



# Best practices and inclusion of team science principles in appointment promotion and tenure documents in research intensive schools of nursing

Abraham Aizer Brody, PhD, RN, FAAN<sup>a,\*</sup>, Ashley Leak Bryant, PhD, RN-BC, OCN<sup>b</sup>,  
G. Adriana Perez, PhD, RN, CRNP, ANP-BC, FAAN<sup>c</sup>, Donald E. Bailey, PhD, RN, FAAN<sup>d</sup>

<sup>a</sup>Hartford Institute for Geriatric Nursing, NYU Rory Meyers College of Nursing, New York, NY

<sup>b</sup>The University of North Carolina at Chapel Hill School of Nursing, Chapel Hill, NC

<sup>c</sup>The University of Pennsylvania School of Nursing, Philadelphia, PA

<sup>d</sup>Duke University School of Nursing, Durham, NC

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## ABSTRACT

**Background:** Nurse scientists are highly sought after and find satisfaction in serving as members of interdisciplinary research teams. These teams also tend to be highly productive. However, nurse scientists in academia also have to reach certain productivity milestones to be promoted and receive tenure that may be incongruent with team science principles.

**Purpose:** This study therefore sought to examine whether APT documents in research intensive nursing schools incorporate team science principles.

**Methods:** Qualitatively analyzed the appointment, promotion and tenure documents of 18 U.S. based research intensive schools of nursing with over \$2 million in NIH funding in fiscal year 2014.

**Findings:** The study found that only 8 of 18 documents included any reference to team science principles and even these mentions were largely negligible. There were few best practices to recommend across documents. By not recognizing team science within these documents, nursing risks marginalization within the larger scientific community by limiting mentorship and learning opportunities for early career nurse scientists.

**Discussion:** Schools of nursing should revisit their promotion and tenure criteria and include a greater commitment to encouragement of team science.

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\* Corresponding author: Abraham Aizer Brody, Hartford Institute for Geriatric Nursing, NYU Rory Meyers College of Nursing, 433 First Avenue, New York, NY 10009.

E-mail address: [Ab.Brody@nyu.edu](mailto:Ab.Brody@nyu.edu) (A.A. Brody).

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## Introduction

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Over the past 20 years, there has been an explosion in health-related knowledge that no single discipline has the skills or knowledge to answer significant questions independently. The rapid increase in complexity has challenged researchers and practitioners as the need to work as teams in both the research and clinical environments is now paramount, yet systems are not comprehensively in place to account for the need for interdisciplinary work (Meleis, 2016; National Research Council, 2015; Organization, 2010). The increasing complexity of health and healthcare requires a significant shift in the scientific enterprise from an individualistic, siloed scientific process whereby single disciplines identify problems, and design and conduct research, to a need for a team-based approach that combines the strengths and insights of multiple disciplines (National Research Council, 2015).

Given nursing's integral role in the health of the population, and as the largest healthcare workforce in the country, there is an increasing "call to action" to promote team science in our field that enhances opportunities for integrating nursing perspectives into interdisciplinary research teams both as principle and co-investigators (Solis, Aristomene, Feitosa, & Smith, 2016).

While the need for nurses to serve in interdisciplinary team-based research is increasing, there has not been a focus in the literature on how moving from individual or within-discipline studies, to a team based interprofessional approach affects the potential for promotion and tenure within schools of nursing. To understand the current landscape and criteria that nurse scientists must navigate as part of their promotion and tenure process, and determine if "team science" is acknowledged or integrated into promotion and tenure criteria, this paper examines the appointment, promotion, and tenure (APT) guidelines for the 18 U.S. based schools of nursing with greater than \$2 million in funding from the National Institutes of Health (NIH) in FY14-15. We aim to examine APT documents in nursing research institutions as it relates to team science principles, promotion activities, and best practices in team science.

## Background: Team Science

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The National Academies of Science recently released a report on *Enhancing the Effectiveness of Team Science* (2015). They offered the following definition: "scientific collaboration, i.e., research conducted by more than one individual in an interdependent fashion, including research conducted by small teams and large groups" (p.2, (National Research Council, 2015) The NIH developed Collaboration and Team Science Field Guide further defines team sciences as "A collaborative, often

cross-disciplinary, effort to address a scientific challenge or question that leverages the strengths and expertise of professionals trained in different fields (p.1; (Bennett, Gadlin, & Levine-Finley, 2010)." For the purpose of this work, we used the NIH Field Guide Definition.

