

Title: Emergency Medicine Research: 2030 Strategic Goals

Short Running Title: EM Research 2030

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10 **Abstract**

11 All academic medical specialties have the obligation to continuously create new knowledge that
12 will improve patient care and outcomes. Emergency medicine (EM) is no exception. Since its
13 origins over 50 year ago, EM has struggled to fulfill its research mission. EM ranks last among
14 clinical specialties in the percent of medical school faculty who are NIH-funded principal
15 investigators (PIs) (1.7%) and percent of medical school departments with NIH-funded PIs
16 (33%). Although there has been a steady increase in the number of NIH-funded projects and
17 total NIH dollars, the slowing growth in the number of NIH-funded PIs and lack of growth in the
18 number of EM departments with NIH-funded PIs is cause for concern. In response, the AACEM
19 Research Task Force proposes a set of 2030 strategic goals for the EM research enterprise that
20 are based on sustaining historic growth rates in NIH-funding. These goals have been endorsed
21 by the AACEM Executive committee and the Boards of SAEM, ACEP, and AAEM. The 2030
22 strategic goals include 200 NIH-funded projects led by 150 EM PIs in at least 50 EM Depts with
23 over \$100M in annual funding resulting in over 3% of EM faculty being NIH-funded PIs.
24 Achieving these goals will require a targeted series of focused strategies to increase the number
25 of EM faculty who are competitive for NIH funding. This requires a coordinated, intentional effort
26 with investments at the national, departmental, and individual levels. These efforts are ideally
27 led by medical school department chairs, who can create the culture and provide the resources
28 needed to be successful. The specialty of EM has the obligation to improve the health of the
29 public and to fulfill its research mission.

30 **Background**

31 The Association of Academic Chairs of Emergency Medicine (AACEM) commissioned a
32 Research Task Force in 2020 with objectives that included: 1) assessing and disseminating the
33 current state of research funding in academic emergency medicine (EM) departments and 2)
34 engaging the EM community to set 10-year targets for research funding among academic EM
35 departments. The Task Force analyzed federal research funding data from publicly available
36 sources and medical school faculty data from the American Association of Medical Colleges
37 (AAMC) to benchmark the current state of EM research funding against other clinical specialties
38 and analyze historical trends. The Task Force recognized that these data only attribute awards
39 to contact PIs, and do not include NIH funding to institutions other than medical schools, funding
40 to EM divisions within non-EM departments, and funding contracts or Small Business Innovation
41 Research (SBIR) and Small Business Technology Transfer (STTR) grants. Therefore, not all
42 funding to EM investigators is captured. This analysis was used to develop the 2030 goals for
43 NIH funding described in this manuscript. These goals were voted on and unanimously
44 supported by the AACEM Research Task Force membership and the American College of
45 Emergency Physicians (ACEP)-Society for Academic Emergency Medicine (SAEM) Federal
46 Research Funding Workgroup. The AACEM Executive Committee and the Boards of SAEM,
47 ACEP, and the American Academy of Emergency Medicine (AAEM) subsequently endorsed the
48 goals. A writing group comprised of the AACEM Research Task Force and representatives
49 from the SAEM, ACEP, and AAEM was formed to generate this manuscript which reports the
50 rationale for setting the 2030 goals, the data used to generate the goals, and recommended
51 strategies to achieve them. The scope of these recommendations is internal facing to the
52 academic emergency medicine community.

53 **Importance of Research in the Tripartite Mission of Emergency Medicine**

54 Any academic medical specialty must continuously create new knowledge that will improve
55 patient outcomes. To be maximally effective, the scope of research activities should span the
56 entire translational spectrum, from basic science through clinical science, implementation, and
57 health policy research. Clinicians who provide patient care within the specialty must be
58 engaged in the research enterprise to assure that the most important and relevant knowledge
59 gaps are being addressed. Finally, it is the obligation of academic departments within the

60 specialty to recruit, train, and support the scientists who will create and disseminate the new
61 knowledge needed to advance the specialty in the future. The specialty of EM is no exception.

62
63 The potential impact of improved emergency care in reducing human suffering is immense. In
64 2018 there were 130 million (M) emergency department (ED) visits resulting in 16.2 M
65 hospitalizations and 2.3 M critical care unit admissions.¹ These patients deserve the best
66 possible care based on current science and best evidence, and improvements in care are driven
67 by new science. Although many clinical specialties provide emergency care and are involved in
68 emergency care research, the specialty of EM would be delinquent in its duty if it simply relied
69 on scientists outside the specialty to advance the field.

70 **History of Emergency Medicine Research**

71 After the first meeting with the American Board of Medical Specialists, it was crystal clear to the
72 EM representatives that if EM was to become a distinct medical specialty, it would require a
73 unique scientific and clinical basis, as well as recognition as a unique academic endeavor,
74 separate from the clinical activity and bedside medical education. The nascent field was tasked
75 with detailing a body of knowledge and expertise that was unique to the specialty. EM was a
76 response to the need to provide a higher quality of care for all patients with acute illnesses and
77 injuries. The recognition of this need was highlighted in 1966 when the National Academy of
78 Sciences report titled "*Accidental Death and Disability: The Neglected Disease of Modern*
79 *Society*," which noted that society was not aware of "the magnitude of the problem of accidental
80 death and injury".² Furthermore, the report noted that the standards for US ambulance services
81 were varied and "often low", and that ambulances were either unsuitable, ill-equipped, or staffed
82 by untrained personnel. This publication resulted in the first federally qualified ambulance
83 services and personnel, the training of whom fell onto EM. In 1973, Congress passed the
84 Emergency Medical Services Systems Act, which directed the Secretary of Health, Education,
85 and Welfare to provide grant funding to study the feasibility of establishing and operating an
86 emergency medical services (EMS) system. Early EM research focused primarily on the newly
87 established EMS system and emergent therapies.

