Occupational Medicine Residency Graduate Survey: Assessment of Training Programs and Core Competencies

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Objective: *This study provides insight into Occupational Medicine (OM) residency graduates and how residency programs are meeting their education goals.* ***Methods:*** *A survey of graduates from nine OM residency program was performed to evaluate the effectiveness of OM residency training in the United States and Canada.* ***Results:*** *Eighty percent of the OM residency graduates were currently practicing OM. Three-quarters worked in clinical practice for a mean of 20 hr/wk. Other activities varied and included management, teaching and consulting. Ninety-five percent were satisfied with their OM residency training. The competencies acquired were mostly ranked highly as practice requisites, although preparation in clinical OM might be better emphasized in training. Recent OM residency graduates were more likely to be board-certified in OM than other American College of Occupational and Environmental Medicine physician members (73% vs 41%).* ***Conclusions:*** *OM residency graduates over the past 10 years were highly satisfied with OM residency training, with the training generally meeting practice needs.* (J Occup Environ Med. *2007;49:1325–1338*)

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DOI: 10.1097/JOM.0b013e318159b48f

The practice of occupational medicine (OM) has changed dramatically during the past three decades in response to broader trends in both health care and employment.[1–7] OM physicians are increasingly asked to optimize all aspects of workers' health, including health promotion and chronic disease management,[8,9] as well as addressing environmental medicine issues. Factors which continue to reshape OM practice in the United States include changes in health care financing, a shift from manufacturing to service-based economy in developed countries, downsizing of traditional corporate medical departments with concomitant shifts to hospital-based or multispecialty practice, and the declining influence of organized labor.[1–7]

The global importance of workplace health and safety has been stressed by the World Health Organization[10]: more than half of the world's population works, and there is growing recognition of the links between working conditions, health, and productivity. Globalization has transformed the workplace, resulting in new employment patterns arising from the growth of manufacturing economies in developing countries, advancing technology, and improved communication tools.[6,10]

The adequacy and relevance of OM residency training must be assessed in light of these changes in health care delivery and OM job opportunities. OM residencies in the United States traditionally consist of 1 year of training in public health, leading to a Master of Public Health (MPH) degree, and at least 1 year of practicum training. OM residents are also required to complete an internship year that is sometimes available within the OM residency program. Many OM residents have additional training in different fields and may be board-certified in other specialties.

OM practice has traditionally required expertise in clinical medicine, toxicology, industrial hygiene, ergonomics, epidemiology, and administration,[11] and "lies at the interface between work and health."[12] The OM specialist must deal with a wide variety of issues, including social, economic, and administrative needs of workers and the work community; promotion of a productive and fulfilling interaction of the worker with his work; and the appraisal, maintenance, restoration, and improvement of the health of workers. OM physicians need to integrate individual clinical treatment and prevention with population-based approaches. McDonald et al[8] assessed the requirements for OM training in Europe, and suggested that OM residency training has lagged behind the evolving definition of occupational health. The current residency training may need to be modified.

Within the past 10 years, the Accreditation Council for Graduate Medical Education (ACGME) has developed competencies for postgraduate medical training based on the traditional paradigm of individually focused clinical practice.[13,14] These include general and core knowledge-specific competencies, which encompass the preventive medicine specialties, including OM. However, OM and preventive medicine physician training includes not only traditional medical training focused on individual patient care but also addresses population-based health issues.[6] OM practice combines clinical medicine, administration, public health, environmental health, and safety and other disciplines; therefore, it is not clear that the ACGME competencies address all aspects of OM practice. As the classical model of medical training focuses on acute care intervention, this training may not be adequate to address issues of population-based health.[15]

The American College of Occupational and Environmental Medicine (ACOEM) has developed core competencies for OM, which are somewhat similar to the ACGME competencies.[16] ACGME mentions the need to focus on "assessment of authentic physician performance that takes into consideration the microsystem in which it is nested."[17] This seems particularly important for OM practice, which combines clinical medicine with many other disciplines. Furthermore, an Institute of Medicine report[18] has highlighted the need to assess competency and health care delivery systems in the United States.

As with any educational effort, the validity and importance of those competencies considered essential to OM practice require evaluation and assessment. In a prior study,[1] we examined the value of specific specialty competencies to OM physician members of ACOEM. The present survey addressed the opinions of OM residency program graduates about competencies acquired during their training and the competencies required in their current practice. In addition, the survey inquired about the graduates' level of general satisfaction with their OM residency program and current employment. We also examined whether residency graduates had encountered difficulty obtaining suitable employment, and if so, why. This study provides insight into how OM residency programs are meeting their goals, and the results provide a framework for OM residencies to assess the outcomes of their training programs.

Materials and Methods

We conducted a cross-sectional survey of OM residents who graduated from accredited OM residency programs between 1996 and 2006. The respective Human Subjects' Committees of the University of Minnesota and HealthPartners approved this study. The HealthPartners institutional review board and several of the individual institutions would not permit direct contact with the residency graduates, so the survey was designed to have each institution's current residency director forward mail questionnaires to the prospective participants. The Residency Directors Committee of ACOEM provided prospective review of the questionnaire. In return for their cooperation, we agreed to return de-identified study data back to each participating residency director. Many programs had only a few graduates each year, so for reasons of confidentiality, we did not request personal information such as name, gender, or age from the survey respondents.

Each OM Residency Director within the United States and one in Canada received a letter requesting their participation in the study. Residency Directors were asked to mail the initial study packet and one follow-up letter 4 weeks later to their OM residency graduates from the past 10 years. Nine of 33 OM residency directors agreed to participate in the study.

The residency director of each participating OM residency program was sent a packet for each of their residency graduates over the previous 10 years. Initial study packets contained a cover letter, survey questionnaire, and preaddressed postage-paid return envelope to the Minnesota Center for Survey Research at the University of Minnesota. Participating residency programs were asked to distribute the survey to each graduate of the program in two forms: a survey packet mailed to each graduate and an e-mail version of the survey to each graduate for whom an e-mail address was available. The residency graduates were sent one reminder letter by the residency director approximately 4 weeks after the initial mailing. Study questionnaires were returned to the MN Center for Survey Research at the University of

Minnesota, where they were coded by study number and the data were entered into an electronic file.

