Maher Patrick J. (Orcid ID: 0000-0002-4860-8643)
Sharp Willard William (Orcid ID: 0000-0002-7175-3523)
Kaji Amy H. (Orcid ID: 0000-0003-4588-7939)

Title:

T32 Programs in Emergency Medicine: A Report from the ACEP-SAEM Federal Research Funding Workgroup

Running Short Title: T32 Programs in Emergency Medicine

Author Affiliations:

Patrick J Maher, MD[1]; Richard Rothman, MD PhD[2]; Robert Neumar, MD PhD[3]; Jeremy Brown, MD[4]; Willard Sharp, MD PhD[5]; Charles Cairns, MD[6]; Gabor D Kelen, MD[2]; Amy Kaji, MD PhD[7]; Jody A Vogel, MD; Lynne D Richardson, MD[1]

[1] Department of Emergency Medicine, Icahn School of Medicine at Mount Sinai, New York, NY

[2] Department of Emergency Medicine, Johns Hopkins University School of Medicine, Baltimore, MD

[3] Department of Emergency Medicine, University of Michigan Medical School, Ann Arbor, MI

[4] Office of Emergency Care Research, National Institutes of Health, Rockville, MD

[5] Department of Medicine, Section of Emergency Medicine, University of Chicago School of Medicine, Chicago, IL

[6] College of Medicine, Drexel University, Philadelphia, PA

[7] Department of Emergency Medicine, David Geffen School of Medicine at the University of California Los Angeles, Los Angeles, CA

[8] Department of Emergency Medicine, Stanford University Medical School, Stanford, CA

Contact Information:

Patrick J Maher: patrick.maher@mountsinai.org

Richard Rothman: rrothma1@jhmi.edu

Robert Neumar: neumar@med.umich.edu

Jeremy Brown: jeremy.brown@nih.gov

Willard Sharp: willsharplab@gmail.com

Charles Cairns: cbc77@drexel.edu

Gabor D Kelen: gkelen@jhmi.edu

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Amy Kaji: AKaji@emedharbor.edu
Jody A Vogel: vogelj@stanford.edu
Lynne D Richardson: lynne.richardson@mountsinai.org

Corresponding Author (for Reprints):
Patrick Maher, MD
Department of Emergency Medicine, Icahn School of Medicine at Mount Sinai
1 Gustave L. Levy Place New York, NY 10029-5674
E-mail: patrick.maher@mountsinai.org

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Abstract:

Advancing care in Emergency Medicine (EM) requires the development of well-trained researchers, but our specialty has lower amounts of research funding compared to similar medical fields. Increasing the number of pathways available for research training supports the growth of new investigators. To address the need for more EM researchers, the Society of Academic Emergency Medicine and the American College of Emergency Physicians convened a Federal Research Funding Workgroup. Here, we report the workgroup recommendations regarding the creation of Research Training Fellowships using the T32 grant structure sponsored by the National Institutes of

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Health. After reviewing the history of NIH-grant supported research fellowships in EM, we outline the rationale and describe the core components of T32-supported research fellowships, including program design, fellow evaluation, and recruitment considerations.

1. Introduction

The clinical practice of Emergency Medicine (EM) incorporates skills to care for patients suffering from a wide range of conditions requiring rapid diagnostic and therapeutic intervention, rather than a focus on an organ-system or disease-entity based practice model. Because of this breadth of practice, research in EM has evolved to address the critical issues impacting patient care across a similarly broad range of topics. The scope and scale of EM care is vast, with over 140 million emergency department (ED) patient visits a year, representing nearly 14% of all health care encounters in the USA.[1] To advance care for the patients we serve, the specialty must develop a cadre of well-trained EM researchers able to compete for independent research funding.

