Training Pathways for Occupational Medicine

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Objective: *Consider the funding, organization, and applicant pool for occupational medicine residency training positions concerns in the United States.* ***Methods:*** *Postgraduate training models are compared for responsiveness to competence and workforce needs, including traditional residency, nontraditional residency, postdoctoral fellowship, extended courses, multiple certificate preparation, continuing medical education, "executive MPH," and implicit education (learning from consultants in the course of practice).* ***Results:*** *Educational models differ in comprehensiveness, crossdisciplinary experience, socialization to core professional values, financial requirements, accessibility to physicians currently in practice, potential number of trainees, and short- and long-term impact on training outcomes.* ***Conclusion:*** *There are tradeoffs between the benefits of comprehensive program standards and the benefit of facilitated training access by reducing barriers or requirements. Recognizing and understanding assumptions about training in our discipline may inform future choices.* (J Occup Environ Med. *2006; 48:366–375*)

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This study was supported in part by the Southern California Education and Research Center of the National Institute for Occupational Safety and Health (NIOSH).

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DOI: 10.1097/01.jom.0000205206.54491.1c

Occupational medicine (OM) training discussions have focused on too few well-trained occupational medicine physicians.[1–3] There are too few funded training positions available, and the cost of training residents is high.[2] OM remains unusual in that a minority of practitioners are board-certified in the specialty.[2] Also, the pool of well-qualified applicants is limited. Many physicians enter the discipline laterally after practice in other areas of medicine.[3–6] Second-career applicants represent the largest potential training pool. It is unclear how the profession and its training apparatus should respond to the varying needs of second-career practitioners in a way that meets their needs, the needs of the public, and the needs of specialists in the discipline. Furthermore, there are several distinct goals to be achieved in establishing educational policy with alternative targets for recruitment and competence. These are summarized in Table 1.

In this environment, an Institute of Medicine (IOM) report has suggested training and certification processes other than the traditional residency.[2] In leadership discussions, these are sometimes referred to as "grow the pipeline" strategies. This article reviews possible alternative pathways for training and discusses potential advantages and disadvantages of each.

Materials and Methods

The investigators relied on their professional experience, existing literature, addresses at leadership meetings, and numerous ad hoc discussions with experts to create this document. This represents the opinion of the authors and should not be construed to represent the views of any organization

with which the authors have been or are associated.

Results

Several training paradigms were identified. These are summarized in Table 2 and discussed in more detail subsequently.

Traditional Residency Training

Description. Occupational medicine is the largest of three disciplines of the American Board of Preventive Medicine (ABPM), which provides the certifying examination to resident graduates. The PG-1 year is most often obtained outside the context of the occupational medicine residency, and program admission often follows additional training in other disciplines. Many, but not all, of the nonmilitary OM residencies receive financial support for tuition and other needs from the National Institute for Occupational Safety and Health (NIOSH) for the PG-2 and PG-3 years based on a competitive grant application model. Residents in externally supported programs receive salary support during the training period, covering much of the cost of salary and benefits.

Advantages. The traditional residency is intended to assure comprehensive qualification in both the clinical and population-based (eg, public health) aspects of the field. Formal residency training programs maintain status as a specialty of medicine on equal footing with larger specialties. The Accreditation Council for Graduate Medical Education (ACGME) requirements for certification of residency programs are most directly addressed by traditional residencies. Dispersed training programs provide trainees for regional markets. University-based programs can sometimes rely on residents for their service needs. Knowledgeable applicants can apply to programs with different "flavors" to meet their specific training needs for experience in clinical consulting, research, and administrative emphases.

TABLE 1
Training Alternatives in Occupational and Environmental Medicine

Whom to train
1. New graduates
2. Midcareer clinicians—clinical
3. Midcareer manager conversions
4. Current practitioners
5. Nonspecialists (eg, primary care clinicians, specialists such as anesthesiologists who deal with unique issues such as chronic pain)
6. Nonphysicians

What to train
1. Clinical occupational medicine—focused on treating common occupational injuries and illnesses
2. Clinical occupational medicine—subspecialist (eg, toxicology emphasis)
3. Public health and health policy
4. Health systems management—occupational
5. Research

Disadvantages. The absence of within-specialty PG-1 training increases the difficulty of recruiting for the largest potential applicant pool, medical school graduates. The number of training positions available do not meet the IOM-projected needs of the field[1,2] (whether or not these projections are correct), and even these positions are chronically undersubscribed. In 2003–2004, there were a total of 351 trainees in all of preventive medicine, including 129 in OM specifically, a decrease from 404 and 160, respectively, in 2001–2002.[7] Although approximately 50% of preventive medicine (PM) certificate holders are in the OM field, fewer attend OM residencies. The discrepancy exists because PM specialists in all three specialty areas become eligible to take other PM boards without additional training. This lateral pathway tunnels PM specialists into OM, and may serve manpower needs for specialists. It may also compete with residency program needs for a critical mass of trainees. Training programs are mostly small (approximately two trainees per year), creating cost inefficiencies and limiting the extent of educational programs feasible at each location.