The questionnaire addressed graduates' satisfaction with their OM residency training and asked them to identify areas for programmatic improvements. The graduates' overall satisfaction with OM residency training and any problems they encountered during their OM residency were assessed. Graduates' training in OM core competencies, and the value of these core competencies for their current job, was also assessed. The core competencies assessed in this survey included the ACGME 6 general competencies, the preventive medicine academic competencies, and the OM knowledge content core competencies listed by the Residency Review Committee for Preventive Medicine on the ACGME Web site. We also asked residency graduates if they were well prepared to take the Preventive Medicine and the OM sections of the American Board of Preventive Medicine (ABPM) certification examination. Ordinal rankings were requested for most items on a scale of 1 to 5 for satisfaction or importance (1 = not at all satisfied/important, 5 = extremely satisfied/important). Graduates provided information about their current job or employment status and how many hours per week they spent performing specific job duties. Graduates were also asked whether they had any difficulty finding a job (yes or no). If they reported difficulty finding a job, they were asked to identify possible barriers they encountered during their job search from a checklist. Lastly, information on having taken and passed OM board examinations was requested.

The results for each question were summarized with descriptive statistics including frequencies of each response and means. Resident satisfaction with training in specific competencies was compared with how important they rated each competency in their current job. Specific problem areas or concerns about residency training, job search, or employment opportunities were highlighted and tabulated. For some items differences in mean responses were compared using t tests. An F test was performed to compare the variances of the two groups being compared. If the variances were unequal (F test $P < 0.05$), then the Satterthwaite t test method for unequal variances was used, or otherwise the pooled t test method for equal variances was used. Statistical comparisons of categorical and ordinal responses were assessed with χ^2 tests or Fisher exact test.

The present results were compared with information obtained from ACOEM for 4725 self-identified physicians who were members of that organization October 1, 2005 to September 30, 2006. The second comparison group used survey data collected from 610 members of ACOEM who had MD or equivalent degrees.[1] These were respondents in a random survey of 1500 OM physicians listed in the ACOEM Membership Directory 2006.[1] One hundred six of the OM physician respondents in the prior study had completed an OM residency program within the past 10 years similar to the graduate group surveyed in the present study. This subset (OMPhyRG) was used for direct comparisons with the present survey results. Four hundred ninety-one of the OM physicians in the prior study had not completed a residency within the past 10 year, and this subset was also used as a comparison group (OMPhynotRG).[1] Where corresponding information was available, we compared the results of the present study with data for all ACOEM physicians and for the subset of ACOEM physicians surveyed previously. In the prior survey of ACOEM physicians, many of the questions were identical or very similar. This allowed us to compare the professional characteristics of the respondents as well as their views about the value and usefulness of core competencies.

Results

Demographics

Residency directors distributed 224 surveys, 18 could not be delivered. Ninety residency graduates returned the study questionnaires (44% response rate). Among responders, the mode of survey response was almost equal; 57% completed the mailed survey and 43% completed an on-line electronic survey. Nine of 31 residency programs participated in the study (eight in the United States and one in Canada), and from 1 to 27 residents per program completed the survey.

A greater proportion of the OM residency graduates were certified in OM by the ABPM than was seen in the ACOEM physician member database (73% vs 41%) (Table 1). Fifty-eight percent of graduates in this survey had completed an MPH degree, 2.6% an MBA, and 2.6% a PhD (Table 1). Eighty-three percent had taken OM board certification examinations (Table 1). Those who had not taken the OM board examination cited the following reasons: already certified in another specialty (n = 7 participants); lack of time to study (n = 7); military deployment (n = 3); personal or family issues (n = 2); taking examinations next year (n = 2); cost (n = 1); and had not completed the MPH degree (n = 1) (more than one answer was allowed). Twenty-seven of the survey participants (30%) had completed a military-based OM residency program. Twenty-seven percent of the OM residency graduates had completed their OM residency before 2000, 72% between 2000 and 2005, and one in 2006.

Sixty-two percent of the OM residency graduates were board-certified in other specialties similar to ACOEM database; most frequently in family practice, aerospace medicine, and internal medicine. The OM residency graduates were more likely to be board-certified in aerospace medicine (31% vs 3%) and family practice (34% vs 19%) than the ACOEM membership. Thirteen per-

TABLE 1

Comparisons of Demographics for OM Residency Graduates, ACOEM Physician Members, and Prior Participants in OM Physician Study[a]

	OM Residency Graduates	ACOEM Physician Membership Data Base	ACOEM Physician Participants Who Had Completed OM Residency in Last 10 yr (OMPhyRG)[a]	ACOEM Physician Participants Who Had Not Completed OM Residency in Last 10 yr (OMPhynotRG)[a]
Number	90	4725	106	491
Mean age (yr)	NA	54.5	47.8	56.7
Gender				
Male (%)	NA	82.1	58.5	84.6
Female (%)	NA	17.9	41.5	15.4
Completed other post-graduate degrees (%)[b]	62.9	40.1	63.4	39.9
Post graduate degrees				
MPH (%)	57.7	33.7	55.1	35.1
MBA (%)	2.6	2.1	5.1	3.3
JD (%)	0.0	1.1	0.0	1.0
PhD (%)	2.6	2.1	2.6	0.5
Board-certified in Occupational Medicine (OM) (%)	72.7	41.5	82.1*	55.8**
Took board examinations in OM (%)	83.3	NA	87.7*	58.4**
Board-certified in at least one other specialty (%)[c]	62.5	64.5	56.2*	70.1*
Family practice (%)	34.5	18.8	31.0	31.6
Internal medicine (%)	20.0	17.9	31.0	34.6
Aerospace medicine (%)	30.7	2.6	10.3	6.3
Emergency medicine (%)	5.5	5.8	3.4	11.3
General preventive medicine (%)	0.0	3.8	6.9	5.7
Medical toxicology (%)	0.0	NA	0.0	2.7
Psychiatry (%)	0.0	1.9	3.5	1.8
General surgery (%)	0.0	NA	0.0	1.8
Other (%)	2.8	13.7	13.8	13.1

*$P > 0.05$ for chi-square test comparing results to OM residency graduate data.
**$P < 0.05$ for chi-square test comparing results to OM residency graduate data.
[a]See text and reference 1 for description of groups.
[b]Some physicians had multiple postgraduate degrees.
[c]Some physicians were board-certified in multiple specialties.
NA indicates not available.

cent reported additional certification as Medical Review Officers.

