Emergency Medicine Research Directors and Research Programs: Characteristics and Factors Associated with Productivity

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Abstract

Background: Periodic surveys of research directors (RDs) in emergency medicine (EM) are useful to assess the specialty's development and evolution of the RD role.

Objectives: To assess associations between characteristics and research productivity of RDs and EM programs.

Methods: A survey of EM RDs was developed using the nominal group technique and pilot tested. RDs or surrogate respondents at programs certified by the Accreditation Council for Graduate Medical Education were contacted by e-mail in early 2005. The survey assessed programs' research infrastructure and productivity, as well as RD characteristics, responsibilities, and career satisfaction. Three measures of research productivity were empirically defined: research publications, grant awards, and grant revenue.

Results: Responses were received from 86% of 123 EM programs. Productivity was associated with the presence of nonclinical faculty, dedicated research coordinators, and reduced clinical hours for research faculty. Programs with an RD did not have greater research productivity, using any measure, than those without an RD. The majority of RDs cited pursuing their own studies, obtaining funding, research mentoring, and research administration to be major responsibilities. The majority characterized internal research funding, grant development support, and support from other faculty as inadequate. Most RDs are satisfied with their careers and expect to remain in the position for three or more years.

Conclusions: Research productivity of EM residency programs is associated with the presence of dedicated research faculty and staff and with reduced clinical demands for research faculty. Despite perceiving deficiencies in important resources, most RDs are professionally satisfied.

ACADEMIC EMERGENCY MEDICINE 2006; 13:637–644 © 2006 by the Society for Academic Emergency Medicine

Keywords: emergency medicine research education, medical, graduate internship and residency questionnaires time factors

The research director position is an accepted, and often expected, component of emergency medicine (EM) residency programs. The role was created in response to the relatively junior status of EM as an academic specialty and the associated paucity of experienced research mentors in the field.[1–5] Early in the development of the specialty, leaders recognized the need for key individuals at each EM program to lead research development, train future investigators, and enable the specialty to compete with better-established disciplines for federal grant funding, industry trials, and institutional support.[4,5] Biros and colleagues encapsulated the intent of the research director position as providing research education, mentoring faculty and resident projects, and facilitating departmental scientific inquiry.[1]

In published recommendations, EM leaders have called for critical resources to be made available to academic programs to advance and sustain research productivity, generate high-quality research, and obtain funding.[1–5] Periodic surveys of EM programs and research directors are important to gauge the integration

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Received October 31, 2005; revision received December 29, 2005; accepted January 14, 2006.

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doi: 10.1197/j.aem.2006.01.027
ISSN 1069-6563
PII ISSN 1069-6563583

of these recommendations into the EM infrastructure and to assess the current state of EM research. The most recent formal assessment of EM research directors and research programs was published in 1999 by Blanda and colleagues, based on data collected in 1996.[6] Since that time, there has been significant growth in the number of residency programs and academic departments of EM.[7,8]

We performed a detailed survey of the status of research in EM residency programs and of research directors of these programs. The objectives of our study were to characterize the research infrastructure and financial support of EM programs and to investigate associations between program characteristics and markers of research productivity. We further sought to assess the attributes, responsibilities, perceived performance barriers, and career satisfaction of EM research directors.

METHODS

Study Design and Population

This was a cross-sectional survey of research directors or their surrogates at EM residency programs certified by the Accreditation Council for Graduate Medical Education (ACGME). The study was endorsed by the Board of Directors of the Society for Academic Emergency Medicine (SAEM) and was deemed exempt from informed consent by the institutional review board of Temple University School of Medicine. Potential participants were initially identified by using a database of EM research directors that was provided by SAEM, accessed in December 2004. If the research director position was vacant, the survey was sent to the associate or acting research director. If the program had no research director position, the survey was sent to the chair or chief of EM. If an appropriate participant could not be identified by using the information provided by SAEM, the program was contacted directly by study research staff to obtain the identity and contact information of the most suitable potential respondent.