The importance of team science cannot be understated. The National Academy of Science (2015) report finds it necessary for creating conceptually sound and rigorous research where complexity exists. Studies have found that team science increases the novelty of science as well as its impact (Uzzi, Mukherjee, Stringer, & Jones, 2013; Wuchty, Jones, & Uzzi, 2007). Work also found that scientists who are part of teams are more productive, the effects of their science are longer lasting, and work performed by teams impacts more disciplines than individual scientists (Stipelman et al., 2014; Uzzi et al., 2013; Wuchty et al., 2007). Thus, those involved in team science early in their careers are likely to have a more impactful scientific career earlier on, setting up for future successes.

While the benefits of team science are clear for both the field and individual researcher, team science raises difficult questions about how one evaluates the individual member's contribution, particularly in academic settings with specific promotion criteria. The traditional means of evaluating scientists, nursing or otherwise, has been related to their productivity as an independent investigator. Thus while a more impactful career may very well be in store for a nurse scientist who starts as part of a team early in their career, there are questions regarding how their individual contributions to a team can be measured and utilized as part of the APT process.

One recent publication offers a framework for academic institutions to use in developing evaluative criteria that can be applied to promotion and tenure decisions. One key portion of the evaluation is the individual scientist's intellectual contribution and impact on the team (Mazumdar et al., 2015). Evaluation of impact as a team member requires the faculty member to articulate their work and how it has impacted the overall research. Mazumadar et al. recommended five areas to help APT committees move beyond the usual counts of grants, publications, teaching, and service. They include the following: (1) describe the team scientist's specific contributions to manuscripts and not rely solely on authorship position; (2) synthesize the team scientist's specific contributions to grant proposals; (3) collect specific evidence from principle investigators (PIs) about the team scientist's contributions to grants and manuscripts; (4) collect information from training grant PIs, and leaders of journal clubs and seminars related to the team scientist's contributions to these initiatives; and (5) evaluate the team scientist's service contributions by level of importance. Mazumandar et al. posit that integrating these five areas into the criteria for appointment and promotion will offer both the scientists and the evaluation committee member's clearer understanding of

**Table 1 – Description of Schools and APT Documents**

Type of School	
Private NonProfit	35.7%
Public	64.3%
Region of School	
Northeast	25.0%
Midwest	28.6%
South	28.6%
West	17.9%
APT Document Approval	
Mean	2011
SD	3.5 years
Median	2012
Range	2002-2014
NIH Dollars	
Mean	\$3,543,182
SD	\$2,523,990
Median	\$2,697,176
Range	\$2,016,023-\$10,149,031

expectations and outcomes. However, this is neither simple nor straightforward to implement. Prior to making recommendations regarding best practices within nursing as to how to integrate team science principles into APT criteria and evaluations, it is important to understand the current state of the field. As there is no systematically performed published research on how nursing as a field is evaluating team science as part of the APT process, we undertook an examination of the state of APT criteria.

## Methods

This was a qualitative study of APT documents from the 18 schools of nursing in Fiscal Year 2014 who received over \$2 million in NIH funding. The study was designed to address three specific aims related to APT in research intensive nursing schools: (1). Determine whether team science principles are integrated into APT guidelines among the top U.S. based nursing research institutions; (2). Examine whether APT guidelines take into account for promotion activities other than large independent grants and first author publications as the PI; and (3). Identify best practices found in team-science integrated within APT guidelines. Summary data of the schools can be found in [Table 1](#).

The data set consisted of 18 individual text files obtained from the participating schools, blinded to the researchers and entered into [Atlas.TI version 7](#) (“Atlas.TI,” 2014) for analysis. The authors initially met bimonthly to review documents, code data, and discuss coding issues. To calibrate coding procedures, the coders individually coded the same text with the a priori codes, adding new codes using emergent coding ([Guest, MacQueen, & Namey, 2012](#)). The authors coded one document using the A priori coding schema, and from these codes data were merged and

definitions developed. A second document was then used for verification of the A priori coding and emergent codes were added. The coders discussed the codes and definitions, expanding and refining the code book until no new codes emerged. Reconciliation was then performed by all four coders. All codes and definitions were placed into Atlas.TI so that as coding occurred, the coder could refer to the actual definition of the code as was previously defined by the team. After reconciliation and codebook insertion in Atlas.TI, two independent teams from the four primary authors were developed and each assigned half of the documents, which excluded the document from their home institution if applicable, to code in Atlas.TI. Each team member coded two documents within their bundle and then discussed for convergence or divergence, and whether there were any differences in how definitions were applied. The remainder of the documents were then coded by each team and the coded documents were merged into a single Atlas.TI file for analysis.