Results from the OM residency graduates were compared with data from the OM Physician Study, which was completed concurrently.[1] Data from the surveyed sample of OM physician members were additionally stratified based on whether or not the OM physicians had graduated from an OM residency program within the past 10 years is presented in Table 1. The recent OM residency graduates (OMPhyRG) in the prior study were younger (mean age 47.8 vs 56.7 years) and had a higher proportion of women respondents (41% vs 15%) than surveyed OM physicians who had not graduated from a residency within the past 10 years (OMPhynotRG).[1] The recent OM residency graduates in our study were also significantly more likely to be board-certified in OM than OM physicians in the prior study who had not graduated from an OM residency within the past 10 years (OMPhynotRG) (73% vs 56%) (χ^2, $P = 0.003$). The OM Residency graduates in our current study were also significantly more likely to have taken the board OM board examination than OM physicians in the prior study who had not completed an OM residency in the past 10 years (OMPhynotRG) ((83% vs 58%; χ^2, $P < 0.0001$).

In the prior study of OM physicians, those who had graduated from an OM residency in the past 10 years (OMPhyRG) were more likely to have completed other post graduate degrees (63% vs 40%) and more likely to have completed an MPH degree (55% vs 35%; Table 1) than those who had graduated from a residency within the past 10 years (OMPhynotRG).[1] The OM residency graduates were significantly more likely to have taken the board OM board examination than OM physicians in the prior study who had not completed an OM residency in the past 10 years (OMPhynotRG) (83% vs 58%; χ^2, $P < 0.0001$). OM Residency graduates within the past 10 years in the current study were as likely as OM residency graduates within the past 10 years in the prior study (OMPhyRG) to be board-certified in OM (73% vs 82%, $P = 0.12$), and to have taken the OM board examination (84% vs 88%, $P = 0.38$).

Confidentiality constraints did not permit us to collect personal identifiers for the OM residency graduates (including name, age, and gender). It was possible, therefore, that some OM residency graduates were also respondents in the OM physician study subset who had graduated from a residency in the past 10 years.[1] However, there were some differences in the demographics of the 90 OM residency graduates and the 106 OM physicians in the prior study who graduated from an OM residency within the past 10 years (OM-PhyRG). As previously noted, 30% of the OM residency graduates in the current study came from a military residency program, so it was not surprising that about 31% of residency graduates were board-certified in aerospace medicine. By contrast, only 10% of the OM physicians in the prior study who had graduated from an OM residency within the past 10 years (OMPhyRG) were board-certified in aerospace medicine, indicating at least some lack of overlap between the two groups. Other differences between the two groups included the proportions having completed an MBA (5.1% for recent residency graduates in prior physician study vs 2.6% for OM residency graduates in current study), who were boarded in internal medicine (31% vs 20%), general preventive medicine (6.9% vs 0%), psychiatry (3.5% vs 0%), or with other board certification (14% vs 2.8%; Table 1).

The OM residency graduates in the current were more likely to be board-certified in aerospace medicine (31% vs 3%) and family practice (34% vs 19%) than the ACOEM membership.

Satisfaction With OM as a Career

The OM residency graduates were asked: "Knowing what you now know, if you had to choose today to select the specialty of OM, what would you do?" They were given five options ranging from "Definitely would not select OM" to "Definitely would select OM." Most (82%) of OM residency graduates would chose OM again as a specialty The group of OM residency graduates were more likely to *definitely* select OM again as a specialty than respondents in the prior physician study who had not graduated from a residency in the past 10 years (OM-PhyRG) (48% vs 33%).[1] Overall, 82% of the OM residency graduates reported that they would *probably* or *definitely* select OM, which was similar to 80% of the OM physicians in the prior study who had not graduated from a OM residency within the past 10 years (OMPhyRG) who reported they would *probably* or *definitely* select OM as a specialty (χ^2 $P = 0.84$).[1] Only 1% of OM residency graduates would *definitely not* select OM again as a specialty. OM physicians in the prior study who had not completed a residency within the past 10 years (OMPhynotRG) were more likely to *definitely not* select OM again than the OM residency graduates (χ^2, $P = 0.32$) The OM physicians who had completed an OM residency within the past 10 years were also more likely than other ACOEM physicians to *definitely* select (45% vs 33%) and slightly less likely to *definitely not* select (2.9% vs 3.7%) OM again as a specialty. Overall, the proportion of physicians who would probably or definitely select OM again was closely comparable in the three groups, ranging from 83% (OM residency graduates in physician study) to 80% among those in the OM physician survey who did not complete residency within the past 10 years (OM-PhynotRG) (χ^2, $P > 0.05$).

Current Employment Settings

Eighty percent of the OM residency graduates were currently working in OM settings; 70% were working full time. Fifty-eight percent described their practice as a clinical setting, similar to the proportion of ACOEM physicians database (Table 2). Residency graduates responding to the survey were more likely to work for the government (35% vs 9%) or in academics (13% vs 7%) than ACOEM physicians (Table 2). The OM physicians who had completed an OM residency within the past 10 years (OMPhyRG) were also more than twice as likely to work in government (14% vs 5.5%) or academic settings (15% vs 7%) than OM physicians who had not graduated from an OM residency program within the past 10 years (OM-PhynotRG) (Table 2).

The major areas for practice for OM residency graduates are shown in Table 3. Three-quarters of residency graduates were engaged in some clinical OM practice, with 38% working between 21 and 50 hr/wk in this area. However, 48% only worked in clinical practice 1 to 20 hours weekly and 14% worked less than 1 hr/wk in clinical OM practice. Other areas of practice that engage at least 25% of graduates in their weekly duties are corporate and management functions, teaching, consulting, medical-legal or expert services, environmental medicine, and health care administration, while substantial minorities are involved in a large variety of other facets of practice. None of the OM residency graduates spent more than 20 hours in an average week working in the following areas: teaching, environmental medicine, risk assessment and toxicology, medical legal or expert witness services, international health, or medical toxicology. There were no comparable data from the prior ACOEM physician survey or from the ACOEM database for the number of hours worked per practice setting in an average week.