Since 2012, there has been an increase in the total number and distribution of funded EM projects from various NIH Institutes and Centers, with the most significant increases after 2017.[2,3] In an initial report describing four years from 2011-2014, an increase from 62 to 153 NIH applications (excluding career development awards) submitted per year was seen, with an increase in total NIH support for new projects climbing from $3.7 million to $4.8 million.[4] New grant applications continued to increase through 2018, with

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a total of 434 submissions that year, including career development awards.[5] However, Departments of EM continue to lag behind nearly every other clinical specialty including Anesthesiology, Internal Medicine, Psychiatry and Pediatrics in total federal grant support from the NIH and percentage of full-time faculty members that are NIH-funded investigators.[2,3,6,7]

As a specialty, creating pathways and infrastructure to encourage physicians to pursue formal research training is a necessary step to increasing the number of federally funded independent physician scientists, continuing a culture of research in EM, and advancing knowledge to optimize care for the patients we serve in the acute care setting.[8] The purpose of this paper is to outline the rationale and describe the design of postdoctoral EM research fellowships supported by the NIH T32 grant mechanism. The intended audience is stakeholders in academic EM departments who are considering creating or have already established research fellowships and have an interest in developing their institutional capacity for the support of early career researchers through the addition of a funded research training pathway. Content of this paper includes feedback from prior and current T32 grantees, and the report is written by a Federal Research Funding Workgroup specially convened by the Society for Academic Emergency Medicine (SAEM) and the American College of Emergency Physicians (ACEP).

2. Background of NIH Grant-Supported Research Training in Emergency Medicine

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In this section, we introduce the T32 mechanism for NIH-funded research fellowships of early career investigators including prior recommendations from national societies in EM. In addition, we review data obtained from the director of the NIH Office of Emergency Care Research (OECR) highlighting recent funding trends in EM.

The traditional and most widely used program to support institutional training for early investigators across all clinical specialties is the NIH T32 program. This program aims to enhance predoctoral and postdoctoral research training opportunities to ensure a diverse, highly trained biomedical research workforce. The NIH T32 training programs are intended to provide a strong foundation in research to individuals whose careers are likely to have a significant impact on health-related research needs across the nation.[9] T32 programs have specific research missions based on their funding structure through their sponsoring NIH institute. Rates for progression to primary investigator role on R01 awards for graduates of T32 fellowships surpass 15% at ten years following T32 awards matriculation and suggest a strong value for these programs in establishing a robust research environment.[10] Research fellowships without NIH grant support, some of which are endorsed by SAEM through its Fellowship Approval Program, also exist at various institutions and usually require that the research fellow work enough clinical hours to earn their salary through direct patient care while providing unfunded research training from departmental faculty.

A list of recommended strategies to achieve the 2030 goals for increasing NIH funding in the field of EM has been published previously and endorsed by SAEM, ACEP, and

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the American Academy of Emergency Medicine (AAEM).[3] This statement recommended integrating research training into both ACGME and non-ACGME fellowships by encouraging departments to apply for T32 grants to support postdoctoral research training or by leveraging existing institutional T32, K12 and KL2 training programs to support research training within existing EM fellowships.

Recent Funding Trends from the NIH OECR: As a coordinating office, the OECR has the objectives of developing funding opportunities, matching researchers with opportunities, creating collaborations between researchers, and fostering the careers of EM researchers in training. The OECR assists with applications for the T32 program by matching PIs to program staff across the NIH and providing advice on the content of the application. Since the OECR is not a funding source, it is not able to directly fund a T32 or any other grant application. As such, the main role for the OECR is to facilitate applications and track outcomes for EM grantees over time.

The most recent data provided unofficially by the OECR (see Table 1) continues to indicate an overall increase in applications from Emergency Departments specifically. Prior publications on these trends have included all applications within the NIH Research, Condition, and Disease Categories (RCDC) condition for Emergency Care.[5] When limited to applications coming only from Departments of Emergency Medicine, the overall number of applications more than doubled in the past 5 years, whereas the number of funded Career Development Grants tripled. The NIH-defined Research Project Group (DP1, DP2, P01, P43, PN1, R01, R03, R15, R21, R29, R33, R34, R35,

R36, R37, R55, RL1, RL2, RL5, U01, U19, U34, UC1, and UC7) grants show similar increases over this most recent period.

While the increases in both career development and independent investigator applications and funding in EM in recent years should be acknowledged, a need remains for the creation of a larger research presence in the field of emergency care. As a mechanism to foster and develop researchers who are early in their careers, particularly those without prior grant experience or prior to submission of individual mentored career development awards, expanding the availability of T32 programs is a reliable option for recruiting and retaining the most promising future physician scientists.