The traditional residency program duration is 2 years, with approximately 1 year of the effort allocated to obtaining a Master of Public Health (MPH) or equivalent degree, so that in effect, 1 year is available to learn the clinical and practical aspects of the field. It is unclear whether one year's effort is sufficient to master clinical and managerial skills necessary for the field if the only prior clinical postgraduate training was a PG-1 year. A state licensure board may interpret the "academic" (MPH or MPH-equivalent) year as nonclinical, leading to rejection of licensure of physicians who do not have clinical training outside occupational medicine.[8]

TABLE 2
Alternative Structural Approaches

1. Traditional residency
2. Nontraditional residency
3. Combined residencies
4. Postdoctoral fellowship
5. Extended course
6. Multiple competencies
7. Continuing medical education
8. Executive MPH
9. Implicit education

Many physicians enter occupational and environmental medicine after a period of practice in another specialty.[3,4] A 2-year full-time commitment and associated reduction of income to residency levels are barriers for individuals already in practice.

Residency support from NIOSH is typically limited to levels defined by the federal National Research Service Awards (NRSA). It may not fully cover resident salaries and may

not cover faculty and staff educational time at all institutions funded. This creates program deficits and negative institutional incentives. The Centers for Medicare/Medicaid Services (CMS) supplements payment for services provided in academic hospitals to support training. PM specialties, including OM, are excluded from this.[9] Returned service to the institution is also limited in traditional OM residencies because of the "academic year" (MPH or MPH-equivalent requirement year). Trainees participate as graduate students as well as clinicians-in-training providing service yet receive tuition waivers and are paid comparably to residents who provide extensive clinical service.

A limited scope of clinical practice at some host institutions may direct training energy to a particular research interest or service function, which may not provide a well-rounded educational advantage (eg, routine screening examinations at corporate-affiliated programs, data analysis in research-active programs, or evaluations based on a particular clinical or research interest such as asbestos screenings, veterans' impairment evaluations, or "sick-building" evaluations). Also, it is unclear whether residents entering OM from other PM disciplines, by virtue of board certification examination, have received well-rounded clinical supervision experience.

Faculty face disincentives for traditional residency training. Competitive applications for funding of residency training entail a stressful, time-consuming process. In most other fields, residency directors do not need to regularly prepare grant applications for basic funding, a requirement that may contribute to OM turnover rates.[8,10] Legitimate increasing demands of competitive NIOSH funding, evolving ACGME residency requirements, and ABPM resident credentialing requirements interfere with the ability of faculty members to conduct research, remain active clinical consultants, and provide data relevant to public policy. The need to objectively test and document resident competence has created additional demands, particularly because PM does not have well-recognized measures for clinical competence.[11] Training a small number of residents may not represent the optimal use of faculty resources within academic institutions, and OM programs have recently closed.

The areas of occupational and environmental medicine considered most important by academic faculty may differ from the priorities of practitioners. For example, a European survey showed interest focused mainly in disease rather than areas such as safety and employee absence management.[12] Much of the training in the United States focuses on prevention; it is less clear that American trainees' first jobs focus on prevention. Many enter the job market in positions with substantial clinical responsibility, suggesting the need for assuring that OM residency graduates are predictably ready for the clinical aspects of the entry-level job market.

Nontraditional Residency Training Programs

Description. Several residency programs have modified their structures so that trainees need not be physically present (ie, a residency without residence). The components are the distance-learning MPH and the "on-the-job" practicum.[13] The distance-learning MPH permits self-paced internet courses, mailed-home assignments, videocassette lectures, or some blend of these with little time spent with colleagues in class.

Nontraditional residency programs depend on the trainees' employment sites for the majority (often entirety) of the practicum experience. The resident trainee continues usual work duties with additional supervision from a faculty member who is recruited as a temporary, unpaid adjunct for the university. The local supervising faculty, in practice a supervisor or colleague, rarely or never participates on campus. The trainee may be required to come to campus for additional, nonclinical enrichment experiences yet is employed and paid by the practicum site. Program trainees come from different practice locations. Consequently, training sites and experiences are often unique for each resident, although structural alliances between the sponsoring residency institution and a military location, a major industrial employer, or a large practice group (eg, an HMO with a central facility) are possible in theory and may foster some consistency of sites.

Advantages. The distance MPH and practicum both meet the needs of physicians who enter OM after practice in another field. They encourage these practicing physicians to obtain a broader scope of OM-related knowledge.