TABLE 2

Current Employment for OM Residency Graduates Compared With ACOEM Physicians and Participants in a Prior Survey of OM Physicians[a]

Who Completed	OM Residency Graduates	ACOEM Physician Membership Data Base	ACOEM Physicians Who Completed OM Residency in Last 10 yr (OMPhyRG)[a]	ACOEM Physicians Who Had Not Completed OM Residency in Last 10 yr (OMStudynotRG)[a]
Number	90	4725	106	491
Occupational medicine (%)	80.0	NA	NA	NA
Working full time (%)	70.4	NA	NA	NA
Working part time (%)	29.6	NA	NA	NA
Clinical settings (%)	58.1	51.6	39.5	52.4
Freestanding OM clinic (%)	29.1	25.2	19.8	26.4
Multispecialty clinic/hospital (%)	25.6	18.9	17.0	19.5
Multispecialty clinic (%)	14.0	NA	NA	NA
Hospital system (%)	11.6	NA	NA	NA
Other clinical setting (%)	3.4	7.5	2.7	6.5
Consulting firm/self-employed (%)	11.7	11.5	7.5	11.9
Self-employed (%)	7.0	NA	NA	NA
Consulting firm (%)	4.7	NA	NA	NA
Corporate/industry (%)	18.6	16.3	14.1	8.8
Corporate (management) (%)	9.3	NA	NA	NA
Local physician in plant (%)	9.3	NA	NA	NA
Government (%)	34.9	9.4	14.1	5.5
Academic setting (%)	12.8	6.6	15.1	6.8
Other settings (%)	9.4	4.6	6.9	17.8

[a]See text and reference 1 for description of groups.
NA indicates not available.

TABLE 3

Number of Hours Worked in an Average Week in Different Practice Settings by OM Residency Graduates

	No. OM Residency Graduates (%)	Mean hr Worked in an Average Week	Maximum hr Worked Per Week in This Area	Percent Who worked <1 hr Per Week in This Area	Percent Who Worked 1–20 hr Per Week in This Area	Percent Who Worked >20 hr Per wk in This Area
Clinical occupational medicine	68 (75.5)	20.2	50	13.9	48.1	38.0
Corporate/management functions	51 (56.7)	11.8	50	13.6	74.5	11.9
Teaching	30 (33.3)	3.7	20	33.3	66.7	0.0
Consulting	28 (31.1)	8.2	60	31.7	61.0	7.2
Medical legal or expert services	27 (30.0)	3.4	12	38.6	61.4	0.0
Environmental medicine	24 (26.7)	2.1	10	36.8	63.2	0.0
Health care administration	23 (25.5)	14.9	60	41.0	48.7	10.3
Risk assessment and toxicology	20 (22.2)	2.2	10	37.5	62.5	0.0
Government agencies	17 (18.9)	22.4	50	54.1	24.3	21.6
Preventive medicine/public health	16 (17.8)	9.6	30	38.5	57.7	3.8
International health	15 (16.7)	3.3	10	58.3	41.7	0.0
Clinical family practice	14 (15.5)	13.0	50	50.0	46.4	3.6
Research	12 (13.3)	18.5	60	67.6	24.3	8.1
Environmental medicine	6 (6.7)	24.8	50	71.4	14.3	14.3
Clinical emergency medicine	4 (4.4)	10.3	30	80.0	15.0	5.0
Medical toxicology	3 (3.3)	2.7	5	83.3	16.7	0.0

TABLE 4
Ratings of How Well OM Residency Programs Trained Residents in Specific Core Competencies

		Distribution of Ratings by OM Residency Graduates (%)				
	Mean Scores	1 Not prepared	2	3	4	5 Well prepared
Professionalism	4.38	1.1	1.1	15.9	22.7	59.1
Hazard recognition, evaluation and control	4.20	0.0	4.5	15.9	34.1	45.5
Epidemiology	4.15	0.0	4.5	20.2	31.5	43.8
Medical knowledge	4.15	0.0	4.7	17.4	36.0	41.9
Workplace health and surveillance	4.14	0.0	5.7	15.9	37.5	40.9
Toxicology	4.14	2.3	4.5	14.8	34.1	44.3
Environmental health	4.13	0.0	3.5	16.3	44.2	36.0
Preparation for OM section of ABPM boards	4.10	4.5	6.7	16.9	18.0	53.9
Biostatistics	3.94	1.1	12.6	14.9	33.3	37.9
Interpersonal skills and communication	3.92	1.1	9.1	22.7	30.7	36.4
Clinical OM	3.90	6.7	5.6	16.9	32.6	38.3
Environmental risk assessment	3.84	0.0	10.1	24.7	36.0	29.2
Preparation for preventive medicine section of ABPM boards	3.83	1.1	9.0	22.5	40.4	27.0
Disability management and work fitness	3.78	5.7	10.3	21.8	24.1	37.9
Patient care	3.78	5.7	9.2	18.4	34.5	32.2
Health promotion and prevention	3.78	2.2	15.7	18.0	30.3	33.7
Public health	3.73	1.1	9.0	27.0	41.6	21.3
Clinical preventive medicine	3.71	2.2	9.0	28.1	37.1	23.6
Behavioral aspects of health	3.67	2.2	11.2	25.8	38.2	22.5
Management and administration	3.51	2.3	15.9	28.4	35.2	18.2
Regulation and government agencies	3.48	4.5	12.5	30.7	35.2	17.0
Health services administration	3.44	3.4	16.1	27.6	39.1	13.8
Practice based learning	3.38	7.1	12.9	31.8	31.8	16.5
Systems based practice	3.16	7.1	17.6	35.3	31.8	8.2
Aerospace medical knowledge	3.13	18.0	20.2	20.2	13.5	28.1

Residency Program Satisfaction and Problems During Residency

The OM residency graduates were asked to rate their satisfaction with their residency program on a scale of 1 to 5 (1 = very dissatisfied, 5 = very satisfied). Eighty-one percent of residency graduates were satisfied with their OM residency program (48% were very satisfied and 33% were somewhat satisfied). Approximately 9% were dissatisfied with their OM residency program overall (4.9% very dissatisfied, 3.7% somewhat dissatisfied). The OM residency graduates were also asked to rank perceived problems in their OM residencies. Fewer than 12% of OM residency graduates cited "major problems" within OM residency programs, and those most commonly reported were support and funding for research, OM residency funding, having enough time for personal life, and salary.

