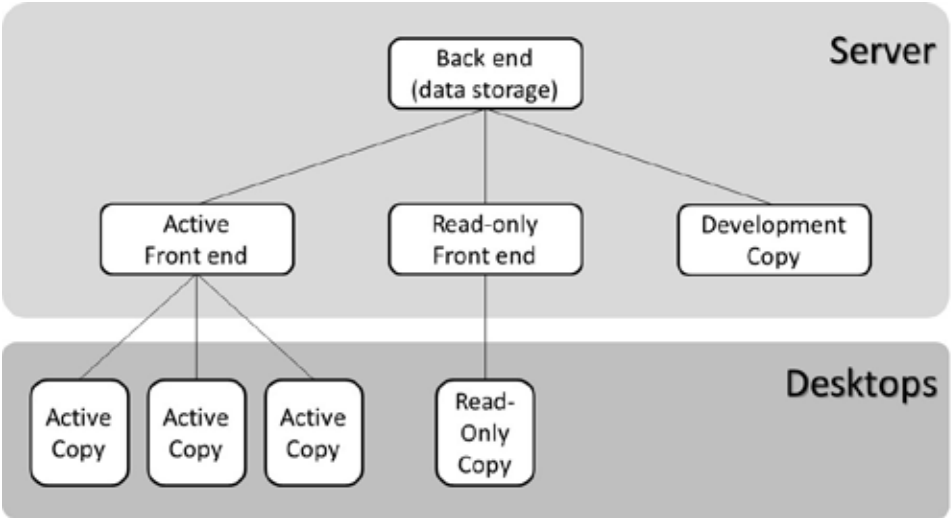
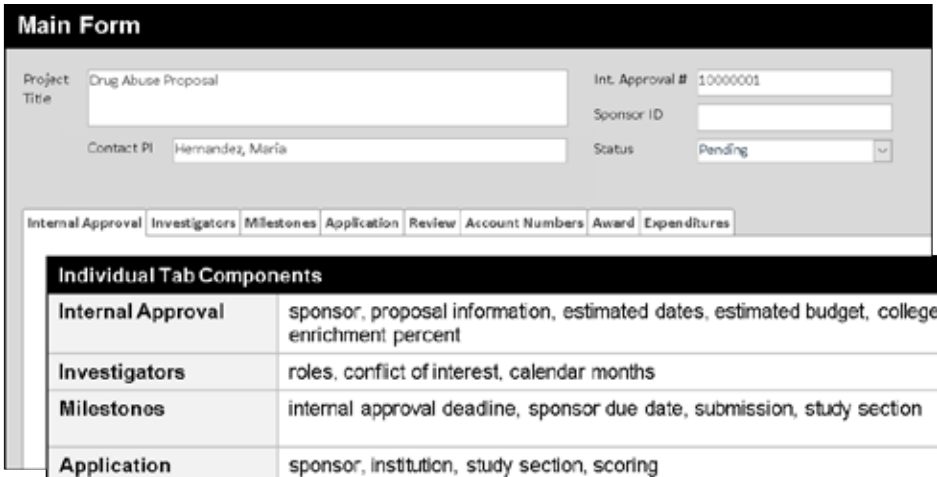


Figure 3. Location and configuration of the split database.

copies of the front end, which were versioned and archived once adopted by the broader team (see Figure 3).

User Interface

The application opened to a switchboard form that displayed options to 1) view the main form with all data, 2) search for specific information, or 3) run reports. The main form, the primary point of interaction with the database, facilitated daily workflow by allowing office staff to view all



Individual Tab Components	
Internal Approval	sponsor, proposal information, estimated dates, estimated budget, college enrichment percent
Investigators	roles, conflict of interest, calendar months
Milestones	internal approval deadline, sponsor due date, submission, study section
Application	sponsor, institution, study section, scoring
Review	grant reviews, specific aims sessions, mock study sections
Account Numbers	prime and subaccount numbers, responsible investigators
Award	overall dates and amounts (direct, indirect, and total), categories, detailed budget for each grant year with expected and actual amounts
Expenditures	monthly expenditures for all prime and subaccounts

Figure 4. Components of the main form.

information pertinent to each grant proposal. The main form featured a header area with primary data points and overlapping tabs that track proposals from preparation to close (see Figure 4).

The search button on the switchboard provided options to limit results by investigator and

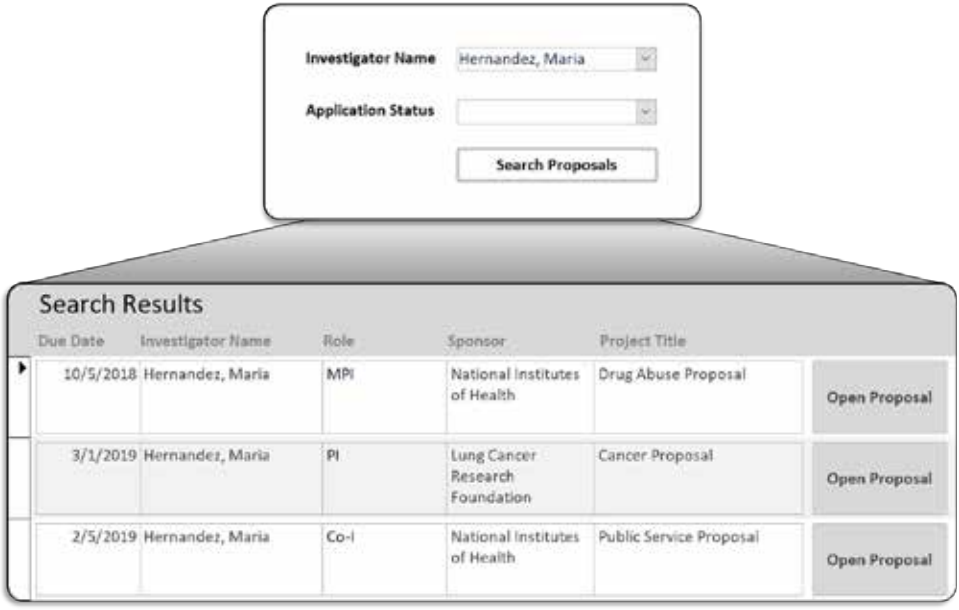


Figure 5. Search function.

proposal status. A narrow list of proposals appeared with enough information to choose the specific proposal desired (see Figure 5). The end user could then navigate to the desired proposal displayed in the main form.

Data Input and Output

The college grants officer manually entered the majority of information. Expenditure data, however, were imported from the financial component of the university enterprise system to the database after some minor manipulation in Excel®. The office also developed a system for quality control where inputs were verified at scheduled intervals throughout the year.

The research office extracted data from the system using standard queries and reports designed for information frequently needed or requested. The ability to present information on demand in meetings reduced preparation time and assured up-to-date results. Custom reporting was accomplished with new objects or by adjusting existing queries and reports. When needed, the office exported queries to Excel® for further adjustments and refinement.

Project Evaluation

Two years after the database went live, the group reflected on the success of the new system and if it possessed enough value to remain in use. Overall, the new database met expectations for improving office capacity for reporting metrics—the primary purpose for its construction. In addition, the database provided other benefits beyond reporting within the office and across the

university.

The database captured the complete profile for individual grants and faculty members, including roles as MPI, co-investigator, and mentor. As a result, the office provided broader and faster reporting with the ability to retrieve live data on demand from the database. For example, the office completed current and pending support for seven investigators in the same amount of time previously required for one investigator. For a separate annual report, the office formerly reviewed and checked multiple sources to assign proportional credit for MPI and co-investigator awards. With the database, the total workload decreased by one to two days, and the task was delegated due to the efficiency and ease of reporting with the database. Additionally, the organization of the data allowed new reporting capabilities, such as calculation of success rates.

The team realized additional benefits post build. Importantly, the relational database provided a visually cleaner and seamless experience for multiple users compared to the flat files of Excel®. The primary database user (grants officer) immediately recognized its value for daily work activities, especially the ability to view and track information in one convenient location.

Outside the research office, the project also fostered relationships throughout the university. Research groups from two healthcare colleges requested copies of the database structure. Preliminary activity suggests that the value widely transferred and saved time for the consultant and units. Since the database only required minor adjustments for both groups, they avoided the time dedicated to the planning and build phases. In this way, the database served a broader benefit to the university beyond its originally intended scope.