### Aim 1: Team Science Analysis

We used directed content analysis to code using a priori codes from the literature on team science ([Hsieh & Shannon, 2005](#)). A list was generated with any text coded as “team science.” The list was exported to a spreadsheet where each quote was reviewed by the team, until agreement was reached on whether the excerpt was accurately applied based on the study definition (see background). We then attempted to create a grading system for the level of team science a document presented, however we found limited evidence of team science principles embedded within the documents, which created compression at the bottom, negating the purpose of the grading system. We therefore took a holistic perspective on analyzing the team text data, examining the types of team science mentioned, and level of integration within the document.

### Aim 2: Promotion Criteria Other Than Large Grant PI and Primary Authorship

Related to team science is whether any other criteria were acceptable for promotion other than being the PI of a large grant or primary author of published manuscripts. For Aim 2, we analyzed the coded promotion criteria from assistant to associate and associate to full professor separately by document in Atlas.TI and exported coded excerpts into a spreadsheet. Each “other form” of promotion was analyzed and then each document was described as either fully allowing for other forms, allowing other forms in some cases, or not allowing other forms to be a major portion of consideration for promotion to the next step. Other acceptable forms were also examined for consistency across documents and frequency.

### Aim 3: Best Practices Analysis

A list of text data coded as best practices in Atlas.TI was generated. For coding purposes, best practice was defined as “A superior method or an innovative approach that consistently exceeds standard levels of performance.” Once generated, the list was sorted by document and then separated into type of best practice. After initial sorting, the list was reviewed by all members of the team, and where disagreement occurred, discussion between team members took place until consensus was reached. Best practices were then condensed by type and each type was analyzed individually.

#### Second Level Review

Upon completion of the initial analysis of all three aims, we convened a second level panel of reviewers consisting of three long-standing tenured professors, with expertise in academic nursing and research with current and/or past NIH and equivalent funding as part of teams, who currently hold positions as dean, associate dean for research and associate dean for faculty affairs from geographically distinct areas. The aim of the panel was to examine the findings of the initial analysis and provide expert review and analysis based on their significant experience with APT and team science at multiple institutions over their many experienced years. These reviewers were provided with all raw analyses, excerpts, and spreadsheets, and given the opportunity to provide any feedback, disagreement, or commentary, and approved and assisted in framing the findings below.

## Results

### Findings: Team Science

Aim 1: Determine whether team science principles are integrated into APT guidelines among the top U.S. based nursing research institutions.

We found limited evidence that team science principles had been integrated into the guidelines for promotion and tenure. Only eight of 18 documents included any discussion of team science, and even in those the mentions were not thoroughly integrated, but only tangentially included in the guidelines for promotion if at all, or clearly marked as secondary to independent investigation.

Through thematic analysis of the APT criteria we found that in those documents that did include principles of team science, they coalesced in two areas: collaborator and leader.

**Collaborator:** The role of collaborator on a multidisciplinary research team was described in six of the documents. As a collaborator, scholars seeking promotion, or tenure were expected to contribute to

interdisciplinary research teams and in some cases the documents specified the actions or behaviors that could be evaluated. These specific behaviors included the following:

*“Demonstrates ways to improve the interdisciplinary collaborative relationship”*

*“...consultant on SON or institutional collaborative, interdisciplinary or community based research or scholarship project”*

*“Develops and/or collaborates research studies to test models of clinical nursing”*

*“Participates actively in international collaboration”*

**Leader:** To advance their careers, scholars needed to provide leadership for interdisciplinary research teams. Leadership behaviors were described in five of the documents and included the following:

*“Demonstrates leadership and mentoring of an extramurally funded research team. . . Participates on study section”*

*“Leadership in interdisciplinary or collaborative research or scholarly activities in academic health center or university”*

*“Serves in a leadership role on collaborative inter- or trans- disciplinary research project(s)”*

### Findings: Promotion

Aim 2. Examine whether APT guidelines take into account for promotion activities other than large independent grants and first author publications as the PI.