88
89 Although this act was helpful, it was not sufficient to support the formation of an entirely new
90 research specialty. Early EM research was focused primarily on narrow clinical questions, which
91 was inconsistent with the model and priorities of federal funders and larger foundations. Though
92 the AMA and the specialty board recognized the clinical specialty of EM, the academic portion

93 of EM was stagnant. In 1994 the Macy report entitled, *The Role of Emergency Medicine in the*
94 *Future of American Medical Care* provided a defined road map for the future development of
95 academic EM.³ Along with recommendations for the creation of university departments and
96 required medical school rotations, it also recommended the development of modern,
97 scientifically, and methodologically sophisticated research programs that would be competitive
98 for federal funding. These programs included: (1) a cadre of rigorously trained investigators with
99 dedicated research time and resources, similar to those of their peers housed in other clinical
100 departments; (2) productive collaborations with experienced, federally funded investigators
101 across medical and scientific disciplines; and (3) the development and sustenance of funding
102 and other resources for the most promising research activities. In 2003, a published update on
103 the implementation of the original Macy report recommendations noted persistent gaps in
104 federal support for EM.⁴

105
106 In 2006, the Institute of Medicine published three coordinated reports focused on the Future of
107 Emergency Care in the U.S. Health System⁵⁻⁷ and recommended "...that the Secretary of the
108 Department of Health and Human Services conduct a study to examine the gaps and
109 opportunities in emergency and trauma care research, and recommend a strategy for the
110 optimal organization and funding of the research effort. This study should include consideration
111 of training of new investigators, development of multicenter research networks, funding of
112 General Clinical Research Centers that specifically include an emergency and trauma care
113 component, involvement of emergency and trauma care researchers in the grant review and
114 research advisory processes, and improved research coordination through a dedicated center
115 or institute." EM responded in 2007 by creating the ACEP-SAEM Joint Task Force on
116 Emergency Care Research. Members of the Task Force met with the NIH Director at the time,
117 Dr. Elias Zerhouni, to advocate for the recommendations outlined in the IOM report.⁸ An internal
118 NIH Task Force on Emergency Care Research, led by Walter Koroschetz, was formed in 2007⁹
119 and coordinated three NIH-hosted roundtables focused on medical-surgical, trauma and
120 neurologic, and psychiatric emergency research that identified key knowledge gaps and
121 recommended strategies for advancing research in these areas.¹⁰⁻¹² The ACEP-SAEM Joint
122 Task Force on Emergency Care Research had a follow-up meeting with the subsequent NIH
123 Director, Dr. Francis Collins, in 2011 to further advocate for implementation of the IOM
124 recommendations. These activities ultimately led to the creation of the NIH Office for
125 Emergency Care Research (OECR) in 2012. Dr. Jeremy Brown became the first permanent
126 OECR Director in 2013. The OECR works across the 27 institutes and centers at NIH to foster,

127 coordinate, and advocate for clinical and translational emergency care research and research
128 training. Although a valuable resource, there are structural barriers limiting the OEER's impact,
129 which include the absence of dedicated funds to support research programs and not being
130 housed in the NIH Office of the Director, where similar programs that transcend multiple
131 institutes are housed.

132
133 Significant milestones in federal support for emergency care research have been achieved over
134 the past two decades. These include the creation of multicenter clinical research networks such
135 as the Pediatric Emergency Care Applied Research Network (PECARN, 2001 to present), the
136 Resuscitation Outcomes Consortium (ROC, 2004-2015), the Neurologic Emergencies
137 Treatment Trials Network (NETT, 2006 to 2017), and the Strategies to Innovate Emergency
138 Care Clinical Trials (SIREN) Research Network (2017 to present). One limitation of these
139 networks is the lack of funded research training positions that would support a pipeline of
140 investigators to perform the network research. The first NIH K12 Career Development Program
141 in Emergency Care Research was created by the National Heart Lung and Blood Institute
142 (NHLBI) in 2011 (see additional details below). This was followed by a second NIH K12
143 Program in Emergency Care Research initiated in 2016 that was co-sponsored by NHLBI, the
144 National Institute of Mental Health (NIMH), and the National Institute of Nursing Research
145 (NINR).

146

147 **Benchmarking EM Faculty and Departments Against Other Clinical Specialties**

148 One method of assessing the status of research in the EM specialty is to benchmark faculty and
149 academic departments against other specialties. An appealing and most feasible option is to
150 use NIH funding, which is the largest research funding source for all clinical specialties, and
151 annual data is publicly available. Figure 1A illustrates the percentage of full-time medical school
152 faculty that were NIH-funded principal investigators (PIs) in the Association of American Medical
153 Colleges (AAMC) recognized clinical specialties in 2019. EM ranks last at 1.7% (mean 8.1%,
154 median 6.1%). In terms of the percentage of AAMC-recognized departments with NIH-funded
155 faculty, EM again ranks last at 33% (mean 54%, median 51%, Figure 1B). Potential contributing
156 factors are the low percentages of MD/PhDs and PhDs (without an MD) among faculty in
157 medical school Departments of EM with rankings of "last" in both categories. Only 3% of EM
158 medical school faculty are MD/PhDs compared to a mean of 8.3% for all clinical specialties
159 (Figure 1C). Similarly, only 2.1% of EM medical school faculty are PhDs (without an MD)
160 compared to a mean of 15.5% for all clinical specialties (Figure 1D).

161
162 Not surprisingly, there is a “strong” correlation between the percentage of full-time faculty with
163 PhD or other doctoral degrees and the percentage of full-time faculty who are NIH-funded PIs in
164 a department. The adjusted R^2 for the percentage of MD/PhDs is 0.72 (i.e., this explains 72% of
165 the variability in the percentage of full-time faculty who are NIH-funded PIs) (Supplementary
166 Figure 1A). For faculty members who are PhDs or hold another doctoral degree the adjusted R^2
167 is 0.63. (Supplementary Figure 1B). These data suggest that strong consideration should be
168 given to recruiting faculty members with PhDs and other doctoral degrees into medical school
169 Departments of EM.

170
171 Despite this, the available evidence indicates that the success rate of NIH grant applications
172 submitted by EM faculty is comparable to the success rate of faculty from other clinical
173 specialties. Consistent with the absence of a difference in success rates, the annual number of
174 NIH applications per 100 faculty correlates strongly with the percentage of full-time faculty who
175 are NIH-funded PIs (R^2 0.90; $p=0.03$), (Supplementary Figure 2). Therefore, increasing the
176 annual number of NIH grant submissions by EM faculty should be a major focus in future years
177 as we strive to reach the goals presented below.

178 179 **Emergency Medicine NIH Funding Trends**

180 The fact that EM ranks last among clinical specialties in all the NIH benchmarks described
181 above should be considered in the context of the youth of the specialty and growth that has
182 been achieved over the past several decades (Figure 2A). In 2000 there were 12 NIH funded
183 projects with EM PIs for a total of \$3.9M in funding. In 2020, 150 projects were NIH funded with
184 EM PIs, for a total of \$91.5M.

185
186 It is encouraging that the number of NIH-funded EM PIs increased by 63% and the number of
187 NIH-funded PIs per funded department increased by 50% over the past decade (Figure 2B).
188 However, the absolute number remains relatively small, and growth has been minimal in the last
189 3 years. Additionally concerning is the fact that the number of EM departments with NIH-funded
190 PIs has only increased by 9% in the past 10 years and appears to be reaching a plateau. With
191 only 33% of medical school EM departments with NIH-funded PIs relative to an average of 54%
192 across all clinical specialties, increasing the number of EM departments with NIH-funded PIs is
193 an important goal moving forward.