	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Applications -All	152	152	242	127	305	346	1324
Funded	27	24	37	34	54	84	260
% Success – All	18%	16%	15%	27%	18%	24%	20%
RPG Equivalent Applications	122	131	193	95	219	245	1005
RPG Equivalent Funded	17	14	31	21	29	47	159
% Success - RPG	14%	11%	16%	22%	13%	19%	16%
R01 only – Applications	65	77	120	52	145	174	633
R01 only -Funded	10	10	21	12	21	32	106

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% Success – R01	15%	13%	18%	23%	14%	18%	17%
K 08,22,23,24, 38, 76, 99, KL2 Applications	15	8	19	25	43	48	158
K 08,22,23,24, 38, 76, 99, KL2 Funded	4	3	2	13	12	12	46
% Success- K 08,22,23,24, 38, 76, 99, KL2	27%	38%	11%	52%	28%	25%	29%

Table 1. NIH Applications and Outcomes from Emergency Medicine 2018-2023. Data provided by the Office of Emergency Care Research, NIH.

3. Funding Research Training

This section describes in detail the funding mechanisms of T32-grant funded post-doctoral fellowships in terms of structure and benefits for institutions and trainees, including comparisons with alternate grant structures. A review of currently existing and previous funded fellowships within EM is included.

The NIH T32 Research Fellowship Training: An important component of the mission of academic departments of Emergency Medicine is training the EM research workforce. Just as they invest faculty time and departmental resources in training EM residents to join the clinical workforce, the mission of academic EM necessitates an

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investment of faculty time and departmental resources toward training EM investigators to join the biomedical research workforce. Several departments have addressed this objective by investing resources and applying for federally supported awards for research training via the T32 mechanism. The NIH T32 program adds federal support which: 1) provides a stipend for each fellow, reducing their clinical commitment; 2) pays tuition for the fellows to obtain a research degree such as a Master in Clinical Research during the fellowship; and 3) provides a small amount of funding to be used to support research expenses or program administration expenses.

The NIH T32 post-doctoral training program must be done as a full-time commitment but may include sufficient clinical duties to assure that physician scientists maintain their clinical skills; the clinical obligations are specified by each program. In contrast, federally funded career development (K) awards strictly limit activities other than research career development to 25% of a full-time effort, including all assigned clinical activities, moonlighting, teaching, and administrative activities. Fellows funded using a T32 must enroll in one-year increments at full-time, unlike programs which use the R25 mechanism, sometimes used for residency research as it only requires an 80% research time commitment for increments which can range less than one year.

Although the T32 grant defrays the fellow's salaries and tuition expenses, the department will have to financially support the effort of the Program Director and Program Administrator; support for other research costs such as laboratory staff or clinical research staff is also usually provided by the department. Each Institutional T32

award lasts 5 years but can be renewed indefinitely; there are T32 programs in other specialties that have been continuously funded for more than 20 years.

Currently, there are several NIH-funded T32 programs awarded to Departments of EM, each of which address research priorities that fit within the funding Institute's research goals. Programs with a focus on general Emergency Care research include the NHLBI-funded T32 programs established at the Icahn School of Medicine at Mount Sinai, the University of Pittsburgh, Vanderbilt University, and Boston University. The NHLBI also funds a T32 fellowship in resuscitation medicine at Beth Israel Deaconess, and an NICHD-funded T32 focusing on Firearm Injury Prevention currently exists at the University of Michigan.[11,12] In addition, funded programs whose contact PI is not primarily appointed in a Department of Emergency Medicine may choose to enroll T32 trainees with EM training according to the specific interest of the applicant and the program's selection criteria.

Career Development (K) Awards: To continue building an infrastructure for training the next generation of physician scientists, academic departments in EM should encourage supported researchers in training programs including T32 supported programs to apply for individual NIH career development awards, known as K awards, to support their continued research development upon completion of their training program.

