Influence of Residency Training on Occupational Medicine Practice Patterns

Philip Harber, MD, MPH
Sri Mummaneni, MD, MPH
Lori Crawford, BS

Objectives: *A relatively high proportion of occupational medicine (OM) specialists have not had formal residency training in OM. Members of the Western Occupational and Environmental Medicine Association, a professional organization of OM specialists, completed a postal questionnaire (160 of 561 members).* ***Methods:*** *Educational background, practice setting, practice activities, and skills considered relevant were compared between those with and without formal training.* ***Results:*** *Both groups had considerable focus in clinical care, musculoskeletal medicine, and workers' compensation. However, those with formal training practice in a broader variety of settings were less likely to have practiced another specialty, and used additional skills (toxicology, industrial hygiene, and epidemiology) in their practices. Formal education appears to create a greater diversity of skills and opportunities, but it does not appear to create a group of physicians disinterested in "front-line" occupational medicine practice.* ***Conclusions:*** *The data support the need for formal residency programs but also highlight the importance of access to formal training for midcareer physicians.* (J Occup Environ Med. *2005;47:161–167*)

Occupational–environmental medicine is unusual as a medical specialty because of the relatively small proportion of practitioners who are board-certified in the specialty.[1,2] The practice is particularly diverse, ranging from clinical single patient-oriented medicine to public health/public policy. Many occupational environmental medicine specialists have entered the field after prior training and practice in another area.[2,3] This analysis was conducted to gain insight into the impact of residency training in occupational–environmental medicine. We sought to compare practice patterns of those who are formally trained with those who have not had formal residency training.

Methods

A mail survey concerning practice patterns and educational background was conducted among members of the Western Occupational and Environmental Medical Association (WOEMA). The survey addressed educational background, practice patterns, practice types, and the perceived need for specific areas of competency. In addition, a question was asked about what percentage of income was derived from each of several types of activities or payment sources; 10 categories of percentage income were employed. The responses included no personal identifiers, and all information was maintained confidentially. The survey was distributed to all 561 members of WOEMA; 160 were returned.

Data were managed with a relational database (Microsoft Access;

From Division of Occupational & Environmental Medicine, Department of Family Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California.

Address correspondence to: Philip Harber, MD, MPH, Division of Occupational & Environmental Medicine, Department of Family Medicine, David Geffen School of Medicine at UCLA, 10880 Wilshire Blvd., Suite 1800, Los Angeles, CA 90024-7027. E-mail address: pharber@mednet.ucla.edu.

Microsoft, Redmond, WA), and statistical analyses were performed with SAS for PC (SAS Institute, Cary, NC). Categorical data were analyzed descriptively; hypothesis testing was performed with χ^2 analysis. Where these data were meaningfully ordered, comparison of the groups with and without formal training was conducted using the Mantel Haenszel statistic to compare patterns and Wilcoxon for differences in central tendency. Continuous data were evaluated with t- testing. For the "source of income" data, groups were compared using *t*-tests and by the χ^2/ Mantel Haenszel after collapsing the 10 deciles into 5.

Results

Study participants were classified into those with and without formal training in occupational medicine based upon their response to the question about residency training in occupational medicine. There were 70 participants classified as OM trained whereas 90 were classified as not OM trained.

Table 1 compares the personal characteristics of the subjects. The year of medical school graduation differed slightly (average of 1980 in those with training, and 1977 in those without formal training, $P < 0.05$). Those with OM training had an average of 15 years of practice in OM, whereas those without formal training had an average of 16 years of OM practice. These differences were not statistically significant. Physicians who practice occupational medicine but have not had formal training are more likely to have practiced in another specialty first (84% vs. 49%; $P < 0.001$).

Table 2 summarizes the practice characteristics of respondents. OM training status significantly affected main practice type ($P < 0.001$). Nearly all (79.7%) of those without formal OM training practiced in predominantly clinical settings, whereas only 63.6% of those with formal training did so. Both groups were nearly equal in the percent in administrative practice types but in nonclinical practices the trained were much more prevalent (27.3%) compared with the nontrained who were in nonclinical practices only 10.8% of the time.

OM training status significantly affected the setting of the main practice. A higher proportion of those with formal training (15%) practiced mainly in governmental or academic settings than those without such training. The proportions in institutional practices (health care maintenance organization plus hospital-based practices) did not differ between the two groups, nor did the likelihood of practicing in corporate settings.

Other questions addressed the degree to which the practice was focused in occupational medicine. Both groups had practices focused largely focused within the specialty. For example, 55% and 53% of the formally trained/not formally practiced exclusively occupational medicine. The degree of focus did not differ according to training status.