These residency programs do not pay salaries; indeed, trainees (or their employer) pay resident tuition for participation limited only by market forces affecting the perceived value of a board-certification credential to employers or participants. This frees programs from fiscal models that constrain traditional residencies.

Nontraditional-format residency programs offer economies of scale. A small paid faculty, operating without geographic constraints, can train a large number of students with the assistance of a rotating corps of voluntary off-site faculty. Furthermore, trainees may hold preexisting responsible positions in industry or government; faculty and the wider discipline may benefit if this facilitates participation of worker populations in research endeavors or faculty participation in policy activities of the host agency or corporation.

Disadvantages. A theoretical disadvantage is the absence of "socialization" into the thought process and values of the field. Even if nontraditional residencies effectively transmit factual public health knowledge and problem-solving competence in population sciences, they may re-

main deficient in interactions among faculty and trainees by which the resident acquires the orientation and values of the field.[14] Practical experience working closely with professionals in the other occupational health disciplines is regarded as essential for trainees.[12,15,16] If the trainee's educational site is a distant office or clinic, such practical interaction with core faculty may occur exclusively in a didactic setting.

Consistency, monitoring, and quality assurance of the clinical educational experience challenge residency programs for which the primary training site differs for every resident. In traditional models, experiences at practicum rotation locations are described by previous generations of residents helping choose site mentors who have honed teaching skills over time. Development of resident experiences and faculty skills for a single trainee, with a single local mentor, will create inconsistencies. The off-site model provides limited opportunity or incentive for verification of practice quality as opposed to testing knowledge. The residency director, responsible for verifying the residents' overall competency, rarely works with the resident in a practice setting.

Residency training in any field builds on a wide variety of experiences. Programs at remote locations, created for a single trainee's needs, may encounter difficulty in providing the wide variety of experiences necessary for OM learning or may attempt to substitute distance classroom learning for supervised "hands-on" experiential learning, especially in the clinic. The current accreditation system is built on a different model. Resident "teaching and learning" occurs ". . . when expert senior physicians observe the practice of junior physicians, and provide feedback, reflecting on the learner's performance compared to standards or benchmarks."[17]; distance-learning residencies depend heavily on the site supervisor for each trainee. Since the publication of the Flexner Report and the development of the teaching hospital, clinical and other practical aspects of residency programs have generally not been designed on a single-mentorship model. If residents are considered so experienced that they do not need clinical supervision, it then becomes unclear that they benefit from the opportunity for mentored professional growth in the residency setting.

Although traditional residencies also have potential conflict between educational goals and residents' service responsibilities, nontraditional residencies face a starker role conflict. The resident's primary, often full-time job duties are outside the residency structure. Supervisors with dual roles may also face conflicts between employment-related and educational goals. These challenges may be diminished through experience if there is a consistent, long-term relationship between the sponsoring educational institution (eg, university) and the practicum site.

The traditional residency model faces real questions about sufficient supervised clinical training. The distance-learning model offers less clinical supervision.

Finally, these approaches have implications for the prestige and acceptance of the field. They set OM residency training apart from residences in other fields and invoke professional consideration for credibility, residency applicant pool, and licensure.

Freestanding 'Executive' Public Health Degree Programs (MPH)

Description. Master of Public Health degrees may be obtained independently of additional training, and they increasingly have nontraditional formats allowing maintenance of employment while studying for the degree. Most MPH students (two thirds according to one study) are employed while obtaining their degrees.[18] "Executive MPH" programs meet the needs of this population, including physicians interested in OM certification. Some "executive" programs maintain on-campus interactions by scheduling concentrated attendance as a substitute for full-time in-residence activity. Other programs include little actual contact. Many emphasize areas of perceived demand for public health executives interested in a credential.

Advantages. These programs are accessible and offer economies of scale. They permit the trainee to continue full-time employment while obtaining the graduate degree. They do not require payment of salary support for the trainee. They may be particularly helpful at guiding clinically focused physicians to understand the broader aspects of PM. They create a recognized credential and a steppingstone for licensed clinicians who want to pursue practicum training in a single year.

Disadvantages. Many executive MPH programs emphasize healthcare administration, managed care, and Medicare rather than OM. (Perhaps this is equally advantageous in OM job positions that require extensive administrative skill.) Clinical supervision is not provided.

Combined Programs

Description. Training in occupational medicine may be explicitly combined with training in another medical specialty in a structured manner. There are two common approaches: concurrent and sequential. In a concurrent residency program, trainees complete OM residency as well as residency in another specialty concomitantly in a single integrated program. The training time is usually less than the sum of the two independent residencies.