194

195 Individual and institutional NIH Career Development Awards (i.e., K Awards) provide a critical
196 mechanism by which EM faculty can have dedicated research time, structured mentorship, and
197 funding to develop into independent federally funded PIs. As illustrated in Figure 2C, the growth
198 of active individual K-awardees has been significant since 2000 but limited in the past decade.
199 Comparing 2010 to 2020, however, the number of active K23 awardees (n=15) and K08
200 awardees (n=5) is unchanged.

201
202 The National Heart, Lung, and Blood Institute (NHLBI) of the NIH funded six departments of EM
203 in 2011 to initiate institutional K12 training programs in emergency care research training.¹³ This
204 multi-site K12 program marked the first large-scale NIH investment in emergency care research
205 training for clinician-scientists. The K12 program was interdisciplinary by design, reflecting
206 clinician-scientists from multiple specialties functioning under the umbrella of “emergency care”.
207 The primary goals of the K12 program were for each faculty scholar to submit and secure an
208 individual career development award (CDA), e.g., K23 and K08 awards or a federal research
209 project grant (RPG), e.g., R01 or R21 awards, to generate peer-reviewed emergency care
210 research publications, and, more broadly, to catalyze the field of emergency care research. Of
211 the 43 scholars across the original six K12 sites, 40 (93%) submitted a CDA or RPG application.
212 In an evaluation completed shortly after completion of the first 5-year funding cycle, 26 (60%)
213 scholars had secured independent grant funding (19 CDAs and 8 RPGs, with one scholar
214 receiving both). Overall funding success rates were 61% for CDAs and 50% for RPG
215 applications, which exceeded overall NIH success rates for K08/K23 applications (37%) and
216 RPG applications (17%) during a similar time period.¹⁴ This program was renewed with support
217 from multiple NIH institutes (NHLBI, NIMH, and NINR) for a second round of funding beginning
218 in 2016. Four training centers were awarded funding. To date, all sites have filled available
219 training slots, with multiple scholars securing CDAs. However, the program ends in June 2021
220 with no plan for renewal.

221
222 The Ruth L. Kirschstein Institutional National Research Service Award (T32) is another well-
223 established NIH funding mechanism for institutions to support pre-doctoral and post-doctoral
224 research training slots. Although commonly used by other clinical specialties to support
225 research training of residents and fellows, as of 2020 only two T32 grants have been awarded
226 to Departments of EM, with an additional T32 grant focused on pediatric emergency care. To
227 mitigate the loss of the K12 program, an important strategy moving forward will be to increase
228 the number of T32 training grant applications submitted by departments of EM.

229
230 Individual NIH institutes have established career development awards tailored towards the
231 needs of early career emergency physicians. For example, the National Institute on Aging (NIA)
232 developed the GEMSSTAR program to provide support for early career physician-scientists
233 trained in medical or surgical specialties, including EM, to launch careers as future leaders in
234 aging- or geriatric-focused research. The GEMSSTAR award is intended to offer support in a
235 particularly vulnerable time in a new clinical faculty member's career.¹⁵ The GEMSSTAR
236 program also provides an opportunity for a companion award for a professional development
237 plan (PDP). These PDP awards are supported by professional societies and coordinated by the
238 American Geriatric Society.¹⁶ The EM GEMSSTAR PDP awards are supported by the SAEM
239 Foundation.¹⁷ Another NIA program to develop specialty based (including EM) research career
240 awards includes the Paul B. Beeson Emerging Leaders Career Development Award in Aging,
241 which is supported by the NIA, American Federation for Aging Research, and the John A.
242 Hartford Foundation.¹⁸

243
244 In summary, the EM specialty has made significant progress in NIH funding over the past two
245 decades. However, the number of individual K awards has plateaued. Although the NIH-funded
246 K12 Career Development Programs in Emergency Care Research were successful, they have
247 ended despite a persistent need to develop scientists focused on emergency care research.
248 Finally, while the overall number of NIH-funded PIs has grown, the number of departments with
249 NIH-funded PIs has not and remains relatively low compared to other specialties.

250 **Other Federal Funding Sources for Emergency Medicine Research**

251 While the NIH provides most of the research funding to the specialty of EM, other federal and
252 non-federal sources are strategically important. Federal funding from the Agency for Healthcare
253 Research and Quality (AHRQ), Centers for Disease Control (CDC), Veterans Administration
254 (VA), Department of Defense (DOD), Biomedical Advanced Research Development Authority
255 (BARDA), Patient-Centered Outcomes Research Institute (PCORI), Health Resources and
256 Service Administration (HRSA), and Substance Abuse and Mental Health Services
257 Administration (SAMHSA) provides important research funding to EM investigators, especially
258 for research areas not typically funded by the NIH. Supplemental Figure 3 illustrates historical
259 funding trends for AHRQ and CDC. Since its inception in 2010, PCORI has awarded 10 grants
260 to nine different EM PIs in seven U.S. departments of EM.¹⁹ While similar data for VA, HRSA,

261 SAMHSA, BARDA, and DOD funding are not publicly available, these all provide significant
262 funding for emergency care research.

263

264 **Foundation Funding for Emergency Medicine Research**

265 Foundations provide another important mechanism of research funding for Departments of EM.
266 Outside the specialty, examples include the American Heart Association (AHA), the Wallace H.
267 Coulter Foundation, the American Geriatrics Society, the American Federation for Aging
268 Research, the John A. Hartford Foundation, and the Robert Wood Johnson Foundation. Within
269 the specialty of EM, the major research funding foundations include the Emergency Medicine
270 Foundation (EMF) and the Society for Academic Emergency Medicine (SAEM) Foundation.
271 Figure 3 illustrates the annual research funding provided by these two foundations since their
272 inception. The National Foundation of Emergency Medicine (NFEM) also provides career
273 development awards. While not at the level of federal funding, this support is essential for early
274 career investigators to gain the research experience and training needed to be competitive for
275 federal funding.

276

277 **2030 Emergency Medicine Strategic Goals for NIH Funding**

278 The purpose of setting 2030 strategic goals for EM NIH funding is to openly and publicly set
279 forth an ambitious, yet realistic, trajectory for achieving the research mission of the specialty.
280 Using available historical data through 2020, the authors used linear regression to establish
281 targets for 2030, based on the goal of sustaining the historic growth rate over the next decade
282 (Supplemental Figure 4). These strategic goals are summarized in Figure 4.

283

284 These goals have been endorsed by the AACEM Executive Committee and the Boards of
285 SAEM, ACEP, and AACEM. While working to achieve these growth targets, it will be important
286 to invest in diversity and inclusion of the scientific workforce within the specialty. We know from
287 Jagsi et al. that women and URiM from all specialties tend to lag behind their counterparts in the
288 total amount of funding and time it takes to become successfully funded.^{20,21} The COVID-19
289 pandemic may exacerbate these differences disproportionately.²² The activities and influence of
290 the Academy for Women in Academic Emergency Medicine (AWAEM) and The Academy for
291 Diversity and Inclusion in Emergency Medicine (ADIEM) will undoubtedly influence this
292 trajectory.