Survey Content and Administration

The survey instrument was divided into two main sections. The first section sought program characteristics related to research productivity and resources and was intended for completion by the research director or, if the program had no current research director, by the acting research director, by the chair or chief of EM, or by an appropriate designee of the chair or chief. The second section of the survey was related to research directors' demographics, responsibilities, and career satisfaction and was intended only for completion by the research director. Respondents who were not research directors were asked to complete only the first section of the survey.

In December 2004, potential respondents were sent an e-mail message soliciting their participation in the survey. The message contained a cover letter citing the purpose of the study, the group performing the study, a notice of endorsement by the SAEM Board of Directors, a voluntary participation statement, and assurances of anonymity and confidentiality. The survey instrument was attached to the e-mail message. Instructions for opting out of the survey were provided.

Nonresponders received an e-mail reminder two weeks after the initial message was delivered. The program associated with each nonresponder was contacted to confirm the identity and e-mail address of the research director or other appropriate respondent. Confirmed potential respondents received another survey by e-mail and a telephone call from an investigator in February 2005.

Completed surveys were returned by e-mail directly to SAEM and forwarded to the coordinating site (Temple University School of Medicine). Responses were tracked by an initial question asking the participant to identify his or her institution; this information was removed from the data collection instrument upon receipt. All further data processing used deidentified survey responses.

The study survey was developed by using the nominal group technique. A task force of the SAEM Research Directors' Interest Group collaborated to develop the questionnaire. Through an examination of prior surveys of EM research directors[6] and research status in other specialties, a pool of items was generated to assess program characteristics, available research resources, level of research activity, research revenue, and perceived barriers to productivity. The working group then generated sample test questions and assessed them with respect to face content and construct validity. All items were in the form of closed-end questions. The instrument was pilot-tested by administration to six senior EM faculty who were not research directors. On the basis of comments received from this test group, survey questions were further modified to address any ambiguities. The final version of this instrument may be found in the Data Supplement (available online at http://www.aemj.org/cgi/content/full/j.aem.2006.01.027/DC1).

The primary outcomes were descriptive summaries of research productivity, resources, grant funding, and program director characteristics at the surveyed sites. The survey task force empirically selected three parameters as representative indicators of research program productivity: 1) the number of unique peer-reviewed research publications on which faculty were cited as authors during the preceding academic year (2004–2005); 2) gross revenue from investigator-initiated grants during the preceding academic year; and 3) the number of grants awarded during the preceding three academic years (2002–2005), excluding private industry and intramural grants.

Data Analysis

Deidentified data were entered into a database by research coordinators, with double entry to ensure data integrity. Data were analyzed by using SPSS version 12.0 (SPSS Inc., Chicago, IL). Descriptive statistics were generated regarding the characteristics of programs and of research directors, research support, and research activity. These results are reported as medians with interquartile ranges (IQR). Dollar values are reported in thousands (abbreviated as "K").

The Spearman rank-ordered correlation test was used to assess the association between each of the three productivity parameters. The Wilcoxon-Mann-Whitney U test with Bonferroni post hoc correction was used to assess associations between productivity parameters and

dichotomous program characteristics. For analyses in which program characteristics were categorical, analysis of variance (ANOVA) and post hoc Tukey honestly significant difference (HSD) test were performed with rank-ordered productivity measures. All statistical analyses were two tailed and considered significant at $p < 0.002$ because of correction for multiple comparisons. Because this was not designed to be a hypothesis-testing study, multivariate analyses were not performed.

RESULTS

One hundred six individuals responded to the survey, representing 86% of 123 ACGME-accredited EM residency programs. Ninety-five respondents (90%) identified themselves as their program's research director or acting research director; 9 (8%), as the chair or chief of EM; and 2 (2%), as residency directors responding as the designee of the chair or chief. Sixty-four respondents (60%) described their program as the primary teaching site of a medical school and 36 (34%), as a secondary medical-school teaching site; 6 (6%), claimed no medical school affiliation.

Ninety-seven respondents (92%) reported that their program had a formal research director position, and 33 (31%) had a formal assistant or associate research director position. There was no association between the presence of a research director position and the programs' research productivity as indicated by the number of publications, total grant awards, or number of grants received.