In general, as shown in Table 3, the frequency of time spent in most activities was generally similar between the two groups. However, OM training was associated with more time in "prevention" activities and in "consulting to employers." Both groups spent considerable time in clinical activities (54% of the for-

TABLE 1
Subject Characteristics

	OEM Training						*P* Value
	Yes			No			
	mean/*n*	SD/%	*n*	mean/*n*	SD/%	*n*	
Year of medical school graduation	1980	10	69	1977	8	76	<0.05
Years Practicing OM	15	9	69	16	8	77	ns
Other Specialty before OM?							
(No): Directly into OM	35	51		12	16		
(Yes): Practiced other specialty first	34	49		63	84		<0.01

OM, Occupational medicine.
P value refers to value of the hypothesis test comparing those with (Yes) and without (No) formal OM training.

TABLE 2
Practice Characteristics

	OM Training				
	Yes		No		
	n	%	No	%	*P* Value
Practice type					<0.05
Clinical	42	63.6	59	79.7	
Nonclinical	18	27.3	8	10.8	
Administrative	6	9.1	7	9.5	
Practice setting					<0.01
Corporate	8	11.8	12	16.7	
Gov-state	10	14.7	4	5.6	
HMO	6	8.8	2	2.8	
Hospital	4	5.9	11	15.3	
Private -ractice	30	44.1	42	58.3	
Univ-Acad	10	14.7	1	1.4	
Focus on OM in practice					NS
Only field practiced	37	55.2	39	53.4	
Primarily OM but other specialty	19	28.4	19	26.0	
OM is secondary field	10	14.9	14	19.2	
OM has no role	1	1.5	1	1.4	

TABLE 3
Practice Activities and Percentage of Response

	OM Trained	Very Often	Frequent	Occasional	Unusual	Never	Nonresponse	*n*	*P* (χ^2)*	*P* (MH)*
Treat injured Workers	Y	41	13	21	10	7	7	70	NS	NS
	N	48	11	18	7	3	13	90		
Performing medical	Y	20	20	24	19	10	7	70	NS	NS
Surveillance exams	N	13	20	28	14	11	13	90		
Performing medical-	Y	6	13	31	27	13	10	70	NS	NS
legal evaluations	N	7	4	28	31	17	13	90		
Consulting to industry/employers	Y	19	10	47	13	4	7	70	NS	0.045
	N	12	9	39	18	10	12	90		
Visiting workplaces	Y	3	14	36	34	6	7	70	NS	NS
	N	3	4	41	28	9	14	90		
Administration	Y	19	33	19	11	10	9	70	NS	NS
	N	21	23	20	17	6	13	90		
Nonclinical consulting	Y	4	11	21	29	20	14	70	NS	NS
	N	12	9	20	27	14	18	90		
Prevention activities	Y	10	13	31	30	6	10	70	NS	0.08
	N	6	12	24	31	11	16	90		
Other nonclinical consulting	Y	9	7	1	6	4	73	70	NS	NS
	N	3	10	6	3	7	71	90		

*Comparison of OM trained and not-OM trained by χ^2 and Mantel–Haenszel (MH) tests.
Data are percentages with each response within training category.

mally trained and 59% not formally trained OM physicians described clinical activity in the two highest categories).

Table 4 discusses the skills needed by physicians practicing occupational medicine. The first half of the table describes skills needed for their personal practices, whereas the second half discusses skills needed for OM in general. For both groups, musculoskeletal examination received the highest priority. Both groups felt "workers compensation" skills were important, but the highest rating ("very important") was used more frequently by those without formal training. Thus, formal training does not lead to withdrawal from active clinical practice.

The two groups differed significantly in the importance of occupational toxicology, epidemiology methods, and industrial hygiene. Occupational toxicology and industrial hygiene were felt to be considerably more important by those with formal training. These differences were present whether considering the utility of the skill in the subjects' personal practices or the importance of the skill in general. However, the extent of the difference appeared to be greater for the "personal practice" rather than "importance in general."

Several clinically related skills, such as soft tissue joint injection and suturing, appeared to be somewhat more important in general by the less trained than by those with formal training; results had a borderline statistical significance.

Sources of income are summarized in Table 5. Workers compensation treatment was significant for both groups, but it accounted for a significantly higher proportion of income for those without formal training. Additionally, Private insurance payments were more important to those without formal training in OM. Overall, research grants accounted for only a small percentage of income in either group, but the proportion was greater in those with formal training. The results on income source, however, should be interpreted with caution because a relatively high proportion of subjects (approximately 25–30%) did not answer these questions.