Lessons Learned

1. **Stay the course**
   Similar to other major projects, we pursued changes beyond small, incremental steps and needed to build confidence in the process and maintain forward momentum (Eyerly, Forstmeier, & Killoren, 2000). Ultimately, our entire team supported the project, but encouragement and direction were critical in the planning phase when no tangible product was available. The consultant and director addressed concerns and provided assurances that final implementation would require demonstration of an effective product.
2. **Prioritize the planning phase**
   Fortunately, the beta version of our database possessed no major issues. Extensive process mapping at the beginning of the project allowed us to avoid time-intensive corrections after database implementation. In our opinion, the pre-build process, though challenging at times, enabled a smooth transition to the live product and facilitated overall project success.
3. **Recruit the right people**
   We maximized team contributions by setting clear expectations and defining roles at the start of the project. Specifically, the director served as team champion and motivated super user to maintain progression and foster buy-in from office staff. The research office team provided valuable perspectives and supported feasibility of implementation. The database

consultant proved essential and served as facilitator, build consultant, and external advisor.

4. **Consider additional team benefits**
   The database supplied better data management and reporting as intended. In addition, the project offered an intellectually rewarding opportunity for team building that led to process improvements and refined operating procedures. Employees also expanded technical skills and forged valuable relationships across the university.

Authors' Notes

The authors submitted a disclosure for this database and presented a poster of this work at the 2016 Society of Research Administrators International Annual Meeting. This work was performed at the University of Kentucky when Dr. Oestreich served as Director of the College of Pharmacy Research Office.

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Providing Administrative Research Training for Everyone! It's a PART-E! Taking the "They Don't Know What They Don't Know" Out of the Equation

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Abstract: *Faculty new to an institution typically go through an orientation process during which they are presented with the information and resources available to aid in successful navigation of their new environment. An orientation often will include in-person presentations, online training modules, and other paper/digital resources in an attempt to cover the broad range of activities and responsibilities that fall within a faculty member's job description. One such orientation topic crucial to faculty at a research institution is research administration. While awareness and understanding of the research administration resources available to them can ease faculty's administrative burden and make the process more positive, research onboarding, particularly at a large research institution like the University of Michigan, may not be standard across the university or even within schools/units. Considering the impact familiarizing faculty with research*

administration can potentially have on faculty satisfaction, implementing additional training focused on research administration could be beneficial for individual departments. In this case study, the authors detail a research administration onboarding program designed for faculty in the Department of Pediatrics at the University of Michigan. This program goes beyond the orientation introduction to offer the tools and knowledge necessary for a seamless transition into the research enterprise.

Keywords: *onboarding, faculty, training, research administration*

Background

Literature suggests an inherent divide between professional staff and academic researchers (Wimsatt, Trice, & Langley, 2009; Szekeres, 2011). Research administration uniquely exists in both worlds, supporting the research enterprise and technical science through an administrative lens. As such, bridging the gap between research and administration for faculty is crucial, particularly given the importance of research administration in submitting competitive proposals, securing and appropriately managing funding, and complying with policy at multiple governing levels (Lintz, 2008). While research on faculty training/onboarding specific to research administration is lacking, various studies indicate faculty are overwhelmed by the administrative burden of research and are looking for more support in the grant submission process (Wimsatt et al., 2009; Cole, 2007). Additionally, faculty can feel restricted and laden by the many policies surrounding research at every level (Cole, 2007). At an institution like the University of Michigan, existing resources and support is likely not the issue, as a robust, extensive research administration infrastructure is in place at many large research institutions. In order to bridge the research administration gap for faculty, programs like the one detailed in this article could be the solution to alleviating any perceived burden by helping faculty better navigate the resources and support available to them and better understand the need for compliance in research.

Introduction

In 2011, the Department of Pediatrics at the University of Michigan centralized pre-award grant administration activities. Before centralization, the department had 15 divisions with 26 administrative assistants providing grant services, among their many other job responsibilities. By creating a dedicated research office, the department aimed to reduce the number of staff involved in grant administration and increase the level of expertise. With centralization complete, the Pediatric Research Office (PRO) now exists to provide faculty with specialized grant administration support.

The newly established PRO, looking for a way to advertise research processes and services available to faculty, started offering "Research Administration Onboarding" sessions in 2015. In 2017, the PRO expanded the sessions beyond faculty to include anyone interested in the research administrative process and renamed the sessions "Providing Administrative Research Training for Everyone (PART-E)." PART-E sessions are scheduled from 12 PM – 1 PM with lunch served to facilitate attendance. This report reviews the information imparted to faculty

within PART-E. We view this information as essential knowledge in research administration for all faculty. PART-E sessions are offered twice a year with the purpose of providing new/junior faculty and other stakeholders with; 1) information needed to navigate the university's research environment, and 2) up-to-date information about research administration processes. Though the basics of research administration remain consistent, we encourage individuals to attend the one-hour PART-E session as frequently as time allows to obtain access to the most relevant updates from sponsors, the university, and other governances impacting research administration.

Pre-Award

Each session begins with introducing faculty to their designated research support staff. For the pre-award portion, the Primary Research Administrators (PRA) explain the pre-award process, available tools, timelines, systems, and roles and responsibilities. The topics covered in relation to pre-award activities are shown in Table 1. We endeavor to present the process in a manner in which faculty feel protected rather than burdened by the various required levels of internal review and approval. One example we use to support this sense of protection is the fact that some sponsors include publication restrictions within their agreements. During the internal review process, the university legal team will negotiate with sponsors to have such language revised to ensure our faculty's publishing rights are protected. Additionally, external funds are awarded to the institution rather than an individual. Our institution has specific terms for accepting external funding. Sponsor terms are reviewed and sometimes negotiated to ensure legal compliance. Throughout the presentation, we emphasize there are few individuals who are authorized to sign on behalf of the institution. As a result, faculty should never sign any agreement and send it directly to a sponsor. We communicate our mission to alleviate administrative burden associated with grant submissions allowing faculty to focus their time and energy on the science.

Table 1. Pre-Award Activities

Preliminary Activity	Application Development	Submission	Post-Submission Support
• Provide checklist and timeline • Provide Qualtrics survey to collect required information • Develop project budget • Interpret guidelines • Advise on required elements • Collaborate with other departments and institutions to develop subaccounts	• Communicate with sponsor • Collect and format documents • Populate sponsor application • Route for internal approvals	• Compile final PDF • Send PDF to PI for review of technical elements • Review final PDF for administrative compliance • Finalize and submit application	• Assist with progress reports • Prepare MTAs, DUAs, NDAs • Provide compliance reminders/Assist with publication compliance • Maintain Biosketches and Other Support Pages • Compile Just-in-Time documentation • Disseminate funding opportunities • Provide a series of "brown-bag" educational sessions

Post-Award

During the post-award portion of PART-E, the Post-Award Accountants (PAA) provide a high-level overview of the post-award processes and services offered. The topics covered in relation to post-award activities are shown in Table 2. Our goals are to give faculty a better understanding of the PAA's role in easing any post-award burden and to encourage frequent communication between the PI and his/her PAA. We highlight common areas of misperception and offer some best practices for post-award management. We urge faculty to work regularly with their PAA in order to better understand their finances and ask faculty to contact the PAAs for any of their post-award needs.

Table 2. Post-Award Activities

Receiving Funding	Managing the Award	Close-Out
• Review each award notice for specific terms and conditions • Establish accounts and ensure budgets are allocated appropriately • Provide account information to enable spending • Add personnel effort to projects • Set up subcontracts	• Monthly account reconciliation • Individual project and overall portfolio analysis • Process effort changes • Complete annual financial reports • Provide forecasting/burn rates to aid in financial management	• Complete final financial reports • Remove effort from projects • Review and transfer any trailing charges • Inactivate projects

Unfunded Agreements

Unfunded agreements, including non-disclosure (NDA), material transfer (MTA), and data use (DUA), require institutional review and approval, although faculty commonly believe they can sign these agreements. During this portion of the session, we inform faculty of the reasons why these agreements must be reviewed and negotiated by legal experts for the protection of both the sponsor and the university. One example provided is the University of Michigan's status as a public institution which abides by the Open Access (OA) policy. Therefore, information held within the university can be made publically available. When a sponsor requests a signed confidentiality agreement before sharing information, legal experts include language in the agreement to protect the confidential information from falling prey to the OA policy. Even though funding is not involved in these agreements, they are legal contracts and require the same level of review and approval as funded agreements. Most importantly at the session, rather than faculty remembering all the steps involved in these types of agreement, we want faculty to know the PRO must be involved when establishing these agreements.