We found several examples of best practices related to promotion within the guidelines. Five of 18 documents included examples of best practice activities separate from large PI led grants and first authored publications. Using thematic analysis, we identified three areas of activities supporting promotion. They included the following; (1). Leading national committees/organizations, (2). Receiving awards or delivering invited lectures, and (3). Consulting and mentoring of pre and post docs/visiting scholars.

- Leading national committees or organizations included the following activities; leadership role in committees at the national and international level of a clinical specialty or professional organization, member of national/ international scientific advisory committee, consensus group or expert panel, member/fellow of prestigious professional society.
- Receiving awards or delivering invited lectures constituted another set of activities that led to promotion and included the following; awards from local, regional, national and/or international organizations, invitations to speak in area of expertise at

regional or national programs, invited keynote presentations at national and international meetings, local, state, and/or regional award for research or scholarship, international award for research or scholarship, delivers keynote and/or plenary presentations at local, regional, international, and national professional meetings.

- Consulting and mentoring comprised another set of activities leading to promotion. Activities included the following; consultant on SoN and/or [Institution] collaborative, interdisciplinary or community based research/scholarship project, national research consultation, facilitates the advancement colleague's research, directs research associates, visiting scholars and research technicians, provides leadership in the development of research careers for colleagues and students, evidence of sustained research training of pre-doctoral students and/or post-doctoral fellows, and evidence of efforts in obtaining research sponsorship for pre- and/or post-doctoral trainees (e.g., F- or T-series or foundation funding).

However, as noted above in Aim 1 analysis, while other forms of activities are taken into account for promotion, the primary metric was first/senior authored publications and serving as PI of large grants. Moreover, the above criteria largely relate to individual rather than collective or team-based contributions.

### Findings: Best Practices

Aim 3. Identify best practices in team-science integrated within APT guidelines.

We found few examples of best practices within the guidelines. Only four of 18 documents were coded as having an example of a best practice related to team science or other tenure and promotion activities. Using thematic analysis, we identified two areas of scholarly behaviors; (1). Scholarship, and (2). Research.

We identified two examples of Scholarship:

*“Leadership in interdisciplinary or collaborative research or scholarly activities...”*

*“Substantive participation in interdisciplinary collaborative research projects/initiatives.”*

The behavior related to Research includes the following example:

*“Participates actively in interdisciplinary... [and]... international collaboration”*

### Discussion

We defined team science as the collaborative, often cross-disciplinary, effort to address a scientific challenge or question that leverages the strengths and

expertise of professionals trained in different fields (Bennett et al., 2010). Only eight of 18 APT documents integrated team science principles into APT guidelines among the 18 top NIH funded nursing research institutions, and only 10 of 18 documents had any meaningful inclusion across all three aims combined.

This report lays bare the current state of integration of team science within research intensive academic nursing APT processes. There are three primary reasons focusing on team science within the APT process are key to our continued health and growth as a scientific field. First and foremost, when we don't explicitly recognize and encourage team science in our APT process, it disincentivizes early career researchers from working in teams, and team-based science can increase productivity, quality and rigor of science (Disis & Slattery, 2010; Hall et al., 2012; Nair & Finucane, 2003; Petersen, 2015). Moreover, teams produce more frequently cited research than individuals (Wuchty et al., 2007). However, without team-based science it is exceedingly difficult to create effective and efficient interdisciplinary and interprofessional models (Kirchner et al., 2016).

Second, funding rates are currently low, 19.1% for NIH as a whole and 9% for NINR (National Institutes of Health, 2017), and it may be unreasonable to expect individuals to obtain a large grants as PI from the NIH or otherwise within the promotion timeframe found at many of the research intensive schools examined herein. Requiring large grants as PI as part of the APT criteria has the potential to discourage nurse scientists from continuing in research. Additionally, by requiring investigators to serve as PI, for those working in teams, there is the potential for increased tension around recognition of a team member's contribution, especially for earlier career faculty or faculty outside of a single discipline. When the metrics around APT as they relate to team science are unclear, negative tension can occur between team members, affecting team dynamics and cohesiveness, leading to a loss of productivity (National Research Council, 2015; Stokols, Misra, Moser, Hall, & Taylor, 2008).