Respondents reported a median of 14 core faculty (IQR: 10 to 21) per program, with a median of 6 faculty (IQR: 4 to 8) actively involved in research. Eighty-three programs (78%) reduced clinical hours for faculty involved in research. Thirty programs (28%) used specific financial or productivity criteria to determine the extent of clinical hour reduction (known as *buy-down criteria*), 22 respondents (21%) stated that the chair or chief adjusted clinical hours without a specific buy-down formula, and 24 programs (23%) offered faculty active in research a fixed number of reduced clinical hours with or without additional buy-down criteria. Seven programs (7%) used some combination of these options, and 22 programs (21%) reported no reduction in clinical hours for faculty active in research.

Programs with reduced clinical hours for faculty active in research reported receiving more research grants and more revenue from investigator-initiated research than other programs (median grants, four [IQR: 2 to 8] vs. one [IQR: 0 to 3], $p = 0.002$; median income, $200K [IQR: $5K to $1,152K] vs. $0 [IQR: $0 to $66K], $p = 0.001$). No differences were seen in the number of publications between programs with and without clinical-hours reduction for research faculty. Programs with specific buy-down criteria for clinical-hours reduction trended toward greater productivity measures than other programs, but these differences did not prove to be significant when analyses were corrected for multiple comparisons.

Nonclinical faculty devoted primarily to research were present at 36 programs (34%), with a median of one (IQR: 1 to 2) nonclinical faculty member per program. The highest level of education of nonclinical faculty was a PhD ($n = 41$; 53%), Master's in Public Health (MPH) ($n = 8$; 10%), other Master's degree ($n = 11$; 14%), Bachelor's degree ($n = 6$; 8%), MD ($n = 3$; 4%), or other degree ($n = 8$; 10%). Programs with nonclinical research faculty reported receiving more grants than did other programs (median, 4.5 [IQR: 3 to 11] vs. 2 [IQR: 0 to 4], $p < 0.001$). Programs with nonclinical research faculty also reported receiving greater research income than did other programs (median, $400K [IQR: $48K to $985K] vs. $10K [IQR: $0 to $145K], $p < 0.001$). Although there was a trend toward more publications among programs with nonclinical research faculty, this difference did not reach statistical significance when corrected for multiple comparisons ($p = 0.006$).

Programs were divided in their approach to resident participation in research. Thirty-one programs (29%) required that all residents participate in research to fulfill their scholarly project. Thirty-eight programs (36%) preferred resident participation in research but regarded other scholarly activities as acceptable, and 37 programs (35%) indicated that research-related and non–research-related projects were equally acceptable methods of fulfilling the scholarly requirement. The programs' approach to resident research requirements was unassociated with measures of productivity.

Research Grants and Publications

Table 1 shows the number and type of grants awarded to faculty as principal investigators during the three years before the survey date. Seventy-eight programs (74%) reported receiving funding for investigator-initiated studies awarded by federal and other governmental agencies and by nonprofit organizations. Among all responding programs, the median gross revenue for investigator-initiated research during the 2003–2004 academic year (AY2004) was $58K (IQR: $0 to $388K). A median of three (IQR: 2 to 5) unique faculty members had received funding during the preceding three-year period. Among the only programs receiving investigator-initiated grants, the median number of awards received during the prior three-year period was four (IQR: 2 to 6), and the median gross revenue during AY2004 was $119,500 (IQR: $10K to $502,250). Programs characterized as primary medical school teaching sites received more revenue from investigator-initiated trials than those that were secondary sites or unaffiliated with a medical school (median revenue, $200K [IQR: $10K to $706K] vs. $0 [IQR: $0 to $69K], $p < 0.001$). Although primary medical school teaching sites also had greater numbers of grants and publications

Table 1
Research Grants within the Past Three Years among Programs Receiving Investigator-initiated Funding

Funding Origin	Grants Awarded
Federal funding agencies	1 (0 to 3)
National nonprofit organizations	1 (0 to 2)
Other governmental agencies	0 (0 to 1)
Other nonprofit organizations	0 (0 to 2)
Intramural grants	2 (0 to 2)
Private industry	1 (1 to 3)

Funding awards originating during the academic years 2001 to 2004, among programs reporting receipt of external funding during that period. Data reported are median (interquartile range).

than did nonprimary sites, these differences did not prove significant when analyses were corrected for multiple comparisons.