Core Competencies in OM Residency and Relevance to OM Practice

The OM residency graduates in this study were asked to rate on a scale of 1 to 5 (1 = not prepared, 5 = well prepared) how well their OM residency prepared them in various competencies (Table 4). Respondents indicated that they believed that they were well prepared for a variety of practice competencies by their OM residency program. OM residency graduates were also asked to rate on a scale from 1 to 5 (1 = not valuable, 5 = very valuable) how useful these competencies were for their current job (Table 5).

The residency graduates believed that they were best prepared in the following areas: professionalism (mean 4.38). hazard recognition, evaluation, and control (4.20), epidemiology (4.15), medical knowledge (4.15), workplace health and surveillance (4.14), toxicology (4.14), environmental health (4.13), and preparation for the OM section of the ABPM boards (4.10) (Table 4). OM residency graduates believed that they were least prepared by their OM residency programs in the following areas: aerospace medical knowledge (mean 3.13), system-based practice (3.16), practice-based learning (3.38), and health services administration (3.44).

Professionalism was rated by the OM residency graduates as the area where they were best prepared by their residency training, and also as the most important factor for their current job (Tables 4 and 5). OM Physicians in the prior study also rated professionalism as the most important core competency for their current job.[1] The OM residency graduates rated medical knowledge as the second most important factor on the job, which contrasts with its fourth-place ranking as to how well

TABLE 5

Perceived Value of Specific Core Competencies in Current Job for OM Residency Graduates: Results Compared With Prior OM Physician Study[a]

	OM Residency Graduates Data						
	Residency Graduates Mean Scores	1 Not Valuable (%)	2 (%)	3 (%)	4 (%)	5 Very Valuable (%)	ACOEM Physician Study Data[a] Overall OM Physician Mean Scores
Professionalism	4.66	0.0	1.1	4.5	21.6	72.7	4.75
Medical knowledge	4.52	0.0	2.3	5.7	29.95	62.1	NA
Interpersonal skills and communication	4.48	0.0	1.1	9.2	29.9	59.8	4.72*
Clinical occupational medicine	4.26	3.4	8.0	8.0	20.5	59.8	4.63*
Patient care	4.16	3.4	8.0	14.8	17.0	56.8	4.43*
Disability management and work fitness	4.13	4.7	8.1	8.1	27.9	51.2	4.53*
Workplace health and surveillance	4.07	4.5	1.1	21.6	28.4	44.3	4.23
Regulation and government agencies	3.92	3.4	4.5	21.6	37.5	33.0	4.02
Hazard recognition, evaluation, control	3.90	4.5	3.4	21.6	38.6	31.8	4.13*
Management and administration	3.81	4.5	6.8	23.9	33.0	31.8	3.59
Behavioral aspects of health	3.78	3.4	8.0	23.9	36.4	28.4	3.82
Health promotion and prevention	3.77	3.4	6.8	25.0	38.6	26.1	3.74
Environmental health	3.74	1.1	10.2	28.4	34.1	26.1	3.76
Clinical preventive medicine	3.74	3.4	8.0	26.1	36.4	26.1	3.79
Toxicology	3.71	0.0	16.1	26.4	27.6	29.9	3.80
Public health	3.69	3.4	11.4	23.9	35.2	26.1	3.42
Epidemiology	3.66	4.5	11.4	25.0	31.8	29.9	3.36*
Environmental risk assessment	3.60	5.7	10.2	26.1	34.1	23.9	NA
Practice based learning	3.52	8.1	4.7	33.7	33.7	19.8	4.23*
Health services administration	3.38	8.0	15.9	23.9	35.2	17.0	3.23
Systems based practice	3.18	11.8	11.8	32.9	34.1	9.4	3.65*
Biostatistics	3.15	10.2	27.3	18.2	26.1	18.2	2.99
Aerospace medical knowledge	2.80	27.3	33.0	3.4	5.7	30.7	2.22*

*$P < 0.05$ for t test comparing mean results to OM residency graduate data.
[a]See text and reference 1 for description of groups.
NA indicates not available.

they were trained by the OM residency program. Some discrepancies in perception of importance versus preparation were noted for the next three most important competencies for current job (Tables 4 and 5): interpersonal skills and communication (mean value for job 4.48; mean rating of training 3.92), clinical OM (mean value for job 4.26; mean rating of training 3.90), and patient care (mean value for job 4.16; mean rating of training 3.78) although mean values for rating of training all remain over the median value on the Likert scale used. Patient care was rated as the fifth most important competency for their current job, but ranked fifteenth for how well the graduates were prepared by the OM residency program. Similarly, disability management was rated the 6th most important competency with respect to current employment (mean 4.13) but ranked 14th for how well the residency graduates were prepared by their OM residency program (mean 3.78). The OM residency graduates appeared to receive adequate training in workplace health and surveillance, which ranked seventh in value for their job, and fifth in how well they were prepared by their residency program.

The OM residency graduates rated the following core competencies as least important in the performance of their current job: aerospace medical knowledge (mean 2.80), biostatistics (3.15), systems-based practice (3.18), and health services administration (3.38) (Table 5). In contrast, they believed they were least prepared by their residency programs in aerospace medical knowledge (mean 3.13). systems-based practice (3.16), practice-based learning (3.38), and health services administration (3.44) (Table 4). The OM residency graduates rated biostatistics as the second least valuable of the core competencies for their current job, but it was ranked as the ninth highest competency with respect to how well they were trained by the OM residency program (Tables 4 and 5).