EM research has suffered from disproportionately low rates of submission for K awards from the NIH, despite similar overall rates of grant success for submitted applications

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compared to other specialties in medicine.[13] Reasons for low rates of K applications based on survey data include elements that may be addressed by increasing availability of research fellowships supported through T32 grants, including insufficient mentorship and freedom from competing responsibilities.[14]

Advanced research training fellowships, such as those supported by T32 grants, have frequently led to successful applications for individual K awards. In a sample of EM physicians with individual K awards (K08 or K23), 60% reported having completed a prior research fellowship.[15] For R01 recipients in EM, the proportion who completed prior advanced research training including mentored research training grants, fellowship, or an advanced degree is even higher at 94%.[16]

4. Core Components of NIH T32 Programs

In this section, we describe the core components of an NIH-funded T32 research fellowship from the perspective of the host department. Specific considerations with regards to program design, including research training curriculum and focus, are incorporated.

Core principles of postdoctoral training include mastering research skills through structured mentoring, support of research successes such as major publications and awards, and the facilitation of interdisciplinary collaborations.[17] A set of core

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components shared across all sponsoring institutions provides a successful model for the creation of an EM Research Training program. Emergency departments that are considering applying for T32 funding should consider developing or integrating existing programs available at their institution for focused mentorship, formal didactic instruction in research methods, collaborative research activities, dissemination and translation strategies, and career and leadership development activities directed towards optimizing support for trainees.

When considering an application for T32 funding from the NIH, a program must consider how to define the theme or focus of the program in a way that aligns with the research goals of the target funding Institute. Given the wide range of pathology in emergency medical care, a particular challenge of scope exists to sufficiently narrow research questions while remaining open to projects across a diverse spectrum of clinical issues. In the past, NIH funding for EM research fellowships has predominantly come from the NHLBI. Based on the individual expertise and research backgrounds of the Program Director and the resources of the host department, other NIH institutes, such as the National Institute of Allergy and Infectious Diseases (NIAID) for infectious disease research, or National Institute on Drug Abuse (NIDA) for drug abuse and addiction treatment research, also may be well-chosen funding sources.

Didactic Instruction: One foundational method that training programs can use to advance the research skills of their trainees is formal coursework at the sponsoring institution, which can culminate in the attainment of an advanced degree, such as a

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Master of Science or, less commonly, a Doctorate in Clinical Research. Since some degrees such as a Master of Public Health may not provide an adequate foundation for a future independent research career, it is important to pay attention to the coursework requirements and ensure the coursework aligns with the goals of the training. For institutions associated with graduate schools, these degree programs may take place on-site, which can provide additional local mentorship options and have financial savings for the program. Enrollment of trainees in programs outside of the host institution can lead to distance-mentorship opportunities but can carry logistical and financial burdens. Non-degree granting learning options, including NIH Summer Courses and grant and manuscript-writing workshops such as those hosted by ACEP and SAEM, may also be included as part of the didactic curriculum. The fellowship should provide a specific description of their own curriculum, with focused attention to research methods and analyses specific to emergency care research, training on practical skills such as laboratory management for basic science research, budget management, recruiting and training staff, dissemination and translation strategies, and career and leadership development seminars.

Experiential Curriculum: There must be robust opportunities available for mentored research experiences. This requires having a cadre of experienced senior level faculty who are committed to serving as research mentors and who have active NIH-funded research projects that the fellows can join permitting access to resources such as databases, specimens, assays, clinical populations, and research cohorts. Faculty who can arrange participation in national research networks (e.g., SIREN, PETAL) are an

excellent resource for learning how to conduct team science. Program faculty should not be limited to EM; indeed, the review committee sees a multidisciplinary faculty as a strength.

The program must also provide access to biostatistical or epidemiological support, as well as opportunities for networking in works-in-progress sessions, journal clubs, peer-support activities (e.g., K-Club), and community partnerships working with diverse populations. A pool of students or residents to assist fellows with their research provide the fellows with an opportunity to learn mentoring skills.

Overall, the T32 program should facilitate training, opportunities, and mentorship necessary for the trainee to develop a strong foundation in scientific reasoning, research design, experimental methods, presentation and publication skills, networking, career development, and the skillset necessary to conduct research responsibly and with integrity.