Compliance & Reporting

National and institutional policies and systems exist for regulating and certifying compliance involved with research and extramural funding. We explain to faculty these regulations exist to

protect everyone participating in the research program. Compliance regarding Financial Conflict of Interest certification, for example, is in place to help ensure unbiased research and reporting, protecting faculty against potential legal prosecution. Lack of compliance with reporting requirements, on the other hand, can jeopardize not only a single Principal Investigator's funding but funding for an entire institution. Often, faculty do not understand the importance of staying current with certifications and compliance issues. In order to bring this awareness, we emphasize the consequences, from legal ramifications to loss of funding, and offer the PRO as a primary resource, as well as, other institutional resources to help faculty remain compliant.

Take-Homes

We understand attendees will likely remember few, if any, details from the PART-E session. However, there are three main points stressed at the end of each session we do want attendees to always remember:

1. Never sign anything, unless directed by the department, college, or central office. If an individual signs and submits documentation directly, they make themselves personally liable and nullify institutional protections.
2. Compliance is key to funding.
3. Always contact the departmental office.

When the formal presentation is complete, sessions typically end with attendees staying to meet their PRA and/or PAA in person or to ask specific questions, often prompted by the presentation.

Lessons Learned

Research administrators are charged with relieving faculty of the administrative burden of research. We found in early iterations of the program that the presentation was heavy in the details of our work. This resulted not only in attendees losing interest and attention, but we realized sharing our work in such detail was transferring some of the administrative burden back on the faculty. Faculty generally are not interested in our time or workload (Cole, 2007), so when presenting this information to faculty, it is important to find the "sweet spot" of awareness without burdensome detail. Keeping the presentation broader has led to fewer "glazed-over" stares during the session.

The format of the presentation was initially formal. Attendees sat around a conference table, and the speaker stood behind a podium. During this set up, faculty seemed less engaged and less likely to contribute or ask questions. We decided to change the format to a more informal presentation, in which research office staff distribute themselves around the table and sit amongst the attendees, presenting from their seat. This combats the feeling of being lectured, and we have found attendees to be more engaged and likely to ask questions.

Originally intended to educate new faculty, we found the session was also helpful as a refresher for established faculty. As such, advertising as onboarding was a deterrent for experienced faculty to attend. We adjusted the name of the program to PART-E to broaden our attendees and more accurately describe the session. Although all the information presented will not be new to

established faculty, we try to bring new updates and topics to each session and provide a refresher on our services to appeal to all faculty. Since rebranding, we have seen a positive impact with the number of attendees for PART-E sessions increasing by 40%.

Conclusion

Before starting PART-E sessions, the total grant submissions in fiscal year 2014 was 265. By the end of fiscal year 2017 with PART-E sessions in place for two years, the department submissions increased to 311, which is a 17% increase compared to the overall Medical School increase of 8%. While this does not necessarily indicate PART-E is responsible for the increase in submissions, it certainly supports the continued need for education and training surrounding research administration. We know the program has impact by the many inquiries the PRO receives following a session. After each presentation, the PRO receives a numerous emails and phone calls from faculty asking questions, looping the PRO into transactions already in process, and notifying PRAs of upcoming submissions. On many occasions, the inquiries to our office initiated by PART-E have protected the faculty, the PRO, and the university from time-consuming, difficult, and potentially non-compliant situations.

With the majority of research administration work completed online and over email, in-person interactions with faculty are rare. PART-E sessions allow us to meet new faculty right away and meet faculty face-to-face, some of whom we have worked with for a year and have never met in person. Connecting a name to a face, for both the PRO and faculty, has increased the number and quality of our interactions. Building stronger relationships and partnerships based on mutual trust and respect will allow us to "enhance customer service ability, facilitate enforcement of policies and procedures, and help us accomplish tasks" (Luongo & Moody, 2015, p. 9).

The results of PART-E have been invaluable for our department; however, we have found the issue of onboarding faculty expands outside our department. The topic of training/onboarding faculty at the University of Michigan is becoming a key area of focus on many university-wide committees. As a result of presenting the PART-E program at multiple internal and local conferences to share our experience and learn from what others are doing, PART-E has become a model and starting point in an initiative to streamline faculty research administration training and onboarding at the university and is a topic of interest for research administrators outside the University of Michigan, as evidenced by attendee comments from the SRA Michigan Chapter Meeting in 2017 (see Table 3).

Table 3. Attendee Comments from SRA Michigan Chapter Meeting 2017 Presentation

"Presentation was relevant and something that I can take back and apply to my job."
"Excellent topic! The peds presentation is so very much more than information for new faculty only. It's a good way to present a consistent message to research faculty over a large organization (particularly when staff turnover is high. Helps to keep expectations for both direcdtions [directions] clear)."
"This is really an amazing topic. This could be presented around the university to engage other departments to onboard not only with a senior faculty member; but engage with their research team to build those relationships. Thank you! Never, never sign anything [anything] (to faculty) is my favorite part."

We strive to provide the most productive and beneficial program we can to improve the research administration process for faculty, and we will continue to adapt the program as needs change and the department evolves. The PRO looks forward to developing departmental training opportunities for faculty to compliment the broad overview of PART-E. As our office grows, we hope to expand the positive impact past this program by focusing on our mission, because, after all, we are here to support the faculty, and of course, to PART-E.

Authors' Note

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Building a Research Onboarding Program in a Pediatric Hospital: Filling the Orientation Gap with Onboarding and Just-in-Time Education

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Abstract: *An onboarding program is a powerful tool to welcome new employees and support their productivity. Children's Mercy Hospital created a systematic Research Faculty Onboarding Program (RFOP) to engage new research faculty from their first day with the hospital and to shorten the startup time to productivity. Surveys and interviews indicated that onboarding has provided new faculty with a sense of community with the larger organization. The RFOP has four aims: 1) to increase new researcher productivity, 2) to improve retention rates of new faculty by helping them become involved and connected with the organization, 3) to provide audience-specific, in-depth, timely information that is useful and memorable, and 4) to reduce redundant conversations while guaranteeing the delivery of high-quality, consistent, and accurate information. Prior to their start date, faculty receive a web survey designed to communicate the scope of their research and immediate logistical needs. Based on this information, faculty receive personalized quick-start guides, crucial introductions, and logistical setup within their first 10 days. Finally, the program includes a Triage Unit to provide just-in-time training as faculty set up their first research projects. This structured Research Faculty Onboarding Program is competency-based through mentorship and classroom-setting lectures.*

Keywords: *Employee Satisfaction, New Employees, Best Practices*

Introduction

Expectations of excellence and productivity in academic medical centers can be challenging for new research faculty as they struggle to make sense of their new environment (Birden, 2017; Goldschmidt, Rust, Torowicz, & Kolb, 2011; Ellis et al., 2015). Faculty members, with broad responsibilities that may include clinical care, may be vulnerable to frustrated idleness during their first few months (McCarthy et al., 2016a). New hires nearly always arrive with passion to start their research immediately, but can quickly become overwhelmed by the amount of new information and complexity associated with starting work at a new organization (Klein & Polin, 2012). One study shows that 69% of employees are more likely to stay with the company for at least three years, if they experience a good onboarding program (O.C. Tanner, 2018). Studies also show that a newly hired employee takes an average of eight months to reach full productivity

(Ferrazzi, 2015). This timeframe can apply to both established investigators, as well junior investigators.

Research Context

Children's Mercy Hospital (CMH) is recognized as one of the nation's top pediatric hospitals, according to U.S. News & World Report's 2018-2019 "Best Children's Hospitals" report (U.S. News, 2018). Part of its overall academic mission is to be an international leader in pediatric translational research. This commitment has led to a 400% increase in the number of full-time investigators hired annually between 2011 and 2017, as shown in Figure 1. This number is expected to double again by 2020. The biggest catalyst for this growth has been the creation of a new research institute that will incorporate researchers at all levels, both at CMH and at collaborating institutions in the Kansas City, Missouri area. Over the past two fiscal years, a total of 26 newcomers were onboarded. In Fiscal Year (FY) 2017, 10 newcomers elected to participate in the onboarding program. Of those, 60% were female and 40% male. In FY 2018, 16 newcomers elected to participate in the onboarding program. Of those, 38% were female and 63% were male.