Third, and arguably most important, if we don't match our APT criteria to where the field is moving versus where it has been, we posit that early career faculty will leave research intensive roles. A recent NIH survey found that new nurse scientists prefer to work as part of teams, which could contribute to a more collaborative and productive environment (Physician-Scientist WorkForce Working Group, 2014) and could potentially enhance their recruitment and retention. Misaligned APT criteria thus create a disservice for two reasons. First, to the field given the amount of time, effort, and funding invested on training early career investigators and the significant paucity we already have in nurse scientists. Second, to population health as nurse scientists who leave the field rather than contributing as part of teams might otherwise have influenced the science in a way that furthers health of the population.

Therefore, it is in nursing's best interest to consider how APT criteria and processes are currently written and can be modified to incorporate team science. Integrating team science principles and focusing on individual contributions within the larger team rather than authorship place or PI status is the future of all fields of science. Those schools that resist the principle of individual contribution versus traditional markers of success risk putting great effort and financial resources into developing outstanding early career nurse scientists only to see them leave when they cannot meet unrealistic and oftentimes nebulous APT criteria that focus on status over substance. Given these concerns, the American Association of Colleges of Nursing is currently in the process of updating its definition of scholarship for academic nursing, and chief amongst the changes is the recognition that team science is increasing and needs to be accounted for in scholarship, though the draft does not prescribe specific recommendations for how this should relate to APT decisions/documents ([American Association of Colleges of Nursing, May 23, 2018](#)). With the growing interest of interprofessional education (IPE), team science aligns with the philosophy undergirding IPE. IPE has been defined as "when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" ([World Health Organization, 2010](#)). The pedagogical approach of IPE allows different disciplines to engage in interactive learning and discussions to achieve a desired goal. Similarly team science which is often cross-disciplinary leverages content experts to answer research question(s) to advance science and generate new knowledge. The use of team science can potentially benefit IPE as science that integrated multiple professions can help to address clinical or team challenges in care.

The misalignment of APT documents/criteria and team science however can be rectified. First, institutional leaders should recognize, promote and support team science within their academic environments. They can and should push for APT committees to evaluate their current APT documents and processes and consider how best to include team science principles for long term use. These discussions should include how being a member of a large interdisciplinary team is factored for promotion and tenure, how authorship other than first or last and contribution to science are considered as part of large team-based research, and how to elicit and evaluate these contributions. Additionally, our findings suggest another strategy may be to deliberately create space and dialogue that enhances team science training and problem-solving among team members in order to promote healthy and productive teams ([Stokols et al., 2008](#)).

### Strengths and Limitations

The study described herein has several strengths. First, while the study of APT policies in health sciences

in general is not new ([Bunton & Mallon, 2007](#)), our analysis includes a purposive, representative group of APT documents of schools of nursing amongst top research institutions, and rigor in qualitative coding and analysis. Second, to our knowledge, this is the first study, to date, to examine use of team science principles in APT documents. Third, the authors attempted to identify best practices that can be adopted and disseminated to other schools of nursing and other academic units.

One limitation includes the descriptive nature of the study, including a limited sample of APT documents. Another limitation is age of the data (APT documents) and the potential that newer APT documents have been developed in the interceding years between start and completion of analysis that might have additional content about team science principles, and exclusion of most non-research institutions that might have team science principles as it relates to pedagogical strategies or interprofessional education. Lastly, we did not solicit or review university-level APT documents from the 18 institutions. We presume that the school of nursing APT criteria and guidelines align with the university's criteria with the university being responsible in awarding tenure, not schools of nursing. The interface between schools of nursing and university APT criteria are essential in insuring clarity in the role of team science principles in APT criteria.

### Conclusion

Given the rising concerns regarding the shortage of nurse scientists needed to build the scientific evidence base for improving the nation's health, these findings describe the current mechanisms in place for APT within the top NIH funded schools of nursing. While historically, individual research accomplishments have determined tenure and tenure-track success, emerging tenure policies emphasize team science in the APT process. However, our analysis of APT documents from research intensive nursing schools found that there is significant room for growth and recognition of team science in nursing as only 55% of schools included (at the time of our review) any mention of such practices in their APT process. There is thus significant room for further work to align APT documents and processes with team science to ensure a 21st century nursing science work force is able to work to solve the increasingly complex health and healthcare problems presented to them.

### Supplementary material

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.outlook.2018.11.005](https://doi.org/10.1016/j.outlook.2018.11.005).

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