TABLE 6

Difficulties With Job Search and Ranking of Perceived Barriers During Job Search by 12 (13.3%) Residency Graduates Who Had Difficulty Finding a Job

		Barriers for the 12 OM Residency Graduates Who Had Difficulty Finding a Job				
	Number (%)	Mean Scores	1 Not a Barrier (%)	2 Minor Barrier (%)	3 Moderate Barrier (%)	4 Major Barrier (%)
Did you have trouble finding a job? Yes	12 (13.3%)					
If you had trouble finding a job: how much of a barrier were the following issues when you were looking for a job?						
Geographic location		2.75	25.0	0.0	50.0	25.0
Salary or benefits		2.58	25.0	16.7	33.3	25.0
Opportunities for advancement		2.50	25.0	25.0	25.0	25.0
No job available		2.50	41.7	8.3	25.0	25.0
Family or personal issues		2.42	25.0	16.7	50.0	8.3
Lack of public health emphasis		2.42	33.3	8.3	41.7	16.7
Lack of academic or teaching opportunities		2.33	33.3	33.3	0.0	33.3
Lack of research opportunities		2.17	41.7	25.0	8.3	25.0
Lack of clinical or occupational medicine emphasis		2.08	41.7	25.0	16.7	16.7
Job available in another specialty or setting more appealing		2.00	36.4	36.4	18.2	9.1
Lack of interest in field of OM		2.00	50.0	16.7	16.7	16.7
Lack of serving underserved populations		2.00	33.3	33.3	33.3	0.0

OM residency graduates' ratings of the importance of many of the competencies parallel those of the OM physicians who were surveyed in the prior study.[1] Both groups rated professionalism as the most important competency for their current job. Interpersonal skills and communication were also rated highly by both groups (Table 5). OM residency graduates in this study gave a lower rating for the value of the following core competencies compared with the other OM physicians previously surveyed: interpersonal skills and communications (t test, $P = 0.004$), clinical OM ($P = 0.002$), patient care ($P = 0.008$), disability management (P-value $= 0.002$), hazard recognition, evaluation, and control ($P = 0.048$), practice based learning ($P < 0.001$), and systems-based practice ($P < 0.001$) (Table 5). OM residency graduates gave a higher rating for the value of the following core competencies compared with the OM physicians in the prior study: epidemiology ($P = 0.015$) and aerospace medical knowledge ($P = 0.002$).

Job Opportunities

Only 13% of OM residency graduates reported difficulty finding a job. Twenty-five percent responded that difficulty finding a job was "not applicable;" most of these respondents were military personnel who did not need to seek a job upon completion of OM residency training. Most of the 12 OM residency graduates who had difficulty finding a job identified no major barrier to finding employment (Table 6). Geographic location, salary or benefits, lack of opportunities for advancement, and no jobs available were cited as the most common barriers to finding a job for small numbers of graduates (Table 6).

Important Factors and Perceived Problems in OM Practice

The OM residency graduates were asked to rate on a scale of 1 to 4 (1 = not a problem, 4 = major problem) a series of issues and challenges facing OM (Table 7). Among these responses, OM residency graduates thought that establishing a solid base for OM research was the biggest concern.[1] The OM residency graduates thought that funding under the new health care reimbursement model and meeting employer and patient expectations were the next most significant problems for OM practice. The OM residency graduates gave ratings for the important aspects of OM practice which were similar to the physicians in the prior study who had graduated from a residency within the past 10 years (OMPhyRG) (t test comparing means $P > 0.05$) The OM residency

TABLE 7
Rankings by OM Residency Graduates of Currently Perceived Problems in OM: Results Compared With Prior Survey of OM Physicians[a]

	OM Residency Graduates Data						OM Physician Study Data[a]	
How Much of a Problem are the Following in OM at This Time?	Residency Graduate Mean Scores	1 Not a Problem (%)	2 Minor Problem (%)	3 Moderate Problem (%)	4 Major Problem (%)	Don't Know or No Opinion (%)	RG Within Last 10 yr (OMPhyRG) Means	OM Physician Not RG Within Last 10 yr (OMPhynotRG RG) Means
Establishing solid base of OM research	2.47	15.1	23.3	25.6	12.8	23.4	2.54	2.38
Funding under new healthcare reimbursement model	2.29	19.8	17.4	20.9	9.3	32.6	2.39	2.35
Meeting expectations of employers	2.27	18.2	40.9	33.0	5.7	2.3	2.51	2.65*
Meeting expectations of patients	2.27	15.93	44.3	30.7	5.7	3.4	2.30	2.36
Closing of OM non-residency track	1.84	30.2	11.6	9.3	5.8	43.0	2.06	2.48*
Practicing in a multi-specialty model	1.73	43.7	24.1	16.1	2.3	13.8	1.75	1.80

*$P < 0.05$ for t test comparing mean results to OM residency graduate data.
[a]See text and reference 1 for description of groups.
NA indicates not available.

graduates in the current study were significantly less likely to be concerned about employer expectations ($P < 0.001$) and closure of the OM non-residency track ($P < 0.001$) than the OM physicians in the previous study who had not graduated from a residency within the past 10 years (OMPhynotRG).[1]

The OM residency graduates were also asked to rate on a scale of 1 to 5 (1 = not important, 5 = very important) various aspects of an OM practitioner's professional role (Table 8). The OM residency graduates thought that the most important aspect of OM practice was being involved in interesting and challenging work (mean 4.63). Other important factors in OM practice included having control over professional time (mean 4.43), promoting workplace safety (4.38), and interacting with colleagues (4.28). Recent OM residency graduates gave a significantly higher rating to involvement in interesting and challenging work ($P = 0.021$), interacting with colleagues ($P = 0.011$) and diverse job or career opportunities ($P = 0.005$) than OM physicians in the prior study who had not graduated from a residency within the past 10 years (OMPhynotRG).[1] Recent OM residency graduates rated the importance of treating patients significantly lower ($P = 0.011$) than the OM physicians in the prior study who had not graduated from a residency within the past 10 years (OMPhynotRG) (Table 8).