293

294 **Strategies to Achieve 2030 Strategic Goals**

295 Increasing the number of EM faculty prepared to submit competitive applications for NIH funding
296 is fundamental to achieving these goals. This can be achieved by recruiting, training, and
297 developing more scientists within academic departments of EM and by increasing the number of
298 academic departments of EM participating in the research enterprise. Undoubtedly this requires
299 departmental monies and resources, necessitating a multi-pronged national and institutional
300 approach. A coordinated national effort by EM societies, foundations, and departments is
301 needed to recruit a diverse group of scientists to the specialty and to leverage existing funding
302 mechanisms for research training as well as advocate for new ones. The endorsement of this
303 document by key stakeholder organizations demonstrates the feasibility of our specialty
304 embracing a common set of goals. However, accountability will also be required if the goals are
305 to be achieved. Perhaps the greatest responsibility falls upon the department chairs at
306 academic medical centers that currently support or are capable of supporting federally funded
307 research programs. These are the individuals who set and model the departments' culture and
308 have access to resources needed to support a research enterprise. A critical time in the
309 trajectory of any academic department is the hiring of a new chair. At that time, it is the new
310 chair's responsibility to negotiate a startup package that provides adequate resources to create
311 or grow a sustainable research program (see table for details), being attentive to the historical
312 gaps of our specialty as well as gaps which may have been present at the institution. The
313 amount of such support should accordingly be at a minimum comparable to what other similar
314 sized clinical departments at that institution have received. A shared institutional investment in
315 Department of Emergency Medicine research, investigators, and trainees fuels the institutional
316 need for innovation in health care delivery, especially given the key role of emergency care in
317 academic health systems.

318 Department chairs seeking to initiate or grow a research enterprise should also be supported by
319 a national infrastructure to leverage the expertise and resources in order to maximize success.
320 AACEM, SAEM, ACEP, and AAEM can support this mission by promoting scientists and
321 scientific discovery at the same level as our clinical and education missions. EMF and the
322 SAEM Foundation can expand the impact of their research career development programs by
323 leveraging or partnering with existing federally funded research training programs. EM
324 departments with established federally funded research programs should assist EM
325 departments trying to build a federally funded research program, through structured consulting
326 facilitated by AACEM and/or leading learning collaboratives that offer a variety of workshops

327 and research in progress sessions for faculty early in their research careers. Finally, at the
328 individual level, research-oriented EM residents, fellows, and faculty need to commit to the
329 training, mentorship, and time required to become an independent NIH-funded investigator.
330 Specific strategies that national organizations, departments, and individuals can adopt are
331 outlined in more detail in Table below.

332 **Conclusions**

333 The specialty of EM has the obligation to improve the health of the public and patient outcomes
334 by creating knowledge and adopting evidence-based practices in emergency care. However,
335 success will require a coordinated effort, led primarily by chairs of academic departments of EM,
336 who can effectively advocate at the institutional level with support from a more robust national
337 EM research infrastructure. This effort should aim to create a sustainable pipeline of diverse
338 and well-trained scientists capable of successfully obtaining federal research funding to
339 develop, test, and implement innovative diagnostic, monitoring, treatment, and prevention
340 strategies focused on emergency care. Creating and supporting a set of common goals to be
341 achieved over the next decade is the first step in this journey.

342 FIGURE LEGENDS

343

344 Figure 1: Benchmarking by Clinical Specialty

345 A. The percent of full-time faculty members that are NIH-funded PIs in each clinical specialty
346 was calculated using the number of NIH-funded PIs in each specialty in 2019 reported from
347 Blue Ridge Institute for Medical Research (BRIMR)²⁴ as the numerator and the number of full-
348 time medical school faculty members in each specialty in 2019 reported by the Association of
349 American Medical Colleges (AAMC).²⁵ B. The percent of U.S. medical schools with respective
350 clinical departments that have NIH-funded principal investigators in those departments was
351 calculated using the number of medical schools with NIH funding in a clinical specialty in 2019
352 as reported from the BRIMR²⁴ as the numerator and the number of U.S. medical school
353 departments in each specialty in 2019 reported by the AAMC²⁶ as the denominator. C. The
354 percent of full-time faculty members that have MD/PhD degrees in each specialty is calculated
355 using the number of MD/PhD full time medical school faculty in each clinical specialty in 2019 as
356 reported by the AAMC²⁵ as the numerator and the total number of full-time medical school
357 faculty in each specialty in 2019 as reported by the AAMC²⁵ as the denominator. D. The
358 percent of full-time faculty members that have a PhD or other doctoral degree without an MD
359 degree in each specialty is calculated using the number of PhDs or other doctoral degree full
360 time medical school faculty in each clinical specialty in 2019 as reported by the AAMC²⁵ as the
361 numerator and the total number of full-time medical school faculty in each specialty in 2019 as
362 reported by the AAMC²⁵ as the denominator.

363

364 Figure 2 Annual NIH Funding to Departments of Emergency Medicine

365 A. NIH funding to departments of emergency medicine by fiscal year as reported by the
366 BRIMR.²⁴ B. NIH funded emergency medicine PIs and emergency medicine departments with
367 NIH-funded PIs by fiscal year as reported by the BRIMR.²⁴ C. Active NIH career development
368 and training grants in departments of emergency medicine based by fiscal year based on NIH
369 Reporter.²⁷

370

371 Figure 3. Annual EMF and SAEM Foundation Funding

372 A. Emergency Medicine Foundation funding since inception based on total dollars awarded and
373 number of grants awarded in each year.²⁸ B. Society for Academic Emergency Medicine
374 Foundation funding since inception base on total dollars awarded and number of grants
375 awarded in each year.²⁹

376

377 Figure 4. 2030 Emergency Medicine Strategic Goals for NIH Funding

378 2030 EM strategic goals for NIH funding are based on sustaining historic growth rates over the
379 past 12-15 years (See supplemental figure 4).

380

**381 Supplemental Figure 1. Correlation of MD/PhD and PhD (without MD) Faculty with NIH-
382 Funded PIs**

383 A. The correlation of MD/PhD faculty with NIH-funded PIs was performed using linear
384 regression based on the number of full-time medical school MD/PhD Faculty in 2019 in each
385 clinical specialty as reported by the AAMC²⁵ and the number of NIH-funded PIs in each clinical
386 specialty as reported by the BRIMR.²⁴ B. The correlation of a PhD or other doctoral degree
387 (without MD Degree) faculty with NIH-funded PIs was performed using linear regression based
388 on the number of full time medical school faculty with a PhD or other doctoral degree (without a
389 MD) in 2019 in each clinical specialty as reported by the AAMC²⁵ and the number of NIH-funded
390 PIs in each clinical specialty as reported by the BRIMR.²⁴ *This correlation excluded Psychiatry
391 and PM&R due to the significant number of clinical faculty that hold PhDs or other doctoral
392 degrees (without a MD).