Eighty respondents (76%) reported that their programs participate in industry-initiated studies, such as pharmaceutical or medical device studies developed by the product manufacturer. Among programs participating in industry-initiated studies, the median number of such trials active at the time of the survey was two (IQR: 1 to 3), and the median gross revenue from these studies during AY2004 was $20K (IQR: $0 to $85K). Among the 65 programs in which at least one industry-initiated trial was active at the time of the survey, the median gross revenue from such studies during AY2004 was $20K (IQR: $5K to $100K).

Respondents reported a median of five (IQR: 3 to 8) faculty members per program who were named as authors of an original research article appearing in a peer-reviewed journal during AY2004. A median of 10 (IQR: 5 to 17) peer-reviewed original research articles per program were published in that year. A median of five original research articles (IQR: 3 to 9) appeared in EM specialty journals, two (IQR: 1 to 6) in non-EM specialty journals, and one (IQR: 0 to 3) in a general readership peer-reviewed medical journal.

Internal Research Support

Eighty-four respondents (79%) reported that intramural funds from any source are available to EM faculty at their program for research support, exclusive of salary support or overhead expenses. Sources of funding are listed in Table 2. The availability of intramural research funds was not associated with the number of grants received by the program, total grant awards, or the number of faculty research publications.

Research coordinators were available to faculty at 83 responding programs (78%). Table 3 lists the number and funding sources of research coordinators at responding sites. Among programs with research coordinators, 66 respondents (80%) stated that the coordinators were available for assistance with unfunded studies as well as funded projects. The highest academic degree obtained by the research coordinators was a nursing degree (n = 44; 53%), Bachelor's degree (n = 22; 27%), Master's degree or PhD (n = 19; 23%), or MD (n = 10; 12%). Thirty-two programs (30%) report having secretarial support dedicated to research.

Availability of research coordinators was highly associated with program research productivity (analysis of variance results: research revenue, p = 0.002; number of publications, p < 0.001). Follow-up analyses reveal that programs employing one or more full-time research coordinators had more research revenue (median revenue, $140K [IQR: $10K to $656K]) than did programs using only pooled institutional study coordinators (median revenue, $5K [IQR: $0 to $62K], p = 0.023) and programs with no available study coordinators (median revenue, $0K [IQR: $0 to $180K], p = 0.008). Number of original research publications also was greater when programs employed a full-time research coordinator (median publications, 13 [IQR: 8 to 23]) than when only pooled institutional study coordinators were available (median publications, three [IQR: 1 to 9], p = 0.009) or when no research coordinators were available (median publications, seven [IQR: 1 to 10], p = 0.001). Although programs with full-time research coordinators also had greater numbers of grants than did sites with either pooled or no available coordinators, these differences were not significant when correcting for multiple comparisons.

Table 2
Internal Research Support at EM Residency Programs

Funding Source	n (%)
Departmental or divisional funds	68 (64)
Affiliated university or medical school	27 (27)
Hospital	25 (24)
Intramural funds available from any source	84 (79)

Respondents reporting that intramural funds supporting research, exclusive of salary support, are available at their program. Programs may have cited more than one source of funding; numbers add up to more than 100%.

Table 3
Research Coordinator Availability and Funding

Parameter	n (%)
Research coordinators available at EM residency programs	
Any research coordinator available	83 (78)
One or more FTE employed by program	59 (56)
Less than one FTE employed by program	14 (13)
Available through institutional pool only	10 (9)
Funding sources of EM research coordinators	
External grants	56 (68)
Departmental or divisional funds	49 (59)
Medical school or hospital funds	18 (22)

Numbers of research coordinators employed by responding EM residency programs as well as sources of financial support cited by the 83 EM residency programs employing research coordinators. Respondents could designate more than one funding source.
FTE = full-time equivalent.

Research Director Characteristics

Ninety-eight individuals (92% of respondents) completed the second part of the survey, intended only for current research directors. Responding research directors were predominantly male (n = 81; 83%) and had practiced EM after residency for a median of 11 years (IQR: 6 to 16). Professional degrees held by respondents were an MD (n = 79; 81%), DO (n = 4; 4%), PhD (n = 15; 15%), MPH (n = 16; 16%), or other Master's degrees (n = 5; 5%). Forty-one respondents (42%) reported holding two or more advanced degrees.