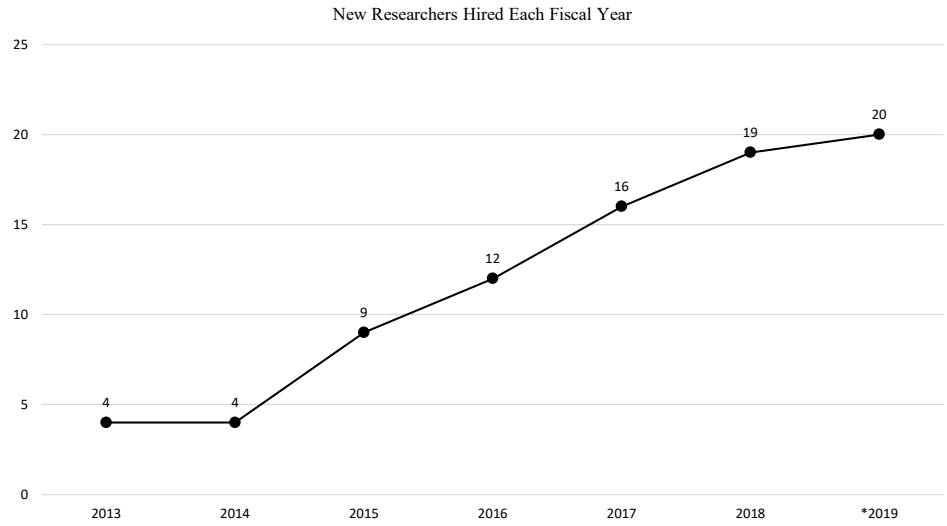

Figure 1. Number of New Investigators Hired Each Academic Year.

The Children's Research Institute (CRI) is creating an integrated research environment in a dedicated, state-of-the-art 9-story building with 375,000 square feet, including more than 3,000 linear feet of bench space for research and significant dry space. Construction began in winter 2018 and is expected to be completed by mid-2020. Two generous donations of $75 million each were provided to fund the construction of the future home of the CRI, and to accelerate the recruitment of top researchers from around the globe.

Prior to 2016, research faculty at CMH were onboarded primarily by clinical divisions and had trouble integrating into the research culture. Investigators encountered barriers in building relationships with other researchers and key research administrative staff, such as grants specialists, contract specialists, and grant accountants, and in lacking a clear path or support structure to break down those barriers (McCarthy et al., 2016a).

To address these challenges, CMH created a comprehensive research faculty onboarding program that was first implemented in July 2016. The Research Faculty Onboarding Program (RFOP) is an evolving model with components that may be helpful to other research centers in addressing similar challenges and may serve as a starting point for dialogue across academic medical centers for developing best practices for onboarding. In this case study, we describe the initial challenges, the formation of a working group, the components of the onboarding program, and the ongoing challenges of creating an onboarding program for research faculty.

Specific Aims

The general goal of onboarding is to help new hires understand how to be successful in their day-to-day job and how their work contributes to the overall organization. After reviewing the unique departmental goals and systems currently in place, key stakeholders settled on four specific aims for the RFOP: to (1) increase new researcher productivity, (2) train new research faculty on centralized knowledge critical to the organizational culture, (3) engage new research faculty with the research culture, and (4) connect new research faculty with different research departments throughout the organization. The goal was to provide the necessary tangible and intangible resources to become fully functioning investigators at Children's Mercy.

Making the Case

Definition of Terms

A critical part of designing the program was distinguishing onboarding from orientation (Garcia, Watt, Falder-Saeed, Lewis, & Patton, 2017; Graybill, Carpenter, Offord, Piorun, & Shaffer, 2013). Our institution, like most academic medical centers, engages new faculty with an orientation program. Orientation is typically characterized as a one-time event. In 2016, employee orientation primarily focused on the newcomer's role in the institution as a general faculty member. The program highlighted the mission and vision of the hospital, but neglected the specific needs of research faculty such as to develop, submit and then administer a grant.

Orientation was a classroom-style event that included information on the hospital's strategic plan, hospital-wide policies, and broad expectations for dress and conduct. The goal for orientation was for the employee to be ready for training wherever they happen to work in the organization. The challenge was that "wherever they happen to work in the organization" was often not prepared to initiate a robust research onboarding experience for research faculty. Many areas had experience onboarding clinicians, but not specifically physician scientists or independent investigators. The advisory committee needed a tool stronger than employee orientation to meet the needs of faculty with diverse research interests and at different academic levels.

Unlike orientation, onboarding is characterized by a series of events (including orientation) that helps newcomers understand how to be successful in their day-to-day job and how their work contributes to the overall organization. Instead of taking place in a classroom, onboarding generally occurs as on-the-job one-on-one interactions between the new employee and their manager (Baldwin, 2016). Onboarding is highly customized and individualized to the new employee. The goal of onboarding is for the employee to feel ready to contribute to the company—not just to understand the company and its mission, vision, values and goals.

Formation of Committee

Over the past decade, faculty orientation programs have been delivered by Human Resources and Medical Administration to meet the needs of incoming clinical and research employees. In 2016, at the request of the Executive Director, a multidisciplinary advisory committee met to define the challenges facing all research faculty and especially new research faculty, and to design a framework to foster research faculty development and retention (McCarthy et al., 2016a; Del Giudice, Nicotra, Romano, & Schillaci, 2017).

This advisory committee included representatives from 14 different departments who represent decades of combined research experience, with subject matter experts from the department of Pediatrics, the Office of Research Integrity, Research Education, Research Contract Administration, Grants Administration, Research Technology Services, Research and Grants Accounting, Research Business Operations and Project Support, Institutional Research Safety, Institutional Biosafety, Technology Transfer and Communication, Corporate Compliance and Graduate Medical Education. The group has remained intact with approximately 11 participants who remained engaged over a two-year period between January 2016 and July 2018. The onboarding program was planned to start on July 1, 2016 to coincide with the hospital's fiscal year.

The advisory committee articulated a number of themes they believed would be helpful for faculty: (1) centralized resources to increase new researcher productivity, (2) training on institutional knowledge critical to the organizational culture, (3) a mentoring framework, (4) a just-in-time training platform, and (5) engaging new employees into the research culture. Table 1 indicates the professional needs from an onboarding program. The themes and data were presented to the department chairs, with the strong support of the Executive Director, which endorsed establishing the RFOP. Because retaining excellent and satisfied faculty is more cost-effective than recruitment, the case for creating such a program was compelling (Emans, Teperow-Goldberg, Milstein, & Dobriner, 2008; Baldwin, 2016).

Table 1. Professional Needs from Onboarding Program.

Institutional Professional Needs	What the Research Faculty Onboarding Program Provides
Increase new researcher productivity.	Trains new faculty about the research culture and system, allowing them to navigate the system faster and more efficiently.
Train new faculty on centralized knowledge critical to the organizational culture.	Provides audience-specific, in-depth, up-to-date and timely information over a short period of time, so that the information is useful and memorable for the new employee.
Engage new faculty with the research culture.	Offers opportunities for new faculty to meet one another, thereby involving them in the culture of the organization from an early date.
Connect new faculty with different research departments throughout the organization.	Offers a systematic method for introducing new faculty to different research departments throughout the organization, allowing them to get up to speed more quickly with the organization's infrastructure and research business processes.

Stakeholder Engagement

Integral to the success of the initiative is frequent and honest feedback with our research faculty and support staff (Ross, Huang, & Jones 2014). The advisory committee held conversations with administrative leaders within the departments and individual divisions, current research faculty, and members of the research community in our affiliated universities. The common message was that a long-term investment into a well-crafted onboarding program would increase employee productivity, improve retention rates, provide memorable information, and reduce conflicting redundancies in new employee education.

Perhaps the most robust and important group of stakeholders engaged in the process were the newly hired research faculty themselves. Those who had most recently been hired into the institution most acutely felt the need for a targeted research onboarding program. The advisory committee engaged these new research faculty members with frequent messaging and regularly scheduled face-to-face meetings to give candid and critical feedback about the design for the RFOP. All stakeholder feedback was reviewed by the advisory committee in regularly scheduled meetings. The engagement at multiple levels was a crucial component of the initiative.

Program Framework

Staffing

The initial infrastructure of the RFOP included a 0.35 full-time equivalent (FTE) onboarding trainer, a 0.20 FTE administrative director, and the advisory committee. The onboarding trainer position was key in providing individual assistance to the newcomer during the orientation phase and in solving day-to-day challenges (Ross et al., 2014). Collaborations were established with the division directors, recruitment officers in Human Resources and Medical Administration, and all research administration staff (Del Giudice et al., 2017). The RFOP reports directly to the Executive Director and the Department of Pediatrics Chair, is a member of the Research Working Group (which meets bi-monthly), and presents data on the progress annually to the

Executive Director and Chief Scientific Officer of the CRI.