393

394

**395 Supplemental Figure 2. Correlation of Percent NIH Funded PIs with Annual NIH Grant
396 Applications per 100 Faculty.**

397 The correlation of percent NIH-funded PIs with annual NIH
398 grant applications/100 faculty/year within specific specialties was performed using the linear
399 regression (Microsoft Excel Data Analysis Tool). The percent of NIH-funded PIs for four
400 specialties was calculated by dividing the number of NIH-funded PIs in 2018 based on BRIBR²⁴
401 by the number for full time medical school faculty members in each specialty in 2018 based on
402 the AAMC.²⁵ The average number of annual NIH grant submission from the same four
403 specialties between 2015 and 2018 was calculated based on data published by Brown 2021.³⁰

403

**404 Supplemental Figure 3. Annual AHRQ and CDC Funding to Departments of Emergency
405 Medicine.** A. Annual AHRQ funding to departments of EM as reported by NIH Reporter.²⁷ B.

406 Annual CDC funding to departments of EM as reported by NIH Reporter.²⁷

407

408 Supplemental Figure 4. Projections for Emergency Medicine NIH funding

409 A. Projections for annual NIH funded projects with EM PIs were calculated based on a linear
410 regression equation derived from historic values from 2006 to 2020 as reported by NIH
411 Reporter.²⁷ Projections for total annual NIH funding to EM departments were calculated based
412 on a linear regression equation derived from historic values from 2006 to 2020 as reported by
413 BRIMR.²⁴ B. Projections for NIH funded EM PIs were calculated based on a linear regression
414 equation derived from historic values from 2009 to 2020 as reported BRIMR.²⁴ Projections for
415 EM departments with NIH funded PIs were calculated based on a linear regression equation
416 derived from historic values from 2006 to 2020 as reported BRIMR.²⁴ Linear regression
417 equations were calculated using Microsoft Excel Data Analysis Tool.

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Table. Proposed Strategies to Achieve the 2030 Emergency Medicine Strategic Goals for NIH Funding

National Level: Goal - Increase number of federally funded EM PIs and the number of EM departments with federally funded PIs	
Strategy	Recommended Approach to Implementation
Create a dashboard	AACEM creates a public facing dashboard to monitor progress toward these 2030 NIH funding goals
Hold a national consensus conference	SAEM holds a national consensus conference focused on creating and sustaining a pipeline of diverse federally funded emergency medicine scientists.
Create a First K Supplement	EMF and SAEM Foundation provide supplemental funding for departments of EM with their first individual NIH K grant to facilitate successful transition to an independent NIH R grant.
Advocate for a NIH-Funded National K12 Program	The ACEP-SAEM Federal Research Funding Workgroup works with the Director of the Office of Emergency Care Research and stakeholder NIH Institutes to advocate for a NIH-Funded National K12 program for Emergency Care Research to identify and prepare the most outstanding junior faculty candidates nationally for sustained training as scholars in EM research. This could be modeled after the NICHD-funded Pediatric Critical Care and Trauma Scientist Development Program. ²³
Advocate for funded training slots in clinical research networks	The ACEP-SAEM Federal Research Funding Workgroup works with the Director of the Office of Emergency Care Research and stakeholder NIH Institutes to advocate for funded research training slots in federally funded EM research networks such as SIREN, PECARN, and ED INNOVATION.
Advertise existing research training programs	The SAEM Research Committee develops and maintains an online resource that includes all extramurally funded institutional research training programs to which EM candidates can apply.

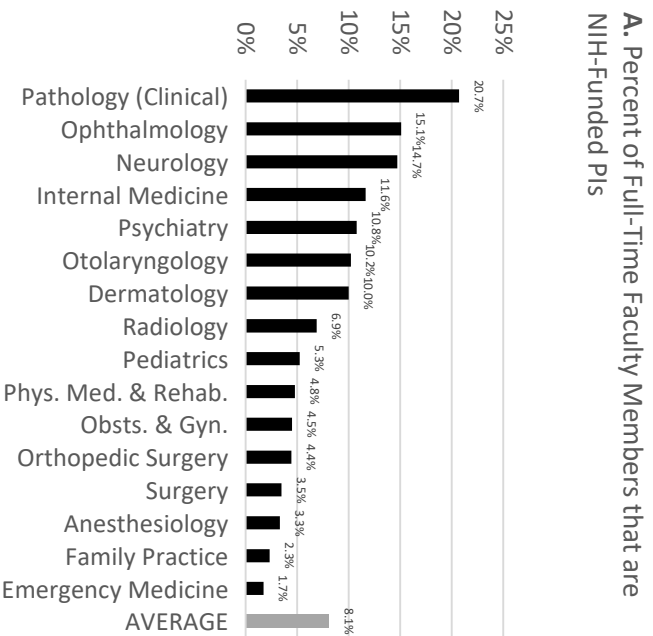
Create a Research Program Development Consult Service	AACEM creates a formal consulting service through which Chairs and Associate/Vice Chairs for Research from established research programs which can provide formal consultation to interested Chairs and Associate/Vice Chairs for Research regarding necessary resources for initiating or expanding a federally funded research enterprise.
Develop a national EM research curriculum	AACEM and SAEM partner to develop online webinars and small classroom curriculum for investigators at all levels to standardize outstanding research training. This could include virtual K and R grant writing boot camps. These efforts should specifically include strategies to enhance the diversity of individuals in the research training pipeline.
Create research collaboration networks	AACEM, SAEM, ACEP, and AAEM create a national infrastructure to support inter-institutional research collaborations. This could include development of learning collaboratives among EM departments to offer workshops and research in progress sessions for new research faculty
Promote EM scientists	AACEM, SAEM, ACEP, and AAEM highlight EM scientists and accomplishments in national and regional newsletters and conferences, and in social media platforms. These efforts should be intentional about promoting diversity among EM scientists.
Promote DEI	AWAEM and ADIEM work with department chairs to ensure a diverse scientific workforce.
Departmental Level: Goal - Increase number of federally funded faculty	
Strategy	Recommended Approach to Implementation
Engage research-oriented medical students in EM research	EM faculty investigators actively engage medical students and Medical Scientist Training Program (MSTP) students in EM research and serve as role models for careers as an EM physician-scientist.
Expand innovative opportunities for combined residency/research	EM Residency Program Directors adopt and adapt combined residency/research programs that include formal research training,