5. Overview of NIH T32 Program Administration / Advising / Evaluation

In this section, we continue our discussion of the specific components critical to the design of an NIH-funded T32 grant supported research fellowship, with focus on the design of the program administration including leadership and advisory committees.

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Mentorship and assessment strategies are included with input from currently successful program leadership.

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Institutional Commitment to Program: The sponsoring institution must provide support for the proposed program including sufficient time for the Program Director and other program faculty to contribute to the proposed research training program. The application must include a signed letter on institutional letterhead that describes the applicant institution's commitment to the planned program. Appropriate institutional commitment includes the provision of adequate staff, facilities, and educational and research resources including in-kind financial support for the proposed program. Institutions with other institutional research training or career development programs that receive external funding should explain what distinguishes the proposed program from existing ones at the same trainee level, how the programs will synergize, if applicable, whether trainees are expected to transition from one support program to another, and how the training faculty, pool of potential trainees, and resources are sufficiently robust to support the proposed program in addition to existing ones.

Program Leadership and Faculty: T32 training programs must have a strong and compelling leadership approach with designated roles and responsibilities, governance, and organizational structure consistent with and justified by the aims of the training program and with the complementary expertise of each of the PD/PIs. The PI for a prospective T32 research program should have a strong history of successful and

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current NIH-funding, experience as a research mentor with multiple prior mentees, and have excellent leadership and administrative skills. A PI should expect to devote 10-20% time commitment to this program. Multiple Principal Investigator (MPI) mechanisms are well regarded, with MPIs having distinct and complementary areas of expertise and clearly defined roles. Associate/Assistant Directors with specified roles and responsibilities is another common format. A MPI mechanism with partnership between EM and another specialty discipline can be a particularly effective design to enhance both scientific integrity of the application as well as create pipelines for training fellows.

A research fellowship should have leaders in clinical or basic science research involved in the program with multiple ongoing research projects. A group of experienced, NIH-funded, senior research faculty with established track records of mentorship and independent grant support should be listed on the application. Current or recent service on NIH review sections should also be common amongst the program faculty.[18,19] As noted above, they need not all be in EM; indeed, multidisciplinary faculty mentors will be regarded as a strength as a number of research trainees can be expected to acquire mentors in fields outside of EM. Mentors must commit to frequent meetings with their designated fellows. With respect to individual faculty members, unfortunately, despite efforts dating back many years, studies show persisting disparities in gender and racial presence based on academic rank and leadership roles, with no change between 2015-2020.[20] Research program leadership should include a focus on diversity across all levels including program leadership and faculty, and internal and external advisory

committees as part of the broader mission in EM of increasing the number of racially and ethnically diverse faculty in academic departments.

A clear process for how the program leadership will recruit and select the T32 fellows, identify appropriate research mentors and required resources, and oversee their career and training progress is necessary for a competitive program application. Often the program leadership includes an Executive Committee composed of the program director, associate and assistant directors, and key research faculty. The program leadership should review and critique research proposals prior to IRB submission, as well as each fellow's individual development plan (IDP) and regularly monitor their progress in acquiring the required competencies.

Advisory Committees: Composed of experienced faculty leaders from multiple disciplines across the local institution, advisory committees serve as a resource to the PI/Co-PIs regarding T32 curriculum features, policies, and procedures, the *Internal Advisory Committee* (IAC) helps define fellow and mentor responsibilities, supports candidate recruitment strategies, and takes part in evaluation procedures for the fellows, mentors, and the overall program. In the unlikely event that disciplinary action is required, the IAC can be convened for a disciplinary hearing independent of the fellows' primary mentors.

An *External Advisory Committee* (EAC) comprised of experts from outside the host institution provides additional support and oversight to the training program and

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broadens the fellows' national networks. Typically, the EAC meets annually to hear formal presentations from fellows and offer feedback on their research progress. They also meet privately with the fellows to offer career development advice and to identify opportunities to improve the program. The EAC then provides recommendations to the program leadership on faculty mentors, program implementation, recruitment strategies, and any recruitment or retention issues that arise.