Respondents reported holding the title of research director for a median of four years (IQR: 2 to 8). Twenty-five current research directors (26%) had served previously as an associate or assistant research director, for a median duration of three years (IQR: 2 to 6) before attaining their present position. Twenty research directors (20%) had completed a formal EM research fellowship, and 32 (42%) of those not completing a fellowship or professional-degree program had obtained another type of formal training in research methodology, such as a certificate course or intensive program offered by a professional society. There was no association

between any measure of research productivity and completion of a research fellowship or other formal research-training course.

Sixty-nine respondents (65%) stated that they had assumed the role of research director from another individual at their program. The current status of the former research director was a department chair or division chief (11 [11%]), an EM faculty member active in research (22 [22%]), an EM faculty member not active in research (4 [4%]), practicing EM but not at an academic center (9 [9%]), employed by private industry (4 [4%]), working nonclinically in administration (2 [2%]), retired (1 [1%]), or other (7 [7%]).

The survey presented a list of 14 academic and administrative activities identified as common responsibilities of research directors. Respondents were asked to indicate whether they perceived each activity to be a major responsibility, a minor responsibility, or not a responsibility of their job. They also were asked to estimate the number of hours each week devoted to each activity. The responses to these survey items are presented in Table 4.

Research directors worked a median of 20 clinical hours per week (IQR: 14 to 24). Thirty-nine research directors (40%) were members of an institutional review board. Twenty-five (26%) reported that a portion of their salary (including bonuses) varied according to the number of publications or grants produced, whereas 17 (17%) stated that a portion of their salary varied according to the amount of research revenue generated.

Career Satisfaction

Thirty-five research directors (36%) anticipated remaining in their position for greater than six years, 43 (44%) stated that they expected to remain in their position for an additional three to six years, and 18 (18%) anticipated remaining in their position as research director for fewer than three years. Fifty-six respondents (57%) agreed or strongly agreed with the statement that they were satisfied with their career as a research director, whereas 18 (18%) disagreed or strongly disagreed with the statement. Seventy-five research directors (76%) agreed or strongly agreed with the statement that they are satisfied with their career as an emergency physician. Increased satisfaction with a career as a research director was associated with the individual's perception that he or she has adequate resources to be effective ($p < 0.001$).

Research Support and Resource Adequacy

Research directors were presented with a number of questions related to research support for faculty at their program and were asked to indicate whether they believed the available support was adequate or inadequate. Responses are presented in Table 5. In response to a global question of whether they had the resources needed to be an effective research director, 38 (39%) agreed or strongly agreed that they have needed resources, 27 (28%) were neutral, and 32 (33%) disagreed or strongly disagreed that they have needed resources.

We investigated associations between measures of program productivity and the resources cited as being inadequate by more than half of research directors. Programs in which the research director perceived institutional research funds to be adequate had significantly more grant revenue than those in which institutional research funding was deemed inadequate (median revenue, \$250K [IQR: \$15K to \$900K] vs. \$6K [IQR: \$0 to \$150K]; $p < 0.001$). Programs in which institutional grant development support was considered adequate also had significantly more grant revenue than did other programs (median revenue, \$250K [IQR: \$50K to \$800K] vs. \$10K [IQR: \$0 to \$155K]; $p < 0.001$). Programs reported to have adequate support from other faculty had significantly more publications than other programs (median articles, 12 [IQR: 8 to 27] vs. 7.5 [IQR: 2.25 to 12.5]; $p = 0.001$). There were no significant differences in other measures of productivity. There was no association between any measure of productivity and the research

Table 4
Research Directors' Assessment of Their Responsibility for Specific Nonclinical Tasks