training	mentorship, and opportunities for pilot studies, with the goal of becoming independent investigators. Resident applicants rank programs through the common EM match. The Yale Emergency Medicine Scholars (YES) Program and The Iowa Physician Scientist Training Pathway foster early career research development and integrate residency training, clinical fellowship, and postdoctoral research training in a 5-year program. The Stimulating Access to Research in Residency (StARR) (R38) is one NIH-funding mechanism that can support such programs.
Integrate research training into ACGME and non-ACGME fellowships	EM Fellowship Program Directors offer pathways to formal research training that include master's or doctoral degrees. Established programs should apply for NIH T32 grants to support post-doctoral research training. Less established programs should leverage existing institutional NIH-funded T32 and KL2 training programs to support research training within existing EM fellowships.
Recruit clinical trainees with formal research degrees	EM Residency and Fellowship Program Directors recruit more trainees with MD/PhDs. Recruiting clinical trainees with formal research training will establish a pipeline of potential faculty scientists.
Recruit faculty with formal research degrees	EM Department Chairs recruit faculty with formal research degrees. This requires developing mechanisms to support research effort from clinical revenue, hospital contributions from shared services agreements, Chair packages, and/or Dean's designated funds. Appropriate salaries and incentives should be provided. Non-clinical PhD faculty should be well-integrated into the mission of EM and the department.
Develop research collaborations with other departments and schools at your own institution or nationally	EM Department Chairs and Assoc/Vice Chairs for Research promote EM research to Deans, other Dept. Chairs and other institutional leaders including interdisciplinary research programs and institutional training programs that include the broad scope of emergency care. EM Department Chairs and Assoc/Vice Chairs for Research

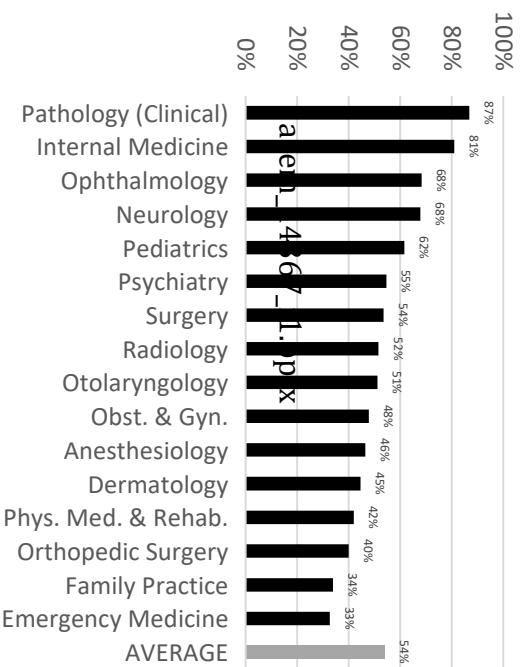
	<p>establish close collaborations with local CTSA programs that have their own KL2 programs that EM research candidates can access.</p> <p>EM Department Chairs and Assoc/Vice Chairs for Research create recruitment packages with other departments with shared visions and projects.</p> <p>EM Department Chairs and Assoc/Vice Chairs for Research Identify other schools such as Engineering, Public Health, Management, that may join EM as core faculty and/or contribute intellectual content, funds, or resources to assist with recruitments, career development or grant applications.</p>
Create necessary infrastructure	<p>EM Department Chairs and Assoc/Vice Chairs for Research create or gain access to the infrastructure needed to support a federally funded research program including pre- and post-award administrative staff and wet and dry lab space.</p> <p>New Department Chairs should negotiate for chair packages that provide adequate funding and commitments to support and grow a robust research enterprise. Components include a Vice Chair for Research, endowed professorships, tenure lines for clinician and non-clinician investigators, funds for faculty startup packages, and wet and dry research space. It is also important to secure funds or mechanisms for supporting ongoing research infrastructure cost that cannot be covered with extramural grant funding such as pre- and post-award administrative staff, fixed infra-structure supply costs, and rent for research space (if applicable). Such expenses are often covered by the department being allocated a fraction of grant indirect cost received by the institution.</p>
Create a departmental culture that values research and researchers	<p>EM Department Chairs and Assoc/Vice Chairs for Research, Fellowship Directors, and Residency Program Directors create a departmental culture that supports the physician scientist career path as viable, respected, and essential to the specialty. Adequate amounts and duration of support should be provided to ensure success.</p>
<p>Individual Level - Goal: Obtain independent federal funding</p>	

Strategy	Recommended Approach to Implementation
Obtain Formal Research Training	EM research trainees and faculty obtain formal research training that leads to master's or doctoral degrees.
Engage Mentors	EM research trainees and faculty engage local, regional and/or national EM and non-EM mentors. Team mentorship is ideal, and trainees should be assisted in developing these mentorship teams. Developing EM researchers access and nurture their own networks from organizational meetings, both EM and content based. Set short- and long-term goals and objectives with specific timelines for projects, accomplishments.
Apply for training slots on existing institutional training grants	EM research trainees and faculty apply for institutional T32, KL2, and K12 post-doctoral and early career faculty research training slots that are accessible to EM fellows and faculty at their home institution. These are typically awarded through an internal competitive process.
Apply for individual career development grants	EM research trainees and faculty apply for individual career development grants available through foundations and professional organizations [e.g., EMF, SAEM Foundation, NFEM, AHA, American Academy of Pediatrics (AAP), and American Pediatric Association (APA)], and the NIH (K08 and K23).
Apply for diversity supplements	Funded EM PIs apply for intramural or extramural diversity supplements. For example, Research Supplements to Promote Diversity are available to NIH-funded PIs of grants with any activity code except individual training grants.
Develop network of investigators with similar interests	EM research trainees and faculty seek out and develop collaborations with faculty in other departments and schools.
Maintain a diversified funding portfolio	EM research trainees and faculty apply to a broad, diverse group of federal and non-federal funding sources.