Program Administrator Role: The Program Administrator manages the day-to-day activities of the program by tracking participation of the T32 fellows in all required educational activities. With the program mentors, the administrator monitors the progress of each trainee according to the timeline of their individualized training plan and collects and maintains evaluation data solicited from fellows and faculty. Additional logistical duties of a Program Administrator include scheduling and providing support to the IAC and EAC members managing the program's budget, preparing and submitting annual progress reports to the sponsoring institute, and updating the website and responding to queries. In centers that have access to research assistants to conduct prospective enrollment of research subjects, the Program Administrator can supervise the interaction between research fellows and this staff. The administrator or other specified staff should be available to assist trainees with individual grant submissions.

Evaluation Plan: A detailed formal evaluation plan to assess the fellows, the faculty, the program leadership, and all aspects of the program must be included in the application. Clear metrics for success should be specified. Evaluation data should

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include trainee and mentor feedback, research project updates, current and former fellow rates of grant submissions, funding successes, publications, and impact. Based on reports of similar institutional-based NIH grants, graduates report high rates of career satisfaction and confidence in their ability to maintain a research-focused career in the future, and similar metrics should be tracked for T32 training program graduates.[21] Instruments to collect evaluation data should be included in an application appendix. Some programs use an external consultant to conduct the program evaluation.

6. Fellow Recruitment

This section addresses recruitment and retention of prospective research fellows, with particular focus on the diversity of the applicant pool. The application should describe the pools of potential applicants from which candidates will be recruited, both within and outside of the sponsoring institution. Given the breadth of emergency care research, existing networks of emergency care researchers from both within and outside the EM specialty should be leveraged to encourage applicants from residency programs that lack T32 programs into centers which have well-structured research divisions including T32 funding mechanisms. While unfunded research fellowships may not be expected to fill yearly, a funded research program should reliably maintain a pipeline of future applicants to occupy all funded positions or else risk not being renewed or having its allocated slots reduced on renewal.

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Scientific, Disciplinary and Demographic Diversity: Although a significant number of EM graduates have degrees from osteopathic schools, the DO graduates have been under-represented in both publications and grants compared to allopathic graduates.[22] Recipients of career development awards in EM have historically been disproportionately male, white, and from non-Hispanic ethnic backgrounds.[19] The trend parallels a broader trend in NIH research awards at all levels outside of EM as well.[23,24] Programs in EM research should make extensive efforts to identify and encourage applicants from a range of backgrounds in both demographics and in research interests to increase diversity in the future leaders of EM research. Specific outreach to institutions and programs with large numbers of underrepresented minorities should be undertaken. Efforts are already underway at many programs to increase diversity in the recruitment of EM residents, with recommendations from the Council of Residency Directors in Emergency Medicine having been updated several years ago highlighting several strategies to recruit and retain racially and ethnically diverse residency candidates at training programs and to promote diversity in faculty for academic departments.[25] Establishment of T32 supported research training infrastructure is one option to enlarge the pipeline for diverse researchers for the future of emergency medicine.

One potential pool for future researchers should include those currently finishing or planning to pursue additional clinical fellowship training after their EM residency. Interest in EM subspeciality research has been increasing, and many fellowship options within EM lack adequate dedicated time for the development of research skills, which

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would benefit these graduates in their future academic practice. For example, surveys of Pediatric EM fellows demonstrated a significant interest in future research endeavors but a need for additional research-specific training to overcome barriers.[26,27] Trainees in clinical fellowship programs may be unaware of research being performed at their own institutions, and this may contribute to a perception of lack of mentorship and research support. Given the nature of EM research, applicants from non-EM fields with research interests that fit well within an EM context should also be considered as applicants for research support. Within the broad field of Emergency Care Research, competitive applicants from other clinical specialties or non-clinical applicants may be viewed favorably as contributors to the future of our practice.