Target Audience

Data were reviewed on the number of new academic faculty who actively participate in research. New research faculty facing the most issues were found to be those who were with the institution for fewer than 30 days and who were expected to spend 40% or more of their effort in research, as determined by their offer letter (Langley, Dority, Fraser, & Hatton, 2018).

Research education is provided to various levels of learners throughout the organization, including principal investigators (PIs), co-investigators, and research faculty; research coordinators; postdoctoral fellows; other study staff (clinical vs. non clinical); research office staff; graduate medical students; study team members from outside institutions; and other students, interns, or volunteers. This onboarding program focused exclusively on PIs, co-investigators, and research faculty.

Consideration was given to creating a separate onboarding experience for early career vs. established career faculty because these groups often require different knowledge and have different learning styles. However, ultimately it was decided that these differences could be accommodated within the flexibility of the just-in-time training portion of the program.

Curriculum and Collaborations

The RFOP used a blended learning model with synchronous (instructor-led) and asynchronous (self-paced) learning approaches, as well as e-learning instructional strategies (McCarthy et al., 2016b). We cross-examined all newcomer education currently in place within our organization. This included a general employee orientation, the Educational Office orientation, Quality and Safety education, Clinical Faculty orientation, and New Faculty Orientation provided by the Faculty Development office. After examining the content already being provided across the organization, we isolated the research-specific information that needed to be addressed (McCarthy et al., 2016b).

The research curriculum needed to address the following areas: recognizing research vs. quality improvement, research education requirements, IRB/CITI requirements, software systems, people and support teams, organizational charts, forms, lifecycle and deadlines, human subjects research, lab science, legal agreements, and equipment and facilities. The committee also collaborated closely with other groups in the hospital who are also teaching new employees. These groups included the Office of Faculty Development, Library, Education Office, Research Central Office/Department Administrator, Quality Improvement, Professional Development, as well as Department Associate Chairs, Administrative Directors, and Divisions Chiefs.

As we began to lay the framework for the onboarding program, we conducted several interviews and brainstorming sessions to understand what it means to be a researcher at CMH. We wanted to ensure consistency and continuity throughout the central research office and all department divisions. We used quality commitments, standards and expectations to form a common language around onboarding throughout the organization. It was important to follow the "common

thread" all the way through the onboarding process to ensure that it made sense to outsiders.

Just-In-Time Training

The final phase of the RFOP includes a just-in-time (JIT) training component affectionately called the Triage Unit. The JIT training component is based on this concept of triage—to sort those in-need into groups based on their need for education and their likely benefit from that education. The JIT training component has three distinct platforms: (1) competence—how to do, (2) character—way of being, and (3) technique—way of doing. The competence platform is low-level of accountability and is geared towards those who need beginner guidance and support. The character platform is mid- to high-level accountability and is geared towards those who need direction and counsel. The final capability platform is a high-level accountability program for those who need immediate instruction to complete a vital time-sensitive task.

JIT Competence Platform. Most often, JIT training is considered part of the competence platform, offering the new hire general basic instruction, technical guidance, and structured support. The value of this training depends on the coach's skills, the PI's motivation to learn, and the successful transfer of knowledge. Table 2 illustrates the competence platform in the Just-in-Time Training Triage Unit. This platform consists of pre-award training that focuses on how to start a first project. The purpose of this platform is for the new hire to meet and interact with others, to receive knowledge, and to improve performance in their new role. The investigator receives basic instruction on the institutional software and processes related to submitting a grant application, and also receives structured support in problem-solving techniques to use during their first grant submission.

Table 2. Just-in-Time Training Triage Unit, Competence.

Type	**Competence** (How to Do)	
	Training / Teaching	**Coaching**
Example	Beginner software or institutional processes training, newcomer doesn't know how to work the internal system	Newcomer wants to submit an application in the next 6 months, but is unsure of how to start the process
Focus	Receiving instruction and guidance	Receiving structured support to find own solutions to issues
Context	Community and the organization or team	The individual's job and work
Orientation	Discussion	Probing
Number	Ten to twenty, Group efforts, systems approach	One-on-one to one-on-twenty, Group efforts, systems approach
Value depends on:	Attendees learning and transfer of knowledge	The coach's skills and the coach's motivation
Content	Based on the leader	Based on job needs
Goal	Goal is collective	Performance improvement
Progress/Pace	Continuous, Incremental	Depends on motivation
Level of Accountability	Low level	Low level
Method	Community (Heart and Mind)	Question and probing (will and mind)
Purpose	To meet and interact and receive knowledge	To improve performance in role
Resources	Scheduled Basic Foundational Classes	Advanced Classes on Specific Topics

JIT Character Platform. The second JIT platform is used by more established investigators, or those already familiar with our systems and processes, since they may require encouragement and mentoring more than basic instruction. Table 3 illustrates the character platform in the Just-in-Time Training Triage Unit. This platform offers tools and resources to build constructive research practices. Researchers may be paired with a mentor or asked to participate in a special-interest group or collaboration. The value of this platform depends on the PI's motivation, the mentor's experiences and knowledge, and the application of tools provided. The main purpose of this JIT platform is to develop a growth plan for the new hire to reach full career potential.

Table 3. Just-in-Time Training Triage Unit, Character.

Type	**Character** (Way of Being)	
	Counseling	**Mentoring**
Example	Application due in 2 months, newcomer aware of requirements but unsure of deadlines	Newcomer has an application started, but wants to consider all options
Focus	Cognitive and emotional well-being	Giving and receiving direction and evaluating options
Context	Self-understanding to adopt more constructive research practices	Personal development for future career
Orientation	Discussion	Application
Number	One-on-one, Individual ideas, efforts	One-on-one, Individual ideas, efforts
Value depends on:	The experience and motivation of the counselor and willingness to share	The mentor's experience and knowledge and willingness to share
Content	Based on client needs	Based on mentee needs
Goal	Personal well-being and growth investment	Intentional growth investment
Progress/Pace	Depends on severity of issues	Made by pre-determined goals
Level of Accountability	Mid-level	Mid to high level
Method	Direction and leadership (heart, will and mind)	Direction and leadership (heart, will and mind)
Purpose	Personal well-being and the development of a growth plan	To reach potential in career and life
Resources	Printed Resources and Checklists	Mentoring Program and Special Interest Groups

JIT Technique Platform. Last, new hires may require JIT training in performing important institution-specific tasks that often arise at the last minute. The third JIT platform is intended to improve task performance and efficiency to perform a task, such as completing a complex internal form. Table 4 illustrates the technique platform in the Just-in-Time Training Triage Unit. This instruction is delivered via one-on-one consultation, or via specialized short instructional videos, lists, or checklists. The value of this JIT platform depends on the PI's motivation, learning, and successful skill application.

Table 4. Just-in-Time Training Triage Unit, Capability.

Type	**Capability** (Way of Doing)	
	Performing	**Managing**
Example	Application due in 2 weeks, newcomer unaware of deadlines and requirements	Application due tomorrow, newcomer has nothing done
Focus	Giving instruction and direction to complete a single task	Giving instruction and direction to complete a single event
Context	The individual's immediate task	Tasks to be done within the role
Orientation	Skill transfer	Skill transfer
Number	One-on-one, Individual ideas, efforts	One-on-one, Individual ideas, efforts
Value depends on:	The attendee's learning and skill application	The manager's authority and skill
Content	Based on task needs	Based on event needs
Goal	Job skill development task efficiency	Task completion and efficiency
Progress/Pace	Depends on skills	Made by pre-determined goals
Level of Accountability	Mid to high level	High, intense level
Method	Question and probing (will and mind)	Motivation and management (mind)
Purpose	To improve task performance	Efficiency and effectiveness
Resources	Specialized Videos and Checklists	One-on-One

Delivery Format and Marketing Strategy

Several educational delivery formats are available today. The committee considered the following methods: articles, audio, checklists, email, event, examples, forms, glossaries, infographics, lectures, meetings, policies, printables/handouts, PowerPoint slides, social media, station rotation style events, storytelling, videos, webinars, websites, and workshops. Of these options, an internal website, several printable handouts, an online webinar, and several boilerplate email messages were chosen.