Advantages. A properly structured combined program can eliminate duplication, focus training in the combined field on the most relevant aspects (eg, a resident in a combined occupational/internal medicine program may spend more internal medicine time in ambulatory care than critical care and do rotations such as physical medicine that are most helpful for a future career in OM), and

attract a more desirable applicant pool. Completing much of the "academic" education (eg, MPH degree) early in the combined training provides useful perspective when learning both specialties. Combined models address perceived weakness in our clinical training. In the planned sequential model, OM becomes a de facto fellowship.

Several routes to the OM training may be possible (eg, OM combined with family medicine, internal medicine, and virtually any other specialty). Combined models can provide a "critical mass" of trainees in an institution because residents may participate in OM activities even when assigned to the other field, providing economies of scale and increasing both intellectual activity and socialization. Stipend support from CMS may also be possible for at least part of the training. The number of residency slots available to OM may be increased. Graduates with dual certification are highly sought by organizations and are considered to become specialty leaders.

Disadvantages. Combined programs require significant long-term institutional planning and commitments. Combined programs address the training needs of only those applicants who have the foresight to select an OM career while in medical school. Aggressive marketing and increased prestige of the field are likely prerequisites before this approach addresses perceived "pipeline" needs. At any institution, combined program planning may be dominated by the more powerful program(s) and may diminish the independent institutional identity of OM.

Postdoctoral Research Fellowship Model

Description. Physicians may enter OM by working in the research program of an accomplished physician–investigator. Their work is comparable to that of a postdoctoral fellow in a scientific discipline, typically focusing on conduct of a research project. Clinical work may be added to meet minimal requirements.

Advantages. This approach can develop research leaders, augmenting the limited opportunity to develop research expertise during the usual residency period with its requirements and necessary competencies.[19] The presence of postdoctoral fellows increases discipline status within universities, provides a route for recruiting research-oriented physicians, and enhances faculty research. Imbus has suggested development of subspecialties within occupational medicine, citing certification in toxicology as a model for an additional subspecialty fellowship.[20]

Disadvantages. Although motivated trainees may acquire sufficient breadth in the field of occupational medicine while doing a research-oriented postdoctoral fellowship, systematic means to assure that this is accomplished have not been developed. Furthermore, the fellowship model is explicitly not a residency. If the training in OM followed this model exclusively, the field could experience loss of its place at the ACGME table as a key constituent of training in organized medicine.

Extended Courses

Description. Several program variants provide shortened alternatives to residency training while endeavoring to provide comprehensive education. Over a period of several years, participants travel to a site and receive variable amounts of didactic instruction. Such programs have been called "miniresidencies" by presenting universities. Now, professional organizations such as the American College of Occupational and Environmental Medicine (ACOEM) also provide similar programs as a "core curriculum." These programs do not award university degrees.

Advantages. The abbreviated timeframe attracts participants, fosters economies of scale, and can provide high-quality instruction. Historically, these programs addressed needs of previously untrained physicians already practicing occupational medicine and provided an intermediate training experience. The financial structure was organizationally advantageous to host institutions because trainees received no salary and generally paid substantial fees for attendance, and to trainees because the programs were, at one time, accepted as a prerequisite to sit for the OM-certifying examination. Because some of these programs involved in-residence activities for a week or more at a time, there were opportunities to interact with both full-time faculty and colleagues, facilitating "socialization into the field." Programs focus on topics most relevant to OM because they need not meet more diffuse university requirements.

Disadvantages. Licensure requirements and insurance considerations have generally precluded a supervised clinical experience. This approach relies predominantly on classroom experience and does not provide the practical experience common to other medical fields. In addition, the programs are often inflexible with regard to content. The loss of a pathway to board certification has reduced the stature of such training programs. Furthermore, these programs are not residency programs and therefore not subject to external quality monitoring by ACGME and graduate medical education committees of medical schools. These programs did not historically contribute to research or policy involvement of trainees in ongoing projects. Absent quality assurance, extended course programs may resemble more basic continuing medical education (CME) programs, may not add substantially to the educational outcome experienced by trainees, and do not fully address the "competency" model for training of the ACGME.

Multiple-Certificates Training

Description. Selected aspects of occupational medicine practice are provided by intensive, short, narrowly focused courses aiming to cre-

ate competency within a defined practice domain (eg, radiographic interpretation by the International Labor Organization [ILO] system,[21,22] Medical Review Officer [MRO] training, spirometry testing, application of AMA Impairment Guidelines, DOT examinations, and FAA examiner training). Often, the student receives a certificate of completion or even completes a formal examination implying special competence in this area.

Advantages. Courses in well-delineated practice areas can be effective at both creating and testing competencies. They can provide substantial depth in specific areas, including areas that might not be considered important or that would otherwise not be emphasized during a formal residency program. The trainee chooses courses most relevant to his or her practice needs. In-depth focused courses encourage lifelong learning and meet evolving needs of practitioners in a flexible manner. Certification of successful completion of some of these courses is often required (de facto or de jure) for certain areas of practice in some states, motivating occupational medicine and other physicians to participate. Narrowly focused courses that are amply financed by attendee tuition can provide excellent educational materials.