Task	Major Responsibility	Minor Responsibility	No Responsibility	Hours per Week
Developing and conducting own research	81 (83)	14 (14)	1 (1)	10 (5 to 19)
Obtaining research funding	59 (60)	31 (32)	6 (6)	3 (1 to 5)
Helping other faculty perform research	64 (65)	30 (31)	3 (3)	3 (1 to 5)
Helping other faculty obtain funding	29 (30)	42 (43)	26 (27)	1 (1 to 2)
Career mentoring for junior faculty	38 (39)	43 (44)	14 (14)	1 (1 to 2)
Helping residents perform research	58 (59)	32 (33)	6 (6)	2 (1 to 4)
Career mentoring for residents	24 (25)	56 (57)	16 (16)	1 (0 to 1)
Teaching research principles to residents	53 (54)	33 (34)	6 (6)	1 (1 to 2)
Teaching research principles to students	14 (14)	43 (44)	36 (37)	1 (0 to 1)
Leading journal club	26 (27)	32 (33)	36 (37)	1 (0 to 1)
Teaching evidence-based medicine	29 (30)	29 (30)	37 (38)	1 (0 to 2)
Participation in institutional review board	27 (28)	21 (21)	45 (46)	1 (1 to 2)
Research administration*	67 (68)	20 (20)	7 (7)	2 (1 to 4)
Nonresearch administration†	19 (19)	43 (44)	31 (32)	1 (1 to 2)
Other	5 (5)	3 (3)	8 (8)	1 (0 to 5)

Data represent the number (%) of respondents stating that they have major, minor, or no responsibility for the task listed, and the median (interquartile range) hours weekly devoted to each task.
* Research administration includes, for example, oversight of program research activities, research committees, protocol review, and financial record administration.
† Nonresearch administration includes, for example, clinical operations and hospital or medical school committees.

Table 5
Research Directors' Perception of Resource Adequacy

Resource	Adequate	Inadequate	Not Applicable
Departmental research funds	42 (43)	48 (49)	7 (7)
Institutional (school or hospital) research funds	35 (36)	56 (57)	5 (5)
Secretarial support	36 (37)	57 (58)	4 (4)
Research study coordinator support	47 (48)	44 (45)	6 (6)
Protected time for yourself	59 (60)	36 (37)	2 (2)
Protected time for other faculty	45 (46)	49 (50)	3 (3)
Office space for yourself	72 (74)	24 (25)	0
Office space for other faculty	64 (65)	33 (34)	0
Office space for research staff	57 (58)	34 (35)	6 (6)
Institutional grant development support	36 (37)	56 (57)	4 (4)
Departmental grant development support	35 (36)	57 (58)	5 (5)
Statistical consultation within institution	54 (55)	41 (42)	2 (2)
Research motivation of faculty by chair or chief	62 (63)	33 (34)	0
Research expertise of chair or chief	56 (57)	35 (36)	5 (5)
Support from other faculty for research	40 (41)	53 (54)	2 (2)
Your own research training	68 (69)	28 (29)	1 (1)

Data represent the number (%) of research directors stating that each resource available at their institution is adequate, inadequate, or not applicable.

motivation by the program chair or chief or other resources cited as inadequate by a majority of research directors, including secretarial support and protected time for other faculty.

DISCUSSION

The evolution of the research director's role and the development of EM research programs are difficult to assess, largely because of the limited body of literature that has not been systematically updated. Blanda and colleagues published the most recent formal survey of research directors in 1999, using data collected in 1996 and surveying activities occurring as early as 1993.[6] Any assessment of the current role of research directors and research infrastructure in EM clearly requires more recent comprehensive data.

The authors of the previous survey concluded that a significant percentage of EM research directors had inadequate experience and training for their position. Career satisfaction was generally poor, and the great majority of research directors anticipated relinquishing the position within five years.[6] In both the 1996 survey and the current study, women are underrepresented among research directors, accounting for less than 20% of the group. In other important aspects, however, the current survey presents a more optimistic impression of the experience, training, and professional satisfaction of research directors. The majority of current research directors report being satisfied with their role and plan to remain at their position for at least another three to six years. More than half of research directors received formal research training, and about one quarter served as an associate or assistant research director. The number of nonclinician research directors has risen from a scant 9% in 1996 to 34% currently. It is plausible that the enhanced job satisfaction currently seen among research directors is related to better suitability and career dedication to the role. We also note a strong association between research directors' professional satisfaction and their perception of having adequate research resources.