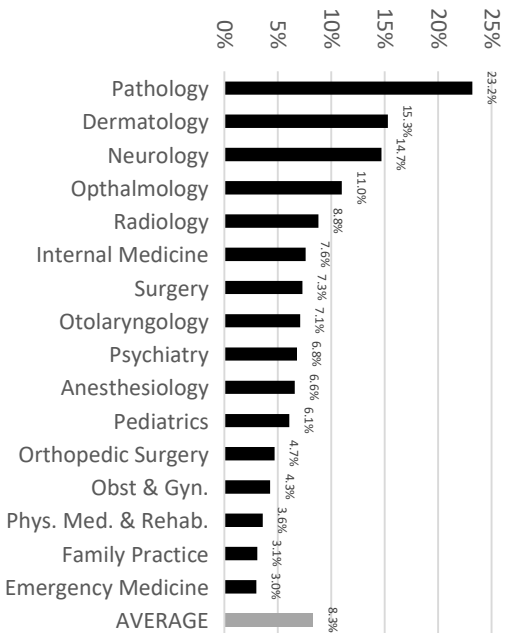
Figure 1. Benchmarking by Clinical Specialty



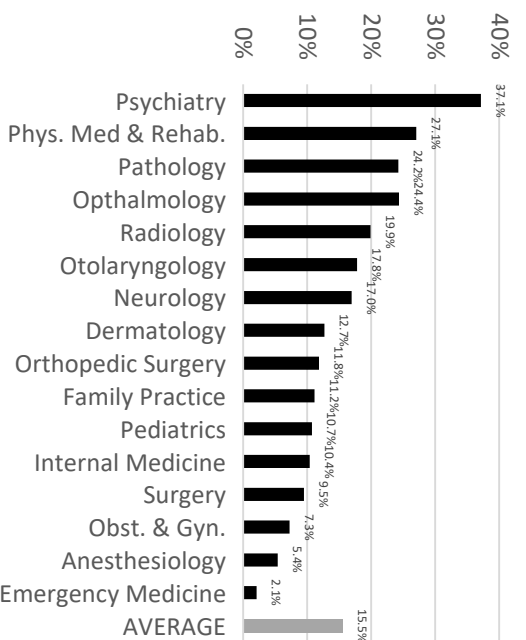
B. Percent of U.S. Medical Schools with Respective Clinical Departments that have NIH-Funded PIs in those Departments



C. Percent of Full-Time Faculty Members that have MD-PhD Degrees



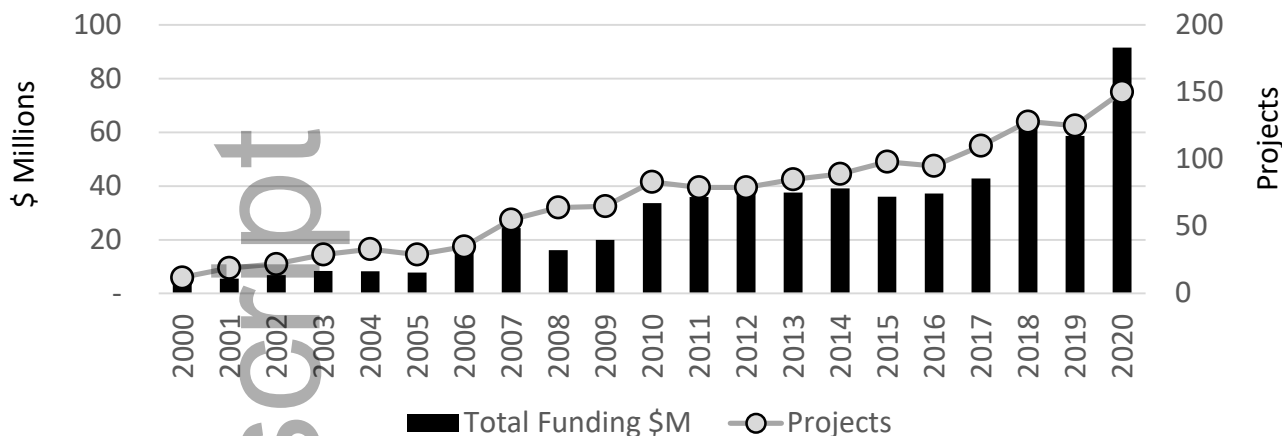
D. Percent of Full-Time Faculty Members that have PhD or other Doctoral Degree (without MD)



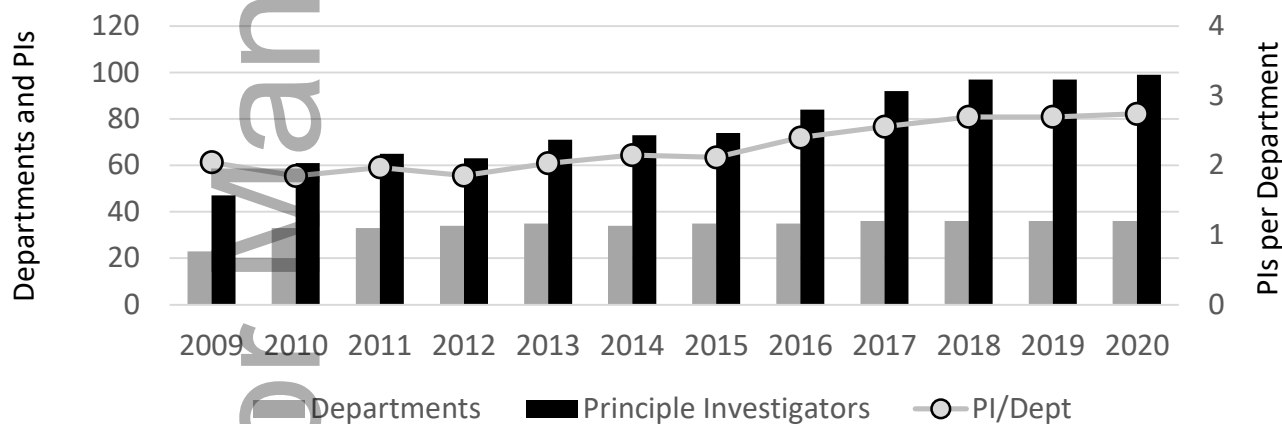
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Figure 2. Annual NIH Funding to Departments of Emergency Medicine