Disadvantages. The narrow focus can also be a disadvantage, ie, the trainee does not acquire a comprehensive understanding of OM. Furthermore, such courses may compete with the concept of specialty certification and are sometimes interpreted to mean that OM is not a unified specific field. The focus is on niche market skill sets, not core concepts. Selected skills can be mastered without emphasizing public health, population efficacy, and ethical underpinnings of the training; problematic limitations of the training may be ignored to meet market needs.

Market-driven courses strive to imply that a certificate holder will be able to perform a procedure not permitted to others. This may increase cost and reduce availability of services if the ad hoc "certification" process restricts the number of providers. This is a concern for society and also a concern for the specialty if the narrow certification competes with rather than augments the value of specialty board certification or if quality assurance mechanisms are not in place. Although several narrow certifications are legally mandated (eg, for Department of Transportation drug testing), there is no legally mandated benefit for the more comprehensive broad certification by the ABPM, a serious problem for the discipline.[20]

The course provider often has an economic interest in tuition while acting as the institution providing a certificate of special competency, a potentially significant conflict of interest. (A notable exception is the training for ILO interpretation, which is offered by the American College of Radiology, but the certification is performed by NIOSH.)[21,22] Proliferation of self-designated certification processes has raised concerns in many areas of medicine.[23,24] Private, for-profit, self-designated "boards" have been viewed as providing disinformation to consumers.

A proliferation of certificates of special competency (often called "merit badges") may restrict the practice opportunities of those who hold a single comprehensive personal certification (ie, in OM, by ABPM). Certificate-oriented training may be redundant for some OM residents and, conversely, the presence of freestanding short-focused certificate courses may lead to dropping these topics from comprehensive OM residency training.

Continuing Medical Education

Description. Continuing medical education includes freestanding programs (eg, a 2-day conference on occupational lung disease), regularly scheduled periodic educational meetings (such as annual meetings of the American College of Occupational and Environmental Medicine), and inclusion of occasional occupational topics in other ongoing series (eg, an occasional topic in the weekly medical grand rounds of a university hospital).

Advantages. CME is a recognized component of medical education, useful for maintaining competency and currency of discipline specialists as well as outreach to clinicians in other fields. CME is a setting for OM education of primary care and nonoccupational specialist physicians, who often provide care for patients presenting with occupational health problems.[25–28] Within medical schools, increasing curricular time committed to OM would similarly improve the knowledge of future clinicians who will not specialize in OM.[29,30] Many states require that physicians participate in CME to maintain licensure. A wide audience can be targeted. In addition, CME allows physicians the opportunity to choose topics most relevant to their practices with few constraints on time and location.

Disadvantages. No specialty has advocated for CME as a replacement for specialty training. CME is limited in scope, not providing either in-depth or comprehensive education. CME activities compete in their own economic marketplace, which is inadequately funded to support resident trainee needs. The quality of CME offerings is variable. Competency testing is not yet a routine part of CME. Only attendance and short-term memory for a few facts can be inferred by the CME process. There is little coordination among CME programs so that the trainee is not led to a comprehensive understanding. (CME provided as part of a board recertification process may be more comprehensive when fully available.) External review is generally limited to recipient feedback, and there is no recognized peer process.

Implicit Education

Description. "Implicit education" is the process by which physicians continuously learn in the course of their practices. Case-by-case education diffuses from expert consultants to learn-

ers in the clinical setting. Other methods such as computer-based expert systems can also provide case-focused education.[31–33] The concept that senior physicians need less training than junior counterparts relies on assumptions about implicit education.

Advantages. Implicit education is an ongoing process leading to continuous improvement of practitioners' knowledge of their field. Furthermore, implicit education directly addresses motivation as well as factual education because it derives from clinical practice.

Disadvantages. Implicit education relies on OM medical consultants, whose scarcity, particularly in primary care clinical settings, limits this approach. Although there has been a decades-long shift in OM practice from corporate to clinical settings,[34,35] the total number of OM specialists in primary care settings is still low.[36] Furthermore, implicit education requires that the learner take the first step of requesting consultative assistance. A concern about traditional training is the adequacy of supervised clinical experience. The same concern is magnified in implicit education. The participant needs to recognize the educational needs and become both director and learner.