The role of research directors appears largely faithful to the original intent of research mentorship and education.[1] The majority of research directors report their main responsibilities to be research education and assisting faculty and residents with research execution and funding. Pursuit of personal research goals is likely to add to a research director's professional satisfaction, and it is reassuring that most research directors report that their single greatest responsibility is conducting their own research, accounting for more hours of time than any other nonclinical task. It probably is inevitable that the administrative oversight of departmental research also is reported by most research directors to be a major responsibility. The majority of research directors surveyed believed they had adequate protected time, and directors worked a median of 20 clinical hours weekly.

Support from the chair has been identified as a critical factor in the development of a program's research infrastructure, as well as in ongoing research productivity in established departments.[9–11] The chair allocates limited resources (including funds and protected time), creates a local environment conducive to scientific inquiry, recruits suitable faculty, and negotiates with the institution on behalf of the department.[1] The majority of research directors in our survey characterized the research support and expertise of their chair or chief as adequate. Surprisingly, we failed to find an association between any measure of research productivity and perceived support from the chair or chief. This may be a result of the fact that we assessed supportiveness by asking research directors a single global question, which likely evoked subjective responses. We did not ask specific questions that probed attributes that might have provided a more objective assessment of the chairs' support for research activities.

Funding is of paramount concern to research directors, who often are mandated to generate grants for themselves and other faculty and, in one quarter of cases, have their compensation tied to research revenue or grant awards. The majority of research directors characterized their internal research funding and institutional grant development support as inadequate. This is consistent with

earlier surveys of EM researchers.[10] Our study further demonstrates that programs reporting inadequate internal funding or grant development support received significantly less grant revenue than other programs. It has been shown in other specialties that internal seed funding is strongly associated with receipt of external grants.[11] However, this association does not necessarily imply a causative link between internal funding and grant receipt.

Other resources cited as being inadequate by the majority of research directors were protected time for other faculty, research support from other faculty, and secretarial support for research. Although programs reporting inadequate faculty support did have fewer publications than other programs, we were unable to detect associations between other measures of productivity and the presence or absence of these resources. It is possible that faculty at many programs have compensated for resource deficiencies and that the deficiencies therefore are not reflected in objective differences in productivity outcome measures. It also is possible that there is a distinction between research directors' perceived needs and actual resource deficiency. Again, we did not attempt to elicit objective information regarding resource adequacy but simply asked research directors to provide their global impression. Our study methodology does not allow us to distinguish between perceived and actual deficiencies in resources or support. Previously published studies in other specialties have demonstrated an association between research productivity and environmental factors such as the presence of full-time research support personnel, sufficient clerical, computer, and laboratory (clinical or basic science) resources, and adequate protected time.[12,13]

The need for a research director has been called into question. It has been argued that as EM further matures and more faculty develop research expertise, it will become unnecessary to dedicate one faculty member to mentoring, teaching, and overseeing research.[1] The research director role would, in effect, undergo apoptosis as the specialty develops. We detected no association between the presence of a research director and any measure of departmental research productivity. It is important to note, however, that only 8% of responding programs lacked a research director position, and therefore comparisons between programs with and without research directors may not be valid.

Our study demonstrates that research productivity is strongly associated with the presence of nonclinician personnel dedicated to supporting program research. Greater productivity was noted among programs with nonclinical research faculty, most commonly individuals with a PhD, MPH, or other advanced degree. This is consistent with studies in other specialties, which concluded that nonclinical research faculty should be integrated into clinical departments.[13,14] Clearly, nonclinical faculty have the benefit of devoting a greater proportion of their time to research activities without being distracted by clinical obligations and without the need to accommodate the shift-work inherent to EM. What is not clear from our study, however, is whether nonclinical faculty benefit departments primarily by assisting other faculty with their efforts or by pursuing their own research interests.