Discussion

The present survey assessed OM residency graduates' demographic characteristics, satisfaction with their residency program, and the importance of specific competencies in their training and to their work. Eighty-two percent of the OM residency graduates were satisfied with their residency training. Fewer than 12% cited major problems with their OM residency program. The four major problems identified with the

TABLE 8

Rankings of Perceived Importance of Various Aspects of OM Practice for OM Residency Graduates Compared With Responses From a Prior Survey OM Physicians[a]

	OM Residency Graduates Data							OM Physician Study Data[a]	
	Residency Graduates Mean Scores	1 Not Important (%)	2 (%)	3 (%)	4 (%)	5 Very Important (%)	Don't Know or No Opinion (%)	OM Physicians Who Were RG Within Last 10 yr (OMPhyRG) Mean Scores	OM Physicians Who Were Not RG Within Last 10 yr (OM-PhynotRG RG) Mean Scores
Being involved in interesting and challenging work	4.63	1.1	0	4.5	23.6	70.8	0%	4.45	4.43†
Having control over professional time	4.43	0	2.2	6.7	36.0	53.9	1.1	4.43	4.32
Promoting worker safety	4.38	2.2	2.2	7.9	30.3	57.3	0	4.39	4.40
Interaction with colleagues	4.28	0	2.2	12.4	39.3	44.9	1.1	4.11	4.04*
Treating patients	4.20	5.7	5.7	11.4	14.8	59.1	3.4	4.47	4.55*
Having a leadership role	4.18	3.4	5.6	9.0	33.7	48.3	0	4.31	4.17
Being involved in a respected profession	4.10	4.5	4.5	15.7	27.6	48.3	0	4.20	4.13
Having a comfortable lifestyle	4.08	1.1	5.6	18.0	32.6	40.4	2.21	4.18	3.88
Diverse job or career opportunities	4.01	3.4	6.9	14.9	33.3	40.2	1.1	4.08	3.65*
Doing medical legal work	2.84	19.1	20.2	20.2	21.3	11.2	7.9	2.97	2.94
Doing research	2.57	30.7	19.3	20.5	10.2	14.8	4.5	2.67	2.51

*$P < 0.05$ for t test comparing mean results to OM residency graduate data.
[a]See text and reference 1 for description of groups.

residency programs clustered around issues of funding; including organizational support and funding for research, OM physician salary and overall concern with OM residency funding. Funding of OM residency training and research continues to be a significant issue.

The OM residency graduates appeared to be satisfied with career choice. Eighty percent of the residency graduates were currently working in OM, despite the fact that 62% were board-certified in other specialties (Tables 1 and 2). Eighty-two percent would select OM again as a career (48% definitely, and 33% probably) and only 1% definitely would not select OM again as a career. Only 14% of the OM residency graduates expressed some difficulty finding a job in OM (Table 6). These findings indicate a high degree of satisfaction with the participating OM residency training programs, and that positions for OM graduates remain available. There continues to be a demand for OM residency trained physicians within the specialty, and the present supply does not seem to exceed current demand.

The results of this study may not be generalizable to the experience of all OM residency graduates and programs in the U.S. and Canada due to the participation of only nine residency programs, (29%), small sample size (90 graduates) and relatively low participation rate (44%). Residency graduates could participate only if the current director of their residency program chose to participate in the present study and current addresses were available for resident graduates of the program. These factors limited the pool of total possible participants. The low response rate is similar to other physician surveys. For example, Jepson et al[19] obtained a response rate of 38% when mailing questionnaires of similar length (more than 1000 words) to a sample of generalist physicians randomly selected from the American Medical Association's master file. Despite these reservations, even limited data about the adequacy and relevance of OM residency training can help guide the content and direction of these programs.

To address possible selection bias or limited generalizability of our findings, we compared our results with data obtained from OM physician members of ACOEM which were surveyed during the same time period, with stratification of respondents into groups: graduates of an OM residency within the past 10 years (OMPhyRG), and those who had not (OMPhynotRG).[1] It is possible that some of the same participants were included in the current survey of OM residency graduates and the previously published survey of OM physicians. We were not permitted to collect names and personal identifiers of the OM residency graduates, so we were unable to verify whether any of the 90 residents in the current OM residency study were also included in the group of 106 OM physicians previously studied who reported graduation from an OM residency within the past 10 years.

Nevertheless, examination of the two data sets suggests little overlap in the participants of each study, including the differences between the two groups in the numbers employed in academic institutions or governmental agencies and the differing proportions of board certification in aerospace medicine, internal medicine, general preventive medicine, and psychiatry. Of the OM residency graduates in our study, 30% had graduated from military-based OM programs, which likely explains the higher fraction of physicians board-certified in aerospace medicine (31%) and working in a government agency (35%). However, the fraction of OM physicians who had graduated from an OM residency within the past 10 years (OMPhyRG) and worked in government (14%) was less than participants in the present study, but more than other OM physicians who had not graduated from an OM residency within the past 10 years (OMPhynotRG) (5.5%) (Table 2).

Recent OM residency graduates appeared to be well trained. The OM residency graduates were more likely to be board-certified in OM than ACOEM physician members (73% vs 41%) and more likely to have completed other post graduate degrees (63% vs 40%). The OM residency graduates also were more likely than ACOEM physician members to be board-certified in family practice and aerospace medicine, but less likely to be board-certified in general preventive medicine (Table 1). A similar fraction of ACOEM physician members were board-certified in other specialties compared with the OM residency graduates. The OM residency graduates were more likely to have completed an MPH degree (58% vs 34%) than the ACOEM physician members, probably because many OM residencies require an MPH degree to graduate. OM residency graduates were significantly more likely to be board-certified in OM and more likely to have taken the OM board examination than OM physicians in the prior study who had not graduated from a residency within the past 10 years (OMPhynotRG).

Most OM residency graduates have a diverse practice, and work in several areas of OM during an average week. The average residency graduate works 20.4 hr/wk in clinical OM (Table 3). In recent years, there has been a general assumption that the substantial majority of OM physicians spend most of their time providing clinical care, although there are minimal objective data in support of this. Ducatman's analysis of open positions in the late 1980s disclosed a shifting job market away from corporate-based practice and toward freestanding clinics, multispecialty groups and other forms of clinical practice closer to primary and urgent care office models.[4] Imbus,[7] in considering the future of OM, asserted that most occupational physicians today are in clinic practice. Harber and Ducatman report that the first jobs of many OM residency graduates have substantial clinical responsibility.[20] McDonald et al also stressed the need for more comprehensive clinical training.[8] Although these authors have emphasized clinical training and skills, it is possible that they have underestimated the diversity of OM practice, and the importance of other areas of emphasis within a residency program.