The internal website contained the most important content in the most visible and accessible place for hiring managers and new employees. The website contained information for all newcomers affected by the program. In addition, the website was easily monitored and updated by the onboarding trainers. The printed brochures and information leaflets were also updated by the onboarding trainers. The primary goal of all printed information was usually to drive the target to the internal website. All email messages were uniform in look and wording to ensure

continuity of message.

An important point for us to consider in content delivery was the power of public relations and face-to-face interactions. The key to individualized content is a steady flow of interesting and relevant material. Once the framework and basic structure of the onboarding program was finalized, the committee considered the marketing strategy for the initiative.

Finally, we used promotional branding to define the program to our faculty. Our core message and image was embedded in the four phases of the program: Discover You, Discover Our Research, Discover Your Research Here, and Discover Community. Newcomers value participation, seek validation of their decision to move, and need information. Faculty in general are looking for pride in association, awareness among peers, and recognition of their work and publications. The four phases of the program focused on our target audience by addressing the combined needs of both newcomers and established faculty.

Instrumentation

Given the complexities presented by each individual researcher entering a new institution, the advisory committee needed to design a program flexible enough to accommodate every researcher, no matter where they were coming from, whether they were a young or established investigator, or what department or division they were settling into. In order to be successful, we needed to build a framework that could be activated prior to the employee's first day and flexible enough to be used in a variety of situations. This flexibility was possible because of the onboarding survey that serves as the foundation for the rest of the onboarding program (Garcia et al., 2017).

The onboarding survey communicates vital information about a new employee's research, their immediate startup needs, and any action steps (such as data transfer) that may need to be taken prior to their last day at their previous institution. The survey is completed online and contains 10 sections. The survey requests only the most vital information about the new researcher and their research enterprise. The survey has 49 questions and is delivered via REDCap© (a free, secure, web-based data capture and survey system). The survey takes an estimated 10 minutes to complete depending on the nature and breadth of the new employee's research enterprise.

Once the survey is completed and returned to the onboarding trainer, key members of the advisory committee, the CRI, and the relevant Department are then notified of the new researcher's start date and provided all vital information in the survey.

The onboarding trainer uses the information provided in the online survey to build a custom onboarding experience for the new hire. For example, if the survey reveals that the new hire is an established investigator who has permission to start a laboratory at CMH and plans to use radioactive materials, their onboarding would focus on the Institutional Biosafety protocols and include substantial face-to-face time with the Biosafety Officer and staff. However, if the survey reveals a young investigator with plans to submit a grant application, the onboarding experience would focus more heavily on introductions to the pre-award staff and enrollment into the mentorship program. Table 5 shows all questions asked on the 2016-2018 researcher onboarding survey.

Table 5. Onboarding survey.

Researcher Onboarding Survey
This survey is designed to aid in the onboarding process by providing us with a brief overview of the nature of your research activities. The primary intent of collecting this information is to make grant transfer and preparation for your research activities go as smoothly as possible upon arrival at CMH.
People and Places
Section 1: Basic Information
1. Please list your full name and credentials: (First M. Last, Credentials) 2. Please list your expected start date at Children's Mercy Hospital: (MM-DD-YYYY) 3. What organization are you coming from? 4. Please list your research interests:
Section 2: Clinical Trials, Research Operations, and Research Development
5. Children's Mercy has central research coordinators available to help support clinical trials in a short-term capacity. Are you interested in hearing more about this service? 6. Are you bringing or will continue collaboration with post docs or other trainees (e.g. MD Fellows, training grant fellows, etc.) from your current institution to CMH? If yes, please provide a brief description of personnel and their level of training: 7. Does your current research involve an Investigational New Drug (IND) or Investigational Device Exemption (IDE) application? 8. Do you currently hold any IND or IDE that will not be closed with the FDA prior to your arrival at CMH? If yes, please provide a brief description of your IDE or IND. If yes, is the IND/IDE in good standing? 9. Do you plan to use any of the research clinical or research laboratory facilities at CMH? 10. Do you plan to use any investigational drugs in your research? If yes, please provide a brief description:
Sponsored Research
Section 3: Sponsored Projects and Research Management
11. Do you have any grants and/or awards that must be transferred to CMH from your current institution? If yes, please provide a brief description of the grants and/or awards (specifically sponsor, full title, and full performance period): 12. Please provide contact information for the research staff office at your previous organization including a name and email address. 13. Are you submitting any award applications immediately before or upon your arrival? If yes, please provide a brief description and indicate the sponsor, application due date, and RFA number, if available: 14. Do you have, or are you submitting any grants and/or awards under contract with the Department of Defense (as a primary contractor or subcontractor)? If yes, does the contract require that CMH possess a Facility Safety Plan registered with the DoD?

15. Do you have any other agreements under which work will continue once you are at CMH (i.e. consulting, storage, etc.)? If yes, please provide a brief description of the agreement(s):
16. Do you have capital equipment purchases (purchase of more than $5,000) that you plan to make before or immediately upon arrival at CMH? If yes, please provide a brief description of the capital equipment purchases:
17. Please list all specialized equipment (e.g. freezers, carbon dioxide incubators, biosafety cabinets (BSC, or "tissue culture hoods") hoods, mass spectrometers, cell sorters, etc.) that you plan to bring to CMH. Please indicate model name, number and serial number, if available.
18. Do you need to move any materials (e.g. frozen samples, cell lines, lab chemicals, bio-hazardous materials, animal tissues, etc.)? If yes, please provide a list of all materials. Identify if materials include infectious agents, Risk Group 3 materials, toxins, and/or recombinant or synthetic nucleic acid molecules.
19. Do you have specialized equipment that will require an emergency power source (i.e., -80 degree and -20 degree centigrade freezers, carbon dioxide incubators, etc.)? Please list each item that will require an emergency power source:

Active Protocols

Section 4: Animal Research Management

20. Do you have any IACUC protocols to transfer or submit upon your arrival? If yes, please provide a brief description of the protocol. Indicate if the protocols will involve recombinant or synthetic nucleic acid molecules (includes transgenic animals).
21. List all research animals you would like to transfer to UMKC. NOTE: CMH small animal research is conducted through University of Missouri Kansas City (UMKC). Indicate if the animals are transgenic, have been inoculated with or otherwise exposed to recombinant or synthetic nucleic acid molecules.
22. During the conduct of your research, will you be transporting animal tissues or cells from animal facilities other than UMKC to a CMH laboratory?
23. If yes, please describe. Include if animal materials are transgenic, if they contain infectious agents or other recombinant or synthetic nucleic acid molecules.

Section 5: Institutional Review Board (IRB) Protocols

24. Do you have any current Institutional Review Board (IRB) protocols to transfer or submit upon your arrival? Or any studies that you will continue to work on from your previous IRB? Please describe the protocol and also note if the original IRB will remain the IRB of record:
25. Are you bringing any de-identified data sets with you on which you anticipate further analysis activity and which will need a Data Use Agreement? If yes, please provide a brief description:
26. Do you plan to transfer current or submit new Human Gene Transfer protocols?
27. Will your IRB protocol involve laboratory research procedures conducted at CMH (Includes sample processing; does not include Standard of Care laboratory testing)? If yes, please provide a brief description:

Section 6: Institutional Biosafety Committee (IBC) Protocols:
28. Does your offer letter grant permission for you to start a new research laboratory (wet or dry) at CMH?
29. Will you be joining an existing research laboratory at CMH?
30. Please identify the CMH laboratory and provide a brief description of the research, focusing on the research materials and procedures.
31. Will you be bringing equipment that may contain radioactive materials (e.g., Geiger counters, liquid scintillation counter, irradiator, electron capture detector, etc.)?
32. Do you plan to use Risk Group (RG) 3, RG4 etiologic agents, Select Biological Agents, or Toxins (SBAT) in your research? If yes, please provide a brief description:
33. Do you plan to conduct research involve radioisotopes or radioactive materials (RAM)? Please provide a brief description including the identity of the isotope(s).
Technology Services
Section 7: Technology Services
34. Are there any specialty computer purchases that you will need to make specifically for your research activities (aside from a standard desktop) upon your arrival at CMH? If yes, please provide a brief description of the computer equipment:
35. Are you bringing computers(s) or any specialized technology equipment with you to CMH? If yes, please provide a brief description of the computer equipment, including if possible name, model and serial numbers:
36. Will you need to transfer data from your previous organization to Children's Mercy?
37. How much data storage do you envision you will need for your first year at Children's Mercy? a. None b. 10 GB Flash Drive c. 1 TB External Hard Drive 1 TB Network Storage d. 1 PB Extensive I Don't Know
38. Do you have any externally housed data that will need to be brought into the CMH system (data saved outside of your previous organization)?
39. Do you have any current specific software needs? a. Software available for purchase through an existing vendor b. Existing custom software created by yourself or your previous organization c. New custom software not yet created d. None at this time
40. Please provide additional information about your software:
41. Describe any technology related needs that are not previously covered:

Section 8: Office of Technology Transfer and Commercialization
42. Do any of the following apply to you or your Research?: a. research materials such as cell lines, antibodies, etc. b. corporate sponsored research programs c. research that may lead to patents or licensing d. a startup company based on your research e. research involving Clinical Trial Agreements
43. Have you submitted an invention disclosure on your research with a previous institution?
44. Are you listed as an inventor on any patent applications or issued patents? If yes, do you plan to continue this research at CMH?
Research Compliance
Section 9: Conflict of Interest and Research Compliance
45. Do you have a significant relationship (i.e., consultant, speaker's bureau, advisory board, etc.) with an sponsor or a sponsoring organization that may pose a conflict of interest?
46. In the past 10 years, has a study you have been involved in been inspected and/or reported for non-compliance to any external entities such as the FDA, OHRP, EMA, NIH, or similar organizations?
Final Comments
Section 10: Final Comments
47. Would you like to meet with someone regarding any of the following issues during your first month at Children's Mercy Hospital?
48. Describe any research related needs or questions that were not previously covered:
49. Please upload any requested or relevant files.

Section 1 of the research onboarding survey includes four questions asking for basic information about the new employee, including name, contact information, research interests, and expected arrival date. This information allows the orientation trainer to confirm the identity of the new arrival and gain contact information for all communications prior to the first day of employment. It also allows the trainer to begin making connections with potential mentors and collaborators within the institution that share interests. Mentors were selected based on the newcomer's clinical division and academic rank.

Section 2 covers clinical trials, research operations and research development plans. This section asks two questions regarding the use of a research coordinator and/or any continued collaborations with any post docs or other trainees from the previous institution. This section also asks three questions regarding the use of an Investigational New Drug (IND) or an Investigational Device Exemption (IDE) application. The newcomer is also asked to clarify if they plan to use any of the research clinical or research laboratory facilities at CMH.

Sponsored Research

Section 3 of the research onboarding survey has nine questions relating to sponsored projects and research business management. This section also asks questions regarding current grants and awards that must be transferred to CMH from their current institution. New employees are asked to describe the grants and/or awards with special attention to sponsor, full title and full performance period of the project. They are also asked to provide the name, address, and phone number for the research staff office at their previous organization where the work is currently being performed. This section also requests information on any grant proposals that the new employee may plan to submit within the first three months of arrival. Last, this section covers any large capital equipment purchases (greater than $5,000) or specialist equipment purchases (e.g., freezers, carbon dioxide incubators, and biosafety cabinets) that they may plan to make prior to, or immediately upon arrival at CMH. The responses allow our facilities team to prepare for incoming equipment and equipment that may require an emergency power source (e.g., -90 degree and -20 degree centigrade freezers, and carbon dioxide incubators).

Active Protocols

Section 4 of the survey has four questions on any planned animal research management. The new employee is asked about any IACUC protocols that they may have or plan to transfer or submit upon their arrival. The new employee is also asked whether animal tissues or cells will need to be transported from external animal facilities, and whether those animal materials are transgenic, or if they contain infectious agents or other recombinant or synthetic nucleic acid molecules.

Section 5 of the survey includes four questions from the Institutional Review Board (IRB) office regarding any current IRB protocols that will need to be transferred upon the new employee's arrival. This section also includes questions regarding the continued analysis on de-identified data sets. Last, this section asks for any needed information regarding the transfer of current or new Human Gene Transfer protocols.

Section 6 of the survey poses six questions from the Institutional Biosafety Committee (IBC) regarding any equipment or research to be performed in a laboratory. Information regarding radioactive materials (e.g., Geiger counters, liquid scintillation counter, irradiator, and electron capture detector) and Risk Group (RG) 3 or RG4 etiologic agents or Select Biological Agents or Toxins (SBAT) is collected within this section.

Technology

Section 7 focuses on technology services and includes eight questions regarding specialty computers, technology or equipment that the researcher is bringing with them or will need upon arrival. This section also includes information about how much data the employee will need to transfer from their previous institution and how much storage space they will require (e.g., 10 GB Flash Drive, 1 TB External Hard Drive, 1 TB Network Storage, 1 PB Extensive, etc.). The employee is also asked if they have any externally housed data that will need to be brought into the CMH system (data saved outside of their previous organization). Any software needs are also communicated in this section.

Section 8 comes from the Office of Technology Transfer and Commercialization. Three questions include information about the use of research materials such as cell lines and antibodies, corporate-sponsored research programs, research that may lead to patents or licensing, a startup company based on their research, and research involving Clinical Trial Agreements. Questions are also included regarding inventions, patent applications, or issued patents.

Compliance

Section 9 includes two questions about conflict of interest and any reports of non-compliance from any external entities such as the FDA, OHRP, EMA, NIH, or similar organizations.

Closing

The 10th and final section of the survey includes three questions that allow the employee to request meetings with specific research offices, describe any questions or comments not addressed elsewhere in the survey, and to upload any relevant documents (e.g., protocols and CV).

Implementation

The onboarding program is implemented in four phases (Langley et al., 2018). With completion of each phase, the focus shifts from a broader understanding of research issues to fundamental project management, including progressively more complex activities and productivity requirements (Langley et al., 2018). Phase I begins when the offer letter is accepted, focuses on assessment and triage of critically important startup details, and has minimal expectations for new knowledge acquisition. The Phase II goal is to provide the newcomer with increasing autonomy, experience, and expectations in the conduct and management of research. Phase III continues the expectation of self-directed learning while the newcomer begins to practice research independently. Last, the Phase IV goal is continued mentorship, which allows the newcomer the freedom to discuss expected and unexpected research issues with the assigned mentor.

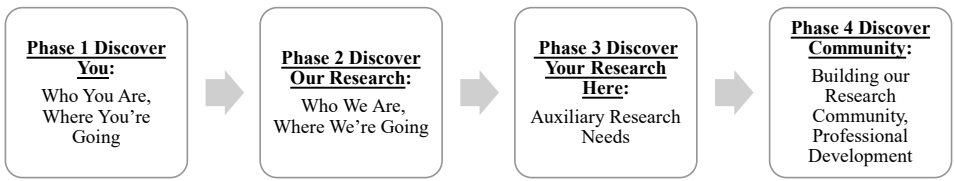

Figure 2. Phases of the Research Faculty Onboarding Program.

Phase I: Discover You

Phase I takes places once the employment contract has been finalized. During this stage, the newcomer is preparing to move to CMH. This stage addresses the technical and organizational logistics of moving research and equipment from one institution to another. During this stage, it is important for the mentor and onboarding trainer to take time to get to know the newcomer and their career goals. This is also a good time to discuss productivity and effort expectations with

the newcomer.

Phase I includes the online survey, transfer of data and sponsored projects, and basic research orientation. After the offer letter has been signed, the employee is asked to complete the onboarding survey that asks about their current and future research needs. This survey will form the foundation of the rest of the onboarding experience for that faculty member. Once the newcomer completes and returns the survey, the onboarding trainer will process the survey results and communicate the newcomer's information to the rest of the onboarding team. Prior to their first day, the onboarding trainer will work with the newcomer to transfer data via the cloud to eliminate the need for external hard-drives.

On the first day of employment, the new employee receives an email welcoming them and their research to the institution. The email contains information regarding their personal onboarding trainer and informing them about the RFOP. This first email is informational, intended to welcome the new employee to the RFOP and let them know that an onboarding program has already been activated for them. The welcome email states that their onboarding trainer will contact them in a few days to begin scheduling a few introductory meetings. It acknowledges that the first month of a new job can be stressful, and that we want to make this transition as seamless as possible.