Underlying Assumptions Concerning the Structure of Occupational Medicine Training

Four assumptions about OM training underlie discussions about the future of the field. The belief that many more trained, board-certified occupational physicians are actually needed[2,37] depends on a strongly clinical model of OM practice (the number of board-certified trainees required if most treatment of work-related injury and illness is rendered by OM-trained practitioners). Yet, the discipline has a strong population focus in its training, much OM clinical care is provided by nonspecialists, and many educational leaders assert that they are training preventive specialists who will interact with the clinic at a health services research, health policy, or supervisory level. An alternative possibility is that the field is presently "right-sized" for the public health and supervising market, and its biggest training dislocation is failure to recognize the limited market size for preventionists who are not firmly rooted in day-to-day clinical practice. There are settings for which current training may be very appropriate. Consider the academic marketplace: the PM disciplines hold more slots than those in dermatology and neurosurgery and almost as many as emergency medicine with a strong junior-faculty pipeline.[38] A recent historical review of OM suggested that "its sudden growth since 1970 may have exceeded the demand, if not the need, for its services" and implied that the implementation of the Occupational Safety and Health Administration has reduced the frequency and severity of occupational diseases and injuries.[20]

A related set of assumptions concerns the content of training. Are we orienting training for the right future of our trainees? European experts have suggested a need for better clinical training underscoring clinical processes and treatment[12] in contrast to an existing emphasis on safety and management. Does the U.S. training model need to explore the actual skills needed by trainees? There are many possible views of the needed outcomes of training, and a public discussion should serve the field.

The third assumption is that the way to improve the flow of trainees ("grow the pipeline") is to remove the barriers to program entry; this has sometimes equated to alternative approaches to reducing the time commitments and completing training without altering day-to-day employment activities. After over a decade of alternative programs designed to meet this need, there is no evidence that the number of OM graduates has increased although experimental programs removed barriers to second-career clinicians. Possible explanations include a shift of trainees from traditional programs to programs that do not cause practice dislocations so that the net gain was zero; or, loss of discipline prestige associated with alternative programs may reduce the pool and affect gains. Conversely, it is possible that the alternative programs prevented actual reduction in trainees. A competing assumption would be that raising standards would improve prestige and quality of the educational product. Several programs in OM and in general PM have taken this tack by requiring strong backgrounds and emphasizing academic excellence. OM might consider raising requirements and linking training to academic activities such as health services/outcomes analysis.[8]

The fourth assumption has been that a uniform structure applies to all three PM specialties (across OM, aerospace medicine, and general PM). For example, is the traditional model of an "academic" (classroom) year followed by a "practicum" year fully applicable to OM, which has a major clinical component?

This assumption also bears on the role of diplomates in other PM specialties. The admission of non-OM-trained PM residents to sit for the boards has implications for OM residency training programs and for the already substantial absence of uniformity in training products. Is it appropriate that OM certification be "the final common pathway" for general PM and aerospace medicine residents seeking job opportunities? If general PM trains for a predominantly nonclinical health services market and OM training accommodates the needs of a robust market for entry-level clinical jobs, the skill sets of general PM and OM trainees may diverge even more. Occupational medicine might want to add an outpatient clinical year in such a circumstance, and general PM might want to pursue a postresidency fellowship market with considerable research and flexibility. As these possibilities are considered, they

might best be framed as follows: What clinician market is OM training for, how big is it, and what specific experiences will best serve the trainees, the public, and the field? In addition to the need for clinical competence, prevention-oriented skills are also needed. An international survey of occupational health curricula has demonstrated that prevention-oriented competencies are generally considered more important in developed countries than in developing nations,[39] yet the ethical and practical imperatives to address public health needs in developing economies are also clear.

Summary Implications

Changes in the healthcare environment and a recent IOM report[2] have triggered ongoing extensive discussion of training needs in OM. There are several potential inputs, differing in structure and content, for improving the availability and quality of OM expertise. Choices have very different long-term implications for the profession. Some of these questions are also relevant to the other PM specialties.[8]

Short-term and long-term goals of our discipline may require different strategies. There are tradeoffs between creating "convenient" educational approaches to overcome short-term constraints (such as funding and supply of potential trainees) versus the long-term goals of maximizing program quality and providing an "occupational medicine specialist" whose skills are valuable, desirable in the job market, and comparable to other specialties. Adherence to traditional training program structures may limit growth, an acceptable outcome only if the present "pipeline" is "right-sized." Decision-making for the future of OM demands defining choices about the target marketplace and its service to public needs. Are we training physicians for the routine care of workers, a currently robust market, or for future data services needed to foster growth in an economy encumbered by healthcare costs or for preventive services aimed at protecting workers in a changing workplace? What is the right balance? There are dangers of imprecisely framed questions or inaccurate assumptions about these choices. If the available supply of fully trained occupational physicians is seen as grossly inadequate, is it logical to mandate their involvement in providing service? If clinical service is not the goal, will there be a reduction of both demand and supply? Alternatively, if we assume a large clinical market but residencies train for health policy and health services careers, will employers be eager to pay the premium for physician trainees? PhDs, master's-level nonclinicians, and nurses with similar data skills are also entering this field.