A. NIH Funding to Departments of Emergency Medicine



B. NIH-Funded Emergency Medicine PIs and Emergency Medicine Departments with NIH-Funded PIs



C. Emergency Medicine NIH Career Development and Training Grants

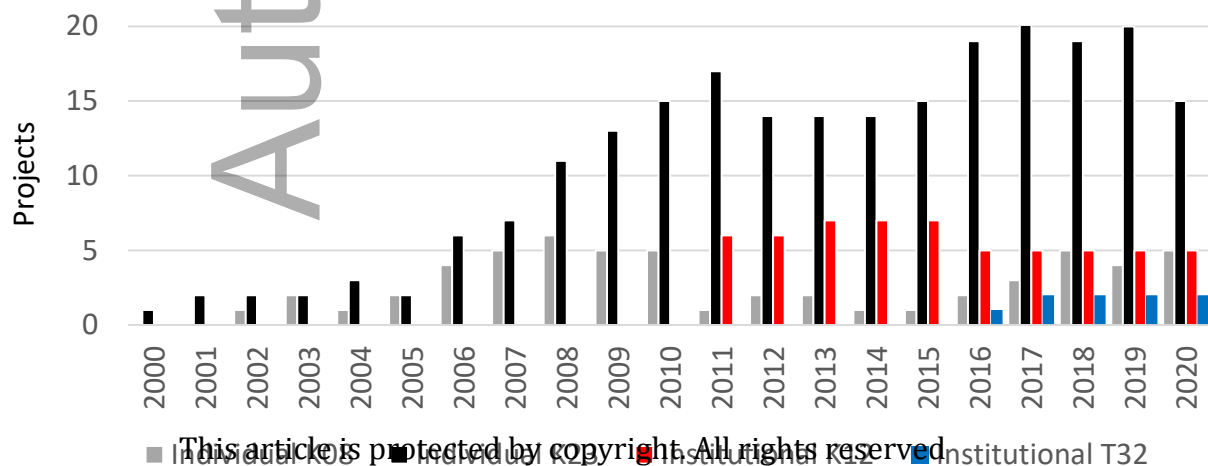


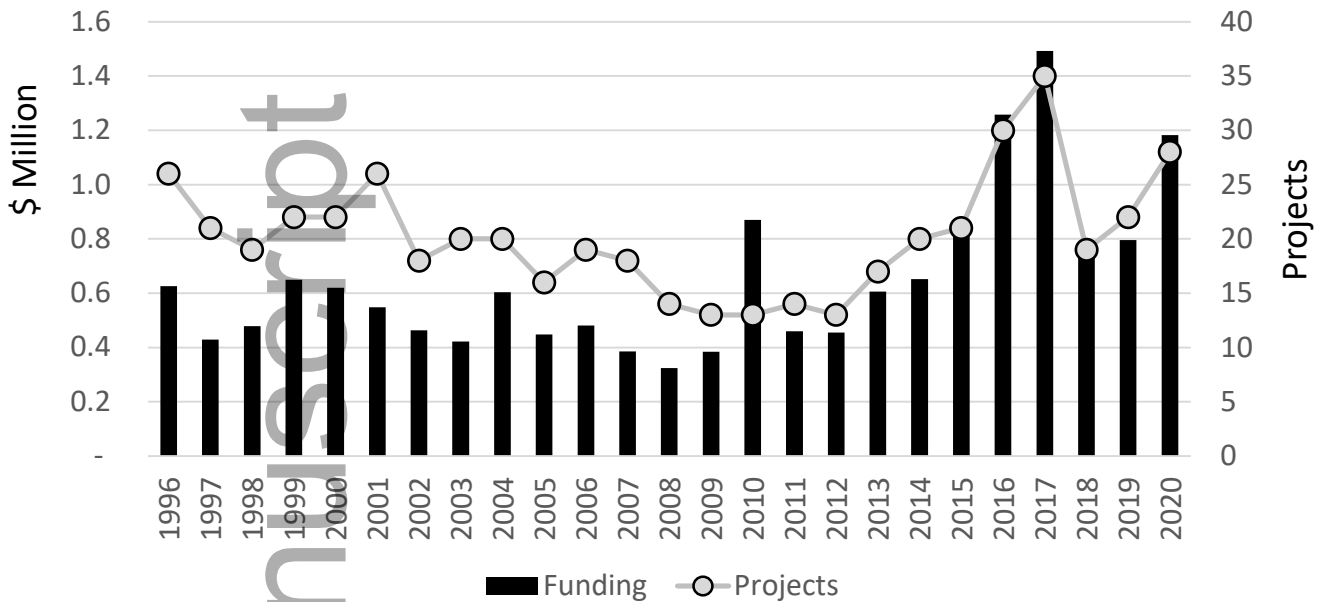
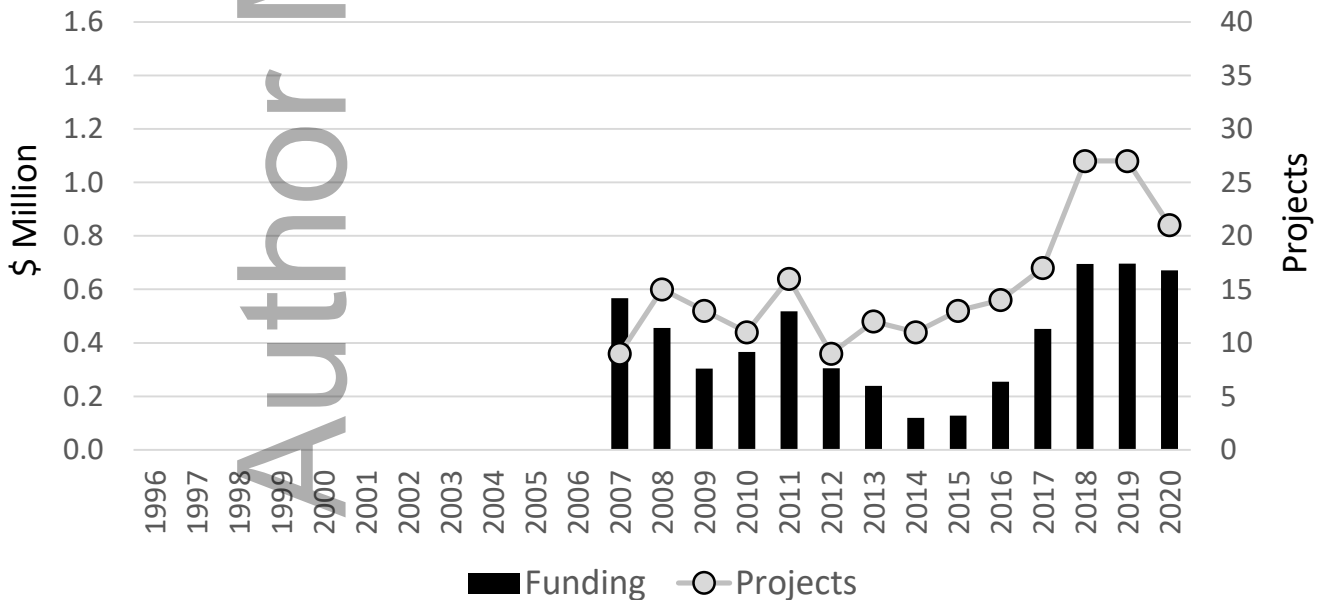
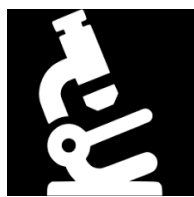
Figure 3. Annual EMF and SAEM Foundation Funding**A. Emergency Medicine Foundation Funding****B. Society for Academic Emergency Medicine Foundation Funding**

Figure 4. 2030 Strategic Goals for Emergency Medicine NIH Funding



200

Active
NIH Projects



\$100 M

Annual
NIH Funding



150

NIH PIs
(25% K)



50

Departments with
NIH-Funded PIs



3%

of EM Medical School
Faculty NIH PIs

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