Two analyses were conducted to assess whether the respondents differed from the overall group. The year of graduation from medical school was determined from a public data source (American Medical Association listing) for a sample of 50 members of the organization and compared to that of the respondents. There were no significant differences. In addition, the overall proportion of members of the organization who are board-certified in occupational medicine was determined from a web a site listing for 200 members[4]; 84 of 200 (41%) were board-certified in occupational medicine; this percentage is nearly equal to that of the respondents (42%). Therefore, these results suggest that those who did not return questionnaires are generally similar to those who did so.

Discussion

This analysis compared physicians working in occupational medicine who have had formal training (ie, residency or residency equivalent) in occupational medicine to those who have not had such training. Unlike surveys of the opinions of university based educators,[5–8] the data presented here are empirically derived from "real-life" practitioners. The re-

TABLE 4
Important Skills

	OM Trained	5	4	3	2	1	0	*n*	*P* (χ^2)	*P* (MH)
Skills in your personal practice										
Occupational toxicology	Y	40	26	22	3	9	0	142	0.00	0.00
	N	14	22	38	9	13	4			
Musculoskeletal exam	Y	74	8	11	2	6	0	142	NS	NS
	N	79	10	4	4	1	1			
Epidemiology methods	Y	18	22	25	18	12	5	142	0.09	0.01
	N	6	19	22	16	25	12			
Industrial hygiene evaluation	Y	11	23	38	17	8	3	140	0.07	0.01
	N	8	15	27	19	23	9			
Strategic planning	Y	15	15	29	15	18	6	140	NS	NS
	N	12	16	32	13	17	9			
Patient education	Y	40	35	13	6	3	3	140	NS	NS
	N	44	38	14	1	1	1			
EPA understanding	Y	6	15	28	26	20	5	141	NS	NS
	N	8	11	29	26	20	7			
OSHA understanding	Y	22	38	28	9	3	0	142	NS	NS
	N	21	34	26	13	1	5			
Worker's compensation	Y	63	31	5	0	2	0	142	NS	NS
	N	81	16	1	1	1	0			
Management skills	Y	43	15	28	12	0	2	142	NS	NS
	N	43	29	17	8	4	0			
Communication/presentation	Y	0	66	20	9	3	2	142	NS	NS
	N	1	65	23	9	0	1			
Acute emergency care	Y	33	25	14	10	13	5	140	NS	NS
	N	44	22	17	8	6	3			
Use of slit lamp	Y	22	19	14	8	13	24	140	NS	NS
	N	25	14	17	12	17	16			
Joint/soft-tissue injection	Y	27	14	22	8	13	16	140	NS	NS
	N	32	19	18	9	9	12			
Suturing	Y	33	27	8	6	10	16	140	NS	NS
	N	48	21	8	3	9	12			
Skills needed in OM in general										
Occupational toxicology	Y	36	41	16	5	2	2	139	NS	NS
	N	28	31	28	11	3	0			
Musculoskeletal exam	Y	70	30	0	0	0	0	139	NS	NS
	N	83	15	1	0	0	1			
Epidemiology methods	Y	17	31	33	13	5	2	139	NS	NS
	N	17	27	28	13	9	5			
Industrial hygiene evaluation	Y	19	48	20	11	0	2	138	0.01	0.03
	N	18	23	39	12	7	1			
Strategic planning	Y	13	27	38	17	6	0	137	NS	NS
	N	14	29	33	15	5	4			
Patient education	Y	42	42	11	3	2	0	139	0.02	0.08
	N	64	19	16	1	0	0			
EPA understanding	Y	9	23	38	22	6	2	139	NS	NS
	N	17	25	32	16	8	1			
OSHA understanding	Y	41	36	17	6	0	0	139	NS	NS
	N	32	39	20	5	4	0			
Worker's compensation	Y	67	25	8	0	0	0	139	NS	NS
	N	75	23	1	1	0	0			
Management skills	Y	30	33	30	8	0	0	139	NS	NS
	N	37	35	24	1	3	0			
Communication/presentation	Y	50	28	20	2	0	0	139	NS	0.06
	N	63	28	8	1	0	0			
Acute emergency care	Y	33	42	19	3	3	0	138	NS	NS
	N	48	21	22	4	3	3			
Use of slit lamp	Y	23	25	23	14	14	0	138	NS	NS
	N	28	23	16	16	14	3			
Joint/soft-tissue injection	Y	25	29	25	8	11	2	137	0.07	NS
	N	38	27	16	14	1	4			
Suturing	Y	33	38	16	3	8	2	137	0.06	NS
	N	49	27	15	4	0	5			

This table summarizes the estimated importance of stills.
0 = not at all important; 1 = minor importance; 2, 3 = somewhat important; 4, 5 = very important; and NS = not significant. MH, Mantel–Haenszel.