7. Conclusion

The NIH T32 is a grant mechanism that may be used to provide focused research training in many areas of interest to emergency physicians. The creation and expansion of T32 programs addresses the need for institutionally based research support for trainees and provides a foundation for future advancement of trainees into self-supporting research careers, building the specialty overall and advancing collaborations to address clinically relevant research questions. While additional outcomes research within the field of EM will strengthen the assessment of these programs' value, a need for infrastructural support for mentoring early-stage researchers certainly exists. The basic principles and structure for advancing T32 program application outlined in this

paper may be useful to other institutions to help advance successful applications and programs.

8. References

1. FastStats. Published September 15, 2023. Accessed November 20, 2023. https://www.cdc.gov/nchs/fastats/emergency-department.htm
2. Jang DH, Levy PD, Shofer FS, Sun B, Brown J. A comparative analysis of National Institutes of Health research support for emergency medicine - 2008 to 2017. *Am J Emerg Med*. 2019;37(10):1850-1854. doi:10.1016/j.ajem.2018.12.045
3. Neumar RW, Blomkalns AL, Cairns CB, et al. Emergency medicine research: 2030 strategic goals. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2022;29(2):241-251. doi:10.1111/acem.14367
4. Brown J. National Institutes of Health Support for Clinical Emergency Care Research, 2011 to 2014. *Ann Emerg Med*. 2016;68(2):164-171. doi:10.1016/j.annemergmed.2016.01.039
5. Brown J. National Institutes of Health Support for Clinical Emergency Care Research, 2015 to 2018. *Ann Emerg Med*. 2021;77(1):57-61. doi:10.1016/j.annemergmed.2020.06.031
6. Bessman SC, Agada NO, Ding R, Chiang W, Bernstein SL, McCarthy ML. Comparing National Institutes of Health funding of emergency medicine to four medical specialties. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2011;18(9):1001-1004. doi:10.1111/j.1553-2712.2011.01138.x
7. Schlafly A, Sebro R. Does NIH funding differ between medical specialties? A longitudinal analysis of NIH grant data by specialty and type of grant, 2011-2020. *BMJ Open*. 2022;12(12):e058191. doi:10.1136/bmjopen-2021-058191
8. Ranney ML, Limkakeng AT, Carr B, Zink B, Kaji AH. Improving the emergency care research investigator pipeline– SAEM/ACEP recommendations. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2015;22(7):849-851. doi:10.1111/acem.12699
9. PA-23-048: Ruth L. Kirschstein National Research Service Award (NRSA) Institutional Research Training Grant (Parent T32). Accessed September 12, 2023. https://grants.nih.gov/grants/guide/pa-files/PA-23-048.html
10. NIH R01 Grant Outcomes of T32 Postdoctoral Participants: Associations with Demographics, Cohort, Degree, and Career Development (K) Awards – NIH

Author Manuscript

Extramural Nexus. Published February 1, 2021. Accessed November 21, 2023. https://nexus.od.nih.gov/all/2021/02/01/nih-r01-grant-outcomes-of-t32-postdoctoral-participants-associations-with-demographics-cohort-degree-and-career-development-k-awards/

11. Fellowship Program. Center for Resuscitation Science. Accessed September 27, 2023. https://resuscitationscience.com/fellowship-program/

12. Postdoctoral Fellowships | Institute for Firearm Injury Prevention. Accessed September 27, 2023. https://firearminjury.umich.edu/education-training/postdoctoral-fellowships/

13. Brown J. National Institutes of Health support for individual mentored career development grants in emergency medicine. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2014;21(11):1269-1273. doi:10.1111/acem.12517

14. Mumma BE, Chang AM, Kea B, Ranney ML, Society for Academic Emergency Medicine Research Committee. Career Development Awards in Emergency Medicine: Resources and Challenges. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2017;24(7):855-863. doi:10.1111/acem.13189

15. Nishijima DK, Yadav K, May L, Kraynov L, Courtney DM, 2011-2012 and 2012-2013 Society for Academic Emergency Medicine Research Committees. Description and productivity of emergency medicine researchers receiving K23 or K08 mentored research career development awards. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2013;20(6):611-617. doi:10.1111/acem.12152

16. Scott Van Epps J, Younger JG. Early career academic productivity among emergency physicians with R01 grant funding. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2011;18(7):759-762. doi:10.1111/j.1553-2712.2011.01118.x