During this phase, the newcomer will be required to complete the online research orientation. CMH requires a basic research orientation for anyone prior to their participation in research activities. For new hires, this has included watching two online self-learning modules: Research Bootcamp and Research BrushUp (Carcich & Rafti, 2007; McCarthy et al., 2016b). Bootcamp topics include organizational structure and systems, responsible conduct of research, compliance, budget and patient care charges, the protection of human subjects, research accounting, and conflict of interest. BrushUp is updated yearly and is a mechanism to communicate any updates or changes throughout the organization in the last year. This could include changes to pre- or post-award procedures, research education elective notices, modifications to internal deadlines, a compliance review of the most common mistakes of the past year, and updates on upcoming process changes. Together, these two modules communicate all necessary research education to anyone new to research in the organization.

Phase 2: Discover Our Research

Phase II takes place within the first two weeks of employment. The focus is an introduction to research, giving an overview of research, our institutional processes, technology systems, oversight committees, and educational requirements. This phase provides a warm-up to the culture and equips the new faculty with basic research knowledge.

All new researchers will meet one-on-one with a specific core set of leaders and research staff. However, based on their online survey data, additional auxiliary meetings may be required based on the researcher's individual needs. This process highlights the true flexibility of the RFOP.

All faculty meet with the onboarding trainer for an overview of the research lifecycle at Children's Mercy, allowing the new employee to see the systems and programs used to complete a project

from start to finish. All employees also meet with the Office of Research Integrity for an overview of human research protections, with Research Education to ensure they understand the requirements prior to starting research activity, and receive a group introduction to Research Business Operations (Legal, Accounting, Patient Care, and Grants Specialist). Together, these meetings create the core foundation of the RFOP.

Optional meetings may also be scheduled based on the individual employee's needs. These meetings could include face time with our Intellectual Property team, Conflict of Interest, Research Contracts, Biosafety, Research Accounting, Graduate Medical Education, and Research Pharmacy.

Phase 3: Discover Your Research Here

Phase III takes place within the first six weeks of employment. The focus of this phase is in-depth, specialized, and research-specific introductions. A suggested agenda and meetings times are sent to the newcomer to ensure faculty want and can attend onboarding meetings. Meetings are tailored to the specific and individual research needs of the faculty member and are designed to get that faculty's research up and running as fast as possible. Meetings may include specialized consultations with technology services, research contracts, grant specialists, and many other auxiliary offices. The Executive Director of CRI strongly recommends the program to all newcomers during and after recruitment.

After all the onboarding introductory meetings are completed, the onboarding trainer follows up with the new employee to answer any lingering questions or discover any ongoing transition issues. The onboarding trainer will also contact everyone the new employee met with to discuss any impressions or issues from their meetings that may need follow-up or further clarification. The onboarding trainer will continue to visit with new employees as they transition their research and begin their career at Children's Mercy. Once all onboarding meetings have been completed and any continuing issues have been resolved, this phase of the new employee's onboarding is considered complete.

Phase 4: Discover Community

Phase IV takes place within the first eight weeks of employment and lasts for six months. The focus of this phase is to introduce the newcomer to fellow researchers with similar interests and connect them with the larger research community. Topics covered in this phase include exploration of mentorships and collaborations, technology development, public and patient engagement, and professional development. The Just-in-Time Education program, explained previously, is also included within this phase.

The final step of the onboarding program is to follow up with both the newcomer and the onboarding team to get their impressions and feedback on the program, bring closure to any ongoing issues, and clarify future expectations for research development, such as upcoming grant deadlines.

Results

Pilot Testing

RFOP was presented to two newly hired research faculty members. Research faculty came from two different institutions and from two different areas of research. The pilot testing was successful and the RFOP was met with voiced appreciation. Our pilot faculty emphasized problems with information management and technology, citing prodigious difficulty in transferring data and information over to CMH from their previous institution and difficulty with getting their new computers and software installed in order to begin their research at Children's Mercy.

Based on this feedback, we added three questions to our online survey to assess the amount of data the new hire would need to transfer and any special software or computer needs. We also added specific information about transferring data in the very first communication after the offer letter is signed. Last, we created an onboarding checklist for division staff that included instructions for ordering computer hardware and research software prior to the new hire's arrival. Since research information technology is often more complex and different from the average office technology, a liaison from the Research Informatics team was assigned to the advisory committee onboarding stakeholder group. Together, these changes fortified the onboarding process to ensure future success for those elements related to information management and technology.

Discussion

The RFOP was designed to inform new research faculty about the research culture and system, allowing them to navigate the system faster and more efficiently. The training provided audience-specific, in-depth, up-to-date and timely information over a short period, designed to be useful and memorable for the new employee. The RFOP offered a systematic method for introducing new research faculty to different research departments throughout the organization, allowing them to get up-to-speed more quickly with the organization's infrastructure and research business processes.

A research faculty onboarding program has the potential to bring a consistent and high level of service to new research faculty, while minimizing employee turnover and compliance risk. The RFOP sought to reduce newcomer uncertainty and anxiety through knowledge and interaction. The program also provided new employees with the necessary tangible and intangible resources to become fully functioning PIs at Children's Mercy. Over the last two years, we have onboarded over 39 new research faculty members. Based on information provided from faculty recruitment and subsequent effort reports, the RFOP has been a valued addition to the research program. Flexibility and adaptability is key to the RFOP's continued success. All materials are reviewed quarterly to ensure the program continues to provide timely information that is useful and memorable.

Lessons Learned

For the first year, the advisory committee agreed to target only new faculty who were promised 40% or more research effort in their initial offer letter (Langley et al., 2018). This translated to 16

new faculty members who were approached to participate in the research onboarding program. Of the 16 surveys sent out, the RFOP received 12 online onboarding surveys in response. Of those 12 respondents, 10 faculty chose to have the full onboarding experience in the first year. The two research faculty who completed the survey but ultimately declined onboarding were hired from partner institutions in the immediate Kansas City area. They felt that onboarding was not necessary as they already had substantial organizational knowledge.

In the second year of implementation, the enrollment criteria for the onboarding program changed. In 2017, all new research faculty, regardless of research effort, were entered into the onboarding program. The program also included not just new hires, but all PIs, co-investigators, or research faculty participating in research activities at CMH for the first time. This inclusion opened the door for existing clinical faculty who had recently decided to conduct research for the first time. All investigators were required to complete onboarding prior to engaging in research activities. An investigator was considered new if they were new to CMH and this is the first protocol application submitted through the institution. This translated to 19 new faculty members who were approached to participate in the research onboarding program. Of these, 10 received the full onboarding experience in the second year.

Other changes made in the second year included an updated Research Orientation module to replace the original two-part Research Bootcamp and Research BrushUp modules. The new broader orientation module included an overview of research leadership, areas of institutional research emphasis, information on organizational structure and business operations, as well as information on the protection of human subjects, research compliance, and scientific misconduct.

Future Considerations

The RFOP was designed under Children's Mercy Hospital (CMH) in 2016 and was fully absorbed into the new Children's Research Institute (CRI) in early 2018. The CRI will be responsible for providing a high-quality onboarding experience for all new faculty involved in research. It is important to mention that the RFOP was created when the CRI hired only 4-6 researchers per year. The program is much more critical now that CRI expects to hire several new researchers each year in 2019 and 2020. In the coming years it will become increasingly important for the RFOP to be refined and improved.

As it evolves, the RFOP will need more data and metrics to ensure that the program is working and continues to deliver a valued experience. The moment when a newcomer has truly met the objective of being ready to contribute to the organization is a difficult target to define. The association between the onboarding intervention and the total startup time between the start date and the point in which the new investigator's laboratory is fully functional needs to be examined in order to collect quantitative data and keep metrics. The just-in-time training component was initially designed to allow further growth and expansion. We hope to include a more robust mentoring and coaching system for new investigators in the next year. Last, once the employee's onboarding is considered complete, they will respond to a feedback form to make sure the RFOP continues to meet its goals.

Conclusion

One essential key to a successful onboarding program is communication prior to employment, in order to prepare for the needs of the researcher ahead of time. Institutions seeking to design an onboarding program for new investigators should consider making contact with the researcher as soon as the offer letter has been accepted. A blended program with both online modules and one-on-one interactions is also recommended. The online modules should be brief, helpful, informative, and easy to complete. Individual meetings should be planned as a half-day session (morning or afternoon) for ease of scheduling and out of respect for the new employee's time. All program materials should be reviewed regularly for redundancy and relevancy. The onboarding program should seek to: 1) increase new researcher productivity, 2) improve retention rates of new research faculty by helping them become involved and connected, 3) provide audience-specific, in-depth, timely information that is useful and memorable, and 4) reduce redundant conversations while guaranteeing the delivery of high-quality, consistent, and accurate information.

Authors' Note

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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