It is possible that prior studies, which asked OM physicians to select one employment setting to describe their job duties, underestimated the diversity of tasks that encompass modern OM practice. In this study, majority (58%) of OM physicians described their current employment as "clinical practice" although the average time spent weekly in this activity was 20.4 hours. To some extent, it is not surprising that entry-level work in the field is primarily clinical and that greater administrative responsibilities follow subsequently, as they likely do in most other areas of medical practice. Noteworthy in this study is the extent to which recent graduates are engaged in consultative, managerial, and other "non-clinical" aspects of OM practice early in their careers. This appears to contradict widespread perception that available positions of employment in OM are principally injury-care or similar individual patient-focused clinical work. The results in this study indicate rather, that competencies targeting population wellness, required as part of preventive medicine residency training, are utilized and essential early in a physician's practice in the field of OM. Moreover, when ACOEM data are considered, it is apparent that only 52% of the general physician membership worked currently in clinical practice (Table 2).

Current OM residency programs are structured to provide comprehensive training and competency in both clinical medicine and population-based health.[20] The OM residency graduates in this study had diverse practice experience, spending about half of their working week, on average, in clinical practice with half of their time spent in other activities. The present balance of a typical OM residency experience, providing about half of a resident's training in clinical activities and half in population-based experiences, appears appropriate for the future career of a graduate, based on the findings of this study.

The OM residency graduates reported that professionalism was the most important core competency for their current job, and also rated professionalism as the core competency for which they were best prepared by their OM residency program (Table 4 and 5). The OM physicians in a prior study also rated professionalism as the most important general competency for their current job.[1] Professionalism has also been identified by the ACGME as one of the six general competencies applicable to all medical specialties. Professionalism embraces values that apply to all medical practice, including commitment to service, advocacy, and altruism.[21] Although rapid advances in knowledge during the past 30 to 40 years have changed the nature of all professions, particularly significant changes have occurred in medicine–especially in OM.

Both the OM residency graduates and OM physicians rated interpersonal skills and communication as the second most important competency for their current job. However, the acquiring of those skills within OM residencies was given a lower score than their importance (Table 4), suggesting a relative deficiency of training in interpersonal skills and communication among the programs surveyed.

In addition to practice patterns, examination of the utility of general competencies promulgated as training objectives by accreditation bodies is instructive. Of the 23 broad general competencies, which encompass those for general postgraduate training, preventive medicine and public health, and OM, only three (systems-based practice, biostatistics, and aerospace medical knowledge) were not endorsed by 50% or more of the OM graduates as being important or very important (4 or 5 on Likert scale; Table 5) for their current job. Although variation in individual practice may dictate the need for expertise beyond the expected level as outlined within the relevant competencies, this survey would appear to support the general competencies now extant as relevant to OM practice. Two of the three that were not considered relevant by most—biostatistics and aerospace medicine—are primarily the purview of academic physicians and specialists in aviation medicine. These may be considered useful for subsets of practitioners, although perhaps not universally so for all OM resident trainees. Inclusion of the third, systems-based practice, as a less-valued competency is somewhat curious; the ACGME defines this as "an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value."[14] For OM physicians, this could be considered a competency-based description of work within the context of the worker's compensation system as well as other disability and benefit programs with which most OM clinicians interact frequently. The low value placed on this competency by those now in practice may speak more to the opacity of the language used to describe requisite skills than the practitioner's true perception of its utility.

The traditional OM residency program is structured to provide comprehensive training and competency in clinical and population based health.[20] OM residency graduates in this study have a diverse practice and spend on average on 20.4 hours a week doing clinical practice, indicating that a comprehensive training approach may still be appropriate. The relatively high proportions of those graduates noting inadequate preparation in clinical OM, disability management, and patient care, by comparison with such areas as hazard recognition and control, epidemiology, and environmental health as seen in Table 4, may lead programs to reconsider their curriculum in light of the extent to which clinical skills are required early in the practice of graduates.

A prior study by Reetoo et al[22] assessed the value of a slightly different set of OM core competencies based on United Kingdom and European recommendations from employers, employees, and other health and safety professionals in the United Kingdom. Customers rated communications as the most important OM physician competency followed by: assessing injury, disability, and handicap in relation to work; assessing fitness for work; and assessing health hazards and health problems.[22] MacDonald and coworkers[8] assessed the importance of European-derived core competencies for OM physicians and found the most important competencies were: occupational hazards in health, research methods, health promotion, occupational health law and ethics, and communication. It is difficult to compare the European findings with the results of the present study as the list of core competencies was different. However, both the European study and the present study noted consistently the highest ratings for: communication skills, professionalism or ethics, medical knowledge and the ability to assess health hazards and health problems. Based on the consensus that has emerged from the present study previous reports, each of these areas may be considered, therefore, competencies that are *essential* for an OM training program.

Residency training programs in OM have traditionally demonstrated flexibility in curriculum and emphasis, which speaks to the field's diversity and strength. We primarily surveyed OM residency program graduates with regard to the general competencies identified by ACGME. These competencies and skills are required across residency programs throughout the United States, although specific training may vary among programs. As part of this survey, we returned program-specific, de-identified individual data to each residency director. We hope that this study will provide insight into how residency directors may enhance these programs and more effectively reach their goals. The results may also provide a framework for OM residency programs to assess their training outcomes, as is now required by ACGME. In this sense, graduate surveys and ongoing data collection may be extremely valuable as a surveillance mechanism to demonstrate the consistency of residency training with skills essential to current OM practice. In this way, we might utilize the experience of our graduates in a continual effort to enhance the quality of training to ensure that OM residency graduates are optimally prepared to practice OM in the present and in the future.

Acknowledgment

Funding for this study was provided by the Midwest Center for Occupational Health and Safety through grant number 1 T42 OH008434-01 awarded by CDC/NIOSH.

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