TABLE 5
Practice Revenue Source and Percentage of Response

	OM Trained	0–1%	2–20%	21–40%	41–65%	66–89%	90–100%	*n*	*P* (χ^2)*	*P* (MH)*
WC treatment	Y	29	17	8	15	25	5	59	0.050	0.024
	N	11	13	17	25	22	13	72		
WC medical–legal	Y	52	38	5	2	2	2	56	NS	NS
	N	45	43	3	3	3	3	65		
Other medica–legal	Y	58	31	7	2	0	2	55	NS	NS
	N	58	34	3	2	2	2	62		
Payments directly from companies	Y	32	27	14	13	4	11	56	NS	NS
	N	35	26	15	15	5	5	66		
Private insurance	Y	86	12	2	0	0	0	50	0.037	0.001
(eg, HMO, PPO)	N	59	23	5	5	5	3	61		
Medicare/Medicaid	Y	88	10	2	0	0	0	50	NS	NS
	N	78	14	7	2	0	0	59		
Research and consulting contracts	Y	73	24	2	2	0	0	51	0.056	NS
	N	80	8	2	0	5	5	61		
Research grants	Y	85	6	2	4	4	0	52	NS	0.017
	N	96	4	0	0	0	0	56		
Other	Y	64	9	5	2	5	16	44	NS	NS
	N	69	8	6	2	0	14	49		

*Comparison of OM trained and Not-OM trained by χ^2 and Mantel–Haenszel (MH) tests.
WC, workers compensation.
Data are percentages with each response within training category.

sults demonstrate that there are significant differences between those with and without formal training.

OM physicians with formal training have a greater diversity of practice and of skills. Those with formal OM training much more frequently practice in academic and government settings.

A consistent pattern regarding skills was seen: the occupational medicine trained physicians employ a greater variety of skills in their personal practices. In particular, they consider the traditional "public health" skills of toxicology, industrial hygiene, and epidemiology to be much more directly relevant to their practices than do their less trained colleagues. As seen in Table 3a and 3b, the differences are greater for "personal practice" than for "occupational medicine in general." This suggests that formal training creates practice opportunities.

These data do not support the hypothesis that there are two populations of occupational physicians: a "residency-trained" group that focuses in areas such as toxicology and public health but eschews front-line clinical medicine and a second non-residency-trained group that provides primary care occupational services, predominately for common musculoskeletal disorders. For example, among the formally trained persons, 81% percent considered musculoskeletal examination to be "very important" or "important" in their personnel practices. Similarly, practice activities of the formally trained physicians include a significant time commitment to clinical and musculoskeletal medicine.

Implications for Educational Policy

These data have several implications for educational policy. The survey results support the need for ongoing formal residency training in the specialty of occupational medicine.[9] The competencies unique to occupational/preventive medicine training, such as epidemiology and industrial hygiene, were considered to be relevant to actual practice. Furthermore, training enhances the practice opportunities for occupational physicians: they have significantly greater diversity of practice settings and revenue sources. They also use a more diverse skill set in their professional activities.

Although benefit to the individual physician is important, formal education is likely to produce benefits for patients, public health, and for employers as well. Patients benefit from the ability of their physicians to better understand workplaces conditions in terms of causation and accommodation. Public health is likely to significantly benefit since the greatest difference between those with and without formal education is in the disciplinary areas most related to public health (epidemiology, industrial hygiene, and toxicology). A well-qualified cadre of physicians who understand both clinical medicine and public health helps bridge the gap between single patient oriented medicine and population medicine. Employers also are very likely to benefit from physicians fully trained in OM because of both factual knowledge (eg, assessing workplace conditions) and attitude (eg, appreciating the broad context in which care is delivered).

Both groups of physicians have considerable years of experience in OM practice, yet differences persist.

This suggests that it is unlikely that physicians will learn the breadth of the field simply by practicing OM without more formal education.

Although this study showed several differences, those with and without formal training had a great deal in common. Both groups recognize the importance of health systems issues (eg, workers compensation system), the regulatory context (eg, Occupational Safety and Health Act), and the importance of effective communication. Many activities, such as surveillance examinations and workplace visits, are conducted with equal frequency. This demonstrates that those physicians who identified with the field by joining the relevant professional organization are likely to have skills that differentiate them from clinicians who simply treat the presenting injury or illness.