17. Kross EK, Rosenberg AR, Engelberg RA, Curtis JR. Postdoctoral Research Training in Palliative Care: Lessons Learned From a T32 Program. *J Pain Symptom Manage*. 2020;59(3):750-760.e8. doi:10.1016/j.jpainsymman.2019.11.013

18. Moore AB, Puskarich M, Vogel JA, Brown J, Sharp WW. Emergency medicine faculty serving on standing NIH and AHRQ study sections from 2019 to 2020. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2022;29(1):118-122. doi:10.1111/acem.14342

19. Chai PR, Carreiro S, Chapman BP, Boyer EW, O'Laughlin KN. Federal Funding in Emergency Medicine: Demographics and Perspectives of Awardees. *West J Emerg Med*. 2020;21(2):304-312. doi:10.5811/westjem.2019.12.45249

20. Linden JA, Baird J, Madsen TE, et al. Diversity of leadership in academic emergency medicine: Are we making progress? *Am J Emerg Med*. 2022;57:6-13. doi:10.1016/j.ajem.2022.04.009

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21. Smyth SS, Coller BS, Jackson RD, et al. KL2 scholars' perceptions of factors contributing to sustained translational science career success. *J Clin Transl Sci*. 2022;6(1):e34. doi:10.1017/cts.2021.886

22. Antony M, Savino J, Ashurst J. Difference in R01 Grant Funding Among Osteopathic and Allopathic Emergency Physicians over the Last Decade. *West J Emerg Med*. 2017;18(4):621-623. doi:10.5811/westjem.2017.1.32964

23. Nguyen M, Chaudhry SI, Desai MM, Dzirasa K, Cavazos JE, Boatright D. Gender, Racial, and Ethnic and Inequities in Receipt of Multiple National Institutes of Health Research Project Grants. *JAMA Netw Open*. 2023;6(2):e230855. doi:10.1001/jamanetworkopen.2023.0855

24. Ginther DK, Kahn S, Schaffer WT. Gender, Race/Ethnicity, and National Institutes of Health R01 Research Awards: Is There Evidence of a Double Bind for Women of Color? *Acad Med J Assoc Am Med Coll*. 2016;91(8):1098-1107. doi:10.1097/ACM.0000000000001278

25. Boatright D, Branzetti J, Duong D, et al. Racial and Ethnic Diversity in Academic Emergency Medicine: How Far Have We Come? Next Steps for the Future. *AEM Educ Train*. 2018;2(Suppl Suppl 1):S31-S39. doi:10.1002/aet2.10204

26. Michelson KA, Nigrovic LE, Nagler J, McAneney CM, Mistry RD, Survey Committee of the Pediatric Emergency Medicine Collaborative Research Committee. Research Interest in Pediatric Emergency Medicine Fellows. *Pediatr Emerg Care*. 2020;36(2):e38-e42. doi:10.1097/PEC.0000000000001085

27. DesPain AW, Gutman CK, Cruz AT, et al. Research environment and resources to support pediatric emergency medicine fellow research. *AEM Educ Train*. 2021;5(3):e10585. doi:10.1002/aet2.10585

	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Applications -All	152	152	242	127	305	346	1324
Funded	27	24	37	34	54	84	260
% Success – All	18%	16%	15%	27%	18%	24%	20%
RPG Equivalent Applications	122	131	193	95	219	245	1005

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RPG Equivalent Funded	17	14	31	21	29	47	159
% Success - RPG	14%	11%	16%	22%	13%	19%	16%
R01 only – Applications	65	77	120	52	145	174	633
R01 only -Funded	10	10	21	12	21	32	106
% Success – R01	15%	13%	18%	23%	14%	18%	17%
K 08,22,23,24, 38, 76, 99, KL2 Applications	15	8	19	25	43	48	158
K 08,22,23,24, 38, 76, 99, KL2 Funded	4	3	2	13	12	12	46
% Success- K 08,22,23,24, 38, 76, 99, KL2	27%	38%	11%	52%	28%	25%	29%

Table 2. NIH Applications and Outcomes from Emergency Medicine 2018-2023. Data provided by the Office of Emergency Care Research, NIH.

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