There also are tradeoffs between an emphasis on creating fully trained specialists in occupational/environmental medicine versus providing more limited education in specific areas of occupational health to practitioners in other fields (including physicians and nonphysicians). The latter approach may address immediate service delivery needs and increase the visibility of the field. Intermediate certifications attached to such training can also reflect the varying effort required by different residency training models. However, emphasis on training such alternative providers may have the long-term impact of markedly lowering overall quality by reducing standards, creating competition with our own training, and diminishing the prestige of the field as a bona fide medical specialty. Multitiered education, in which some physicians receive considerably less training,[37] may face a "Gresham's law" phenomenon if the public cannot distinguish differences in certification and less excellent models prevail. The availability of less comprehensively trained providers may drive the fully trained OM specialist out of the general market if their certification credentials appear the same. Ultimately, the quality of services provided by graduates[40] will determine whether there is a perceived need for training.

An understanding of market forces is essential. In the United States, there is little or no legal mandate for board-certified OM specialists comparable to the de facto requirement of successful completion of a surgical residency before performing cholecystectomies. The situation is different in several European countries, where occupational medical services are mandated for businesses of certain sizes.[41–43] Indeed, the trend in the United States is to remove even the requirement of a medical degree, focusing only on the minimal operational requirements that can be met by any "licensed health care provider."

Occupational medicine faculty members in universities have special responsibility. They must create an appreciation and demand for their expertise internally, including high-quality research by the faculty and trainees. They must provide the highest quality occupational health service for university employees, effectively selling clinical service outside the university and providing outreach services.[44]

The ACGME is undergoing a major shift in the philosophical underpinning of graduate medical education in the United States.[45,46] Through the Outcomes Project, emphasis is shifting from process to defining and evaluating mastery of specified competencies. The ACGME has defined six broad general competencies; however, there is an unmet need to define the OM-specific competencies. A successful transition from emphasis on the process to the outcomes of education may facilitate identifying the most effective program structures. Furthermore, alternative pathways to achieving competency may be feasible.

In summary, the current era presents both opportunities and pitfalls. It is important to carefully balance short-term approaches with longer-

term strategic needs. To do either, the OM specialty should question its assumptions, define its ideal training product, and market it clearly and effectively.