Program productivity was strongly associated with having research coordinators dedicated to the EM program but not with having research coordinators who were available through an institutional pool. Programs with dedicated research coordinators produce more peer-reviewed research publications and trended toward receiving greater numbers of competitive grants than other programs. Although utilizing institutional research coordinators has been advocated as a mechanism to advance research at new or underfunded programs and may facilitate the execution of industry-support trials, this strategy does not appear to be useful in enhancing original research publications or obtaining competitive grants. Because departments with greater productivity for any reason may have more funding available to hire support staff, the association between the presence of dedicated research coordinators and research productivity does not necessarily demonstrate a causative relationship.

Not surprisingly, research funding and grant awards are greater among programs that reduce clinical demands of faculty active in research. Although 20% of programs surveyed reported that they did not reduce clinical hours for research faculty, our study suggests that this strategy is unlikely to be successful. Studies in other specialties also have detected associations between protected time for research and productivity.[9,11,14,15] Adequate time must be budgeted for performance of the concrete and easily defined research activities such as grant development, data collection, and manuscript preparation, as well as for creative thinking, perusal of the literature, interaction with fellow researchers, and pursuit of new hypotheses. Again, the finding of an association between these factors does not prove that they are causatively related.

Programs were mixed in their approach to the resident scholarly requirement. Approximately equal proportions of programs required a research project, encouraged a research activity, or expressed no preference whether research or other activities were used to satisfy the requirement. It has been argued that the purpose of the scholarly requirement is to expose residents to scientific inquiry, systematic problem solving, and research mechanics.[16] We found no association between the approach to the scholarly requirement and departmental research productivity.

LIMITATIONS

Reliance on self-report is a significant limitation of this investigation but was essential to assure the anonymity of the respondents. It is not possible for us to determine the reliability of participants' responses. We cannot exclude the possibility of recall bias. Respondents may not have been able to account for all publications and grants emanating from their program's faculty; conversely, respondents may have inflated their program's productivity. Although careful definitions were provided for publication types and funding sources, it is possible that respondents incorrectly characterized articles and grants.

Our outcome measures (e.g., publications and research grants as well as research revenue) were chosen empirically, as there is no universal standard for assessing research productivity. The validity of these outcome measures has

not been tested. Further, significant associations were found among these measures of research productivity. The number of grants awarded was significantly associated with grant revenue ($r = 0.74$, $p < 0.001$) and the number of research publications ($r = 0.63$, $p < 0.001$). Similarly, research revenue was associated significantly with the number of research publications ($r = 0.56$, $p < 0.001$). These associations may reflect confounding of our outcome parameters, which may have artificially given the appearance of statistically significant associations between program characteristics and multiple indicators of research productivity. Identifying and validating independent measures of research productivity would be an important focus for future research.

Although survey response rate ultimately was very high, the initial response rate was only 35%. About one third of potential subjects who were initially identified by using the SAEM database were not the correct respondents. We did not attempt to compare characteristics of nonresponders with those of responders. Data collection was performed during a 5-month period, which may have resulted in responses reflecting slightly different time frames.

We surveyed EM residency programs accredited by the ACGME, which certifies post-MD residency-training programs within the United States.[17] This study was conducted with the endorsement and assistance of SAEM, which includes in its directory only ACGME-accredited programs. The American College of Osteopathic Emergency Physicians accredits additional EM residency-training programs in the United States. To ensure consistency in the criteria for survey eligibility and in the source of contact information, we did not include osteopathic programs in this survey. Canadian EM residency programs were excluded from this survey for similar reasons.

CONCLUSIONS

Research productivity among EM residency programs is strongly associated with the presence of dedicated research staff, including nonclinical faculty and research coordinators, as well as clinical-hours reduction for faculty engaged in research. Although the vast majority of EM programs have a research director, there is no evidence that having this faculty position enhances the department's research productivity. Research directors generally are satisfied with their role and invest most of their nonclinical time in research-related activities. Further periodic surveys of EM research programs and research directors are necessary to gauge the maturation of the specialty and further assess the utility of the research director role.

The authors are indebted to the staff of the Society for Academic Emergency Medicine for assistance with study logistics, communications, and data collection, and to the SAEM Board of Directors for its support and valuable feedback. The authors are grateful to Kathleen Hatala, BSN, and Carol von Hofen, BSN, for study execution and data management. The authors acknowledge the contribution of Prem Shukla, MD, to the study design.

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