Many OM physicians have not had formal OM training. They are not simply "part-timers"[2]; most practice OM predominately or completely. Because residency training does have benefit, there is a need for programs to foster residency training or its equivalent for those in the field.

Many physicians enter the field after training and practice in another specialty, and many of these do not receive formal residency training in OM.[2,3] Of those without formal OM training, 84% practiced another area first. Despite the probable benefits of full-time residency training for those who transfer specialty, there are significant obstacles (eg, inability to interrupt a career path to do a residency, significant income reduction while serving as a resident and potential difficulty with moving a family to a residency location). Therefore, there is a need for innovative residency structures that can provide high-quality training without all the constraints of traditional full-time in-residence programs.[10]

In addition to formal residency type training, high-quality, intense continuing education programs are necessary to meet the needs of the many committed physicians practicing in the field. The existence of many physicians without residency training but who are committed to full-time practice and membership in the relevant professional organization presents unique opportunities for professional organizations and governmental agencies to have significant impact via continuing education and meaningful short courses.[11]

Limitations

The differences between those with and without formal training are unlikely to simply reflect an effort of the more trained individuals to provide the "expected" answer because they have been trained about "what is expected." Although such bias theoretically might affect responses to the "subjective" questions about perceived importance of skills, concordant differences were also seen for questions that are more objective and specific (eg, practice structure and organization). Those with and without formal training differed only to a limited degree (mean of 3.3 years) in year of medical school graduation. Therefore, the observed differences are unlikely to represent an age or cohort effect rather than an actual effect of training. Furthermore, although the response rate was relatively low, the respondents were remarkably similar in year of graduation and proportion with board certification status to the overall group; therefore, responder bias is unlikely.

Several potential limitations exist for generalizing from these results. Subjects were all selected from membership of one specific professional association. However, the diversity of practice types in this study demonstrates that this organization is broadly based. The membership organization is predominant in the professional community and does not particularly focus on those with board certification status. It is likely that the data are truly representative. Furthermore, although all the participants were from a regionally based organization (WOEMA), the organization includes five states and a wide variety of practice situations.

Overall Conclusions

This study shows that there are significant differences in the practice patterns and skills of physicians with and without formal training in occupational medicine. Formal education appears to create a greater diversity of skills and opportunities, but it does not appear to create a group of physicians disinterested in "front-line" occupational medicine practice. Thus, formal training adds rather than substitutes. The data support the need for formal residency type training programs and highlights the need for program structures that can accommodate physicians who move into this field after a period of practice in another medical specialty. The data demonstrate that formal training produces physicians with both clinical and public health orientation.

Acknowledgments

The authors thank the members of the Western Occupational and Environmental Medical Association for participation and Katie Liu for assistance with data management.

Supported in part by the National Institute for Occupational Safety and Health/CDC (Southern California Education and Research Center).

References

1. Pransky G. Occupational medicine specialists in the United States: a survey. *J Occup Med*. 1990;32:985–988.
2. US Institute of Medicine. Committee to Assess Training Needs for Occupational Safety and Health Personnel in the United States. Occupational safety and health professionals. In: *Safe Work in the 21st Century: Education and Training Needs for the Next Decade's Occupational Safety and Health Personnel*. Washington, DC: National Academy Press; 2000:32–89.
3. Pearson RJ, Kane WM, Keimowitz HK. The preventive medicine physician: a national study. *Am J Prev Med*. 1988;4: 289–97.
4. Membership Directory. Available at: http://members.acoem.org/directory/search_new.asp; Internet; accessed December 9, 2004.
5. Franco G. Occupational physicians' edu-

cation and training across European Union countries. *Int Arch Occup Environ Health*. 1999;72:338–342.
6. Harrison J. Occupational and environmental medicine: sustainable development? *Occup Med (Lond)*. 2000;50:213–216.
7. Felton JS. Practice mode of occupational medicine residency graduates. *J Occup Med*. 1987;29:616–617.
8. Macdonald EB, Ritchie KA, Murray KJ, Gilmour WH. Requirements for occupational medicine training in Europe: a Delphi study. *Occup Environ Med*. 2000; 57:98–105.
9. Castorina JS, Rosenstock L. Physician shortage in occupational and environmental medicine. *Ann Intern Med*. 1990; 113:983–986.
10. Emmett EA, Green-McKenzie J. External Practicum-Year Residency Training in Occupational and Environmental Medicine: the University of Pennsylvania Medical Center Program. *J Occup Environ Med*. 2001;43:501–11.
11. Davis MV, Dandoy S, Greaves WW. Graduate programs: what is their contribution to the training of the public health workforce? *Am J Prev Med*. 2003;24: 361–366.