References

1. Castorina, JS, Rosenstock L. Physician shortage in occupational and environmental medicine. *Ann Intern Med*. 1990; 113:983–986.
2. Institute of Medicine. Committee to Assess Training Needs for Occupational Safety and Health Personnel in the United States. *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.
3. LaDou J. The rise and fall of occupational medicine in the United States. *Am J Prev Med*. 2002;22:285–295.
4. Harber P, Mummaneni S, Crawford L. Influence of residency training on occupational medicine practice patterns. *J Occup Environ Med*. 2005;47:161–167.
5. Schwartz BS, Pransky G, Lashley D. Recruiting the occupational and environmental medicine physicians of the future: results of a survey of current residents. *J Occup Environ Med*. 1995;37:739–743.
6. Pearson RJ, Kane WM, Keimowitz HK. The preventive medicine physician: a national study. *Am J Prev Med*. 1988;4: 289–297.
7. Brotherton SE, Rockey PH, Etzel SI. US graduate medical education, 2002–2003. *JAMA*. 2003;290:1197–1202.
8. Ducatman AM, Vanderploeg JM, Johnson M, et al. Challenges and opportunities. *Am J Prev Med*. 2005;28: 403–412.
9. Lane DS. A threat to the public health workforce: evidence from trends in preventive medicine certification and training. *Am J Prev Med*. 2000;18: 87–96.
10. ACGME. 2003. Number of new Program Directors for a Specific Academic Year (excluding combined programs) (7/1/2002–6/30/2003) Available at: http://www.acgme.org/adspublic/.
11. Landon BE, Normand SL, Blumenthal D, Daley J. Physician clinical performance assessment: prospects and barriers. *JAMA*. 2003;290:1183–1189.
12. 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.
13. 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;43:501–511.
14. Dinman BD. Education for the practice of occupational medicine: knowledge, competence, and professionalism. *J Occup Environ Med*. 2000;42:115–120.
15. Bertsche PK, Sanborn JS, Jones ER. Occupational medicine residency training programs. The role occupational health nurses play. *AAOHN J*. 1989;37:316–320.
16. Meyer JD, Becker PE, Stockdale T, Ducatman AM. The West Virginia Occupational Safety and Health Initiative: practicum training for a new marketplace. *Am J Prev Med*. 1999;16:347–350.
17. Duffy F. The accreditation system after next. *ACGME Bulletin*. 2003:3–5.
18. 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.
19. American College of Occupational and Environmental Medicine Panel to Define the Competencies of Occupational and Environmental Medicine. Occupational and environmental medicine competencies—v 1.0. *J Occup Environ Med*. 1998; 40:427–440.
20. Imbus HR. Fifty years of hope and concern for the future of occupational medicine. *J Occup Environ Med*. 2004;46: 96–103.
21. Attfield MD, Wagner GR. A report on a workshop on the National Institute for Occupational Safety and Health B reader certification program. *J Occup Med*. 1992;34:875–878.
22. Wagner GR, Attfield MD, Kennedy RD, Parker JE. The NIOSH B reader certification program. An update report. *J Occup Med*. 1992;34:879–884.
23. Chase RS. Sounding board. Proliferation of certification in medical specialties: productive or counterproductive. *N Engl J Med*. 1976;294:497–499.
24. Kassirer JP. The new surrogates for board certification—what should the standards be? *N Engl J Med*. 1997;337: 43–44.
25. Harber P, Bublik M, Steimberg C, Wallace J, Merz B. Occupational issues in episodic care populations. *Am J Ind Med*. 2003;43:221–226.
26. Harber P, Mullin M, Merz B, Tarazi M. Frequency of occupational health concerns in general clinics. *J Occup Environ Med*. 2001;43:939–945.
27. Schwartz DA, Wakefield DS, Fieselmann JF, Berger-Wesley M, Zeitler R. The occupational history in the primary care setting. *Am J Med*. 1991;90:315–319.
28. Thompson JN, Brodkin CA, Kyes K, Neighbor W, Evanoff B. Use of a questionnaire to improve occupational and environmental history taking in primary care physicians. *J Occup Environ Med*. 2000;42:1188–1194.
29. Levy BS. Measures for increasing the teaching of occupational health in medical schools. *J Occup Med*. 1985;27: 791.
30. Burstein JM, Levy BS. The teaching of occupational health in US medical schools: little improvement in 9 years. *Am J Public Health*. 1994;84:846–849.
31. Harber P, Merz B, Lam I, Yuan M, Parker JE, Chen W. Intelligent database generated occupational questionnaire system. *J Occup Environ Med*. 2000;42: 483–490.
32. Harber P, McCoy JM, Shimozaki S, Coffman P, Bailey K. The structure of expert diagnostic knowledge in occupational medicine. *Am J Ind Med*. 1991;19: 109–120.
33. Harber P, McCoy JM, Howard K, Greer D, Luo J. Artificial intelligence-assisted occupational lung disease diagnosis. *Chest*. 1991;100:340–346.
34. Pedersen DH, Venable HL, Sieber WK Jr. An examination of occupational medicine practices. *J Occup Med*. 1990;32: 1037–1041.
35. Ducatman AM. Career options of occupational physicians. *J Occup Med*. 1988; 30:776–779.
36. Pransky G. Occupational medicine specialists in the United States: a survey. *J Occup Med*. 1990;32:985–988.
37. Institute of Medicine. *Addressing the Physician Shortage in Occupational and Environmental Medicine.* Washington, DC: National Academy Press; 1991.
38. Barzansky B, Etzel SI. Educational programs in US medical schools, 2002–2003. *JAMA*. 2003;290:1190–1196.
39. Delclos GL, Bright KA, Carson AI, et al. A global survey of occupational health competencies and curriculum. *Int J Occup Environ Health*. 2005;11: 185–198.
40. Harrison J. Occupational and environmental medicine: sustainable development? *Occup Med (Lond)*. 2000;50: 213–216.
41. Weel AN. Training of occupational physicians in The Netherlands with regard to occupational health services delivered to the population. *Int J Occup Med Environ Health*. 2001;14:57–61.
42. Alcouffe J, Manillier P, Brehier M, Fabin

C, Faupin F. Analysis by sex of low back pain among workers from small companies in the Paris area: severity and occupational consequences. *Occup Environ Med*. 1999;56:696–701.
43. Buijs P, van Amstel R, van Dijk F. Dutch occupational physicians and general practitioners wish to improve cooperation. *Occup Environ Med*. 1999;56:709–713.
44. Levine RS, St. Onge J, Moriarty CJ, et al. Preventive practicum training in healthcare organizations. The Meharry model. *Am J Prev Med*. 1999;17:91–96.
45. Carraccio C, Englander R, Wolfsthal S, Martin C, Ferentz K. Educating the pediatrician of the 21st century: defining and implementing a competency-based system. *Pediatrics*. 2004;113:252–258.
46. Leach DC. The ACGME competencies: substance or form? Accreditation Council for Graduate Medical Education. *J Am Coll Surg*. 2001;192:396–398.